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MODIFICATION IN A PROTOTYPE FOR PEANUT DECORTICATOR FABRICATED IN SHUATS

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Abstract– Peanut is an annual legume and most importantly a cash crop. It is a rich source of edible oil and protein. India produces 25% of the total oil seed production. Hands are generally employed for breaking the pods with thumb pressure but it is not so efficient for large quantity and requires much labor and more time for better shelling. Power operated as well as manual decorticators are also used for performing the same in large amount. Decorticators are used to extract seeds from peanut. Raw peanut is produced from the fields and decorticated with the help of decorticator to remove kernel from the peanut. A modified prototype was developed on AUTOCAD software which was pedal operated and reduced drudgery related to the removal of kernels of peanut. The developed prototype was stationary machine with a mechanism which involved conversion of human power to reciprocating movement of the rocker arm.

INTRODUCTION

The method of breaking pods of peanut is termed as peanut decortications. Breaking of shell is manually done with thumb that is also called shelling of peanut. But this method is not suitable for large quantity as it involves large amount of cost of shelling and is time consuming. The output per man per hour is very low resulting in its high cost of shelling and also human fatigue. This can be reduced if development and modification of peanut decorticator is done. The modification is highly desirable and justified. Hand operated peanut decorticator also has less efficiency and the percentage of broken kernels is more. Thus modification of the hand operated peanut decorticator is highly in need to enhance its efficiency and lessen the human fatigue. Singh (1993) tested two types of concave in manual sheller, the first was wire mesh concave and the second was slotted grate. Shelling capacity with wire mesh concave was higher (86kg/h) compared to that of slotted grate (60kg/h). This was due to increased opening area. Mishra *et al.* (2009) developed prototype of a low cost and pedal powered peanut decorticator for small and marginalized farmers. They further developed a new mechanism of shelling in which peanuts were decorticated by attrition between rubber mounted roller and rubber mounted flat surface. This prototype was fabricated and experiments were performed to assess the performance with two grades of peanuts. The results demonstrated that 74.36% of shelled kernels were without any visible damage and fit for the market. Kale *et al.* (2011) modified the Pedal Operated Rotary Type Peanut Decorticator-cum-Cleaner. The machine consisted of main shaft which was driven by chain and freewheels through pedaling, which rotated the rotary unit in decorticating cylinder where decortications took place. Agitator shaft was driven by chain and freewheel through main shaft, which agitated Peanut pods present in the hopper, thus avoided clogging problem. A blower was also driven by pulleys and V belt through main shaft which blew husk and separated kernels. Taking leads from previous researchers following design constraints were established the design should be easy to maintain and should not require highly skilled labor, which is difficult to be found in rural areas and the design should be based on easily available material in rural areas. To attain the above objective

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a design was developed on the software AUTOCAD in the computer laboratory of Sam Higginbottom Institute of Agriculture science and technology.

Principle Involved in Designing the Pedal Operated Peanut Decorticator

Before designing the peanut decorticator the human effort needed from the thumb was observed and to put the impact on the peanut in the same way as the thumb rotary motion was given to the rocker arm through the connecting rod which was simply converting the rotary motion developed at the pedal through the feet of the operator to mechanical reciprocating motion of the rocker arm.

The connecting rod is driven by the help of chain and sprocket. The chain and sprocket is attached to the paddle of the operator. The operator is supposed to sit on the seat and drive the paddle. Thus, rotary motion applied by the paddle gets converted to the mechanical motion of the connecting arm attached with rocker arm which moves in reciprocating motion.

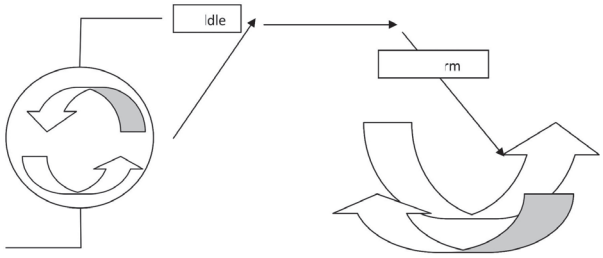

Fig. 1.1. Conversion of energy in proposed prototype.

Experimental Setup of The Proposed Model

The proposed model was constructed on AUTOCAD software which is shown in the following Figs. 1, 2 and 3 with the front view, top view and side view.

Constructional Parts of the Pedal Operated Peanut Decorticator

Main frame: The frame is the important part & it must be so strong to handle loads of pressure, resist shock and vibration on working condition. It was made up of angled iron. The main driving shaft, shelling unit and hopper was mounted on the frame. The main frame was constructed of plates of 100 x 6 mm size. The overall frame is 1610 x 330 x 1070 mm. making use of the advantage of the electric arc welding the frame had been fabricated rectangular in shape. The main driving shaft, shelling unit and

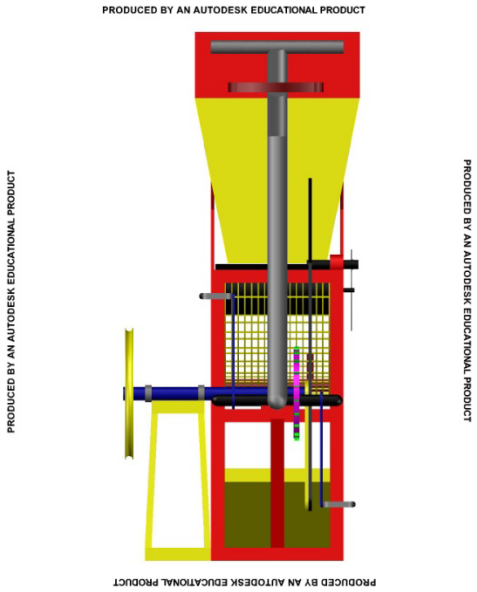

Fig. 1. Front View of Peanut decorticator

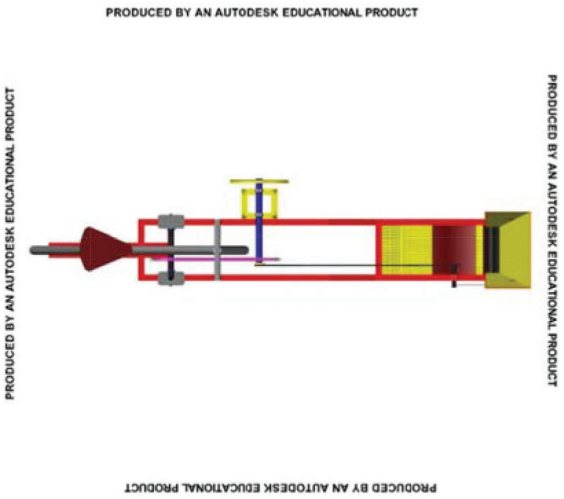

Fig. 2. Top view of peanut decorticator

hopper were mounted on the frame.

Hopper: The hopper was made of 18 gauge mild steel sheet, with a storage capacity of about 3 kg peanut. The hopper was made such a way that the three sides offer some slope to peanut to ensure free falling of peanut. One side of the hopper was kept straight to facilitate free motion of the rocker arm. The shutter was fabricated in such a way that the feed rate could be easily adjust with the help of nut & bolts.

This hopper was provided with a shutter of 18 gauge mild steel sheet. The overall dimension of the hopper was 240 x 240 x310 mm. the hopper is

provided with an 80 x 80 mm square outlet, to drop the peanut in the feeder cup.

Feeder cup: It was made of a cup of 18 gauge MS sheet. Its main purpose was to receive the peanut pods from the hopper and deliver it to the concave. The cup was in the shape of hollow cylinder, closed at both ends by 90 mm dia. of 18 gauge MS sheet. At one side, a rectangular opening of size 90 x 80 mm was provided. Hole at the centre of the both ends, through which the feed shaft was passed and welded.

Concave: A semi circular shaped concave of 544 mm dia. was constructed by the angled iron & spacing between the wires was adjusted in such a way that only broken shell & kernels will pass through it. This wire type concave is made of 12 SWG wire welded in mesh form with an opening of 12 x 28 mm. The overall dimension of the wire mesh was 855 x 275 mm.

The spacing between the wire mesh is such that only broken shells and kernels could pass through them. The concave had been welded to the angle iron breadth wise. Two MS flats of size 20 x 3 mm were welded to the concave to give semi-circular shape and strength.

Rasp-bar: It will be mounted on the rocker arm with the help of nuts &bolts. The rectangular metal frame will be welded to the central shoe; this frame will be consisting of slot. The rocker arm will be inserted into the slot by mean of nut & bolts and tightened to the crushing shoe. It will be made up of mild steel.

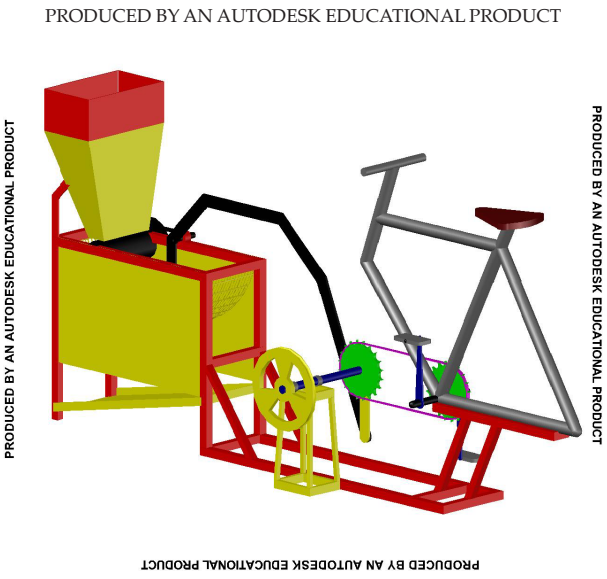

Fig. 3. Side View of the peanut decorticator.

Rocker arm: The main purpose of rocker arm is to fix the rasp bar assembly over it. This arm will be welded to the main shaft. It will be made by mild steel. The arm was made of 35 x 5 mm size MS flat. The length of the rocker arm was 800 mm. the lower side of the arm was slotted for the adjustment of the rasp bar assembly. There were two holes on the upper side for the connecting rod assembly. In the middle, a hole was provided through which a flat bar was attached, which transfers the motion from rocker arm to feeder shaft. Below this a 25 mm dia. hole was made, through which main shaft was welded.

Shaft: There will be two shaft- main shafts and the feeder shaft. The shaft will be rested over bushing. The feeder shaft will be supported by two angled iron piece with holes. Both the shaft will be made up of mild steel.

Bushing: Two gudgeon pins will be used as bushing. It will be made up of alloy steel; one bushing will be welded to the frame while the other will be fixed using nuts and bolts for easy dismantling of rocker arm and pressing shoe assembly.

Seat: Keeping the comfort factor in mind (for the operator running the machine) a metal seat was provided at the required height. It was fixed to the angle iron by means of screw. According to the requirement the height of the seat was adjusted.

Chain and sprocket drive: Chain and sprocket drive was used to transmit the power from of pedal drive to the rocker arm for shelling operation. Chain & sprocket was made up of high grade or malleable iron.

Pedal: A cycle pedal with shaft was fixed on tripod stand (will be made of mild steel) as required height to transmit the generated power to the rocker arm for shelling operation.

ASSEMBLY OF PEANUT DECORTICATOR

The complete assembly of the manually operated Peanut Decorticator is shown in Fig. 1 and 2, showing plan and elevations. The hopper and feed cup was fixed at the end of the frame. The metering unit was converted to the switch type metering device. In this a spring was used to reduce the load and permit the feeding cup to regain its original position after dropping of the kernels of peanut to the concave. The feeding unit was covered with a feed cup cover to prevent the fall of the peanut during operation. The clearance of the rasp- bar was

set as per the need of crushing. The plate on which the broken kernels fall was provided with a shovel so that the kernels could be taken out easily. The transmission system was made paddle operated. The seat was set up in such a way that it reduced the fatigue effect on the operator. For the proper working of the transmission system a shaft was provided with a support of two cobs that had a shaft. Sprocket was provided with proper alignment with the paddle. A crank, attached with ball bearing was joined with a connecting rod in four point linkage pattern that was aligned along the rasp bar .The rasp bar was kept in proper clearance with the concave. This unit works on the principle of "Inversion of double slider crank chain"; Scotch yoke mechanism was used along with crank and lever mechanism in which rotary motion is converted into reciprocating motion. When the crank; which consisted of four links rotated at the centre, the connecting rod that was connected to the rasp bar reciprocated according to the Grashof's law for the four bar mechanism which states that the sum of the shortest and longest link lengths should not be greater than the sum of the remaining two length if, continuous relative motion is present between the two links. The most important consideration in designing this mechanism was to ensure that the input crank makes a complete revolution relative to the other links. Thus, when the crank was considered as the driver the mechanism was transforming rotary motion into oscillating motion. A v-belt pulley was attached to the shaft in order to reduce the load and proper alignment of the transmission system.

CONCLUSION

Based on the analysis from design made on AUTOCAD software on the peanut decorticator, the major modification in the peanut decorticator was carried out in: The feeding unit of the decorticator, The metering unit of the machine, The transmission system in the machine, The seat of the operator and The working of all the component of the peanut decorticator (modified) was found satisfactory during the operational analysis of software.

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