Grain Separator

R. Karthik Kumar[1] K. Santhiya[2] R. Subalakshmi[3] I. R. Jai Pragadeesh[4]
[1]Assistant Professor [2,3,4]UG Student
[1,2,3,4]Department of Electrical and Electronics Engineering
[1,2,3,4]Kongu Engineering College, Erode, Tamil Nadu

Abstract— The abstract of our project deals about the grain separator. For separating the grains from straw or bundle, farmers mainly depend on heavier machine. These grain separators though available now are beyond the reach of the most due to their cost. These separators had a lot of maintenance issues and needed regular upkeep and will be applicable for those having a larger area, for which the farmers hesitate to buy the high cost grain separators. To reduce the problems faced by the farmers, we have proposed an idea. This is to help the farmers to separate the grains from straw or bundle. In this project, the grain separator is a low cost motorized machine for separating the grains without breaking the straw and capable of threshing moist crop as well. It consists of a cylindrical drum attached with a shaft and it is driven by a simple motor. When the machine is in on condition, the straw will be kept on the cylindrical drum and the grains will be separated from the straw. Moreover the separated grains can be sieved using the winnower. These separators are safer than the heavier machine. Another feature of the thresher is that it retains the complete straw and does not chop it.

Key words: Separator, Straw, Motorized Machine, Moist Crop, Cylindrical Drum, Shaft, Sieved, Winnower

I. INTRODUCTION

India is predominantly an agricultural country. About 90 per cent of rice grown in the world is produced and consumed only in Asian countries and it supplies 50 to 80 per cent calories of energy to Asians. India has largest area under rice (43.95 million ha.) and with the production of about 106.54 million tonnes. In paddy cultivation major operations are land preparation, puddling, sowing or transplanting, weeding, harvesting, threshing and storage. Traditionally most of these operations are carried out by human labour. This requires large number of labour. The labour cost shares 60-65 per cent of total production cost of paddy which involve, labour cost on transplanting 38 per cent, harvesting 20 per cent, weeding 19 per cent, threshing 32 per cent and puddling 11 per cent. Threshing is a drudgerious as well as dangerous operation. Timely threshing is essential to reduce post-harvest losses. In most of the rice farms, harvesting is carried out by sickle or mechanical reapers. After harvesting, the reaped plant left on the field to reduce crop moisture content, and then bundled together and transferred to outside of the field for threshing operation. In many cases farmers stack the paddy bundles for several days and gradually complete the threshing. Late threshing of stacked materials causes both qualitative and quantitative losses due to warm and moist environment inside the stack. Large number of farmers in India follows old age traditional method of threshing such as beating and treading. It involves high labour cost. It is also drudgerious and timing consuming. In some of the area pedal operated hold on paddy thresher is used. The bundles of harvested crops are needed to hold in front of rotating drum. It also involves drudgery and results into shoulder and waist pain of the workers. Looking into the limitations of the above process, it is decided to design a simple and low cost engine operated paddy thresher of high capacity, having good threshing and cleaning efficiency. It will be operated by engine and threshing and cleaning will be done in a single operation. It is capable to reduce drudgery, labour requirement, time requirement and able to give full length straw.

II. EXISTING WORK

The present grain separators consist of reaper machine in which the thresher was attached. The portable grain separator was consisted of feed chute, threshing cylinder concave, winnower and main frame. This thresher failed to meet the low cost. Moreover it also leads to wastage of seeds and it does not give full length straw. Another disadvantage is that, this thresher is applicable only to the large scale farms. So we designed a grain separator which is suitable for small and medium scale farmers.

III. SIGNIFICANCE OF THE SYSTEM

In order to separate wheat, peas, soybeans, and other small grain and seed crops from their chaff and straw, the grain separator is used. The Maintenance of this grain separator is easy and cheaper. The motor operated grain separator threshes the paddy four times more than the heavier machine. It leads to less seed breakage. Full length straw is obtained after processing and hence more fodders can be obtained. Easily affordable by all classes of people.

IV. LITERATURE SURVEY

Dash and Das developed pedal operated grain separator with a view to increase threshing efficiency in comparison with conventional threshing mechanisms. The cylinder diameter was 35 cm at the tip of the wire loops. The length of the shaft between two bearings was 130 cm. Twelve equally spaced wooden slats of 7 cm width, 1.5 cm thickness and 110 cm length were fixed on the on the end disk over rim of 3 mm thickness and 25 mm width welded to the disk. Threshing teeth of 4 mm diameter G.I. wire were curved and fixed to the slats. Threshing teeth project 5 cm above the surface of the slat. The distance between the tips of the two adjacent teeth was 4.4 cm. There were 25 wire loops in each slat. This pedal operated grain separator is used to thresh the major crop paddy. It involves drudgery and it results in shoulder and leg pain. The threshing efficiency was very low. Sessiz and Ulger reviewed many papers on different aspects of paddy threshing methods for optimum performance. The main objective of this review paper is to have proper understanding of different aspects of present grain separating practices to reduce the efforts which was put in by farmers in terms of money, labour, time, physical efforts for optimum performance. Due to this analyse the sincere efforts must be made to design

suitable grain separating machine in order to provide more profit stability in terms of economic considerations to help those farmers having small and medium farms. Behera et al. designed pedal operated wheat thresher. It was consisted of threshing unit, conveying unit, separating and cleaning unit, which comprised of threshing cylinder and adjustable concave with a little clearance between them. The cylinder of 45 cm length and 50 cm diameter having the pegs 7.7 cm high on the cylinder arranged in staggered manner at an interval of 6.5 cm. There were 16 slats and the cylinder had 56 pegs. The threshing efficiency was comparatively very less which was around 40% only. The concave sieve plate used in this thresher machine, does not produce the high cleaning efficiency. Dhananchezhiyan et al. developed the paddy thresher. It mainly consisted of reaper machine in which the thresher was attached. The portable paddy thresher was consisted of feed chute, threshing cylinder concave, winnower and main frame. This thresher failed to meet the low cost. Moreover it also leads to wastage of seeds and it does not give full length straw. Another disadvantage is that, this thresher is applicable only to the large scale farms.

V. PROPOSED ASSISTIVE SYSTEM

As the large threshing machines are useful only for large scale farmers, the proposed system can be used by small scale and medium scale farmers. By using this grain separator, the efficiency increases to a great extent.

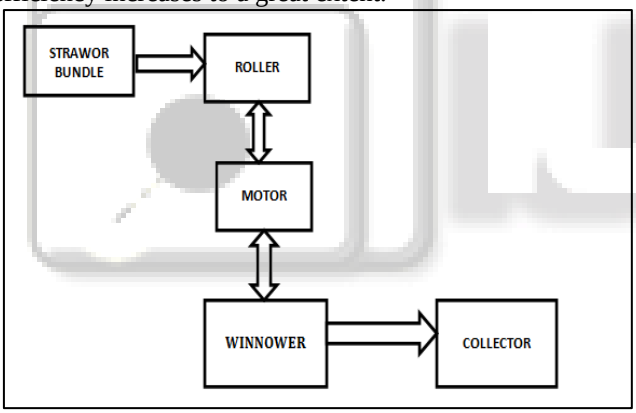

Fig. 1: Block Diagram of the proposed system

This shows the block representation of proposed system. It mainly consists of two components 1) roller, 2) winnower. The roller is nothing but the rotating cylinder which is of loop type cylinder. The loops of the cylinder are arranged in a staggered fashion. The winnower is attached below the rotating cylinder which is used to clear the immature grains or dust particles. Both the rotating cylinder and the winnower is connected to a single phase induction motor. When the straw or bundle is kept on the rotating cylinder, the grains will be separated from the straw. Moreover the grains will be transferred to the winnower to remove the dust particles. Finally it will be collected in the collector.

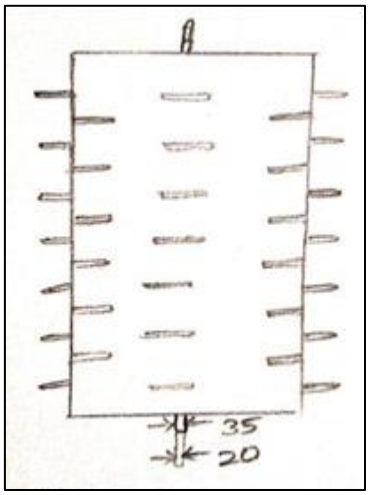

Fig. 2: Top view

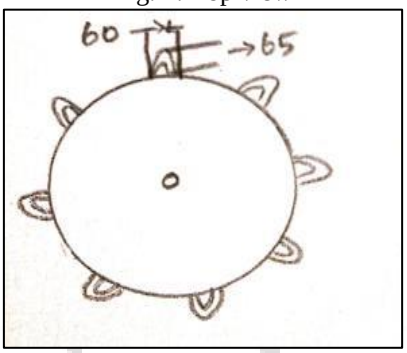

Fig. 3: Side View

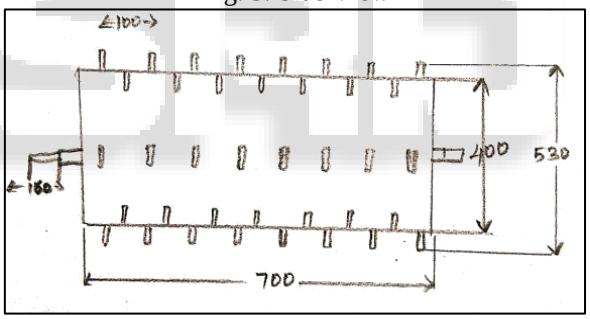

Fig. 4: Front View

VI. ACTIVATION OF WORK

A. *Rotating Cylinder:*

Threshing drum designed for the speed of 660 rpm. The diameter of threshing drum at mid-point is calculated to be 400 mm as threshing drum was to design for paddy; most commonly suitable type viz. loop type drum is selected for the thresher. It orders to reduce the man power requirement and increase the comfort, the thresher is provided with a feeding conveying system. For higher capacity, higher cylinder speed, better threshing the threshing cylinder length to diameter ratio is selected 1.75. The cylindrical drum of M.S. sheet of 16 SWG is fabricated of dimension as 700 mm length and 400 mm diameter. Diameter of shaft for threshing drum was selected by considering torsional moment and bending moment and was 35 mm with total length of 1000 mm. Shaft was supported by means of pedestal ball bearing. Total 104 loops were studded on periphery of drum throughout its length. The height of loop was kept as 65 mm.

This gave tip diameter of the drum of 530 mm. The loops were fixed on drum by welding and placed in staggered fashion. The larger and smaller size loops were fixed in loop in loop. The loops were placed in perpendicular fashion to drum length.

B. Winnower Section:

Winnower is used to clean the grains from the lighter particles of straw especially by throwing it into the air and allowing the wind or a forced current of air to blow away impurities and it is also used to drive or blow (chaff, dirt, etc.) away by fanning. Winnowing improves the cleaning efficiency.

C. Outer Frame Section:

The outer frame is the important and main system in the project. This section is the one which supports all the other components of the project. This is to be designed in way that it can withstand the weight of all the components and also the load which will be exerted on the machine during the time of operation. Angle welded together to form square pipe. Width of frame was selected according to total width of threshing drum with sufficient clearance between drum and angle. Height of frame was selected on the basis of position of threshing drum and average height of human labour. This section will have the surface to house all the components.

VII. Experimental Test Results

It is implemented for the usage of small scale farmers where the larger threshing machineries cannot be affordable to them and moreover it requires less dependency of labours. It retains the full length straw which can be used as raw materials for many industries.

Fig. 5: Prototype Model of grain separator

The engine operated grain separator mainly consists of various components i.e. threshing drum, sieve plate and frame. The main frame of the machine was made from 25 × 25 × 3 mm mild steel angle welded together to form square pipe. The threshing drum used is of loop type cylinder. Threshing drum is designed for the speed of 660 rpm. The diameter of threshing drum at mid-point is calculated to be 400 mm. The cylindrical drum of M.S. sheet of 16 SWG is fabricated of dimension as 700 mm length and 400 mm diameter. The hub was made from two circular plates to both sides on cylinder (size 125 × 25× 3 mm). Total 104 loops were studded on periphery of drum throughout its length. The height of loop and base width were taken as 65 and 60 mm respectively. The loops were placed in perpendicular fashion to drum length. The power required for threshing drum 0.746 Kw (1 HP). For initial scalping operation, the 12.5 × 12.5 mm size of screen was used and fixed below the threshing cylinder with nut and bolt. The size of concave was 134×76 mm and curvature was given to screen below threshing drum. The cylinder concave clearance will be maintained as 20 mm. This threshing drum cover prevents the spillage of grains from above and side of drum. When the straw or bundle is placed on the loop type rotating cylinder, the grains will be separated from the straw. With the help of the winnower, the dust particles and the immature seeds will be removed from the grains. Finally the grains will be collected in the grain outlet.

VIII. Conclusion and Future Work

At the end of the design, construction and testing, a satisfactory low cost grain separating machine having ideal mechanical advantage was fabricated using available raw materials and techniques. The grains were separated from the paddy straw or bundle (after the reaping process) using the grain separating machine. This machine's overall performance was confirmed to be efficient when compared to the already existing machine. The cost of production and maintenance is considerably cheap. Hence the machine will be used by the industries given its performance, affordability and simplicity. Thus a simple design and low cost grain separating machine was fabricated. This machine does not require human labour thus it reduces the dependency on human labour for grain separation. Moreover, full length straw will be obtained after processing and hence more fodders can be obtained. Thus efficiently reducing the labour cost for harvesting.

This project can be designed not only to separate the grains from paddy. By adding small loops to the threshing drum, it can also be used to separate grains from various plants. The pulley belt system can be replaced by gear system to have an efficient power transfer and increase the durability of the machine. The base frame of the machine can be made as an adjustable one so that the machine can be used for variety of farms.

References

[1] Gobbett D L, Hochman Z, Horan H. Yield gap analysis of rainfed wheat demonstrates local to global relevance. The Journal of Agricultural Science, 2017; 155(2): 282–299.

[2] Zami M A, Hossain M A, Sayed M A, Biswas B K, Hossain M A. Performance Evaluation of the BRRI Reaper and Chinese Reaper Compared to Manual Harvesting of Rice (Oryzasativa L.). The Agriculturists, 2015; 12(2): 142–150.

[3] Unakıtan G, Aydın B. A comparison of energy use efficiency and economic analysis of wheat and sunflower production in Turkey: A case study in Thrace Region. Energy, 2018; 149: 279–285.

[4] Alizadeh M R, Bagheri I. Field performance evaluation of different rice threshing methods. International Journal of Natural and Engineering Sciences, 2009; 3(3): 139–143.

[5] Zareiforoush H, Komarizadeh M H, Alizadeh M R. Effects of crop-machine variables on paddy grain damage during handling with an inclined screw auger. Biosystems Engineering, 2010; 106(3): 234–242.
[6] Ndirika V I O. A mathematical model for predicting output capacity of selected stationary grain threshers. Agricultural Mechanization in Asia, Africa, and Latin America, 2005; 36(2): 9–13.
[7] Dhananchezhiyan P, Parveen S, Pandian S. Development and comparative study of cast Iron rasp bar and nylon rasp bar threshing cylinders for paddy threshing.
[8] Boyd R S, Lauwers A V, Farley H M. Combine crop conveying and feeding system, 2016

