

Fabrication of Integrated Thresher and Pallet Making Machine

**Asst. Prof. Safal Shambharkar^a, Ashukesh Pagote^b, Rajat Singh^b, Aditya Parate^b,
Swapnil Gajbhiye^b, Rushikesh Sukhdeve^b, Rohit Chouriwar^b**

^aAssistant Professor, Mechanical Engineering Department

^bStudents, Mechanical Engineering Department,
Jhulelal Institute of Technology, Nagpur, Maharashtra

Abstract: *Rice is one of the chief grains in India, and as such, is a major food crop, especially in the eastern and southern regions of India. Rice production amounts for a sizable amount of economy. However, farmers continue to harvest with the traditional methods, which affect their yield, and thereby affecting their earning. This paper deals with the fabrication of integrated thresher and pallet making machine. marks a significant milestone in agricultural technology, offering a novel approach to streamline multiple processes within a single unit. Traditional agricultural practices often involve separate equipment for crop threshing and agricultural residue management, leading to inefficiencies in labor, time, and resource utilization. In response to these challenges, the integrated machine presents a comprehensive solution by combining the functions of threshing harvested crops and producing pallets from agricultural residues. The fabrication of the integrated thresher and pallet making machine represents a convergence of mechanical, electrical, and agricultural engineering principles. The design and engineering of the machine involve careful consideration of factors such as power requirements, material handling mechanisms, and safety features. Automation plays a crucial role in coordinating and controlling the various operations of the machine, ensuring smooth and efficient performance while minimizing human intervention.*

Keywords: *Crop cutting, Integrated Thresher, Pallet Making, Agricultural Machinery, Optimization*

I. INTRODUCTION

In this current generation most of the countries do not have sufficient skilled man power especially in agriculture sector and it affects the growth of developing countries. So it is a time to automate the sector to overcome this problem. In India there is 70% people dependant on agriculture.

This paper deals with the fabrication of integrated thresher and pallet making machine. represents a groundbreaking advancement in agricultural machinery, revolutionizing the way multiple processes are carried out in the agricultural sector. Traditionally, the tasks of threshing harvested crops and processing agricultural residues into useful materials such as pallets have been performed separately, requiring different equipment and substantial manual labor. However, with the development of the integrated machine, these processes can now be seamlessly combined into a single unit, offering unprecedented efficiency, productivity, and resource utilization in agricultural operations.

The introduction of the integrated thresher and pallet making machine addresses several key challenges faced by farmers and agricultural industries. Firstly, it streamlines operations by eliminating the need for multiple pieces of equipment and manual labor for each task. By integrating the functions of threshing and pallet making, the machine simplifies workflow and reduces the overall complexity of agricultural processes. This not only saves time and labor but also increases the efficiency and productivity of agricultural operations, ultimately leading to higher yields and profitability for farmers. Moreover, the integration of thresher and pallet making processes in a single machine contributes to resource optimization and sustainability in agriculture. Agricultural residues, such as straw, husks, and stalks, which are often considered waste products, can now be efficiently converted into valuable materials such as pallets. This not only reduces waste but also maximizes the utilization of agricultural by-products, promoting eco-friendly and sustainable practices in agriculture.

II. LITERATURE SURVEY

1. Wei-Neng Chen et. al.[1] : Proposed new set based discrete optimization technique is proposed based on the concept of set and possibility theory. In this technique set-based representation scheme is designed to describe the discrete search, based on this representation scheme many different kind of combinatorial optimization problem can be solved. For example a velocity is defined as a set with possibilities, that is , each element in velocity is assigned with possibility. The function is defined as $V1(V_{i1}, V_{i2}, V_{i3}, V_{i4}, \dots)$ based on positioning of (i) particle $X1(X_{i1}, X_{i2}, X_{i3}, X_{i4}, \dots)$ Similarly universal set E is given for N dimension and solution for analysis if found by equation $E = E1 \cup E2 \dots, E1 = f(PS, f, \Omega), \Omega = \text{constraints}$. PS –search space , f – objective function.
2. Michael A. Saunders et. al [2] : Performs a study on constrained optimization through SQP. Sequential quadratic programming (SQP) method is a technique used for optimizing the problems regarding constrained optimization. As in present work the design will be subjected to various constrained regarding geometry, strength, space, weight & cost. Here we consider problems with general inequality constraints (linear and nonlinear). In SQP an algorithm is designed that uses a smooth augmented Lagrangian merit function and makes explicit provision for infeasibility in the original problem. The sequential quadratic programming (SQP) methods is to solve the nonlinearly constrained problem using a sequence of quadratic programming (QP) sub-problems. An alternative QP solver is also proposed instead of algorithm. The optimality of this method gives the feasibility through tolerance band.
3. Kaul et. al [3] : Stated that an optimum speed is desirable to get an optimum performance of a thresher as excessive speed can cause the grain to crack, and too low a speed can give unthreshed heads.
4. A. Valentea et al [5] : This research work proposes an integrated methodology and a software infrastructure to support the process planning and pallet configuration solutions whose major goal is to minimizing production costs – including costs for energy consumption and cutting tool wear - while maximizing the number of finished work pieces per pallet.
5. Pellegrinellia,n, T.Tolio , [6] : This paper studied the pallet sequencing based on the network part program logic. Part program of non-production movements for each possible sequence of two operations are automatically generated at the shop floor level are simulated to obtain the non-production time.
6. Terry D. Gerhardt et al [7] : This paper focuses on the effect of notches on the on pallet stringers such as stiffness and strength of pallet by changing the notch depth and radius of the stringers of pallet and also developed the design equations for conventional double notched oak pallet stringers by using the experimental method and finite element approach.

III. COMPONENTS DESCRIPTION

1. Roller drum
2. Belt pulley Mechanism
3. Feeding System
4. V-belt transmission housing (base).
5. Granulator matrix drive.
6. Granulator rollers.
7. Loading hopper.
8. Electric motor
9. Belt tension device.
10. V-belt transmission.

1. **ROLLER DRUM** : The roller drum having cylindrical shape and is use to remove the grains from the mature crops by its rotational movement. The drum connected to the shaft which is driven by the motor which is been fixed by the pedestal bearing to both the ends of the roller. It has steel planks having tooth which is made up of EN8 material. The roller drum is made up of mild steel material.

2. **BELT PULLEY MECHANISM** : We have used a flat belt pulley system to attach the motor to the shaft of the threshing roller drum. This is the driving force of the machine. The pulley system also helps reduce the speed of the motor.

3. **FEEDING SYSTEM** : The feeding system is responsible for transporting the raw material from the hopper to the pelletizing chamber. Depending on the design of the machine, this system may utilize conveyors, augers, screws, or other mechanisms to control the flow of material into the processing area.

4. **V-BELT TRANSMISSION HOUSING** : The V-belt transmission housing is a protective housing that encloses the components of a v-belt transmission system, including the pulleys and belts. it provides safety for the internal components and helps to keep them properly aligned for efficient power transfer.

5. **GRANULATOR MATRIX DRIVE** : Generator matrix drive is a mechanism used in mechanics typically in industries like agriculture or Pharmaceuticals. it's responsible for controlling the rotation and speed of generators matrix or dye which shape the material into granules of desired size and constituency please drive system ensure efficient and prices resolution process.

6. **GRANULATOR ROLLERS** : Granulator rollers are circular components in granulation mechanism, which are used to break down materials into smaller, more manageable particles or granules. These rollers exert pressure on the materials as it passes through the granulators helping to crush compress and shape it into the desired size and constituency. Granulator rollers play a key role in the granulation process, ensuring efficient and uniform particles formation.

7. **LOADING HOPPER** : The hopper is the initial point where the raw material is loaded into the machine. It serves as a reservoir for holding the bulk material before it is fed into the pelletizing chamber.

8. **ELECTRIC MOTOR** : A single phase IHP induction motor is used to give the sufficient rotation and loading bearing capacity to the threshing roller drum to separate the grains from the mature crops for the particular rice threshing. The pulley of the motor is connected to the pulley of the threshing roller drum by v belt and the mechanism is known as belt pulley mechanism.

9. **BELT TENSION DEVICE** : Drive is a system used to maintain proper tension in a belt-driven mechanism such as n a conveyor belt or power transmission system. it typically consists of a tensioner mechanism that adjusts the position of one of fully to keep the belt at the desired tension this helps ensure smooth operation prevents slippage, and extends the life of both the belt and the pulleys.

10. **V-BELT TRANSMISSION** : V-belt transmission is a type of power transmission system that uses v-shape belt and pulley to transfer mechanical power between two rotating shafts. The v-belt fit into grooves on the pulleys, providing traction and transferring torque from the driving pulley to thr driven pulley. V-belt transmission are commonly used in the various applications such as industrial machinery, automotive engineers, agriculture equipment and HVAC system due to their simplicity efficiency and ability to accommodate misalignment.

IV. METHODOLOGY

We have designed our machine in solid works software; here we have attached some images of the machine which we have designed.

We have designed our machine according to our requirements. But we are ready to apply the changes in design which we get as a result from the trial & error method. As per the design the working procedure of the machine is as follows: Initially when we switched ON the power supply; the motor start and the thresher rotate. The thresher will rotate with the help of electric motor.

The rice plant can passed over the thresher then the rotating motion of the thresher can removed the rice seeds from the plant.



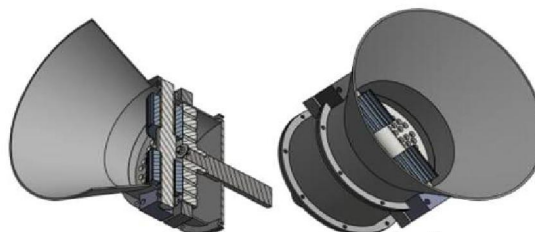
Fig 1. Rice thresher

Applied plant on thresher can remove the seeds from the plant this removed seeds through the front side of the machine.



Fig 2. Rice thresher

The formulated feed that must be turned into pellets is fed via the hopper and then towards the pelleting chamber.



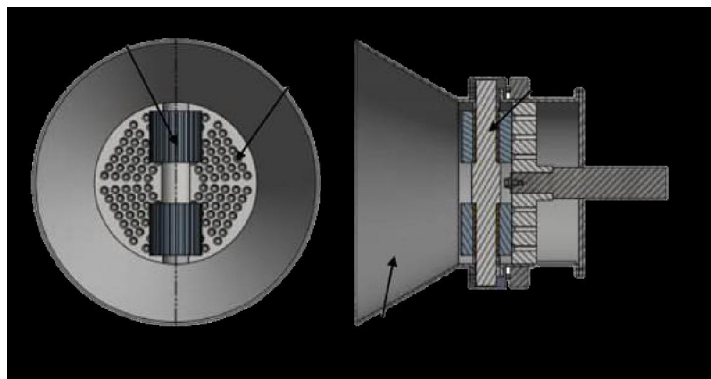


Fig 3. Pellet hopper & roller

The pulley of the die pellet shaft was attached to the pulley of the electric motor, allowing the power source to rotate the die pellet shaft

The spinning of the die drives the rollers to squeeze and compress feed material into the die holes, resulting in feed pellets. A blade sliced the created feed pellets and discharged them through the outlet.

V. WORKING

1. Input Material Loading: The process begins with loading the raw agricultural material into the machine's hopper. This material can vary depending on the application and may include grains, seeds, or biomass such as crop residues or straw.
2. Threshing Process: Once the material is loaded, it undergoes the threshing process. In this stage, the machine separates the grains or seeds from the stalks, husks, or other unwanted materials. Threshing can be accomplished using various mechanisms such as beaters, rollers, or centrifugal force, depending on the design of the machine.
3. Separation of Threshed Material: After threshing, the separated grains or seeds are directed towards one outlet of the machine, where they are collected for further processing or storage. Meanwhile, the remaining stalks, husks, or other residues are directed towards the pallet making section of the machine for further processing.
4. Pallet Making Process: In the integrated machine, the residues from the threshing process are fed into the pallet making unit. Here, the machine compresses and shapes the residues into uniform pellets or pellets. This is typically achieved using a combination of pressure and heat, which helps bind the material together and form solid pellets of consistent size and shape.

VI. EXPERIMENTAL RESULTS

Experiment 1 - Mix in a ratio of 2 rice bran to 2 corn bran. - The product is made into pellets but easily crushed without adhesion.



Experiment 2 - Mix in the ratio of 3 rice bran to 3 corn bran, 100 ml water, and some vegetables to increase the moisture content of the product. - The product is in the form of pellets, the moisture is moderate, and the color is beautiful.



Experiment 3 - Mix in a rice bran and 100 ml water.



VII. CONCLUSION

In conclusion, the fabrication of an integrated thresher and pallet making machine represents a significant advancement in agricultural machinery design and innovation. Through meticulous planning, design, and fabrication processes, we have successfully merged two critical functions into a single, efficient machine. Our research has demonstrated promising results in terms of throughput capacity, operational efficiency, and potential cost savings for farmers.

Special features of the machine: - Time and Labor Efficiency - Continuous Processing - Space Saving - Customization Option - Ease of Operation - Less

material stuck in the press. - The machine can create different kinds of pellet shape because we only need to change the size and shape of the press. - The lid is designed with a quick disassembly system to help workers reduce cleaning time. - The machine is mainly used in the feed-making system by the high-productivity line.

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