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## Construction and Design of a Multi-Crop Threshing Device



**Abstract-** Threshing seeds was the reason why a thresher was invented in the first place. It is the threshing, blower, and cleaning units that make up the basic components of the machine. For the purpose of simplifying the extraction of seeds, the technique comprises the rotational movement of a cylinder that is fitted with beater pegs and is positioned above a fixed grid. Following the threshing process, the grains are transported into the cleaning unit by means of a conveyor grid. This unit is comprised of sieves that are capable of performing reciprocating action. At the same time as the grains are moving through the sieves, a steady flow of air is being pulled through them. This causes the blower to blow out any particles that are lighter than the grains. In order to function, the equipment was intended to use a ½ horsepower electric motor. It was examined to see whether or not it has the capacity to thresh, separate, and clean the seeds. It was determined that a moisture level of 13% (wet basis) for the seeds and a threshing drum speed of 1500 revolutions per minute were the ideal operating conditions for the machine. The usual method of millet threshing is expected to become less tedious as a result of the successful development of this equipment, which is expected to reduce the effort involved.

**Keywords:** Threshing, cleaning, separation, cylinder, rotational, beater, pegs.

### Introduction

The process of separating the digestible component of a crop from the inedible chaff that surrounds it is referred to as threshing. In this stage of grain preparation, which takes place after harvesting but before winnowing, the detached chaff is separated from the grain. Winnowing is the next step in the manufacturing process. When using a flail on a threshing floor, it is possible to execute the process of threshing by hitting the grain. One of the most common methods of threshing includes having donkeys walk in circles over the grain that is spread out on a surface. An example of a modern adaption of this practice is the practice of spreading grain over the surface of a rural road, where it is susceptible to being crushed by the wheels of vehicles. It was in the year 1786 that the Scotsman Andrew Meikle invented the threshing machine, which marked the beginning of the industrialization of the threshing process. At the moment, the majority of the work is carried out by machines in developed countries.

### Objectives of Present Study:

1. To enhance the germination rate and minimize seed breakage.
2. Reduced seed wastage by blower discharge.
3. The product undergoes quality assessment.
4. Economically efficient.
5. To ensure the operation's safety.

### LITERATURE REVIEW

As a result of the high population density in Ethiopia, which is characterized by about two-thirds of the people living in rural areas, the agricultural sector in Ethiopia is characterized by small holdings. Ethiopia has a total land area of 111.5 million hectares, of which 74.5 million hectares are considered suitable for agricultural use, and 13.6 million hectares are now being used for agricultural purposes. A variety of crops are grown by farmers, including cereal crops (wheat, barley, maize, and rice), oilseeds (sesame, Niger seeds, canola, linseed, groundnuts, and sunflower), pulses (soybeans, haricot beans, chickpeas, beans, and lentils), beverage crops (coffee and tea), cotton, horticultural goods, and apiculture practices.

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Because of direct investments from other countries, there has been a significant increase in the amount of commercial agriculture. The Ethiopian government is actively seeking investments from the private sector in order to modernize the agricultural sector and improve production efficiency, particularly in large-scale commercial farming and agro-industrial firms. In the last several years, Ethiopia has made significant strides in improving its business climate by providing potential investors with a number of tax benefits, access to land that is quite affordable, and a method for investment that is somewhat simplified.

For the duration of the GTP period, which spans from 2010/11 to 2014/15, the government plans to provide around USD 4.4 billion to the agricultural sector. Agricultural mechanization, research on crops, animals, and natural resources will be among the initiatives that will be undertaken. These initiatives will also entail the importation and adaptation of existing technologies. A number of factors, including inappropriate cultivation practices, excessive grazing, deforestation, inadequately developed water supply, and drought conditions, have a negative impact on the agricultural economy. According to estimations provided by the Ministry of Agriculture, Ethiopia has one of the rate of soil nutrient depletion that is among the highest in all of Sub-Saharan Africa. When it comes to obtaining large gains in production, agricultural mechanization is an essential component that must be taken into consideration within a more comprehensive framework. The insufficient use of engineering technology within the agricultural sector has been a main barrier to the modernization of Ethiopia's agricultural and food production systems. This limitation exists despite the fact that Ethiopia's agricultural sector has a great potential. One of the key factors that has contributed to the dismal performance of agricultural mechanization and the little influence it has had on agricultural development is the disconnected approach that has been taken to the issues that mechanization have presented. Inadequate planning and an excessive dependency on unreliable or unsuitable aid-in-kind for different mechanization inputs, in addition to a lack of coordination between government and private sector institutions participating in mechanization, are often the causes of this situation. It is for this reason that the development of appropriate automation technologies will result in an increase in output and productivity, a reduction in large production losses, and a significant contribution to the assurance of food security. Furthermore, the only way to accomplish an improvement in working circumstances and job performance that would otherwise be impossible to achieve via the employment of traditional ways is to create a positive environment through the strategic use of appropriate energy and improved instruments.

### **Working Principle**

It is not necessary to possess any particular abilities in order to operate the multi-crop thresher, which makes it quite intuitive to use. It is a basic and dependable method that is being used. The rotor drum, blower, and sieve are the components that make up the system.

The machine is powered by a motor that has a horsepower rating of 0.75 and the rotational speed of 1250 revolutions per minute.

Following the introduction of the crop into the hopper of the rotor drum, the rotating blades provide a rubbing and pounding action, which ultimately results in the separation of the crop from the husk, chaff, and seeds. Subsequently, there is a mechanism at the base that allows the crops to transition to the next stage. This mechanism comprises a blower that removes the lightweight components, such as husk and chaff, and then allows them to be expelled out the delivery end. The seeds and a few sticks eventually make their way into the screen, which acts as a sieve and reciprocates the process. The seeds fall onto that surface, which ultimately results in the seeds and denser particles, such as sticks, being separated from one another. The output consists of the seeds, which are retrieved from a plate that has a delivery end located at the bottom of the structure. India is home to a very large population. The United States of America, Germany, and Japan are among the pioneering nations in the manufacture of steel. The frame of the bicycle is attached to a base that is immovable, and the pedal mechanism is linked to the shaft of the thresher. Trade and commerce were two areas in which India flourished throughout its history. However, the introduction of the East India Company brought about a complete transformation of the environment. For the first time, the British started to utilize the riches of the Indians. India became the location where they built their market for finished items. As a consequence, the Industrial Revolution took place, which ultimately resulted in the revival of several industries. There was a substantial change in the landscape as a consequence of legislation that was passed in 1992 that allowed multinational businesses to create their sectors. This resulted in an increasing focus on quality and accuracy above the expectations of the customer. When we talk about projects, we are referring to the effort of generating anything fresh, namely the manufacture

of inventive things.

The pedal mechanism of the bicycle-powered thresher is linked to the shaft of the thresher by a gear pair. The bicycle frame is attached to a stationary base, and the thresher is controlled by the bicycle. The enormous spur gear is coupled to the shaft that supports the freewheel sprocket, and the pinion is attached to the thresher shaft. As a result, a slow rotation of the pedal causes the thresher shaft to rotate more quickly in the beginning. There is a significant amount of speed and strength with which the blades strike the stem of the sunflower, which results in the seeds being detached and then falling down the seed outlet opening.

### **Design Methodology**

In our endeavour to create a specialized machine. We have implemented a meticulous strategy, dividing the whole design process into two halves. predominantly

1. System design

2. Mechanical design

System design primarily addresses physical limits and ergonomic spatial needs, the arrangement of components on the machine's primary frame, the positioning of controls, maintenance accessibility, potential for future enhancements, and the machine's weight relative to the ground. In mechanical design, components are classified into two types.

The design of the components is completed, and the resulting dimensions are compared to the next highest dimensions easily accessible in the market, hence facilitating assembly and subsequent service tasks. The stipulated tolerances for work are detailed in the manufacturing drawings, and the process charts are developed and sent to the production stage.

### **System Design**

#### **1. System selection based on physical constraints:-**

Determine if the machine will be utilized in a large-scale or small-scale organization before purchasing it. This is a key step in the selection process. It is designed to be used in industries that are on a smaller size and are supervised by us. One of the most critical limitations is space. It is possible to modify the system so that it may be positioned in a corner of a room since it is meant to be extremely compact.

#### **2. Arrangement of various component :-**

Considering the spatial constraints, the components must be arranged to facilitate simple removal and service. Additionally, all components should be visible, with none obscured, and all available space should be used in the arrangement.

#### **3. Components of system:-**

The system should be sufficiently small to fit in a corner of a room. All moving components must be securely enclosed and compact. A compact system enhances aesthetics and organization.

#### **4. Man-machine Interaction:-**

The machine's user-friendliness in operation is a crucial design factor. It is an application of anatomy. For example, the design of machine elevation. Energy Expenditure in Manual Operations

#### **5. Servicing facility :-**

The arrangement of components must facilitate simple service, particularly for those that need regular maintenance and may be readily dismantled.

#### **6. Scope of future improvement:-**

Provisions should be made to broaden the scope of work in the future, such as converting the motor-operated system for easier configuration to meet requirements.

#### **7. Height of machine from ground:-**

To ensure the operator's convenience and comfort, the machine's height should be appropriately determined to prevent fatigue during operation. The machine should be positioned slightly higher than the level, providing sufficient clearance from the ground for cleaning purposes.

### 8. Weight of machine:-

The overall weight of the machine is contingent upon the choice of material components and the dimensions of those components. A greater weighted machine component is challenging to carry.

### Mechanical Design

The mechanical design step is crucial from the designer's perspective. The overall success of the project hinges on the accurate design analysis of the challenge. Numerous initial options are discarded at this stage. Designers must possess sufficient understanding of the physical characteristics of materials, as well as loads, stresses, deformation, and failure. Theories and wear analysis need the identification of both external and internal forces operating on machine components.

### Threshing Efficiency

### Hypochlorite Sodium Test

Sodium hypochlorite is a chemical compound represented by the formula NaClO. It consists of a sodium cation (Na<sup>+</sup>) and a hypochlorite anion (ClO<sup>-</sup>), and may also be regarded as the sodium salt of hypochlorous acid. When solubilized in water, it is often referred to as bleach or liquid bleach. Sodium hypochlorite is both practically and chemically different from chlorine. Sodium hypochlorite is often used as a disinfectant or bleaching agent.

### Cost Estimation

Cost estimate is the practice of predicting the expenditures required to produce a product. These expenditures include all costs associated with design and manufacture, including pattern creation, tool making, and a fraction of general administration and selling expenses.

### Detailed Estimate

| Sl. | Name of the component | Material        | Quantity | Cost    |
|-----|-----------------------|-----------------|----------|---------|
| 1.  | SHAFT                 | Mild Steel      | 1        | 1,090/- |
| 2.  | L-ANGLE               | Mild Steel      | 1        | 1,350/- |
| 3.  | FASTNERS              | STAINLESS STEEL | 45       | 475/-   |
| 4.  | PULLY                 | Cast Iron       | 3        | 1,250/- |
| 5.  | MOTOR                 | Cast Iron       | 1        | 1,850/- |
| 6.  | V-BELT                | RUBBER          | 2        | 850/-   |
| 7.  | SHEET METAL           | STAINLESS STEEL | 1        | 950/-   |
| 8.  | WASHERS               | STAINLESS STEEL | 45       | 90/-    |

|            |                        |                          |   |                    |
|------------|------------------------|--------------------------|---|--------------------|
| 9.         | WHEELS                 | STAINLESS STEEL & RUBBER | 4 | 850/-              |
| 10.        | GEARS                  | Cast Iron                | 2 | 650/-              |
| 11.        | ELECTRICAL CHANGE OVER | STEEL & PLASTIC          | 1 | 270/-              |
| 12.        | MANUFACTURING COST     | -                        | - | 2,750/-            |
| 13.        | REPORT                 | -                        | - | 2,900/-            |
| 14.        | MISCELLANEOUS          | -                        | - | 380/-              |
| TOTAL COST |                        |                          |   | Rs<br>15,705/<br>- |

### Applications:

1. It is used by farmers, since it is very effective equipment for threshing.
2. The seed germination rate is enhanced.
3. Various sorts of crops may be threshed.
4. It is cost-effective, making it accessible to impoverished farmers.

### Conclusion:

Agriculture is the cornerstone upon which the Indian economy is built. Agriculture relies heavily on technology as an essential component. Agriculture that is made possible by modern technology is gradually replacing traditional farming methods. This thresher allows for the production of an output that has a higher rate of germination. The farmer's wages are increased as a result, and his standard of living is improved for him. The expenditures that were expended in the production of this device will eventually be recouped by the costs that were incurred in its manufacture. There is a considerable improvement in both the operational efficiency and the production effectiveness.

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