SEMI AUTOMATED GRAIN AND COPRA COLLECTOR

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ABSTRACT

Grains like paddy, maize, copra etc., after harvestation is spread up in an open area under the sunlight for the drying process. After drying, the grains need to be collected, so we are using a grain collector. Though the machine already exists, we are modifying the manual operated machine into semi-automated by using the motor and also increasing grain collecting efficient. The main objective behind designing and fabricating the bagging and collecting of grains is to reduce the human effort and also reduce the time taken for storing. This project is mainly helpful to neglect the problems faced by small scale farmers relating with the availability of labours and the cost of collecting and storing it finally. It also reduces the cost of the existing machine. We are using locally available materials like mild steel and sheet metal for fabrication. By pushing forward, the grains are collected through a hopper and then it is lifted using the motor. When the lifter plate rotated by motor up to a certain angle, the grains are poured by hopper into the bag. Here, the Motor rating is selected based on the load collected during one cycle and lifter plate weight (approximately 3kg). The total weight of the machine will be around 11kg before collecting grains. Grains spread on the surface can be collected efficiently using this machine. This machine will reduce collecting time and labour costs.

KEYWORDS: DC Motor, Grains, Hopper, Pulley, Rope, Shaft & Sun drying

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INTRODUCTION

As the population increases, the demand for food increases proportionally. Grains are being developed at an increasing rate to satisfy the growing demand for food. Grains like paddy, maize, etc., are harvested and are stored in container/bags for transportation. But before storing of grains, it needs to be dried. Thus, traditionally sun drying is used as a common drying method in many areas. Sun-drying means exposure of grains to direct sunlight by the wide spreading of grains on the floor. Drying leads to reduction in the moisture content of the grains. Presence of moisture in grains will reduce its quality and it will be affected by insects and pests. So, drying should be properly done to remove the moisture content before storing it. A review of previous literature reveals the problems faced by pneumatic based machines. This project comes with an idea to overcome the existing problems.

2. PROBLEM IDENTIFICATION

2.1 Problem Identification in the Existing System

Earlier, pneumatic / hydraulic methods were used to collect grains. The pneumatic based machines use a suction pipe to collect grains from the lower level. The suction of grains is done by creating a vacuum inside the machine and suck the lower level grains. Nevertheless, this device does not collect grains efficiently. The problems faced by this method are:-

- A lot of hazards are associated with pneumatic based machines.

- It needs large maintenance for each part of the machine.
- Skilled operators for operating this machine.

2.2 Objective of the Experiment

- To design and fabricate a semi-automated grain collector using motor-pulley mechanisms.
- To overcome the already existing problems and make benefit to small scale farmers.
- To reduce labour cost and time for collecting grains.

3. DESIGN AND CALCULATION

3.1 Design of Semi-Automated Collector

The below Figure 3.1 shows the design of the semi-automated grain and copra collector.

Figure 3.1: Design of Semi-Automated Grain and Copra Collector

3.2 Calculation

3.2.1 Frame

Thickness of the sheet metal (t) = 1.5 mm

Total weight of the frame (w) = 16 Kg

3.2.2 Dc Motor

For a 12V DC motor,

$$P_{\text{(rotational)}} = 48 \text{ watt}$$

$$= 0.0065 \text{ HP}$$

$$P_{\text{(rotational)}} = M \times \omega$$

Where, ω = Angular velocity

M = Torque

Angular velocity, $\omega = \text{rpm} \times (2 \times \pi) / 60$

12V DC motor has 60 rpm so,

$$\begin{aligned}\omega &= 60 \times (2 \times 3.14) / 60 \\ &= 6.28 \text{ rad/sec}\end{aligned}$$

Torque,

$$\begin{aligned}M &= P_{\text{(rotational)}} / \omega \\ &= 48 / 6.28 \\ &= 7.64 \text{ N m}\end{aligned}$$

To get actual torque divide the torque by factor f,

$$\begin{aligned}M_{\text{(actual)}} &= M / f \\ &= 0.184 / 0.0147 = 12.51 \text{ N/m}\end{aligned}$$

4. METHODOLOGY AND WORK DESCRIPTION

The methodology involves designing new ideas and converting ideas into a final product by using the manufacturing process. Initially, it involves following steps include:-

Identifying the problems

- Collecting the related journals
- Analyzing the gap
- Creating new ideas to overcome them
- Designing of idea
- Fabricating the model
- Testing the results
- Scope for improvements

4.1 Working Principle

This project consists of a base plate in the back part to carry the bag and the front part consists of a hopper to collect grains. The grains are stored in the hopper when the unit is moved forward. Then the hopper is rotated up to a certain angle and the grains collected are poured into the bag. Using rope, the hopper is rotated, and this rope raises the hopper.

4.2 List of Materials

The materials used to fabricate the collector machine is shown in the below table 4.1.

Table 4.1: Components Used

Sl. No.	COMPONENTS	MATERIAL	DIMENSIONS IN mm
1.	FRAME	MILD STEEL	(L×B×H) 1100×430×950
2.	HOPPER	SHEET METAL	(L×B×H) 340×300×740
3.	SHAFT	MILD STEEL	150
4.	SPUR GEAR	MILD STEEL	80
5.	BEARING	STEEL	Hole Dia. =15
6.	BASE PLATE	CARDBOARD	(L×B) 740×430
7.	WHEEL	POLYMER	D=700 t=25

4.3 Fabrication Process

After fabricating each part, the parts are needed to be assembled. The following procedure has been done to assemble our project:-

- Firstly, the total frame is constructed by welding MS square pipe.
- A base plate is fitted above the base of the frame in the backside which is used to place collecting bags.
- A hopper is constructed using sheet metal as per the required dimensions.
- A bearing and shaft are attached at the front side of the frame.
- The hopper is welded to the shaft so that it can rotate freely with the help of bearing.
- A motor is fixed to the top of the frame firmly.
- The motor is connected to a spur gear which is attached with a shaft in order to produce high torque for the lifting mechanism.
- A rope is used for the lifting mechanism. One end is winded over the shaft and the other end is tied with the hopper base.
- When the gear rotates using a motor, the hopper will be lifted with the help of rope.
- The motor is powered using a step-down transformer and a rectifier.

Figure 4.2: Fabricated Model

5. RESULTS AND DISCUSSIONS

The fabricated model is tested by comparing it with the human's work. Thus, the time taken for collecting grains using machine and hands are given below in the table 5.1.

Table 5.1: Testing of Fabricated Machine

S. NO.	PARAMETER	MANUAL COLLECTION	SEMI-AUTOMATED COLLECTION
1.	Grains in kg	50	50
2.	Labours required	2	1
3.	Labours cost/day	Rs.200	One-time investment
4.	Time required	90 sec	40-50 sec

CONCLUSIONS

From the results obtained through testing the collector machine, following advantages are obtained.

- Fabrication of Semi-automated Grain collector machine using locally available raw materials is done successfully.
- The construction of this machine is simple and robust.
- The price of the machine is comparatively lesser than that of the Pneumatic based machine.

- Need less maintenance and less skilled workers to operate.
- More compact in size compared to other types of machines.
- No hazards to operators.
- Single labour is sufficient to operate the machine.

FUTURE SCOPE

The present work can be modified in the following ways

- Using solar panels and batteries to drive the motor can be further implemented.
- The design can be modified by making it more compact and light in weight compared to the present work.

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