Design and Fabrication of Portable Nuts and Grains Collecting Conveyor

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Abstract—Agriculture is now one of the most important sectors in the Indian economy. Nut Cultivation is one of the major livelihoods of farmers of Kerala and Karnataka. Nuts and Grains is commercially available in dried, cured, and fresh forms. Many nuts will be dried by spreading out those on grounds and exposing it to the sun environment. After proper drying, nuts and grains are collected from the ground to basket manually with the help of scraper fixed to a lengthy wooden handle. This process is laborious, requires more time and human effort. Labour Problems in every sector is leading to mechanization of processes. Agricultural sector is also facing such problem due to which most of the farmers tend to give up the practice. The Nuts and Grains Collecting and Bagging machine is new one. The machine is intended to collect nuts, grains from ground directly to gunny bags fixed in a moveable trolley. After the bag is filled, the trolley can also be used to move the bags to store rooms. The machine is operated by a person so that farmer alone himself can use it. In addition, it can be used anytime. Another advantage of this machine is that after loading/filling the nut, grains from ground to bag and also weight indication is provided to check the weight. Since the machine is manually driven, the machine is designed to reduce the user effort.

Keywords — Nuts, Grains, Belt Conveyor, Bucket Conveyor

I. INTRODUCTION

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in material handling and packaging industries. Belt conveyor & Bucket elevator are the media of transportation of material from one location to another in a commercial space. Bucket conveyors are used for vertical or inclined transportation of different grain size materials. These bucket conveyors need no less power consumption.

The material transport is without spillage and contamination, the closed conveyor design prevents dusting. Product is conveyed directly on the bucket so both regular and irregular shaped objects, large or small, light and heavy grains can be transported successfully. Buckets are attached to a rotating belt/drum and fill with the material at the bottom of the elevator then move it to a designated point. Now a day’s labour’s problem is one of the major problems especially in agriculture sector. Some of the problems that are faced by farmers from labours are delayed reporting time, inefficient working and higher wage. Hence to tackle labour problem farmers has to find some alternative means to carry on their tasks. After harvesting from the plant/tree, the nuts are dried by exposing it to sun on flat prepared ground for about 30-45 days, depending on intensity of sunlight. These nuts after sufficient drying it is put in to use. The collecting process manually requires 3 - 4 persons in which one or two people is required to hold the gunny bag. This task consumes lot of time to collect the areca nut for more no. of gunny bags. Therefore, if human interfere is more and money spent on labours also increases.

II. LITERATURE SURVEY

Ghazi Abu Taher et al: Published a paper which is mainly based on the combination of Belt & Bucket Conveyors to perform complex task within a short time and successfully in a cost-effective way. Bucket elevator OR conveyor are the media of transportation of material from one location to another in a commercial space. Belt conveyor has huge load carrying capacity, large covering area simplified design, easy maintenance and high reliability of operation. Bucket elevator can be of great use during bulk material handling. [1]
Mukund V. Pawar et al: Made a study on material handling systems and proposed a project to reduce the effort required by worker at construction site, also to reduce the manpower needed for the same purpose & run this machine without electricity as an energy source so that we can also save it. A material-handling system can be defined as movement, handling, storage and controlling of materials throughout the process. [2]

Punithkumar N.K et al: Conducted a research for Areca nut collecting and bagging machine technology to understand more about the current scenario. To overcome the problems of an existing concepts like motorized, engine, solar and pedal operated the proposed design is best suitable for collecting and bagging the areca nut from ground to gunny bag. The machine is operated by a person so that farmer alone himself can use it. [3]

Vaitla Rakesh et al: Published a paper which provides to design the conveyor system used for which includes belt speed, belt width, motor selection, belt specification, shaft diameter, pulley, gear box selection, with the help of standard model calculation. Belt conveyor is the transportation of material from one location to another. [4]

Dr. Ashok Mehatha et al: Published a paper which provides detail about a machine intended to collect areca nuts from ground directly to gunny bags fixed in a moveable trolley. After the bag is filled the trolley can also be used to move the bags to store rooms. The machine is operated by single person so that farmer himself can use it. In addition, since the machine doesn’t use any power units, it can be used anytime. Since the machine is manually driven, the machine is made light weight materials to reduce the user effort. The major enabling mechanism in the machine is an inversion of slider crank mechanism that pulls the areca nuts from ground. A belt driven Conveyor carries the collected areca nuts up into the bags. [5]

III. WORKING PRINCIPLE

Rotary Drum: Used to rotate the belt conveyor using rotary gear mechanism.
Gear: Used to rotate the drums, driven by wheels.
Tray: Used as path flow between ground and frame, nuts and grains flow over this to get collected inside buckets.
Conveyor: Used to move materials from bottom to top, consist of buckets for collection. The belt is rotating upon drum rotation.
Wheels: Used for movements of machine, as operator pushes the machine from behind using handle.

i. The whole mechanism is used to collect and bag nuts and grains using conveyor which is mounted on a movable machine.
ii. The Belt Conveyor is made up of a belt drive consisting of buckets that carry the nut and grains in the constrained space. The rotary gear mechanism consists of rotary drums which is driven by wheels.
iii. When machine is moved with handle wheels moves forward, which make 2nd gear(pinion) rotate, then meshed gear rotate drum in anticlockwise. Upon moving front nuts keeps coming inside buckets and that keeps rotating.
iv. The collected nuts in buckets is transferred to the collecting bag, at the back of belt elevator.
v. Product design is the process to full fill the needs of the customer or the market place in which the generated product takes the value.
vi. A weighing scale can be used to measure the weight of filled bag.

IV. WORKING SYSTEM

After literature survey and reviewing, a model is developed and fabricated to collect and bag nuts and grains directly from ground. Main body consisting of Chassis Frame, on front a tray will be given for path flow between it and frame. Frame attached with wheels for movements. Drum fixed with belt conveyor rotating due to rotary gear mechanism. Gear is connected to wheel shaft. Two Gears meshed connected to two parallel shafts.

Figure 1. Model Front View
V. CALCULATIONS

1. Volume of 1 bucket = \( \frac{1}{2} \times l \times w \times h \)
   \( = \frac{1}{2} \times (0.31 \times 0.06 \times 0.05) \)
   \( = 4.65 \times 10^{-4} \text{m}^3 \)

Considering the use of coffee seeds for testing purposes,

Density of coffee = \( 365 \text{ kg/m}^3 \)

Density = \( \frac{\text{mass}}{\text{volume}} \)

Mass = density \times volume
\( = 365 \times 4.65 \times 10^{-4} \)

2. \( M = 0.2 \text{ kg} \)

To find Conveyor belt speed

Diameter of roller = 5.5 inches = 0.1397m
Circumference = \( 5.5 \times \pi = 17.26 \text{ inches} \)
Every time the roller completes one rotation, the conveyor is moved a linear distance equivalent to circumference of roller.
Number of full rotations made by the roller in 1 minute = 16
Linear distance traversed by a point on the conveyor belt in 1 minute
\( = 17.27 \times 16 = 276.32 \text{ inch/min} \)

\( \frac{276.32}{\frac{12}{3600}} = 0.116 \text{ m/s} \)

3. The speed of the conveyor belt is = 0.116 \text{ m/s} 

VI. RESULTS

Testing was carried out in one trial where in 30kgs of coffee seeds were placed on the floor for collection.
Testing yielded the following results
- Each bucket has a capacity of holding 0.2kg of coffee seeds.
- In one complete rotation of the conveyer belt 2.8kg of coffee seeds can be collected.
- All the seeds were collected and bagged in 10 to 11 rotations of the conveyer.

VII. CONCLUSION

From the test results the following conclusions can be made
- The grain collecting machine was successfully able to collect the seeds and convey them to the bag.
- This has reduced the labour costs incurred.
- This has also reduced the time interval taken in between collection process.

REFERENCES