

Design and Analysis of Bulk Feeding System

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Abstract: *The growing need for poultry products by users has urged the necessity for small and medium scale poultry farmers to meet up the demand since they supply the bulk need of the market especially in the developing countries. This project is devoted to design and analysis of bulk feeding system for the application of poultry farms. The project implements the design and analysis of feeding system of mechanical system to quantitative and qualitative feeding system. This system uses both horizontal as well as inclined screw conveyor roller mechanism to dispense the food in feed trough. This screw conveyor roller has significance like high rate of production and minimum per unit cost of product. In this project the variety of operations are performed at common work station. In present project the intensions is given on quality improvement along with production rate and cost minimization. Bulk Feeding components are modeled in CATIA with selected dimensions for sheet metal plate. Finite element analysis is conducted for screw conveyor roller obtaining deformation and stresses on roller component by using ANSYS software.*

Keywords: *Automatic feeding equipment, small, medium and big poultry, design, analysis, testing, feeder, hopper, Conveyor screw*

I. INTRODUCTION

The design and analysis of bulk feeding system, Few years ago, almost all poultry feed was distributed by hand to birds mainly in square bottom troughs, wooden or metal feeders. Later mechanical and automated feed systems were invented and they help to modify the feeding system, save labour and increase production. Nowadays, the automated feeding system is available in the market. This method is actually better than manual. But, there are also some problems and weaknesses that need to be overcome and solved, firstly, the automation, of the computerized method is suitable and caters more to the commercial purpose. Also there is the need for huge investment for equipment and devices, and precise manual guide and knowledgeable as well as skilled people to operate the machines.

Now a days fast improvement in feeding process, there has been a substantial decrease in the time it takes to grow a broiler to market weight. Much of this

improvement is subject to increased food intake. The invention of improved mechanical feeding system led to a dramatic reduction in stress due to the elimination of manual feed sorting and relocation of birds by weight, more efficient feeding, less disturbance by staff.

The elimination of meal replacement due to better weight control monitoring and increased productivity due to less handling. All of these factors contribute to the realisation of the birds' genetic capabilities. Before the development of the automatic feeder technology, people were used to the conventional method of feeding chickens which is by filling containers with grains and foods manually. The main problem encountered by using this method is, the need to continuously provide the food, be alert and conscious of the food remaining in cages by the feeder.

The sufficient amount of the food provided also cannot be determined clearly. There is much waste and is non-economical. There are various designs of feeding equipment which vary from country to country. Irrespective of the method of design and analysis, the guiding principles in feeder design is that it must be easy to fill and clean, built to avoid waste. Thus our project aims at the design and analysis of feeding screw in bulk feeding system.

There is no doubt that accuracy achieved by the new ideas in design and construction applied by the conveyor roller designer, coupled latest development made in related fields made more productive, quality, time durability and economical. Hardened and toughened new part & heat treatment process made the design easy.

The value of feeder design factor is required to be higher in case an intermediate section of casting is required between the feeder and the hot spot.

- **Feed path:** A clear path of feeder is defined in between the feeder and the casting region. Necessarily, for the flow of bird food from feeder to the bird. To attain the above condition, the feeder is required to be designed in way of neck of feeder.
- **Feeder volume:** the feeder is required to balance the process of solidification shrinkage in the region of bird feeder. The feeding efficiency of the feeder is dependent on the feeder dimensions, its shape, and

type of feeder. When the single feeder is associated with various other casting, the feed metal volume condition is probable to fail for large casting having thin section.

II. TYPES OF FEEDER

Feeder are classified by type of different design performed and type of construction of poultry sites. The various types of Feeder are as:

1. Ground : many species of bird prefer to feed on large, flat surface and may not visit any type of elevator feeder. These type of condition ground feeding system used.
2. Large hopper : A hopper feeder is a platform upon which walls and a roof are built, forming a hopper that protect seed against the weather. Large hoppers attract most species of feeder bird and will allow large species. These type feeder uses large amount of feed stores and large quantity bird plant.
3. Large tube feeder: A tube feeder is hollow cylinder, open made of plastic with multiple feeding port and perches. Tube feeders keep seed fairly dry. This type of feeder use small birds..
4. small tube feeder: this type feeder is like large tube feeder but small tube like cylinder used in this feeder. This type of feeder used for small skill bird plant.

Silo feeder: This type of feeder is fully automated system, which consist of any component. This type of feeder is large skill and feeding capacity is also high. Now a days this type of fully automated feeder a many used in large poultry project.



Fig.2.1 Main silo tank for feed storage

It has become the practice more and more to produce from other material by some form of design and analysis process, work on that would have been made

from various part, drawing or design two or three decades ago. Also, the handling of both strip material and semi-finished components has assumed an importance simply because fast and efficient movement means cheap products from operators who do not suffer fatigue from the handling of awkward or heavy components. However, it should not be forgotten that press design has made many advances in recent years in common. So development of a computer-aided progressive feeder design and roller is become beneficial because of the ability to build feeding in less time and at a lower cost.

2.1 Main Purpose Fixture

- A) Reduce the Cost of Production
- B) Maintain Consistent Quality.
- C) Increase feed transfer rate.
- D) To reduce material required for production and to improve the quality and productivity.

2.2 Scope

- a) To design a feed conveyor screw roller for the operations of feeding process, cost reduction, increase cycle time.
- b) By using analyzing methods, analyses the feed conveyor screw roller for quality, productivity, production time and lowering of cost of production.

2.3 Working

Case study - In this project case study of different metal is deformed to a shear failure in order to work various condition.

Costing – costing of material which are used in bulk feeding system.

Drawing – Drawing is a deformation that involving considerable change of shape.

Design – Design the drawing in 3D model using software.

Design verification – Check design and failure.

Analysis – Analysis design by using software.

2.4 Elements of Bulk Feeding System

- Silo tank - It is one of the basic elements of the bulk feeding system which can be defined as a silo is a cylindrical tower used for bulk storage, like grains, feed that stands near farms, plants. Silo tank is a tall tower

with a cylindrical (rounded) shape. The purpose of silo tank holds anything the farmer needs to store in bulk, especially feed for the animals and birds.

- Feeding screw- The working of the feeding screw is screw that imparts feed motion as in a lathe compare lead screw. A long screw employed to impart a regular motion to a tool rest or to the work. In bulk feeding system feeding screw work for transport feed for tank to bird.
- Accu-feed boot assembly – The accu-feed boot is a handle a much large spool as well as heavy material. A large arm, strong drive transmission and revised part eliminates reverse bending during the feed process and heavy gauge materials. This is automatic operates in bulk feeding system.



Fig.2.4.1 Accu-feed boot screw

- Hopper – Hopper is an initial components of bulk feeding system. Hopper defines a container that is used for pouring material such as grains or bird food into a machine or opening. Hopper can be used as a container, as a crafting ingredient, and feed components. Hopper has an output tube at its bottom that can face down and provides visual feedback of which direction the hopper will output items to if a container or tank is present.
- Vertical panel- A vertical panel consist of boot assembly. Vertical panel holding the accu-feed boot assembly. Accu-feed boot assembly operates using and supporting through vertical panel.
- Motor – In feeding system various HP motor are used in this assembly. 0.25 Hp motor used for boot assembly, 1.5 Hp motor used for vertical panel. 0.5

Hp motor used for trolley. Motor main work is supply to the components and assembly.

- Feed trolley – A trolley is a small vehicle like with wheels that can carry things. People and automatic assembly can push trolley easily. There are different kinds of trolleys. In feeding system feed trolley are used, it can carry feed through the birds. This trolley works automatically using assembly.
- Silo boot – silo boot is a control unit which is placed in the bottom of hopper. Silo boot controls the feed supply rate. Required amount of feed collect from hopper and carry to feed screw. Silo boot control the extra amount of feed from hopper. This is a main unit and compounds in bulk feeding system
- Heavy plastic screw – These are located in the accu-feed boot assembly. These are heavy plastic used because of maximum strength. These screw carry feed from hopper to boot and boot to screw conveyor. These plastic screw move continually along with itself and carry feed to screw conveyor.
- Big conveyor pipe – Big conveyor pipe is a carry unit, with consist of conveyor feed screw. In this conveyor pipe large capacity to carry food from tank assembly to plant assembly. This is a main input device to connect silo tank and plant assembly.
- Feed sample- feed sample is a one of main part in feeding system. In poultry farms feed sample are mainly used grains like a main food for birds. Feed sample size and weight mainly considered in design of feeding system. In our project feed sample is 1.5 to 2 gm. per sample but feed carry capacity is mass unit quantity.
- G I Pipe –G I pipe are used for big conveyor pipe for high strength and good quality. 5 mm thickness and 20 cm diameter pipe are used for assembly. It consist of screw roller for carry feed.

- MS Material- MS material are used for manufacturing screw roller assembly consist of shaft. 3 mm MS sheet are used for manufacturing assembly in bulk feeding system.

electrical drafting, electronics drafting and aeronautical drafting.

AUTOCAD and CATIA is used for drafting the components and the assembly.

III.DATA ANALYSIS AND INTERPRETATION

3.1 Reading table :-

SR. NO	WEIGHT (in gram)	RPM	TIME (in sec)
1	1075	2822	60
2	1125	2831	60
3	1170	2842	60
4	1150	2818	60
5	1090	2827	60
6	1120	2825	60

Interpretation –

From above table it shows that the total average quantity of feed is 1100 gram dispensed in a one minute (60 sec) with respect to average 2800 rpm of feeding screw.

III. MODELING

3.1 Cad Modeling

AUTOCAD and CATIA is a computer aided drafting software program used for creating blue prints for mechanical, automotive, aerospace, shipping, ocean engineering etc. AUTOCAD and CATIA is used mainly by drafters, although engineers, surveyors and may need to use the software time to time. AUTOCAD and CATIA is a 2-D, 3-D computer aided drafting software used in architecture, construction and manufacturing to assist in the preparation of blue prints and other engineering plans. Professionals who use AutoCAD and CATIA are often referred as drafters. While drafters to work in a number of specialties, this is most common specialization areas are mechanical drafting, architectural drafting, civil drafting,

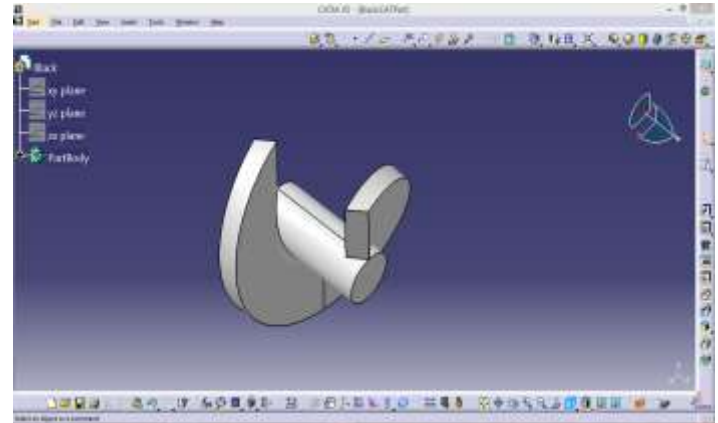


Fig. 3.1.1 3D CATIA model of screw

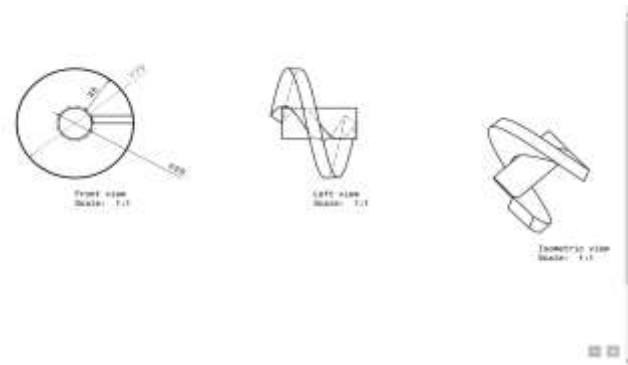


Fig. 3.1.2 CATIA 2D model of screw

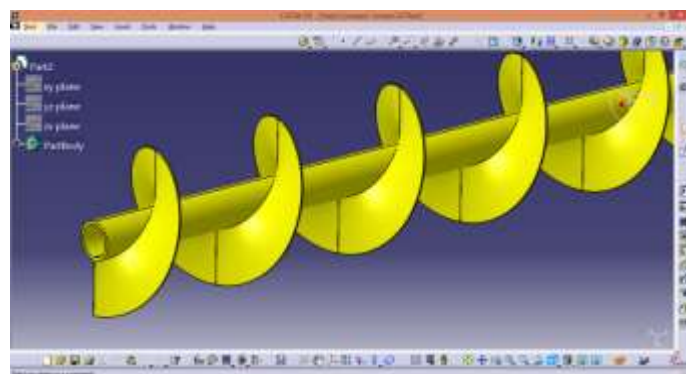


Fig. 3.1.3 3D CATIA model of conveyor screw

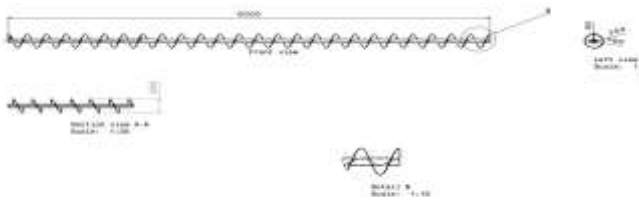


Fig. 3.1.4 CATIA 2D model of conveyor screw

Dimension of screw –

1. FEED SCREW FOR BOOT –

Total length = 460 mm

Pitch = 45 mm

Shaft = 557 X 16 mm

3.1 FINDINGS:-

1. Time required to dispense feed through Accu-feed assembly is 1600 gram per minute.
2. Requirement of feed for one bird at time is 30gram.
3. For these feeding process we need to two stroke feed of 30 gram feed for one bird
4. Total cycle time is 45 minute, which is more as it is “Automatic system”.
5. Two stroke required to 30 gram feed to a one bird.

3.2 Suggestions -

1. As it is automatic feeding system time required to feed to bird 45min is also more it can be minimized by feeding amount in one stroke instead of two strokes
2. it can be done by increasing RPM of screw or adjusting.
3. It can be done by adjusting screw pitch, by increasing rpm and by decreasing pitch distance.

3.3 Utility of Project to Organizations -

1. Increase productivity.
2. Decrease cycle time.
3. Increase customer satisfaction

IV. CONCLUSION

The design and analysis of bulk feeding process includes various steps. We have studied the necessity of designing and analyzing of bulk feeding process for reducing production, increasing quality and productivity, lowering of cost etc. Also, we studied various literature related to journey of bulk feeding process. The project development includes from design model to analysis of bulk feeding process.

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