

A review: Design and Development of Bucket Elevator for Small Scale Industry

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Abstract— In a rural Area there is increasing demand of cattle feeds. Whereas there is animal husbandry is the main resource of money. Animals in India have limited access to cultivated green fodder and grasses. Most of the macro and micro nutrients to meet animals' requirement are provided by compound feed, especially on crop residue based diets. Now days for completing these demand of cattle feed product various manufacture are work on it. To production of maximum amount of feed within the less time. But the problem occurring is, there is more interference of human being while operating which tends to require more time and more manpower at time of production on actually at workplace. This is increasing costing and also time requiring for product. Our aim of project is to be reducing human interference and also product within less time. We are working on bucket elevator to lifting the raw material from ground level to hoper of cattle feed machine. Bucket elevator is 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. Belt Conveyor system is also used in material transport in foundry shop like supply and distribution of molding sand, mold sand removal of waste. On the other hand Bucket elevator can be of great use during bulk material handling.

Key words: Belts, Belt Conveyor, Drive Units, Conveyor Frame, Weight Sensor, Bulk Material, Roller

I. INTRODUCTION

Initial stage is to form a pre project plan. During the project design stage for the transport of raw materials or finished products, the choice of the method must favor the most cost effective solution for the volume of material moved; the plant and its maintenance; its flexibility for adaptation and its ability to carry a variety of loads and even be overloaded at times. Again a rough sketch of the proposed machine is evaluated so that the basic parts can be easily understood. More importantly a development team was formed to monitor the design to be robust and accelerate the work.

Bucket elevators are the most used systems for vertical transport of bulk, dry, wet and even liquid materials. Designed with various options of height, speed and constructive details depending on the type of material to be transported. are constructed by pieces or units to allow defining efficiently the needed height. Used for transport of abrasive and big size materials. Chain/belt travelling speed is low. Used for transport of materials that offers no resistance to extraction, like fine grain and dusty materials. A bucket elevator consists of a series of uniformly fed buckets mounted on an endless chain or belt which operates over head and foot wheels. The buckets are used to elevate (usually vertically) pulverized, granular, or lumpy materials.

The material is received at the boot, raised and then discharged by passing over the head wheel at the top, into a discharge chute. Generally this mechanism is enclosed in a casing, especially the head and foot sections. Some elevators are self-supporting, but more often they are supported by, or at least braced against a structural steel frame. Inclined elevators, which are seldom enclosed, are popular for handling.

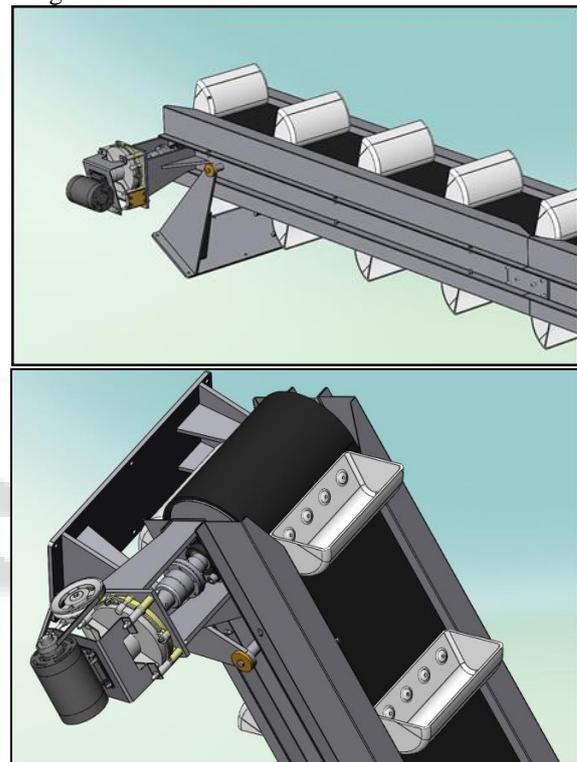


Fig. 1: Primary sketch of bucket elevator machine

Nearly all centrifugal discharge elevators have spaced buckets with rounded bottoms. They pick up their load from a boot, a pit, or a pile of material at the foot pulley. The buckets can be also triangular in cross section and set close to on the belt with little or no clearance between them. This is a continuous bucket elevator. Its main use is to carry difficult materials at slow speed. Early bucket elevators used a flat chain with small, steel buckets attached every few inches. Current construction uses a rubber belt with plastic buckets. Pulleys several feet in diameter are used at the top and bottom

II. HOW TO BUCKET ELEVATORS WORK?

In simple terms, bucket elevators vertically convey bulk materials. They are considered similar to conveyor belts, with the greatest difference being that bucket elevators move material using buckets attached to a rotating belt or chain. The buckets work to pick up material, move it to the desired endpoint, discharge material, and finally return to

the starting point to pick up a new load. Bucket elevator configurations are engineered based on the application, material, required horsepower, and elevator height. Configuration options include centrifugal bucket elevators and continuous bucket elevators, with both models including belt and chain options.

III. PROJECT PLANNING

Our project is based on the handling of bulk material and its packaging process. It is a combination of bucket elevator and belt conveyor. A weight sensor is attached with the microcontroller which helps to package the bulk material at proper amount. At first we thought about the design of this machine. Though we build a prototype we had to be careful about the design and dimension. After surveying on various industries we cleared our concept and designed our machine with proper dimension.

IV. CLASSIFICATION OF BUCKET ELEVATOR:

Generally bucket classified based on the two types,

- 1) Belt type bucket elevator.
- 2) Chain type bucket elevator.

Now days there are many types of bucket elevator are available and each one is different from according to their feature, application, and design. Major classification of bucket elevator is as follows;

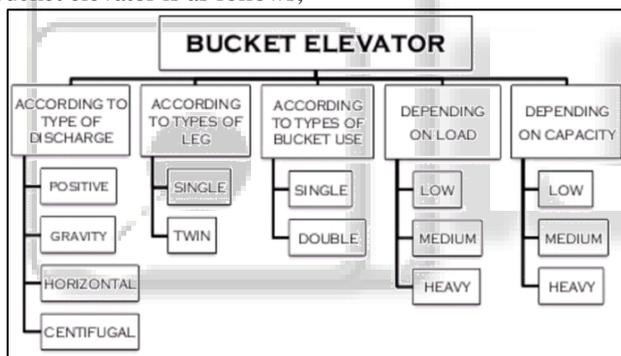


Fig. 2:

A. Centrifugal Bucket Elevators :

A centrifugal bucket elevator employs centrifugal force to throw material out of the buckets as they travel over the head pulley or sprocket. This type of bucket elevator operates at a higher speed and spaces buckets further apart versus continuous bucket elevators. The result of the high speed and bucket spacing is optimized material fill and reduced interference between buckets. Centrifugal bucket elevators are available with belt or single chain.

B. Continuous Bucket Elevators:

Continuous bucket elevators operate at a low speed with closely spaced buckets compared to centrifugal bucket elevators. This action permits material flow over the backside of the preceding bucket. Additionally, extended sides on the buckets gently guide material into the discharge spout. These modifications create an ideal environment for fragile, abrasive, and sluggish materials. Benefits include limited material aeration, minimized breakage of friable material, and minimized product damage of fragile material. Continuous bucket elevators are available with a belt, single

chain, or double chain. In addition to varying configuration options, there are also a number of bucket options available, with material and elevator design being primary bucket selection criteria.

C. Cement Mill Bucket Elevator:

Cement Mill Bucket Elevators are furnished with Style AC buckets mounted on a single strand of chain. When buckets are closely spaced, material is directed to the buckets through a loading leg. If buckets are more widely spaced, loading is accomplished through a combination of picking up the material from the boot and direct loading.

D. Super Capacity Bucket Elevators:

Super Capacity Bucket Elevators are a continuous type elevator in which the buckets are mounted between two strands of chain. This design permits the bucket to extend back of the chain centerline resulting in greater capacities. Thorough the loading leg. Material is discharged by centrifugal force over the Head Sprocket.

V. LITERATURE REVIEW

A. Snehal Patel, Sumant Patel, Jigar Patel, et.al.

This paper deals with the design and analysis of different parts of elevator for conveying different types of materials. The modeling of bucket elevator done using solid modeling software and analyzed using conventional finite element software (Ansys) and stresses and deflections are obtained. This study also shows that the negative influences of support of the shaft reflected through the increase in the stress concentration and occurrence of the initial crack are the main International Journal of Engineering Science and Computing, July 2016 8350

B. N. Yashaswini, Raju. B and A. Purushotham, et.al.

“Authors have designed a bucket elevator and analyzed it for conveying granular materials to the height of 15m at the rate of 10 tones/hour output. This paper gives basic design calculations for the development of the bucket elevator, in 3D environment of NX software. Static and vibration analysis carried out on the bucket elevator in order to need the required output from 10 tonnes/hr-20 tonnes/hr. This paper also gives the dynamic behavior of the bucket and gear shaft assembly. The results obtained from the analysis study critically examine the modification of design parameters.

C. Snehal Patel, Sumant Patel, Jigar Patel, et.al.

This work deals with the design and analysis of elevator for conveying granular materials at 2 tonnes/hr output and lifting height 12m. Modeling of different components of bucket elevator has been done using 3d Solid Modeling software based upon the dimensions obtained from analytical design. The new modified design of the bucket elevator is proposed and validated using CAE tools which are well within the safe limit. Bucket elevator mainly fails due to breaking occurs at the inner edge of the pulley, it consider as fretting corrosion. So new material EN24 has been suggested for the shaft. From the analysis, it can be seen that for modified design has higher FOS than existing design.

D. Hemlata H.Mulik, Bhaskar D.Gaikwad, "Design of Sugar Bucket Elevator and Roller Conveyor Chain for 20 Tonnes per Hour Capacity", *International Journal of Engineering Trends and Technology*.

In this paper the different components of roller conveyor chains are designed for sugar bucket elevator used in sugar industries for 20 tonnes per hour capacity and the loading conditions are described. the advantages of chain drive as compared with other drives are discussed. The chain wear mechanisms found in literature are listed. Abrasive and adhesive wear between pin, bushing, and roller are also discussed.

VI. MODELING OF BUCKET ELEVATOR

A. Cad Model

Computer-aided design (CAD), also known as computer aided design and drafting (CADD), is the use of computer technology for the process of design and design documentation. Computer Aided Drafting describes the process of drafting with a computer. CADD software, or environments, provides the user with input-tools for the purpose of streamlining design processes; drafting, documentation, and manufacturing processes. CAD is mainly used for detailed engineering of 3D models and/or 2D drawings of physical components, but it is also used throughout the engineering process from conceptual design and layout of products, through strength and dynamic analysis of assemblies to definition of manufacturing methods of components. It can also be used to design objects.

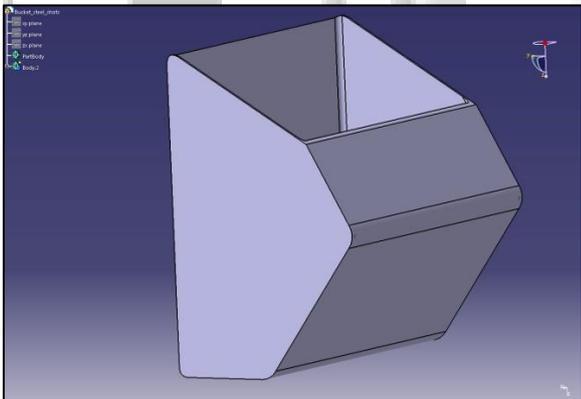


Fig. 3: Bucket elevator CATIAV5

B. 3D Model of Bucket

With the help of NX, 3D model of bucket elevator is developed and is shown in fig. 1. The mesh model of the bucket

C. Objective:

To provide auto belt tensioned unit to existing bucket elevator for handling of grains in cattle feed, which should be reliable, safe and of less maintenance cost.

D. Methodology:

- 1) Requirement understanding
- 2) Problem identification
- 3) Solution of Problem
- 4) Data collection

- 5) Development of solution
- 6) Review of task
- 7) Delivery of task

VII. CONCLUSION

The current development of automatic bucket conveyor unit is used to avoid more human interference and maintain constant discharge of equipment which in turn reduces the downtime of equipment, reduces manual work of operators, improve efficiency and productivity of equipment and reduce the cost of operation . this project will be base for future development on the tensioner unit in the bucket elevator and other similar kind of equipment .

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