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Design and Fabrication of Bucket Elevator

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Abstract: Bucket elevators are mostly used as transporting method for many industries. Selecting this method commonly depends upon material to be transported, its weight, height, matter. Usefulness of this system totally depends upon type of material to be transporting. This system comes under material handling equipment. In this paper practical application of bucket elevator is considered, where belt drive operated elevator is analysed.
Keywords: Bucket Elevator, Chain Drive, Material Handling, Productivity

I. INTRODUCTION

Bucket elevators belong to a group of vertical or inclined transport equipment that efficiently moves goods between floors, vessels or other structures. These are the simplest and the most dependable units for performing vertical lifting. They are available during a wide selection of capacities and should operate entirely within the open or be totally enclosed. The trend is toward highly standardized units, except for special materials and high capacities, it's knowing use specially engineered equipment. Main design variations are found in: casing thickness, bucket thickness, belt or chain quality and drive equipment.

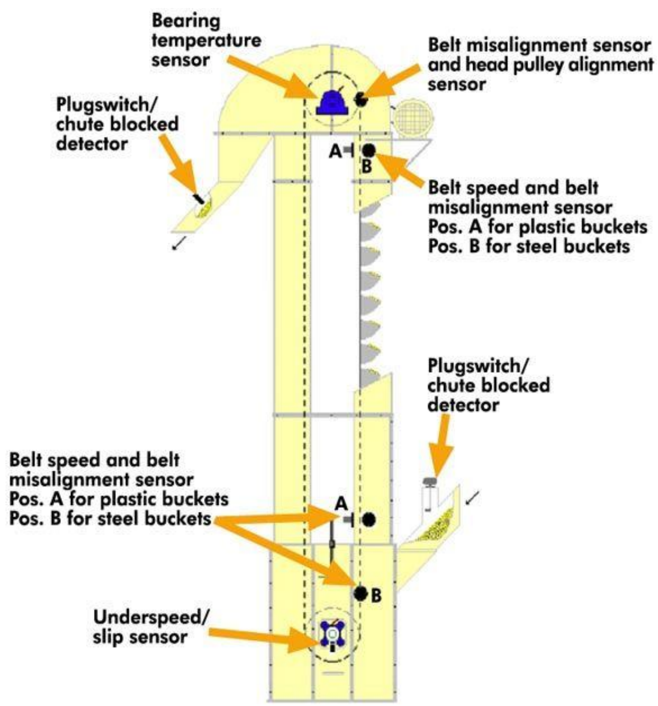

Fig.1 bucket elevator

It consists of:
1) Buckets to contain the material;
2) Belt to hold the buckets and transmit the pull;
3) Devices to drive the belt;
4) Accessories for loading the buckets or learning the fabric , for receiving the discharged material, for maintaining the belt tension and for enclosing and protecting the elevator.

A bucket elevator can lift different types of bulk materials, from light to heavy and from fine to large grains. A centrifugal discharge elevator could also be vertical or inclined. Vertical elevators depend entirely on the action of force to urge the fabric into the discharge chute and must be run at relatively high speeds. Inclined elevators with buckets spaced apart or set approximate may have the discharge chute set partly under the top pulley. Since they are doing not depend entirely on the force to place the fabric into the chute, the speed could also be relatively lower. [3]

Centrifugal discharge elevators mostly have spaced buckets with rounded bottoms. They devour their load from a boot, a pit, or a pile of fabric at the foot pulley. The buckets can have triangular cross sections and may be set close on the belt with little or no clearance between them.

Now a days bucket elevators use a flat chain with small, steel buckets attached at every few inches. Current designs use a rubber belt with plastic buckets. Pulleys several feet in diameter are used at the highest and at rock bottom . electrical motor drives the top pulley. The bucket elevator is that the enabling technology that permitted the development of grain elevators. A diverter at the top of the elevator allows the grain to be sent to the chosen bin.[4] A similar device with flat steps is occasionally used as an elevator for humans, e.g., for workers in parking garages. (The public generally considers this sort of elevator too dangerous to allow use.)

There are three common bucket elevator designs in bulk material handling facilities worldwide:

a) *Centrifugal Discharge Elevator:* Typically, this elevator is used in grain handling facilities along rivers, ports or on the farms. The elevator buckets discharge product freely by the utilization of force. Product pushed out of the bucket into the discharge spout located at the highest of the elevator by means of gravitational force. Buckets are attached onto belt or chain at regular distance to avoid interference in loading and discharge. This type of elevators is usually vertical operational and may handle practically any free flowing fine or small lumpy materials. The material is poured into the boot of the elevator and lifted up by the buckets as they pass round the bottom pulley or sprocket. The material is discharged by force because the buckets skip the top or sprocket.

b) *Continuous Discharge Elevator:* In a continuous discharge elevator, buckets are mounted with none gap on a sequence or belt. This type of elevator is usually used for handling larger lumps of fabric which will be difficult to convey by centrifugal type. The buckets used with this sort of elevator are given such a shape that the belt or chain passes over the top wheel, the flanged end of the preceding bucket acts as a chute to steer the fabric to the discharge spout. These elevators operate at a speed range of 30 to 50 m/min, which is far slower than that of the centrifugal discharge type. Continuous discharge elevators aren't fed by the scooping action of the buckets through the heap of fabric. Material poured directly into the buckets from a loading area. The slow speed and delicate method of loading and discharging makes this sort of elevator suitable for fragile, fluffy or pulverized materials. It can operate within the vertical or inclined condition.

c) *Positive Discharge Elevator:* Elevator designed where the buckets are used to elevate commodities such as popcorn, candy and potato chips where main concern is on gentle handling and finished food grade applications. They are also used in light, fluffy, dusty and sticky materials handling. The feeding is completed by scooping or digging by the buckets. This elevator bucket operates off a double strand chain where it is held in place by two pins, so the bucket is allowed to freely swivel. To discharge the bucket, it is mechanically tripped to flip and discharge but, until this action, the bucket is held parallel with the floor and upright. The speed of the bucket is slow - within the range between 35 – 40 m/min. These elevators mostly are in the shape as an "S" or "L" in design and run throughout a plant.

II. THEORY

Bucket elevators belong to a group of vertical or inclined transport equipment that efficiently moves goods between floors, vessels or other structures to use specially engineered equipment. Main design variations are found in: casing thickness, bucket thickness, belt or chain quality and drive equipment.

A bucket elevator can lift different types of bulk materials, from light to heavy and from fine to large grain. Bulk material handling is an engineering field of design of equipment used for the handling of materials such as ores, coal, cereals, grains, sand, gravel and stone etc. in loose bulk form. Bulk materials handling systems quite often require the lifting of bulk materials to other parts of the plant or process. Various technologies and equipment are currently available to the designer and practitioner. Generally they're classified in to 3 main categories.

1) Pneumatic conveyor or air lifter.
2) Conventional screw conveyor.
3) Bucket elevator.

Bucket elevators operate by using an endless belt or chain on which buckets are mounted. The belt or chain revolves between two pulleys (one at top and one at bottom) and the buckets move with it. Buckets devour product fed at rock bottom of elevator and discharge at top because the bucket turns downward over the top pulley.

In mechanized bulk material handling industry bucket elevator has evolved as advanced material handling equipment. The effective use of different type of bucket elevators depends on design and type of bulk material. The trend is toward highly standardized units, but for high capacities and special material it is wise to use specially engineered bucket elevator. Main variations are in bucket thickness, casing thickness, drive equipment, and belt or chain quality. The major components of belt bucket elevator are drive head and bottom head, buckets, inlet and outlet, casing, drive unit, take up.

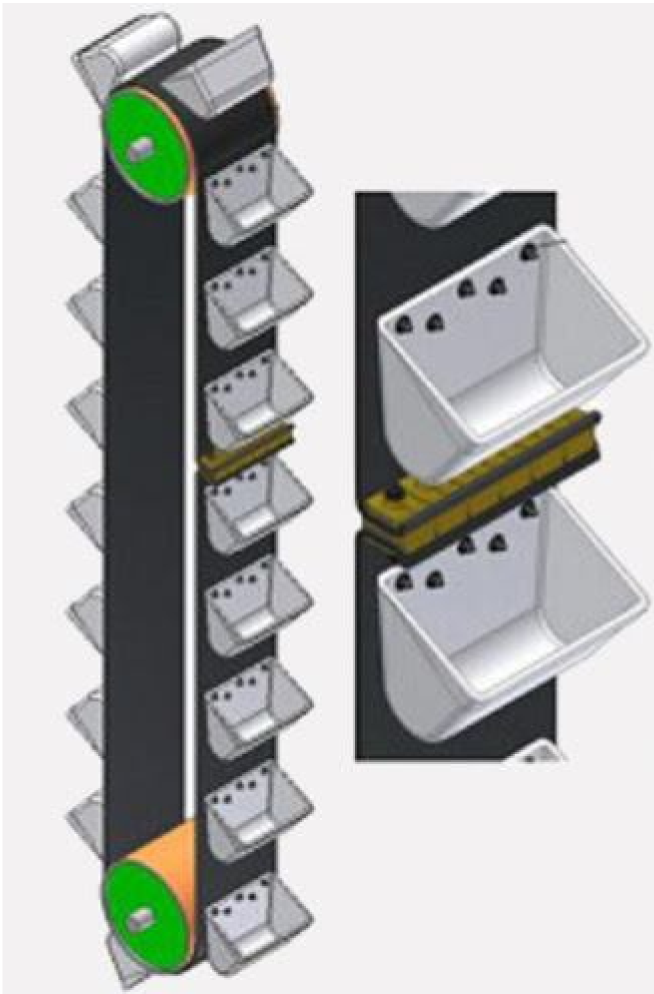

Fig.2. Belt type Bucket elevator

A. Classification of Bucket Elevator

Many types of bucket elevators are available and each is different from other according to their application, feature, and design. The major classifications of bucket elevators are shown in fig 3. The bucket elevator is generally used in chemical industry, building materials, ports and terminal, grain mine, pulp and paper industries, food, fodder, medicine related application and plastic. Cement factories, Power plant, Food industry etc.

Usually, bucket elevators are mainly classified in two types. They are:

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

In this paper we are explaining Belt type bucket elevertor which is also made practically available. All the design and calculations of seleted elevator is discussed below.

B. Foundation

Because most bucket elevators are self-supporting for vertical loads, the foundation must be designed to take the total weight of the elevator and the material that is to be lifted by the bucket elevator. The foundation must be level to supply the right support for the elevator and therefore the casing must be braced for wind loads at intervals shown on the drawings.

C. Casing construction:

Bucket elevators are provided with three sorts of construction. Please ask your general arrangement drawing for the sort of construction used on your elevator. The following is that the list of sorts of construction and the way the filed connection joints must be made for every type.

1) Standard construction – 2” on 20” centers welds for inside casing joints, outside of casing sheets are going to be skip welded 2” on 12” centers to angles. No gaskets or caulking are going to be provided for any joints.
2) Dust tight construction – 2” on 20” centers welds for casing inside joints, outside casing sheets are going to be skip welded 2” on 12” centers to angles. Inside joints are going to be caulked with compound between welds to seal joints. Gaskets will be provided at all bolted joints.
3) Weather tight construction – All inside casing joints are going to be welded continuously, outside of casing sheets are going to be skip welded 2” on 12” centers to angles. Gaskets will be provided at all bolted joints.

D. Installation of Bucket Elevators

1) A bucket elevator is really a belt and pulley transmission enclosed within a casing.
2) For correct operation care must be taken to take care of belt and shaft alignment.
3) Although alignment is checked by the manufacturer before shipment, correct and proper care must be maintained during erection to assure a straight and plumb casing from head to boot section, as a twist or leaning casing would allow appropriate tracking of belt on pulleys.
4) Bucket elevators are made up of three main assemblies: head terminal, boot terminal, and intermediate assemblies and components. All terminals are factory assembled and shipped assembled. All intermediate casings are shipped in individual pieces.
5) Assemble casing first by adjusting boot section and ten to twenty feet of intermediate leg casing. Use a perpendicular from top to bottom to see vertical and level setting of boot aboard , using shims if necessary near anchor bolt holes (not at corners). Grout under boot after elevator is completely assembled.
6) As marked by the manufacturer, assemble remaining intermediate leg sections respectively. Usually the boot are going to be marked ‘A’, then the primary leg section ‘B’, second, ‘C’, etc. These markings are going to be located within the lower right corner of every section and after assembly are often readily checked by sight from bottom to top.

E. Take ups

Take-ups, a robot for adjusting shaft center distances should be provided for all elevators to catch up on elongation as wear occurs and to supply temporary slack for installation or maintenance work.
Take-ups on elevators should be mounted at the foot end. This eliminates the troublesome adjustment of the drives as would be the case if the take-up were mounted on the top end.
For elevators, caution must be used when adjusting take-ups to stop statically over- stressing belt and terminal equipment. A proper amount of slack should be allowed to get smooth belt travel motion. On all belt elevators the adjustment should be made while the elevator is operational to insure the adjustment which can meet the above conditions.

F. Shaft and pulley alignment

Proper alignment of the pulley and shaft efficiently extends belt life. To assure correct alignment, the subsequent steps are necessary:

1) Carefully level the shafts. Use a machinist’s level directly on the shaft.
2) Align the shaft for parallelism, employing a line for long centers. Recheck the level adjustment. Tighten all adjustable bolts and nuts to assure maintenance of shaft alignment.
3) Align the pulley axially on the shafts. A plumb should be wont to check the alignments to go and foot pulleys and shafting after leveling shafts.

G. *Installing Belt*

In the installation of elevator belts, certain general methods should be followed. The first is to make certain you decide on the simplest sort of belt for the service to be performed. Consult your belt catalog or call your nearest belt distributor to see your selection. Install the elevator belt with foot take-ups positioned at upper end of travel, and head end take-ups at lower end of visit provide maximum adjustment.

1) Where it's possible to lower belt from the highest of the elevator casing, the subsequent method are often applied: Make lifting hitch off center, to form one leg long enough to travel round the foot pulley and up to the inspection door. Lower belt into casing from top. When belt is positioned, snub the head shaft. Connect at inspection door employing a come-along or chain fall to draw belt end together. Adjust take-ups.
2) If belt can't be lowered from the highest of the elevator casing, assemble and feed the belt round the bottom of the foot pulley and forward to the top of the head pulley. Next, drop line down near side of casing. Hitch line 3 or 4 feet from the top of the elevator belt, leaving the top liberal to make the ultimate connection at the inspection door. Before making the ultimate connection, make certain that the take-up is about properly. Cut belt length for splice and achieve the right take-up setting.

The method of installation depends to an outsized extent on the peak of the elevator and therefore the available hoisting equipment.

After the belt is assembled, mount the buckets. After the unit has been run-in the units should be re-tightened, and therefore the bolt threads should be prick-punched to stop loosening of the nuts.

H. *Operation of Belt Bucket Elevator*

Bucket elevators operated by using an endless belt onto which rectangular buckets are attached. The belt mounted with buckets revolves between a top and bottom pulley. At rock bottom, the bucket picks up yellow corns into the elevator boot and at the highest the yellow corns are discharged because the bucket turns downward over the top pulley. The bucket elevator is generally designed and made for metallurgy, industry, building materials, mine, pulp and paper industries, ports and terminal, grain and oil food, fodder, plastic and medicine related application.

The choice of conveyor depends largely upon the required capacity, conveying distance and configuration (whether horizontal, vertical or inclined), bulk solids and individual particle properties and temperature

The selection of the sort of elevator is governed by the characteristics of the fabric handled, whether lumpy or fine, abrasive or non-abrasive and whether material will stand centrifugal discharge or it must be handled more slowly to avoid breakage.

Fig.3 attachments on belt drive

I. *Maintenance*

1) Bigger elevators provide suitable walkways and, where necessary, platforms with stairs or permanent ladders for access.
2) Provide suitable protection against the environmental aspects: extreme cold, rain, or snow and sleet.
3) Provide pipe extension for difficult to succeed in grease fitting or an automatic greasing system.
4) Provide adequate cleanup of dribble and spillage.
5) Found out a selected lubrication program and fix definite responsibilities for completing procedure. One successful method for accomplishing this is often to organize master lubrication check sheet or card for every important conveyor or elevator.

6) Establish a definite program of inspection.
7) Elevator belts should be looked out for wear, stretch, edge wear (indication misalignment or material build abreast of pulleys).
8) Pulleys should be looked out for alignment and positioning.
9) Bucket should be surveyed for looseness or damage.
10) All belts should be checked for correct tension (enough slack to flex slightly) and if an excessive amount of slack is present, take-ups should be adjusted to require up excess slack.

J. Lubrication

1) Reducers - Reducers are shipped without oil and should be lubricated per the reducer manufacturer's name tag instructions or the instructions attached to the reducer.
2) Motors - Motors should be lubricated time to time as per motor manufacturer's instructions.
3) Bearings - Bearings are factory lubricated and should be re-lubricated about every 250 hours of operation. The head and tail shaft bearings should be lubricated while the unit is running, adding grease slowly until a slight bleeding of lubricant appears at the seals.

III.METHODOLOGY

A. Systematic Methodology for Project

1) To study about the bucket and the types of failure.
2) To study the different work on this subject including reading previous research papers on this subject.
3) To design the bucket for the particular application by using the analytical method.
4) Modeling the geometry in the CAD software.
5) Pre-processing of geometry in the Analysis software.
6) Processing the results.
7) Post-processing the result including getting various results.
8) Experimentation of the bucket.
9) Validation of the results.

Our project is subjected on the handling of bulk material and its packaging process. It is a mixture of bucket elevator and belt conveyor and therefore the packaging process is controlled automatically by using microcontroller. A weight sensor is attached with the microcontroller which helps to package the majority material at proper amount.

At first we considered the planning of this machine. Though we build a prototype we had to take care about the planning and dimension. After surveying on other industries we discussed our concept and designed our machine with proper dimension. To build this project we distributed our add two parts including the mechanical part and therefore the electrical part. First we decided to create the mechanical part including bucket elevator and therefore the belt conveyor. We built the bucket elevator and therefore the belt conveyor separately then combined it during a single frame. All the works had wiped out our departmental workshop. After completing the mechanical parts we worked on the electronic part. We found out the load sensor on the discharge which connected through the microcontroller in order that it could measure the quantity of bulk material. For making this project completely necessary work had done on the workshop provided by our sponsored company.

B. Machining Processes Required:

The various machining processes those were utilized in making The Bucket Conveyor and therefore the Belt Conveyor are described below:

1) *Metal Cutting:* Different metal cutting tools were used here such as-
a) *Sniping Tool:* to chop the skinny metal sheet to make the form of bucket
b) *Hack Saw:* To chop the shaft into desired length
c) *Grinder Cutting:* For making frame cut the thick metal bar into required length.

2) *Soldering:* The buckets were made from thin metal sheet. So in spite of welding soldering was wont to join the outer edges of the bucket to form the bucket strong enough during operation.

3) *Welding:* In this process welding was widely used. As the project was to form a little prototype and there was a little allow it, welding was used here for many of the joining process.

Welding was used to:

a) Attach the sprocket to the shaft.
b) Attach the bearing to the shaft.
c) Hold the bearing in the bearing holder.
d) Attach the bearing holder to the frame.
e) Create the frame of both bucket and belt conveyor.
f) Join the bucket conveyor's driving shaft and belt conveyor's driving shaft to the electrical motors.
g) And to hitch many other parts to the frame.

4) *Boring:* The sprocket was bought from the market. As the hole of the sprockets was smaller than the outer diameter of the shaft, these holes were enlarged by boring method with the assistance of lathe machine.
5) *Drilling:* Drilling process was also used here for various purposes such as:

a) The shaft of the pulley of the belt conveyor on loading portion is stationary while the pulley is rotatable with the assistance of bearing. This shaft is held by two metal bars and these bars were drilled to support the shaft.
b) During this project two wooden pulleys were used. Both these pulleys were drilled along its central axis to form a path of shaft.
c) Rock bottom portion of the frame was drilled in several points to form hole to screw the entire frame to a wooden board.

6) *Grinding:* As mentioned above welding process was widely used. So, grinding process was also used here to grind the varied parts after cutting to urge a plane surface for welding. The welded parts were then grinded for fine surface.

C. Parts Of Machine

Description of Bucket Elevator and Belt Conveyor is given below.

1) *Casing:* The elevator is typically enclosed during a steel casing, to supply a way of support and as a matter of safety and mud retention. A casing is often made dust-tight, either by employing a sealing medium, or continuously welding the comer angles to the plate. Manholes are provided to the upper casing of the elevator for inspections and repairs. As it was a little project work casing was avoided here.
2) *Buckets:* It is the essential part of this conveyor. It carries the majority material to the specified place. It was made with a 5mm thin plain steel sheet by folding the sheet at a particular dimension.
3) *Chains:* A chain is a pulling member of bucket elevators. The buckets were attached to 2 chains bolted to the rear of buckets. The power from the sprockets was transmitted through the chains. It also helps to tug up the bucket with filled with bulk materials.
4) *Sprockets:* It serves as driving unit. It holds the chains of the conveyor which supports the bucket. With the assistance of sprockets the facility of motor is transmitted from one side to the opposite side of the conveyor. The number of teeth of the sprocket was 30. The sprockets were attached to the shafts rigidly and therefore the shafts were attached to the frame with the assistance of bearings and bearing holders.
5) *Take-ups:* Normally, elevators have the screw-type take-up on the foot or boot shaft unless space doesn't permit. If it's necessary to put the screw-type take-up on head shaft, the centers of the bucket elevator shouldn't exceed 90 feet, because the entire weight of chain (or belt) plus buckets and cargo in buckets on up or carry side, is hanging on the take-up screw in tension. Wherever a head take-up is employed , subsequent larger sized head shaft from that recommended should be used, because the vibration is transferred to the top shaft through the pickup in the boot. Gravity take-ups are used on numerous elevators, particularly on powdery or aerated material like cement, lime, and gypsum. A softening effect is used at the pickup which must be absorbed by this floating take- up. The frame supporting the shaft and wheel simply lifts up and down in angle or channel guides, attached to the inside of the casing. This mechanism was also avoided here.
6) *Boot Section:* The elevator boot holds the feed hopper. When moist slow-flowing materials are transported, the hopper is found comparatively high and its bottom is inclined at an angle of 600; it's located at a coffee height and its bottom is inclined by 450 when dry free-flowing materials are handled. The side walls of the lower casing have covered manholes for maintenance and repair.

7) *Drive Units:* In the bucket elevator locomotion is transmitted to the elevator by friction because it wraps round the driving shaft rotated by an electrical motor. A 24 volt dc motor is employed to run this elevator. The drive comprises the subsequent parts: two sprockets, motor.

IV. DESIGN OF SYSTEM

A. Required motor power[9]

1) The handling capacity of a bucket elevator, Q tons per hour is

$$Q = 3.6*v*\Upsilon*\Psi\ (i_o/a)$$
$$=3.6*0.6*1.5*0.85*8$$
$$=22 \text{ tons per hour}$$

Where,

i_o= bucket capacity

a= bucket area in m^2

v= chain speed in m/sec

Υ= bulk weight of the load, tons / m^3 (for dry sand)

Ψ= bucket loading efficiency

2) The maximum static tension of the driving member S_{max} is

$$\mathbf{S_{max}} = 1.15H\ (q+K_1q_o)$$
$$=1.15*1\ (10.19+ 1.5* 26.4)$$
$$= 171.76\ \mathbf{Kg}$$

Where,

H= height to which the load is elevated, in meter

q= weight of the load per meter of elevator length, (kg/m)

$= Q/ 3.6v\ q_o$

= weight per meter of chain with bucket, (kg/m) K_2Q

K_1, K_2, K_3= factor allowing for the resistance to motion and bending of the driving member and the buckets.

3) Required motor power on the drive shaft (not including losses in the driving gear), N_o is

$$\mathbf{N_o} = (QH/367)*(1.15+K_2K_3v)$$
$$= 375\ \mathbf{W}$$

B. Length of Open Belt Drive[9]:

An open belt drive is used to rotate the driven pulley in the same direction of driving pulley. The length of belt can be calculated by the following equation, Open belt drive is shown in Figure 3.

Where r_1 and r_2 =Radii of the larger and smaller pulleys

x = Distance between the centers of two pulleys

L =Total length of the belt Maximum Tension in the Belt

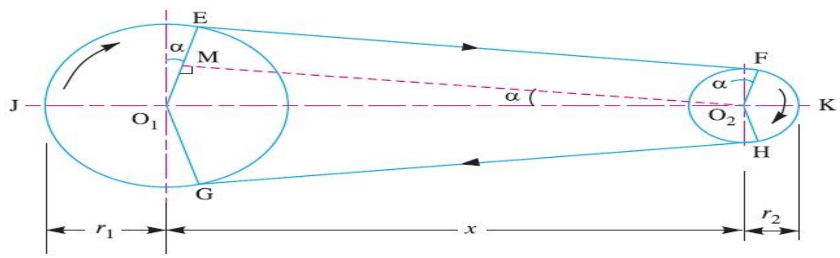

Fig.4 Length of belt drive

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The maximum tension in the belt is equal to the total tension on the right side of the belt.

T= Maximum stress × Cross section area of the belt

$T = \sigma \times b \times t$

When, Centrifugal tension is considered,

$T = T_1 + T_C$

Where

σ=Maximum safe stress

B =Width of the belt

t =Thickness of the belt

T_1 =Tension in the tight side

T = Maximum tension in the belt Centrifugal Tension,

The tension caused by the centrifugal force is called centrifugal tension.

$FC = mv^2$

Where,

F_C=Centrifugal tension

M = Mass of belt per unit length in kg V = Linear velocity of belt in m/s

Ratio of Driving Tension for Flat Belt Drive,

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Where,

T_1=Tension in the tight side T_2 =Tension in the slack side

μ = Coefficient of friction between belt and pulley θ=Angle of contact

Power Transmitted by a Belt

Power transmitted between a belt and a pulley is expressed as the product of difference of tension and belt velocity.

$P = (T_1 - T_2)\, v$

Where,

P=Power transmitted by the belt

T_1 = Tension in the tight side

T_2 = Tension in the slack side

V = Velocity of the belt in m/s

C. Power[9]:

Electrical power is the rate at which electrical energy is converted to another form, such as motion, heat, or an electromagnetic field. The common symbol for power is the uppercase letter P, the standard unit is the WATT, Symbolized by W.

$$P = \frac{2\pi * N * T}{60}$$

$T = F \times r$

$$N = \frac{v * 60}{\pi d}$$

Where,

P=Power (kW)

N = Drive pulley rpm

T = Torque (Nm)

R = Pulley radius (m)

v = Velocity of belt (m/s)

d = Pulley diameter (m)

D. Modelling Of Bucket Elevator[9]

Based on given material - grain, which determines the speed of the elevator of v =1,5 m / s and on elevator type - high speed elevator for centrifugal discharge, the type of the bucket can be selected. For selected material and type of elevator, the deep bucket is assessed as the most adequate [5]. Volume of the bucket, i0, can be calculated using the following equation:

$$\frac{i_0}{t_k} = \frac{Q_m}{3,6 v \rho \psi}, \quad \text{....(1)}$$

where values for bucket pitch, t0, elevator speed, v, material density, ρ, average coefficient of bucket filling, ψ, and capacity, m Q (40 t/h), are given in advance. From the above, the parameters of the bucket may be adopted: bucket volume 0 i = 6,3 l , bucket width 400 k B = mm , mass of the bucket 9 k m = kg and width of the bucket wall 4 kb = mm .

The next step is to determine the actual capacity of the elevator, Qmr:

$$Q_{mr} = 3.6 \cdot \frac{v \cdot \psi \cdot i_0 \cdot \rho}{t_k}. \quad \text{....(2)}$$

The calculated actual capacity of the elevator is $Q_{mr} = 43,54 \frac{t}{h}$. It is higher than the one given by default, so the appropriate bucket has been chosen. The power of electromotor, Pr, is calculated using:

$$P_r = \frac{K_s \cdot P_0}{\eta}, \quad \text{....(3)}$$

Where values for safety factor, s K , and efficiency, η , are adopted from corresponding tables and P0 is the drive power on the shaft. The power, P0 = 3,08 kW , is calculated using

$$P_0 = \frac{F_0 \cdot v}{10^3},$$

where F_0 = 2053,07 N is the traction force on the drive drum calculated as the difference between the forces at points 3 and 4, figure 5, and v is elevator speed.

Fig.5 Bucket design

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V. TESTING OF MACHINE

To test and confirm the working of developed mechanism for bucket elevating as per ISO and IS standard we have taken practical demonstration at sponsored industry. Also we have collected the feedbacks and improvements points in developed model.

A. Testing points and concluded points as below

Table no.1 Testing

Sr.no.	Points observed	Manual method	Using Buckets
1.	Labour requirement	*02 LABOUR* *01 = Skilled labor* *01 = Unskilled labor*	*01 LABOUR* *01 UnSkilled labor*
2.	Time required for production	*17 Min*	*3Min*
3.	Space required for storage of accessories	*Storage space / cupboard required for tools and instruments*	*Work space required*
4.	Electricity required for mechanism or accessories	*Not required*	*Required but 12 volt DC supply*
5.	Material handling	More than developed mechanism	Material handling is very less
6.	Effort	Lot	Less

B. Result

Table no.2 Result

Sr. No	Points considered / activity / cost	Cost for manual Method	Cost for developed Mechanism
01	Labour Cost	`Labour requirement = 02 numbers Cost for skilled labor = 400 per day Cost for Unskilled labor = 300 per day Total cost = 400 + 300 = 700 Rs	`Labour requirement = 01 numbers Cost for Unskilled labor = 300 per day Total cost = 300 x 1 = 300 Rs
02	Maintenance cost	Minimum 150 Rs per year	10 % of initial cost =10000 Rs
03	Storage cost	Neglected	required
04	Rate of Production per day	70 bags per day	200 bags per day
05	Days required for 1000 bags per month	15 days	5 Days
06	Days required per year	15 x 12 months = 180 days	5 x 12months = 60 days
07	Total cost per year		

		a) Per day labour cost = 700 Rs Total Labor cost per year = 180 x 700 = 126000 Rs b) Maintenance cost = 150 Total cost 126000 + 150 = 126150 Rs	a) Per day labour cost = 300 Rs Total Labor cost per year = 60 x 300 = 18000 Rs b) Maintenance cost = 10000 Total cost 18000 + 10000 = 28000Rs
	Total saving per year	= 126150 – 28000 = 98150	

VI. CONCLUSIONS

The main purpose for building this machine is to make an automatic handling of bulk material and its packaging.. The total process is controlled by an impact system automatically. We mainly focus on the packaging system. As we can see in results the need of skilled operator is additionally reduced as compared to a manual system. This paper is made for study of design of bucket elevator and also enhances manufacturing idea about the process and fabrication of the equipment. Though from this study we found to apply our theoretical knowledge of previous coerces like machine design, product design, and kinematics of machinery.

VII. ACKNOWLEDGMENT

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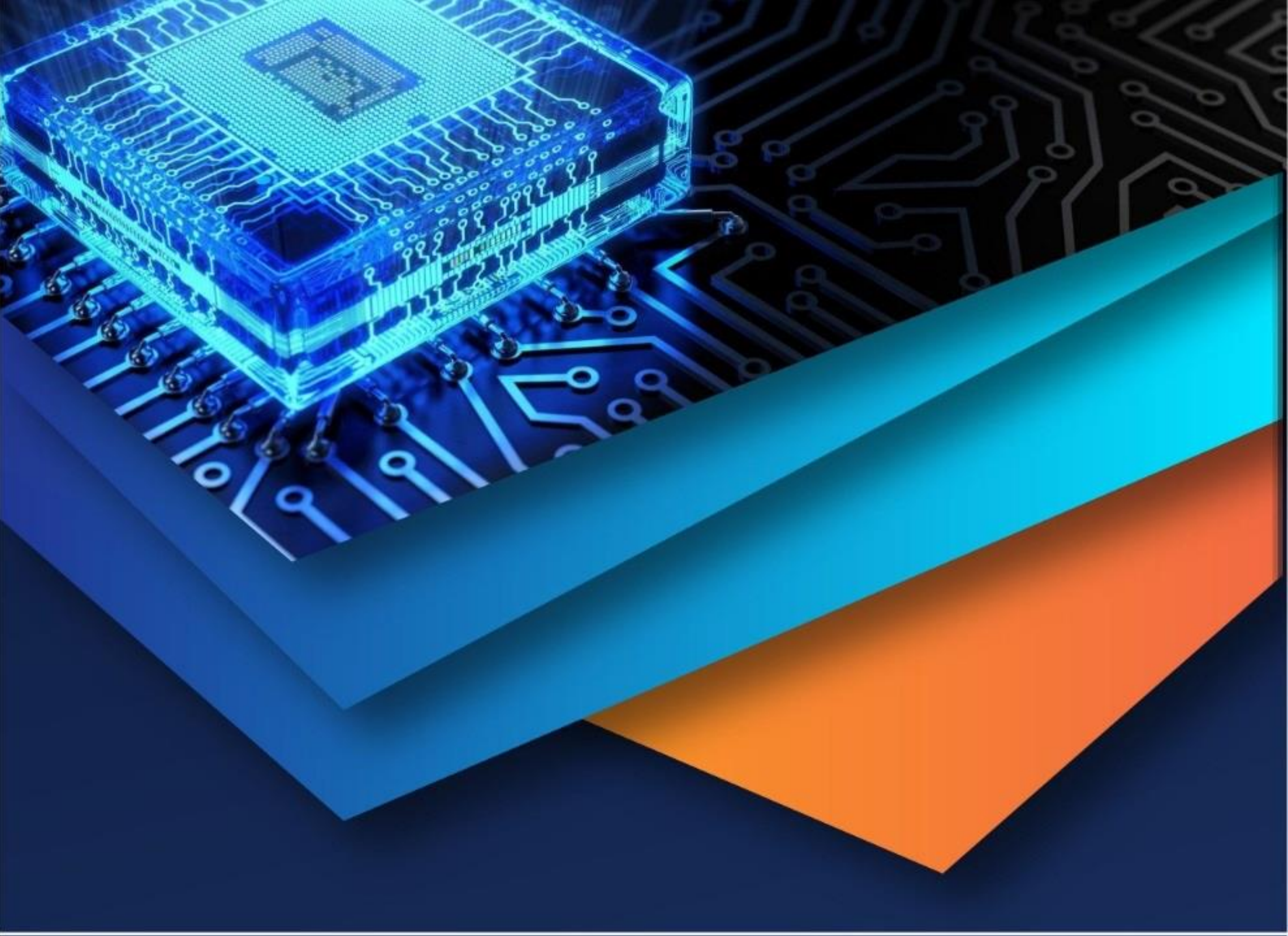

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