ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 5, Issue 6, June 2020

Design and Fabrication of 360° Rotating Conveyer Belt with Up-Down Mechanism

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Abstract: - **Most small scale industries use human effort for transporting of raw material from one place to another. Most of industries uses cranes, hoists , small industrial trucks and conveyers which is in fixed position. The 360-degree belt conveyor system is the transport of material from one place to another with a mechanism of rotation and top to bottom movement. This conveyor belt does not require frequent lubrication. The present work deals with the new trend in the field of belt conveyor system. A 360 °rotating belt conveyor system has been designed for prototype and it includes belt width, motor selection, belt specification, shaft diameter, pulley, bearing selection and economies of the rotating belt conveyor system is presented in this work.**

I. INTRODUCTION

Throughout the world bulk materials handling operations perform a key function in a great number and variety of industries. While the nature of the handling tasks and scale of operations vary from one floor to another and on the international scene, from one country to another according to the industrial and economic base, the relative costs of storing and transporting bulk materials are, in the majority of cases, quite significant. It is important, therefore, that handling systems be designed and operated with a view to achieving maximum efficiency and reliability.

Bulk material transportation requirements have continued to press the belt conveyor industry to carry higher tonnages some distances and more diverse routes. In ordered keep up, significant technology advances have been required in the field of system design, analysis and numerical simulation. The application of traditional components in non- traditional applications requiring horizontal curves and intermediate drives have changed and expanded belt conveyor possibilities. Example of complex conveying applications along with numerical tools require insuring reliability and availability will be reviewed.

II. WORKING PRINCIPLE

One motor is connected with the shaft of the belt which will rotate the conveyor belt. Two motors and two actuator will be used for making the up-down mechanism. Two motor are connected with those actuator and when the motor will rotate the actuator will move in the up-down position. One another motor is provided in the bottom of the base and the shaft will be connecting to the clamp which is connected with that motor shaft with the help of brass coupling. So with the help of this we can rotate the conveyor belt at 360°. So with the help of this 360°rotated conveyor belt the material handling can be done easily at desired place.

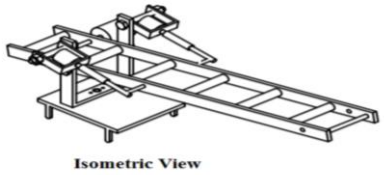

Fig. 360-degree conveyor system with up-down mechanism

III. LITERATURE REVIEW

A. Daniyan Ilesanmi A. (2017)

He has discussed the work for the development of a belt conveyor system for small scale industry. The conveyor is of height 0.75 m at 0o angle of inclination, 35o troughing angle and a surcharge angle of 25o. It also consists of a belt whose width is 410 mm, length 2.4 m and a basic length 4.54 m. The conveyor has an average capacity of 43.75 tonnes/hr.

He concluded that, a belt conveyor system with 3 roll idlers for conveying packs of bottled water was developed. The peculiarities of the belt conveyor is that it is easy and cheap to maintain, it has high loading and unloading capacity and can transport materials economically and at very high efficiency.

The construction of a belt conveyor system requires high capital base. The evaluation of the conveyor system is limited

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ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
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to a conveyor speed of 200 rpm and as such the evaluation cannot be carried out at different speed of operation.

B. Meshram Pradnyaratna A. (2016)

In his paper, he is suggesting a conveyor system for the company who are in a process of atomization of a plant and they are in a need of a dedicated conveyor system for the continuous filling of liquid in the cartons having chamber of two types 1 X 16 (4 X 4) and 1 X 25 (5 X 5). With the proposed conveyor system the labour cost will be reduced also the transportation and material handling cost will be reduced. With this conveyor system the 420 cartons can be filled with the help of programmable filling machine each chamber can be filled in 3 seconds.

C. Aniket A Jagtap (2015)

He explained that, In the process or manufacturing industry, raw materials need to be transported from one manufacturing stage to another. Material handling equipment are designed such that they facilitate easy, cheap, fast and safe loading and unloading with least human interference. For instance, belt conveyor system can be employed for easy handling of materials beyond human capacity in terms of weight and height. This paper discusses the design calculations and considerations of belt conveyor system for biomass wood using 3 rolls idlers, in terms of size, length, capacity and speed, roller diameter, power and tension, idler spacing, type of drive unit, diameter, location and arrangement of pulley, angle and axis of rotation, control mode, intended application.

IV.OBJECTIVES

- Study of existing conveyor system, now in industries only fixed type belt conveyor is available.
- The main purpose of project is the handling of material in compact space in industry i.e. 360° rotation of model.
- Design & development of 360°and up-down mechanism.
- But we will make the conveyor belt such that it can be rotate 360°and up-down mechanism with proto type

V.CONSTRUCTION & WORKING PRINCIPLE

One motor is connected with the shaft of the belt which will rotate the conveyor belt. Two motors and two actuators will be used for making the up-down mechanism. Two motor are connected with those actuator and when the motor will rotate the actuator will move in the up-down position. One another motor is provided in the bottom of the base and the shaft will be connecting to the clamp which is connected with that motor shaft with the help of brass coupling. So with the help of this we can rotate the conveyor belt at 360°.So with the help of this 360°rotated conveyor belt the material handling can be done easily at desired place.

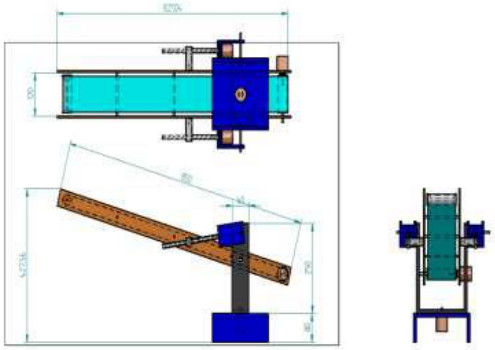

Fig. 3D model of the system

VI .DESIGN CONSIDERATION AND CALCULATIONS

Design Considerations:

- Designing the system for continuous flow of material.
- Going in for standard equipment which ensures low investment and flexibility.
- Incorporating gravity flow in material flow system.
- Ensuring that the ratio of the dead weight to the payload of material handling equipment is minimum.

Design Calculations:

1) Weight carryingCapacity:

Capacity is the product of speed and belt cross sectional area. Generally, belt capacity B.C (kg/sec) is given as:

$B.C = 3.6 A V \rho$

Where,

A= belt sectional area (m2)

ρ = material density (kg/m3)

V= belt speed (m/s).

1.1 Area of Belt:

A = Length x Width

A = 815 x 100

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ISSN (Online) 2456 -1304

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Vol 5, Issue 6, June 2020

A = 81500 mm2
A = 0.081500 m2.
1.2 Belt Speed:

$$V = \frac{2\pi N}{60 \times 60}$$

$$V = \frac{2\pi \times 10}{3600}$$

V = 0.01745 m/sec.

1.3 Density of Material:
P = Density of material
Material used for Belt is flexible Plastic.
Density of plastic is 0.15 x 103 kg/m3. (Considered)
B.C = 3.6 x A x V x ρ
B.C = 3.6 x 0.081500m2 x 0.01745m/sec x 0.15 x 103
B.C = 0.767 Kg/sec.

2) Diameter of Roller (Drive Pulley):
The roller support belt and facilitates easy as well as free rotation of the belt conveyor in all direction. The correct choice of roller diameter must take into consideration the belt width. The relationship between the maximum belt speed, roller diameter and the relative revolution per minute is given as

$$N = \frac{V \times 1000 \times 60}{D \times \pi}$$

Where,
N = RPM of Belt
V = Speed of Belt
D = Dia. Of Roller

$$10 = \frac{0.01745 \times 1000 \times 60}{D \times \pi}$$

D = 33.32 mm
D = 34 mm.

3) Power at Drive Pulley:

$$Pp. = \frac{2 \times \pi \times N \times T}{60}$$

Where,
T = Torque of Drive motor
T = 2 kg. m
T = 19.61 N. m

$$Pp. = \frac{2 \times \pi \times 10 \times 19.61}{60}$$

Pp. = 20 Watt.

Pp. = 0.02 Kw.

4) Material Flow rate:

$$Q = \frac{W \times V}{L}$$

Where,
Q = Material flow rate
W = weight of Material on section of length (Consider – 0.767Kg)
V = Conveyor speed
L = Length of weighing platform

$$Q = \frac{0.767 \times 0.01745}{0.832}$$

Q = 0.0161 kg/sec.

5) Belt Tension at Steady State:
Tss = 1.37 x F x L x g (2 x Mi + (2 x Mb + Mm) x cosθ) + H x g x Mm
Where,
Tss = Belt tension at steady state (N).
F = Coefficient of friction (0.02).
L = Conveyor length (m). (Conveyor belt is approximately half of the total belt length).
= 832mm
= 0.832m.

g = Acceleration due to gravity (9.81 m/sec2).
Mi. = Load due to the idlers (Considering no load).
Mb = Load due to belt (0.18304 kg).
Mm=Load due to conveyed materials (Considering no load).
θ = Inclination angle of the conveyor.
H=Vertical height of the conveyor.
Tss = 1.37 x 0.02 x 0.832 x 9.81 x 2xcos30° x 0.12225
Tss = 0.047 KN.

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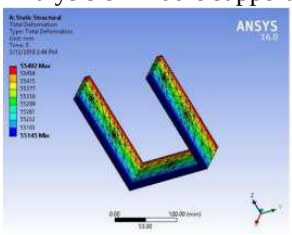
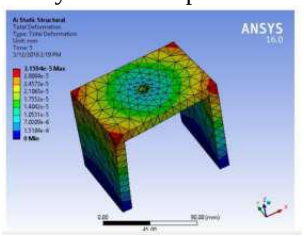
VII. ANALYSIS

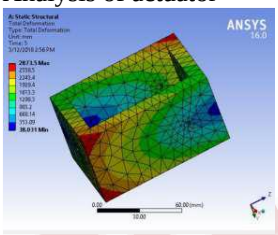
Analysis of middle support



Analysis of base plate



Analysis of actuator



CONCLUSION

The 360 degree conveyor system for material handling has all abundant and outstanding advantage of this equipment in any material handling industry with minimum knowledge about the operation of equipment is very limited time. So in all matter it is the better than fixed conveyor belt.

- Low manufacturing cost of the equipment.
- Easy to handle.
- Less weight.
- Compact in size.
- Cost of checking the error is less.
- All kinds of material can be handled.
- Even a lay man can work in it.

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