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Fabrication of 360° Conveyor System with Up-Down Mechanism for Material Handling using C Clamp

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Abstract - *360-degree belt conveyor is the transportation of material from one location to another with rotating and up-down mechanism. This conveyor has high load carrying capacity, large length of conveying path, simple design, easy maintenance and high reliability of operation. 360-degree belt conveyor system is also used in material transport in foundry shop like supply and distribution of molding sand, molds and removal of waste. This project work is to design the conveyor system used for which includes belt width, motor selection, belt specification, shaft diameter, pulley, bearing selection and specification, with the help of standard model calculation.*

Key Words: **Conveyor belt, DC Motor, bearing, Pulley, Lead Screw, Arduino, Clamp, Wheels, Base plate.**

1. 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.

The system design tools and methods used to put components together into unique conveyance system designed to solve ever expanding bulk material handling needs. In industry for material handling many fixed conveyor belt is required. So, the installation and maintenance charge of fixed conveyor belt is increased for solution of this problem. **New creation is 360 degree rotating flexible conveyor belt.**

This conveyor belt is use in place of fixed conveyor it uses in any place like industry, warehouses, food industry any ware easily. And the installation and maintenance charge are decreased place of number of fixed belt conveyor.

1.1 OBJECTIVE

Now in industries only fixed type belt conveyor is available. But we will make the conveyor belt such that it can be rotate 360°and up-down mechanism with proto type model.

1.2 PROBLEM STATEMENT

Now a days generally in industry Fix type belt conveyor system is available. But we will Make the conveyor belt such that it can be rotate360 degree& Up-Down Mechanism with prototype model. The system is designed and develop the system for safely store or insert the material in appropriate compartment

2. WORKING

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 actuators 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.

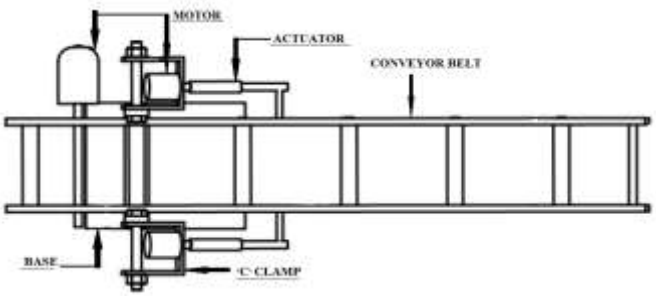

Fig -1: 360^0 conveyor system with up-down mechanism

2.1 DESIGN CONSIDERATIONS

According to the design of an effective and efficient material handling system which will increase productivity and minimize cost, the guidelines normally followed are:

1) Designing the system for continuous flowof material (idle time should be zero)
2) Going in for standard equipment whichensures low investment and flexibility
3) Incorporating gravity flow in material flowSystem
4) Ensuring that the ratio of the dead weightto the payload of material handling equipment is minimum

2.2 DESIGN OF MOTOR TO DRIVE THE CONVEYOR BELT

Let the torque on plate = T_a , Nm
Considering the Arm's weight = .25kg
Conveyor belt weight = .25 kg
Material passing through the belt = 0.5 kg
Total weight = 0.25+0.25+0.5
= 1 kg
consider,
We required 10 rpm motor.

T_a = m*g x L
= 9.81 x 832 x 10^{-3}
= 8.1619 N-m
Total Torque, T = T_a
= 8.1619 N-m

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

$$P = \frac{2\pi \times 10 \times 8.16192}{60} \text{ Watt}$$

P = 8.54 W

P = 0.0854 hp
10 rpm D.C. motor is available in the market. So we have selected this standard motor.
The rotation of the system is required slowly, so we choose a motor with a lower rotational speed.

2.3 DESIGN OF MOTOR CONNECTED TO THE BASE

Considering the total weight of the assembly 2 Kg
The required rpm at upper part is near about 10 rpm. So we selected the motor with 10rpm speed.
Let the torque on one side of the arm = T_b , Nm
We require 10 rpm motor.

T_b = m*g x L
T_b = 2*9.81 x 360 x 10^{-3}
= 7.0632 N-m

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

$$P = \frac{2\pi \times 10 \times 7.0632}{60} \text{ Watt}$$

P = 7.39 W
P = 0.0739 hp

10rpm D.C. motor is available in the market for 2 kg torque. So we have selected this standard motor.

2.4 DIMENSIONS OF CHANNEL PLATE

Material for the channel plate is Aluminum.
Length of channel plate
Channel plate is used to support the conveyor belt, therefor we select the length of channel plate more than conveyed length.
Conveyed length is =1664/2=832;
L=850mm
Width of channel plate considered more than the diameter of roller.
Roller diameter= 34mm
So, we select the width of 50 mm
We required such two plate
Length- 850mm
Width- 50 mm
T = F x l
T = mg x l= 1* 9.81*850= 8338.5 N.mm
T= 8338.5 x 10^{-3}
= 8.38755N.m

$$\frac{M}{I} = \frac{\sigma}{Y}$$

$$\frac{8.3385 \times 10^{\wedge}3}{(B \times t^3)/(12)} = \frac{240}{t/2}$$

$$\frac{8.3385 \times 10^3}{(50 \times t^3)/(12)} = \frac{240}{t/2}$$

t=2.04 mm
t = 2 mm
But in market minimum size available is 2 mm.
t = 2 mm
l = 850 mm
w= 50 mm

2.5 DESIGN OF MOTOR FOR UP-DOWN MECHANISM

Let the torque on one actuator = T_c , N-m
We require 60 rpm motor.
Length for the support rod is 120mm
Support rod is use to move up down the mechanism.
The mass acting on this motor is load coming on the belt

So we consider 1 kg

$T_c = 1*9.81 \times 120 \times 10^{-3}$

$= 1.1772$ N-m

Total Torque, $\mathbf{T = 2 \times T_c}$

$= 2 \times 1.1772$

$= 2.3544$ N-m

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

$$P = \frac{2\pi \times 60 \times 2.3544}{60} \text{ Watt}$$

P = 14.79 W

P = 0.1479 hp

60 rpm D.C. motor is available in the market. So we have selected this standard motor.

2.6 SPECIFICATIONS OF BEARING

N = 10 rpm

W = 1 kg

r = 5 mm

thickness=5mm

We have selected the Standard bearing for the vertical shaft with

ID = 10 mm, OD = 26 mm

$$Pb = \frac{W}{A} = \frac{W}{n \times \Pi (R^2 - r^2)}$$

$$T = \frac{2}{3} \times u \times w \times \left(\frac{R^3 - r^3}{R^2 - r^2}\right)$$

$$P = \frac{1 \times 9.81}{6\,\Pi [(13^2-5^2)]}$$

$= 3.614*10^{-3}$ N/mm^2

$$T = \frac{2}{3} \times 0.03 \times 1 \times 9.81 \times 10\text{-}6 \times \left[\frac{(13^3-5^3)}{(13^2-5^2)}\right]$$

T= 2.82 x 10-6 N-mm

3. ADVANTAGES

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.

- 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.
- Noiseless as compared to chain conveyors.
- Much simpler to maintain and don't require any major lubrication system like chain conveyors.
- Their reliability has been proved over a long period by its use in the industry.

4. APPLICATION

- Can be applied in gear manufacturing unit.
- Used in automobile industry.
- Used in airport.
- Also used in stone crushing industry.
- Used in both small-scale industries as well as the large-scale industries.
- Its outcome can be utilized properly to a great executed in mechanical field as well as the automobile field.
- Also used in Warehouses.
- In coal industry.
- Food and packaging industry.

5. CONCLUSION

Any machine must be inexpensive and easy to build if it is to be accepted by the society. This need is recognized and a "360° rotating conveyor belt with up-down mechanism" is designed for Prototype model. This machine will only contain parts that are readily available and in use regularly. This eliminates the need to order or import components just for conveying the product. Thus a "360° rotating conveyor belt with up-down mechanism" is designed and prototype model is fabricated using D.C motors, batteries and remaining parts with in low cost.

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