International Journal of Research in Engineering, Science and Management
Volume-3, Issue-6, June-2020
www.ijresm.com | ISSN (Online): 2581-5792

Design and Manufacturing of 360^0 Conveyor System

Mayur S. Ahire[1*], Kiran R. Giri[2], Gaurav A. Wagh[3], Sunny S. Patil[4], Sachin D. Rahinj[5]
[1,2,3,4]*Student, Department of Mechanical Engineering, Dr. D. Y. Patil School of Engineering and Technology Lohegaon, Pune, India*
[5]*Assistant Professor, Department of Mechanical Engineering, Dr. D. Y. Patil School of Engineering and Technology Lohegaon, Pune, India*
*Corresponding author: ahiremayur.03@gmail.com

***Abstract*: There are two main industrial classes of belt conveyors; those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volume of resource and agricultural materials. Conveyor belt maintenance not only includes proper care of the belt itself but also includes care and maintenance of the frame and accessories. The same way life of a conveyor belt not only depends on good design and manufactures but also on the care and attention it receives in storage and service. The main damages are occurring in bulk material handling system due to the sticking of the material which is transporting and the damages due to the chemical reaction and also there causes failure due to carry back of product. The problems and failures need a permanent maintenance. The removal of sticking materials can be done by two methods, by using a wire brush which is placing under the conveyor belt; it will remove the sticking materials when the conveyor rotates. There is one more solution for this is problem to use a water spray under the belt conveyor belt for the sticky materials.**

***Keywords*: Belt Conveyors, Material handling system.**

1. Introduction

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available, and are used according to the various needs of different industries. There are Belt conveyor screw conveyor, chain conveyors as well as telescopic conveyors. 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. 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.

- Conveyers have many kinds of benefits, it can almost can be installed anywhere. Besides, using conveyer as transportation to move load are much safer than using forklift or other machines. It also can move loads of all sizes and shapes. There are many types of conveyer machines such as gravity conveyer system, power belt conveyer systems, vibration conveyer systems, flexible conveyer systems and live roller conveyer system. The design capacity of the conveyor belt system was calculated from the information collected using different methods of calculation. Three different methods of calculation were used to determine the design capacity of the conveyor belt system. The design of the belt conveyor must begin with an evaluation of the characteristics of the conveyed material and in particular the angle of repose and the angle of surcharge. The angle of repose of a material, also known as the “angle of natural friction” is the angle at which the material, when heaped freely onto a horizontal surface takes up to the horizontal plane. The conveyer belt installations have been used for moving a wide variety of goods and materials for many decades. They continue to provide the fastest, safest, most effective and economical method of transportation over relative long distance often in areas where space is limited an operating under some of the most adverse conditions imaginable. The conveyer belt plays an integral role in the efficient operation of every conveyer system and has to be able to cope with an enormous variety of stresses and demands.

Functions of the Conveyor System:

Conveyors are able to safely transport materials from one level to another, which when done by human labor would be strenuous and expensive. They can be installed almost anywhere, and are much safer than using a forklift or other

machine to move materials. They can move loads of all shapes, sizes and weights. Also, many have advanced safety features that help prevent accidents. There are a variety of options available for running conveying systems, including the hydraulic, mechanical and fully automated systems, which are equipped to fit individual needs. Conveyors systems are commonly used in many industries, including the automotive, agricultural, computer, electronic processing, aerospace, pharmaceutical, chemical bottling, canning print finishing and packaging.

2. Literature Review

"Design and fabrication of 360^o conveyor system with up-down mechanism for industrial application" by Prof. Nitin Doifode, Prajal Lalwani, Pooja Shirname, Varsha Tambe, Mosin Khan.

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 has a high load capacity, a long transport path, simple design, easy maintenance and high operational safety. The 360-degree belt conveyor system is also used in material handling in the foundry, such as the delivery and distribution of foundry sand, molds and waste disposal. This project work consists of design the conveyor system, motor selection, belt specification, shaft diameter, pulley, bearing selection and specification using the standard model calculation.

The 360-degree conveyor system for material handling has all the abundant and outstanding benefits of this equipment in any materials handling industry with minimum operation time. So, in any case, it's better than a fixed conveyor belt. The system design tools and methods used to assemble the components into a single transport system designed to meet ever-increasing bulk handling requirements. In the industry for handling many solid conveyor belts are needed. Thus, the burden of installation and maintenance of the fixed conveyor

"Conveyor Belt Trouble Bulk Material Handling" by G. Velmurugan, E. Palaniswamy, M. Sambathkumar, R Vijaykumar, T. M. Saktimurag.

There are two main industrial classes of belt conveyors; those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volume of resource and agricultural materials. Conveyor belt maintenance not only includes proper care of the belt itself but also includes care and maintenance of the frame and accessories. The same way life of a conveyor belt not only depends on good design and manufactures but also on the care and attention it receives in storage and service. The main damages are occurring in bulk material handling system due to the sticking of the material which is transporting and the damages due to the chemical reaction and also there causes failure due to carry back of product. The problems and failures need a permanent maintenance. The removal of sticking materials can be done by two methods, by using a wire brush which is placing under the conveyor belt; it will remove the sticking materials when the conveyor rotates. There is one more solution for this is problem to use a water spray under the belt conveyor belt for the sticky materials.

The problems were found in different conveyer system was improper alignment of idlers, belt running off at tail pulley, excessive wear on bottom of belt and corrosion in the frame. Regular maintenance and proper lubrication can keep maintain alignment of idlers. Adjust loading material to properly center the load helps in reducing belt running off at tail pulley. Greasing and painting can reduce corrosion in frames and drum. Use of dual scrap system, brush system and rubber scrapper help in effective running of the conveyor belt. By following these methods, the tendency to breakdown maintenance reduces and gradually the yearly maintenance cost suppresses thereby profiting the companies.

"Design and Fabrication of 360^{0}Rotating Belt Conveyor with Up Down Mechanism" by Hireesh Kumar, G. Prasanthi.

Bulk material transportation requirements have continued to stress the belt conveyor industry to carry higher tonnages, larger distances and more diverse routes. In order to keep up these criteria significant technology advances have been incorporated in the field of the belt conveyor 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. Examples of complex conveying applications along with the numerical tools required to ensure reliability and availability will be reviewed. This work indicates the new developments in belt conveyor technology. The present work deals with the new trend in the field of belt conveyor system. A 3600 rotating belt conveyor system has been designed for prototype operation and the details of the design, fabrication, modeling and economies of the rotating belt conveyor system is presented in this work. 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.

"Study and Performance of Belt Conveyor System with Different Type Parameter" by Deepak Gupta Dheeraj Dave.

Material handling equipment are designed for many advantages such as easy, cheap, fast and safe loading and unloading condition. Belt conveyor systems are design for easy handling of materials in terms of weigh: and height. This paper discusses the design and considerations of belt conveyor system for sample weight, in terms of size, length, capacity and speed, roller diameter, location and arrangement of pulley, angle and axis of rotation, control mode, intended application, product to be handled. A belt conveyor system with two rollers can be developed for handling the weight. The belt conveyor system is designed with high degree of automation, loading, movement

and unloading efficiency. These are very flexible, safe, with low initial, and maintenance cost.

"Improvement of mechanism of conveyor system" by M.A. Muda, F. Imalek, M. Muaz, S. Rubiah, M. N. Mansor.

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Many kinds of conveying systems are available, and are used according to the various needs of different industries. The purpose of this project is to improve the existing conveyor machine that located at the methodology lab in University Malaysia Pahang. The current design of the conveyer machine used timing belt that connected at the motor to move the shaft. The problem of the current design is the timing belt disheveled and shaft was slipping. For the improvement we use sprocket and chain as drive mechanism. Beyond the above improvement the conveyor system is expected to work. This project also helps student to utilize their engineering information and improve the skill of student in solving the mechanical problems.

The conveyor system is successfully improvised using drive chain. The conveyor moves without causing any slippage although the conveyor need a regular maintenance to avoid any casualties in the future. This journal means to improve the current conveyor system which has been not working for quite a long time. The current conveyor uses a belt conveyor system. A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys with an endless loop of carrying medium. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyors.

3. Problem Statement

Our project work deal with utilization of 360 conveyor for reduces the Manpower cost, space required for operation so that it becomes compact, time saving and safe loading and unloading the materials in industries. Our current attempt is towards fabricating an economical telescopic material unloaded by adopting the exiting simple design procedure. We are going to develop conveyor which can height adjustable also works on pneumatic cylinder.

4. Objectives

1. To analyses the performance of traditional conveyors and modify it into conveyor system.
2. Design and develop modified system for extension and retraction in both planes
3. Reduce loading and unloading time as well as human efforts in term of man hours.
4. Develop compact system that consumes minimum storage space and minimum energy.
5. The main purpose of project is the handling of material in compact space in industry i.e. 360° rotation of model.
6. Design and development of 360°and up-down mechanism.
7. But we will make the conveyor belt such that it can be rotate 360°and up-down mechanism with proto type model.

5. Design of Model

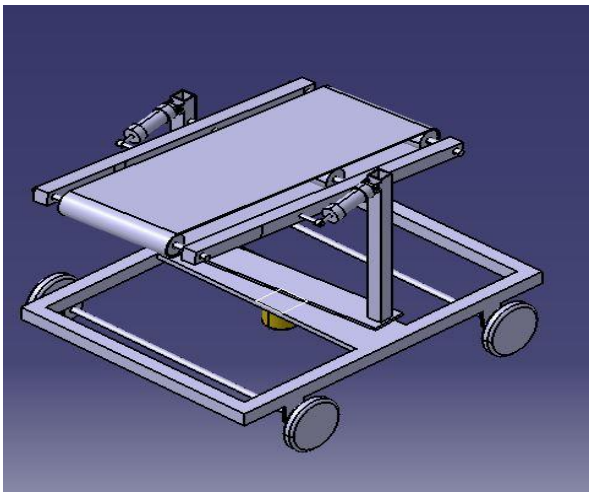


Fig. 1. CATIA Model

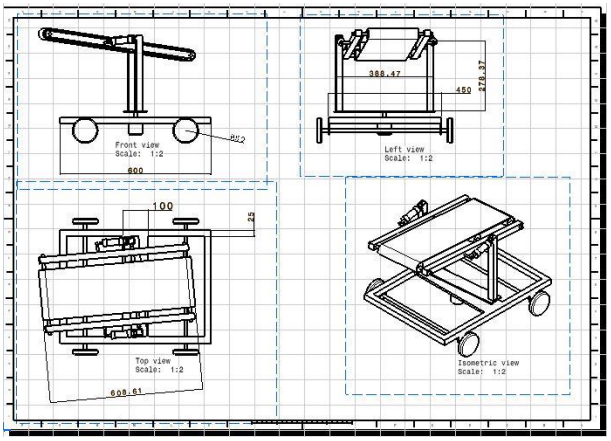
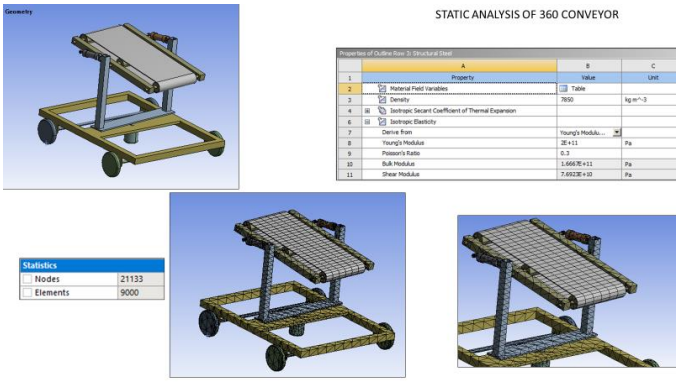
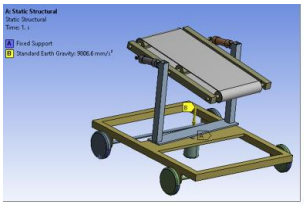
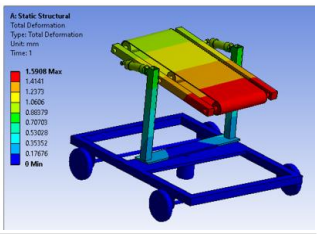


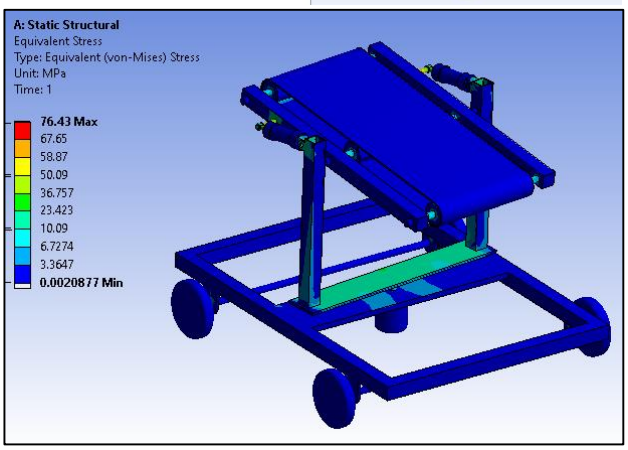
Fig. 2. Drafting of the model

Static structural analysis of model:









6. Basic Design Calculations

A. *Design of belt conveyor*

For the design of conveyor, we are considering some data,

1. We are designing the belt conveyor for light utility, so we took its material as Rubber.
2. Density of rubber=1522kg/m^3
3. Minimum thickness of belt=1.5mm
4. Length of the conveyor(L)=2.5 feet=762mm
5. Mass of the belt=1.7396 kg
6. Coefficient of friction between bottom surface of the belt and top surface of the rollers having length 200 mm (u)=0.4 (Empirical experimental value)
7. RPM of the rollers (N)=10
8. Mass of the objects placed on conveyor= (2*0.5) =1 kg. Here we are placing two boxes of 0.5kg mass.

Now,

The linear speed of belt conveyor is calculated as,

V=2*3.14*N/60

V=1.047 m/s

Now total vertical force applied by packages on belt conveyor

F= (Total mass of boxes) *(Acceleration due to gravity)

= (1) *(9.81)

F1=9.81 N

Total weight of the belt= (Mass of belt) *(Acceleration due to gravity)

F2= (1.7396) *(9.81)

F2=17.065 N

Total belt pull= [(Total weight of all packages) + (Total weight of the belt)] *(Coefficient of friction between belt and rollers)

= [(9.81) +(17.065)] *(0.4)

F =10.755N

Now the total required power to move the conveyor belt is calculated as,

P= (Belt pull) *(Belt speed)

=10.755*1.047N-m/s

P=11.255 Watts----------A

Now we have to give more power than A to move the belt, so select the drive accordingly.

Here we have taken 12V & 2A motor which produces 24-Watt power, so our design is safe.

B. *Design of motor placed at bottom*

We know the total mass of the system is 15 kg.

So total vertical force=15*9.81 =145.15N

Hence, we have to take this total vertical force in consideration to design the bottom motor, which is going to rotate the upper section in 360 degree.

Now the total required torque,

T=F*R

= (145.15) *(0.225)

T =33.108 N-m----------B

Here R is the distance of the extreme point of upper frame from center point where motor is mounted.

Now for 12V&2A motor, with 5 rpm the supplied torque is calculated as,

T= [24*60]/ [2*3.14*5]

T =45.83 N-m----------C

As, C>B our design is safe.

So, we have taken 12V & 2A Motor.

C. *Design of the pneumatically operated cylinder*

Take material of the rollers as M.S.

So, density of M.S.=7860kg/m3

Mass of two rollers with diameter 0.02m and length=0.1m=0.492kg.

Now we know the total weight of the conveyor with objects placed on the it,

F = [Weight of the objects] + [weight of the belt] + [Weight of the rolers] + [weight of the supporting frame]

= (9.81+17.065+4.826) +39.24

F =70.941 N

Now we are supplying P=4 Bar=0.4 N/mm2

We know that, P=F/A

As the total weight is distributed on two cylinders,

O.4= (35.4705)/A

A=14.18 mm2

So, diameter of the cylinder=4.25 mm.

We have taken standard available size cylinder with diameter=10 mm

Here stroke length of the cylinder depends upon the amount for which you have to increase the height of the belt conveyor,

here we are taking it 75 mm.

So, length of cylinder is L=75.

Now volume of the cylinder=A*L

= (14.82) *(75)

V=1111.5mm^3

So, we have taken a standard cylinder size as,

Diameter=10 mm, Length=75mm.

7. Working of the System

The design of the system is such that, the drive required for the conveyor belt through which material has to be transferred from one end to the other end is given with the help of motor and gearbox. For different applications and scenarios, variable height is required at one end of conveyor. So pneumatic actuator does with work by lifting and lowering the conveyor system. As per the requirement, material has to be loaded and unloaded from different locations of the warehouse which again adds complications and reduces efficiency. This is solved by providing the motor and gearbox arrangement to rotate the entire conveyor system in 360 Degree motion. One motor is connected with the shaft of the belt which will rotate the conveyor belt. Then two motors and two actuators will be used for making the up-down mechanism. The motors are connected with those actuators and when the motor will rotate the actuator will move in the up-down position. Therefore, 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.

8. Advantages of the system

- Conveyors are able to safely transport materials from one level to another, which when done by human labor would be strenuous and expensive.
- They can be installed almost anywhere, and are much safer than using a forklift or other machine to move materials.
- They can move loads of all shapes, sizes and weights. Also, many have advanced safety features that help prevent accidents.
- There are a variety of options available for running conveying systems, including the hydraulic, mechanical and fully automated systems, which are equipped to fit individual needs.

9. Disadvantages of the System

- Accumulation difficult.
- complicated marshalling
- The loss of light weight bulk material carried away as dust or spilled from the belt along its path is another objectionable feature.
- Continuous or periodic monitoring of belt is necessary
- Heat affects the material of belt.
- Conveyors used in industries having length up to 8 to 10 meters and they are not adjustable in length as well as height.
- Because of which storage space required is large
- System is large than telescopic conveyor system.
- Number of rollers used in existing conveyor are large hence power consumption of existing conveyor telescopic conveyor system. Maintenance of existing conveyor system is more than telescopic conveyor system.

10. Conclusion

Considering the practical working conditions of the respective warehouse, we have reached a conclusion that it needs a directional conveyor system to regulate the workload at the place. It will help reducing the workload, human labour, mishandling, damage and injuries while loading and unloading of goods from the carrier vehicles to the desired stacking place and increase the efficiency of workplace. The design has comparatively more portability and utility for versatile tasks. Overall, the above deigned system would help out to solve the problem faced at the workplace to the maximum extent.

References

[1] Nitin Doifode, Prajal Lalwani, Pooja Shirname, Varsha Tambe, Mosin Khan, “Design and Fabrication of 360^0 Conveyor System with Up-Down Mechanism for Industrial Application.”

[2] G. Velmurugan, E. Palaniswamy, M. Sambathkumar, R Vijaykumar, T. M. Saktimuraga, “Conveyor Belt Trouble Bulk Material Handling.”

[3] E. Shireesh Kumar, G. Prasanthi, “Design and Fabrication of 3600 Rotating Belt Conveyor with Up Down Mechanism.”

[4] Deepak Gupta and Dheeraj Dave, “Study and Performance of Belt Conveyor System with Different Type Parameter.”

[5] M. A. Muda, F. I. Malek, M. Muaz, S. Rubiah, M. N. Mansor, “Improvement of Mechanism of Conveyor System.”