

Product Rotating Using Conveyor Belts

Virendra Singh K. Solanki¹ Vimal Chandra Mishra² Vishal S. Thakur³ Manishkumar R. Solanki⁴
^{1,2,3,4}UG Student ⁵Assistant Professor

^{1,2,3,4}Department of Mechanical Engineering

¹Vidhyadeep institute of Engineering and Technology, India ²Vadodara Institute of Engineering, India

³Shri S'ad vidya mandal Institute of technology, India ⁴Pacific school of Engineering, India ^{1,2,3,4}Gujarat Technological University, India

Abstract— In modern time for purpose of stamping price, manufacturing and expiration date, inspection sign on bottom, top or other surfaces of the product, the robotic arm or human endeavor is used to accomplish the mentioned activity and then lifting it from one conveyor to other conveyor. In this project we are going to modify a system that is able to rotate the product on “Single Conveyor System” without using robotic arm, which help to make system smoother and reduce cost as well as time of packaging process. This system is cheaper, more reliable, low maintenance and safe than recent robotic system.

Keywords: Conveyor Belt, Belt Transmission, Product Rotation, Product Printing

I. INTRODUCTION

Nowadays, significant numbers of industries switching to Automation, It is concerned with most of manufacturing and labeling or stamping process. Conveyor systems are used by most of the industries due their benefits. Conveyors are able to safely transport product in industry, without conveyor system it required more worker for manual material handling would be very slow and costly. In this project, we are focused on the possible change in design of conveyor belt for purpose of easy, fast and automatic rotation of product on conveyor for stamping or labeling of product on any face of product even at bottom face without help of any robotic arm mechanism.

Furthermore, we are going to modify a system that is able to rotate the product on single conveyor system without using robotic arm, which help to make system smoother and reduce cost and time of packaging system. A conveyor system helps us for fast packaging and efficient transportation for various materials or product in packaging industries.

II. OBJECTIVES

- Enabling seamless and fast transition and rotation of products on conveyor belt.
- Elimination of product rotating robots or manpower, hence reducing the overall costs of production.
- Fast labeling system compare than existing system.
- Automatic product rotation through conveyor belt.
- Automation in labeling.
- Reduce manual product handling.

III. LITERATURE REVIEW

We have read some patent and research paper related to our project requirement and basics about conveyor system to broaden our understanding about said project.

A. e-ISSN: 2278-1684, p-ISSN: 2320-334X, *Design and Development of Automated Conveyor System for Material Handling*, Abhijit Gaikwad, Yogesh Raut, Jitendra Desale, Akshay Palhe, Govinda Shelar, Prof.Shreekant Pawar. *IOSR Journal of Mechanical and Civil Engineering*

In their research paper they have carried out calculation for conveyor belts for material handling over long distance i.e. 30-50km. Moreover they have also listed merits and demerits of long conveyor belts system over convention material handling methods. They successful completion of this project work is help to the development of an automated belt conveyor system which is quick, safe, reliable and efficient. Their focus to reduce human involvement and endeavours at the same time increase the productivity & accuracy levels that cannot be achieved by manual process.

B. Patent Number – Us3960640, *Bottom Labeling Apparatus*, Paul R. Mort, Jr Robert A. Cleary

In this patent they have discussed about labeling at the bottom of products with a feedback loop, which ensures greater accuracy in printing label. It is being attained using multiple sensor to get feedback about products labeling. The first sensor is used to know if the label has applied or not. Second sensor ensures the placement of the label and third label ensures that correct placement of label on correct product is applied. If some false label has applied feedback loop sends information to system to send it on a different path.

C. Patent No. : US6823981B2, *Conveyor system for an automatic accumulation system*, Richard Jogle, Neenah, Steven A. Hellmann, Oshkosh.

This invention is related to flip the product and use to accumulate loose packages in such a way that can be easily send for further processes. In this invention conveyor system, rollers, guide plates, slider plate are used. Slider plate is used to collect loose packages. Guide plate is design in such a way that it can flip the packages on conveyor.

We have learn that we can twist or flip the product with only two conveyor belt, which running simultaneous. We can twist product without twisting table, timing screw and other mechanism. Also we can twist product without using robotic arm and worker.

This invention can more effectively and more efficiently provide a processing system capable of converting loose package into a configuration that can be automatically arrange it in packaging system.

Some Research papers which helps us to understand existing method and modify the existing packaging system for better labeling or stamping on conveyor. It helps us to understand all possible method to rotate the product on conveyor or stamping.

IV. DESIGN OF SINGLE CONVEYOR SYSTEM.

We are accomplishing product rotation. We are going to modify a system that is able to rotate the product about 90 degree to 180 degree without help of robotic mechanism, on single conveyor system for stamping or labeling, which help to make system smoother and reduce cost and time of packaging system and labeling process. This system is cheaper, more reliable and safe than recent system. Moreover, this project utmost useful for micro, small, medium enterprise business, because this kind of industries.

Using two conveyor belts mutually perpendicular to each other, by changing the axis of rotation of conveyor belts from horizontal to vertical and vice versa. In our prototype we have shown how belts are aligned with each other for efficiently rotating the product.

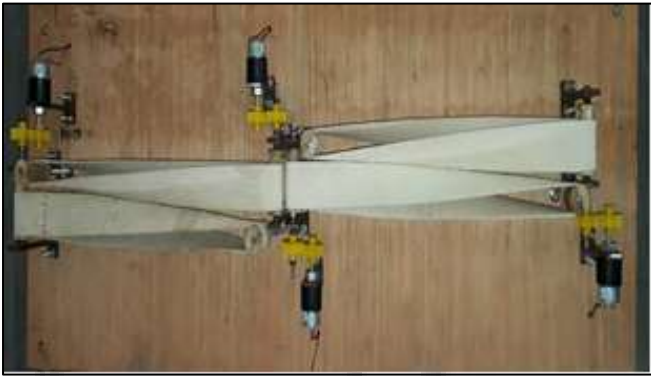


Fig. 1: Product rotating conveyor belts



Fig. 1.1: Working model

V. DESIGN METHODOLOGY

The basics of the Calculations of Conveyor Belt Design Parameters

A. Belt tension:

Owing to motion of electric motors and load of conveyed materials, the belt of conveyor usually experience a tensile load and stress. The belt tension can be calculated by this method.

$$T_b = [2 \cdot m_i + (2 \cdot m_b + m_m) \cdot \cos(\delta)] \cdot 1.37 \cdot f \cdot L \cdot g + (H \cdot g \cdot m_m).$$

Where,

T_b is in Newton. f = Coefficient of friction

L = Conveyor length in meters.

g = Acceleration due to gravity = 9.81 m/sec^2

m_i = Load due to the idlers in Kg/m.

m_b = Load due to belt in Kg/m.

m_m = Load due to the conveyed materials in Kg/m.

δ = Inclination angle of the conveyor in Degree.

H = vertical height of the conveyor in meters.

Load due to idlers (m_i): This can be calculated as below:

$$m_i = (\text{mass of a set of idlers}) / (\text{idlers spacing}).$$

B. Power at drive pulley:

The power required by the driving pulley can be calculated as below.

$$P_p = (T_b \cdot V) / 1000$$

Where,

P_p is in KW.

T_b = steady state belt tension in N.

v = belt speed in m/sec.

C. Sizing of the motor:

The minimum motor power can be calculated as:

$$P_m = P_p / K_d$$

Where,

P_m is in Kw.

P_p = the power at drive pulley in Kw

K_d = Drive efficiency.

D. Acceleration:

The acceleration of the conveyor belt can be calculated as:

$$A = (T_{bs} - T_b) / [L \cdot (2 \cdot m_i + 2 \cdot m_b + m_m)]$$

Where,

A is in m/sec^2

T_{bs} = the belt tension while starting in N.

T_b = the belt tension in steady state in N.

L = the length of the conveyor in meters.

m_i = Load due to the idlers in Kg/m.

m_b = Load due to belt in Kg/m.

m_m = Load due to the conveyed materials in Kg/m.

VI. CONCLUSION

Product rotation can be achieved using conveyor belt systems which is way cheaper and affordable, such system does not require robotic assistance. While considering today's methods of rotation using complex machines and expensive setups.

REFERENCE

- [1] V.B.Bhandari, "Design of Machine Element" [3rd Edition]
- [2] Michael G. Kay, "Material Handling Equipment"
- [3] Fenner Dunlop, "Conveyor Handbook" [Version 2.6, Date 01/02/2016]
- [4] IOSR Journal of Mechanical and Civil Engineering [IOSR-JMCE]
- [5] R. L. Easton, "Conveyor with high speed case turner" [US/5706929]
- [6] Dr. N. M Bhatt, "Elements of Mechanical Engineering"
- [7] R K Jain, "Machine design and component Design for manufacturing industries."