Design and Manufacture of Roller Conveyor for Material Handling of Disc

Rushikesh Pawar[1] Swapnil Patil[2] Vaibhav Pawar[3] Shubham Dharpale[4]
[1,2,3,4]JSPM's Rajarshi Shahu College of Engineering, Maharashtra, India

Abstract— This project is sponsored by Kalyani Maxion Wheels and is related with material handling. The company was facing a problem on carrying the stalk of disc which was conveyed manually and consumed more time due to which its productivity rate was affected. Thus, design of conveyor was suggested and the problem was sorted out.
Keywords: Material Handling System, Roller Conveyor

I. INTRODUCTION

The project which is undertaken by us is a sponsored project by a company named KALYANI MAXION Wheels ltd.

Various processes are carried out on same floor by complete automation but yet the company faces few problems which is severely affecting their productivity rate. We were given a problem to solve which was faced in the disc making process line. Previously the disc made in the first stage of this process was carried manually to the next stage unit.

We studied and finalized the solution for this problem by attaching a conveyor in between these two units. After considering and analyzing various aspects related to the conveyors and the problem we were dealing with, roller conveyor was finalized. So, we successfully completed the design, analysis, manufacturing, testing and installatio9-n of the conveyor.

Basically, the first stage of the disc making process comprises of blanking process of the rectangular plate into circular discs. The robotic arm carries the disc from blanking bed to the passage in between the first and second unit. A forklift caries the stalk of the discs to the place just before the worktable of the second unit. A worker pick disc one by one and place up to the magnetic gripper. This process becomes very time consuming and affects the production rate.

For replacing the manual work and to reduce the time consumed, we have designed a roller conveyor. This roller conveyor is installed before the magnetic gripper. Now a forklift carries the discs and places them on the conveyor. The conveyor is driven by motor.

II. MATERIAL HANDLING SYSTEM

Movement of material within short distance inside or outside of a building using manual or transportation system means material handling. Control of material throughout the manufacturing, warehousing, distribution, consumption, and disposal different level of equipment's are utilized such as manual, semi-automated, and automated equipment and includes consideration of the protection and storage. Material handling can be used to create time and place utility through the handling, storage, and control of material, as distinct from manufacturing, which creates form utility by changing the shape, form, and makeup of material.

III. OBJECTIVES OF MATERIAL HANDLING

1) Accuracy in load transportation: The material handling system should transport the loads to the required place with high degree of positional accuracy.
2) Transportation of load as per scheduled time: The material handling system should move the loads to the required place in the scheduled time. If it is late or early, it may disturb the further processing cycle of the component.

IV. PRINCIPLES IN SELECTING MATERIAL HANDLING EQUIPMENT

1) Direction of load travelled.
2) Length of travel
3) Type and properties of load to be handled
4) Required load moving capacity of unit
5) Characteristics of production processes

V. CONVEYORS

A conveyor 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.

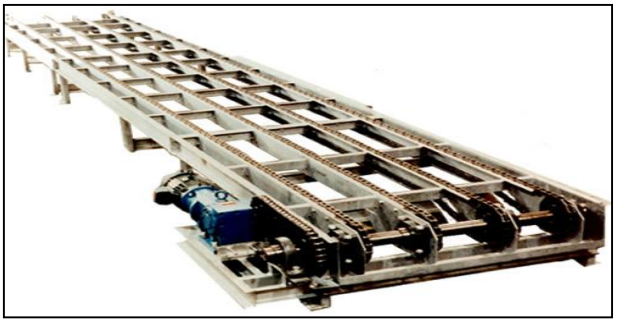
Conveyor systems are used widespread across a range of industries due to the numerous benefits they provide.

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.

A. Types of Conveyor System

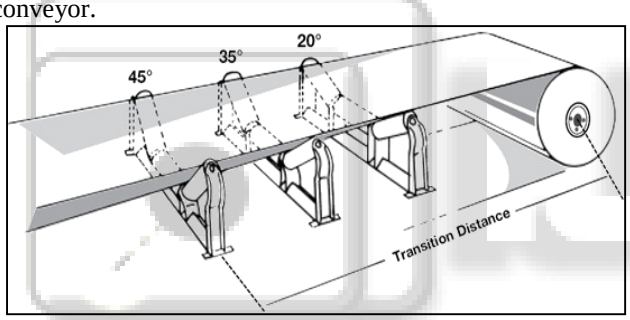
1) Flat Belt Conveyor

A conveyor belt is the carrying medium of 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 the conveyor belt that rotates about them



2) Troughed Belt Conveyor

The width of the conveyor limits the volume carrying capacity of the flat belt conveyor .by giving the trough to the belt by means of volume carrying capacity of the conveyors can be increased such conveyors are known as troughed belt conveyor.



3) Chain Conveyor

A chain conveyor is a type of conveyor system for moving material through production lines. Chain conveyors utilize a powered continuous chain arrangement, carrying a series of single pendants. The chain arrangement is driven by a motor, and the material suspended on the pendants are conveyed.

4) Roller Conveyor

A roller conveyor or line-shaft conveyor is, as its name suggests, powered by a shaft beneath rollers. These conveyors are suitable for light applications up to 50 kg such as cardboard boxes and tote boxes.

A single shaft runs below the rollers running the length of the conveyor. On the shaft are a series of spools, one spool for each roller. An elastic polyurethane O-ring belt runs from a spool on the powered shaft to each roller. When the shaft is powered, the O-ring belt acts as a chain between the spool and the roller making the roller rotate. The rotation of the rollers pushes the product along the conveyor. The shaft is usually driven by an electrical motor that is generally controlled by an electronic PLC (programmable logic controller). The PLC electronically controls how specific sections of the conveyor system interact with the products being conveyed.

Advantages of this conveyor are quiet operation, easy installation, moderate maintenance and low expense. Line-shaft conveyors are also extremely safe for people to work around because the elastic belts can stretch and not injure fingers should any get caught underneath them. Moreover, the spools will slip and allow the rollers to stop moving if clothing, hands or hair gets caught in them. In addition, since the spools are slightly loose on the shaft, they act like clutches that slip when products are required to accumulate (stop moving and bump up against each other. i.e. queue up). With the exception of soft bottomed containers like cement bags, these conveyors can be utilized for almost all applications.

A disadvantage of the roller line shaft conveyor is that it can only be used to convey products that span at least three rollers, but rollers can be as small as 17mm in diameter and as close together as 18.5mm. For items shorter than 74mm, the conveyor belt system is generally used as an alternative option.

VI. PROBLEM DEFINITION

A. Need of the Project

The problem statement that we are dealing with is to reduce the time during disc carrying front from the first unit to the second of wheel disc process, to reduce the time for carrying the disc thereby increasing the production rate.

B. Objectives

To implement the solution of the roller conveyor to the process thereby reducing the time from

To increase the production rate of the component by utilizing the means of automation, since the dumping time is reduced by automating the process this will result in increasing the production rate of the process.

C. Scope

To enhance the productivity through automation. We are using the conveyor belt mechanism for reducing the time required of picking of one dumping box/bin and placing another bin. The bin size and the dimensions as well as the gear box required for driving the conveyor belt is taken into consideration and thus the conveyor belt will be designed in accordance to it and the productivity rate can be increased.

D. Problem definition

This particular work will focus on Design of the conveyor for better material handling characteristics and the problem definition for the project becomes.

Design and validation of conveyor for material handling and improving the performance of the machine.

To eliminate the issue in existing system.

VII. CALCULATIONS

A. Disc Calculations

Mass of each disc $7850*\pi*R^2*h$

B. Limiting Torque for Moving the Roller

$T=f*\mu*r$
Perimeter$=2\pi r$
$\omega= 2\pi N/60$
Power$=T/\omega$
Considering losses= 10% inertia+ friction losses in the driveline

C. Motor Selection

18.3rpm and 141N-m from standard table having 0.37KW (bonfiglioli catalogue)
Sprocket
$m = D/Z$

D. Chain Selection

we selected 12B2(3/4'') Duplex chain is selected.

E. Shaft Calculations

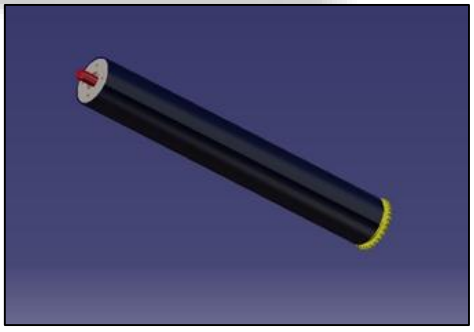
$T_{eq} =\sqrt{(K_bM_b)^2+(K_tT)^2}$
For hollow shaft
$\sigma = \frac{32M}{\pi}*d*(1-k^4)$

F. Bearing selection

$L_n = (\frac{C}{Pe})^a$
$P_e=(XVF_r + YF_a)k_a$
$\tau=\frac{F}{r}$

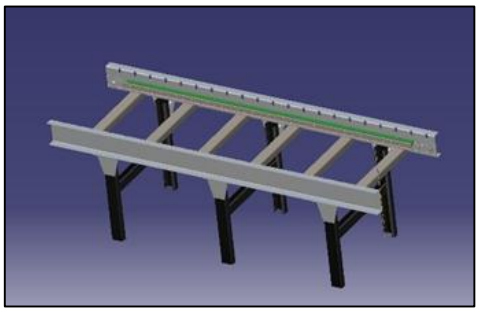
VIII. CONSTRUCTION OF ROLLER CONVEYOR FOR MATERIAL HANDLING PURPOSE

A. Roller

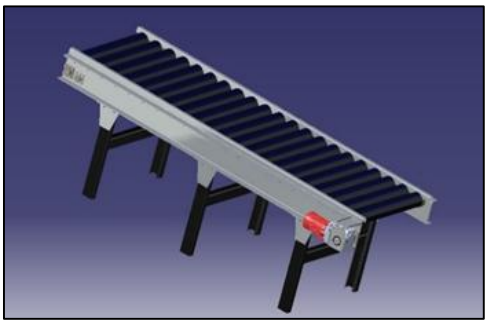


B. Sprocket

C. Frame



D. Assembly



IX. CONCLUSION

Manual Handling	Conveyor handling
1) Time consumed by manual process is more.	1) Time consumed by conveyor process is less.
2) Number of discs carried are less.	2) Number of discs carried are more.
3) Workers may get affected with various injuries and health related hazards	3) No problem of various injuries and hazards.
4) Variety of products cannot be carried.	4) it is multipurpose.

From the comparison we can conclude that, the proposed design is flexible, productivity rate will be increased as the time consumed is reduced.

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