

“A Pneumatic Type Belt Conveyor for Truck Loading & Unloading”

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Abstract: The applications of conveyor are increasing day by day in the manufacturing & transport industries due to its flexibility and accuracy in material handling. Industries like transport, packaging and processing uses conveyor for the rapid production and material handling. In given system we can overcome the problems in material handling & do the Design & fabrication of truck loading conveyor used in the packaging & transportation system in industries material handling. The numbers of trays/boxes to be load handle & transfer by using pneumatics lifting arrangements & conveyor system

Key Words: Pneumatic system, belt conveyor, gravity roller conveyor, design and analysis

Introduction

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyor systems are commonly used in many industries, including the automotive, agricultural, computer, electronic, food processing, aerospace, pharmaceutical, chemical, bottling and canning, print finishing and packaging. Although a wide variety of materials can be conveyed, some of the most common include food items such as beans and nuts, bottles and cans, automotive components, scrap metal, pills and powders, wood and furniture and grain and animal feed. Many factors are important in the accurate selection of a conveyor system. It is important to know how the conveyor system will be used beforehand. Some individual areas that are helpful to consider are the required conveyor operations, such as transportation, accumulation and sorting, the material sizes,

weights and shapes and where the loading and pickup points need.

Problem Definition:

If transport industry wants to loading or unloading the materials from truck or trailer, it required minimum two labours for handling. One Worker is outside the truck and one inside the truck. Worker is outside the trucks is continuously set and lift the material from ground, due to this back pain done to worker. Worker is inside the truck is come to collect the material at end of truck then go inside the truck after picking the material, this cause work fatigue for both workers. In given system we can overcome the problems in material handling & do the design & fabrication of truck loading conveyor used in the packaging & transportation system in industries material handling.

Objective:

To design & development of conveyor system consider following important points regarding this objective of study –

- 1) Study existing conveyor system and its design.
- 2) Geometric modeling of new conveyor system.
- 3) Recommendation of new solution for optimization.
- 4) To reduce the power consumption during material handling.
- 5) To maintain the accuracy in truck loading.
- 6) To develop automation unit, so that system can easily be adopted in today's automated Transport Company.

- 7) To make a system at low cost, low maintenance, low capital investment in less space.
- 8) To perform the most rigid operation with high-speed material handling by reducing fatigue, time & cost of material handling.

Scope of project:

The scope of project is behind to design and development of truck loading & unloading conveyor is to make an automatic system in material handling which is used for ware house & transport in industry.

Conveyors:

Conveyors are essential to productivity, from light-duty package-handling roller conveyors in distribution centres to overhead and towline chain conveyors carrying automobiles through assembly to massive ore-handling belt conveyors. To avert production stoppages due to conveyor failure, progressive companies use predictive condition monitoring technologies to monitor those assets. The objective is to detect impending failures before they occur, and take corrective action during scheduled production shutdowns. One of those technologies is thermograph, or IR Imaging. Thermal imagers capture two dimensional images representing the apparent surface temperatures of conveyor components, and are excellent tools for monitoring conveyors.

- Conveyors are able to safely transport materials from one level to another, which when done by human labour 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.



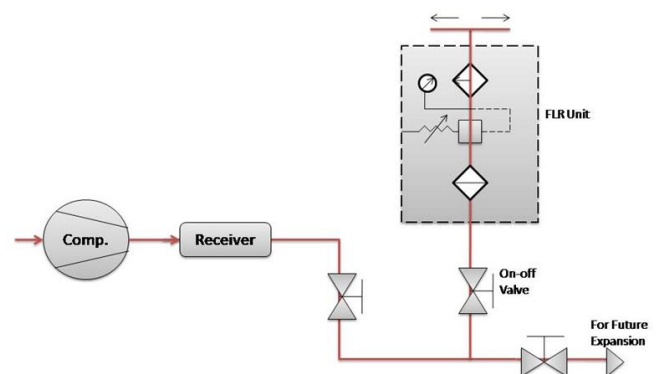
There are a variety of options available for running conveying systems, including the hydraulic,

mechanical and fully automated systems, which are equipped to fit individual needs. It is important to know how the conveyor system will be used beforehand. Some individual areas that are helpful to consider are the required conveyor operations, such as transportation, accumulation and sorting, the material sizes, weights and shapes and where the loading and pickup. Types of conveyor are:

- 1) Powered Belt Conveyor systems – Gravity.
- 2) Pneumatic conveyor systems Conveyor systems.
- 3) Vibrating conveyor systems.
- 4) Live Roller Conveyor systems.

Pneumatic systems introduction:

Pneumatic systems form the most primitive and distinct class of mechanical control engineering. They are classified under the term 'Fluid Power Control', which describes any process or device that converts, transmits, distributes or controls power through the use of pressurized gas or liquid. In a pneumatic system, the working fluid is a gas (mostly air) which is compressed above atmospheric pressure to impart pressure energy to the molecules. This stored pressure potential is converted to a suitable mechanical work in an appropriate controlled sequence using control valves and actuators. The basic layout of a pneumatic system is shown in fig. it could be observed that the basic components involved are similar to a hydraulic system. The basic differences between hydraulic and pneumatic systems are that in



hydraulic system the input mechanical energy is imparted to the oil is by pump, whereas, in pneumatic systems the working fluid being air, the mechanical energy is imparted to air by a compressor. Further, a hydraulic system usually operates at very high pressures to transmit the large

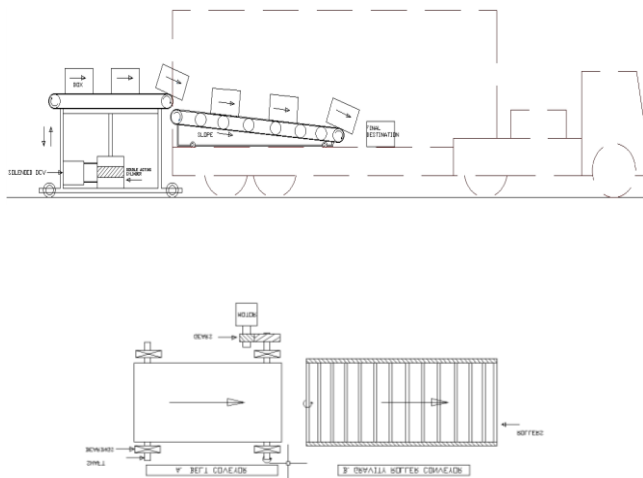
force and power while a pneumatic system operates at low pressures of about 5 – 7 bar for industrial applications.

Construction

The conveyor system having following main components this can be given below,

- 1) Supporting frame.
- 2) Gravity Rollers.
- 3) Conveyor Belt.
- 4) Double acting cylinder.
- 5) Solenoid direction control valve DCV.
- 6) Hose pipes.
- 7) Hoses fittings.
- 8) Flow control valves.
- 9) ON/OFF switch.
- 10) Gear motor.
- 11) Spur Gear drive.
- 12) Shaft
- 13) Bearing
- 14) Roller Wheels.

Conceptual Diagram



Working

In given system we can overcome the problems in material handling & do the Design & fabrication of truck loading conveyor used in the packaging & transportation system in industries material handling. The numbers of trays/boxes to be load handle & transfer by using pneumatics lifting arrangements & conveyer system. The material handling fixed can be easily altered in between the transportation process. These conveyers can transfer material either forward or reverse motion similarly its can be capable to loading and unloading the materials form truck & trailer. The

machine is consisting of mainly belt type conveyer & pneumatic type lifting system outside the truck and one gravity roller conveyer inside the truck. When we place box or container on belt type conveyer then pneumatic cylinder lift the conveyer to final to end of the truck platform, after that belt conveyer is start & move the boxes to gravity roller conveyer inside the truck. That procedure is repeated continuously to manage transporting time. The process can alter loading and unloading as per requirements.

Design

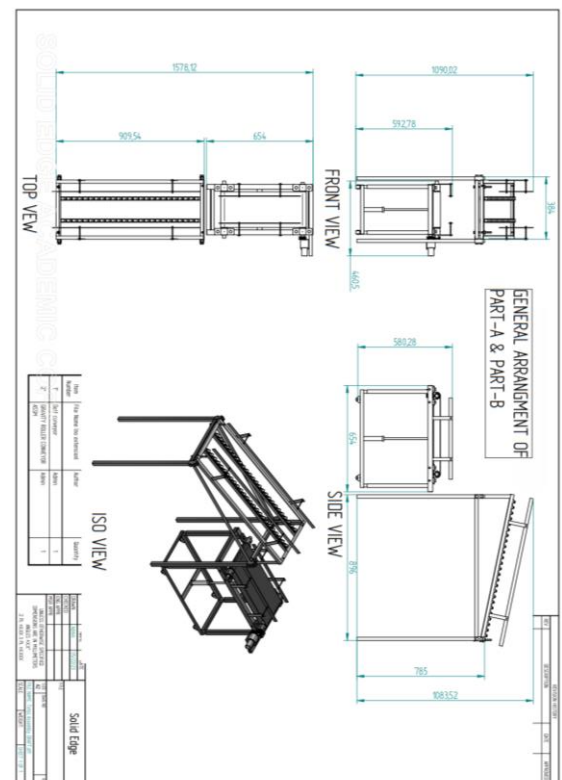
Metallurgical specification:

The machine is basically made up of mild steel.

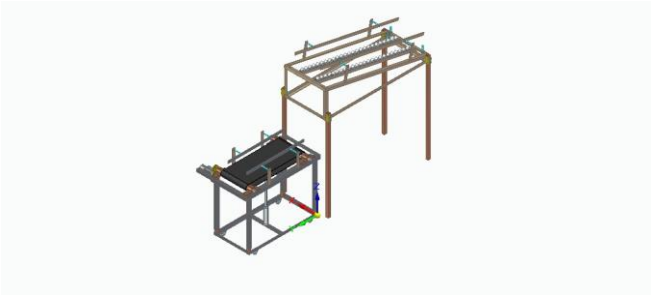
Reasons:

- 1) Mild steel is readily available in market.
- 2) It is economical to use.
- 3) It is available in standard sizes.
- 4) It has good mechanical properties i.e., it is easily machinable.
- 5) It has moderate factor of safety, because factor of safety results in unnecessary wastage of material and heavy selection. Low factor of safety results in unnecessary risk of failure.
- 6) It has high tensile strength.
- 7) Low co-efficient of thermal expansion.

General Arrangement



3D Model



Finite Element Analysis (FEA)

Finite element analysis (FEA) is the use of calculations, models and simulations to predict and understand how an object might behave under various physical conditions. Simply, FEA is a numerical method used for the prediction of how a part or assembly behaves under given conditions.

Type of Analysis Done - Structural Analysis

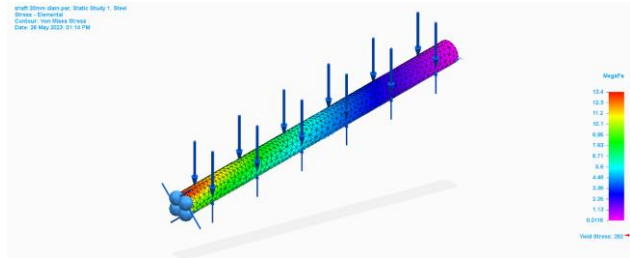
Both linear and non-linear model comes under it. In case of linear models simple parameters are used and it is assumed that the material cannot plastically deformed. In case of non-linear models, the material is stressed beyond its elastic properties for which the stress in the material vary with the amount of deformation.

Software Used for Analysis



Siemens Solid Edge ST10

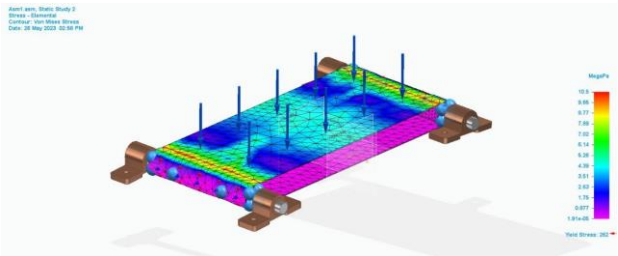
Analysis of Shaft Stress Results



Result component: Von Mises				
Extent	Value	X	Y	Z
Minimum	0.0116 MegaPa	0.011 mm	300.000 mm	0.137 mm
Maximum	13.4 MegaPa	0.000 mm	4.054 mm	10.000 mm

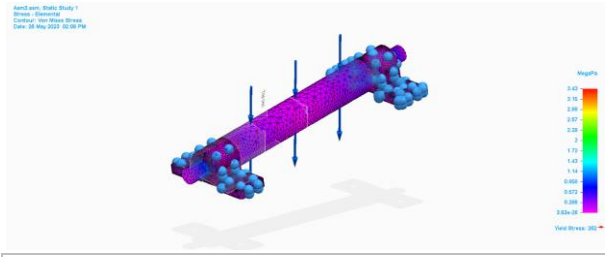
Analysis of Belt and shaft

Stress Results



Result component: Von Mises				
Extent	Value	X	Y	Z
Minimum	1.91e-05 MegaPa	- 24.226 mm	- 224.479 mm	- 11.272 mm
Maximum	10.5 MegaPa	- 96.458 mm	- 227.173 mm	20.000 mm

Analysis of Roller Assembly Stress Results



Result component: Von Mises				
Extent	Value	X	Y	Z
Minimum	3.53e-26 MegaPa	4.812 mm	252.250 mm	61.293 mm
Maximum	3.43 MegaPa	14.789 mm	-1.000 mm	2.510 mm

Trial & Results

Loading (material lift by pneumatic belt conveyor)



Loading (material passed over gravity conveyor)



Unloading (material passed over gravity conveyor)



Unloading (material passed over pneumatic belt conveyor)



2. Buffering
3. Storage
4. Pharmaceutical
5. Agriculture
6. Food processing industries
7. Chemical
8. Aerospace
9. Automotive.

Conclusion

While concluding this report, we feel quite fulfilled in having completed the project assignment well on time, we had enormous practical experience on fulfillment of the manufacturing schedules of the working project model. We are therefore, happy to state that the in calculation of mechanical aptitude proved to be a very useful purpose.

Although the design criteria imposed challenging problems which, however were overcome by us due to availability of good reference books. The selection of choice raw materials helped us in machining of the various components to very close tolerance and thereby minimizing the level of balancing problem. Needless to emphasize here that we had left no stone unturned in our potential efforts during machining, fabrication and assembly work of the project model to our entire satisfaction.

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Result Table (Timing)

Action	1 st Trial (time in seconds)	2 nd trial (time in seconds)
Up	55	54
Down	25	23
Forward	45	46

Advantages

- 1) It can handle only one job at destination with prepared time limits.
- 2) Machine work on the low power consumption as compare to the old machine.
- 3) The operation of the new machine is well controlled, well-balanced system.
- 5) Material transporting time is less.
- 6) Only simple support structures are required Design & fabrication is easy.
- 7) It is a faster process of material transporting.
- 8) Initial investment is low.
- 9) More accurate and economical in mass production packaging & Material transporting.
- 10) It minimizes misalignment & less floor space is required.
- 11) It increases the safety and working condition in material transporting.

Applications

Material transporting & packaging industries.

1. Self-unloading bulk freighters and in live bottom trucks

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Final scale model presented at college workshop

