

Conveyor System and Storage Hopper: Introduction, Types, Design Considerations

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Abstract - 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 are very popular in the material handling and packaging industries. They also have popular consumer applications, as they are often found in supermarkets and airports, constituting the final leg of item/ bag delivery to customers. Many kinds of conveying systems are available and are used according to the various needs of different industries.

Key Words: Conveyor system, conveyors, delivery, transportation, material handling

1. INTRODUCTION

1.1 Conveyor Systems

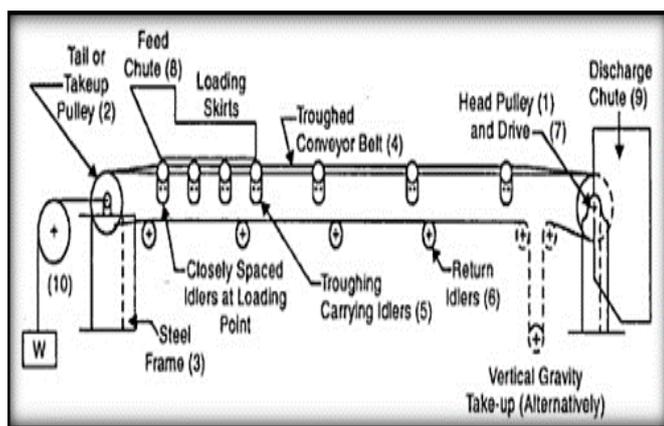


Figure -1: Components of conveyor system

Different methods such as fork lifting, use of bucket elevators, conveyors systems, crane, etc. has been identified for lifting or transporting bulk materials or products from one place to another in the manufacturing industries depending on the speed of handling, height of

transportation, nature, quantity, size and weight of materials to be transported. Conveyor system is a mechanical system used in moving materials from one place to another and finds application in most processing and manufacturing industries. It is easier, safer, faster, more efficient and cheaper to transport materials from one processing stage to another with the aid of material handling equipment devoid of manual handling. Handling of materials which is an important factor in manufacturing is an integral part of facilities design and the efficiency of material handling equipment add to the performance level of a firm. Conveyor systems are durable and reliable in materials transportation and warehousing.

Material handling equipment ranges from those that are operated manually to semiautomatic systems. Material handling involves movement of material in a manufacturing section. It includes loading, moving and unloading of materials from one stage of manufacturing process to another. A belt conveyor consists of an endless and flexible belt of high strength with two end pulleys (driver and driven) at fixed positions supported by rollers.

The peculiarities of a belt conveyor is that it is easy and cheap to maintain, it has high loading and unloading capacity and can transport dense materials economically and at very high efficiency over long distance allowing relative movement of material. Belt conveyor can also be used for diverse materials: abrasive, wet, dry, sticky or dirty material. Only a single roller needs to be powered by driver pulley and the roller will constantly spin causing the materials to be propelled by the driving roller. Material handling equipment such as belt conveyors are designed to load and unload materials from one stage of processing to another in the fastest, smoothest, most judicious, safest, and most economical way with minimum spillage. Belt conveyors are employed for conveying various bulk and unit loads along horizontal or slightly inclined paths and for transporting articles between various operations in production flow lines. A belt conveyor can be horizontal, incline or decline or combination of all.

1.2 Storage Hopper



Figure -2: Hopper

A storage container used to dispense granular materials through the use of a chute to restrict flow, sometimes assisted by mechanical agitation.

A hopper is a large, pyramidal shaped container used in industrial processes to hold particulate matter that has been collected from expelled air. Hoppers are usually installed in groups to allow for a greater collection quantity. They are employed in industrial processes that use air pollution control devices such as dust collectors, electrostatic precipitators, and bag houses/fabric filters. Most hoppers are made of steel.

Hoppers differ in terms of applications. Some hoppers are designed for chemical, pharmaceutical, food processing, or material handling applications. Others are suitable for processing, recycling, or handling hazardous materials. General-purpose hoppers and containers that meet U.S. military specifications (MIL-SPEC) are also available.

2. TYPES OF CONVEYOR SYSTEMS

Based on different principles of operation, there are different conveyor systems namely:

- Gravity conveyor systems
- Belt conveyor systems
- Screw conveyor systems
- Bucket conveyor systems
- Vibrating conveyor systems
- Pneumatic/Hydraulic conveyor systems
- Chain conveyor systems
- Spiral conveyor systems
- Grain conveyor systems, etc.

3. TYPES OF STORAGE HOPPERS

There are many different types of hoppers, dumpers, and tipplers. Examples include: bottom hoppers, live hoppers, cropper hoppers, cullet hoppers, and sludge hoppers; dump boxes, chip boxes, trash boxes, and scrap boxes; and various types of refuse equipment.

- Bottom hoppers
- Live hoppers or live-bottom hoppers
- Tilt hoppers

4. IMPORTANT COMPONENTS OF CONVEYOR SYSTEM

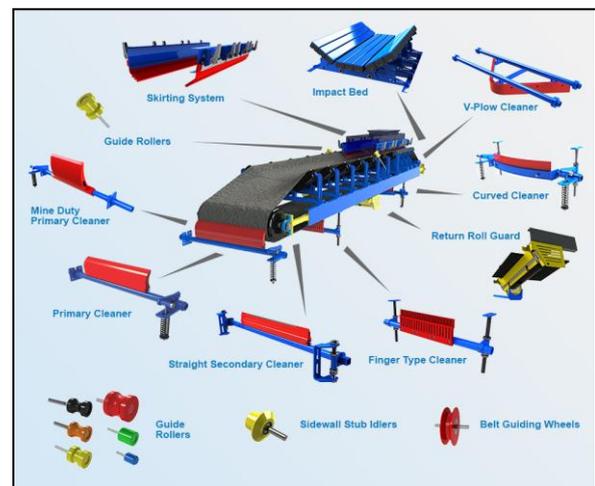


Figure -3: Components of conveyor system

- Conveyor frame parts

Include head frame, tail frame, and intermediate frame and supporting leg which are produced by cutting, welding, punching and polishing with standard channel, angle iron, steel and other.

- Composition of other components:
 - a. Roller
 - b. Drum Pulley
 - c. Conveyor belt
 - d. Driving device
- Cleaning device: Head cleanser, non-loaded cleanser, tail cleanser, spring cleanser and so on.
- Protection device: Pull-cord switch, running deviation switch, skid detector and so on.

- Electronic control device: Electric cabinet, power protection device.

4. DESIGN CONSIDERATIONS OF CONVEYORS

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 flow of material (idle time should be zero)
2. Going in for standard equipment which ensures low investment and flexibility
3. Incorporating gravity flow in material flow system
4. Ensuring that the ratio of the dead weight to the payload of material handling equipment is minimum

The transportation route affects the overall cost of material handling. An efficient material handling equipment will reduce cost per volume of material transported and ensure that materials are delivered to the production line safely. The design of belt conveyor system involves determination of the correct dimension of the belt conveyor components and other critical parameter values so as to ensure optimum efficiency during loading and unloading conditions. Some of the components are: Conveyor belt, motor, pulley and idlers, rollers, pneumatic cylinder, etc.

The design of a belt conveyor system takes into account the followings:

- 1) Dimension, capacity and speed
- 2) Roller diameter
- 3) Belt power and tension
- 4) Idler spacing
- 5) Pulley diameter
- 6) Motor
- 7) Type of drive unit
- 8) Control mode

5. DESIGN CONSIDERATION OF HOPPER

The storage hoppers are designed according to the need of the user. Their dimensions and material is selected as per the purpose to be served. For the safety and quality purpose, the hopper should fit under certain standards which are as follows:

- BS EN 617 - Safety and EMC requirements for the equipment for the storage of bulk materials in silos, bunkers, bins, and hoppers.
- BS 1703 - Refuse chutes and hoppers.

6. CONCLUSION

By the use of conveyor systems, the process of material handling has grown to be more efficient and the capacity of material handling has undergone a drastic increment as compared to conventional material handling process. The storage hopper functions as a storage vessel for the conveyed material. Moreover it's more easy and simple to package the material from storage hopper. This system of Conveyor and Storage Hopper has proved to be a boon for the material handling sector.

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