

Material handling equipment; conveyer and elevators, their principle, working and selection

Material handling Equipment

Material handling includes a number of operations that can be executed either by hand (manual) or by mechanical means or devices to convey material and to reduce the human work. The most common types of mechanical devices for grain handling are;

1. Belt conveyor
2. Bucket elevator
3. Screw conveyor
4. Pneumatic conveyor
5. Chain Conveyor

Selection of Material Handling Machines and Conveyors

The selection of proper conveying system is important for ease in operation and getting desired capacity for a particular product. Principles based on which the material handling equipment is selected:

- Based on the characteristics of the products being conveyed
- Working and climatic conditions.
- The capacity of conveyed products
- In a conveying system possibility of use of gravity.
- The capacity of handling / conveying equipment should match with the capacity of processing unit or items.
- Leakage of conveyed products should be avoided.
- Pollution of the environment due to noise or dust by the conveying system should also be avoided.

1. Belt conveyors

A belt conveyor is an endless belt operating between two pulleys with its load supported on idlers. The belt may be flat for transporting bagged material or V-shaped. The belt conveyor consists of a belt, drive mechanism and end pulleys, idlers, loading and discharge devices.

On the belt conveyor baggage/ product lie still on the surface of belt and there is no relative motion between the product and belt. This results in generally no damage to material. Belt can be run at higher speeds, so, large carrying capacities are possible. The material can be transported to longer distance horizontally. The initial cost of belt conveyor is high for short distances, but for longer distances the initial cost of belt conveying system is low.

The first step in the design of a belt conveyor with a specified conveying capacity is to determine the speed and width of the belt. The belt speed should be selected to minimize product leakage or removal of fines due to velocity of the belt. For transportation of grains, the belt speed should not increase 3.5 m/s. Generally, for grain conveying, belt speed of 2.5 to 2.8 m/s is recommended.

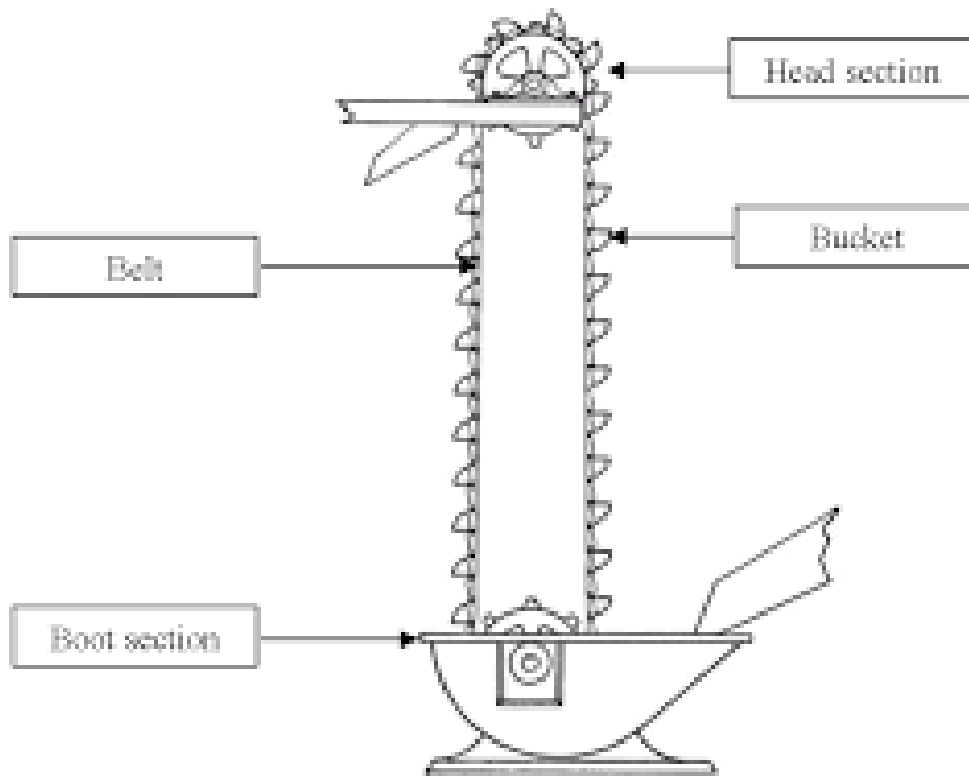


2. Bucket Elevator

A bucket elevator consists of buckets attached to a chain or belt that revolves around two pulleys one at top and the other at bottom. The vertical lift of the elevator may range between few meters to more than 50 m. **Capacities of bucket elevators may vary from 2 to 1000 t/hr.** Bucket elevators are broadly classified into two general types, (1) spaced bucket elevators and (2) continuous bucket elevators.

The spaced bucket elevators are further classified as, (1) centrifugal discharge elevators,

- (2) positive-discharge elevators, (3) marine leg elevators and
- (4) high-speed elevators.



The continuous bucket elevators are classified as

- (1) super capacity bucket elevators and
- (2) Internal discharge bucket elevator

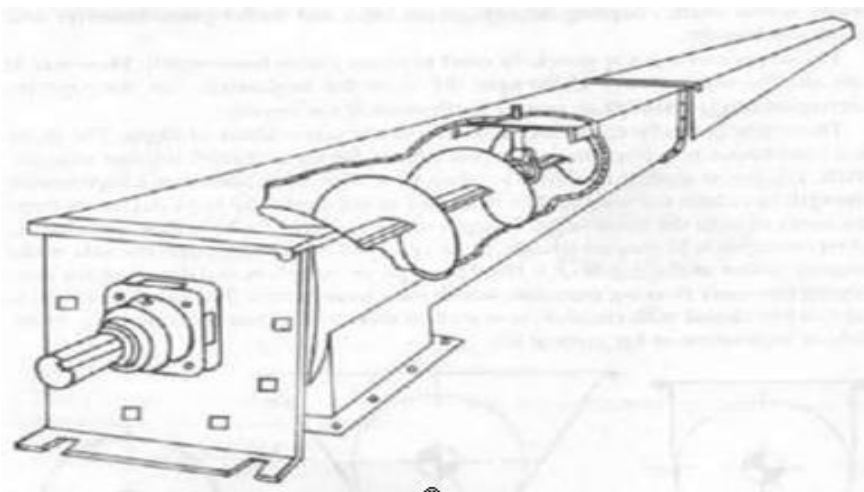
The spaced bucket centrifugal type is most commonly used for elevating grains. The bucket elevator is a very efficient device for the vertical conveyance of bulk grains.

Bucket elevators are usually mounted at a fixed location, but they can also be mounted in a mobile frame. Bucket elevators have high capacities and it is a properly cheap means of vertical conveyance. It requires limited horizontal space and the operation of conveying is enclosed in housing, thus it is dust free and properly quiet. The bucket elevator has limited wear problem since the product is enclosed in buckets. The buckets are enclosed in a single housing called leg, or two legs may be used.

3. Screw Conveyor

The screw conveyor consists of a tubular or U-shaped trough in which a shaft with spiral screw revolves. The screw shaft is supported hanger bearings at ends. The rotation of screw pushes the grain along the trough. A typical screw conveyor is shown in the following Figure. The screw conveyor is used in grain handling facilities, animal feed industries and other installations for conveying of products generally for short distances. Screw conveyor requires relatively high power and is more liable to wear than other types of conveyors.

Fig.1. Screw conveyor



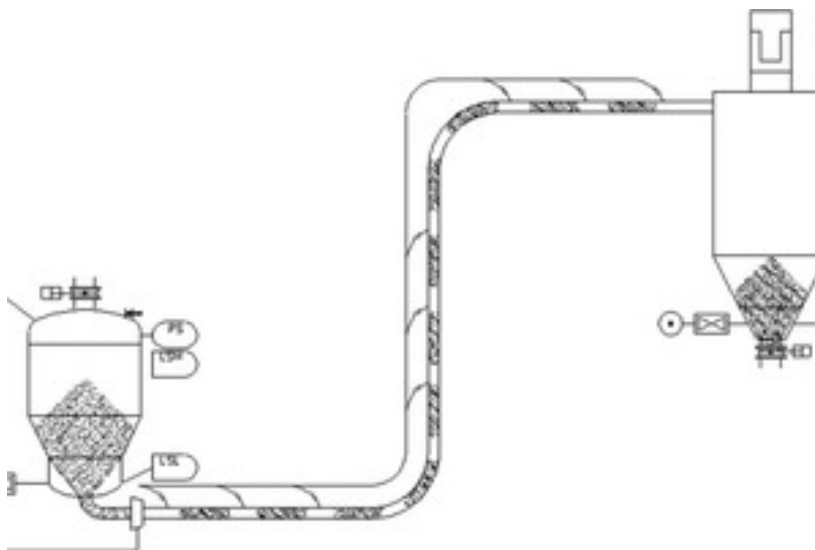
As the screw conveyor's driving mechanism is simpler, and no tensioning device is required, the initial cost of the conveyor is lower than any other conveyor with the same length and capacity. The main parts of a screw conveyor are, screw blade, screw shaft, coupling, holder, cover, inlet and outlet gates, bearings and drive mechanism. The screw conveyor is generally used to move grains horizontally. However, it can also be used at any angle up to 90° from the horizontal, but the capacity individually reduced as per the preference of conveyance.

4. Pneumatic Conveyor

The pneumatic conveyor moves granular materials in a closed duct by a high velocity air stream. Pneumatic conveying is a continuous and flexible transportation method. The material is carried in pipelines either by suction or

blowing pressure of air stream. The granular materials because of high air pressure are conveyed in dispersed condition. For dispersion of bulk material, air velocities in the range of 15-30 m/s are necessary.

The pneumatic conveying system needs a source of air blowing or suction, means of feeding the product into the conveyor, ducts and a cyclone or receiving hopper for collection of products. There are three basic systems of pneumatic conveying. These are pressure or blowing system, suction or vacuum system, and combined push-pull or suck blow system. In blowing or positive pressure systems, the product is conveyed by using air pressures greater than the atmospheric pressure.



Limitations of Pneumatic Conveying

1. Erosion of solid surfaces and equipment surfaces by solid particles with conveying air stream.
2. In case of bends or misaligned sections, the erosion problem becomes severe.
3. Chances of repeated impacts between the particles and the solid surfaces are high. Due to such impacts, product degradation results.

5. Chain Conveyor

A chain is a reliable machine component, which transmits power by means of tensile forces, and is used primarily for power transmission and conveyance systems. The function and uses of chain are similar to a belt. Chains are divided into five types based on material of composition or method of construction.

- Cast iron chain
- Cast steel chain
- Forged chain
- Steel chain
- Plastic chain

