

BELT CONVEYOR PARTS AND PROBLEM ANALYSIS

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Abstract: Belt conveyors are used in different industries and has different applications. In some industries it is used to transport loose material from one place to other and some places it transfers bags filled with materials from one place to another. Different conveyors are mostly used in Cement industries, mining industries, power plant, food industries, production industries etc. depending upon the capacity, material size and distance. Belt conveyor is designed with different features and parts. This paper presents the parts, failures and prevention methods of failure of different parts of a conveyor used in cement industry for clinker transfer. Analysing the technical characteristic of clinker size, other system and the characteristic of different machines used before and after the belt conveyor. The main aim for Design Upgradation by analysing failures of Belt, pulley (drum), Coupling, safety equipment's and rollers. Then at last the full capacity and safe operation of clinker with proper methods are concluded. Analysing the root cause of failure and proposing some methods to solve the problems.

Key Words: Belt Conveyor, Analysing Failure, Pulley, Design Upgradation, Bearing, Rollers

I. INTRODUCTION

Belt conveyor is a commonly used equipment of continuous transport; it has a high efficiency, cost saving and large conveying capacity, it can be achieved at different distances and altitudes, different materials transportation. It is widely used in Cement manufacturing material handling system in Cement industry and other projects. 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. Also, many have advanced safety features that help prevent accidents.



Fig 1: Belt Conveyor (during erection time)

A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two pulleys or drum i.e. head pulley (driving pulley) and tail pulley (driven pulley), joined in an endless loop - the conveyor belt - that rotates about them. Driving side pulley is powered and generally present at the giving end.

The belt consists of one or more layers of material. Many belts in general material handling have two or more layers either steel cord. An under layer of material to provide linear strength and shape called a carcass and an over layer called the cover. The carcass is often a woven fabric having a warp & weft or sometimes steel cord generally depends upon the capacity, strength, length and material type. The most common carcass materials are polyester, nylon and cotton. The cover is often various rubber or plastic compounds specified by use of the belt. The belts are removed layer wise on both end and joined from hot or cold methods.

II. MAJOR PARTS OF BELT CONVEYOR SYSTEM

The belt conveyor system major parts

- Belts
- Pulleys
- Drive unit
- Idlers
- Counter weight
- Safety Equipment's.

Belt:

Depends on application, length, capacity, strength required belt used in conveyor system may be divided into two groups: textile belts and steel cords belts. In clinker handling from mines to manufacturing plant usually steel cord belts are used.

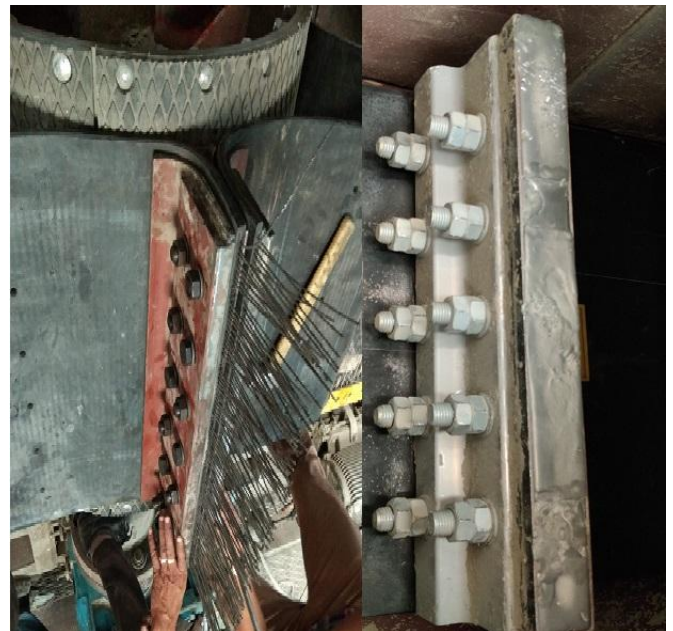


Fig. 2: Mechanical Joints

Wear-tear, puncture, Bubble formation, opening of wires and its joints which may be connected using glue, vulcanized or mechanical joint [1, 2]. Belt is transported in rolls, pieces up to 100-1000 m long, depends on a belt type.



Fig. 3: Belt Roll

2) Pulleys:

The pulley consists of two Housing bearing, shaft, shell and rubber coating. The rubber coating is generally done on the main drive pulley to avoid slippage. The shaft attached to the pulley through ring main feeder. The design of pulley is made according to the capacity of material, motor and coupling configuration.

3) Drive Unit:

It consists of electric motor, damping coupling, Gearbox and coupling that connect output shaft with pulley. Damping coupling generally installed to absorb the impact load generated by motor and to synchronize. Fluid coupling is the most used damping coupling.



Fig. 4: Complete Drive Unit

Gearbox transmit the energy with the required transmittion ratio designed to meet the output. Gearbox teeth and its holdback are the important points and failure are to be avoided by proper lubrication and maintenance.

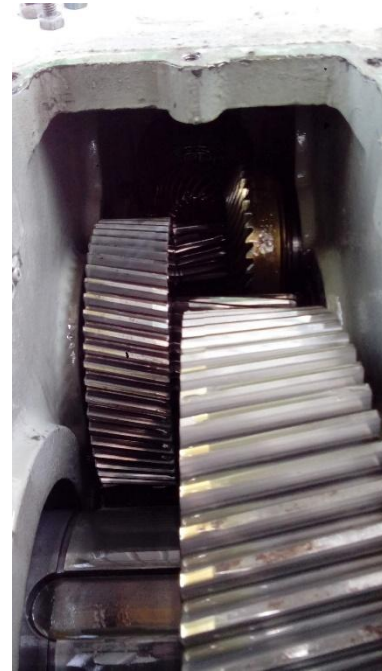


Fig : Gear Teeth and arrangement

4) Idlers:

Idler consist of bearing and shell. [2, 3, and 4]. The number of idlers are decided by the material transfer and belt length as the idlers are more in numbers with proper gap between each. Idler are used for supporting belt with transport materialsand also correcting and controlling belt direction. Bearing failure and surfaces are worn out are major idler failures. The support system for belt may consists of single or three idlers.

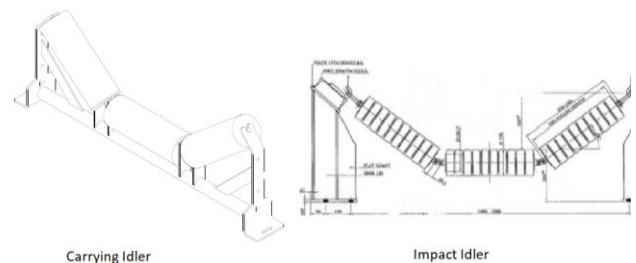


Fig. 5: Types of Idler

Load distribution on single idler are equal whereas in three idler system loads is different at each idler usually side idlers are more subjected to damage. Worn out Bearing in idlers increase load for drive units leads tomore power consumption. Worn out idler surface can damage the belts. Which may cause failure of belt (the cut of a belt) or even may start fire (belt slipping on damaged idler may increase temperature of belt.

5) Counter weight:

Counter weight consists of an arrangement of mechanical load calculated according to length, capacity and weight of the belt. Counter weight is designed in such a way that it may get adjusted on belt elongation or short belt after re-joined because of failure. Failure in counter weight are often and due to some lack of maintenance issue.

6) Safety Equipments

Zero speed switch, Fuse Plug, Pull Cord, Thermal Tripper are some of the major safety equipment used in the Belt Conveyor System for safety. Zero speed switch gives the feedback about the healthy running status of the belt and is installed in tail pulley. Fuse plug used in fluid coupling which drop the oil if reached the specific temperature. Pull cord are used all around the belt length so that in case of emergency the belt can be stopped from anywhere. Belt turning and belt cleaning scrappers are also used.

ANALYSIS

Belt conveyor is essential equipment for transporting material from one point to other. Different problem observed in conveyor belt is slippage around the drive pulley and severe wear marks on pulley. If the grip between the belt and pulley decrease due to less friction possibly due to load variation. So, at work often happen belt and pulley slippage. As the conveyor belt slippage and wear may pulley or drum, cause belt premature damage, putting impact on the life of conveyor, affect the supply, production and cost overall. As the conveyor belt is more important, the most expensive parts. Its price about 30%-55% to the conveyor varies with belt length. So, analysing the reason of belt failure, drive unit and pulley failure are an important part to ensure extent equipment life. The parameters which impacts on designing of conveyor system are Material size, Pulley Design, Belt Design, Driving Unit, Safety controls, operation & maintenance procedure, Dust emission control. Every design is synchronized with each other and finally meeting the major requirement of capacity and safe operations.

ANALYSED SOLUTION

- Belt failure can be avoided by proper arrangements and design accuracy to avoid slippage of belt on drum. To increase the gripping between the belt and pulley we can use rubber laggings on head drum.
- For pulley smooth operation ball bearing should be used with proper lubrication and sealed bearing with tight fix housing are used. The arrangement should be such that easy and frequent maintenance can be done. Temperature of the bearing housing with temperature gun also should be taken in note during maintenance.
- Damping Coupling (Fluid Coupling here) should be filler with proper fluid at proper degree mentioned by its manufacturer.
- Vibration of Gearbox, proper lubrication and regular teeth checking should be done with hold back and breather condition should be checked regularly.
- Proper greasing in idler and noise observation should be regularly done.
- Safety equipment's should be crosschecked in every maintenance so that they remain in healthy condition.

III. CONCLUSION

Belt Conveyors are widely used in today's industries. Most of which are in continuous operation thus leads more tear and wear and gets very less maintenance time. The biggest challenge is to operate the belt conveyors healthy condition for the time period as running equipment in good condition is must for proper operation and production output. Firstly, the proper designing of the belt conveyor should be done by implementing and innovating latest technology matching the proper requirements. Secondly, equipment's should be made of good quality material with proper and accurate fabrication. Thirdly, the maintenance team should be doing proper maintenance and should keep track on the belt during its operation hours to reduce maintenance time. Lastly, the operation team should run the machine on the rated capacity as running machine above rated capacity damages the equipment and reduce its life.

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