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A PATH FOR HORIZING YOUR INNOVATIVE WORK

FAILURE DETECTION AND PREVENTION FOR CHARGING BELT CONVEYOR

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Abstract: The belt conveyor is widely used in today's modern port, especially in the transport of soap and chemical powder industry. The design of belt conveyor is varies according to their application. In soap industry the belt used is of non reactive type. However, the most effective belt conveyor system design depends on various parameters such as, equipment fatal accidents and drums & belt failures. The various failures such as, rip, tear, wear, pulley failure, idler spacing has been identified and studied. In this new proposed method is developed to prevent failures in belt conveyor system. It is concluded that by making change in design and construction, they may be eliminated.

Keywords: Belt Conveyor, Design Modification, Failures.

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INTRODUCTION

In a multitude of commercial applications, it is common to employ a heavy duty conveyor belt for the purpose of transporting product and material .The belts so employed may be relatively long, on the order of industry, and represent a high cost of component of an industrial material handling operation .In many operation ,the belts are susceptible to damage from the transported thereby and a rip (slit ,cut or tear) may develop within the belt .The cost of repairing a heavy duty conveyor belt and the cost of cleaning up material spilled from the damaged belt can be substantial .If however ,such a rip or tear commences and the belt is not immediately stopped , the rip can propagate for a substantial distance along the belt.

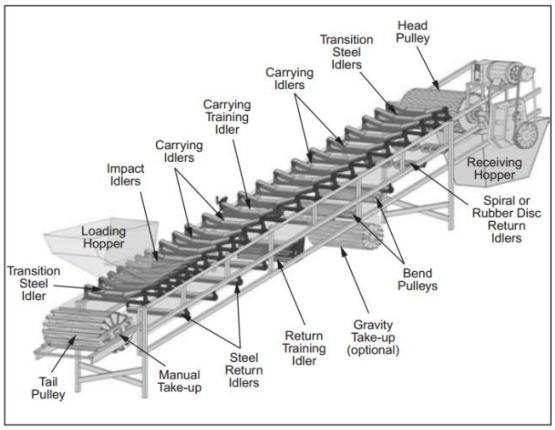
It is therefore ,desirable to detect or locate a rip in the belt as quickly as possible after it commences and to immediately terminates belt operation ,whereby minimizing the extend of the damage of the belt .It is well known to employ sensors within conveyor belts as part of a rip detection system.

However due to complexity of the production conditions, centralized belt conveyor in many industry has to suffer such a problems as impact of big gangue and uneven loads on the belt during the process of material feeding, thus probably leads to decrease the strength of belts, in worse to destroy the driving motor or break the belt, which means great loss in economy and safety. To solve such a problem, this paper, on the background of the production condition of charging belt conveyor in the industry, designs an automated system based on armoured belt feeder and programmable logic controller (PLC).

2.FAULT OCCUR IN BELT CONVEYOR:

- And A Rip (Slit ,Cut Or Tear)
- Motor Failure
- Pulley Failure
- Belt Wear
- Idlers Failure.

3. LAYOUT OF BELT CONVEYOR SYSTEM:



The belt conveyor

The layout shown illustrates a basic belt conveyor. Unlimited variations of elevation, loading, discharge, idlers, their spacing, pulleys and accessories are possible.

4. GENERAL SYSTEM DESIGN:

A. **OPERATION SURROUNDING: B.SYSTEM COMPOSITION**: The following are the main part of the system:

- RAW MATERIAL FEEDER:
- **CONTROLLER:**

COMMUNICATION UNITS: PLC is connected to the armoured belt feeders by optical fiber. Each transducer of the feeder is equipped with a photoelectric converter and profibus is chosen as the communication protocol.

C: SYSTEM SOLUTION: Conveyor driving motor is taken as feedback parameters to judge whether the load on the belt conveyor is in the set range or not.

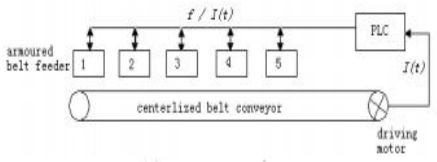


Fig. system structure diagram

5. PROPOSED METHOD OF FAILURE PREVENTION:

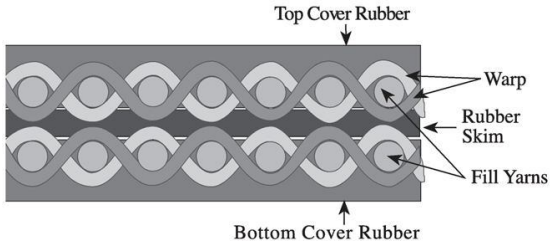


Fig. Conveyor belt construction

A. CONVEYOR BELT CONSTRUCTION:

Conveyor belts generally composed of three main components:

1. Carcass
2. Skims
3. Covers (carry cover and pulley cover)

Carcass

The reinforcement usually found on the inside of a conveyor belt is normally referred to as the "carcass." In a sense, the carcass is the conveyor belt since it must:

1. Provide the tensile strength necessary to move the loaded belt.
2. Absorb the impact of the impinging material being loaded onto the conveyor belt.
2. Provide the bulk and lateral stiffness required for the load support.
3. Provide adequate strength for proper bolt holding and/or fastener holding.

The manufacturer determines the maximum recommended operating tension per inch of width with considerations given to:

1. Stretch characteristics of the belt.
2. Fastener/bolt holding capability.
3. Load characteristics.

4. Stiffness.

5. Impact resistance of the belt construction.

Skims

The rubber, PVC or urethane between plies is called a “skim.” Skims are important contributors to internal belt adhesions, impact resistance, and play a significant role in determining belt “load support” and “trough ability.”

The straight warp carcass design yields a carcass construction wherein the basic lengthwise (warp) yarns are essentially uncrimped. These are the main load-carrying tension yarns. Fill yarns are then laid transversely and alternately, above and below the main tension yarns. This construction gives greater dimensional stability to the belt, and does employ a “beam" effect for better load support and transverse rigidity.

Covers

Covers are used in conveyor belt constructions in order to protect the base conveyor belt carcass and, if possible, to extend its service life. In addition, covers do provide the finished belt with a wide variety of desirable properties, including the following:

A. Textures

To increase friction

To increase inclination

To control product

B. Clean ability

C. A specific coefficient of friction

D. A specific color

E. Cut resistance

F. Enhanced impact resistance, etc.

G. Hardness

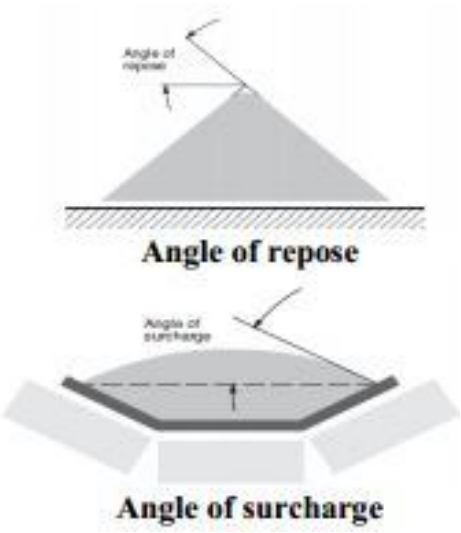
H. Fire Resistance, Oil & Chemical Resistance

Cover type, quality and thickness are matched to the service life of the belt involved. A specific cover formulation used in an individual belt construction is determined by the material to be carried and the environment in which the belt will operate.

In addition to selecting proper compounds for cover material, it is also necessary to deter-mine the proper cover thickness. The thickness of a cover is influenced by the amount of abuse and wear the belt will receive. The cover is usually the lowest cost component of the belt.

B. DESIGN OF BELT CONVEYOR

The design of the belt conveyor must begin with an evaluation of the characteristics of the conveyed material and in particular the angle of repose and the angle of surcharge. The angle of repose of a material, also known as the "angle of natural friction" is the angle at which the material, when heaped freely onto a horizontal surface takes up to the horizontal plane.



Angle of surcharge β: The area of the section "S" may be calculated geometrically adding the area of a circle A1 to that of the trapezoid A2. The value of the conveyed volume Ivt may be easily calculated using the formula:

$$S = \frac{I_{vt}}{3600}[m^2]$$

Where:

Ivt = conveyed volume at a conveyor speed of 1 m/s

Belt speed:

Very high speeds have meant a large increase in the volumes conveyed. Compared with the load in total there is a reduction in the weight of conveyed material per linear meter of conveyor and therefore there is a reduction in the costs of the structure in the toughing set frames and in the belt itself. The physical characteristics of the conveyed material are the determining factor in calculating the belt speed. With the increase of material lump size, or its abrasiveness, or that of its specific weight, it is necessary to reduce the conveyor belt speed Considering the factors that limit the maximum conveyor speed we may conclude: When one considers the inclination of the belt leaving the load point; the greater the inclination, the increase in the amount of turbulence as the material rotates on the belt. This phenomenon is a limiting factor in calculating the maximum belt speed in that its effect is to prematurely wear out the belt surface. The repeated action of abrasion on the belt material, given by numerous loadings onto a particular section of the belt under the load hopper, is directly proportional to the belt speed and inversely proportional to its length.

Belt width:

The optimum belt speed, the determination of the belt width is largely a function of the quantity of conveyed material which is indicated by the design of conveyed belt. In practice the choice and design of a toughing set is that which meets the required loaded volume, using a belt of minimum width and therefore the most economic.

Given the belt width, one may verify the relationship between the belt width and the maximum lump size of material according to the following: belt width ≥ max. Lump size

ABSORBED POWER:

PA = Absorbed power i.e., power required for drive pulley after taking drive pulleys loss into account.

$$= P_{dp} + \frac{(R_{wd}+R_{bd})v}{1000}\ KW$$

Where, Rwd = Wrap resistance for drive pulley (230 N)

Rbd = Pulley bearing resistance for drive pulley (100 N)

MOTOR POWER

The motor output power (shaft) is given by

$$P_M = \frac{P_A}{\eta}$$

Where, η = Overall efficiency by taking the power losses of gear-box and couplings into account = 0.94

MOTOR SELECTION

At present, all the motors are of 1500 rpm.

GEAR BOX SELECTION:

For gear box selection, we need to calculate the reduction ratio

$$Reduction\ ratio = \frac{Input\ RPM}{Output\ RPM}$$

6. BELT SELECTION:

1. A. Belt applicable operational constraints:

•Overall length, Width

•Temperature range.

•Food grade.

•Chemical resistance.

•Antistatic.

•Flammability rating.

•Conveying side adhesiveness.

•Suitable for a slider bed or carrying rollers.

Our application requires an adhesive belt in order to convey the boxes on an upward slope. It will be supported by a slider bed. The adhesiveness between the load and a belt sample is to be tested; this by placing the load on top of the belt, both on an angled surface and increasing the angle. A rubber/polyester belt is a good candidate.

7. CONCLUSION:

The various failures occur in belt conveyor such as, control, equipment fatal accidents and drums & belt failures is studied and prevented. The proposed method discussed about the method of inspection and online monitoring with various sensors for all components when soaps and soap solutions is transferred through the belt conveyor to reduce maintenance cost & fatal accidents in industry. The main problems of normal operation have been analyzed and resolved in order to ensure the good functioning of device. The practical problems of site maintenance staff levels are also prevented by using this proposed method.

REFERENCES:

1. Embedded Intelligent sensor for conveyor Belt-Fuzzy System Application, International journal of Advances in engineering and Technology, Mar 2011.

2. Wei Li, Zhengduo Pang, " Design of Multi-Loading control system for belt conveyor,' name of journal vol. issue page no. China University of mining and technology, Beijing, china.

3. "Design, Manufacture and Analysis of Belt Conveyor System used for cooling of mould,'' International Journal of engineering Research and Applications. Vol 2, Issue3, May-Jun 2012. Pp2162-2167.

4. Idler, Belt Conveyor Components, Whisperol roller and spray nozzles, Field Service Manual pg no.2-5.

5. Beltfix Industrial Products Manual, Unit 2, 5666 12th Avenue, Delta B.C. V4L 1C4 Canada T(604) 943-2212 F(604) 943-2214 www.beltfix.com