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MATERIAL SELECTION PROCESS OF ROLLER CHAIN CONVEYOR

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ABSTRACT

Roller chain is to deal with different chemicals and environment conditions, causes wear and tear of components of chains and hence unexpected failure and costly production. Conveyor consists of two or more endless strands of chain with attached non interlocking slats to carry the material. Some other examples are conveying pallets and tree-stumps. Wheeled cars is example, is carried by the chain but can also be pulled by the chain. Resent work I have studied different failures of roller conveyor chain links under different loading conditions using mild steel. Chain conveyor system motor capacity of conveyor depends on weight of chain. This was determined that maximum amount of weight of chain conveyor is covered by outer link and inner link. We are concentrated on both link and weight reduction of link by using composite material to reduce the power requirement of conveyor.

Keywords: *Chain failure, weight reduce, composite material.*

I. INTRODUCTION

Roller conveyor chains are generally used in assembly line and production where individual large objects need to be conveyed. The main applications of the roller conveyors are carrier conveyors for the transport of steel coils in a steel plant or conveyors that carry objects. Convey is consists of endless strands of chain with attached non inter locking and metal flights to carry material. Mainly industries are based on roller chain conveyers for process atomization. However, failure of this chain is perennial problem in these industries which causes losses to industries. Roller chain important element of the industrial processes. From the various studies, it can be noted that, even though several patents are filed on roller chains, most of the patents based on improvement of efficiency and performance. Hardly here are very few patents available which focuses on improving life of the chain and minimization of its failure. It can also be noted that the analytical work in the literature is focused on load estimation. Very few researchers have explored the fatigue life estimation and stress analysis for the chain assembly Reducing weight and increasing strength of the products research are high in demand in the market. And composites materials are getting up to satisfying those demands. This research deals with the analysis for link plate of roller chain with new material that is glass fiber and carbon fiber. composite material. In this research reducing weight of conveyor chain and increasing the strength of their connected links are considered.

II. REVIEW OF LITRATURE

M.D Jagtap (2014) studied the roller conveyor chain strip under tensile loading he described in his paper that conveyor chain drives are one of the primary systems used in industry to transmit power and convey products. Conveyor chain that suffers from premature elongation due to wear and needs to be replaced on a frequent basis will negatively impact productivity and increase the cost of the operation. Roller conveyor chains are the critical component in sugar mills, paper mill, food processing, fertilizer industry, pharmaceutical industry, cement industry, foundry industry, heat treatment units, coal mines etc.

Umesh, M K and mohan singh, (2013) they discovered that failure analysis of brittle chain which is used for hoisting in mines chain is one of the most familiar for mine hoist as well as one of the most useful of mechanical device. It is made up of a series of links fastened through each other. Each link is made of a rod of wire bent into an oval shape and welded at one or two points. The weld ordinarily causes a slight bulge on the side or end of the link. The chain size refers to the diameter, in millimeter (mm), of the rod used to make the link. Chain is universally employed in hoisting and transmission, and for attaching and securing movable bodies. As a rule, a chain is subjected to heavy loads and must transmit large forces, and upon its ability to withstand the stresses to which it is

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subjected by its loading may depend on the success of a great mechanical operation, or even the safety of lives Chains usually stretch under excessive loading so that the individual links bend slightly. Bent links are a warning that the chain has been overloaded and might fail suddenly under a load

III. METHODOLOGY

Project will start from the study of failure cases of chain. focuses on improving life of the chain and minimization of its failure.

Study of conveyor system and chain

A chain is a machine component that comes with a series of a connected links. It can be used to transmit power or conveyance systems. Usually, there are five types of chains that are cast iron chain, cast steel chain, forged chain, steel chain and plastic chain. Otoshi (1997) stated that, demand for cast iron chain, cast steel chain and forged chain is now decreasing and only being used for special situations such as a cast iron chain is used for water treatment equipment and forged chain is used in overhead conveyors for automobile industries. Referring to above table, chain conveyor has many advantages compared to belt and roller conveyor. In multiple strands, two or more chains are assembled side by side on common pins that maintain the alignment of the rollers in the several strands.

Most of the time chain is under tension which causes failure of chain assembly which is the major problem for industrial sector. Causes of this failure are improper design. It is important to study the influence of these parameters. All these parameters can be considered simultaneously and chain link design optimally. Optimization is the process of obtaining the best result under given circumstances in design of system. In optimization process we can find the conditions that give the maximum and minimum value of function. This process various design variables, such as wall thickness of link, breaking area of link and shape of the link. While deciding the shape optimization of roller chain link raw material plays important role, so it is necessary to decide raw material. Normally medium alloy steel i.e. as per Indian Standard C45, 55C8 or as per British Standard EN8, EN9 has been used in normalized condition and after manufacturing of link it has been heat treated up to 35 to 40 HRC in order to get tensile strength up to 70 to 80 kg mm².

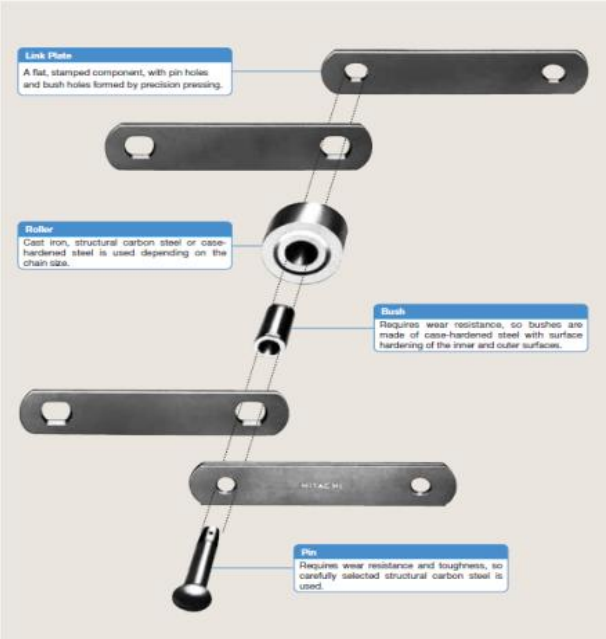

Figure 1: Basic structure of conveyor chain

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Study Of Conveyor Chain

When roller chain that transport pallets moving on a track, the weight of the pallets that applied on the pins on the chain will resulting a normal force N02on each pin. A tensile force Ft is exerted on the chain by the sprocket. Then, this tensile force Ft will be transferred from inner link to the outer link by bushing and pin acting together as a bearing. The normal force N02 is transferred from pin to bushing and then from bushing to track through roller. The pin and bushing have a small clearance resulting in eccentricity e23. Analogous, bushing and roller have a small eccentricity e34".

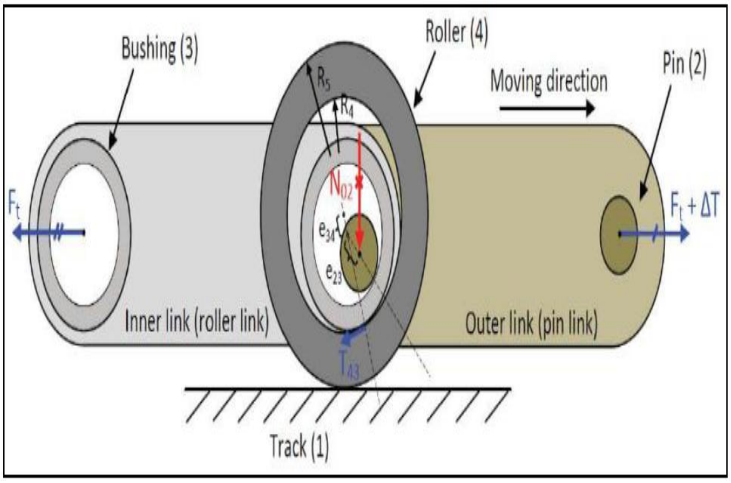

Figure 2 Section view of a roller chain with exaggerated clearances

Study of failure cases of chain system

Failure mean is not meeting a desirable or intended objective. There are five general failure categories that are fracture (full section),cracking (partial section), distortion (bending, elongation, and plastic collapse),corrosion (pitting) and wear (material wastage).Gagg,(2005) and Bošnjak S.et.al.(2011) pointed out in his case study that failures can because by:

i. Designing–in defects
ii. Manufacturing-in defects
iii. Operating-in defects
iv. Environment-in defects

Reddy (2004) described in his investigation that there are two types of defects that are generally observed :

i. Inherited defects where the origin is in the in got
ii. Generated defects that are introduced in the material during various metal working operations and thermal treatments.

Mean while, failure analysis is the process of collecting and analyzing data to determine the cause of a failure. Referring to Aliya (2003), failure analysis is a process that is performed in order to determine the causes or factors that have led to undesired loss or functionality.

Abrasive and adhesive wear between pin, bushing, roller and track are discussed. Roller conveyor chains are common used to transport good sin production lines or assembly lines, such as pallets , cars or steel coils. They are sometimes used in severe environments, soiled with water, foreign particles, chemicals or other contaminants. Normal use will result in wear of the components of the chain which can lead to unexpected failure and costly production downtime.

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Glass Fibers

Glass fibers are most commonly used fibers. They come in two forms: Continuous fibers, Discontinuous or "staple" fibers Chemically, glass is silicon di-oxide (SiO2). Glass fibers used for structural applications come in two "flavors": E-Glass, and S-Glass. E-glass is produced in much larger volumes vis-à-vis S-glass.

Principal advantages

-Low cost
-High strength

Limitations

-Poor abrasion resistance causing reduced usable strength
-Poor adhesion to specific polymer matrix materials
-Poor adhesion in humid environments

Glass fibers are coated with chemicals to enhance their adhesion properties. These chemicals are known as "coupling agents".

-Many of coupling agents are silane compounds

How are Glass Fibers Made?

• Process of producing continuous fibers: Raw materials (sand, limestone, alumina) are mixed and melted in a furnace at approximately 1260 C. Molten glass then Either flows directly into a fiber-drawing facility. This process is known as "direct melt" process. Most of fiber glass in the world is produced this way. Gets formed into marbles.

These marbles are later fused, and drawn into fibers.

• For producing continuous fibers, molten glass passes through multiple holes to form fibers. These fibers are quenched through a light spray of water. Subsequently, fibers are coated with protective and lubricating agents.
• Next fibers are collected in bundles known as "strands". Each strand may have typically 204 individual fibers.
• Next, strands wound on spools. Fibers in these spools are subsequently processed further to produce textiles.
• *Staple fibers* are produced by pushing high pressure air-jet across fibers, as they emanate from holes during the drawing process.
• These fibers, are subsequently collected, sprayed with a binder, and collected into bundles known as "slivers".
• These slivers may subsequently be drawn and twisted into yarns.

Surface Treatment of Glass Fibers

• During production, glass fibers are treated chemically. These treatments are known as sizes.
• There are two types of sizes: Temporary and Compatible.

– Temporary sizes are used to reduce degradation of fiber strength attributable to abrasion of fibers due to inter-fiber friction during fiber drawing process. They are also used to bind fibers for easy handling. They are made from starch-oils (starch, gelatin, polyvinyl alcohol, etc.). These sizes inhibit good resin-fiber adhesion. They also promote moisture absorption.

– During composite fabrication, these sizes are removed by heating the fibers at 340 C for 15-20 hours. Post their removal, these fibers are coated with coupling agents (also known as finishes), which promote resin-fiber adhesion. These agents also inhibit deteriorating effects of humidity on the fiber-resin

Table 1 Typical Chemical Composition of E & S Glass in %

Property	E Glass	S Glass
SiO2	54.3	64.2
Al2O3	15.2	24.8
CaO	17.2	0.01
B2O3	8.0	0.01
MgO	4.7	10.3
Na2O	0.6	0.27
BaO		0.20

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FeO		0.21
Other		0.03

Table 2 Important Properties of Glass Fibers

Property	E-Glass	S-Glass
Specific gravity	2.54	2.49
Tensile strength (MPa)	3450	4590
Tensile modulus (GPa)	72	86
Diameter range (microns)	3 to 20	8 to 13
CTE (per million per C)	5	2.9

IV. RESULT AND DISSCUSSION

Table 3 Comparison between mild steel, E-glass and S-glass

Property	Mild steel	E-Glass	S-Glass
Specific gravity	7.85	2.54	2.49
Tensile strength (MPa)	400 to 550	3450	4590
Tensile modulus (GPa)	90 to 110	72	86

The weight of glass fiber is very low comparative to mild steel, mechanical property is also good compare to mild steel and glass fiber is non corrosive. The failure of chain is reduce and life also increase. Breakdown in industry due to failure of chain is also reduce

V. CONCLUSION

In this topic we are going to see the weight of the glass fiber is very low compare to mild steel. The glass fiber is non corrosive, self lubricant and mechanical property is also good as compare to mild steel.

VI. ACKNOWLEDGEMENTS

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