A Review on Design and Experimental Analysis of Flight of Drag Chain Conveyor Belt with respect to its Breaking Strength by Varying Flight Material

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***Abstract*—**In engineering various researches has been done on the Conveyor system like Drag Chain Conveyor, Roller Conveyor and Belt Conveyor system. Conveyor systems are especially useful in applications involving the transportation of heavy of bulky materials. Drag Chain Conveyor System can handle the material in horizontal directions. In industries generally consist of the drop forged chain conveyor of steel links and flights. Mostly the work has been done on the chain links. In this paper the effort is focused on the Flights of Drag Chain Conveyor System. The paper presents the review of drag chain conveyor flight design modification with changing material and latest technologies used in different applications.

***Keywords*—**Breaking Strength, Composite Material Drag Chain Conveyor, Material Handling Equipments.

I. INTRODUCTION

A Conveyor system is a general piece of mechanical handling equipment that conveys material from one place to another place. Conveyors are mostly useful in applications involving the transportation of heavy or bulky material.

Conveyor system are commonly used in various sectors including Automobile, Agriculture, Cement industry, Fertilizer, Food Processing, Chemical, Pharmaceutical, Coal mine, Limestone, Aerospace, Bottling and Canning etc. The purpose of such material handling equipment is to transfer goods with high efficiency, less material transport time, no need to slacken off the chain or re-tension while changing Flights and easy installation.

The main parts of the conveyor are chain links and flights. There are different types of Flights system based on the profile of conveyor, direction of material travel, carrying element etc. which include, Square Bar Flight, Flat Bar Flight, Paddle Flight, U Flight and Closed U Flight etc.

Fig. 1 Flight Assembly

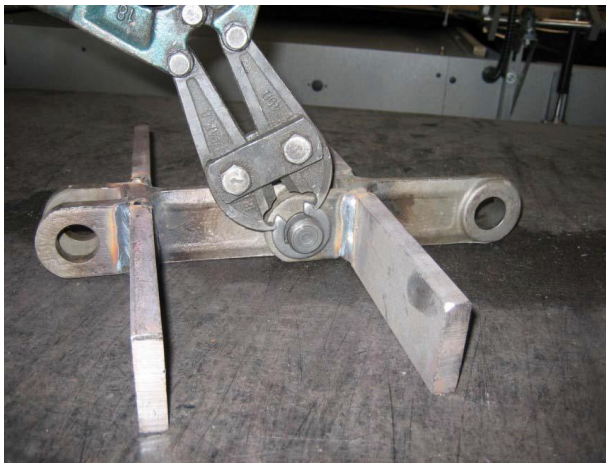

Fig. 2 Flight

II. LITERATURE REVIEW

Kulkarni Shruti S. et al [1]. The work has been done to increase breaking strength of chain link, two options are applied, resolved and validated and best suited option is selected for implementation. Objective to increase the chain link breaking strength from 40T to 70T without changing the pitch, 216 mm has been achieved by following two options [a] Option I: Modified dimension with same (existing) material. [b] Option II: Alternative material with same (existing) dimensions. Option I has less advantages compared with option II. In option I biggest disadvantage is new die requirement but in option II by just changing the material from 20MnCr5 to EN30B target is achieved. Increase in breaking strength from 40T to 70T ultimately increases the tonnage carrying capacity of the conveyor. Based on above discussion, it can be resolved that with increase in fork diameter and thickness of chain link, strength requirements have been met. However, it involves

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increased weight and ultimately cost. On the other hands, only changing the chain link material while meeting the strength requirements presents a viable solution from cost perspective as new die cost is totally eliminated in option II.

Shinde Suhas M. et al [2]. work has done to optimize the critical parts like roller, shaft, c-channels, for chassis and supports by studying the existing conveyor system, to minimize overall weight of assembly and materials saving the result were 30.931% of weight reduction due to optimized design.

Xiaolun Liu et al [3]. They are using three types of chains for conveyor [a] A new type double pitch silent chain which is made by change some plates with Nano-Structured metal mesh polyurethane composite material. [b] Double pitch roller chain. [c] Short pitch silent chain. By analyzing the result was found that the Nano-structured metal mesh polyurethane composite material double pitch silent chain decreases the vibration and noise.

Shirong Zhang et al [4]. They take the all parameter in four coefficients and improve the efficiency of belt conveyor at operational level.

Wankhede Vishal et al [5] work has been done to change a suitable design to reduce cost of drag chain conveyor and increase the performance. In proposed design there are some changes as compared to conventional design. [a] Replace the tedious and costly external threading operation at pin ends with simple turning operation because of this change saving the material up to 4.5% per meter length and reduce operational cost. [b] Use a single fastener circlips by replacing two fastener nuts and spilt dowel pin. It helps to make more strength at the joint against stresses and deformation as compared to existing design. From these changes the proposed design of chain conveyor is performance better compared to conventional when forces are applied.

G. Federko et al [6]. To evince change of physical and mechanical properties of dynamically damaged conveyor belts. It happen because of different values of young's modulus in longitudinal directions. To use the non-destructive method for analyze inner structure conveyor belt carcass and use the computer tomography method for conveyor belt analysis if to interpret the dynamic wear of conveyor belt.

Martin Manual [7]. This Company has more than 60 years to designing and manufacturing of drag conveyors.

Thiele Manual [8]. They are the manufacturer of forged chain links, plate chain links and sprockets. This manual shows the customize design of bolt and go.

Mallick P. K. [9] is a author of "Fiber Reinforced Composite Material, Manufacturing and Design". In this book detailed about the composite materials and its properties.

III. MATERIAL PROPERTIES

A. Mild Steel

TABLE I. MATERIAL PROPERTIES FOR MILD STEEL

PROPERTIES	VALUES
ELASTIC MODULUS, E	190-210 GPA
SHEAR MODULUS, G	75-80 GPA
POISONS RATIO, N	0.27-0.3
YIELD STRENGTH	280-1600 MPA
ULTIMATE STRESS	340-1900 MPA
DENSITY,P	7.85 G/CM^3

B. Aluminum Alloy

TABLE II. MATERIAL PROPERTIES FOR ALUMINIUM ALLOY

PROPERTY	VALUES
ELASTIC MODULUS, E	70-79 GPA
SHEAR MODULUS, G	26-30 GPA
POISONS RATIO, N	0.33
YIELD STRENGTH	35-500 MPA
ULTIMATE STRESS	100-550 MPA
DENSITY, P	2.9 G/CM^3

C. Glass Fiber Reinforcement Epoxy Resin Composite

TABLE III. MATERIAL PROPERTIES FOR GLASS FIBER

PROPERTY	VALUES
LONGITUDINAL MODULUS, E_1	59 GPA
LATERAL MODULUS, E_2	20 GPA
POISONS RATIO, N	0.35
LONGITUDINAL TENSION STRENGTH, X_T	2000 MPA
LONGITUDINAL COMPRESSION STRENGTH, X_C	1240 MPA
TRANSVERSE TENSION STRENGTH, Y_T	82 MPA
TRANSVERSE COMPRESSION STRENGTH, Y_C	200 MPA
DENSITY, P	2.02 G/CM^3
IN PLANE SHEAR, S	165 MPA

IV. CONCLUDING REMARKS

Conveyor system used in many industries like cement, mining, coal, pharmaceutical, chemical etc. It is used to convey material from one place to another place. From above study we observed that the work has been done on the links of the drag chain conveyor with respect to its breaking strength, gravity roller conveyor and also on belt conveyor. By studying these researches we conclude that the load is applied on the flight of a drag chain conveyor while carrying the material. In future scope we can increase the breaking strength of flight by redesign the flight with different material or by change the material of flight.

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REFERENCES

[1] Kulkarni Shruti S, Mitra Anirban C, Nandikar Sameer and Damle Kedar, "Design Of Chain Conveyor TO Increase Breaking Strength", IJARIIE-ISSN(O)-2395-4396, Vol-1 Issue-3, pp219-231, 2015.

[2] Shinde Suhas M and Patil R. B, "Design and Analysis of Roller Conveyor System for Weight Optimization and Material Saving", Internarional Journal on Emerging Technologies-ISSN(O)-2249-3255, Vol-3 Issue-1, pp168-173, April 2012.

[3] Xiaolun Liu, Wencheng Wang, Wei Sun and Tiansong Wu, "Design and Experimental Analysis of Low Noise Double-Pitch Silent Chain for Conveyor", Sciverse Science Direct, Vol-29, pp2146-2150, 2012.

[4] Shirong Zhang and Xiaohua Xia, "Modelling and Energy Efficiency of Belt Conveyors," Scince Direct, Vol-88, pp3061-3071, April 2011.

[5] Wankhede Vishal and Sharma Suman, "Design Improvement for Enhansing the Performance Of Drag Conveyor Chain and its Cost Reduction", IJERGS-ISSN(O)2091-2730, Vol-3 Issue-2, pp524-531, April 2015.

[6] G. Federko, V. Molnar, J. Zivcak, M. Dovica and N. Husakova, "Failure analysis of Textile Rubber Conveyor Belt Damaged by Dynamic Wear", Sciverse Scince Direct, Vol-28, pp103-114, 2013.

[7] Martin maual, " Design and manufacturer of drag chain conveyor,".

[8] Mallick P. K, "Fiber Reinforced Composites Material, Manufacturing and Design".

[9] Katterfeld A and Krause F, "Functional Analysis of Tube Chain Conveyors", Otto-von-Guericke-University Magdeburg, Germany.

[10] Devendra Kumar and R. K. Mandloi, "Analysis and Prospects of Modification in Belt Conveyors-A Review", IJERA-ISSN-2248-9622, Vol-3 Issue-1, pp581-587, Feb 2013.

[11] Thiele Manual, "Conveyor Chains for the Cement Industry".

[12] 4B Group Manual, "Forged Chains and Sprocket for the Toughest applications".

[13] Patil Deogonda and Chawla Vijaykumar N, "Mechanical Property of Glass Fiber Reinforcement Epoxy Composite," Vol-1 Issue-4, pp6-9, 2013.

[14] Patel Jigar, Patel Sumant and Patel Snehal, "A Review on Numerical and Experimental Study of Screw Conveyor", IJAERS-ISSN-2249-8974, Vol-1 Issue-4, pp66-69, Sept 2012.

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