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FATIGUE FAILURE OF FLANGE IN SCREW CONVEYER: A REVIEW

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ABSTRACT
The screw conveyor is one of the oldest methods of conveying material known to mankind with the original design dating back to more than two thousand years. Since the screw conveyor came into general use a little over a century ago for moving grains, fine coal and other bulk material of the times, it has came to occupy a unique place in a growing area of material handling processing. Today, modern technology has made the screw conveyor one of the most efficient and economical method for moving bulk material.
Screw Conveyors are compact and easily adapted to congested locations, versatile and can be employed in horizontal, inclined and vertical installations can be used as a mixer or agitator to blend dry or fluid ingredients, provide crystallization or coagulant action, or to maintain solutions in suspension. Problem associated with screw conveyer is fatigue failure of flange during work. Flange joints are common in screw conveyor. Flange connects the gearbox of motor with casing of screw conveyor. To find the reasons of the fatigue failure a review is to be taken from the literatures.

KEYWORDS: Screw conveyor, flange, fatigue failure.

INTRODUCTION
In industry there are various requirement of motion for which the prime movers are used like Motors or Engines. Motors are widely used as prime movers as it gives uniform motion and control of speed and direction is easy as compared to engines. Requirement of torque and revolution is done by gear box. In most of the industries, Screw conveyors are popular devices for conveying farm products, cement etc. Thousands of portable units have been used to move or elevate grains into and out of storage bins. As one aspect of increased mining mechanization, many auger conveyors are being installed as integral parts of continuous-flow systems. The screw conveyor is one of the oldest methods of conveying materials known to mankind with the original design dating back to more than two thousand years. Since the screw conveyor came into general use a little over a century ago for moving grains, fine coal and other bulk material of the times, it has come to occupy a unique place in a growing area of material handling processing. Today, modern technology has made the screw conveyor one of the most efficient and economical methods of moving bulk material.
They are very effective conveying devices for free flowing or relatively free flowing bulk solids, giving good throughput control and providing environmentally clean solutions to process handling problems because of their simple structure, high efficiency, low cost and maintenance requirement. Flange joints are common in screw conveyor. Flange connects the gearbox of motor with casing of screw conveyor. These flanges are included for support the connection and strength the joint also for it helps to attach many other components. The main problem in the joint assembly and disassembly connection so, bolt and nuts are used. Problem associated with

connection is breakage of flange to overcome the problem the connection must be analyzed in static and dynamic condition. The present work is "stress analysis of flange for screw conveyor"

Figure 1.1 Screw conveyor

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Rigid flange coupling are designed for heavy loads or industrial equipment. When joining shafts within a machine, mechanics can choose between flexible and rigid couplings. The connecting methods for flange couplings are usually very strong because of either the pressure of the material or the sometimes hazardous nature of materials passed through many industrial piping systems.

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Figure 1.2 Flange of Screw conveyor

There are three major components in flange connection they are flange, gasket and bolts and nuts. Gaskets are used to protect from leakage, also for preventing wearing of flanges. Pipe flanges are manufactured with dimensions provided by the customer or they are manufactured according to published specifications such as ASME or ANSI standards. Flanges are affected by the varying forces, pressure, temperature and an environmental effect because of which leakages occurs in the connection. So sealing of a connection must be analyzed. T.Sawaet conducted sealing performance of flange joints using axis symmetric three dimensional theory of elasticity approach.

Stresses produced in the hub and the maximum stress developed in bolts were analyzed and verified with experimental results. All real physical structures, when subjected to loads or displacements, behave dynamically. The additional inertia forces, from Newton's second law, are equal to the mass times the acceleration. If the loads or displacements are applied very slowly then the inertia forces can be neglected and a static load analysis can be justified. Hence, dynamic analysis is a simple extension of static analysis.

The basic principle of material along the trough is similar to the sliding motion of a nut along a rotating screw when the nut is not allowed to rotate. The weight of material and the friction of the material against the wall present the load from rotating with the screw.

The critical angle was considerably smaller than that predicted from static force equilibrium because of the spherical shape of modeled particles. The particles are likely to rotate rather than slip on the screw conveyor components. The transfer velocity of particles was almost equal to the advance velocity of the screw. The overall power is larger by about 15% than that derived from static force equilibrium using calculated results of the critical angle and the center of gravity.

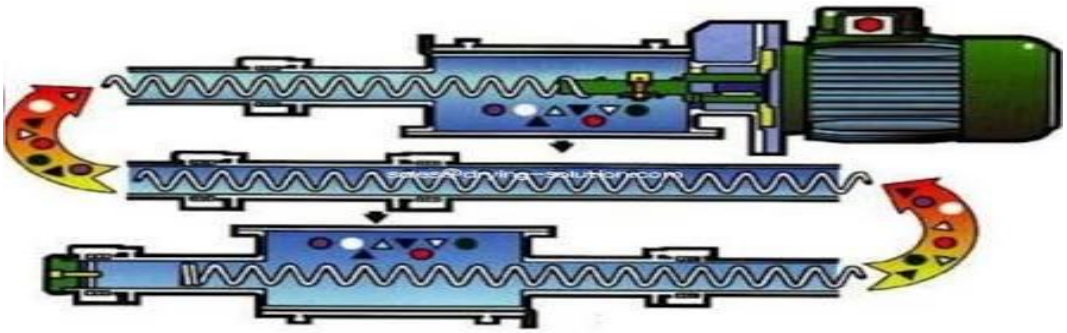

Figure 1.3 Material flows in screw conveyor

As the revolution speed increases, the particles move faster as a bulk mass, which has a compact form in the axial direction. On the other hand, as the revolution speed decreases, the particles move slower, and the mass concentration spreads out in the axial direction. The computed flow rate differs somewhat from that observed in experiments. One reason is that a different way of feeding materials at the inlet is used.

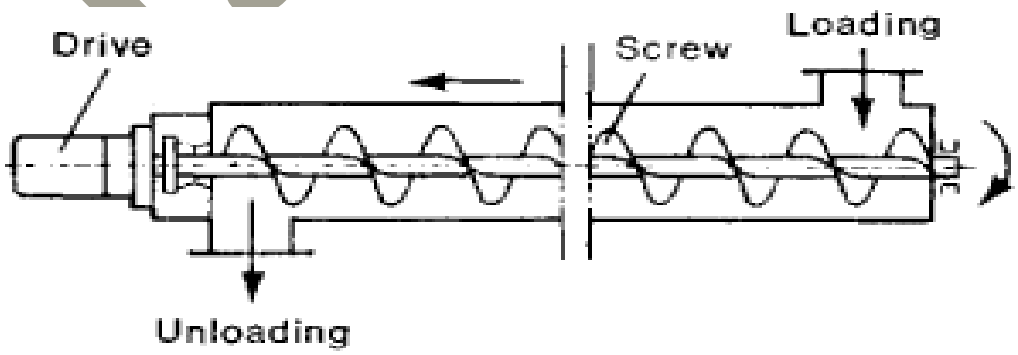

Figure 1.4 Loading and Unloading material

The flange connects the gearbox and the casing of screw conveyor at given power and torque to sustain the flange we have to analyze the problem occurring at working. The problem is that the flange undergoes several static and dynamic forces as well as cyclic stresses. So flange gets break along the periphery as shown in below fig. due to deformation as shoe that force also depends upon the output power, rpm, torque and load on screw conveyor. The flange is made up of FG200 and manufacturing method is casting.

LITERATURE REVIEW

Mohammad Alizadeh and Mahdi Masoomi were conducted research to determine the effects of those parameters believed to have the greatest influence upon horizontal screw conveyors throughput capacity and power requirement when handling paddy grains. Two screw conveyors with diameters of 20 and 25 cm were evaluated at four screw clearances (6, 9, 12 and 15 mm) and five screw rotational speeds (200, 300, 400,500 and 600 rpm). The results revealed that for both the conveyors tested, with increasing the screw rotational speed, the conveyor capacity increased and reached to a maximum point and after the point, the volumetric capacity decreased. Increasing the screw speed caused the volumetric efficiency and power requirements of the conveyors to be decreased and increased, respectively. The throughput capacity and power requirement of the conveyors increased ($P<0.01$) with increasing the auger dimensions.

Bhale Pritish P1, Lavnis Avinash carried out static & Dynamic analysis of flange of flange mounted motor which is also known as B5 type motor by using FEA software ANSYS 15 and modeling is done with help of CATIA V5 R20.

V.G.Vijaya did the stress analysis of rigid flange couplings subjected to torsion using ansys. The theory related to the title will be studied from 'FUNDAMENTALS OF MACHINE DESIGN by T.J.PRABHU Analytical solution will be obtained. To obtain computer solution ANSYS will be used.

N. Higurashi conducted the the use of pipe flange connections is standardized in the codes of JIS, ASME, DIN and so on. However, these codes are almost entirely dependent on experience, and subsequently some problems concerning pipe flange connections have been encountered. The distribution of contact stresses which governs the sealing performance is analyzed as a three-body contact problem, using an axis symmetrical three-dimensional theory of elasticity. The effects of the stiffness and the thickness of raised face metallic gaskets on the contact stresses and the effective gasket seating width are shown by numerical calculation. Moreover, stresses produced on the hub, the load factor (the relationship between an increment of bolt axial force and an internal pressure), and the maximum stress caused in bolts are analyzed. For verification, experiments are carried out. The analytical results are satisfactorily consistent with the experimental results.

Sanjay.S. and Sunil Kumar.B.V carried out concentrating on joints critical areas by adopting a composite flange. Since composite materials are most promising now days so, use of composite flanges can make difference to the existing components. In the present paper metallic flange for radial stress(x-direction) and axial stresses (y-direction) for preload condition and compared with a carbon epoxy composite flange. Analytical solutions are obtained using laminate theory. The analytical results are validated with finite element solution using different fiber orientation.

The stress obtained for different orientations are compared with each other and they are compared with analytical results. From results it can be said that [0/45] and [0/60] orientation will give better results as the analytical and finite element results are very near. Finally it is said

that metallic flanges can be replaced by composite flanges in some industrial applications as the radial and axial stress developed is less when compared to metallic flanges.

PROBLEM IDENTIFICATION

A visit to Laxmi Hydraulics Private Ltd., solapur is done. The problem faced by them is observed. The flange connects the gearbox and the casing of screw conveyor at given power and torque to sustain the flange. The flange undergoes several static and dynamic forces as well as cyclic stresses while working. Due to this problem associated with connection results into breakage of flange. So this problem is chosen for the project work. Flange gets break along the periphery as shown in below fig.

Figure 1.6 Breakage of Flange

FINDINGS OF THE REVIEW

Screw conveyor is one of the Materials handling equipment used in the industry. Minimum time for material handling is required. As well as material handling should require cost for the equipments or machines handling the same. Also it should reduce the fatigue of the workers. Thus material handling plays important role in the industries. If the cost of material handling is more, it will lead to increase in the overall cost of the product which will increase the price of the product. To be competitive, every company tries to keep the material handling cost to the minimum. Thus it is one of the major areas in the industries where improvements can be made.

REFERENCES

1) S.G. Chavan, *Stress analysis of flanged joint using FEM, International journal of research and science, vol.3, Issue 8, Aug.2014.*

2) V.G. Vijaya et al. *Analysis of rigid flange coupling, International Journal of Innovative Research in Science, engineering & Technology, Vol.2, Issue 12, pp. 7118-7126, 2013.*

3) S.N. Datey et. al , *Finite Element Analysis of Universal Joint, IOSR journal of Mechanical and civil Engineering, Vol.2, Issue 3, pp. 64-69, 2010.*

4) 4. V.B. Bhandari, *Design of Machine Elements, Tata McGraw Hill companies, Second Edition, pp.323-389. [5] PSG Design data Book, pp. 01-42.*