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"Design And Optimization Of Locomotive Bearing Cleaning Machine"

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Abstract

An axle bearing play a critical role in the safety of railroad operation, they are periodically disassembled for inspection[1]. For this reason, simple procedures for inspection are important design factors as well. To improve operating efficiency, bearings must offer longer inspection intervals, simplified maintenance procedures and increased integration of bearing components and adjacent parts[2]. To meet these needs, unitizing an appropriate knowledge of procedures involved in its maintenance and cleaning of bearing is important.
This projects aims to design a machine for cleaning cylindrical bearing. The present cleaning operation has consisted of number of processes. We are designing a machine in which all the process like oil bathing , visual inspection , penetration of bearing in special lubricant and passing it through UV lights in dark room. The proposed work will consist of CAD modeling of bearing cleaning machine in CAD software SOLIDWORKS and performing analysis by using Finite Element process.

Keywords: *HydraulicPress,CAD,Hypermesh.*

1. Introduction

Roller bearings are a vital part of the traction system provided on axle i.e. axle box & motor suspension unit as well as traction motor at both the ends[2]. They are mainly grease lubricated, cylindrical roller bearings and are used to support axle or wheel set of the locomotives and armature of traction motors. Thus these bearings carry the weight of the locomotive by allowing free movement to the wheels. They are also subjected to severe impact due to track irregularities, lateral thrust and sometimes, due to wheel skid.
Cylindrical roller bearing consist of an outer ring having a continuous raceway within which it operates, two rows of barrel shaped rollers, which in turn are guided by an inner ring with two raceways separated by a centre rib[8]. The cylindrical roller bearings have self-aligning properties. Bearing made of the right materials, dimensional accuracy, properly installed and lubricated give trouble free service for years. Roller bearings are robust mechanical components which will give long service life, particularly, if they are correctly mounted and well maintained. Correct handling when mounting and dismounting bearings should not present any difficulties, cleanliness, accuracy and care are necessary. The maintenance of roller bearings simply means that they should be protected from dirt and moisture and correctly lubricated and inspected for any cracks occurred internally. If these bearings are not maintained properly can cause the roughness in motion and ultimately jam in it.
The consequences of a roller bearing failure on line are that the section is blocked for the traffic and if roller bearing seizes, then the locomotive cannot be moved until the axle of the locomotive is lifted.

Procedures involved in Axle bearing cleaning:

- Oil bath of train axle bearing with lubricants (like kerosene, etc) in washing cabinet
- Visual inspection of bearing under magnifying glass
- Penetration of bearings in special lubricant
- Inspection of Crack or micro - defects under UV light

Fig: Existing Cleaning Process

3. Objectives:

- Design and optimize a machine for cleaning of locomotive cylindrical roller bearing
- To generate CAD model of bearing cleaning machine
- To perform analysis using FEA on bearing cleaning machine.
- To minimize the accidents and damage caused by labors to bearings while carrying it from one place to another inside workshops
- To reduce number of operators and labors required for the cleaning operation.

4. Literature Review

Maintenance of Spherical Roller Bearing for ICFCoaches This paper is focused on proper maintenance of cylindrical bearing. Roller Bearing Maintenance Shop should be well equipped with all the tools, equipments and facilities for careful bearing handling. It should have proper workflow for easy maintenance of roller bearings. Clean surroundings and dust free atmosphere should be maintained in the shop. It should have adequate equipment and facilities for cleaning, handling, dismounting/mounting, inspection, repair and storage of roller bearings.Roller bearings are required to be inspected periodically at a pre-defined schedule inthe workshops in a Roller Bearing Maintenance Shop well equipped with all the facilities and proper lay out [1]

Maintenance handbook for roller bearing on axle The roller bearing on electric locomotive is a vital equipment and its proper upkeep and maintenance is necessary to ensure good reliability and availability of electric locomotives. This paper on maintenance of roller bearing on axle and traction motor has been prepared by CAMTECH with the objective of making our maintenance personnel aware of correct maintenance and overhaul techniques to be adopted in field [2]

Kugelfischer Georg Schäfer In the proposed paper , lubrication in rolling bearings is discussed . The proposed work consist of functions of lubricants used in roller bearings , different lubrating conditions in roller bearings , Influence of the Lubricant Film and Cleanliness on the Attainable Bearing Life, cleanliness factor , contamination factor Lubricating Film with Grease Lubrication different procedure for bearing cleaning , Lubricating Layers with Dry. Different lubrication systems arediscussed [3]

H. S. Gadiyar,Chintamani Das and K. B. Gaonkar In this proposed work Decontamination and corrosion of metal is discussed. Chemical cleaning of process equipments in chemical/petrochemical industries is necessitated for improving operation, for preventing premature failures and avoiding contamination. In developing a chemical formulation for cleaning equipment the important aspects to be considered include; effective removal of corrosion products and scales. ; Minimum corrosion of the base metal; easy to handle chemicals and economic viability[4]

The Basics of Alkaline In-Process Cleaning for Metal Substrate Thispaper pertains mainly to alkaline cleaners, but includes solvents and acids. Iron phosphate products, which make up the bulk of the acid cleaners, will not be covered. The objective is to acquaint you with metal cleaners, the differences between them, what to look for, and how to choose a cleaner. Regardless of the type or category, all cleaners remove soils by one or more of the following principles: Solvent, Action, Saponification, Detergency, and Emulsification. Throughout this paper, refer to two general types of materials which must be removed prior to processing. One is oily and the other is particulate. Oil, by definition, is a petroleum based product. However, for our purposes, simple waxes, vegetables oils or animal fats may be part of the oily soil [5]

5. Problem Formulation

The cleaning and maintenance of cylindrical bearing is an cylindrical roller bearing plays an vital role in maintenance of trains. At present the bearings to be cleaned has to go through n number of process. First they are made to pass through oil bath, second visual inspection, and third

penetration in special purpose liquid and finally passed through UV lights for more accurate inspection.
This long process involves high number of labors, slow process and is time consuming. Also, moving of bearing from one placeto another for process can damage the bearing or can cause accidents in work shop.
To overcome from the above mentioned problems and to make out the best possible solution we are designing a machine where all the process will be carried out in a single machine and thus reducing number of labors as well as time.

6. Research Methodology

In present study, we will be accumulating all the necessary data from the company. As per the data accumulation the CAD model of the machine will be developed. Analysis of the machinewill be performed. Design of the bearing cleaning machine will be performed as CAD modelling accomplished in CAD software and analysis of developed model will be done with the help of analysis software. After that results will be discussed and design will be finalized.

7. Conclusion

Our project involves the detailed study of the processes being carried out in cleaning process of cylindrical bearings and designing a single machine for cleaning of bearing is concluded. This machine will help the industry to minimize the maintenance cost, labor cost as well as energy required for the whole process .Thus single machine will perform all the cleaning process and will be of great advantage that a cylindrical bearing requires such as removal of dirt, inspection for the cracks, etc .

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