

“Design & Analysis of Metal Surface Treatment Machine”

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Abstract: Indian Railways is a third largest network industry in the world. Average passenger train runs with minimum 100 wheel sets. Train wheels in railway are always exposed directly to the different climate conditions. While the train wheels are in motion debris and many unwanted particles get stick on metal surface of train wheels. Many times it is not possible to see small stones, metals or other debris that gets accumulated on metal surface of train wheels. Changing climatic conditions lead to formation of rust and rust scales on the train wheel surface which needs to be cleaned otherwise the wheels material get corrode and leads to decrease the life of wheel.

In this research the design and analysis of metal surface treatment machine will be performed to overcome the problems mentioned above. This project is an industrial project for DULOCOS ENGINEERING ENTERPRISES. It involves the design and analysis of metal surface treatment machine with the help of CAD and CAE software.

Keywords: Metal surface treatment.

I. Introduction

Cleaning means removal of contaminating or unwanted liquid, solid, or semisolid matter from the surfaces of a work-piece. Debris can stick to wheel or rims from many sources. It is commonly generated any time the brake pads are applied while the train is running.

Metal surface treatment is the method of removing soil particles of different materials and sizes, films and coatings from solid metal surface. Problems of metal surface cleaning from environment substances in the form of small particles and films arise in many fields of human activity like industry, building, artworks conservation and so on. One of the typical examples of metal surface treatment is cleaning of train wheels in railways.

Train wheels in railway are always exposed directly to the different climate conditions. While the train wheels are in motion debris and many unwanted particles get stick on metal surface of train wheels. Many times it is not possible to see small stones, metals or other debris that gets accumulated on metal surface of train wheels. Cleaning of these matters from metal surfaces of wheels is very important. Changing climatic conditions lead to formation of rust and rust scales on the train wheel surface which needs to be cleaned otherwise the wheels material get corrode and leads to decrease the life of wheel.

Therefore, we need to design a metal surface treatment machine which will be of great benefit to metal cleaning processes that are being carried out in railway servicing department. Metal surface treatment machine is a device that is used to clean the rust and rust scales formed on metal wheels of the train. These rust and rust scales when remains for the longer time on the metal surfaces will then be very difficult to remove by hands manually.

II. Problem Definition

In Nagpur railway workshop the maintenance of locomotive perform Metal surface Cleaning operation manually with the help of steel wire brush or with rust cleaning file. This method of cleaning requires high number of labor and it is also very time consuming. It is very dangerous and harmful to the worker as the rusting material is highly toxic which comes directly in contact with the worker. This process is less efficient and precise.

It was observed that due to different climatic conditions and whether changes, there is a formation of rust and rust scales on the surface of metals. These rust if remains for a longer time created difficulty during cleaning of metal surface manually. Metal surface Cleaning operation is generally performed manually with the help of steel wire brush or with rust cleaning file. This method of cleaning requires high number of labor and is also very time consuming. So there is an essential need to design a metal surface treatment machine which will clean the metal surface at optimum time and thus reducing the efforts applied by man.

III. Objectives

The objective of this dissertation is to Design a wheel cleaning machine with the help of CAD software and to analyze the Design of wheel cleaning machine with the help of Finite Element Analysis.

The objectives are:

- To design the metal surface treatment machine.
- To remove the rust and rust scales from the metal wheels and shafts of the trains.
- To increase the life of metal wheels and its components.
- To minimize the man power and time required for cleaning metal surface.
- To reduce the efforts applied by man while cleaning.
- To avoid manual cleaning process.
- To increase the productivity

IV. Literature Review

Gerald A. Lux and William Blum [1]This paper is based on metal cleanliness and environmental metallurgy, to determine whether the "finish" of steel prior to electroplating affects the protective value of the plated coatings. The resultant finishes were measured with a Profilo-meter. The finishes varied from a "super- finish," of less than 1 micro-inch, to 65 micro-inches. The average thickness of steel removed by polishing was measured. The polished specimens were plated with copper, nickel, and chromium of controlled thickness, and were exposed to the atmosphere at New Washington, D. C. The extent of rusting observed at periodic inspections over a period such as 1 year and expressed as "Percentage scores". Comparison of these scores showed that wide differences in the surface finish of the steel had no significant effects on the protective value of the plated coatings.

Sayali Badgujar, Chinmay Dindorkar, Manohar Desale, Prof. Swapnil Ambekar [2] This paper shows the washing mechanism of heat treated blanks. Heat treatment and surface modification techniques are utilized to optimize physical, chemical and mechanical properties of metals.. Cleaning is defined as the application of time, temperature, chemistry and energy to remove contamination from the surface. This paper presents the concept of heat treatment and formation of scale after heat treatment, the various principals to remove that scale effectively and concentrates on formation of scale on different types of metals and ways to avoid it or remove it.

H. S. Gadiyar, Chintamani Das and K. B. Gaonkar [3]: 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. The report enumerates some of the concepts in developing effective formulations for chemical cleaning of carbon steel components and further, makes an attempt to suggest simple formulations to be developed for chemical decontamination.

Gerald A. Lux and william blum [4] This paper 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. 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.

Jing Lin, PhD [5]This paper undertakes a reliability study using both classical and Bayesian semi-parametric frameworks to explore the impact of a locomotive wheel's position on its service lifetime and to predict its other reliability characteristics. The goal is to illustrate how degradation data can be modeled and analyzed by using classical and Bayesian approaches. The adopted data in the case study have been collected from the Swedish company. The results show that: 1) an exponential degradation path is a better choice for the studied locomotive wheels; 2) both classical and Bayesian semi-parametric approaches are useful tools to analysis degradation data; 3) under given operation conditions, the position of the locomotive wheel could influence its reliability.

V. Identified Gaps in the Literature

Many researchers have presented their reviews on metal cleanliness, chemical cleaning techniques of metal, mechanism of metal cleaning machines. Researches based on metal cleaning lubricants. Solvents and maintenance of metal has been carried out. Design and analysis of metal treatment machine should also be given a priority as it is very important to clean metals used in railways to increase their service life. This work is focused on design and analysis of metal surface treatment machine.

VI. Research Methodology

In this work, we will be accumulating all the essential and necessary data of metal surface cleaning operation. Considering the problems identified in the existing methods of metal surface cleaning we will create and design metal surface treatment machine to remove rust and scales from the metal wheels or shaft of the trains. The CAD model of the machine will be generated on CAD software and analysis of design using FEA software. After analysis the results will be discussed and design will be finalized.

VII. Conclusions

In this research the design and analysis of metal surface treatment machine will be performed to overcome the limitations of the existing process of metal surface cleaning. This project is an industrial project for DULOCOS ENGINEERING ENTERPRISES. It involves the design and analysis of metal surface treatment machine with the help of CAD and CAE software. after the successful completion of this project Dulocos Engineering enterprises will be directly benefited with CAD and CAE techniques.

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