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Design and Development of Test Rig for brake fluid

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ABSTRACT

The problems caused by brake failure are very severe. It may cause even danger to life. So in hydraulic system it is essential to test the brake fluid before in use under different conditions. In order to enable this process it is essential to design some device which would be able to predict the failure of the brake. In case of hydraulic braking system the brake failure takes place due to failure of the hydraulic oil present in the brake system. If the hydraulic fluid fails, it results to the failure of the brake simultaneously. Design of the device which will fulfil these requirements should be done. Different types of hydraulic fluids can be tested by the use of this equipment. It is useful for many of the hydraulic fluid manufacturing companies. Many manufacturers require periodic fluid changes to ensure reliability and safety. Once installed, moisture diffuses into the fluid through brake hoses and rubber seals and eventually, the fluid will have to be replaced when the water content becomes too high. For getting the perfect information about the failure of brake fluid the testing of fluid is essential. The test is performed under different pressure and temperature conditions.

Keywords- Brake Fluid, Hydraulic System, Safety, Temperature, Test Rig.

I. INTRODUCTION

Test rig is an apparatus used for assessing the performance of a piece of mechanical or electrical equipment. This system is designed to evaluate the lubrication quality of the brake fluid under dynamic conditions. The testing is designed as per IS-8654:2001 and SAEJ 1703 oct 88. In this set up the test rig is designed in order to test the performance of the brake fluid in working condition under applied pressure and temperature.

1. Brake fluid is stroked under controlled conditions at an elevated temperature in a simulated motor vehicle hydraulic braking system consisting of three slave wheel cylinders and an actuating master cylinder connected by steel tubing.
2. During the test, temperature, rate of pressure rise, maximum pressure and rate of stroking are specified and controlled.
3. The system is examined periodically during stroking in order to assure that excessive leakage of fluid is not occurring. Afterwards the system is disassembled.
4. Metal parts and SRB cups are examined and reassembled. The brake fluid and any resultant sludge and debris are collected, examined and tested.

The research work to be done in this project is to design the test rig which is to be used for the test work. The test rig consists of design of master cylinder, wheel cylinders, brake assembly, master cylinder assembly, braking pressure actuating mechanism. Wheel cylinder assembly is designed in order to mount the three cylinders in the oven. The oven is designed to apply temperature. Power pack is designed for actuating the hydraulic assembly. And the total circuit is controlled by PLC programming.

II. LITERATURE REVIEW

Rahul Singh et al.[1], studied Design of new type of master cylinder to avoid the undesirable bleeding in the disc brake system, they designed a new type of master cylinder containing air vessel, to minimize or eliminate the undesirable bleeding and some other problems related to brake system of vehicle, and method of locking of all four wheels simultaneously. Braking system is one of the most important parts of our vehicle required to have a better control on vehicle and to stop it within a safe stopping distance. Master cylinder is a control device that converts non-hydraulic pressure (commonly from a driver's foot) into hydraulic pressure. This is used, for stopping vehicle. They designed a new type of master cylinder containing air vessel, to minimize or eliminate undesirable bleeding and some other problems, and a new method for locking of all four wheels simultaneously.

Fabio Burlon [2], published a paper on Energy Efficiency of Combined Ovens, he published a paper to focuses on professional ovens, which consume a large amount of energy. They need to satisfy high quality standards, high adaptability and reliability but they still do not have worldwide recognized standards for energy classification. The analysis has highlighted an impossible comparison among the results and a consequent difficult evaluation of the energy efficiency of the oven. The subsequent step of the work presented in this paper is the identification and the development of a detailed methodology for analyzing the energy efficiency of the oven. The result of the methodology is then a guide in the identification of improved design technical solutions. Some of these are finally applied, showing remarkable results in the overall energy efficiency of the oven.

David Amienyoa et al.[3], Studied on Sustainable manufacturing of consumer appliances: Reducing life cycle environmental impacts and costs of domestic oven.This study has considered life cycle environmental and economic impacts of conventional and novel highly-efficient ovens. The GWP of the former ranges from 812–1478 kg CO2 eq. and of the latter between 576–738 kg CO2 eq. over the lifetime of 19 years. Therefore, HEO ovens have a potential to save up to 30% of energy and between 9% and 61% of the GWP, depending on the assumptions for the cleaning options for the conventional oven as well as on the amount of electricity used per cycle by HEO. Most of the GWP for both oven types is generated during the use stage, with the electricity contributing 53%–97% to the total. The raw materials contribute around 1%–2%, while the manufacture of the oven cavity accounts for less than 1% of the total impact. The other environmental impacts are reduced by 24%–62%.

Robert Bosch GmbH [4] studied on Braking system master cylinder gasket. This invention relates to a gasket for a master cylinder. According to this patent, it is provided in a groove around the piston, and comprises a core connected to three substantially annular and concentric lips. The core engages a side of the groove that has a surface provided with an inner edge followed by a peripheral plate, through which at least one channel extends,

and supports an outer crown. A connection area is formed by an interruption in the crown and deformable by means of the pressure inside the gasket for re-creating the continuity of the crown and of the tightness, essentially along a line, while facilitating the drainage of the brake system in the absence of pressure through the channel and the connection area.

Yuan Mao Huang et al.[5], Published a paper On Pressure Distributions of Drum Brakes. The purpose of this study is to analyze the effect of the effective lift at the actuation end on the friction force, effects of the Young's modulus of elasticity for metal shoes, the angles of the arc lengths of metal shoes and lining plates, respectively, the leading location of the lining plates, the thickness of the lining plate, the friction coefficient, the Young's modulus of elasticity for lining plates, and the location of the actuating force of the drum brake on the pressure distributions. A two-dimensional model of the drum brake is developed by using the BEM, and independent and less expensive software is generated for the personal computer to reduce the cost for designing drum brakes. By selecting proper values of these parameters, a drum brake can be designed to have a more uniform pressure distribution and a longer life.

B.Sandhya Rani et al.[6], Published a paper on Design and Analysis of Plastic Brake Master Cylinder for Automobiles .In this Paper the design and analysis of plastic and aluminum master cylinder are performed. And it is concluded that, the plastic master cylinder is more advantages for Automobiles. The following conclusions were made:

1) The weight of Master Cylinder made up of Acetyl Polymer i.e.0.157 Kg is less than Master cylinder made up of Aluminium i.e. 0.355 Kg.

2) The Master Cylinder made up of Acetyl Polymer material can bear more stress i.e.0.826358 N/mm^2 than master cylinder made up of Aluminium i.e. 0.661251 N/mm^2.

3) Heat transfer rate is good for Acetyl polymer than Aluminium.

Cengiz Yegin et al.[7], Published a journal named, Journal of Petroleum Science and Engineering. In hydraulic fracturing, the design of the fracturing fluids is a crucial step in optimizing the effectiveness of hydrocarbon recovery. Herein, we describe a supramolecular dispersion with highly adjustable, reversible viscosity behavior, enabling control over the mobility, settling, and deposition of proppants. The supramolecular dispersion was obtained by complexation of an amino amide and maleic acid in an aqueous solution. The rheological properties of the developed fracturing fluid involving this supramolecular solution and proppant (silica sand) were characterized by frequency sweep and tixotropy tests, and settling studies.

III.OBJECTIVES

1. Testing of the brake fluid.
2. Considering temperature and pressure conditions on the brake.
3. To develop efficient braking system.
4. To reduce accidents due to brake fluid failure.

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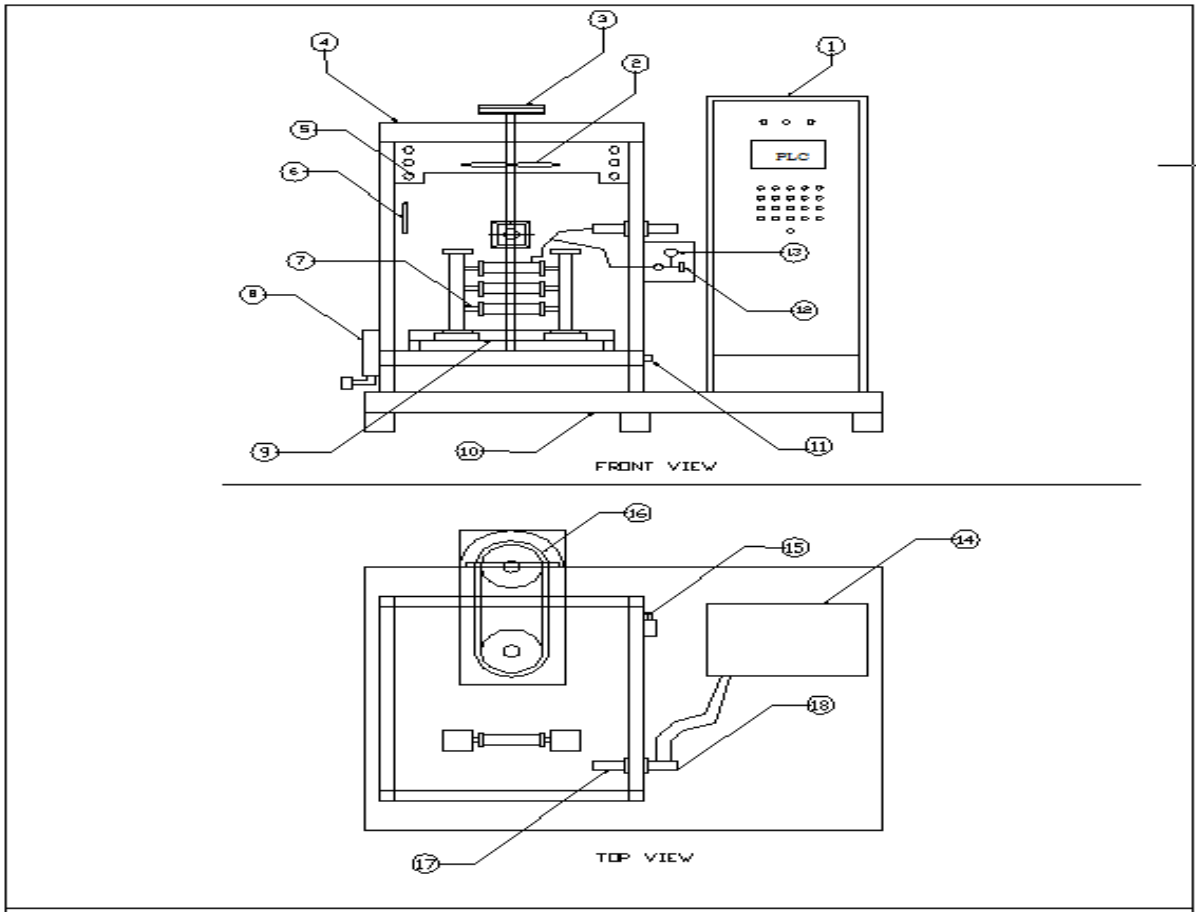
IV.METHODOLOGY

The aim of this dissertation is to study the detailed parts of the system to be developed. The parameters specified by the sponsoring company will be studied in detail. Design calculations of the desired parameters will be done. Use of aids like Design Data book, CAD software, ANSYS will be utilised whenever and however necessary. The Design of individual parts will be made and analysis for different loading conditions will be checked. When the design will be safe then the parts drawing will be made and simulated in available software. Manufacturing and assembly of these parts will be done. The test results will be compared with the results obtained by ANSYS, and F.E.A. method and arrive to final conclusion.

V.FIGURE AND TABLE



PART LIST			
PART NO	PART NAME	PART NO	PART NAME
1	CONTROLPANEL	11	LIMIT SWITCH
2	HEATING FAN	12	PRESSURE TRANSMITTER
3	PULLEY	13	PRESSURE GAUGE
4	CHAMBER	14	POWER PACK
5	HEATER	15	DIRECTIONAL VALVE
6	PT100	16	MOTOR
7	WHEEL CYLINDER	17	MASTER CYLINDER
8	FLOAT SWITCH FOR LEAKAGE DETECTION	18	HYDRAULIC CYLINDER
9	TRAY		
10	BASEFRAME		

VI.CONCLUSION

From this literature survey it can be seen that, the test rig is essential to be designed for the developing the efficiency of braking the vehicle. The testing of the brake fluid should be done in order to avoid the accidents which are caused due to failure of brake. Testing of the fluid by design of test rig is hardly made. The work is to design the different parts associated with the test rig. The design is to be checked for failure under applied conditions of temperature and pressure. Some parts are to be analysed using Finite Element Methodology for the given application. The results obtained by the Numerical methodology are compared with the Experimental Methodology using physical Experimentation for the given application.

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