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Design and Fabrication of Hydraulic Magnetic Braking System

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ABSTRACT: Motor vehicle accident can be fatal and contribute a high economic burden. Road crashes are the second leading cause of death globally among young people. The main factor for the road accidents are the brake inability. The aim of this work is to develop a hydraulic magnetic braking (HMB) system that has performance advantages over the conventional hydraulic braking system. Braking is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axial or prevent its motion most often accomplished by means of friction. Mainly disc brakes and drum brakes are used. But these braking systems have few demerits such as failure of mechanical components, leakage of oil. To avoid these limitations, we introduce hydraulic magnetic braking.

The proposed braking system consists of rotating disc, solenoid, hydraulic fluid, a timer circuit. In this braking system the main advantages are inbuilt reckless anti-lock braking system (ABS). By applying brake, current flows to the calliper in which solenoid are housed which produce magnetic field, by the application of magnetic field and with the concept of the pascal's law the fluid is forced the asbestos material to causes breaking action. Similarly, as the brake pedal get released, current flow stops, and the asbestos material will lose its hold over the tires.

KEYWORDS: Timer circuit, solenoid, calliper, disc

I. INTRODUCTION

By analysing that vehicle always start and brake more frequently in urban areas. So, the energy dissipated to the air in the process of vehicle braking is about half of the driving energy. However, the traditional mechanical braking system takes more energy in the form of heat energy. So that failure of brake system happens. By our hydraulic magnetic braking system, the braking action is faster than hydraulic and mechanical braking system, by this system full action of ABS is provided in all speed. The ABS can be applicable and also reduce the braking time and skidding of vehicle. Braking is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axial or prevent its motion most often accomplished by means of friction. Brakes are one of the most important component of vehicles. They are required to stop the vehicle within the smallest distance and this is done by converting the kinetic energy of the vehicle into the heat energy which is dissipated into the atmosphere. Brakes are classified according to the purpose as the service or the primary and the parking or the secondary brakes. The service brakes are the main brakes used for stopping the vehicle while in motion, whereas the parking brakes are meant to hold the vehicle on a slope. The brakes are located either at transmission or at the wheels. If the brakes are located on the transmission, the braking torque is equally divided automatically by the differential between the two wheels and no special compensation is needed and the transmission brakes would be stronger than the brakes of similar capacity at the wheels. From construction point of view two categories are the drum and disc brake.

II. RELATED WORK

1. Chunyan Wang et al [1]. This paper mainly discusses the braking sense stability strategy from two aspects of multi-objective optimization and compensation control.

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2. Oliver Maier et al [2]. As a consequence of the high braking performance, typical bicycle braking errors lead to more serious accidents. This is the initial point for the progress of a Braking Dynamics Assistance system (BDA) to prevent front wheel lockup and nose-over (falling over the handlebars).
3. Chi-chian sun et al [3]. One of the major reasons to design upright magnetic system is to find out the magnetic flux. Due to the changes in the magnetic flux, an eddy current gets induced in the conductor and these currents dissipate energy in the conductor and generate drag force which slow down the motion. The results will aid the design of magnetic braking systems
4. M.Pagliai et al [4]. In this work it is proposed an innovative solution based on the adoption of a system aimed to recover braking energy in order to feed an efficient on board hydraulic actuation system.
5. Yusuf Yasa et al [5]. In this study, a comprehensive design procedure for the electromagnetic brake is presented. Simple and efficient mechanical and thermal models are derived analytically and numerically.
- 6.

III.COMPONENTS

The major components are Timer circuit, Solenoid, Calliper and Fluid

A) Timer circuit [6]

The timer consists of resistor, relay, LED, IC 555

Resistor is used for controlling the current, relay is for switching the current, IC gives the timer or ABS action while the current is to be controlled. Capacitor is used for blinking of LED. LED is used for viewing the ABS action.

B) Solenoid

When the electric power is applied, the magnetic action is performed and demagnetized when the power is switched off.

C) Calliper

The calliper is made by the material called Delran. It consists of two pistons, one is used for compress the fluid and other for braking action.

D) Fluid

The fluid used is carboxyl methyl cellulose salt (CMC). This is to be dissolved in water within a specific ratio. It takes about 6hrs to dissolves

IV.WORKING

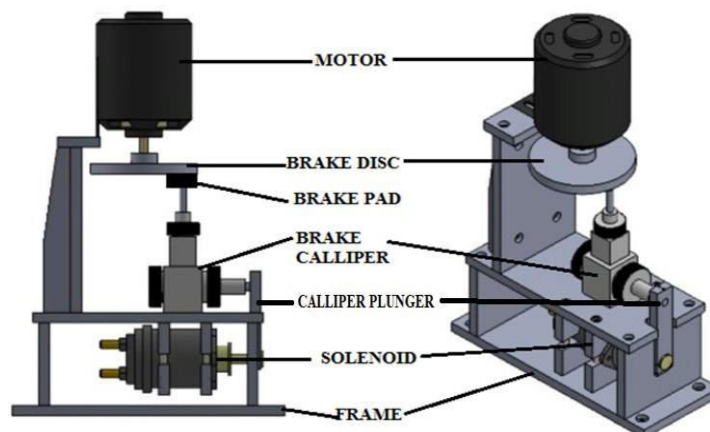


Fig:1 Schematic diagram of the system

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The schematic diagram of the set-up is shown in fig.1, all the components are housed on an aluminium frame.. When the brake pedal is applied, the current flows from the timer circuit to the solenoid. The timer circuit consist of relay, resistor, capacitor, IC[7], potentiometer and LED. By the flow of current, the actuation of potentiometer takes place and the current flows through the circuit then the solenoid[8][9]gets energized and it forces the calliper plunger to move front and back.by the movement of calliper plunger.A force is created by the piston[10][11] which forces the brake fluid CMC (carboxyl methyl cellulose sodium salt) inside the brake calliper to exert force to the next piston by the application of pascals law then the piston forces the brake shoe to compress the brake rotor which in turn is connected to the wheel. Thus, the braking action occurs.

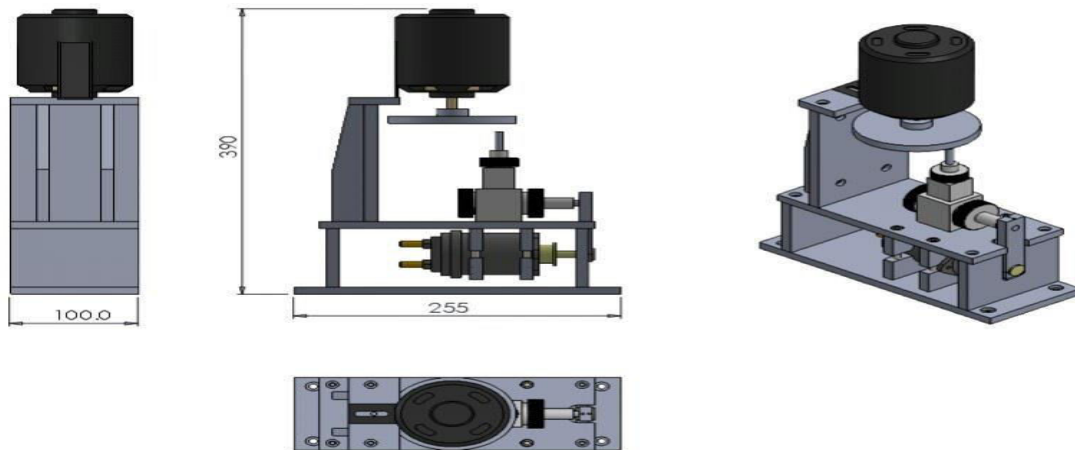


Fig: 2 Assembly view of the system

While passing the current with the circuit then the relay cut and pass the current with a specific time interval. So that the brake gets ABS[12] action. While the use of magnetic field the vehicle gets easily stopped without any skidding.

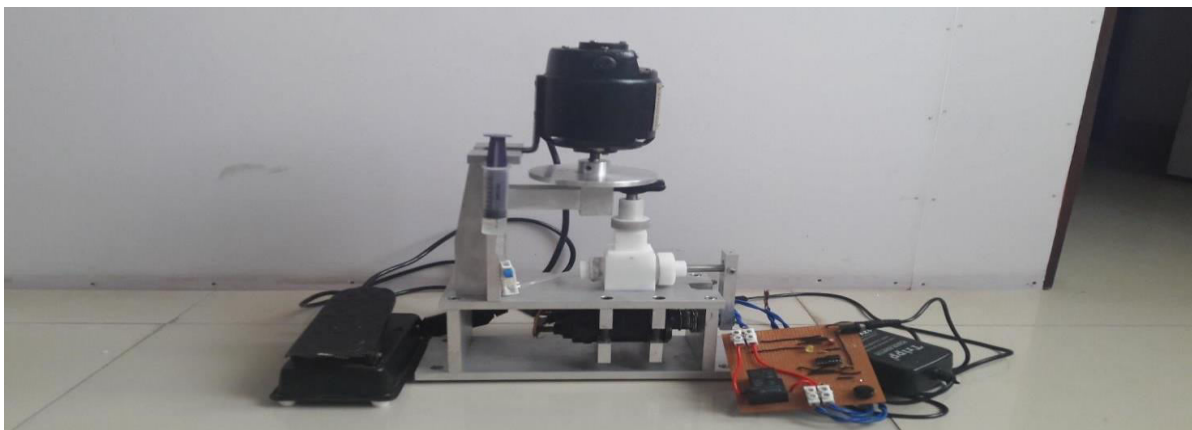


Fig:3 Image of the setup

The IC circuit is connected to the braking system by the means of a adaptor, an AC power source is provided to both motor and IC circuit. Either AC/DC power source can be given to the system of sufficient current rating depending upon the solenoid specification. Motor can be adjusted by adjusting the position of the accelerating pedal. The clearance between the disc and brake shoe can be adjusted by varying the pressure of the fluid. By noting that a

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minimum clearance of 0.15mm should be provided. By adjusting the potentiometer (brake pedal) the braking action take place.

V.CONCLUSION

In the commercially available vehicle extra installation of the ABS is quite expensive. In this hydraulic magnetic braking the inbuilt ABS is provided with low cost and it works within full range of speed. So, we can avoid skidding of vehicle as well as the braking time is reduced. Magnetic hydraulic brake has very advantages which possess great braking efficiency so can be used as retardation equipment during mechanical process.

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