Design and development of frictionless brake

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ABSTRACT

In this paper, we develop an electromagnetic braking system. The braking system should ensure safety comfort for passengers, drivers and other road users. Brakes must be strong enough to stop the vehicle the shortest distance possible in an emergency. Conventional braking systems are bulky and have a low power-to-weight ratio the transmission ratio is low. Electromagnetic braking system is a high-tech braking system for small and heavy vehicles b. Cars, jeeps, trucks, buses, etc. This article is about minimizing brake failures to avoid them accident. It also reduces brake system maintenance. The effectiveness of the brake should be continuous. Proper cooling of the brakes ensures anti-fade characteristics and efficient operation of the brakes. Correct must be lubricated and maintained to operate the brakes safely, effectively and gradually with minimal effort the driver is tired. This system provides better response times in emergency situations and generally maintains friction brakes work longer and are safer.

Keywords - Brake, Electromagnetism, Brake power, Torque

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1. Introduction

This is an electric braking system based on the principle that the eddy currents generated therein cancel out the drive torque. This reactive torque is used to brake the car. The system is mainly based entirely on Faraday's law of electromagnetic induction and Lenz's law. This system minimizes slippage and complications of mechanical braking systems. Wear and tear on the system can also be reduced.
As research irons out some of the system's shortcomings, we can expect it to become the standard system within a few years. Many of the brakes in common use today stop the vehicle by mechanical blocking. This causes the vehicle to skid and wear. And when the vehicle speed is high, the brakes can no longer provide that much braking force, and problems will arise. These disadvantages of conventional brakes can be overcome by the simple and effective mechanism of the "eddy current brake" braking system. It is a non-abrasive method of braking vehicles, including trains. Taking advantage of the opposite tendency of eddy currents.

Eddy currents are eddy currents in conductors that are subjected to changes in the magnetic field. Eddy currents cause energy loss due to their tendency to oppose each other. More specifically, vortices convert a more useful form of energy, such as kinetic energy, into heat, which is much less useful. In many applications, the loss of useful energy is not particularly desirable. But there are some practical uses. One such application is eddy current brakes.

2. Literature Survey

M.Z. Baharomet.al [1] found that Aluminium is the best material to be used as brake disc compared to Copper and Zinc as Aluminium has higher electrical conductivity.

M.Z.Baharomet.al [2-3] has focussed on two series of Aluminium as the brake disc which are Al6061 and Al7075. The authors compare both the series for various Eddy current parameters such as air gap, number of turns and brake disc thickness. The findings shows that smaller the air gap, the larger the electromagnetic turns and higher the disc thickness, higher braking torque is generated and hence a great performance for Eddy current braking. Also, it is found that the higher electrical conductivity influenced the generation of greater braking torque.
Der – Ming Ma, Jaw – Kuen Shiau [4 – 6] have presented four systematic engineering design
scenarios to design a braking system. They are
- A constant magnetic field

- An optimal magnetic field distribution
- Piecewise constant magnetic fields
- Section wise guide rail with a constant magnetic field Simulation results of the above four designs show that the optimal magnetic field has a deceleration peak of 9g which is not suitable for most people.

Piecewise constant magnetic field has the advantage of a pre-set terminal speed and predictable wire current but it produces a higher speed. Piecewise constant magnetic fields and section wise guide rail with a constant magnetic field have tolerable deceleration and easy manufacturing. An experimental braking system using constant magnetic field was built to demonstrate the design procedure.

For high speed trains (speeds up to 350Km/hr.) with heavier loads on the axle and more complex functions, the conventional braking systems relying on the adhesion force between the rail and the wheel are no longer adequate. Firstly the increase in braking distance is unusable. Secondly, weather dependence of braking system is unsuited. Thirdly, in the event of failure of brake based on adhesion force between wheel and rail, it requires alternate braking system [7] that shall perform the profitable braking. Sergey Kitano and Anatoly Podolski [8] describe the investigation of eddy current and magnetic rail brake structures. A brake that contains permanent magnet pieces [9] and combining both magnetic rail brake and eddy current brake is built.

3. Cad Design

Procedure

- The entire model has been designed with the help of designing software solid works.
- With the help of colour feature the colours are given to the entire model.

SOLID MODELING

The entire model has been designed with the help of designing software solid works.

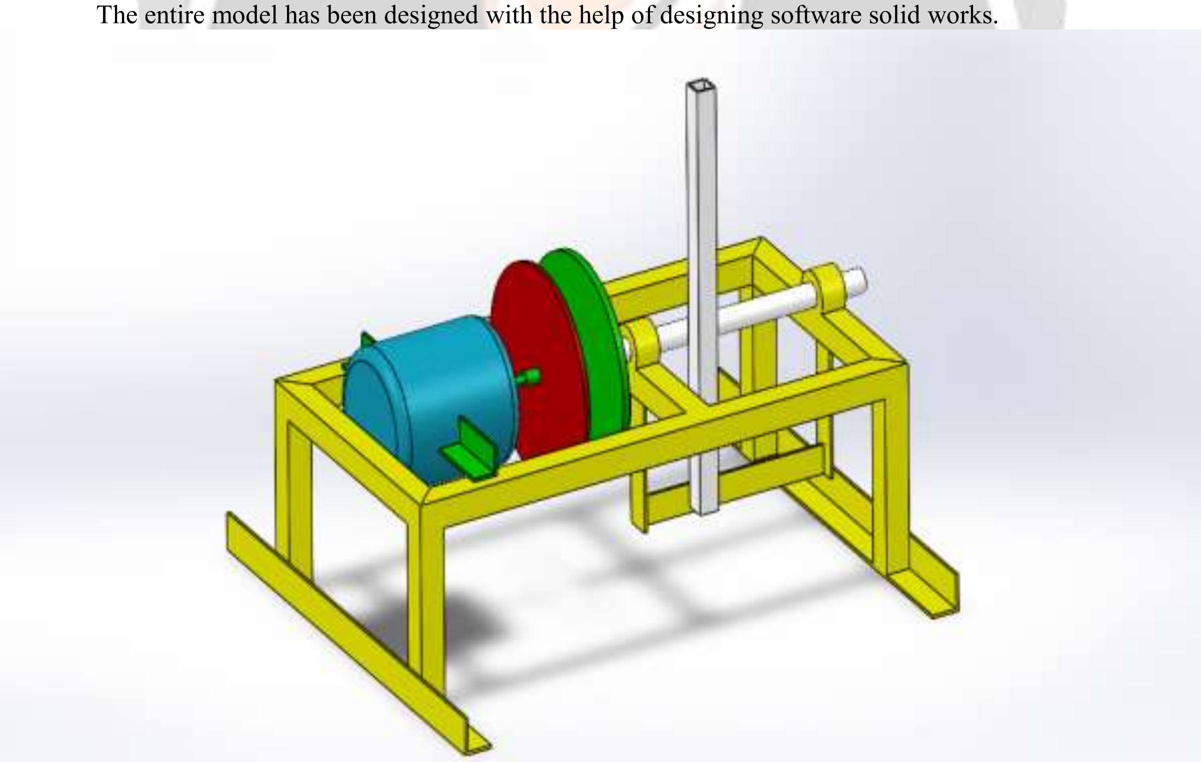

Fig 1

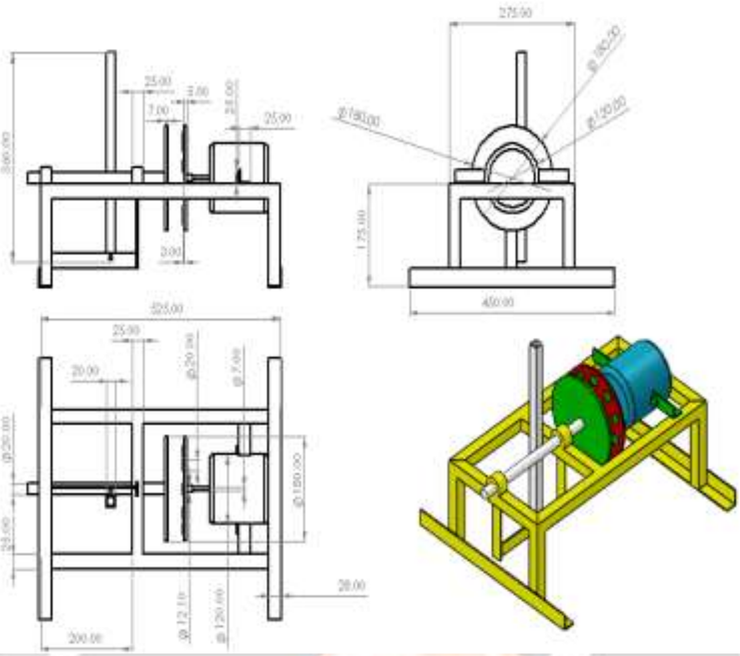

Fig 2

4. Methodology

An electromagnetic frictionless braking system is a braking mechanism that uses electromagnetic force to slow or stop a moving object without relying on traditional friction-based braking. While there are several ways to design such a system, I'll outline a common approach below: 1. Magnetic field generation: The first step is to generate a magnetic field, which interacts with moving objects to generate braking force. This is usually achieved by using permanent magnets or electromagnets. 2. Magnetic interaction: The generated magnetic field should interact with the conductive material on the moving object. One common method is to use a conductive metal disc or plate, such as aluminum or copper, mounted to the rotating part of the object.

1. Eddy current induction: When a conductive material moves in a magnetic field, a phenomenon called "eddy current induction" occurs. This phenomenon occurs when a changing magnetic field induces a current in a nearby conductor, which in turn generates its own magnetic field.

2. Generation of braking force: The eddy current induced in the conductive material generates its own magnetic field, which cancels the original magnetic field generated by the braking system. This gives the moving object a drag to counteract its motion, effectively slowing it down.

3. Control and adjustment: In order to control the braking force, the system needs a control mechanism. This can be achieved using various techniques, such as adjusting the strength of the magnetic field, controlling the speed of a rotating object, or modulating induced eddy currents.

Following these general steps, an electromagnetic frictionless braking system can be designed and implemented. It should be noted that specific details and components of the system may vary depending on the application and braking system requirements.

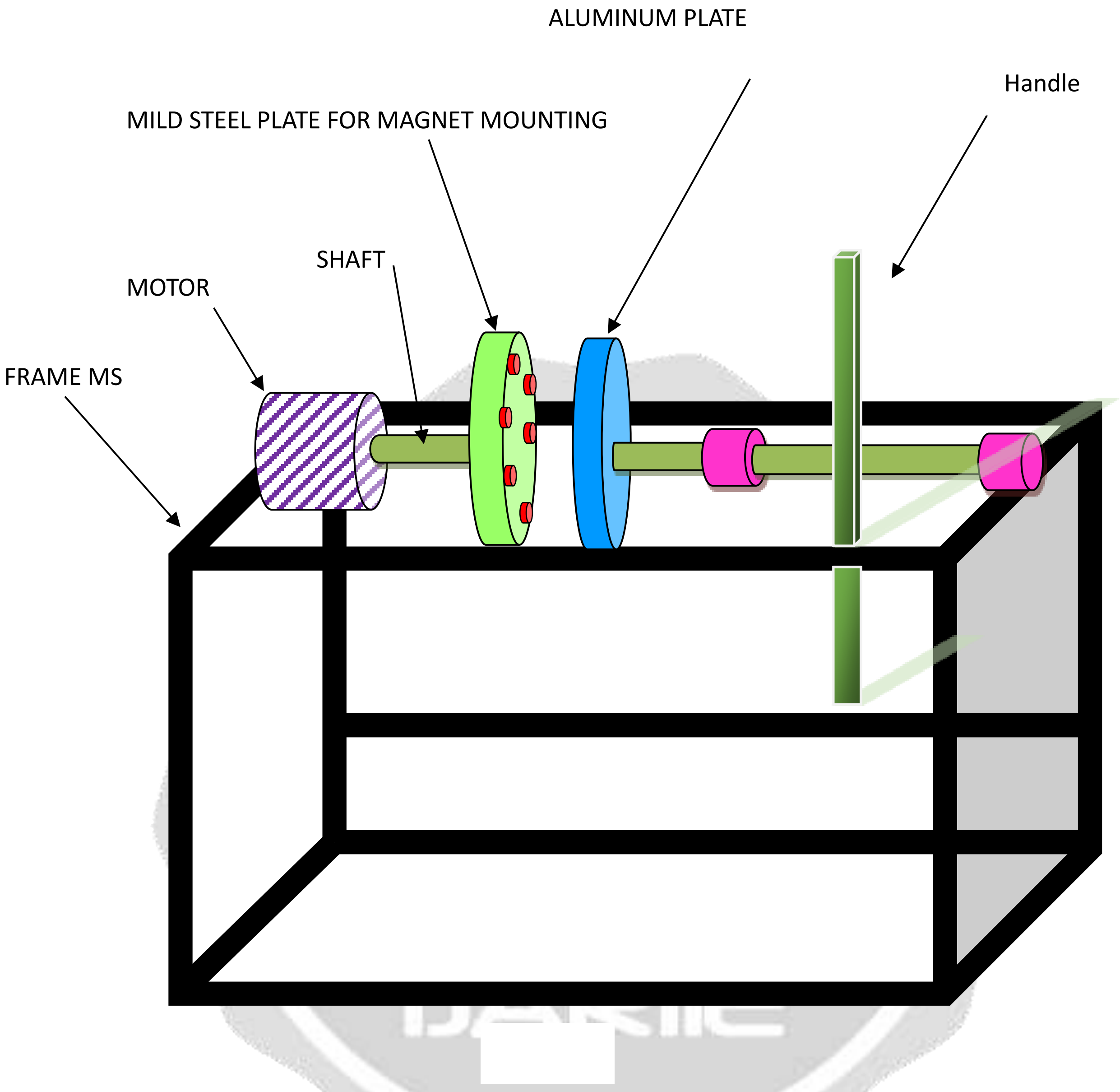

Fig 3

5. CONCLUSION

Eddy current brakes are the best choice when the highest demands are placed on reliability and safety. They can work even under the harshest environmental conditions. Even a lightning strike does not result in a loss of braking power. Eddy current braking systems are no longer popular these days. However, we hope that the simpler and more efficient eddy current braking system will replace the traditional braking system, and we can expect it to become the standard system within a few years.

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