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Electro Magnetic Braking System

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Abstract: **The intention of the project is to design an electromagnetic braking system that can be used without friction and without losing the power provided. It uses two magnetic fields. Also, a wheel is attached to the motor, so when given power, the wheel rotates with the help of the engine. The fan is connected to an adjacent to electromagnet to cool the electromagnets at high temperatures. The metal bar is inside the magnetic field and the wheel, so when the electromagnets initiate eddy currents, they turn off the rotating wheel or rotor. This model serves as a handy tool to use for cars.**

Key words: Brake horse power, Centimetre, Electromagnetic braking system, Miles per hour, Revolution per minute.

1. Introduction

Electric brakes (also known as electromechanical brakes or EM brakes) use mechanical resistance (percussion) to slow down or stop motion using magnetic force. The first name was "electromechanical brake", but over the years it was changed to "electromagnetic brake", which marked their starting point. Since its popularity in the mid-20th century, especially on trains and trains, a variety of applications and brake designs have developed rapidly, but the basic functionality remains the same. Electric brake Electric power brake. Those systems work on electromagnetism. These brakes are a great way to replace convection brakes due to their versatility. The reason for applying these brakes on cars is to reduce friction due to lack of power. Modern cars have electric brakes. The principle of operation of this system is that when passing through the magnetic flux and perpendicular to a rotating wheel, the eddy current flows opposite the rotating wheel / rotor. This eddy current attempts to stop the rotating wheel or rotor. Comes with a spinning wheel or rotor resting area / neutral area.

2. *Literature Review:*

It has been found that electric brakes have a negative effect on twice the power of a typical engine and the braking force of at least three times exhaust brakes. (Issued 1994). This function of the brakes makes it more competitive with other retractable devices, making them less efficient than others. Equipment that uses additional barriers to electromagnetic brakes, friction brakes can be used frequently, so that they never reach high temperatures. Brake linings last longer, you need to take care of them and avoid the problem of "break fade". electric brakes prevent accidental damage for a long time, making the use of the brakes longer. This is most likely to happen while driving downhill. 6% reduction in gradient at a steady speed between 35 and 40 mph, calculate the required braking force and maintain this speed in the range of 450 hp. Therefore, the brakes should have 300 hp, which means that each 5-axis brakes will pull 30. hp, which may be the brakes colliding. They see this in self-harm. Magnetic brakes are ideal for such situations because they can absorb more than 300 hp (honoured in 1974). It can therefore exceed I requirements for complete smoothness, without continuous uninterrupted brakes, l and collision brakes. Ready to use emergency brakes for protection. The installation of electric brakes is very common and not difficult when there is enough space between the gearbox and rear axle. If an auxiliary cooling system is not required. It tells of the efficient operation of engine parts for its use, making exhaust and hydrokinetic brakes. [8] There is a device for opening / closing the exhaust brake and hydrokinetic brake fitted with a highly advanced control system. Electromagnetic brake control system Electromechanical replacement system that provides superior control. In fact, the second phase of the hydraulic braking system project is electromagnetic research and analysis braking system. First, I made a base for the electric magnet and the tire for measuring tires. Then, the wheel is made and added to the frame, while the ghost can be heard with the help of stand bearings [4]. The copper wire is electro magnetized by winding and the body is cylinder and attached to its base. In addition, the U-shaped steel rod has an L-shaped strap that forms the brake shoe and rests on an electric magnet inside its ends. And the fan is connected to the engine and connected to the base of the engine. Therefore, the battery is an electric magnet and the engine is sent to the car and the fan and by opening it they operate smoothly. Automatic setup power is turned on when the circuit is connected to an electric magnet for automation. Make it easy. When the wheel rotates somewhere for a while, the wheel is made to rotate or stand with the help of a magnetic field, where the set is maintained by controlling the remote control of the RF channel. Rotation stops the cycle by controlling the RF controller, where the controller transmits the signal to the transmission point. Activate the circuit and turn on the electric magnet directly, while the electric magnet usually closes the circuit using energy. Thus, the cycle lasts half a second on disk and the controller is removed when the default setting is reached. It cuts off the electromagnetic field and leaves the attached tires and discs free. Therefore, the cycle is designed to reduce or effectively stop the amount of disability. The main objective of our project is to control the speed of the vehicle and to stop it quickly and effectively when and where [5]. By using electromagnetic braking, we can automatically reduce the braking response time so that the system can use it in vehicles with daily safety precautions. We can reduce the braking time and use these systems for up to 3 seconds as an additional flight braking system that provides additional security measures. In this way the system can be used in industries where we can control the speed of machines with large moving parts, where the size is large and the parts are solid, which is difficult to control other traditional methods. ujo et al. [4] is reviewed in the design and analysis of the electric brake system, using a magnetic field. They used the Finite element method and showed that gravity is below the acceptable range of final volume. They concluded that it could be an electromagnetic braking system. Tiwari et al. [16] analyzed the power of an electric brake system consisting of aluminum alloys, by designing PRO / E and performing feature-specific analysis with ANSYS. They conclude that stress levels are within the normal range and the natural frequency is low

compared to other alloys. Liudvinavičius et al. [15] studied the mechanisms of the electrodynamic braking system and concluded that the electrodynamic braking system ensures stability, recovery may be more than 30% effective in restoring electrodynamic braking, while less than 25% in pneumatic braking Prasad et al. [7] analyzed the mechanical properties of aluminum aerospace alloys, and reviewed those aluminum alloys that are much stronger than those first introduced. They also concluded that 6061 is the most efficient of all alloys and 7075 and 7475 have the highest strength.

3. ***Magnetic Brakes:*** Based on magnetic it can be broadcast as:
    - Electro-magnetic brake
    - Permanent magnet brake

Electromagnetic brakes include the use of electrical energy to produce a magnetic field to produce eddy currents. These brakes require constant power supply to work and may not work properly for any power outages. On the other hand, the use of permanent magnets does not require the provision of any kind of power and is effective over a wide range of operating conditions [16 - 9].

Advantages of magnetic braking system:

- System of brakes without touch.
- Decreased aging.
- Long-term growth of the brakes.
- A modular concept that can be used in a variety of applications.

4. Summary of proposed work:

The research is about conceptual design and the development of a magnetic braking system. Since, conventional and frequently used brake systems involve wasting energy under the action of a collision leading to aging, the Magnetic braking system is found to be profitable and to try properly. The magnetic braking system uses magnetic forces that lead to contactless i.e., the zero-aberration type braking system. The braking action is achieved by using the opposing magnetic force created as a result of the hiring of eddy curs when the puller is drawn closer to the rotating disk. This blueprint was repeated on an analyst of the existing braking system design and the magnetic braking test design phase. This braking system can be adjusted to suit many different systems due to its increased length and durability compared to its regular counterparts.

Electromagnetic induction:
The production of electromagnetic induction from electrical energy due to changes in the magnetic area.

Force:
The ability to push or pull over an object is the result of the interaction of an object with another object.

Torque:

It is the use of Force that operates in the radial range and tends to create rotation.

The principle of operation is based on the creation of eddy currents within a rotating metal disk associated with permanent magnets, which puts a force against the rotation of the disk. When the magnets are held away from the disc, the rotation of the disc is free and equally fast.

The formula for working to calculate magnetic braking torque is (Hollowell et al., 2010) [8].

$$T = n \times A \times \sigma \times d \times B^2 \times R^2 \times \omega$$

n = number of magnets,
A = surface area of magnet,
r = specific conductivity of material,
d = width of the disc,
B = magnetic field intensity,
R = effective radius,
x = angular velocity.[17]

Specific conductivity:
The specific conductivity of an object is its ability to conduct electricity. Conductivity of an object is the opposite of its resistance.[17]

Width of the disc: As the size of the objects that will interact with the magnetic field increases the resistance force increases due to eddy currents. Therefore, d plays an important role [17]in calculating brake torque.

Magnetic Field intensity: Magnetic Field Intensity is the magnitude of the field strength within an object under the Magnetic field (H).[17]

Effective radius: Active Radius The distance between the axis of the disk rotation and the magnetic field considering the magnetic field as working is focused instead of simplifying torque calculations. Active radius can be obtained by finding the distance between the rotating axis and the centre point of the magnet.

Angular velocity: The degree of change in the angular position of an object is defined as its angular velocity [10 - 14].

5. ***Methodology:*** Continuing the process of designing and developing a new type of Braking system requires extensive research and evaluation of existing systems and validated theories. The first step was to make sure by exploring the theories of magnetic theatre by creating an artificial environment of real life. In this experimental step, the project involved the design and development of a conceptual verification prototype to ensure and ensure conceptual accuracy through components and to force the production of objects with the same conceptual significance but with varying in size and size.

Design parameters: The main parameters of a prototype design are as follows:

- Material for providing a strong Magnetic field - Neodymium Permanent Magnet[17]
- Frequent magnetic field - Aluminium disc.
- Forced to maintain a consistent motion between the permanent magnet and the 1000 rpm DC motor.

6. ***Working of Braking system:***

When the brake lever is pulled, the brake cable is pulled back, thus pulling the slide near the disc that pushes the shank heads toward the brake disc and draws the puller closer to the brake disc, thus producing the required performance. When the brakes are released, the spring pushes the slide into its original position that absorbs the magnet and removes the brake action.

We were therefore able to move the drag near or away from the brake disc thus increasing or decreasing the eddy currents produced on the disc and the associated braking action.

Driving Unit:

- **Electric motor**: Electric motor is an electrical device that converts electrical energy into mechanical force. In normal motor mode, most electric motors work the interaction between the electric field of the electric car and the turning currents to generate power within the engine. Electric motors can be separated by electric power source type, internal structure, application, type of motion output, and[18] more.

Fig: 3.1 DC motor

- **Wheel**: The wheel moves with the help of a running car. Both motor and wheel is connected with the help of a connecting chain and ring chain.
- **Power Control:** It consist of power supply to the motion.

Braking Unit

- **Electromagnet**: Electromagnetic is a type of magnet in which a magnetic field is produced electricity The magnetic field disappears when the current is turned off. Electromagnets usually consist of a cord wound enclosed by a coil.[21] Current through the wire creates a magnetic field centred on the centre hole coil. Rotating wires usually surround the magnetic field.
- **Brake shoe:** It is a part that will stop the main wheel.

Other Parts:

- **Spring:** The coil spring, also known as a helical spring, is a typical mechanical tool used to store energy and later to release, absorb shock, or conserve energy between contact areas. [20] Two pressure springs are used to push back break the shoe and return it to its original position.

Fig: 5.1 Spring

- **Bearing:** The purpose of the Ball Bearing is to reduce the rotating friction and to support the radial as well axial loads. In this project type 608 2RS loading is used.[19]

Fig: 5.2 Bearing

Limitations of EMBS:

Limitations of this system are as follow

1. It is very difficult to apply electric braking when there is not enough space between the gearbox and the rear axle.

2. You cannot use oil or grease.

3. EM brakes are good for reducing stress, not stopping them completely.[20]

Over all Fabrications of the System:

How to Model Electromagnetic Braking System:

1. Analyse problems in installing an electric brake system
2. Design the required parts.
3. Selection of required items.
4. Buying building materials.
5. Electromagnetic synthesis.
6. Report preparation and delivery.

Conclusions:

This report introduces the operation of the electromagnetic braking system which combines the various components and its cost-effectiveness and efficiency ways to use given power. [20].By successfully using once a powerful electromagnetic can have a very efficient braking system.

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