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SYSTEM OF ELECTROMAGNETIC BRAKING

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ABSTRACT

A non-contact braking system was proposed to solve the shortcomings of standard braking systems. Upright magnetic braking methods get very little mention in the extensive literature, which is good news for businesses. To build an upright magnetic system, determining the magnetic flux is a critical step. Fluctuating magnetic flux induces eddy currents in the conductor. These currents burn energy in the conductor and generate drag force in order to slow down the movement. Thus, a finite element model is utilised to examine the impacts of air gaps and track materials on magnetic flux density. The model's predicted magnetic flux is within the permissible range, according to the test findings. Based on the results, it will be simpler to develop magnetic braking systems.

Conventional braking methods, friction, heat, and so forth all fall under this umbrella.

Introduction

For heavy-duty vehicles, standard friction brakes may not be enough. There are many techniques to reduce the distance it takes for a vehicle to come to a complete stop, including the use of standard brakes. In the next section, we'll discuss the foundations of electromagnetic brake operation and design. We're working on a method to slow things down for this project. A two-wheeled vehicle may be used in certain situations As a result of its fast speed and cheap maintenance needs, electromagnetic brakes have been deployed as a supplemental slowing mechanism. A plunger and an electromagnetic coil are used in this experiment. The plunger is pushed in the direction of braking by an electromagnetic force. Only electricity can create a magnetic flux in a magnetic field. A hysteresis disc across the field collects the resulting flux. There is a hysteresis disc on the braking shaft. The output shaft may be dragged indefinitely using a magnet attached to the hysteresis disc.

Electro-mechanical brakes (also known as EM brakes) use electromagnetic force to create mechanical resistance and slow or halt motion (friction). Although they were first referred to as "electric-mechanical" brakes, they have now been renamed "electromagnetic brakes" because of the method in which they work. There has been a tremendous rise in the number of applications and brake designs since the mid-20th century when they were extensively utilised in trains and trolleys. Despite these alterations, the system's essential functionality has remained constant. The magnetic force of eddy current brakes, as opposed to the friction of electromagnetic brakes, is used directly to stop the vehicle.

1.1 Theory and main concept

A theoretical work's framework and primary concept Traditionally, magnetic brakes have been the only option for heavy-duty vehicles and equipment. The vast majority of these gadgets rely on magnetism to move one or more mechanical parts. In order to slow down a moving object, a mechanical device may be used. In spite of this, the procedure takes a long time. It is possible to create frictionless brakes using electromagnets. Our goal is to reduce the rotational speed of a bicycle wheel in order to reduce its angular velocity. As a result, a brake that reduces rotational energy is desired. Rotating magnetic fields might hypothetically generate electromagnetic currents. This disc cannot spin because of the heat it generates from these currents (causing the temperature of the disc to increase). Given my reservations, I decided to give this idea a shot. Electromagnets are the most common generator of magnetic fields. An electromagnet may have an effect on the wheel's spinning, therefore I decided to do an experiment. In addition, I was interested in seeing what type of deceleration the intensity of the magnetic field would experience with an increase in voltage. Despite the fact that this test seems to be simple, I decided to do an experiment before drawing any conclusions.

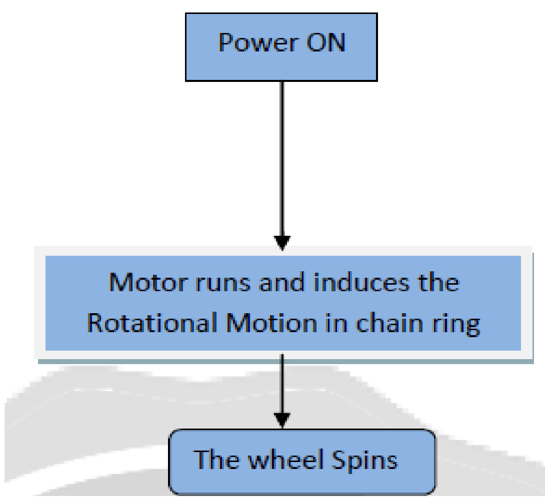
1.2 Principle of electromagnet Brake system

During automobile braking, heat may be created (heat). The effort required to bring an automobile to a stop generates a lot of heat, and this heat is evacuated as a consequence. Ideally, an automobile's brakes should be capable of stopping it in a matter of seconds while it is travelling at excessive speeds. Consequently, significant energy production and absorption rates are required for brakes in order to meet this need. Large vehicles may have to engage their brakes for a long time in order to descend at a high rate of speed. Heat-absorbing capacity is important for brakes to function properly.

Design and practical work

There are three primary parts to Model: the base unit, the driving unit, and the braking unit. Our model's driving unit includes an electric motor, power control, and a bearing as part of the base unit. An electromagnet is used in the braking system.

Electromagnetic brakes (sometimes referred to as electro-mechanical brakes or EM brakes) use electromagnetic force to provide mechanical resistance and slow or halt the motion (friction). Electric brakes were originally called "electric-mechanical brakes," but over time, they were renamed "electromagnetic brakes" in reference to the mode of actuation. Since they became widespread in trains and trolleys in the middle of the twentieth century, the number of applications and brake designs has risen rapidly. However, the fundamental functioning has remained the same during this time. Unlike electromagnetic brakes, eddy current brakes do not rely on friction, but instead employ magnetic force directly to stop the vehicle.



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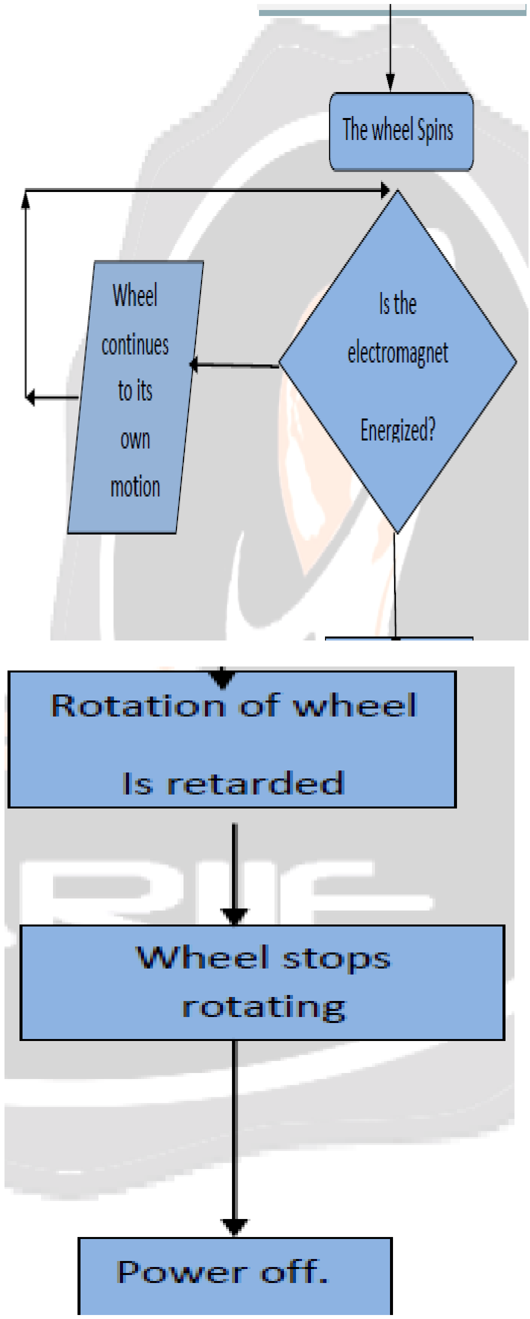

Chart -1: Flow Chart

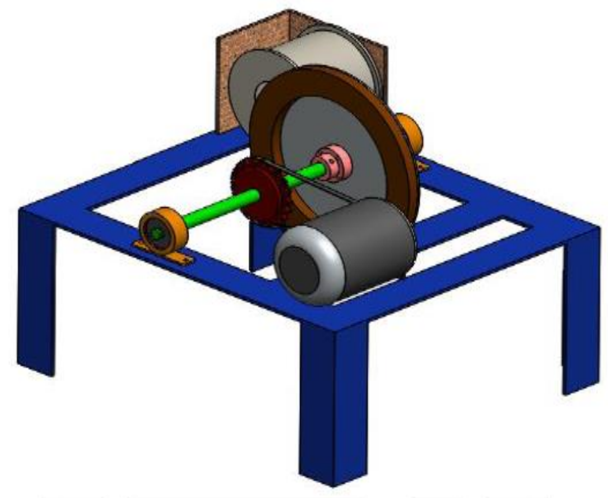

Fig -1: Isometric View (Solidworks)

Material Selection

Brake application dictates which materials are used for the project. For the most part, plate is employed in aluminium because it is very efficient at producing eddy current. A copper plate with the greatest efficiency should be purchased, but it is expensive and not suitable for all customers.

Table -1: Specification of parts

Title	Electromagnet	AC motor	Round Plate	battery
Specification	36 gauge magnet wire	5-12 V	180 mm	12 volt

Construction

Assembling the electromagnetic braking system is a simple process. The rheostats are built using sensors and magnetic insulation. Disc/rotor of the wheel has an electromagnet with a coil running parallel to the cylinder. The stator and coils of the electromagnet are used to secure it in place, and the same technique is used to do so. There is just one rheostat in this circuit, which is linked to the brake pedal and to the coils. Two components are employed to regulate the flow of electricity through the coils of the electromagnetic field: an adjustable resistor and an insulator. It is avoided by employing the axle as both a frame and an electromagnet support. sensors that show when the whole circuit is out of order. When anything goes awry, an alarm rings, providing us the chance to prevent an accident. All controls are at rest at the beginning of an operation. The electromagnet is powered by the rheostats when the brake pedal is depressed. The rheostat regulates the flow of electricity via it. The stream's direction and speed may affect the amount of magnetism it produces. Different types of brakes may be achieved by varying the magnetic flux. A rheostat can use all of its available energy to stop the car's engine if the brake pedal is pressed all the way to the floor. To slow down the vehicle, we may also softly tap the brake.

Parts of Electromagnet Braking system

- AC Motor
- Disc

- Frame
- Electromagnet
- Chain
- Shaft
- Bearing
- Sprocket

3. Installation

High-speed braking may now be achieved without the requirement for friction thanks to magnetic brakes. Electromagnetic brakes are better at dispersing heat than friction brakes because of where they are installed (the transmission line of rigid cars). Typically, the propeller shaft is removed and replaced with a sliding universal joint when installing electromagnetic brakes in vehicles. Anti-vibration attachments are used to connect the brake to the vehicle's chassis. The retarder's practical position within the car prevents air from directly affecting it when the vehicle is in motion. Air movement in the vehicle chassis has no influence on either tyre airflow or disc temperatures, according to new study. Because the retarder has no effect on the regular brakes, the temperature of the brakes is unaffected. Regular brakes may be kept cold in an emergency by retarders, which assist extend their life. Electrical retarders come in a variety of shapes and sizes. Two common kinds of electromagnetic retarders are axial and focal. electromagnetic retarders meant to be fitted between a vehicle's transmission and its rear axle are called axial electromagnetic retarders. The transmission shaft comprises two pieces for connecting the retarder's shafts. A vehicle's transmission shaft or axle may be fitted with an electromagnetic retarder known as a Focal type. There is at least one of the vehicle's axles that drives at least one of the vehicle's remaining road wheels.

3.1 Electromagnet

Electromagnets come in a wide variety of shapes and sizes, including the ones listed below:

- Brakes with a single disc and no rotor:

Technical Features:

- Specifications Torque ranges from 400 to 600 Newton-meters.
- Type of Dry Plate for a Single Product
- Maintaining a high level of regularity and reliability
- Procedures that are outlined in detail
- There are no other products like it on the market.
- DIN standards govern the quality of raw materials.
- Coefficient of a substance that increases friction

(2) Multi disc electromagnetic brakes
Technical Features:

- A voltage of 24 volts is required by the coil.
- The available torque varies from 3 N-m to 3660 N-m.
- Sized down from the norm
- Additionally, electromagnetic brakes may be purchased.
- Components may be added or deleted as needed.
- Each of the rim's discs, both on the inside and outside, helps distribute weight.

(3) Spring type

An inner pressure plate and an outer cover plate squeeze the friction disc together when no power is supplied to the brake. The hub, which is connected to a shaft, is clamped down by friction.

(4) Permanente magnet Type

A basic electromagnetic brake's appearance is quite similar to that of a permanent magnet retaining brake. Compression is achieved by magnets, rather than springs, which results in less wear and tear, making it more efficient. A reduction in braking performance might be the consequence of magnetic flux lines drawing the armature closer to the brake housing. To release the brake, a coil creates a magnetic field that counteracts the permanent magnet's magnetic flux.

If none of the brakes have power, both power off brakes will be applied. When the power goes off, it's common for machines to need their own internal circuits to hold or stop. In order to counteract the magnetic field, permanent magnet brakes need continual current control. The torque of spring-applied brakes may be improved by stacking friction discs or using a simple rectifier instead of a constant current control.

(5) Power off Brake

When electrical power is disconnected, whether on purpose or by accident, the power off brakes engage. Companies have employed brakes with fail-safe features in the past. The majority of the time, you'll find these brakes near or coupled to an electric motor. Z-Axis ball screws and servo motors may be held in place by a variety of retaining brakes. There is a wide variety of voltages available for brakes with conventional backlash and zero backlash hubs. Using several brake discs is a second way to increase braking torque without expanding the rotor's diameter.. Holding brakes come in two flavours. Spring-loaded brakes are one option. A permanent magnet is used in the second kind of brake.

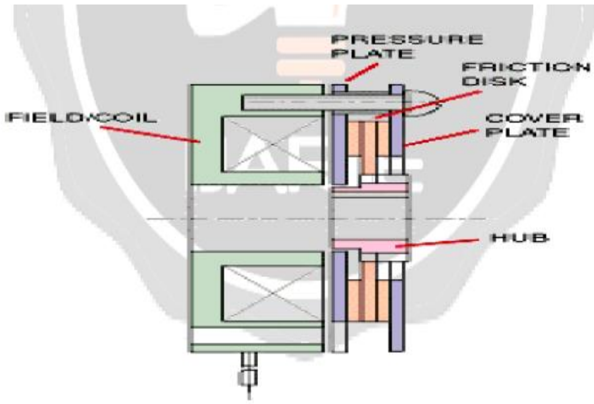

Fig -2: Power off Brake

4.CONCLUSIONS

Compared to drum, hydraulic, and pneumatic brakes, the electromagnetic braking system is much more reliable. The electromagnetic brake control system has a switching mechanism that allows for more precise adjustment. Electromagnetic brakes are easy to install. According to the following examples, electromagnetic brakes may be useful for large vehicles. In the current design, a larger budget might provide even greater results.

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