Design & Fabrication of Electromagnetic Breaking System

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Abstract- *Electromagnetic brake slows down a moving object by means of electromagnetic induction, in which it will create a resistance. A pressure is created by the Friction brakes on two separate objects to gradually reduce the speed of the vehicle in a controlled way. The current of the magnet turns in the form of heat of the plate which will reduce the kinetic energy. In this magnetic type of braking system whenever force is applied by the driver on the brake pedal the intensity of braking is sensed by a pressure transducer and delivers the output actuating signals to the microprocessor. This controller sends a signal to the capacitor and from the respective unit a pulsating D.C. current is sent to the power pack. As per the driver's requirement a proportionate torque is developed to decelerate the vehicle.*

I. INTRODUCTION

The basic principle involved in the braking system employed in all vehicles involves the energy conversion from kinetic to thermal. While applying force on brake, a stopping force is observed which is several times powerful than the momentum of the car and dissipates heat by absorbing the associated kinetic energy. Even when the vehicle is running at high speed the braking system should be capable enough to arrest the speed of the vehicle within a short duration of time. As a result, at extremely high rates the brakes have the highest ability to generate maximum torque and absorbing energy within minimum period of time. Brakes in heavy vehicles are sometimes applied for a prolonged duration descending a long gradient at high speed. Brakes always have the mechanism to keep ensure heat absorption capability for the whole period of as an auxiliary braking system in turn a decelerator to ensure safety of the vehicle. brake application. In this work we have suggested an electromagnetic braking system which can be installed in any vehicle. Because of its simplicity in construction it can be used.

II. PRINCIPLE & OBJECTIVE

Principle :

Principle of Electromagnetism is employed in Electromagnetic Braking system. When specific amount of current is skilled a round conductor then it produces magnetic flux, which is uniform everywhere the conductor. The magnetic flux strength depends on the present flowing through conductor and therefore the no of turn's more than oof turns and higher the current flowing through conductor higher the magnetic flux gets created.

Solenoid is that the coil having more no of turns and its want to produce high strength magnetic flux which is employed during this Electromagnetic Braking.
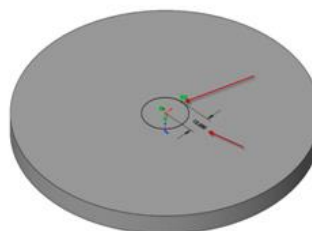
Objectives:

The main objective of is to design and fabricate Electromagnetic Braking System model. Besides the main objective, following are secondary objectives:

- To understand project planning and execution.
- To understand the fabrication techniques in a mechanical workshop.
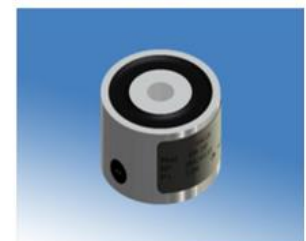- To make human life easier by using technology.

III. MODELLING OF DIFFERENT PARTS & WORKING PRINCIPLE

Before making any machine, that is very important step to design that machine and decide dimensions of the components and decide weight of the whole machine. For the modelling of our Electromagnetic Brake. we use SOLIDWORKS.
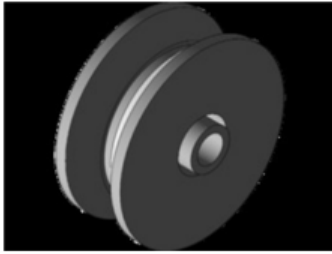

1. Iron disc   2. Electromagnet

3. Pulleys   4. Motor

3.1 Working principle :

When the power supply is given the motor, the pulley is driven by the belt. Now the pulley is continuously rotated. As the steel plate is connected along with pulley it is rotated in-front of the electromagnet. When the braking is required the control switch is turned on. So, the current or voltage is applied on the electromagnet. A magnetic field is created by an energizing coil by the application of voltage or current. This coil develops magnetic lines of flux between the metal disc thus attracting the armature to the face of the metal disc. When the current or voltage is removed from the brake (electromagnet) the metal disc is free to rotate. Here springs are used as medium to hold the armature winding of the electromagnet away from the disc. Rotating motion in wheels is achieved by switching controls of the supply to the coil. Slippage occurs only during deceleration only when the brake is engaged, there should not be slippage once the brake comes to a full halt.

3.2 Advantages

- No contact, therefore no wear or tear.
- No noise or smell.
- Adjustable brake force.
- High brake forces at high speeds.
- Also used as service brake.
- It uses electromagnetic force and no friction Non-mechanical (no moving parts, no friction).
- Can be activated at will via electrical signal
- Low maintenance
- Light weight
- No grating misfortune.
- Less warmth misfortune.
- Less wear of segments.
- Fully electronically controlled.
- Great braking proficiency potential to recover vitality lost in braking.
- Potential to recapture vitality lost in braking.
- Potential danger of tire crumbling and blasts because of grinding is disposed of.

- No need to change brake oils consistently.
- No oil spillage.
- Problem of brake liquid vaporization and solidifying is dispensed with.
- Less support cost.

IV. CALCULATIONS

1. Forces at wheel lock or maximum braking force can be calculated by following: $FL = Mdal \times g \times ur$

FL = possible braking force on axle $Mdal$ = dynamic axle load
g = acceleration due to gravity
ur = coefficient of friction between road and tire

2. Braking torque require to stop wheel

$T = BF \times R/ r$
BF = Braking force
T = brake torque
R = Radius of tire
r = speed ratio between the wheel and brake

3. Brake force obtained by magnetic field $Fe = pie \times D2 \times d \times B0 \times 2 \times c \times v/ 4p$
$c = 1/ 2 [1-(1/ 4) * 1/ (1+ r/ A)2 (A-r/ D)2]$ Fe = Braking force (N)
D = diameter of soft iron pole (m) d = disc thickness
$B0$ = air gap induction at 0 speed (T) A = disc thickness
c = proportionality factor, ratio of total disc contour (outward curve) resistance to resistance of disc contour (outward curve) part under pole.
v = tangential speed of the rotating disc
p = specific resistance of disc material

V. RESULTS

By using the electromagnetic brake as supplementary retardation equipment, the frictions brakes are often used less frequently and thus practically never reach high temperatures. The brake linings would last considerably longer before requiring maintenance, and therefore the potentially "brake fade" problem might be avoided.

In research conducted by a truck manufacturer, it had been proved that the electromagnetic brake assumed 80 percent of the duty which might otherwise is demanded of the regular service brake (Reverdin 1974). Furthermore, the electromagnetic brake prevents the risks which will arise from the prolonged use of brakes beyond their capability to dissipate heat. This is often presumably to occur while a vehicle descending an extended gradient at high speed.

The installation of an electromagnetic brake isn't very difficult. It doesn't need a subsidiary cooling system. It doesn't effect on the efficiency of engine. Electromagnetic brake also has better controllability. Thermal stability of the electromagnetic brakes is achieved by means of the convection and radiation of the warmth energy at heat. The electromagnetic brakes have excellent cooling efficiency. Electromagnetic brakes have better thermal dynamic performance than regular.

VI. CONCLUSION & FUTURE SCOPE

Electromagnetic brakes have numerous preferences over frictional slowing mechanism. The blend of swirl present and attractive powers makes this brake more successful. This brake is often utilized as assistant stopping mechanism in vehicle. The use of abs is often dismissed by utilizing a smaller scale controlled electromagnetic framework. It is often utilized as a neighborhood of rail mentors to decelerate the prepare occupation fast. Mixture of these brakes expands the brake life and act like completely stacked brakes. These brakes are often utilized as a part of wet condition, so there's no utilization of against slipping instrument it is completely electrically controlled which brings about fewer mishaps. The braking power delivered during this brake isn't the maximum amount because the plate brakes. Subsequently, it is often utilized as an auxiliary or crisis slowing mechanism within the autos.

VII. ACKNOWLEDGMENT

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