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Design and Development of Electromagnetic Braking System

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Abstract: *The principle of braking in road vehicles involves the conversion of kinetic energy into heat. This high energy conversion therefore demands an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location features severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the friction brakes can be used less frequently and therefore practically never reach high temperatures. The brake linings thus have a longer life span, and the potential brake fade problem can be avoided. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles.*

Keywords: Braking System, Electromagnetic Force, Automation, Optimization

I. INTRODUCTION

In this paper we are trying to make a braking system. Which can be applicable in two wheeler at high speed and low maintenance cost. Here we are using an electromagnetic coil and a plunger. There is an electromagnetic effect which moves the plunger in the braking direction. When electricity is applied to the field, it creates an internal magnetic flux. That flux is then transferred into a hysteresis disk passing through the field. The hysteresis disk is attached to the brake shaft. A magnetic drag on the hysteresis disk allows for a constant drag, or eventual stoppage of the output shaft.

- This projects intends to the design and implementation of new system of retardation (braking) for automobiles
- The design of the new brakes is based upon the phenomenon of electromagnetic induction and eddy currents
- The design basically consists of very strong magnet and rotating metallic wheel
- The wheel develops eddy currents due to the change in magnetic flux associated to the wheel due to its rotation
- The current in turn dissipates the rotational energy of the wheel as heat bringing the wheel to a stop

II. PRINCIPLE AND OBJECTIVE

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

The main objective of is to design and fabricate Electromagnetic Braking System model. Besides the main objective, following are secondary objectives: 1. To understand project planning and execution. 2. To understand the fabrication techniques in a mechanical workshop. 3. To make human life easier by using technology.

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III. COMPONENTS REQUIRED

Alternate current motor, Resistance type current regulator, 'V 'belt, Wheel, Metal disc, Electromagnet, Vertical holding column, Control Switch, Bolt and Nut, Fasteners.

3.1 Manufacturing Process Sheet

The following figure shows the Manufacturing Process sheet which used in this paper.

Name of part - Base /Stand
Size - 430mm height and 304mm
Material-Mild-steel
Quantity-1

Sr.No	Machine	Operation	Feed	Tool	Time(Min)
1	Grinding Machine	Cutting Of Mild Steel Plate	Manual	Grinding Wheel	30
2	Drilling Machine	Drill A Hole Of Diameter 5mm	Auto	Drill	10
3	Welding	Weld The All Corner Of Base	Manual	Welding Electrode	30

Fig.3.1: Process Sheet 1

Name of part-Connecting Rod
Size-430mm Length
Material-Mild steel
Quantity-1

Sr. No.	Machine	Operation	Feed	Tool	Time(Min)
1	Grinding Machine	Cutting of 430mm length of mild steel rod	Manual	Grinding Wheel	10

Fig. 3.2: Process Sheet 2

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IV. ASSEMBLY DRAWING

The following figure shows the assembly drawing of Electromagnetic braking system.

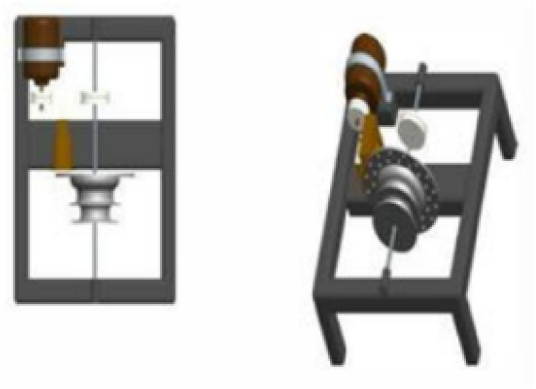

Fig. 4.1: Assembly drawing of Electromagnetic Braking System

CALCULATIONS

1. Force at wheel lock or maximum braking force can be calculated by following:

FL = Mdal × g × 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 × R/r

BF = Braking force

T = brake torque

R = radius of tire

r = speed ratio between the wheel and brake

3. Braking force obtained by eddy current

Fe = pie × D2 × d × B0

2 × c × v/4p

c = ½ [1 − (1/4) * 1/(1 + r/A)2 (A − r/D)2]

Fe = braking force (N)

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D = diameter of soft iron pole (m)

d = disk thickness

B0 = air gap induction at 0 speed (T)

A = disk radius (m)

c = proportionality factor, ratio of total disk contour (outward curve) resistance to resistance of disk contour (outward curve) part under pole.

v= tangential speed of the rotating disk

ρ = specific resistance of disc material.

V. RESULT

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 AND 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.

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