Electromagnetic Braking System

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Abstract- ***In this paper we had develop the electromagnetic braking system. Braking System should ensure the safety and comfort of the passenger, driver and other road user. The brake must be strong enough to stop the vehicle during emergency within shortest distance. The conventional braking system is bulky and power to weight ratio is low. Electromagnetic braking system is high-tech braking system find its use in small & heavy vehicle like car, jeep, truck, busses etc. This paper represents about minimizing the brake failure in order to avoid the accident. It also reduces the upkeep of braking system. The effectiveness of brake should remain constant. The proper cooling of brake gives anti fade character and efficient operation of brake. Proper lubrication and maintenance must be done to operate brake safe, effective and progressive with minimum fatigue to driver. This system provides better response time for emergency situations and in general keeps the friction brake working longer and safer.***

Indexed Terms- ***Brake, Electromagnetism, Brake power, Torque***

I. INTRODUCTION

A brake may be a device, where it restricts motion. it's commonly known that the brakes use friction to convert K.E. into heat. But the Electromagnetic brakes are used as supplementary retardation equipment additionally to the regular friction brakes on heavy vehicles. They work on the principle of electromagnetism. The working rule of this technique is that when the magnetic flux passes through and perpendicular to the rotating wheel the eddy current flows opposite to the rotating wheel/rotor direction. By using the electromagnetic brake as supplementary retardation equipment, the frictions brakes are often used less frequently and thus practically never reach high temperatures. During this research work, with a view to reinforce to the braking system in automobile, a prototype model is made and analyzed. It aims to attenuate the breakdown to avoid the road accidents. It also reduces the upkeep of braking system. A plus of this technique is that it is often used on any vehicle with minor modifications to the transmission and electrical systems. Electromagnetic brakes operate electrically, but transmit torque mechanically. This is often why they won't to be mentioned as electro-mechanical brakes. Over the years, EM brakes became referred to as electromagnetic, pertaining to their actuation method. Since the brakes started becoming popular over sixty years ago, the variability of applications and brake designs has increased dramatically, but the essential operation remains the same. The electromagnetic brakes structure exactly 80% of all of the facility applied brake applications. Electromagnetic brakes are used as retardation equipment additionally to the regular friction brakes on heavy vehicles and in some cars.

II. LITERATURE SURVEY

- Stephen Z:- Oldakowski, Bedford, Ohio A magnetic brake provides braking or locking capability and is remotely controlled by electric power. The magnetic brake comprises a rotatable shaft and a brake disc mounted on the shaft. A non-rotating core housing assembly located around the shaft includes a permanent magnet and a bipolar solenoid. A magnetic armature adjacent to the core housing assembly is capable of movement toward the core housing assembly and toward and into engagement with a brake disc to prevent rotation of the shaft. A spring urges the armature away from the core housing assembly and into engagement with the brake disc. The brake does not use any electric power to maintain the brake in the set mode with the rotating shaft fully locked or in the released

mode with the rotating shaft fully released. The permanent magnet is of sufficient strength to hold the armature against urging of the spring until an opposite polarity is supplied by the solenoid.

- Karl Erny: - Holzhausem an elevator drive has a brake device with compression springs to actuate brake levers, and brake linings on a brake drum creating a braking force. A sensor is provided to detect the movement of a brake magnet armature tappet. A bracket is attached to the brake magnet tappet on one end and a distance piece carrying the sensor housing is arranged on the other end. A restoring lug is attached to the existing mechanical indicator. A monitor evaluates the sensor signal and turns off the elevator drive in the event of dangerous operational states via a safety circuit. The system allows the state of the brake device to be monitored. The more the brake linings wear off due to abrasion, the smaller the distance between the armature and the brake magnet housing. If the armature is in contact with the brake magnet housing, the braking ability of the brake linings is completely void.

- Hung-Chi Wu :- 958-2, Ghung Shan Rd., Tao-Yuan, Taiwan This invention relates to an adjustable magnetic brake and in particular to one including an aluminum fan, a magnetic conducting ring enclosing the aluminum fan, a permanent magnet disposed within the aluminum fan, a fixing seat for keeping the permanent magnet in position, a sliding seat mounted in the fixing seat and provided with a bearing, a housing, bolts provided on one side of the fixing seat and extending out of the housing, a mounting plate connected with the bolts and a wire connected with the mounting plate such that when the wire is pulled outwards, the permanent magnet will be moved outwards.

- Jae-WoongLee:- Seoul, Rep .of Korea Disclose disamagnetic brake system for a vehicle. comprising: a plurality of brake disk solenoids for generating the magnetic force; a plurality of brake pad solenoids for generating the magnetic force; a braking sensor for detecting whether a brake pedal is applied; a wheel speed sensor for detecting wheel speed; a magnetic polarity sensor for detecting magnetic polarity of the brake disk solenoids; and a control unit for controlling the brake pad solenoids using signals from the braking sensor. The wheel speed sensor and the magnetic polarity sensor.

III. PRINCIPLE AND 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

- Objective

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.

IV. COMPONENTS REQUIRED

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

V. MANUFATURING PROCESS SHEET

5.1 Process Sheet 1

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

5.2 Process sheet 2

Name Of Part - disc

Size-Diameter 20mm

Material-Cast Iron

Quantity-1

Sr No	Machine	Operation	Feed	Tool	Time(min)
1	Drilling Machine	Drill A Whole Of Diameter 20	Auto	Drill	15

5.3 Process sheet 3

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

VI. ASSEMBLY DRAWING

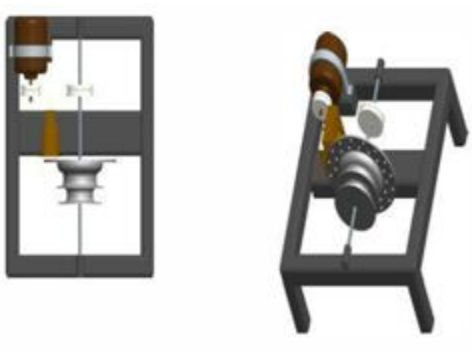

Figure No. 6.1 Assembly Drawing of Electromagnetic Braking system

VII. 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/4ρ

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

Fe = braking force (N)

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.

VIII. 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.

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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REFERENCES

[1] Dr Kirpal Singh. Automobile Engineering and Technology, Vol

[2] R. A. Barapte "Electromagnetic Engineering" Technova Educational Publication

[3] Khurmi & Gupta "Machine Design" S Chand Publication.

[4] V. B. Bhandari" Design of Machine Elements "Tata McGraw hill.

[5] K. Balaveera Reddy. "Design data hand-book for mechanical engineering.

[6] Flemming, Frank; Shapiro, Jessica (July 7, 2009). "Basics of Electromagnetic Brakes". machine design: pp.57–58

[7] Kren, Lawrence; Flemming, Frank (August 5, 1999). "Getting a Handle on Inertia". machine design: pp.92–93.

[8] Auguston, Karen; Flemming, Frank (September 1999). "Floating Armature Speeds Response". Global Design News: pp.46–47.

[9] Zalud, Todd; Flemming, Frank (September 9, 1999). "Getting a Grip on Brake Selection". machine design: pp.83–86.