

Design & Fabrication of Frictionless Electromagnetic Disc Braking System

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ABSTRACT

An electromagnetic brake is a new and revolutionary concept. These are totally friction less. Electromagnetic brakes are the brakes working on the electric power & magnetic power. An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. Electromagnetic braking system is a modern technology braking system used in light motor & heavy motor vehicles. This system is a combination of electro-mechanical concepts. The frequency of accidents is now-a-days increasing due to inefficient braking system. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles. It aims to minimize the brake failure to avoid the road accidents. It also reduces the maintenance of braking system. An advantage of this system is that it can be used on any vehicle with minor modifications to the transmission and electrical systems. An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. The disc is connected to a shaft and the electromagnet is mounted on the frame. When electricity is applied to the coil a magnetic field is developed across the armature because of the current flowing across the coil and causes armature to get attracted towards the coil. As a result, it develops a torque and eventually the vehicle comes to rest. These brakes can be incorporated in heavy vehicles as an auxiliary brake. The electromagnetic brakes can be used in commercial vehicles by controlling the current supplied to produce the magnetic flux. Making some improvements in the brakes it can be used in automobiles in future.

Keyword: - Component, formatting, styling, insert.

1. INTRODUCTION

Brakes are the device which are wont to retard the motion of moving vehicle for purpose of decreasing the speed and to avoid the accidents. In brakes the K.E. converted into heat with the assistance of friction between the restraint and disk. During this tremendous amount of warmth is generated and lost to the environment. Which in turns decreases the lifetime of restraint. The method of adjusting the restraint of auto isn't a cheap one. To avoid such energy losses and to form process more economical standard braking system is replaced by the more advance frictionless electromagnetic braking system. This works on the principal of electromagnets.

An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. The disc is connected to a shaft and the electromagnet is mounted on the frame. When electricity is applied to the coil a magnetic field is developed across the armature because of the current flowing across the coil and causes armature to get attracted towards the coil. As a result, it develops a torque and eventually the vehicle comes to rest. In this project the advantage of using the electromagnetic braking system in automobile is studied. These brakes can be incorporated in heavy vehicles as an auxiliary brake. The electromagnetic brakes can be used in commercial vehicles by controlling the current supplied to produce the magnetic flux. Making some improvements in the brakes it can be used in automobiles in future.

1.1 Objective

- To reduce the braking effort.
- To maintain the accuracy in braking system.
- To develop automation unit for braking so that, it can easily be adopted in today's automated vehicle.
- This type of system works practically at low cost, low maintenance, low capital investment in less space.
- To performed the most rigid operation with high-speed braking.

2. LITERATURE SURVEY

[1] Senthil Kumar, Dinesh Kumar, Gokul Krishnan, Gokulan M., Jagadesh V., are done the work on, design and fabrication of automatic Eddy current braking, according to this work, this study has been undertaken to investigate the determinants of Eddy current braking, majority of braking system works on the friction of kinetic energy with heat energy. this method has its own drawbacks and must be replaced with a more reliable braking system that is quick in response, doesn't heat up and is maintenance free. In this project the design an eddy current braking system and optimization for various operational parameters has been done. These parameters have been previously iterated in cited projects and papers and also in the simulation models and are to be cross-checked with the experimental setup. If suppose mechanical braking has been failure automatically electromagnetic braking induced by electrical circuit board connections and sensor.

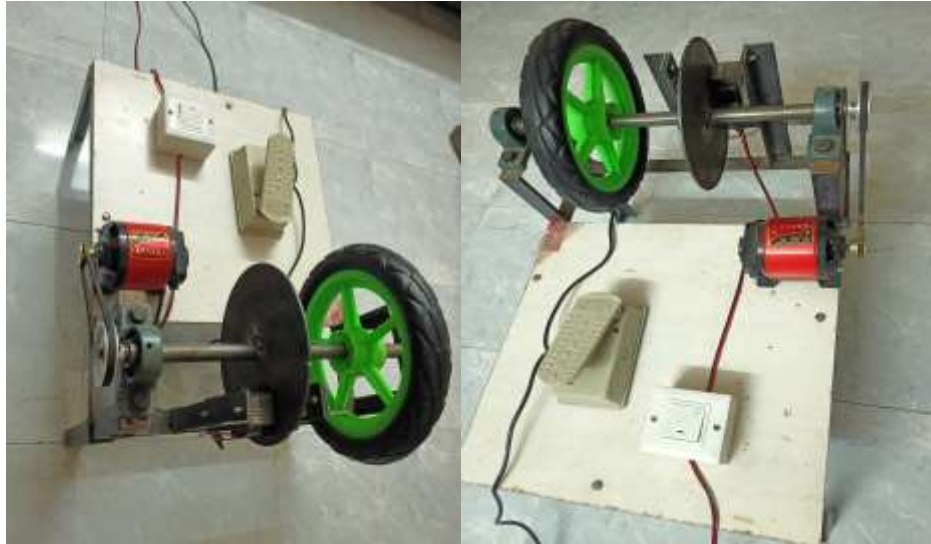
[2] Sagar Wagh, Aditya Mahakode, Abhishek Mehta and Vaneela Pyla, are done the work on, Electromagnetic Braking System in Automobile, according to this work, this paper elaborates Electromagnetic Braking system and its impact on other conventional Braking system. Braking System should ensure safety and comfort to the driver while driving the vehicle on road. There are various types of Conventional systems of Braking such as Drum Brake, Disc Brake, Hydraulic brakes, Pneumatic brakes etc. This Braking System produce higher amount of friction which produces heat wear and tear of braking parts and eventually reduces efficiency of braking system. Therefore, Electromagnetic Braking System is used which is efficient way of braking with high power to torque ratio and also provide less amount of friction.

[3] Smit Patel, Meet Patel, Anand Patel and Chetan Sanghani, are done the work on, Development of the Electro-Magnetic Brake, according to this work, most of the braking systems utilize friction forces to transform the kinetic energy of a moving body into heat that is dissipated by the braking pads. The overuse of friction-type braking systems causes the temperature of the braking pads to rise, reducing the effectiveness of the system. An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. The disc is connected to a shaft and the electromagnet is mounted on the frame. When electricity is applied to the coil a magnetic field is developed across the armature. The eddy-current is created by the relative motion between a magnet and a metal (or alloy) conductor. The current induces the reverse magnetic field and results in the deceleration of motion. The proposed mechanism implements this phenomenon in developing a braking system. The potential applications of the braking system can be a decelerating system to increase the safety of an elevator or any guided rail transportation system as a result it develops a torque and eventually the vehicle comes to rest. In this project the advantage of using the electromagnetic braking system in automobile is studied. These brakes can be incorporated in heavy vehicles as an auxiliary brake. The electromagnetic brakes can be used in commercial vehicles by controlling the current supplied to produce the magnetic flux. Making some improvements in the brakes it can be used in automobiles in future. It also reduces the maintenance of braking system. An advantage of this system is that it can be used on any vehicle with minor modifications to the transmission and electrical systems.

[4] Kunal Saurabh, Inzamam Ali, Mohammad Yusuf Khan & Ayush Gupta, are done the work on, Fabrication of Electromagnetic Clutches & Braking System, according to this work, this paper reveals the fabrication of electromagnetic clutch and braking System. An electromagnetic clutch is a device used to make and break contact from the transmission operate electrically but transmit torque mechanically. An electromagnetic braking system uses magnetic force to engage the brake but the power required for braking is transmitted manually. The disc is connected to a shaft and the electromagnet is mounted on the frame. In this paper when electricity is applied to the coil a magnetic field is developed across the armature. The eddy current is created by the relative motion between a

magnet and a metal (or alloy) conductor. The reverse magnetic field is induced which results in the deceleration of motion. This proposed the mechanism which implements this phenomenon in developing an electromagnetic clutch and braking system. This reduces complication to control of clutch and brakes. The operating temperature is limited, because at high temperature insulation of the electromagnet gets damaged.

3. CONSTRUCTION AND WORKING



3.1 Working Principal

The electromagnet is energized by the AC supply where the magnetic field produced is used to provide the braking mechanism. When the electromagnet is not energized, the rotation of the disc is free and accelerates uniformly under the action of weight to which the shaft is connected. When the electromagnet is energized, magnetic field is produced thereby applying brake by retarding the rotation of the disc and the energy absorbed is used to stop the discs when the armature is attracted to the field the stopping torque is transferred into the field housing and into the machine frame decelerating the load. The AC motor makes the disc to rotate through the shaft by means of pulleys connected to the shaft. The control panel is used to control performance of the braking system by varying number of turns of coil. When the current will pass through coil then ultimately the magnetic properties will change.

3.2 Components Used

The Electromagnetic braking system is mainly consisting of following components which are given bellow,

3.2.1 Electromagnet



Electromagnets usually consist of a large number of closely spaced turns of wire that create the magnetic field, which will eventually stop the rotating wheel. The electromagnets work in the base of induction. Were the process induction causes electrical field to produce magnetic field thus the electromagnet uses the source of power from the electrical field into the magnetic field. The strength of the magnetic field from the magnet is a static property of the electromagnet. Hence the electromagnets work by a source of power which a magnet naturally produces.

3.2.2 Shaft



The shaft is attached to the motor and aluminum disk with help of the flange coupling. The shaft may be hollow or solid. The shaft is supported on bearings and it rotates a set of gears or pulleys for the purpose of power transmission. Material for Shafts is ferrous, non-ferrous materials and non-metals are used as shaft material depending on the application.

3.2.3. Metal Disc



Disk is mounted on the shaft, and the shaft is connected to the ac motor so that the aluminum disk is rotates as the same speed of the motor.

3.2.4. V-Belt



It is power transmission drive. Its primary function is to transmit power from motor to shaft.

3.2.5. Pedestal bearings



The detailed drawing of a pedestal bearing is shown in image below. The rotation of the bush inside the bearing housing is arrested by a snug at the bottom of the lower brass. The cap is tightened on the pedestal block by means of bolts and nuts. The detailed part drawings of another Plummer block with slightly different dimensions.

3.2.6. Motor With VFD



Motor is a Single-phase AC motor, Power 50 watt; Speed is continuously variable from 0 to 8600 rpm. The speed of motor is variator by means of an electronic speed variator. Motor is a commutator motor i.e., the current to motor is supplied to motor by means of carbon brushes. The power input to motor is varied by changing the current supply to these brushes by the electronic speed variator; thereby the speed is also changes. Motor is foot mounted and is bolted to the motor base plate welded to the base frame of the indexer table.

3.2.7. Nut and Bolt

As nuts and bolts are not perfectly rigid, but stretch slightly under load, the distribution of stress on the threads is not uniform. In fact, on a theoretically infinitely long bolt, the first thread takes a third of the load, the first three threads take three-quarters of the load, and the first six threads take essentially the whole load. Beyond the first six threads, the remaining threads are under essentially no load at all. Therefore, a nut or bolt with six threads acts very much like an infinitely long nut or bolt.

3.2.8. Wheel

It will show the actual representation of one type of vehicle wheel demonstration.

3.2.9. Base Frame

It is made by plywood. It is use for the foundation of system means on the base we fitted all braking system components

4. COST ESTIMATION

4.1. Cost of Machining

Machine Name	Using Time (min)	Rate /hr	Total Rate Rs/-
Gas cutting	20	200	70
Lath machine	15	500	150
Cutting machine	50	200	180
Welding machine	65	400	425
Grinding machine	30	100	50
Drilling machine	60	200	200

4.2. Cost of Standard Parts

Sr.No.	Name	Qty.	Rate	Total Rate
1	Magnet	2	1000	2000
2	Control panel	1	150	150
3	Wheel	1	250	250
4	Pedestal bearing	2	250	500
5	Motor	1	850	850
6	VFD	1	200	200
7	Belt Drive	1	135	135

Cost of Standard Part = 4,085/-

4.3. Cost of Transportation & Overhead = 1000 / -

COST OF PROJECT:

Cost of material + Cost of machining + Cost of STD part + Cost of transportation & overhead
 = 820+1075 +4085 +1000
 = 6,980/- Rs.

5. RESULTS AND DISCUSSION

5.1. Advantages

- Safety of the vehicle is assured.
- Accident rate is reduced.
- It acts as a secondary braking system.
- No contact therefore no wear or tear.
- No noise.
- It is highly suitable at high speed.
- It works on electricity and consumes very small amount of power for a tiny time period. Can be easily controlled and resettable.
- Very light weight and low maintenance.
- Consumes small space therefore installation is easy.
- Running cost is less.

5.2. Disadvantages

- Dependence on battery power to energize the brake system drains down the battery much faster.
- Due to residual magnetism present in electromagnets, the brake shoe takes time to come back to its original position.
- The installation of an electromagnetic brake is very difficult if there is Not enough space between the gearbox and the rear axle.

6. CONCLUSION

With all the advantages of electromagnetic brakes over friction brakes, they have been widely used on heavy vehicles where the 'brake fading' problem exists. The same concept is being developed for application on lighter vehicles. The concept designed by us is just a prototype and needs to be developed more because of the above-mentioned disadvantages. These electromagnetic brakes can be used as an auxiliary braking system along with the friction braking system to avoid overheating and brake failure. ABS usage can be neglected by simply using a micro controlled electromagnetic disk brake system. These find vast applications in heavy vehicles where high heat dissipation is required. In rail coaches it can be used in combination of disc brake to bring the trains moving in high speed. When these brakes are combined it increases the life of brake and act like fully loaded brakes. These electromagnetic brakes can be used in wet conditions which eliminate the anti-skidding equipment, and cost of these brake are cheaper than the other types. Hence the braking force produced in this is less than the disc brakes if can be used as a secondary or emergency braking system in the automobiles.

The braking is the major operation performed in automobile used to control & reduced the speed of a vehicle and to perform most rigid operation in automobile safety. The accuracy of braking is increases by using automation in system, so we will be trying to do a work on new system in Frictionless Electromagnetic braking system. The statement of project is "design & fabrication of frictionless electromagnetic braking system" for the braking application in automobile as per requirements for braking performance will be apply for future electric cars after successful implementation. By applying this braking system vehicle performance will be improve for future Cars to reduce the braking effort & maintain the accuracy in braking system. After successful implementation of this system, will develop automation unit for braking so that, it can easily be adopted in today's automated vehicle.

7. ACKNOWLEDGEMENTS

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