

DESIGN AND MANUFACTURING OF ELECTROMAGNETIC BRAKING SYSTEM

Prof. P. R. Gajbhiye¹, Rubal Tembhurne², Zameer Ansari³

¹Assistant professor, Mechanical Dept. of kdk college of engineering, Nagpur 440039, Maharashtra, India.

^{2&3} Final Year Student Of Mechanical Dept. Of KDK College Of Engineering, Nagpur 440039, Maharashtra, India.

ABSTRACT:- Electromagnetic braking system is new high-tech braking system and also called as electro-mechanical brakes. We can use in LMV and HMV like jeep, buses, car, truck, train and motor bikes. An electromagnetic braking system uses magnetic force to engage the brake. The disc is connected to a shaft and the electromagnet is mounted on the frame. When electricity is applied to the coil of electromagnet a magnetic field is developed. An electromagnetic braking system used magnetic force while applied the force on brake, but the power is transmitted on manually operate the brake⁶. As a result it develops a resisting torque and eventually the vehicle comes to rest.

Keywords: Peak Force, Fade, Drag, Flux, Electro Magnet.

I. INTRODUCTION

The automobile industry uses braking system like to drum brake, disc brake, hydraulic brake, pneumatic brake, air brake. The conventional braking system are bulky and power to weight ratio is low. So automobile industry needs new concept, new concept is Electromagnetic brakes, are also called electro-mechanical brakes or EM brakes. Electromagnetic brakes slow or stop motion using electromagnetic force to apply mechanical resistance². The brakes are different to use in stopped the reciprocating parts and motion of the vehicle. The different brakes are working on different principle operation³. The different types of friction brake and electromagnetic brake use. The main principle of electromagnetic brake to induced kinetic energy into heat energy⁶.

II. PRINCIPLE OF OPERATION

The principle of braking in road vehicles involves the conversion of kinetic energy into thermal energy (heat). When brakes are applied the driver commands a stopping force to the moving vehicle and dissipates the associated kinetic energy as heat. Brakes must be able to stop the speed of a vehicle in short periods of time however the vehicle is in fast or slow speed. As a result, the brakes are required to have the ability to generating high torque and absorbing energy in short periods of time⁶.

III. EXISTING BRAKES

The principle of braking in road vehicles involves the conversion of kinetic energy into thermal energy (heat).

The commonly used types of brakes used in automobiles are :

- Drum brakes
- Disc brakes
- Air brakes

Various types of braking system used are :

- Hydraulic
- Pneumatic

The conventional braking system are bulky and power to weight ratio is low. The conventional friction brake system is composed of the following basic components, the master cylinder which is located under the hood is directly connected to the brake pedal, and converts the drivers foot pressure into hydraulic pressure. Shoes or pads are pushed by the slave cylinders to contact the drums or rotors, thus causing drag, which slows the car. Two major kinds of friction brakes are disc brakes and drum brakes.

IV. EXISTING BRAKING PROBLEMS

Conventional braking systems absorb and convert enormous energy. This high energy conversion therefore demands an appropriate rate of heat dissipation, which is not possible in conventional braking. Conventional brakes can absorb energy up to 25 hp if the proper braking condition is maintained. Friction-based braking methods are also not efficient under wet conditions, as braking is totally dependent on contact friction. Brake fluid leakage: If your vehicle has worn brake pads or brake shoes, the fluid level in your brake fluid reservoir will be low. Other major problems and other problems include brake fluid vaporization and brake fluid freezing though vaporization occurs only in rare cases.

V. ELECTROMAGNETIC BRAKES

Electromagnetic brakes operate electrically, but transmit torque mechanically. This is why they are used to be referred to as electro-mechanical brakes. Over the years, EM brakes became known as electromagnetic, referring to their actuation method¹. Electromagnetic brakes are used in various machines like gym equipments, electric trains, roller coaster rides, food processing and packaging machinery, medical equipment, industrial machines, servo motors and robotics, elevators and escalators, etc. from a day, so we can use it in the automobile sector also⁶. Electromagnetic brakes work in a relatively cool condition and satisfy all the energy requirements of braking at high speeds, completely without the use of friction. Due to its specific installation location, electromagnetic brakes have better heat dissipation capability to avoid problems that friction brakes face as mentioned before.

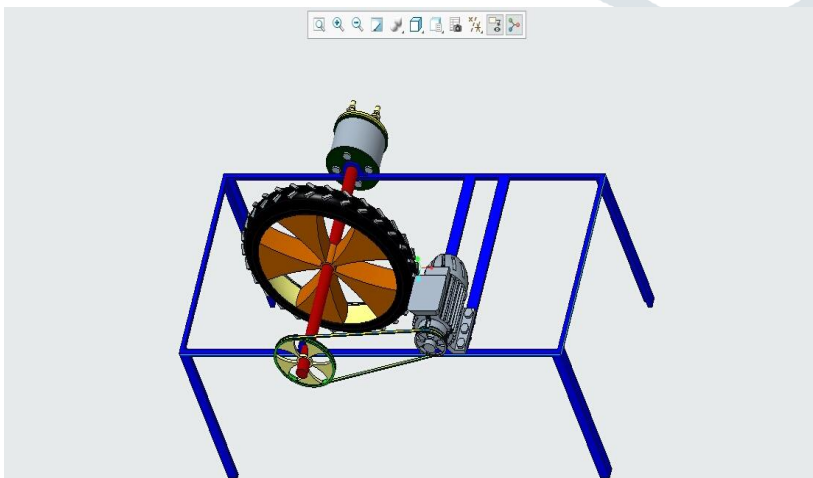
VI. CONSTRUCTION

The electromagnetic brake needs

- Electromagnet
- Frame
- AC Motor
- Disc
- Pulleys & Belt
- Shaft

Electromagnetic brake needs proper electromagnet with considering power to weight ratio. Electromagnet should be sufficient of producing torque needed to stop the vehicle with safety in any speed.

3D MODEL OF ELECTROMAGNETIC BRAKING



VII. WORKING

The AC motor makes the disc to rotate through the shaft by means of pulleys connected to the shaft. When certain amount of current is passed through a round conductor then it produces magnetic field which is uniform all over the conductor. The magnetic field strength depends on the current flowing through conductor and if the no of turns more, then the current flowing through conductor is higher and higher the magnetic field gets created. This creates an opposing force to the wheel rotation and in turn slows down the wheel. 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. Thus we achieve electromagnetic braking as a better braking system for future automobiles. It can be proven from study that the electromagnetic brake is effective.

ASSEMBLED MODEL



VIII. ADVANTAGES OF ELECTROMAGNETIC BRAKING SYSTEM

- 1)It stop's the vehicle fast and in short distance .
- 2)It has Low maintainance braking.
- 3)To increase the capacity of the system(like higher speeds, heavy loads) can be increased.
- 4)A part of energy is returned to the supply consequently the running cost is reduced.
- 5)Brakes should be work in a relatively cool condition.
- 6)In braking negligible amount of heat should be generated .
- 7)Friction brake can normally absorb without self- destruction is 25 h.p. and electromagnetic braking will independently absorb more than 300 h.p. energy.

IX. DISADVATAGES OF ELECTROMAGNETIC BRAKING SYSTEM

- 1)Dependence on battery power to energize the brake system drains down the battery much faster.
- 2) Due to residual magnetism present in electromagnets, the brake shoe takes time to come back to its original position.
- 3) A special spring mechanism needs to be provided for the quick return of the brake shoe.

X. CONCLUSION

Thus we have learned that by the use of eddy current braking system we can reduce the wear, maintenance cost, increased durability is achieved. Hence, due to all these factors, overall cost is reduced. Eddy current braking system is used for dynamic braking. Braking of electromagnetic braking is faster than regular brakes and power consume is less. Due to its various applications as discussed earlier, it can use as a braking system.

REFERENCE

- 1) Sevvell P1, Nirmal Kannan V2, Mars Mukesh S3 "Innovative Electro Magnetic Braking system"
International Journal of Innovative Research in Science, Engineering and Technology "2, April 2014"
- 2) Smit Patel Meet Patel Anand Patel Chetan Sanghani, "Development of the Electro-Magnetic Brake " IJRST –International Journal for Innovative Research in Science & Technology"
- 3) 1Sagar Wagh, 2Aditya Mahakode, 3Abhishek Mehta and 4Vaneela Pyla,
"Electromagnetic Braking System in Automobile" "International Journal of Trend in Research and Development, Volume 4"
- 4) Prof. N.B.Totala[1] Priya Bhosle[2], Seema Jarhad[3], Soniya Jadhav[4], Kamlesh Kuchekar[5]
"Electromagnetic Braking System" "National Conference on Innovations in Mechanical Engineering" "April 2015"
- 5) Mahadeo Gurav, Neeraj Gupta, Shivam Chaturvedi, Pratik Raut, " EDDY Current Braking System"
"International Journal of Advance Research, Ideas and Innovations in Technology" (Volume 3, Issue 6)
- 6) 1Krunal Prajapati, 2Rahul Vibhandik, 3Devendrasinh Baria, 4Yash Patel, "Electronic Braking System" "International Journal of Scientific Research in Engineering" (IJSRE) Vol. 1 (3), March, 2017

