IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2024

DOI: 10.17148/IJIREEICE.2024.12539

DESIGN & DEVELOPMENT OF FRICTIONLESS BRAKE

PEDNEKAR SATYAM KIRAN[1], CHOUGALE GANESH RAGHUNAT[2], KSHIRSAGAR SUSHANT ANIL[3], GHODKE TIRUPATI BABURAO[4], Prof. V.K. Mehtre[5]

Student, of Mechanical Engineering, Anantrao Pawar College of Engineering and Research, Pune Maharashtra, India[1-4]

Professor, Dept. of Mechanical Engineering, Anantrao Pawar College of Engineering And Research, Pune Maharashtra, India[5]

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.

Keywords: Electromagnetic brake, electromagnetic induction, Friction brakes, microprocessor.

I. INTRODUCTION

Magnetic brakes are a relatively new technology that is beginning to gain popularity due to their high degree of safety. Rather than slowing a train via friction (such as fin or skid brakes), which can often be affected by various elements such as rain, magnetic brakes rely completely on certain magnetic properties and resistance. In fact, magnetic brakes never come in contact with the train. Magnetic brakes are made up of one or two rows of neodymium magnets. When a metal fin (typically copper or a copper/aluminum alloy) passes between the rows of magnets, eddy currents are generated in the fin, which creates a magnetic field opposing the fin's motion. The resultant braking force is directly proportional to the speed at which the fin is moving through the brake element. This very property, however, is also one of magnetic braking's disadvantages in that the eddy force itself can never completely hold a train in ideal condition. It is then often necessary to hold the train in place with an additional set of fin brakes or "kicker wheels" which are simple rubber tires that make contact with the train and effectively park it.

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. The current study involves the fabrication of electromagnetic brake which acts as an effective decelerator for the vehicle.

Magnetic brakes are silent and are much smoother than friction brakes, gradually increasing the braking power so that the people on the ride do not experience rapid changes in deceleration. Many modern roller coasters, especially those being manufactured by Intiman, have utilized magnetic braking for several years. Another major roller coaster designer implementing these brakes is Bollinger & Maxillary in 2004 on their Silver Bullet inverted coaster, making it the first suspended roller coaster to feature magnetic brakes, and again used them on their newer projects, such as Leviathan at Canada's Wonderland. These later applications have proven effectively comfortable and relevant for these inverted

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2024

DOI: 10.17148/IJIREEICE.2024.12539

coasters which often give the sense of flight. There also exist third party companies such as Magnatar tech. which provide various configurations of the technology to be used to replace and retrofit braking systems on existing roller coasters to increase safety, improve rider comfort, and lower maintenance costs and labor.

II. LITERATURE SURVEY

Literature review on Design Study in Single Disk Axial Eddy Current Brake. 2018 5th International Conference on Electric Vehicular Technology (ICEVT) October 30-31, 2018, Surakarta, Indonesia. In daily life the role of brake is very important. In generally vehicle is used conventional braking like disc brake drum brake etc. Eddy current brake can be alternative for conventional brake ECB is an electromagnetic brake which use the principle of eddy current brake. This research aims to investigate the relationship between braking torque with the amount of coil and the air gap in single disc axial brake ECB. FEM is used in ECB performance modelling. The eddy current brake has many parameters that need to be developed. In this paper by changing the air gap and number of conductors the torque is also changed. by using FEM, we can find this. The braking torque is strongly affected by the parameter of eddy current brake. By result of this research, we can conclude that smaller air gap increases the braking torque and also number of conductors is improving the performance of eddy current brake also by change in design the braking torque is also change. Better braking performance is obtained when using 0.5mm air gap and 360 conductors.

Literature review on electromagnetic brake. Inventors: Lindberg; Teppo (Napelline, FI) Assignee: Kone Oy (Helsinki, FI) United States Patent 5,186,286. Lindberg February 16, 1993.

A vehicle braking system having a Brake disk structure defining an annular surface and having axis, annular magnet support assembly, an annular pole piece support assembly the system is an adjustment mechanism for producing relative angular movement between the magnet support and the pole piece support assembly, so as to change the circumferential alignment between each of the pole pieces and the pair of permanent magnets adjacent there to. The invention is a vehicle braking system including a brake disk structure defining an annular surface means and having an axis, an annular magnet support assembly disposed adjacent to the annular surface means in the direction of the axis, a plurality of circumferentially spaced apart pairs of circumferentially spaced apart permanent magnets mounted on the magnet support and circumferentially spaced apart thereon, each pair Arranged with like polarities facing the annular surface means and the polarities.

Literature review on contactless eddy current brake for cars. United States Patent, US 6,286,637B1, Kwangju Institute of Science & Technology (KR): Sep. 11, 2001. A contactless eddy current brake for car is disclosed in the brake two cores are arranged the edge of the brake disc while being spaced apart from each other at an angle of 90 each of the cores is wound with a coil thus forming and electric magnet A control units calculates Dc or Ac control in response to a speed signal output from the sensor thus outputting control current value to the coils, while the AC current is variable in the frequency in accordance with the pedaling force As well known to those skilled in a art known contact brakes for cars are designed to be operated by hydraulic or pneumatic pressure thus pressing against the brake disc of a wheel using frictional brake pads are frictionally in that the brake pads and making a car go slow or stop. However, such known contact brakes in are problematic in that the brake pads with the brake disc. Another problem experienced in the known brake the wheels while driving a car at high speed.

III. METHODOLOGY

3.1 Working Principal:

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 Infront 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.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2024

DOI: 10.17148/IJIREEICE.2024.12539

3.2 SOLID MODELING

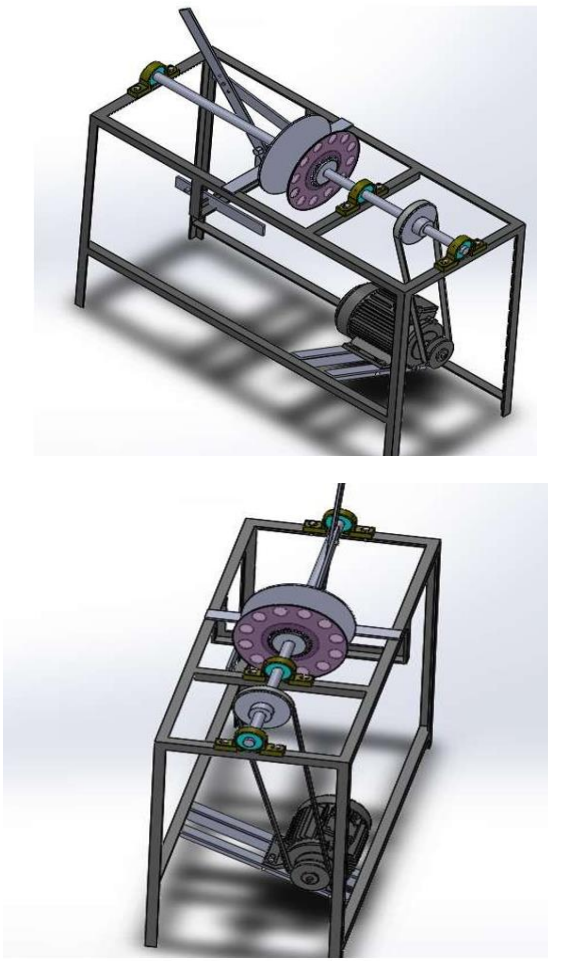

Figure 9 Drafting

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2024

DOI: 10.17148/IJIREEICE.2024.12539

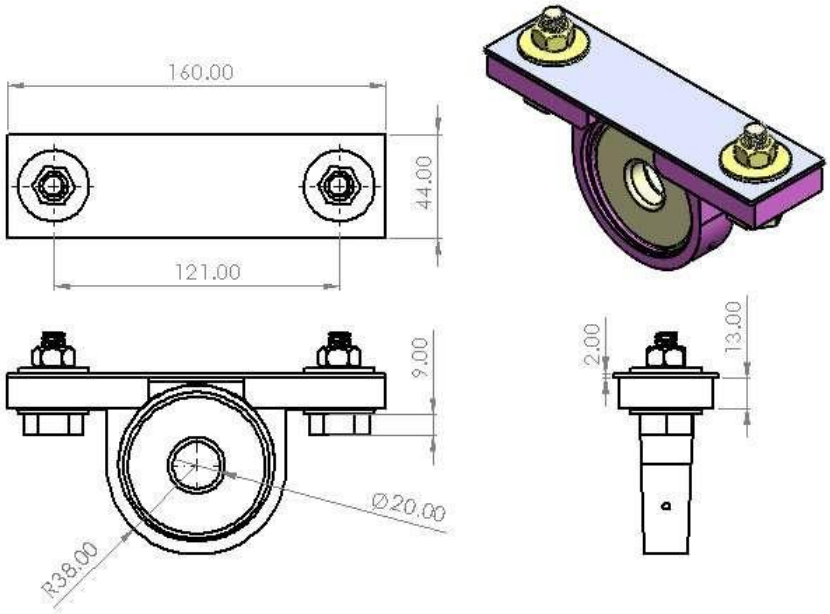

Fig. Pedestal bearing

IV. CALCULATIONS

DESIGN OF MOTOR:

The motor is prime drive in our machine it converts electrical power in to mechanical power. It gives rotary motion to mechanism. The motor design is very important design aspect in machine design practice.

Breaking load = 1.5 kg = 15 N

We take dia of flywheel = 220 mm So, torque required to lift the load T = F x R

T = 15 x 110 = 1650 N- mm = 1.65 N-m

Speed of flywheel rotation N = 2400 rpm

Hp required for motor selection P = 2 x 3.14 x 2400 x T / 60

P = 2 x 3.14 x 2400 x 1.65 / 60

P =414.69 watt = 0.56 hp

So, we take standard motor of Power 0.5 HP and 1420 rpm Total ratio required for desire torque = 1420/2400 = 71:120 For this speed reduction we select belt drive for reduction for pulley = 75:100 Now, Angular velocity (ω) for flywheel.

$\omega = 2\pi N/60$

= 3.142 x 2 x 2400/60

= 251.32 rad/s. Design of V- belt:

V. CONCLUSION

An electromagnetic brake system could substantially increase braking efficiency while reducing friction brake wear. Bringing this technology to market would create extra revenue for automobile companies and could increase client base. It reaffirms the company's commitment to safety and quality. By producing this brake will be possible to sell it for substantially less than outsourced systems while still making a profit. Most potential truck owners will consider this option, since it reduces the upkeep and cost of traditional brakes and increases truck safety. Electromagnetic braking systems represent the future of brake technology. An eddy current (magnetic)and electromagnetic braking mainly use to stop or slow down the heavy and highspeed vehicle like train etc. And also, for

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2024
DOI: 10.17148/IJIREEICE.2024.12539

automobiles like hike, car has an effective braking system. In addition, by using the electromagnetic and magnetic brake, we can increase the life of the braking unit. The working principle of this system that when the eddy current (magnetic) and electromagnetic and flux cut by the rotating wheel or disc the eddy current is induce in rotating wheel or rotter. This eddy current flows opposite to the rotating wheel. This eddy current tries to stop the rotating wheel at rotor. This results in the rotating wheel or rotor comes to rest. The Electromagnetic braking system is found to be more reliable as compared to other braking systems. Electromagnetic braking system is found to be more reliable as compared to other braking systems. In friction or mechanical braking system or air baking system, even a small amount of leakage may lead to complete failure of brakes.

REFERENCES

[1]. Marcel Bachmann Vjaceslav Avilov Andrey Gumenyuk Michael Rethmeier (2014), Experimental and numerical investigation of an electromagnetic weld pool support system for high power laser beam welding of austenitic stainless steel, Elsevier ,Vol. 214, No. 3,pp.578-591.
[2]. Putman, P.T, (1986) „Capture Dynamics of Coaxial Magnetic Brakes‟ Vol.
[3]. G. Guna , S. Dinesh ,()2016),Electro Magnetic Braking System, Journal of Chemical and Pharmaceutical Sciences, Issue No - 5,pp.427-428.
[4]. Sagar Wagh, 2Aditya Mahak ode, 3Abhishek Mehta and 4Vaneela Pila (2017),"Electromagnetic Braking System in Automobile" International Journal of Trend in Research and Development, Volume 4(3),228-231.
[5]. John Willard Tielking, (1926) „Electromagnet Braking‟ Vol.3.
[6]. U. M. Saravanan1 T. R. Manoj 2 P. Meiyazhagan3 R. Mathi4 M. Murali Manoharan5,I2018),‟ Design and Fabrication of Contactless Braking System with Eddy Current‟, International Journal for Scientific Research & Development| Vol. 6, Issue 02,pp.3623-3625.
[7]. William C. Orth vein (2004) „Clutches and Brakes design‟ Vol.
[8]. W.Y.Li, B.P.Tang, J.G.Han, X.N.Lu, N.N.Hu, Z.Z.He ,(2015),The structure healthy condition monitoring and fault diagnosis methods in wind turbines: A review, Renewable and Sustainable Energy Reviews,Elsevier,Vol.44,pp. 466-472.