FABRICATION OF ELECTRO-MAGNETIC SYSTEM

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Abstract: A novel and ground-breaking idea is an electromagnetic brake. A new type of braking system utilized in both light and heavy motor vehicles is the electromagnetic braking system. The components of this system combine electromechanical ideas. Accidents are happening more frequently these days as a result of ineffective braking systems. It is obvious that a key component of heavy truck safety braking is the electromagnetic brake. It tries to reduce brake failure to prevent accidents on the road. Additionally, it lessens the need for brake system maintenance. This system has the benefit of being adaptable to any vehicle with just modest transmission and electrical system adjustments. Although the magnetic force used by an electromagnetic braking system to actuate the brake is transmitted manually. The electromagnet is installed on the frame, and the disc is attached to a shaft by a shaft. A magnetic field is created across the armature when electricity is delivered to the coil as a result of the current flowing across the coil, which attracts the armature to the coil. As a result, a torque is created, and eventually the car comes to a stop. These brakes can be used as an auxiliary brake in big trucks. Commercial vehicles can use electromagnetic brakes by adjusting the current supplied to generate the magnetic flux. Future autos may use brakes that have undergone certain upgrades.

The brakes that operate on both electric and magnetic power are known as electromagnetic brakes. They operate according to the electromagnetic theory. The eddy current travels in the opposite direction to the direction of the revolving wheel or rotor when the magnetic flux passes through and perpendicular to the wheel. The rotating wheel or rotor is being attempted to halt by this eddy current. The whirling wheel or rotor eventually comes to rest or enters neutral as a result. These have no friction at all. As a result, they are stronger and have a longer lifespan. There is less maintenance. Due to its many advantages over conventional brakes, these brakes make a great replacement. This brake was added to cars in order to decrease brake wear since its friction less. So, there won't be any heat loss either. The time required to apply the brakes is also reduced when using electromagnetic brakes as opposed to conventional brakes. Lubrication is not frequently necessary. Today's need is met by electromagnetic breaks, which provide better performance at lower cost.

Key Words: Automobiles, Brakes, Electromagnetic System, Magnetic Flux, Economic

I. INTRODUCTION

The equipment known as brakes is used to slow down moving vehicles in order to reduce speed and prevent accidents. With the aid of friction between the restraint and disc, K.E. in brakes was turned into heat. Huge amounts of heat are produced and lost to the environment during this. which ultimately shortens the duration of restriction. The process for altering an automobile's restraint is not inexpensive. The more sophisticated frictionless electromagnetic braking system is used in place of the normal braking system to prevent these energy losses and create a more efficient operation. It operates using electromagnets as a principle. This project involves building a braking system. This might be used in a two-wheeler at a fast speed and with little maintenance cost. Here, a plunger and an electromagnetic coil will be used. The plunger is moved in the braking direction by an electromagnetic effect. A magnetic flux is produced indoors when electricity is applied to the area. Following that, the flux is transferred into a hysteresis disc that is traversing the sector. The brake shaft is connected to the hysteresis disc. The output shaft may eventually stop moving due to a magnetic pull on the hysteresis disc. Pure electronically controlled brake systems have several advantages. Instead of altering mechanical components, changing software parameters and electrical outputs will make it simple to modify the brake's characteristics and behaviour. Additionally, it facilitates the integration of new and current control elements, such as anti-lock brake systems (ABS), Electronic handbrake (EPB), vehicle stability control (VSC), vehicle chassis control (VCC), and adaptive control, among others (ACC). Additional advantages include reduced component count, streamlined wiring, and a generally optimal layout. The elimination of water-polluting brake fluids and diagnostic features are further advantages.

II. LITERATURE REVIEW In June 2015, Umang S. Modi and Swapnil C. Bhavasar conducted study on electro-magnetic braking system trends. According to the findings of this research, electromagnetic brakes frequently boost the braking system's potential, and sliding mode controllers are frequently utilised to regulate electromagnetic brakes effectively. In order to prevent overheating and breakdown, the authors of this study have sought to create viable electro-magnetic brakes. It is suggested that these brakes be used in conjunction with conventional ones. The use of these electromagnetic brakes is common.

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Researchers Sagar Wagh, Aditya Mahakode, Abhishek Mehta, and Vineela Pyla completed a study on the electromagnetic braking system in automobiles in June 2017. According to this research, electromagnetic braking systems are shown to be more dependable than alternative braking methods. Even a small leak might cause brakes to completely fail in an oil or air braking system. When a coil breaks in an electromagnetic brake, the remaining three coils continue to function normally because each wheel has its own independent firing circuit and coil. Additionally, this procedure requires little to no upkeep. It was discovered during the research for this work that electromagnetic brakes account for about 80% of all facility-applied brake applications. In addition to conventional friction brakes, electromagnetic brakes are utilized as supplemental equipment for retardation. Because they are employed less frequently, friction brakes hardly ever reach high temperatures. The possible brake fade issue might be avoided since the brake linings will last much longer before needing maintenance. This improved braking system aids in effective braking as well as accident avoidance and minimally increasing accident frequency. The hazard that will result from using brakes for an extended period of time beyond their capacity to dissipate heat is also avoided by electromagnetic brakes.

Research was conducted on Modeling Electromagnetic Processes in Electromagnetic Brakes and Slip Clutches with Hollow Ferromagnetic Rotors by Potapov LA, Fedyaeva GA, and Smorudova TV (2016). They claimed that a mathematical and computer model was developed during this research, and that the estimated performance of electromagnetic brakes with hollow ferromagnetic rotors supported these models. After the sting effect factor was introduced, mechanical parameters calculated from these equations matched experimental ones. The equation makes it possible to conduct studies on the effects of various structural parameters on the instantaneous performance of slip clutches and electromagnetic brakes, as well as to improve the planning of those devices. In the hollow electromagnetic rotor, which has a non-linear magnetic characteristic, the examination of the models developed has revealed aspects of electromagnetic processes. The presented characteristic curves demonstrate impact.

Research has been done on the experimental investigation of the influence of various parameters on a static magnet eddy current braking system by G.L. Anantha Krishna1* and K.M. Sathish Kumar (2018). They claimed that Neodymium Iron Boron (NdFeB) magnets with 12.5 mm thick and 50 mm in diameter were used for the investigations on the static magnet eddy current braking system.

There were 27 experiments conducted using discs made of copper, aluminum, and brass that were 4 mm, 6 mm, and 8 mm thick, rotating at 2000 rpm, 3000 rpm, and 4000 rpm. Copper discs with a 6 mm thickness have been shown to reduce speed by 84.8, 86.3, and 81.8 percent, respectively. Speed reductions require times of 16, 15, and 22.5 seconds, respectively. 8 mm thick aluminum disc was found to have speed reductions of 70.6, 86, and 85.1. Speed reductions take 3.3 seconds. It has been found that aluminum discs with an 8mm thickness experience a greater percentage speed drop and a lesser amount of time taken. Higher permeability, positive susceptibility, and superior depth of penetration in Aluminum disc are frequently to blame for this. However, it was noticed in a copper disc with a 6 mm thickness.

A multidisciplinary design method for electromagnetic brakes is the subject of research by Yusuf Yasaa, Eyyup Sincarb, Baris Tugrul, Ertugrul, and Erkan Mese (July 2016). A complete design for EM brakes is produced during this project. The most important design and optimization steps are underlined. To comprehend the time domain electrical performance of the EM brake, straightforward and practical analytical models are developed. FEA software is used to Analyse and determine the relationship between flux linkage and induced magnetism and how they change with ampere-turn and air gap. Analytically developed EM brake thermal model and 3D FEA tools are used to examine EM brake thermal behavior. By balancing the necessary needs and factors, an algorithm is created to optimize EM brake performance. Experimental experiments are conducted with a brake prototype to validate the planning, tests are done on the prototype. There is good agreement between test findings and analytical models. Production tolerances and variations in spring constants result in changes in the current waveform that lead to armature imbalance, which affects how quickly the brakes react and how effectively they work. It has been noted that the symptoms of brake parallelism can be seen in the current waveform during production, allowing for the early detection of issues. It has been discovered that elevated coil temperature causes a degradation in magnetic flux and lining friction capacity, which lowers torque capacity.

III. CONSTRUCTION

The system comprises of a mild steel frame with a rectangular shape. By welding, the roller bearings are attached to the frame. The bearings are holding the shaft in place. A predetermined distance from the shaft is used to mount the wheel and aluminium disc. Two AC-type electromagnets positioned on the frame are placed close to the aluminium disc. Chain drive, which is powered by a motor located on the frame, transmits torque to the shaft. The system also includes an ultrasonic sensor unit that is controlled by an electronic control unit (ECU), which detects obstacles and slows motion..

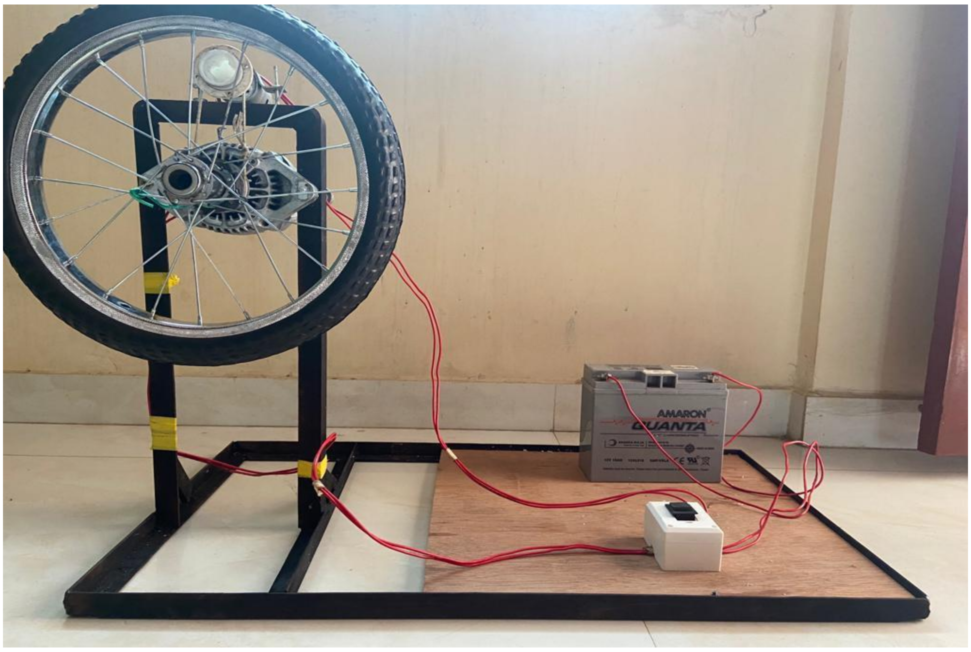

Fig -1: Working Model of Electro-magnetic Braking System

IV. WORKING

Magnetic brakes are electrically powered yet mechanically transmit torque. They are frequently referred to as electro-mechanical brakes for this reason. Due to their actuation technique, electromagnetic brakes have come to be known as such throughout time. The variety of brake designs and uses has greatly increased, yet the fundamental principle of braking has not changed. Approximately 80% of all brake applications used in facilities are single face electromagnetic brakes. The magnetic flux generated by the electromagnet when it is powered by the AC source is used to power the braking system.

When the magnetic is not activated, the disc rotates freely and accelerates uniformly when the shaft is attached to a weight. The energy absorbed appears as heating of the disc when the electromagnet is energized because magnetic flux is produced, applying brake by delaying the rotation of the disc. Therefore, the stopping torque is delivered into the sector housing and the machine frame when the armature is interested in the sector, slowing the load. By using pulleys attached to the shaft, the AC motor causes the disc to rotate through it. The ultrasonic sensor is located in front of the braking system's frame. This ultrasonic sensor emits ultrasonic waves at a certain frequency that are unable to detect surrounding objects. The braking system is activated and the brakes are immediately applied when an item is detected within the frame's range of 5 to 10 meters

V. FUTURE SCOPE

There are many new technologies entering the planet. They have numerous consequences. The introduction of technologies gave the majority of industries new faces. One of them is the automobile sector. The global vehicle sector is booming. As a result, much research is also being done here. Brakes, a crucial component of an automobile, have also undergone advancements. One of them is the electromagnetic brake. This improved braking system aids in efficient stopping as well as accident avoidance and minimally increasing accident frequency. Additionally, electromagnetic brakes eliminate the risk that might result from using brakes for an extended period of time beyond their capacity to disperse heat.

VI. CONCLUSION

Vehicles with electromagnetic brakes, such as bicycles and autos, have an efficient braking system. Additionally, we can lengthen the lifespan of the braking system by using these electromagnetic brakes. Eddy current is induced in the revolving wheel or rotor when the electromagnetic flux passes through and is perpendicular to the wheel, according to the system's operating principle. This eddy current moves in the opposite direction from the rotating wheel. The rotating wheel or rotor is intended to be stopped by the eddy current. The whirling wheel or rotor eventually comes to a stop as a result. When compared to alternative braking systems, electromagnetic brakes are shown to be more dependable. Even a little leak in an oil or air braking system might cause the brakes to completely fail. Even if one of the four-disc plates, coils, and firing circuits on each wheel fail in the electromagnetic braking system, the remaining three coils continue to function as intended. Furthermore, this system requires extremely little upkeep. Additionally, it is discovered that 80% of all power applied braking applications use electromagnetic brakes. On heavy vehicles, electromagnetic brakes have been employed in addition to conventional friction brakes as additional equipment for retardation. Since friction brakes are less commonly used, their temperatures almost never rise. The potential "brake fade" issue might be avoided, and the brake linings would last significantly longer before needing maintenance.

REFERENCES

[1] Umang S. Modi1, Swapnil C. Bhavasar (June-2015) Current trends in Electromagnetic Braking System.

[2] Sagar Wagh, Aditya Mahakode, Abhishek Mehta and Vaneela Pyla (June- 2017) have done research work Electromagnetic Braking System in Automobile.

[3] Potapov L.A., Fedyaeva G.A., Smorudova T.V. (2016) have done research work on Modeling Electromagnetic Processes in Electromagnetic Brakes and Slip Clutcheswith Hollow Ferromagnetic Rotors.

[4] G.L. Anantha Krishna1, K.M. Sathish Kumar (2018) have done research work on Experimental Investigation of Influence of Various Parameters on Permanent Magnet Eddy Current Braking System.

[5] Yusuf Yasaa, Eyyup Sincarb, BarisTugrul ,Ertugrulb, Erkan Mese (July 2016) have done research work on Amultidisciplinary design approach for electromagnetic brakes.

[6] Sudarshan T A, Sefeej, Swathin, Nikith T (June 2018) have done research on design and fabrication of Electromagnetics Bending Machine.

[7] Purohit Harish Laljibhai, Thakor Divyang Javansinh, Vnkar Dipak Dahyabhai, Prajapati Jaimin Rameshbhai(2018) have worked on Electromagnetic Braking System.

[8] Design Data Book by V.B. Bhandari.

[9] Braking System-Wikipedia.