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Design and Development of Electromagnetic Braking System

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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.[8-9] As per the driver's requirement a proportionate torque is developed to decelerate the vehicle.

KEYWORDS: Electromagnetic brake, electromagnetic induction, Friction brakes, microcontroller, Arduino

I. INTRODUCTION

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

II. COMPONENT DETAILS

Electromagnetic brake slows down an object through force created by an electromagnetic induction, which acts as a resistance to motion of the vehicle. This type of brake applies pressure on two distinct objects to gradually slow the vehicle in a uniform manner. The current study involves the fabrication of electromagnetic brake which acts as an effective decelerator for the vehicle.

Components Used:

1. Alternate Current Motor
2. Resistance type current regulator ,,
3. V‟ Belt
4. Wheel
5. Metal Disc
6. Electromagnet
7. Vertical holding column
8. Control Switch
9. Fasteners

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1. Ac Motor: The rotary motion of the wheel is given by the AC motor. The electric motor converts electric energy into mechanical energy by electromagnetic induction. The motor been used here is the typical grinder motor.
2. Regulator: The regulater was used inorder to controll the speed of the electric motor. The speed is controlled by changing the frequency of the electric supply to the motor. The frequency can be adjusted to match the need of the process. The higher the frequency of the output voltage is, the higher the speed of thr motor, and thus, the output of the process. Here the capacity of the regulator are 220V±10% in voltage, 50HZ in frequency and 400watt is usedAbbreviations and Acronyms
3. Belt: A belt is made up of a polymer material used to transmit power between two or more rotary shafts, mostly parallel in arrangement. Belts may be used to transmit power effectively. Belts are fitted over grooves in pulleys and also may have twists between pulleys, and the shafts need not to be parallel in all conditions. Flat belt, vee-belt, round belt is the some important types of belts. Here the vee-belt has been looped over the driving motor and the driven wheel.
4. Pulley: The pulley has been used to mound the metal disc along with it. It provides the rotary motion from motor to the disc by the use of V-belt. Here we used a typical pulley has six arms. The material of the pulley is used as hardened plastic
5. Vertical Column: Vertical is been need to provide the support to pulley. It has base surface of 80mm×130mm and a vertical beam of 80mm×240mm is welded as „L" shape with the base. A hole is drilled on the vertical column which located 81mm from the top with the diameter (10mm) of the shaft of the pulley. A hub is welded at 70mm from the top of the vertical column. The hub has the inner diameter 10mm and the outer diameter 23mm. The base has three holes for bolts with the diameter of 7mm. Material used for this setup is cast iron plate of 5mm thickness. Gas welding is used for the welding joints.
6. Metal Disc: The metal disc is one of the important component been used here. It is made up of cast iron plate of 2 mm thickness. The reason for using cast iron plate is that the plate is to be magnetic material. The diameter of the disc is 255 mm and has a hole of 90 mm in diameter in order to reduce the weight. There four holes are drilled for 4 mm screw.
7. Electromagnet: Electromagnet is the device which gets magnetized when the current is feed into it. Here the electromagnet is designed by modified a typical transformer. The transformes has doube side „E" shape outer core around the inner core. This outside „E" shape core of the transformer is removed and then arranged as single side. Now it is act as an electromagnet.
8. Switch And Wires: ON/OFF switch used to control the power supply to the electromagnet. It is connected with the electromagnet. A typical common electric switch is used here. When the rotation of the pulley is to be stop, the braking is applied by turned the switch on. When the free rotation of the pulley is required the switch is turned off. To provide the electric supply to the motor and the electromagnet the electric wire is used here. The copper wire has been used here since it has the better electrical conductivity.
9. Bolts and Nuts: To join the motor, electromagnet, vertical column with the wooden base and to joint the metal disc with the pulley the bolts and nuts are used. The 7mm bolts and the 13mm nuts are used for the joints with the wooden base. The 4mm bolts and the 8mm nuts are used for the joint of disc with pulley.

III. CONSTRUCTION DETAILS

The construction of the system is done by the following manner. The system consists of a vertical column. The pulley is mounted at the top of the vertical column. This setup is fitted on a wooden board which is act as a base. On the other end of the base, the motor is fitted with the help of bolts. The driving wheel pulley (motor) and the driven wheel pulley are looped by a typical v-belt. A metallic disc is mounted with the front of the driven pulley. An electromagnet is fitted in the front of the metallic disc which is fitted with driven pulley. The important thing is that the electromagnet is to be fitted with the smallest clearance with the metallic disc. The ON/OFF switch and the regulator are connected with the electromagnet and the motor respectively with the help of the electric wires to controll the current supply to them.

IV. WORKING METHDOLOGY

The basic work of an electromagnetic brake is to reduce speed of the vehicle using electromagnetic force to induce a mechanical frictional resistance within the wheels. These kinds of brakes operate through an electric actuation, but transmit torque mechanically.

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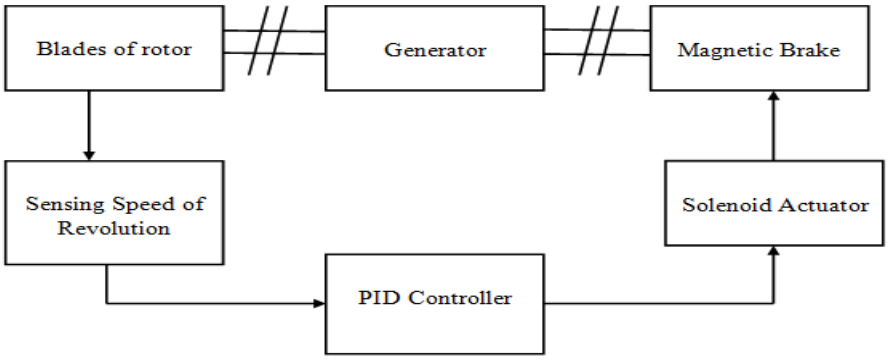

Fig 1: Methodology of proposed scheme

Working Methodology:

When the power supply is given the motor, the pulley is driven by the belt. Now the pulley is continously 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 discs 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.

V. RESULTS

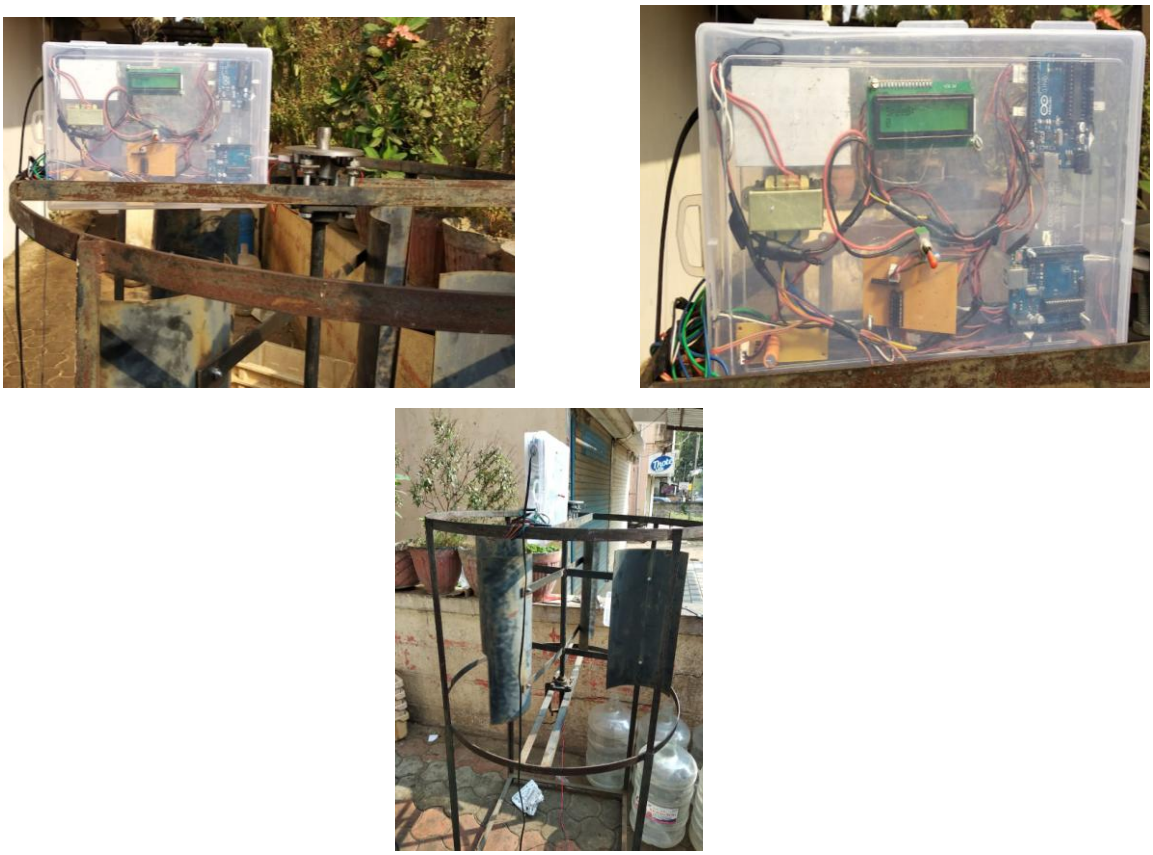

Fig 2: Structure of proposed scheme & Results displaying on display

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The Fig. 2 shows the results that are obtained after implementing electromagnetic braking system for the wind turbine. The speed of rotation of turbine is indicated on the display. In this proposed scheme efficient braking is obtained.

Advantages

- No friction.
- Low maintains requirement
- Less noise.
- Simple in design.
- High degree of safety.

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VI. FUTURE SCOPE

1. With very efficient and practical approach.
2. House owner would be capable for extraction of free and clean energy
3. Electromagnetic brakes satisfy all the energy requirements of braking without the use of friction. They have better heat dissipation capability to avoid problems that friction brakes faces times.
4. These brakes' component cost is less so these brakes are cheap.

VII. 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.

REFERENCES

[1]. 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.6
[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 Mahakode, 3Abhishek Mehta and 4Vaneela Pyla (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. Orthuvein (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.
[9]. Vinodkumar. Vinodkumar.S1, Sujay jairaman2, Anvesh.P3, Viswanath.G4 improvement of braking efficiency in vehicle by using fusion braking system, International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 08,pp.527-529.
[10]. S.Sheeba Rani, R.Maheswari, V.Gomathy and P.Sharmila "Iot driven vehicle license plate extraction approach" in International Journal of Engineering and Technology(IJET) , Volume.7, pp 457-459, April 2018
[11]. S.Sheeba Rani, V.Gomathy and R.Geethamani, "Embedded design in synchronisation of alternator automation" in International Journal of Engineering and Technology(IJET) , Volume No.7, pp 460-463, April