Fabriction of Regenerative Braking System

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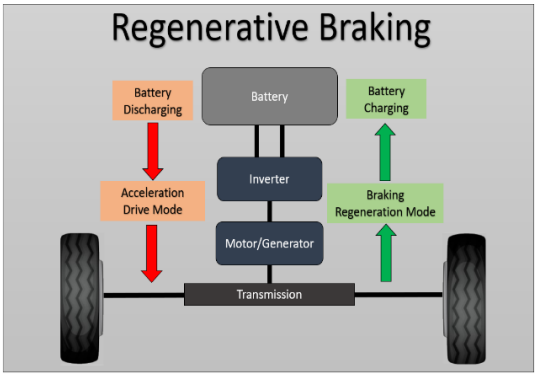
***Abstract*— Regenerative braking system is the system in which the kinetic energy of the vehicle is stored temporarily; during deceleration and is reused as kinetic energy. Regenerative braking is a step to reduce the use of fossil fuels. While braking, a large amount of energy is lost in the form of heat. A regenerative braking system aims to utilize this energy instead of getting it wasted. In this mechanism, the electric traction motor uses the vehicle's momentum to recover energy lost while braking. This contrasts with the conventional braking system, where the excess kinetic energy gets converted to unwanted heat and is wasted due to friction in the brakes, or with dynamic brakes. In most of the regenerative braking systems the energy is recovered by using electric motors as generators.**

Keywords: **Regenerative braking system, electric motors.**

INTRODUCTION

Regenerative braking is not industry specific, but can be difficult to implement cost effectively. In most applications heavy loads must be stopped and started frequently. The action of starting and stopping is controlled to limit power required. In this project we decided to work on all the above factors of the regenerative braking system and we are attempting to sort it out effectively.

Brakes are employed to stop or retard the motion of any moving body. In an automobile, brakes are equally important as the engine. In a conventional braking system, the motion is retarded or stopped by absorbing kinetic energy by friction; by making the contact of the moving body with a frictional rubber pad (called brake liner) which causes the absorption of kinetic energy. This energy dissipates as heat into surroundings. Each time brakes are applied, the momentum gets absorbed to re-accelerate, the vehicle has to start from scratch, redeveloping it using power from the engine. Thus, it will ultimately result in the wastage of energy. A regenerative brake is an energy recovery mechanism that slows a vehicle by converting its kinetic energy into another form, which is used immediately or stored until needed. Thus, the generated energy during the braking is sent back into the supply system (in the case of electric trains), whereas, in battery electric and hybrid electric vehicles, the energy is stored in a battery or bank of capacitors for later use. Energy can also be stored by compressing air or in a rotating flywheel.



A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion. Most often accomplished by means of friction. Regenerative braking is an energy recovery mechanism that slows the object or vehicle by converting its kinetic energy into a form that can be either used immediately or stored until needed. In this project we are applying this concept to one wheel which is rotating. Its mechanical rotary energy is converted into electrical energy. This electrical energy can be stored and utilized in critical situations or to run the internal components present in the vehicle.

LITERATURE REVIEW

Sayed Nashit, Sufiyan Adhikari, Shaikh Farhan, Srivastava Avinash and Amruta Gambhire, 'Design, Fabrication and Testing of Regenerative Braking Test Rig for BLDC Motor', 2016, 1881-84. In this paper a test bench for testing of regenerative braking capability of a Brushless DC Motor is design and then fabricated. The project creates awareness to engineers towards energy efficiency and energy conservation. It concludes that the regenerative

braking systems are more efficient at higher speed and it cannot be used as the only brakes in a vehicle. The definite use of this technology described as in the project in the future automobiles can help us to a certain level to sustainable and bright future of energy efficient world as a part of power that is lost can be regained by using the regenerative braking system.

Tushar L. Patil, Rohit S. Yadav, Abhishek D. are, Mahesh Saggam, Ankul Pratap, 'Performance Improvement of Regenerative braking system', International Journal of Scientific & Engineering Research Volume 9, Issue 5, (2018). 2229-5518. In this paper the techniques to increase the efficiency of the regenerative braking system is mentioned. The technique mentioned was to reduce the weight of the automobile which increase performance, using super capacitor also improves the conversion rate of energy in regenerative braking system, making the automobile compact also tends to increase the efficiency of the system.

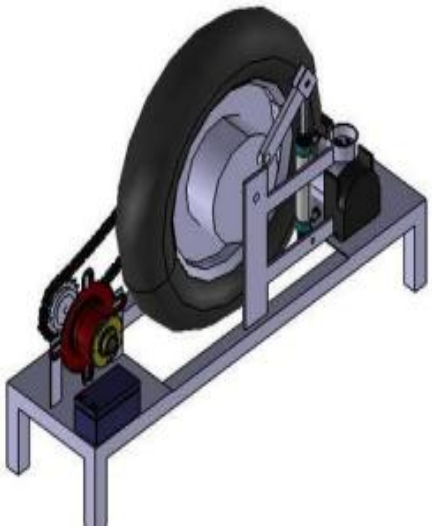
C. Jagadeesh Vikram, D. Mohan Kumar, Dr. P. Naveen Chandra, 'Fabrication of Regenerative Braking System', International Journal of Pure and Applied Mathematics Volume 119, (2018). 9973-9982. In this paper the Fabrication process on the Regenerative Braking System had been implemented as per the prescribed measures has been taken and the future enhancements should be processed on basis of the need of the study. The Implementation of the regenerative braking system be quite essential in automotive transportation with maximized performance in braking.

A. Eswaran, S Ajith, V Karthikeyan, P Kavin, S Loganandh, 'Design and Fabrication of Regenerative Braking System', International Journal of Advance Research and Innovative Ideas in Education-Vol-4 Issue-3 (2018). 2395-4396.

METHODOLOGY

Regenerative braking system is used in vehicles to convert the kinetic energy generated during braking into electrical energy, which can then be used to recharge batteries or power other electrical systems in the vehicle. The materials and methodology used in this system typically involve the following components: Electric motor/generator: A key component of the regenerative braking system is an electric motor/generator that is able to convert the kinetic energy generated during braking into electrical energy. This motor/generator is typically made of materials such as copper, steel, and various alloys. The electrical energy generated during braking is stored in a battery, which is typically made of materials such as lithium ion, nickel-metal hydride, or lead-acid. Power electronics: The electrical energy generated by the motor/generator is converted and controlled by power electronics, which typically include materials such as silicon, gallium arsenide, and various other semiconductors. The regenerative braking system works in conjunction with the conventional hydraulic or mechanical braking system of the vehicle.

When the driver applies the brakes, the regenerative braking system will capture the kinetic energy generated during braking, and the conventional braking system provides additional stopping power as needed. The methodology for implementing a regenerative braking system typically involves designing and integrating the various components mentioned above into the vehicle's existing electrical and mechanical systems. Overall, regenerative braking systems represent an important technology for increasing the energy efficiency of vehicles and reducing their carbon footprint, and continue to be an active area of research and development in the automotive industry.



Construction

The motor or generator is typically integrated into the vehicle's drivetrain, and is used to convert the vehicle's kinetic energy into electrical energy during braking The energy is then stored in a battery or other energy storage device, which can be used to power the vehicle's electrical systems or assist the vehicle's acceleration. The power electronics module is used to control the flow of energy between the motor or

generator and the battery, and to convert the electrical energy into a form that can be stored in the battery. The braking control system is used to determine when the vehicle is braking, and to control the regenerative braking system to capture and store energy.

COMOPONENTS

- Square tube
- ¼ hp motor
- pulley
- belt
- dc motor
- dynamo wheel
- battery
- dynamo
- multi meter

WORKING PRINCIPLE

Regenerative braking is a braking method that utilizes the mechanical energy from the motor by converting kinetic energy into electrical energy and fed back it the produced energy into the battery source. Theoretically, the regenerative braking system can convert a good amount of its kinetic energy to charge up the battery used for other electrical purposes in the vehicle using the same principle as an alternator. In regenerative braking mode, it uses the motor to slow down the car. When the driver applies force to the brake pedal, then the electric motor works in reverse direction thus, slowing it. In the Figure 4 Normal forward driving Figure 5: Regenerative action during braking The figure .4 shows the car in normal running condition where the motor is producing torque by taking energy from the battery. While running backwards, the motor acts as a generator and recharges the batteries

FABRICATION

The main objective of our paper is to design and implement a regenerative braking system that helps to regenerate the amount of energy wasted during braking with the help of generator that energy is stored back in the battery which can be used for further driving. Our goal is to design and implement a regenerative braking system that will handle the task described for the testing the model is made; it is made of the following parts. A new model of regenerative braking in EV is presented in this paper. The modelling of every component is presented with their corresponding parameters The construction of the RBS involves D.C. Motor and Generator, Brake wheel, Battery, LED, Electrical wires, Wood Screws, Clamps. By using all the parts, the model of regenerative braking system is produced. First the wooden plank is cut to the required dimensions for plank and stands. Wooden pieces of the required size are cut for the stand and the spindle. The main motor is fixed with the stand using a clamp and screws. The braking motor is attached to the spindle using a clamp and screws the main stand is fixed with the base and a spindle stand is fixed to the base. The spindle is attached to the spindle stand. LEDs are connected to the braking motor with the wires. The main motor is supported by an additional spindle. The brake wheel is attached to the motors. The DC generator is an electrical machine whose main function is to convert mechanical energy into electricity. One of the two motors is used as the main motor. This is connected to the gear using a spindle shaft.

The motor's tip is connected to a gear which can be meshed with the braking gear. It has a capacity of 12v. One of the brake wheels (gears) is connected to the main motor. It is in continuous motion along with the wheel of the vehicle. The battery is used to run the motor, then the wheel will start rotates. The battery specifications are 12volts 1.5 Amps. It can store the energy and generate the energy when required. These are used in order to show the power generated from the regenerative brakes. Wood for making the frame for the system. The wood is used to make the needed frame. After the assembly of all the parts the motor will be started running with the help of the battery. The battery will produce 12v ,1.5 amps. while the brake pedal is pressed against the wheel the motor is acts as the generator and produces the energy and it will be stored in battery or used for light, electrical parts in the vehicles.

RESULTS

Regenerative braking has a similar energy equation to the equation for the mechanical flywheel. Regenerative braking is a two-step process involving the motor/generator and the battery. The initial kinetic energy is transformed into electrical energy by the generator and is then converted into chemical energy by the battery. This process is less efficient than the flywheel. The efficiency of the generator can be represented by:

η gen = $Wout/Win$ where

• Win is the work in the generator.
•Wout is the work produced by the generator. The only work into the generator is the initial kinetic energy of the car and the only work produced by the generator is the electrical energy. Rearranging this equation to solve for the power produced by the generator gives this equation:
P gen = $\eta genmv$ 2/ 2Δt
• Δt is the amount of time the car brakes = 5.
• m is the mass of the car. = 1.5KG x 9.81 =14.7N
v is the initial velocity of the car just before braking = 0.844 m/s
• η gen efficiency of generator
• η batt efficiency of battery
The efficiency of the battery can be described as:
η batt = $Pout$ /Pin where
P in = P gen
P out = $Wout$ Δt
The work out of the battery represents the amount of energy produced by the regenerative brakes.

Trail
At 500 rpm .
The efficiency of the generator can be represented by :
η gen = $Wout$/ Win
W in = RCF = RPM^2 x 1.118x10^-5xr
= 500^2 x 1.118x10^-5 x 40
=11180 N-M
W out = 460^2x1.118x10^-5x40 .
= 9462.75N-M
η gen =84%
the power produced by the generator gives this equation:
Pgen = ηgen x mv^ 2/ 2Δt
= 84x14.7x0.84^2/(2x5)
=1.2kw
ηbatt = $Pout$ /Pin where
Pin = Pgen
• Pout = $Wout$ Δt
Pin = 1.2kw
Pout =0.9kw
η_{batt} = 0.9/1.2 = 75%

CONCLUSION

The Fabrication process on the Regenerative Braking System had been implemented as per the prescribed measures been taken and the future enhancements should be processed on basis of the need of the study. The Implementation of the regenerative braking system be quite essential in automotive transportation with maximized performance in braking

REFERENCES

[1] Ranjan Kumar ,Department of Mechanical Engineering, Indian School Of Mines, Dhanbad, “Regenerative Brake: To Harness the Kinetic Energy of Braking” Volume 2, Issue 1 ,ISSN23495162,pp 2132-22178, ,January 2015.
[2] KEC Ghaziabad ‘‘Regenerative braking for an electric vehicle using hybrid energy storage system. In: International journal of electrical and electronics engineering research(IJEEEK), volume 3, issue 4, ISSN 2090-4479, page number 42-45. Oct 2013.
[3] S. Moura, D. Callaway, H. Fathy, J. Stein. Trade offs between battery energy capacity and stochastic optimal power management in plug14 in hybrid electric vehicles. Journal of Power Sources, Volume 2, ISSN 2979-2988, pp 195, 2010.
[4] P. J. Grbovic, P. Delarue, P. Le Moigne, and P Bartholomeus, “A bidirectional three-level dc-dc converter for the ultra-capacitor applications”, IEEE Trans. Ind. Electron., volume 57, no. 10, ISSN 2278-8875, pp. 415–3430, Oct. 2010.
[5] Pulkit gupta ,anchal kumar , Sandeep deb, shayan –“REGENERATIVE BRAKING SYSTEMS” International Journal of Mechanical And Production Engineering, Volume- 2, Issue-5, ISSN: 23202092 ,May-2014.