JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Regenerative Braking System

Authors: Himanshu ojha[1], Rajendra kumar[2], Sagar Yadav[3], Rajeev Kumar[4]
Guide: Mr. Rahul Kumar
College: IIMT College of Polytechnic, Greater Noida

Abstract: Regenerative braking system is the system in which the kinetic energy of the vehicle is stored temporarily; during retardation and is reused as kinetic energy. Regenerative retardation is a step to reduce the use of fossil energies. While retardation a large quantum of energy is lost in the form of heat. A regenerative retardation system aims to use this energy rather of getting it wasted.

In this medium, the electric traction motor uses the vehicle's instigation to recover energy lost while retardation. This contrasts with the conventional retardation system, where the redundant kinetic energy gets converted to unwanted heat and is wasted due to disunion in the thickets, or with dynamic thickets. In utmost of the regenerative braking systems the energy is recovered by using electric motors as generator.

Key words: Regenerative, Braking, Kinetic Energy, regenerative retardation

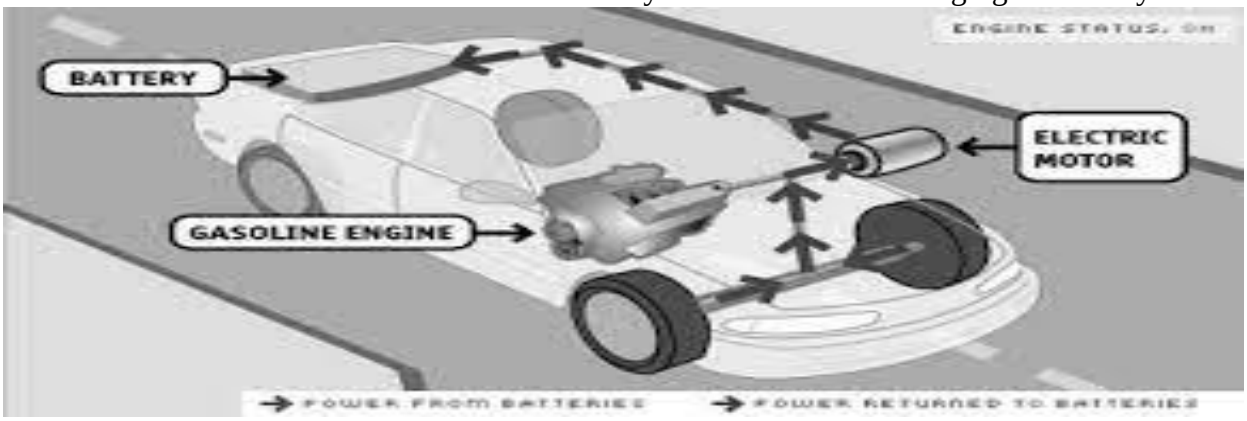
INTRODUCTION:

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. The term 'Braking' in a moving vehicle means the application of the brakes to reduce its speed or stop its movement, usually by depressing a pedal. The braking distance is the distance between the time the brakes are applied and the time the vehicle comes to a complete stop. In braking systems on conventional vehicles, friction is used to counteract the forward momentum of a moving vehicle. As the brake pads rub against the wheels or a disc that is connected to the axles, excessive heat energy is created. This heat energy dissipates into the air, wasting almost 30% of the vehicles generated power. Over time, this cycle of circle of friction and wasted heat energy reduces the vehicles fuel efficiency.
That energy, which could have been used to do work, is essentially wasted. The solution for this kind of this problem is Regenerative Braking System. This is a new type of braking system that can recollect much of the car & kinetic energy and convert it into electrical energy or mechanical energy. The energy so produced can then be stored as mechanical energy in flywheels, or as, electrical energy in the automobile battery, which can be used again.

CONVERSION OF KINETIC ENERGY TO ELECTRICAL ENERGY USING MOTOR:

The most common form of regenerative brake involves using an electric motor as an electric generator. The working of the regenerative braking system depends upon the working principle of an electric motor, which is the important component of the system. Electric motor gets activated when some electric current is passed through it. But, when some external force is applied to activate the motor (during the braking), then it behaves as a generator and generates electricity. This means that whenever motor runs in one direction, the electric energy gets converted into mechanical energy, which is then used to accelerate the vehicle and whenever the motor runs in opposite direction, it performs functions of a generator, which then converts mechanical energy into electrical energy, which makes it possible to utilize the rotational force of the driving axle to turn the electric motors, which results in

regenerating electric energy for storage in the battery and simultaneously reducing the speed of the car with the regenerative resistance of the electric motors. This electricity is then used for recharging the battery.



Regenerative Braking System

Types of Regenerative Braking System : This system uses springs, flywheels, electromagnetic, and hydraulic processes to convert energy. A Regenerative Braking System with a cross-over electromagnetic-flywheel has just evolved. As a result, the shifting efficiency and applications for every kind of Regenerative Braking System are different. Each type makes use of an alternative energy change or capacity method.

1. Electromagnetic
2. Flywheel
3. Electromagnetic flywheel

1.Electromagnetic: In an electromagnetic framework, the vehicle's drive shaft is connected to an electric generator that utilizes an attractive field to confine the turn of the drive shaft, easing back the vehicle and making power. By virtue of electric and hybrid vehicles, the power created is delivered off the batteries, giving them charge. In inward ignition vehicles, the power can be used to control the vehicles equipment or delivered off a battery that may hence be utilized to help the vehicle's power yield. This technique is presently being utilized in a few Le Mans Prototype hustling vehicles.

2. Flywheel: Flywheel Regenerative Braking System utilizes a transmission and gearbox to revolve a flywheel connected to the drive shaft for braking purposes. The spinning flywheel may then exert force on the vehicle's drive shaft, providing it with a source of power.

3. Electromagnetic flywheel: The electro flywheel regenerative brake is a half and half of electromagnetic and flywheel Regenerative Braking Systems. The electromagnetic structure is shown the fundamental standards of the power period, however the energy is put away in a flywheel instead of batteries. The flywheel might be considered a mechanical battery that stores and deliveries electrical energy. Electric flywheel Regenerative Braking System is a more financially savvy power limit method since flywheel batteries have a more extended life expectancy than lithium-molecule batteries.

REGENERATIVE BRAKING EFFICIENCY:

The energy efficiency of a conventional car is only about 20-30 percent, with the remaining 80-70 percent of its energy being converted to heat through friction. The miraculous thing about regenerative braking is that it may be able to capture as much as half of that wasted energy and put it back to work. This could reduce fuel consumption by 15 to 20 percent.

In a century that may see the end of the vast fossil fuel reserves that have provided us with energy for automotive and other technologies for many years, and in which fears about carbon emissions are coming to a peak, this added efficiency is becoming increasingly important.

ADVANTAGES OF REGENERATIVE BRAKING:

1. Improved Fuel Economy.
2. Reduction in Brake and Engine Wear Reducing cost of replacement of brake linings, cost of labor to install them, and vehicle down time.
3. Emissions reduction- engine emissions reduced by engine decoupling, reducing total engine revolutions and total time of engine operation.
4. Operating range is comparable with conventional vehicles- a problem not yet overcome by electric vehicles.

Discussion: As the markets for hybrid, electric, and conventionally driven cars with high efficiency and low emissions expand, so too does the rate of development of regenerative braking systems. Battery-electric vehicles (BEVs) now face two major hurdles in the market: their high cost (especially for the battery packs) and their restricted range. Cost reduction, increased vehicle range, and compliance with more stringent safety and emissions regulations will be major future hurdles for system development. Advanced systems that not only stop the car but also collect braking energy will need to have the brake regulation applied to them. This will be necessary.
Summary: present, "original" regenerative braking methods don't give a second thought to safety. The tests did on one such structure, fitted to a mutt vehicle, raised no security issues. An important factor in determining the strength of a regenerative stopping mechanism may be the capacity of a battery or other energy storage device/framework, that is all there is to it capacity to rapidly change over the dynamic energy of the vehicle into its put away structure.
Essential mechanical designing theory proposes for current frameworks, which can work at exceptionally low power levels (< 30KW, say), the regenerative slowing down part is likely going to be very little, particularly at high speeds. Such frameworks in this way need a significant extra wellspring of slowing down force for medium-high deceleration prevents from such velocities, for example a regular friction braking framework.

Conclusion:

1. It is able to energy while braking which is its primary objective.
2. Stored energy can be used when required.
3. It is compact and easy to install.
4. It should provide adequate stopping/braking force to the vehicle.
5. When used in conjunction with conventional braking systems, it should easily switch as per requirement.
6. Its design should be flexible so that it can cater to the needs of a wide variety of vehicles.

REFERENCES:

1. Allen E. Fuhs, Hybrid Vehicles – The future of personal transportation
2. Mehrdad Ehsani,Yimin Gao and Sebastien E. Gay., Modern Electric, Hybrid Electric, and Fuel Cell Vehicles
3. Chibulka.J,“Kinetic Energy Recovery System by means of Flywheel Energy Storage”, Advanced Engineering, Vol. 3,
4. Ranjan Kumar ,Department of Mechanical Engineering, Indian School Of Mines, Dhanbad, “Regenerative Brake: To Harness the Kinetic Energy of Braking” JETIR (ISSN-2349-5162) January 2015, Volume 2, Issue 1
5. http://energyeducation.ca/encyclopedia/Regenerat ive_braking
6. https://www.tesla.com/blog/magic-tesla-roadsterregenerative-braking