Regenerative Braking For Greener Future

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Abstract- There is an increase in pollution and depletion of resources. It is necessary to conserve resources and energy for future generation. As the basic law of Physics says, 'Energy can neither be created nor be destroyed, it can only be converted from one form to another' and this is made possible in automotive by regenerative braking technology. Whenever a driver applies brakes on a car, a small part of kinetic energy is generated but this kinetic energy developed is of no use and it simply gets dissipated in form of heat which could have been used to do work, is essentially wasted but in order to make use of this generated kinetic energy from brakes regenerative braking came into existence. This utilization of kinetic energy can be useful for conservation of maximum electric charge from battery and plays an important role in conservation of energy in automobiles.

Keywords – Braking systems, Regen-braking, Kinetic energy, Conservation of energy, Electric cars.

I. INTRODUCTION

Generally while driving, it is impossible to drive without hitting brakes. Driver uses brakes either to stop or slow down the movement of a car by using brake pedals. When driver uses brakes there is a friction between wheels and brake pads due to which kinetic energy is generated but this generated kinetic energy gets disappeared in airstream and energy gets wasted, again to develop the momentum of the vehicle more energy gets wasted.

So in order to stop this wastage of energy a beneficial technology known as regenerative braking is used. Regenerative braking not only save the energy from getting wasted but also increases the efficiency of the vehicle, nowadays as the use of vehicles are increased braking events takes place generally but this method can save the energy loss during brakes which can be beneficial in economy. This technology of regenerative braking controls the speed of the vehicle by converting a portion of the vehicle's kinetic energy into another useful form of energy. In short it can be said that regenerative braking can convert generated kinetic energy into electric energy and this is can be made possible by sing electric motor and it can also convert mechanical energy into kinetic energy by using flywheel. Regenerative braking can store the kinetic energy of the vehicle in a short storage system and can be used as acceleration but the effect of regenerative braking is not efficient in lower speeds as compared to higher speed vehicles the portion of energy storage varies according to the vehicle inertia weight, energy storage system, drive train efficiency.

II. DIAGRAM AND WORKING

The block diagram of regenerative braking is given as follows:

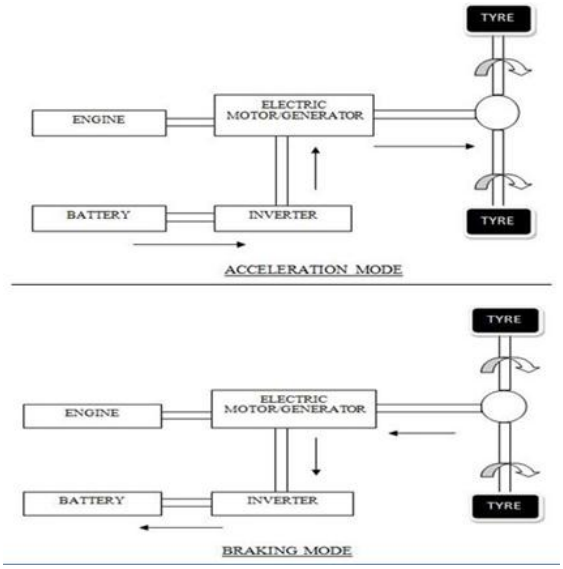

Fig no 1. Block Diagram Of Regenerative Braking

Regenerative braking is one of the most important and biggest properties of the electric motor when it's run in one direction, it converts electrical energy into mechanical energy that can be used to perform work such as turning the wheels of a car. In this breaking method as the vehicle stops the vehicle will remain in the still motion but the motor is run in the opposite direction, a properly designed motor becomes an electric generator converting mechanical energy into electrical energy. The most common form of regenerative brake involves using an electric motor as an electric generator.

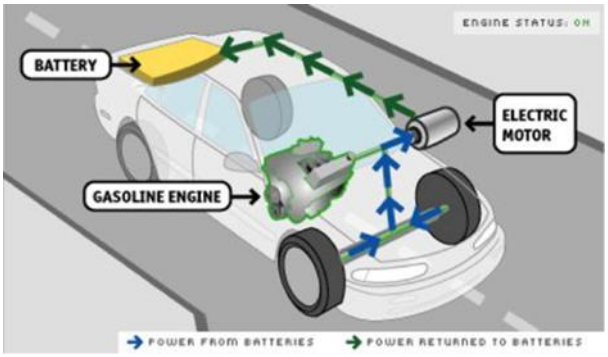

Fig 2. Energy Flow Diagram Of Regenerative Braking

This above diagram shows that whenever motor runs in one direction, the kinetic 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 slowing the car with the regenerative resistance of the electric motors . This electricity is then used for recharging the battery.

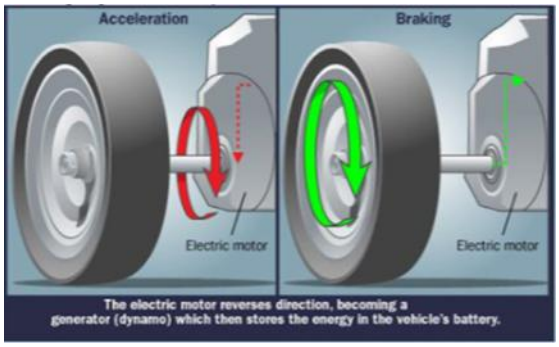

Fig 3. Operation Of Electric Motor

III. CONVERSION OF ENERGY

Conversion of energy from Kinetic to Mechanical is done by using Flywheel Energy Storage. A flywheel is a type of energy storage system which is used to store mechanical energy and then release the stored energy when needed for acceleration. In this energy storage system, the energy is given directly to the vehicle rather than storing it in the battery because of which it boosts the acceleration of vehicle and it avoids the conversion of energy. As, during the recharging of battery, mechanical energy is converted into electrical energy and during discharging electrical energy is converted into mechanical energy which leads to transmission loss and reduction in efficiency. Meanwhile in other cases there is no loss of energy as the mechanical energy stored in the flywheel is directly transferred to the vehicle in its original form. This application in one of the best example of regenerative braking as it is used in KERS system in F1 cars.

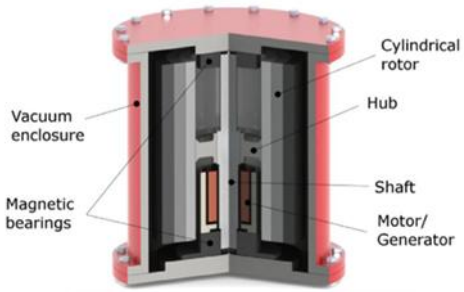

Fig.4: The main components of a typical flywheel.

Regenerative braking system can be implemented in elevator systems. When the elevator decelerates, conventional braking technique is used. A considerable amount of energy is released which can be used for other minimal applications. By using regen-braking, this energy can be stored and used for the electrical equipments in the elevator such as fan, lights.

IV. NEED FOR REGENERATIVE BRAKING

To become a success, Regen-Braking should ideally have the following characteristics:
•Efficient energy conversion.
•An energy store with a high capacity per unit weight and volume.
•A high power rating so large amounts of energy can flow in a short space of time.
•No requirement over complicated control systems to link it with the vehicle transmission.
•Smooth delivery of power from the regenerative system.
•A wide range of road speeds and wheel torques.

V. APPLICATION

•For recovering Kinetic energy of vehicle lost during braking process.
•In a manufacturing plant that moves material from one workstation to another on a conveyer system that stops at each point.
•Regenerative braking is used in some elevator and crane hoist motors.
•Regenerative Braking Systems are also used in electric railway vehicle (London Underground & Virgin Trains).

VI. FUTURE SCOPE

As regenerative braking save up to 30% of energy new inventions can be discovered in the form of new electric motors through which more energy can be saved and installed in many vehicles which can helpful in avoidance of transmission losses, increase the efficiency and helpful in for conservation of energy for greener future.

VII. CONCLUSION

Regenerative braking conserve energy lost during conventional braking and this braking system can operate at high temperature operating range and efficient than other braking system.
Regenerative braking system has a vast scope for further development and energy savings. The use of more efficient systems could lead to huge savings in the economy of any country.

VIII. REFERENCE

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