

# Regenerative Braking System

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**Abstract**— In today’s world there are energy crises and the resources are depleting at a higher rate so there is a need of specific technology that recovers the energy, which gets usually wasted. In case of automobiles one of these useful technology is the regenerative braking system. Generally in automobiles whenever the brakes are applied the vehicle comes to a rest and the kinetic energy gets wasted due to friction in the form of kinetic energy. Using these technology in automobiles to recover the kinetic energy of the vehicle to lost due to the braking process.

**Key words:** Conventional-Braking System, Regenerative Braking, Flywheel, Brake-drum, Electric-motor, Dynamo

## I. INTRODUCTION

Kinetic energy recovery system technology funnels the friction energy created during the braking process & these energies back into the system in the form of charging the battery for further use. Most of the energy waste by the vehical is due to friction. In braking this friction is necessary to stop the vehical but most of the energy used during braking is usually wasted. In a Kinetic energy recovery system, the energy normally lost in the braking process is transferred to the generator from the the rotating shaft and then transferred to the battery, thus saving energy. By channeling the energy back into the system hybrids increase their efficiency.

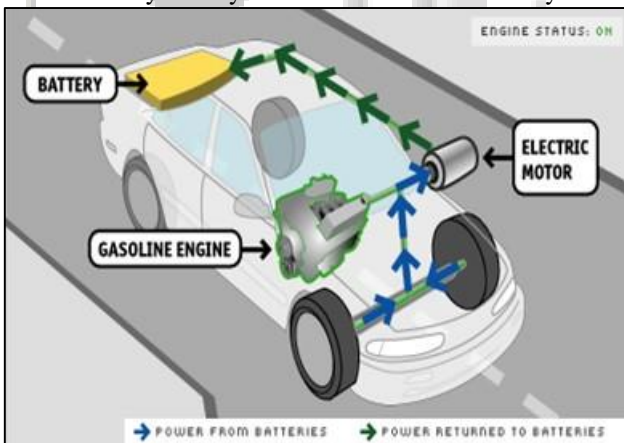


Fig.1: Basic diagram of the energy flow in a Regenerative Braking system

### A. . What Is Regenerative Braking System?:

Regenerative Braking system is used on hybrid gas/electric automobiles to recoup some of the energy lost during stopping. This energy is saved in a storage battery and used later to power the motor whenever the car is in electric mode.

Hybrid gas/electric automobiles now use a completely different method of braking at slower speeds. While hybrid cars still use conventional brake pads at highway speeds, electric motors help the car brake during stop-and-go driving. As the driver applies the brakes through a conventional pedal, the electric motors reverse direction.

The torque created by this reversal counteracts the forward momentum and eventually stops the car.

But Regenerative Braking system does more than simply stopping the car. Electric motors and electric generators (such as a car's alternator) are essentially two sides of the same technology. Both use magnetic fields and coiled wires, but in different configurations. Regenerative Braking system takes advantage of this duality. Whenever the electric motor of a hybrid car begins to reverse direction, it becomes an electric generator or dynamo. This generated electricity is fed into a chemical storage battery and used later to power the car at city speeds.

Regenerative Braking system takes energy normally wasted during braking and turns it into usable energy. Energy is still lost through friction with the road surface and other drains on the system. The energy collected during braking does not restore all the energy lost during driving. It does improve energy efficiency and assist the main alternator.

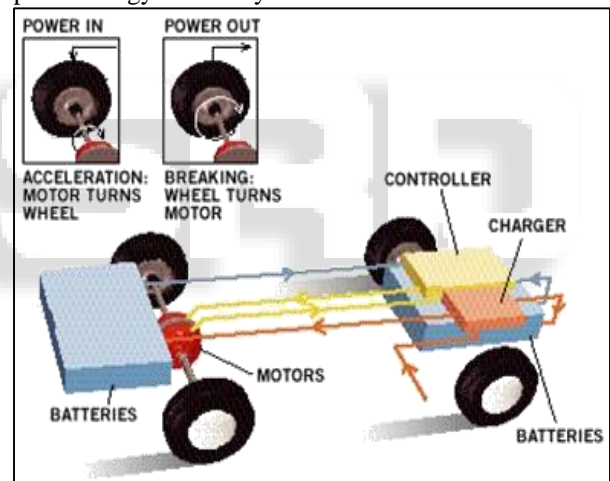


Fig. 2: Typical layout of Regenerative Braking.

This is the other technology to be employed to control vehicle speed by converting a part of its kinetic energy into another useful form of energy. The energy so produced could then be stored as electric charge in the automobile battery, or as compressed gas/air or in flywheels to be used again by the vehicle.

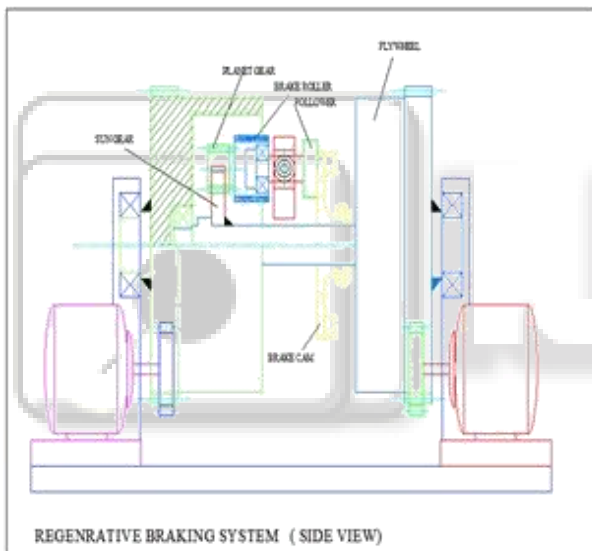
## II. CONSTRUCTION:

The system comprises of the following components

- 1) Prime mover :Prime mover is an single phase AC motor 120 watt power and speed variable from 0 to 6000 rpm.
- 2) Input spur Pinion : It is mounted on motor shaft
- 3) Input spur Gear : It is mounted on the brake drum.
- 4) Brake drum : Brake drum is mounted in ball bearing in the bearing housing.
- 5) Brake rollers : Brake rollers are metal rollers lined with friction material (feredo), mounted in ball bearings held on spring loaded pins which slide in the slotted plate. Three brake rollers are provided. Function of the brake

rollers is to apply braking force and absorb the kinetic energy and convert it in to rotational power and transmit it to the flywheel vial planetary gear set.

- 6) Planetary gear set : Planetary gear set comprises of the planet spur gears mounted on brake rollers in constant mesh with the sun gear. The central sun gear is fastened to the flywheel shaft supported in ball bearing at one end in the brake drum.
- 7) Braking Force arrangement: Braking force is applied on to the planet brake rollers by means of a plate cam and roller follower arrangement. The roller follower is mounted on the pin of brake roller where as the brake lever is connected to the brake plate cam.
- 8) Energy recovery system: The brake power available in rotary form is transmitted by the planetary gear set to the flywheel. Fly wheel stores this energy which is further transmitted to the dynamo , via spur gear ( mounted on the flywheel) and spur pinion mounted on the dynamo shaft.
- 9) Dynamo: Dynamo converts the rotational energy recovered in to DC power output which can be stored in battery for further consumption to drive various vehicle accessories.



### III. WORKING

- Start prime mover motor .... This drives the spur pinion and gear arrangement and there by the brake drum is rotated.
- When brake lever is pressed...The plate cam rotates...This drives the roller followers to move radially out in the slots provided in holder plate...This brings the brake friction rollers in contact with the brake drum...The rollers absorb the kinetic energy and start rotating at high speed...This makes the planet gear to rotate the sun gear.
- Sun gear which is fastened to the main shaft or flywheel shaft thus rotates the fly wheel ....The flywheel absorbs this sudden burst of rotational energy and keeps on rotating.
- Rotational power in the flywheel is transferred from the flywheel to the dynamo via spur gear ring mounted on flywheel and spur pinion mounted on the dynamo shaft.

- Dynamo shaft rotates to convert this rotational energy into electrical energy which can be stored in battery for further use.

### IV. ADVANTAGES

- Better fuel Economy.
- Reduced CO2 Emission.
- Approximately 30% saving in fuel Consumption.
- There is lower operating & environment cost of the vehicle due to regenerative braking system.

### V. CONCLUSION

Hence we have studied the design and manufacturing of kinetic energy recovery system after completing this project.

We also learnt that how mechanical system's designs are done as well as how to build them from theoretical to practical one. We also learnt about energy storage in flywheel and springs and the difference between the real world systems and theoretical ones.

### VI. FUTURE SCOPE

Kinetic energy recovery system can be used on hybrid gas/electric automobiles to recoup some of the energy lost during stopping. This energy is saved in a spring in the form of potential energy and used later to drive the vehicle. By this way we could save energy every time while braking so there would not be any need of the energy from the engine which would increase its fuel efficiency. And after taking a lot of vehicles into consideration there would be a lot of fuel savings as well as less pollution. So there could be advantages like

- 1) Less fuel consumption
- 2) Less pollution
- 3) After making it in mass production cost will be reduced

This system can also be used on heavy duty vehicles where momentum is so high to give enough energy recovery.

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