

REGENERATIVE BRAKING SYSTEM IN AUTOMOBILES

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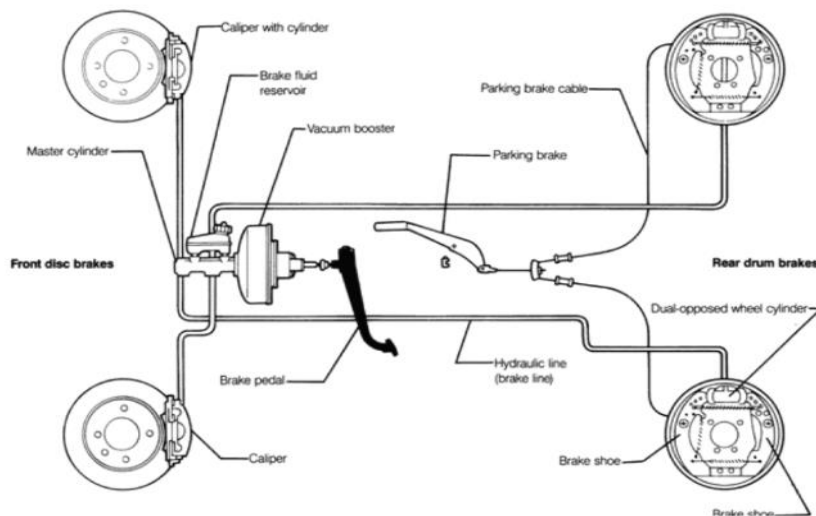
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Abstract:- World today is heading towards the brink of energy crisis. So the need of hour is to save as much energy as possible. In automobiles a lot of energy is lost due to braking in forms of heat due to friction between brake pad and the disc. This paper talks about a regenerative circuit which slows down the vehicle while braking but without energy being lost as heat between disc & pads as well as road & tyres. Further this energy is reused later to power the vehicle in electrical or mechanical form.

Keywords:- Conventional Braking System, Regenerative Braking System, Flywheel ,Generator.

Conventional Braking System:-

In conventional braking, brakes are applied using a foot pedal which when pressed transfers the hydraulic pressure from master cylinder to brake pads with help of fluid lines, brake pads in turn presses against the brake disc to stop the vehicle. In this way the kinetic energy change of vehicle is completely lost in the form of heat between brake pads and disc as well as some amount between tyre and road. This heat is not recovered and is lost to atmosphere. so today there is need of more efficient braking system.



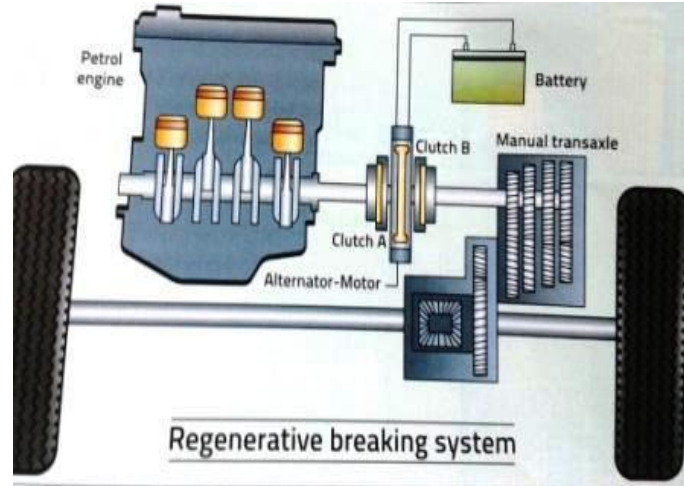
Regenerative Braking System:-

In Regenerative braking system instead of wasting the kinetic energy of vehicle in the form of heat it is converted into electrical energy to be stored in batteries and capacitors or as mechanical energy of a flywheel having large moment of inertia. In this way a large proportion of energy of vehicle is saved only to be used later for either accelerating the vehicle or for different electrical purpose.

A. Motor based regenerative braking:-

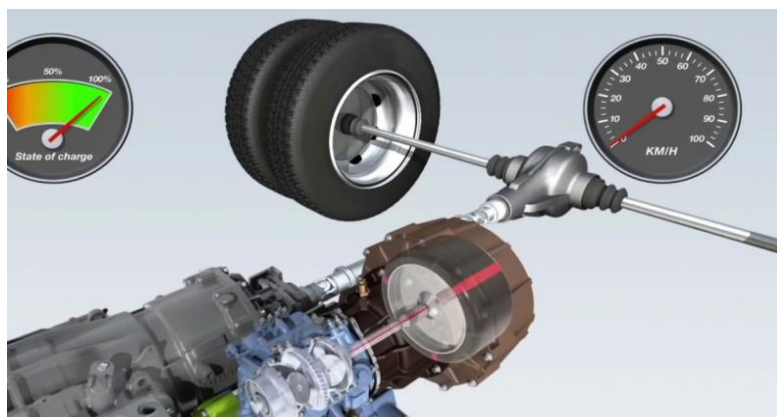
This type of regenerative system is used in electrical or hybrid electrical vehicles as it makes use of electric motors. The drive shaft of vehicle is connected to a motor, when current is supplied to motor it starts rotating and in turn rotates the drive shaft of vehicle. When brakes are to be applied, the driver presses the brake pedal which cuts off the current supply to motor. Now

motor is no longer providing torque to the driving shaft, instead the inertial kinetic energy and momentum of vehicle drives the motor, electric motor now starts acting as a generator resisting the inertial rotational motion of vehicle to slow down the vehicle besides producing electricity. This electricity can be stored in battery or capacitor.



B. Flywheel Based Regenerative Braking:-

This regenerative braking system consists of a flywheel having a large moment of inertia, so that it requires a large torque for rotational acceleration. There is a provision for engagement and disengagement of flywheel with the drive shaft. When driver needs to slow down or stop the vehicle, the flywheel is engaged with the drive shaft with the help of gears. As flywheel gets engaged power now goes divided between driving shaft and flywheel, flywheel having a large moment of inertia absorbs the power from engine in the form of rotational kinetic energy and brings the vehicle to halt and this rotational kinetic energy of flywheel can be used further to accelerating the vehicle. Since it has huge momentum so it takes a great deal of stopping and changing its speed takes a lot of effort. If an engine supplies power intermittently, the flywheel compensates for surplus or deficit power. so flywheel helps to smooth out the power wheel receives. The main drawback of using flywheels in moving vehicles is their heavy weight.



Advantages Of Regenerative Braking Systems:-

- ✓ Improved Fuel Economy
- ✓ Reduction in Engine wears
- ✓ Reduction in Brake Wear
- ✓ Reducing cost of replacement brake linings
- ✓ Emissions reduction

Future Scope:-

Although regenerative braking is more efficient than conventional braking, it is still not popular as electric vehicles and hybrid electric vehicles are still in developing phase. Energy stored in battery can be used to operate air conditioning, lights, mobile charging etc. Besides increasing efficiency of vehicle it increases its weight too that problem can be overcome by using light materials for regenerative circuit components. As our future vehicles will be having electric and hybrid vehicles, regenerative braking system is going to be next revolution in braking system.

Conclusion:-

Regenerative braking can save up to 30% of lost energy as well as can sustain life than conventional braking system. Besides it has a wide scope of development in future that could lead to a huge savings of energy for the world.

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