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

DESIGN AND FABRICATION OF REGENERATIVE BREAKING PROJECT

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ABSTRACT

As in the modern times, where there are energy crises and due to which the resources are depleting at a rapid rate, there's a need of specific technology that recovers the energy, which is usually wasted. So, in the case of automobiles one solution among these useful technologies is that of invention of the regenerative braking system. Regenerative braking is an energy recovery mechanism that slows down a vehicle or object by converting its Kinetic Energy (K.E) into a form that can be either used immediately or stored until needed. Using regenerative braking system in automobiles allows us to recover the K.E. of the vehicle to some degree that's lost during the braking process. The converted K.E. is stored for future utilization or is fed back to the facility system of the vehicle

A brake-pad assembly, mounted in a concentrically arrangement with the hub of a ground-engaging wheel, which is further actuated upon braking to provide frictional engagement between the hub and clutch mechanism, while a decelerating torque is applied to the wheel. The special braking mechanism is selectively held in place by a rider-controlled clutch mechanism, to store energy over several braking actions. Vehicles driven by electric motors make use of the motor as a generator when using regenerative braking and its output is transported to an electrical load. The transfer of energy to the load enables the braking effect and regenerates power.

Keywords: Regenerative Braking, Brake pad, Generator, Energy Recovery, Flywheel.

1. INTRODUCTION

In recent years, there is the lack of dependable alternative energy sources, increasing efficiency and minimizing exhaust gas emissions has become the sole focus of the modern automotive research. A tremendous amount of kinetic energy from commercial vehicles such as refuse trucks and delivery vehicles is lost during frequent braking and constant drive at low speeds on destined city routes, which cause the higher fuel consumption in these vehicles and Green House Emission Gas (GHG) emission compared to other on-road vehicles.

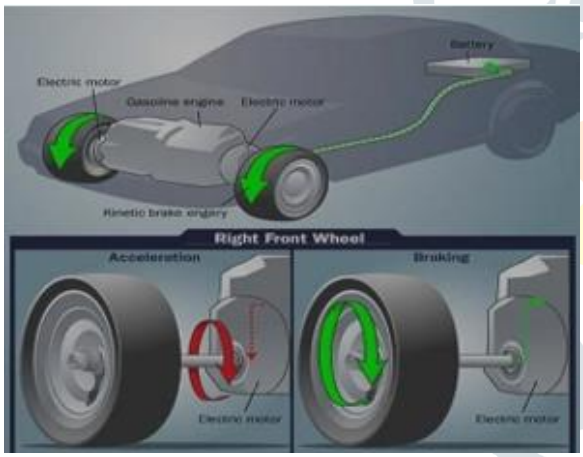

Fig 1 Right Front wheel

2. ANALYSIS

The first type of these systems to be developed was the Flywheel. This system weighs 24 kg and has an energy storage capacity of 400 kJ after allowing for internal losses. Power boost of maximum 60 kW (81.6 PS, 80.4 HP) for 6.67 seconds is available. The 240 mm diameter flywheel weighs 5.0 kg and revolves at up to 64,500 rpm. Maximum torque achieved is 18 Nm (13.3 ft lbs). The system occupies 13 liter of volume

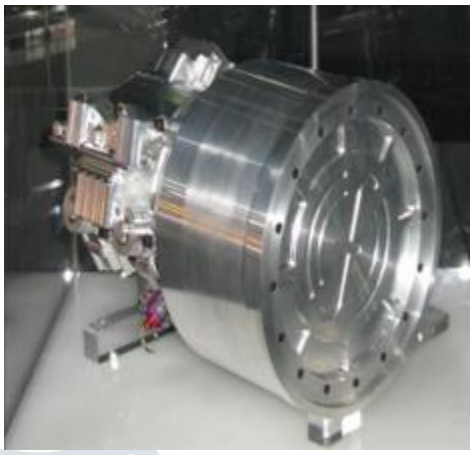

Fig 2 Flywheel system Kinetic energy recovery system

A Flywheel System Kinetic energy recovery system.

3. OBJECTIVES:

- To be able to control the speed of the vehicle as well as to stop it in a quick time and in an efficient manner.
- To minimise the reaction time of braking by utilizing regenerative braking and generating power by transforming kinetic energy into electrical energy.

4. TYPES OF BRAKING SYSTEM

There are various methods of energy transformation in Regenerative Braking System. Each type of Regenerative Braking System makes use of a different type of energy conversion or storage methodology, with differences in

efficiency and applications for them. The Types are:

i. Electromagnetic: In this, the magnetic fields are used to restrict the rotation of the drive shaft of automobile which is connected to an electric generator, which slows down the speed of vehicle and produces electricity.

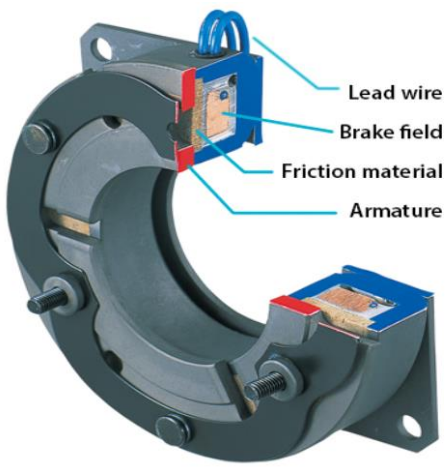

Fig 3: Electromagnetic break

ii. Flywheel: In Flywheel Regenerative Braking System, the system stores the kinetic energy of the vehicle to rotate a flywheel that is connected to the drive shaft with the help of a transmission and gear box. The spinning flywheel can then provide torque to the drive shaft, thus giving a power boost to the vehicle.

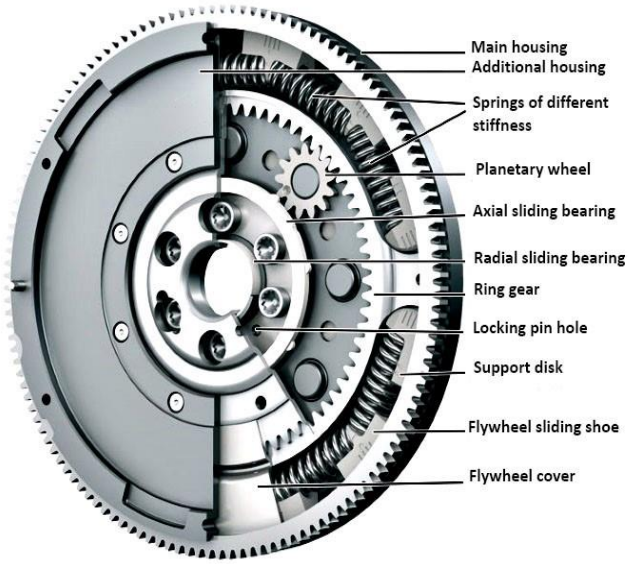

Fig 4 Flywheel construction

iii. Electromagnetic flywheel: Electro flywheel regenerative brake is a combined model of electromagnetic and flywheel Regenerative Braking System. It shares the basic power generation techniques with the electromagnetic system; however, the energy is collected in a flywheel rather than in batteries.

iv. Spring: A coil or spring is winded around a cone during braking to store energy in the form of elastic potential. The potential can then be returned to assist the driver while going uphill or over rough terrain.

v. Hydraulic: The Hydraulic Regenerative Braking System slows the vehicle by generating electricity which is then used to compress a fluid.

5. PROBLEM STATEMENT

At this century, automotive industry has posted a great challenge in order to reduce the vehicle fuel consumption and emission, these is due to the

shortage of fuel resources and worsen air pollution problem. According to figures released by the US Environmental Protection Agency (EPA), conventional ICE vehicles currently contribute 40-50% of ozone, 80-90% of carbon monoxide, and 50-60% of air toxins found in urban areas.

6. DESIGN MATERIAL USED

There are the following list of parts that are used in our model of Regenerative braking system: - Wooden log (ply wood), Rectifier., Resistance, Braking pads, Brake drum, Led lights, DC motors.

7. RESULTS:

After the successful testing, the model is operated and the results obtained in various loading condition are noted and tabulated.

It can be seen from the result tables that the efficiency of the regenerative braking systems using D.C Motors increases as the angular velocity of the motor increases and hence the regenerative braking systems are more efficient as higher angular velocities and the recoverable energy increases with increase in the motor speed. The losses are higher at lower speed because the motors are inefficient at lower speeds, whereas the losses at higher speeds are mainly mechanical losses like friction losses and air drag.

TABLE 1: Result table

S.N	RPM before brake pedal pressed	RPM after brake pedal pressed	Voltage output
1	500	480	9.34
2	900	870	10.88
3	1300	1260	11.81

8. APPLICATION

- Kinetic energy recovery mechanism.
- Regenerative braking systems are used in electric elevators and crane lifting motors.
- Also used in electric and hybrid cars, electric railway vehicles, electric bicycles, etc.
- Could be used in an industry that uses a conveyor system to move material from one workstation to another and halts at a certain distance after a prescribed interval.

9. CONCLUSION

The regenerative braking system used in the vehicles satisfies the purpose of saving a part of the energy lost during braking. The regenerative braking system is designed to partially recover the battery charge wasted in braking of the vehicle. The energy is converted into heat by friction brakes which are dissipated to the environment. This Energy is utilized to rotate the rotor of generator converting mechanical energy of wheels into useful charge of battery. The regenerative braking system cannot be used as main braking system of vehicle as it cannot bring the vehicle to rest.

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