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Kinetic Energy Recovery System (KERS)

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Abstract: *KERS is one of the applications of regenerative braking. Regenerative Braking converts some of the waste heat energy produced during braking into more useful form of energy with the help of MGU (Motor Generator Unit). The system stores the energy in a battery (after applying brakes) produced under breaking in a reservoir and then releases the stored energy under acceleration. The key purpose of the introduction is to significantly reuse the wasted energy in some application of cars. KERS is introduced to improve fuel efficiency of the engine. KERS is one of the applications of regenerative braking. Regenerative Braking converts some of the waste heat energy produced during braking into more useful form of energy with the help of MGU (Motor Generator Unit). The system stores the energy in a battery (after applying brakes) produced under breaking in a reservoir and then releases the stored energy under acceleration. The key purpose of the introduction is to significantly reuse the wasted energy in some application of cars. KERS is introduced to improve fuel efficiency of the engine.*

I. Introduction

In today's busy world vehicles are the most important means of transport. As cars are very friendly with humans, they have some issues. Most of the issues are related to the battery. While driving a car, in case of braking due to friction heat is generated. This heat energy gets dissipated in the environment and wasted. This energy can be harnessed and by converting it into a suitable form of energy can prove very useful for several applications. Kinetic Energy Recovery System (KERS) is able to convert the heat energy into electrical equivalent. There are two types of KERS i.e. Mechanical KERS & Electrical KERS.

1.1. Problem Statement

Mechanical KERS uses a flywheel to convert the commutation into electrical energy. Mostly mechanical KERS is used in Formula 1 (F1) cars. The problem with mechanical KERS is, the flywheel consumes more space and is very tedious to implement. Also, the flywheel adds a weight to the car, this decreases the acceleration efficiency of the car.In most of the KER system, the driver does not have control on the stored energy. The energy is released once the braking is removed to provide acceleration.

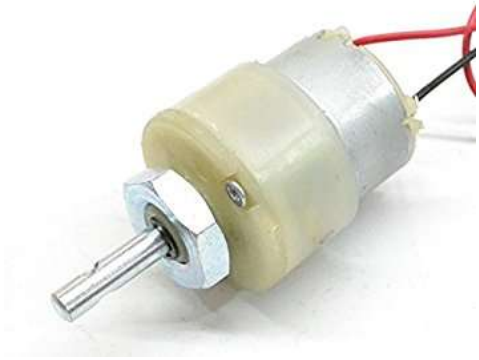
1.2. Objective

The other type of KERS used is Electrical KERS. In Electrical KERS the main component used is the Motor Generator Unit (MGU). MGU converts the rotational energy into electrical energy. The converted electrical energy is stored in a battery for further applications. The Power Control Unit (PCU) enables the user to control the energy that is stored. This helps the driver to use the energy whenever is it needed.Thus, the electrical KERS needs less space and it is easy to implement as compared to mechanical KERS.

II. Material

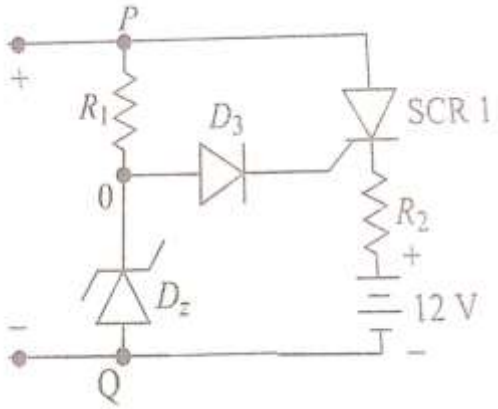
2.1. MGU-K

MGU-K stands for Motor Generator Unit Kinetic. It can be referred to as a heart of the system. It consists of a DC motor.The DC motor can be operated bi-directionally i.e. as motor or as a generator. It converts mechanical energy into electrical energy.Its principle working is that when a dc motor is mechanically rotated, then the output will be the electrical energy. DC motor of 500 rpm is used. When the motor used in KERS, it produces output ranging for 4 volts to 12 volts.



2.2. PCU

PCU stands for Power Control Unit. It consists of a Battery charging circuit and voltage doubler circuit. It is basically used to isolate the battery from MGU-K and also to prevent the over-charging of battery. A pulsating Dc voltage from MGU-K is applied across point P & Q. When SCR1 is off cathode is held at the potential of discharged battery. During each positive half cycle when the potential of point O rises to a sufficient level so to forward bias the diode D3 and gate cathode junction of SCR1, the gate pulse is provided to SCR1 and it is turned on. When SCR1 is turned on the circuit is completed and current starts flowing through the battery. Due to the Zener diode the maximum voltage at- point O is held at 12V. As the battery is fully charged the cathode of SCR 1 is held at 12V therefore diode D3 and gate cathode junction of SCR1 cannot be forward biased Since the potential of Point O can reach up to 12V. Hence no gate current is applied and SCR1 is not triggered. In this way after fully charging further charging is automatically stopped.

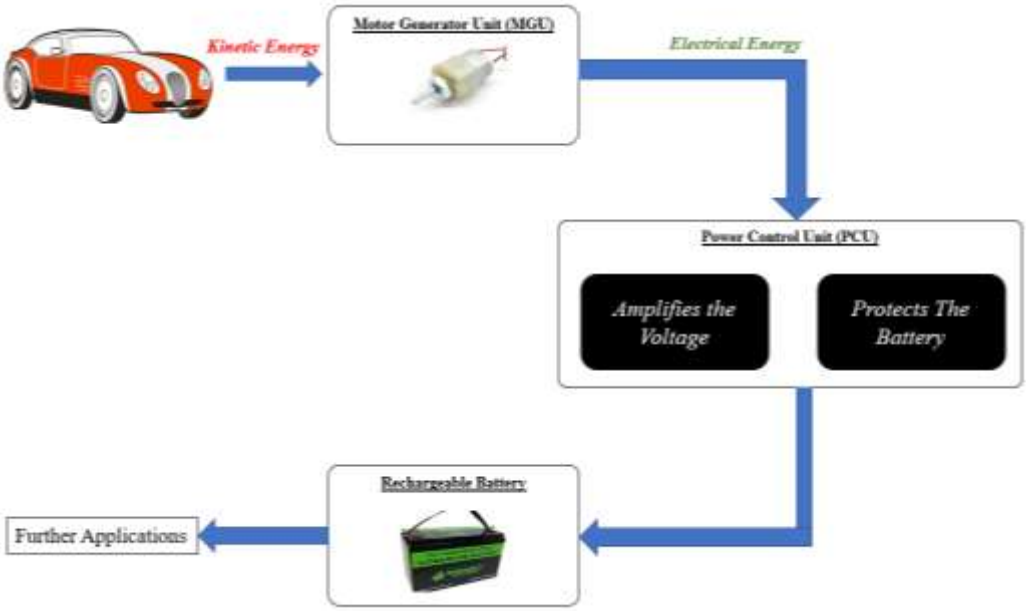


2.3. Battery

It is basically used to store the electrical energy.This electrical energy can be used for further application like headlights and music system of the car. Typically, a lithium ion battery is used for storing purpose. A lithium ion battery is used because its rate of discharge is lower and it also has low maintenance as compared to nickel cadmium battery.

III. Methodology

Initially with the help of stands a metal rod is been mounted which acts as an axle. On this axle a metallic disc is attached which acts as a wheel of a car.The axle and the AC motorarecoupled using a belt. Thus, when the motor starts rotating, it will rotate the axle which in turn rotates the disc. This action is equivalent to a moving wheel of a car. The motor rotates at 7,000 rpm while with the help of a pulley the rotation of the axle is reduced approximately to 3,500 rpm. An arrangement is used with a dc motor coupled on it which acts as a Motor Generator Unit which plays the role of brakes in a car.When brakes are applied, the MGU comes in the contact of wheel. These action causes the shaft of the DC motor to rotate mechanicallyfor sometimes. Thus, we get some output voltage at the terminal of the DC motor. Now, once the output is generated the Power Control Unit (PCU) comes into action.The output is manipulated according to the requirement or applications. This basically includes the amplification of the output and also charging the battery with appropriate protection. In future applications, the Power Control Unit(PCU) can also be used to control the power according to the driver from the battery.



IV. Conclusion

Using a KERS can prove useful to utilise the wasted heat energy. The energy stored can be used for various applications but by even further modifications it can be used to provide a boost of energy to the engine. Thus, by using KERS in automotive can solve the overall battery related issues by using an alternate Lithium Ion battery which is charged by the overall KERS unit. The main limitation of this system is that, the charging time of the battery is more as the power generated is very less because the braking action is not applied continuously for a longer period.

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