REGENERATIVE BRAKING SYSTEM

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***Abstract*---Regenerative Braking Systems (RBS) provide an efficient method to assist vehicle achieve better fuel economy while lowering exhaust emissions. This paper describes the study of regenerative braking systems. In this paper the two types of regenerative braking systems are been mention one of which is electronic regenerative braking system and second is are hydraulic regenerative braking systems. The existing friction based Adjustable Braking System (ABS) on the vehicle is integrated with each of the new braking systems in order to produced the kinetic energy going into waste while breaking .The RBS will be used to convert the vehicle mechanical energy and also the heat that would have been lost during braking into electrical energy or mechanical energy as the storing system is been used .The use of regenerative braking system in the vehicle is very useful as it increase the efficiency of the vehicle and also save the fuel up to 20%-30%**

Keyword—

RBS-Regenerative braking system

ABS-Anti braking system

MGU-Motor generator unit

EM-Elector motor

HBR-Hydraulic braking system

I. INTRODUCTION

Deceleration of a vehicle with a traditional braking system requires that the kinetic and potential energy of the vehicle be converted into thermal energy or heat through the action of friction.

Studies show that in urban driving about one third to one half of the energy required for operation of a vehicle is consumed in braking. With regenerative braking on vehicles, this vehicle kinetic energy can be converted back into electrical energy that can be stored in storing devices for reuse to propel the vehicle during the driving cycle. Therefore, regenerative braking has the potential to conserve energy which will improve fuel economy while reducing emissions that contribute to air pollution. the future viability of electrical power trains is greatly dependent on their range and battery

Storage capacity. Electric vehicles will achieve ranges that are sufficient for everyday use only with efficient batteries intelligent energy management and the recovery of breaking energy. When braking in conventional vehicle, the friction brakes convert much of the kinetic energy into environment .hybrid and electrical vehicles with regenerative breaking system are different in that. They recover some kinetic energy via the electric motor or pressure tank and store it as energy in a storing devises this process is known as recuperation or regeneration breaking .The electrical motor can then use this stored energy when driving off or accelerating.

II.BRAKING

A brake is a mechanical device which inhibits motion, slowing or stopping a moving object or preventing its motion. The rest of this article is dedicated to various types of vehicular brakes. Most commonly brakes use friction between two surfaces pressed together to convert the kinetic energy of the moving object into heat, though other methods of energy conversion may be employed the process of declaration in which the break are used to stop or resist the motion of the object is collets as braking

III.REGENERATIVE BRAKING

Every time you step on your car's brakes, you're wasting energy. Physics tells us that energy cannot be destroyed. So when your car slows down, the kinetic energy that was propelling it forward has to go somewhere. Most of it simply dissipates as heat and becomes useless. That energy, which could have been used to do work, is essentially wasted.

In most cars it's the inevitable by product of braking and there's no way you can drive a car without occasionally hitting the brakes. But automotive engineers have given this problem a lot of thought and have come up with a kind of braking system that can recapture much of the car's kinetic energy and convert it into electricity, so that it can be used to recharge the car's batteries. This system is called regenerative braking.

IV. COMPONENT OF SYSTEM

a) Electric motor-generator

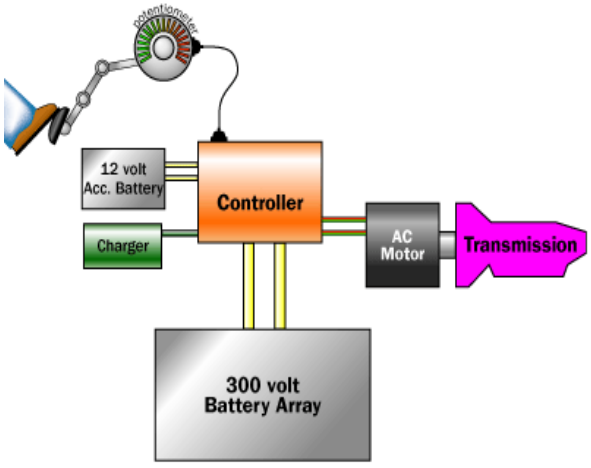
An electric motor positioned between the fuel tank and the engine is connected directly to the engine crankshaft to produce additional power.

b) Braking system

As the break pad is push the regenerative brake get active and start to convert the kinetic energy of the wheel generated during braking into the alternate far as par the system is used.

c) High capacity batteries

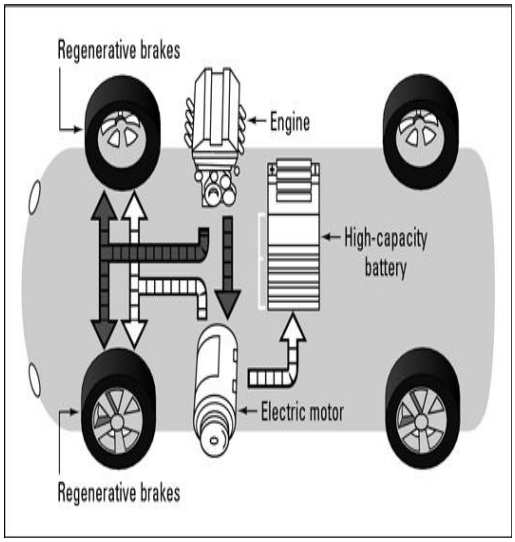
High voltage batteries used to store and deliver quick energy generated during braking into it.



V. PRINCIPLE AND WORKING

- Law of Conservation of Energy states that the total energy of an isolated system cannot change it is said to be *conserved* over time. Energy can be neither created nor destroyed, but can change form, for instance chemical energy can be converted to kinetic energy in the explosion of a stick of dynamite.

- RBS is a collection of parts which takes some of the kinetic energy of a vehicle under deceleration, stores this energy and then releases this stored energy back into the drive train of the vehicle, providing a power boost to that vehicle. For the driver, it is like having two power sources at his disposal, one of the power sources is the engine while the other is the stored kinetic energy.



VI .TYPE OF REGENERATIVE BRAKING

a) Electronic regenerating braking system

b) Hydraulic regenerating braking system

VII .ELECTRONIC REGENERATING BRAKING SYSTEM

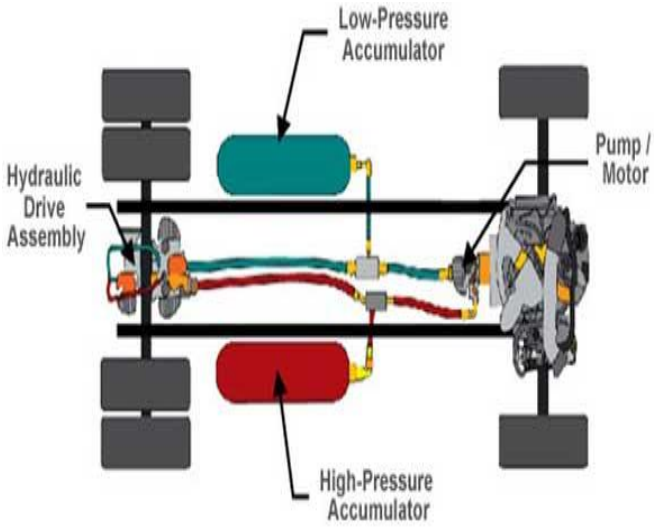
In electronic RBS, braking rotational force is captured by an electric generator unit (MGU) mounted to the engines crankshaft. This MGU takes the electrical energy that it converts from kinetic energy and stores it in batteries. The boost button then summons the electrical energy in the batteries to power the MGU. The most difficult part in designing electronic RBS is how to store the electrical energy.Most racing systems use a lithium battery, which is essentially a large mobile phone battery. Super-capacitors can also be used to store electrical energy instead of batteries; they run cooler Batteries become hot when charging them so many of the RBS cars have more cooling ducts since charging will occur multiple times throughout a race. Super-capacitors can also be used to store electrical energy instead of batteries; they run cooler and are debatably more efficient.

VIII .ELECTRIC MOTOR DYNAMICS

The EM, which functions as generator during braking, batteries and brake resistor. EM is coupled to the rear wheels by drive train. Schematically illustrates the regenerative braking system components. The .Generator and traction performances of electric motor are almost identical. The maximum torque and power of EM is a function of the speed of EM. In the vehicle under study, there are two coupled electric traction motors. The generator's efficiency is defined as the ratio of output electric power to input mechanical power. Efficient the generator is almost equal to efficiency map of EM in traction. During braking, not only does locking of wheels contribute to the increase of stopping distance, but it also lowers the amount of recovered energy. That is because in case of locking wheels, the rotational speed of connected EM becomes close to zero and the maximum amount of generator power of EM decreases. Regenerated energy by EM is given to the batteries. Batteries store a portion of this energy according to their limitations and free capacity, and the additional energy is dissipated in brake resistor. The batteries that are utilized in the bus under study are 40 Ah lithium-polymer batteries. This series of batteries consists of 168×3.7V battery cells. The internal resistance of each battery cell is approximately 2 mÙ. Changes in charge of batteries due to the absorbed energy by generator are expressed by the percentage of the State of Charge (SoC).

IX .HYDRAULIC REGENERATING BREAKING SYSTEM

An alternative regenerative braking system is being developed by the Ford Motor Company and the Eaton Corporation. It's called Hydraulic Regenerative Break or HRB. With HRB, when the driver steps on the brake, the vehicle's kinetic energy is used to power a reversible pump, which sends hydraulic fluid from a low pressure accumulator (a kind of storage tank) inside the vehicle into a high pressure accumulator. The pressure is created by nitrogen gas in the accumulator, which is compressed as the fluid is pumped into the space the gas formerly occupied. This slows the vehicle and helps bring it to a stop. The fluid remains under pressure in the accumulator until the driver pushes the accelerator again, at which point the pump is reversed and the pressurized fluid is used to accelerate the vehicle, effectively translating the kinetic energy that the car had before breaking into the mechanical energy that helps get the vehicle back up to speed. It's predicted that a system like this could store 80 percent of the momentum lost by a vehicle during deceleration and use it to get the vehicle moving again. This percentage represents an even more impressive gain than what is produced by current regenerative braking systems. Like electronic regenerative braking, these kinds of brakes HRB systems -- are best used for city driving, where stop-and-go traffic is common. So far, HRB systems have been used primarily as proofs of concept and in demonstration projects



X .ADVANTAGES OF REGENERATIVE BRAKING SYSTEM

i. Increase of overall energy efficiency of a vehicle.

ii. Improved Performance.

iii. Emission Reduction.

iv. Reduction in Engine Wear.

v. Cuts down on pollution related to electricity generation.

vi. Increases the lifespan of friction braking systems.

vii. Smaller Accessories.

viii. Less use of traditional mechanical brakes leads to less wear over time

ix.

XI .APPLICATION

- Jaipur Metro uses the Regenerative Braking System & saves 35% of Electricity.
- Super capacitor accepts and release charge much more quickly.

- It can be discharged and recharged many more times and with far deterioration than a battery.
- The Mazda Unit can accept a full charge in just 8-10 seconds
- The capacitor may take up to about 113s when the load is at minimum about 18A.

XII.CONCLUSION

- Regenerative braking is an effective method of improving vehicle efficiency and longevity
- Is already in use in many EVs
- The technology to do it exists and is often well worthy
- Mostly dependent on the wider adoption of EVs or further development of hydraulic regeneration systems
- The regeneration systems produced by the teams would have taken the vehicle manufacturers much longer to develop. Both the types of RBS can be retrofitted in vehicle albeit with minor modifications. Given the current trend of engine downsizing they can add substantial amount of performance to the car without affecting the engine and average. The mechanical system is more efficient than the electrical systems that use inefficient batteries which make them more likely to be induced in vehicle in the near future.

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