FABRICATION OF REGENERATIVE BRAKING SYSTEM USING FLYWHEEL

INTRODUCTION

CONVENTIONAL BRAKING

Brakes are employed to stop or retard the motion of any moving body. Thus, in automobiles the brakes are having the most important function to perform. In conventional braking system the motion is retarded or stopped by absorbing kinetic energy by friction, by making the contact of the moving body with frictional rubber pad (called brake liner) which causes the absorption of kinetic energy, and this is wasted in form of heat in surroundings. Each time we brake, the momentum of vehicle is absorbed that it has gained and to re-accelerate the vehicle we have to start from the scratch to redevelop that momentum by using the more power from an engine .Thus, it will ultimately result in huge waste of energy. As the basic law of Physics says „energy can neither be created nor be destroyed; but it can only be converted from one form to another", it will be good if we could store this energy somehow which is otherwise getting wasted out and reuse it next time we started to accelerate. That's the basic concept of regenerative ("regent") brakes, which provide braking for the system when needed, by converting the available energy to some usable form. These are widely used in electric trains and the latest electric cars.

REGENERATIVE BRAKING

Regenerative brake is an energy recovery mechanism which slows a vehicle by converting its kinetic energy into another form, which can be either used immediately or stored until needed. Thus, the generated electricity during the braking is fed back into the supply system (in case of electric trains), whereas in battery electric and hybrid electric vehicles, the energy is stored in a battery or bank of capacitors for later use. Energy may also be stored by compressing air or in a rotating flywheel.

Electric and hybrid electric vehicles typically employ motor-generators that can convert electric current into torque (like a motor) or torque into electric current (like a generator). When the brakes are applied, the motor-generator provides the resistance necessary to slow the vehicle as it supplies current to the battery. In the event that the motor-generator cannot slow the vehicle fast enough, a torque coordinator module will apply traditional friction brakes to the extent necessary.

Some regenerative braking systems store the recaptured energy mechanically, typically by pumping hydraulic fluid into an accumulator where the energy is stored in a REGENERATIVE BRAKING SYSTEM FOR BICYCLE USING FLYWHEEL

NEED FOR REGENERATIVE BRAKES

The regenerative braking system delivers a number of significant advantages over a car that only has friction brakes. In low-speed, stop- and-go traffic where little deceleration is required; the regenerative braking system can provide the majority of the total braking force. This vastly improves fuel economy with a vehicle, and further enhances the attractiveness of vehicles using regenerative braking for city driving. At higher speeds, too, regenerative braking has been shown to contribute to improved fuel economy – by as much as 20%.
Consider a heavy loaded truck having very few stops on the road. It is operated near maximum engine efficiency. The 80% of the energy produced is utilized to overcome the rolling and aerodynamic road forces. The energy wasted in applying brake is about 2%. Also its brake specific fuel consumption is 5%.
Now consider a vehicle, which is operated in the main city where traffic is a major problem here one has to apply brake frequently. For such vehicles the wastage of energy by application of brake is about 60% to 65%.

Types of Regenerative Braking System

Based on the storage of energy, there are four types of regenerative braking systems:

1. Electrical Regenerative Braking
2. Hydraulic-based Regenerative Braking
3. Mechanical Regenerative Braking
4. Regenerative Braking using Compressed Air

FLYWHEEL

Flywheels have been used in cars for a very long time, but they haven‟t been used as kinetic energy restoration systems until recently. The flywheel‟s main use in cars is to convert the power from the engine and transfer it to the clutch plate. An internal combustion engine generates its power by firing pistons. Only one in four of these strokes actually drive the vehicle. This means that the output power of the engine is not steady. This problem is less severe the more cylinders a car has, since the pistons will be firing at different times to make up for the long gaps. Regardless of how many cylinders are present a flywheel is still needed to maintain a steady power supply.

The idea of adding a flywheel is very appealing because it could increase the efficiency of what is already considered an efficient machine. The only concern could be the weight of the flywheel. However when added to the bike it would make a significant difference in accelerating the bike.

The basic idea is that the rotating part of the engine incorporates a wheel with a very heavy metal rim, and this drives whatever machine or device the engine is connected to. It takes much more time to get a flywheel-engine turning but, once it's up to speed, the flywheel stores a huge amount of rotational energy. A heavy spinning flywheel is a bit like a truck going at speed: it has huge momentum so it takes a great deal of stopping and changing its speed takes a lot of effort. That may sound like a drawback, but it's actually very useful. If an engine supplies power erratically, the flywheel compensates, absorbing extra power and making up for temporary lulls, so the machine or equipment it's connected to is driven more smoothly

OBJECTIVES AND METHODOLOGY

OBJECTIVES

The main objectives of this project are:

- To fabricate a regenerative braking system on a bicycle using a flywheel.
- To decrease the energy lost from braking by storing that energy in a device, which in this case is a flywheel.
- To achieve efficient braking by converting the energy loss into energy gain.
- To store energy while braking.
- To return the stored energy to the main drive.

ADVANTAGES AND LIMITATIONS

Advantages of Regenerative braking

1. Efficient use of brakes.

2. Energy loss is converted into energy gain, i.e., energy is effectively utilised

3. In electric vehicles, it allows batteries to be used for longer periods of time without the need to be plugged into an external charger.

4. In some cases, it has helped in increasing the fuel efficiency of a vehicle.

5. In case of regenerative braking in electric trains, when the motor is not receiving power from the battery pack, it resists the turning of the wheels, capturing some of the energy of motion as if it were a generator and returning that energy to the battery pack, hence helping in wear reduction.

6. Braking is not a total loss, because in regenerative braking there is no heat loss associated with braking.

LIMITATIONS OF REGENERATIVE BRAKING

1. Regenerative braking is not effective at lower speeds, because the energy generated is not sufficient.

2. It is not possible to bring the vehicle to a full halt in case of regenerative braking.

3. The friction brakes are a necessary back-up in case of failure of regenerative brakes. Hence regenerative brakes are always used only in conjunction with conventional brakes.