"KINETIC ENERGY RECOVERY SYSTEM IN BICYCLES"

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ABSTRACT

Kinetic Energy Recovery System (KERS) is a regenerative braking system for recovering the moving vehicle's kinetic energy under braking and also to convert the usual loss in kinetic energy into gain in kinetic energy. When riding a bicycle, a great amount of kinetic energy is lost while braking, making start up fairly strenuous. Here we used mechanical kinetic energy recovery system by means of a flywheel to store the energy which is normally lost during braking, and reuse it to help propel the rider when starting. A flywheel is an energy storage device that uses its significant moment of inertia to store energy by rotating. The rider can charge the flywheel when slowing or descending a hill and boost the bike when accelerating or climbing a hill. Also, in cases where one knows before that the brakes are to be definitely applied ahead like at traffic signals or some vehicle traffic or due to obstruction by any object; this system will be very useful. The result of the project is promising and shows a great potential for future work in this field.

Keyword: - *Kinetic energy recovery system in bicycle, KERS bicycle, Regenerative braking in bicycle, Continuous variable transmission in bicycle, CVT in bicycle, Flywheel bicycle.*

1. INTRODUCTION

The system for recovery of kinetic energy can also be alternatively called as Kinetic Energy Recovery System. This setup is a basic model of regenerative braking in which the energy is stored. There are two types for the storage of energy in regenerative braking. Either the acquired energy from the wheels can be stored in the chemical form as in batteries or it can also be stored in a flywheel. These devices which store the energy are called as reservoirs. Regenerative braking is the concept that is getting much popular in hybrid and electric vehicles. The sole colossal purposes of these hybrid and energy vehicles are to conserve the energy as much as possible. Hence the giants in car manufacturing sectors such as Benz, Porsche and Ferrari have devised a new method called regenerative braking. This regenerative braking system harnesses the energy that gets lost during the braking. This energy can be either used immediately as a boost when stored in flywheel or it can also be stored for future use in the battery. Generators and alternators must be used to harness the energy in this braking system.

2. COMPONENTS USED IN BICYCLE

The bicycle which is often referred to as cycle has been in the picture since late 18th century. It is one of the first pedal powered vehicles which enabled the movement faster and easier. The bicycle is a combination of lots of separate individual components. It has two wheels at the front and the rear side of the vehicle. The pedal pads are connected to the chain drive which in turn is connected to the free wheel in the rear wheel. In a conventional bicycle, the chain sprocket at the pedal pads has 32 to 36 teeth while the free wheel has only 12 to 18 teeth. The chain drive is meshed perfectly to drive the back wheel thereby transferring the kinetic energy. Apart from the sprockets, freewheels, chain drive and wheels, the bicycle has lots of component mounted on it such as seat, carrier, handle bar, rim, pedals and in exceptional cases, a dynamo.

3. WORKING

The components used in the system are flywheel, clutch, chain drive, Bearing, frame. Flywheel which is mounted on the frame is driven by the rear wheel through the chain drive and clutch mechanism. When one has to apply the brakes the mechanism is such that clutch gets engaged with the flywheel and it starts rotating thus storing the braking energy. The mechanism designed is such that by manually pressing the lever (Rear brake lever of the bicycle) the clutch can engage with the flywheel this depends upon the convenience of the biker. The stored energy is utilized when the speed of bicycle decreases below the average range of speed i.e. rear wheel speed. The flywheel energy by the means of chain in this case can be restored back to the bicycle thus fulfilling its torque requirement. Consider for instance riding on a slope or in the case of mountain biking, when the speed of bicycle is more than average speed range the engagement of flywheel is facilitated and the flywheel keeps on rotating for a certain period of time mainly due to inertia this motion can be transferred back to the rear wheel thus assisting the forward motion of the bicycle.

4. FABRICATION PROCESS

In order to mount a flywheel an additional frame mounting is imperative as frame is the support structure for the flywheel. Frame mounting is the first step in manufacturing of the flywheel bicycle. Steel tubes are used as the frame structure, they are joined by welding .One end of the frame is to the front end of the bicycle (below the handle) and other end is connected near the rear sprocket. The frame is connected to the bicycle structure by spot welding. However certain considerations are made so the geometry of the frame does not hinder the riding comfort of the driver.

4.1. FLYWHEEL

The flywheel is manufactured by performing lathe operations and certain considerations were made earlier for considering the weight of the flywheel, The weight of the flywheel should be optimum if it exceeds a particular value it will make the bicycle bulky, however even the lesser weight will not offer the required inertia to empower the rear wheel of the bicycle. Material selected for flywheel is MS (mild steel).A hole is bored centrally in the flywheel for mounting the ball bearings so that the shaft rotates with the rotation of the flywheel.

Fig no 4.1.1: Flywheel

4.2. Shaft and Support Fabrication

Considering the inner diameter of the ball bearing and by carrying out shaft design the diameter of shaft is decided. Thus accordingly shaft and the related shaft support structure on the frame is manufactured.

Fig no 4.2.1: Axle

5. IMPLIFICATION FOR FINAL DESIGN

Fig no 5.1: kers cycle

6. RESULT

The flywheel bicycle increases efficiency on rides where the rider slows often. The additional weight is outweighed by the ability to recover energy normally lost during braking. Thus the addition of extra weight does not make it difficult for the rider. Also clutch provided helps in deciding the time period of activity. The overall result is that KERS system is efficient in storing the energy normally lost in braking and returns it for boosting.

7. CONCLUSIONS

KERS (Kinetic energy recovery system) is a system which is very efficiently used in racing cars as an energy recovery device or regenerative braking concept. Similar concept can be employed for a non polluting device such as bicycle with the intention of reducing human effort to ride the bicycle. The proposed design is a simple implementation of the same idea which uses flywheel as an energy bank or energy storing device. The idea was successfully implemented as well as validated by manufacturing and mounting the KERS system on a non geared bicycle and the results obtained were non negligible as well as encouraging. However there are certain areas that need to be looked upon, better results in terms of reduction in pedalling power can be obtained by better weight optimization. Continuously variable transmission can also be an option for better transmission efficiency. Ergonomics can also be taken into account, the idea of double centrifugal clutch if implemented successfully will make the entire transmission automatic leading to better comfort and hassle free driving experience.

8. FUTURESCOPE

Modifications can be made to the design above to make it hypothetically more efficient. Though it would hurt the simplicity of the design, the use of a continuously variable transmission would make the flywheel system better by almost every measure. The flywheel would spin faster and the gear shift mechanism would be more standard. It would be difficult to find a place for the transmission, but this could be overcome by modifying the frame of the bike. Again, this is difficult to implement but is an improvement in the design. Also, the flywheel itself could be heavier to store more energy. This would mean it is harder to accelerate initially, but would give greater boosts to the rider during the trip. When more is known about the measured output of the flywheel, including its energy stored and the efficiency of the transmission, an optimal weight could be selected for maximum efficiency. But this doesn't mean that a person wouldn't want to have additional weight on the flywheel to make it less efficient but more fit to the specific rider's desires.

9. REFERENCES

[1]**Sreevalsan S Menon, Sooraj M S, Sanjay Mohan, Rino Disney, Suneeth Sukumaran** "Design and Analysis of KERS in Bicycles", International Journal of Innovative Research inScience, Engineering & Technology, Vol. 2, Issue 8, 2013.

[2] **Ricardo Chicurel**, "A Compromise Solution for Energy Recovery in Vehicle Braking," Energy, vol.24, 2009.

[3] **Medlicott P.A.C**., "Development of A Light Weight Low Cost Flywheel Energy Storage System for A Regenerative Braking Application," The British Petroleum Company Plc. 20th Inter Society Energy Conversion Engineering Conference (IECEC), Miami Beach, Florida, 1985.

[4] **Radhika Kapoor, C. Malik Parveen**, "Comparative Study on Various KERS", Proceedings on the World Congress on Engineering, Vol. 3, 2013.