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KINETIC ENERGY RECOVERY SYSTEM IN BICYCLE BY USING FLYWHEEL

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ABSTRACT: Kinetic energy recovery system (KERS) is a method used in automobiles for recovering the energy lost in braking of the automobiles and thus providing speed to the vehicle motion. In that same concept for braking regenerative can be applied in bicycle. When riding a bicycle, a great amount of kinetic energy is lost while braking, making start up fairly strenuous. Which method uses a flywheel? Flywheel will be mounted between the frames of the bicycle, in that flywheel can store the braking energy by rotating and this energy can be required time given to the system in that term engagement and disengagement mechanism used to reduce the pedaling power required to drive the bicycle. This Flywheel Energy Storage system uses flywheel with suitable clutch mechanism along with sprocket and chains. The flywheel increases maximum acceleration and nets 10% pedal energy savings during a ride where speeds are between 13 and 15 mph. Further this concludes about efficiency and pedaling power in flywheel bicycle.

KEYWORDS: KERS-kinetic energy recovery system, Flywheel, clutch mechanism.

INTRODUCTION

KERS is a collection of parts which takes the kinetic energy of a vehicle under deceleration, stores this energy then release this stored energy back into the drive train of the vehicle, providing a power 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. Kinetic energy recovery systems (KERS) store energy when the vehicle is braking and return it when accelerating. During braking, energy is wasted because kinetic energy is mostly converted into heat energy or sometimes sound energy that is dissipated into the environment. Vehicles with KERS are able to harness some of this kinetic energy and in doing so will assist in braking. By a proper mechanism, this stored energy is converted back into kinetic energy giving the vehicle extra boost of power.There are two basic types of KERS systems i.e. Electrical and Mechanical. The main difference between them is in the way they convert the energy and how that energy is stored within the vehicle. Battery-based electric KERS systems require a number of energy conversions each with corresponding efficiency losses. On reapplication of the energy to the driveline, the global energy conversion efficiency is 31–34%. The mechanical KERS system storing energy mechanically in a rotating fly wheel eliminates the various energy conversions and provides a global energy conversion efficiency exceeding 70%, more than twice the efficiency of an electric system. This design of KERS bicycle was motivated by a desire to build a flywheel energy storage unit as a proof of concept. On a flat road, the cyclist can maintain a fixed cruising speed to get from point to point. Globally all roads are flat with impediments such as intersections, cars, and turns that force the cyclist to reduce speed, then accelerate.

LITERATURE REVIEW

Flywheels are having energy storing capabilities. It finds always every mechanism that involves gears and centrifugal motion. the flywheels are generating 10 to 15 percent more efficient in storing the energy when compared to the batteries. But If the stored energy would get dissipated and would be of no use at any time. But in the case the lithium-ion, alkaline batteries and some chemical batteries energy can be stored and can be used in near future.

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In This idea of flywheel in a bicycle was brought up by a student Maxwell von Stein. Maxwellvon used a car flywheel which weighed about 15 pounds and he has also used a critical clutch mechanism it makes the device complicated. In this journal paper, a flywheel which weight just 4 kg. in This mechanism was incorporated and it has been tested successfully. It isa perfect in line assembly will enable this engaging mechanism to work smoothly.

METHODOLOGY

By studying about the different literatures regarding to the project we are come to know that, weight of flywheel is high as compare to the efficiency of the bicycle. The project design is based on the weight of flywheel and design of the bicycle body. In this design we are going to reduce the weight of flywheel, the stresses produced on connecting rod it will also minimize and power required to drive the bicycle will also reduced.The material used for fabrication of the flywheel is cast iron which is brittle virtually non-malleable metal that is considered generally inflexible. stiffness and damping properties of cast iron make it an excellent material for flywheel. By fabrication of the flywheel and design is according to the main frame and design of bicycle we got good stability of the bicycle. The frame had modified by adding steel shafts which is of square shape. One end is welded at the handle end and the other at the rear frame of bicycle.

COMPONENTS DESIGNED

1) Flywheel

2) clutch mechanism

3) Shaft

4) Frame

5) Bearing Selection

FLYWHEEL

Flywheel is the energy storing device, mass moment of the force which is exist on the flywheel. It is used to store and restore the energy.

SHAFT

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.

FRAME

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 is manufacturing of the flywheel bicycle. Steel tubes are used as the frame structure, they are joined by welding.

FLYWHEEL DESIGN

The flywheel has to be design according to the weight. steel Shaft is mounted on the frame on which bearing and hub arrangement is made. A hub is provide to run the freewheel along with the shaft. The efficiency of KERS system mainly depends upon the flywheel selection.

MODIFICATION OF FRAME

The modification of frame is help for The flywheel fitting arrangement. And frame is mounted on the bicycle. One end is clamped to the handle of the bicycle and other end of the frame is drilled inside the bolt of the rear wheel. The frame is strong enough to support the flywheel during the motion of the bicycle.The frame which is mounted on the bicycle will not disturbed the rider.

COST OF THE EXPERIMENT

S. No	Name Of The Materials	Material Cost
1	Cycle	1800
2	Flywheel	1600
3	Chain	150
4	Connecting Rod	200
5	Gears 2	800
6	Flywheel lock pin	300
7	Nut And Bolts	100
8	Flywheel Connecting rod	350
9	Gear And Wheel connecting setup	200
10	Clutch	450
11	Bearings	350
	Total	6300

WORKING PRINCIPLE

The working of the KERS system is described below in details. We are manually give the pedaling energy.in that pedaling energy of potential energy is passes to pedaling sprocket into rear sprocket by use of chain drives. In that energy named as kinetic energy. Until this process is worked on normal bicycles. In this design project we are using flywheel. The driving kinetic energy is reused by flywheel and chain drives. The rear axle kinetic energy is passed to the flywheel by use of chain drives in that term we are using extra sprockets in rear wheel axle.in that extra sprocket function is connecting flywheel sprocket through chain drive. In that energy will rotate the flywheel. In that term flywheel act as a energy storing device in

that stored energy will be again reused by this chain mechanism. Inside of the flywheel is attached on bearing. In that bearing is help to reduce the wear and act as a smooth rotation producer. Total flywheel body will be attached on bicycle frame. It cannot affect to the comfortless of drivers. Stored energy will required time only relished by using clutch mechanism.in this mechanism is used for the engagement and disengagement purpose. clutch is act as a lock pin. lock pin is manually operated. Flywheel giving a rotating energy to rear axle. It will help to the extra movement of cycle wheel. for this method to generate the extra rotation of efficiency by using flywheel. The translational motion of the clutch drive pushes the clutch plate to bring it in contact with the flywheel. In this design we have connected the KERS actuator on the opposite side of the left brake lever so when clutch is actuate brake is not actuated and when the brake will be actuated the clutch will automatically disengage. The clutch drive is always in the actuated state with the help of a sprig that always keeps it rotated by nearly 150°. The rest 30° is for wear and tear compensation. The clutch plate is a continuously moving part as it is connected with the front sprocket using three keys.

The front sprocket is driven by the rear sprockets through a chain drive. The rear sprockets are a set of sprockets on which the chain can change position to get different gear ratios. These are interconnected and rotate at same RPM as the rear wheel. During charging of the flywheel, power flows as sprockets on the rear sprocket system we can have 5 different gear ratios and can manipulate them to get the required charging and discharging conditions. During charging it is preferred to use a higher gear ratio (Rear: Front) so that the flywheel can get charged within less time. But this will cause higher initial jerk while engaging.

So it is preferred to engage the clutch at the lowest gear ratio and then increase the gear ratio to the maximum.This has an additional advantage. With every increasing gear ratio the relative velocity of the flywheel as compared to the rear wheel decreases. Thus additional torque acts on the flywheel and accelerates it to even higher speed. This way the flywheel can attain its maximum desired RPM smoothly. Now the flywheel has its maximum potential energy.in that potential energy give the extra efficiency.

DESIGN

CONCLUSION

An overall test is conducted to test the efficiency of the bicycle. It has been found to the flywheel supplies an energy with which the cycle could move forward by 10% of the given input. Based on the input given, the efficiency varies. But only 10% can be obtained by this principle. This system when installed in vehicles would save a high amount of energy lost during the braking of the vehicle. This energy can be stored and can be reused when needed energy. It will give more efficient when compared to the conventional braking system. We would conclude that, this recovery system has to be developed further and has a wide range of research which can be conducted in the future.

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