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Dual Drive System In Two Wheeler Using A Hub Motor And Dual Battery Charging Mechanisms

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ABSTRACT: *As we are gearing towards the quest for a more efficient fuel with less harmful exhaust and better performance in comparison to fossil fuels, we have come across a new technology, the hybrid system which is a combination of mechanical and electrical system prevalent in many cars nowadays. The paper delves the design and fabrication aspects of a similar technology for a two wheeler resulting in more kilometers per liter by absorbing maximum energy of the engine and increasing the efficiency of the process as a whole. the paper investigates the loss of energy during the exhaust stroke which can be utilized with the help of a Exhaust Gas Energy Harvester by assembling a turbine on the exhaust manifold and storing the exhaust pressure energy in form of electricity with the help of filter circuit also a alternator is connected to the crankshaft. With the help of these two mechanisms a battery of 12v/63Ah can be charged in minimum engine runtime. The system incorporates the power of engine and a hub motor (500 W, 210 rpm) for increasing the output of the vehicle. When the battery is charged fully and the two wheeler attains a speed of 60km/hr and more a simple switching press will cut off the engine and switch on the hub motor in the front wheel making the vehicle dual drive as well as increasing efficiency. and when battery is discharged or in case of sudden deceleration the engine can be fired again with same switch press. Also this DC motor mechanism allows easy and efficient braking (retardation), which can be simply obtained by reversing the polarity.*

I. INTRODUCTION

In present statuesque, we are surrounded with sophisticated amenities in our daily life and all these system work on energy sources either electric or chemical, etc. The paper throws light on a system which is a combination of chemical and electrical energy or can be well understood as interchange of energy into forms, but to provide a single work i.e. in the form of mechanical output. The paper deals with a system of charging battery using an alternator, and also using the exhaust pressure energy to charge battery which reduces the overall wastage of energy during the combustion and also storing the surplus energy produced by the engine.

This energy in form of chemical energy is stored in the battery which is used by a hub motor, which is a mechanical transducer to convert the chemical energy to mechanical energy.

As studies based on the popularity of automobiles has proved that motor bikes are more preferable on Indian standards .thus, installation of this system will be give another edge to its popularity and will reduce its running cost to a larger extent.

II. RECENT RESEARCH

A similar system was introduced in which the alternator is coupled to the engine by extending the crankshaft with a pulley at the end and a V belt is used is to connect the pulley and alternator which charges the battery and this is used for driving the external motor which is connected with a chain and gear mechanism to the front wheel [1].

1. About Exhaust Gas Harvester:

This study is aimed at judicious use of energy by generation of electricity from the exhaust pressure of the IC engine and thus reducing the loss of pressure energy during the exhaust stroke. Thus the exhaust energy harvester can be a good prospect.

This invention basically deals with the use of exhaust pressure energy which is wasted during the running process of IC engines. It consists of a turbine similar to the turbine of turbo charger of CI engines in design and

composition. The exhaust pressure through the nozzle of exhaust manifold is axially pointed on the turbine which causes rotation of turbine and the pressure energy thus converting into kinetic energy [2].

2. List of components:

- ALTERNATOR
- CLUTCHING MECHANISM
- HUB MOTOR
- DPDT(FOR CHANGING THE POLARITY)
- POTENTIOMETER
- SPEED SENSOR

3. Working:

On starting the motorbike, it is driven by the engine and alternator [8] is connected with the crankshaft, with the help of pulley and belt. When the bike is in its first gear, the surplus mechanical power from the engine gets utilized by the alternator to convert it into electrical energy which gets stored in the battery.

The battery gets the additional charge with the help of Exhaust Gas Energy Harvester, with a turbine assembled on the outlet of exhaust manifold. In exhaust energy harvester the pressure energy of exhaust converts into electrical energy with the help of a turbine and filter circuit , as approximately **25%** of the energy, which gets wasted in exhaust, is re-utilized by this system for charging of battery.

With the help of these **two** mechanisms a 12V/63Ah battery [9] gets charged in minimum engine runtime. As the bike gains momentum and attains a speed of about 45-50Km/hr, the power from the engine gets cut off and the hub motor on the front wheel is powered using battery, eliminating the torque requirement for the motor. The cut-off speed is sensed using a speed sensor device installed on the wheel axle as Fig.1.

Fig.1 Speed Sensor Device

This hub motor of **750W, 570 rpm** will work till the electric charge is in the battery. With the deceleration of the bike, the power is switched again to engine. Thus the whole system behaves as a simple button switch mechanism.

3.1. Hub Motor at A Glance:

In-wheel electric drive motors represent an effective method of providing propulsion to vehicles which otherwise were not designed to have driven wheels. that is they are good for EV (electric vehicles) hacking and conversion. They are compact and modular , requires no support of rotating axles from the parent vehicle to be propeller [15]. Pure DC electric motor hub as shown in Fig 2, in fact where used in some of the first electric cars. The motor is a transducer. Input electric power and out comes mechanical power usually, electrical power is defined as

$$\mathbf{P_e = V \ X \ I}$$

Where v=voltage (volts)
i= current (amp)

- Mechanical power

P_m= T x w
Where:
- T = Torque.
- W = Rotational velocity (rad/sec).

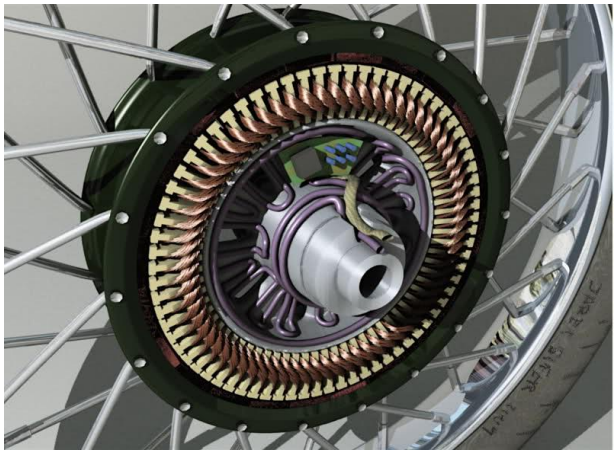

Fig2. Hub Motor

3.2 Maths;
The motor of the two-wheeler should consist of following specification-
- Power-750W
- RPM-570
- Peak torque-45 nm at 150 rpm
- Tires used -3 inches *10 inches provides better grip
- Battery-48V

- Using 1.6 unit of electricity on fully charged battery, vehicle would be able to travel distance of-
- 70-75 Km (with 75kg load)
  - m (with 130 kg load)

3.3 Application:
This system can be used in a lot of ways as it has a wide range of applications.
- The system can be installed in all motor bikes.
- Very suitable for long drives where variation of speed is minimum.
- Fig 3 represents a relation between the output power and specific fuel consumption of an engine.

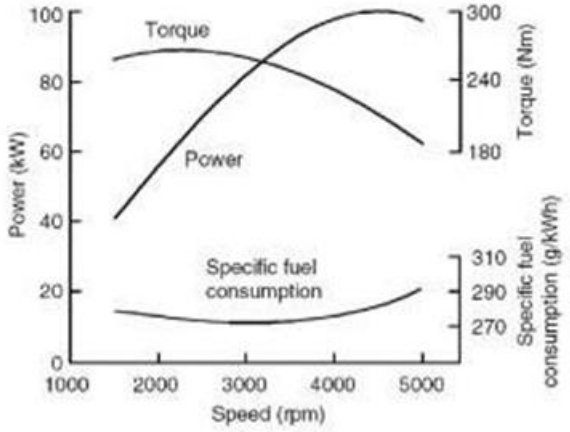

Fig3. Graph between Power and speed along with specific fuel consumption

4.1 Advantages:

The vehicle will provide more kilometers per litre, i.e. better mileage along with

- Increase in the overall efficiency of the two-wheeler.
- Less fuel consumption.
- Use of exhaust pressure energy.
- Multiple battery charging unit.
- Minimum battery charging time due to dual input.
- Auto cut-off of the battery after being fully charged
- Reduce is per kilometer pollutant emission.
- Reducing engine load and overheating as at higher speeds motor is employed.
- Less wear and tear of engine.
- Long life of engine.

4.2 Advantages of using a Hub Motor:

- High stating torque.
- Regeneration.
- Noiseless operation.
- Mounted directly to the rim.
- Maintenance free.

III. DISADVANTAGES

- Installation cost would increase.
- Frequent maintenance on regular basis and tune-up would be required.
- Electronic components should be checked regularly.
- It does not provide high speed in comparison to engine.

IV. CHALLENGES

- Variable speed of turbine may cause fluctuation in the output current.
- Hub motor may not be able to provide desired torque below a given speed.
- Motorbike may become bulky.

V. FUTURE SCOPE

As we are facing scarcity of fossil fuels, this paper can be a good initiative in facing this problem as we cannot minimize the use of automobiles. Hybrid mechanism would be a better option[15]. This will reduce the consumption of fossil fuels to larger extent and will also reduce the net pollutant emission. No stoppage is required during long runs as there will be load sharing during run.

VI. CONCLUSION

The concept emphasizes on a clean aspect of economizing the energy output using Hub motors mounted on each wheels. Hybrid systems incorporating a scope of engine safety in terms of durability is undoubtedly a better option to be adopted in high performance and high speed class of vehicles.

As it involves a turbine assembly driven by exhaust emission, the speed and throttling of main engine can have a direct impact on turbine operations which have elimination possibilities by employing a miniature electrical output stabilizer. Mathematically it's appealing fact that for the same amount of fuel and a mass of 75 kg (avg. human adult driver) can increase the engine mileage up to 70 km/l without much fuel consumption by continuing to work on electrical power generated.

This can be employed as a supporting unit as its functionality is limited by low angular velocity conditions. Being supporting system it's going to be also functional at a range which is uneconomic as per defined by motorbike manufacturers. And hence engine seizure at high speed is eliminated as the vehicle can continue to run on electrical power supply. In near future it is very well possible that we may find another source of energy. But, in these present days the best possible option in front of us is, the judicious use of energy and should strive for the same. So this system would be a judicious way of getting a high rate of overall efficiency. This paper consist of system for harness the energy which is wasted in form of smoke but can be a good source, also a profound study may possibly bring us to a more refined and accurate system for harvesting the pressure energy. Fig 4 graphically represent the whole ideation.

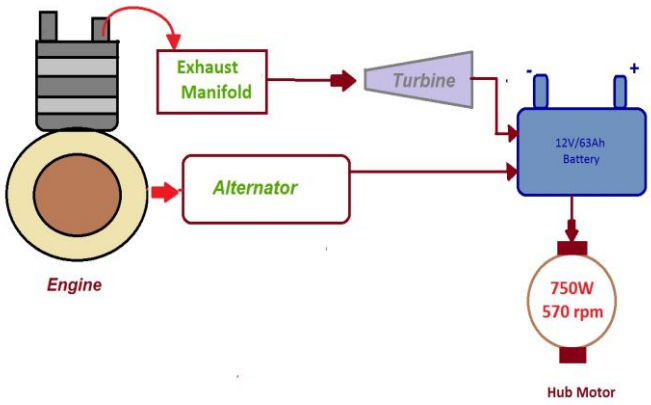

Fig.4 Graphical Representation of the Concept

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