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Air Drag Charging for Electric Vehicles

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***Abstract*: Aerodynamic Drag is the resistance offered by the air to the movement of the body. In our project we are trying to utilize air drag to charge electric vehicles. This is achieved by creating a charging mechanism which gets activated when the electric vehicle apply brake to stop or slow down. Aerodynamic Drag creates a large amount of force on vehicles. Placement of a turbine in the front area of the car could generate electricity from the drag force. But when we place turbine in front of the vehicle it will create additional drag. But at the time of braking the drag is actually assisting the breaking process. At the time of breaking we could utilize this drag force to generate electricity. Here the additional drag created will help the breaking process.**

***Keywords*: Aerodynamic drag, turbine, breaking.**

1. Introduction

As a result of increasing CO2 emissions, as well as those of other greenhouse gases, climate change continues to drive major environmental issues including rising sea levels, more destructive hurricanes, increasing number of forest fires and so on. One of the major contributors to the increasing greenhouse gas emissions has always been combustion engine vehicles. As the global energy demand continues to increase day by day and so as to decrease the increasing atmospheric pollution, the need for electric vehicles are increasing. One significant challenge with the electric vehicles is lower mileage when compared to combustion engines. Various researches are going on to improve electric vehicles demand and use, such as improved aerodynamic efficiency, improved battery composition, capture of wasted energy during braking process, and so on. Here we in this paper aims to generate electricity by effectively using the drag energy produced by the vehicle. Here we propose to place a turbine and generator inside the front portion of an electric vehicle where air is directed through the front grills of the vehicle to the turbine blades. The turbine blade would spin as the result of the drag energy entering through the front grill, that open with respect to the application of brakes during driving. The sudden opening of the front grills also causes an additional drag and helps in the breaking process. The produced power is either stored in a battery or is used for the working of components and devices in the vehicle.

2. Components

1) Front grills

It is front part of the assembly. It is used to allow the passage of air into the device during braking. It has height of 25 cm and is 60 cm wide. It houses 5 grill flaps. They are made of rectangular mild steel sheet of size 58 cm by 4.5 cm size which is welded onto a steel shaft having a lever at one end. The shaft has a length of 63 cm. The lever helps in opening and closing the grills.

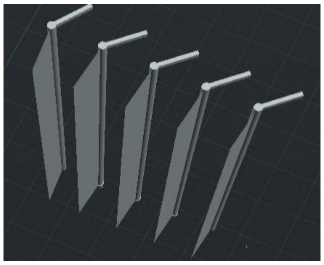

Fig. 1. Grill flaps

2) Brake cable

The brake cable connects the brake and the grills. It is connected to the lever of the grills.

Fig. 2. Brake cable

3) Spring

The spring used to return to the closed position when brakes are not applied. Here the spring used is torsion spring.

Fig. 3. Torsion spring

4) Converging nozzle

It converts the slow moving air to high velocity air. There is turbine at the end of it. It has a rectangular entrance and a circular exit. The entrance is 25 cm high and 60 cm wide. The exit diameter is 16 cm. The total length is 50 cm. It is made with steel sheets.

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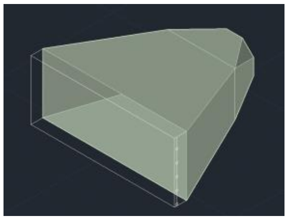
Fig. 4. Shape of converging nozzle

5) Turbine housing and turbine

Turbine housing consists of a cylinder of 16 cm diameter and 15 cm long. It is made of steel of steel sheet. It also has provisions to hold the generator and turbine inside. The turbine used is a reaction turbine with 6 blades. It has an outer diameter of 15 cm.


Fig. 5. Turbine

6) Generator and circuit

The electric generator used is a 12 volt DC motor. An adjustable dc to dc step up boost converter XL6009 and dc to dc buck converter step down module LM2596 is used in the circuit. A voltmeter is used to display output.


Fig. 6. 12 volt permanent magnet DC motor


Fig. 7. XL6009 Step up boost converter

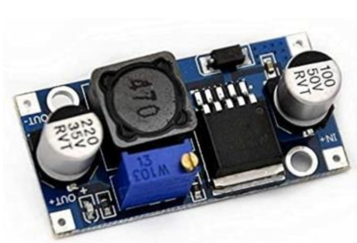

Fig. 8. LM2596 step down module

3. Design

A three dimensional image of the design is shown in the fig. 9. There are three main sections. The front section consists of the grill flaps and the grill frame. There are five grill flaps as described in the previous section. Five holes are drilled on the side walls of the grill frame for placing the grill flaps. The lever of each grill flap is connected to each other so that they opens and closes together. The lever of the bottom grill flap is connected to the brake cable. The torsion spring is placed on the other end of the shaft of grill flap opposite to the end having the lever. One leg of the spring is fixed on the grill frame and the other on the shaft. The middle section is a converging nozzle having a rectangular entrance which is joined to the front section and a circular exit which is joined to the back section, which is the turbine housing. There is provision to hold the electric generator inside turbine housing. The turbine is placed on the just after the exit of the nozzle

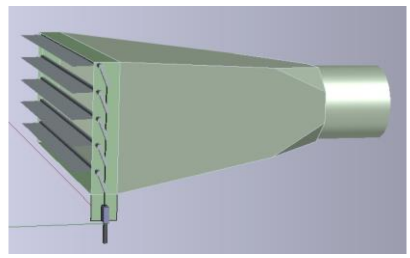
Fig. 9. 3D image of design

4. Working

Drag force is not desirable during acceleration but it helps in slowing down the vehicle during braking. So the grill flaps remain open only when brakes are applied. The brakes are connected to the grill with the brake cable. The cable is attached to the lever of the grill and each lever is connected to each other. Hence they all open at the same time. This allow air into the device. The spring helps the grills to return to close position when the brakes are not applied.

The air entering has low velocity and hence cannot produce enough torque to run the turbine. Hence the air is allowed to pass through converging nozzle section. This increases the velocity of the air which can provide adequate initial torque and run the turbine. The turbine is connected to the DC motor shaft. The motor rotates to produce electricity. The output of the motor is varying. So a circuit is used to condition the output from the motor to a constant voltage output. The step up boost converter is used to step up the output from the DC motor to a higher voltage. The step down module converts the varying high voltage output from the step up module to a lower constant voltage output.

5. Results

The design was tested at different wind speeds. And the circuit was adjusted to give the output at a maximum cut off voltage of 12 volts. It produced a constant output voltage of 12 volts at wind speeds greater than 25 km/h. At lower speeds it produced voltages less than 12 volts.

6. Conclusion

The need for switching to electric vehicles is increasing day by day. But the production and demand is not increasing mainly due to issues regarding mileage, availability of charging points and lack of power supply in many regions. Hence we need to develop all possible ways of increasing the efficiency and minimize energy losses in order to attain maximum mileage. The project investigated and created a novel method of harvesting drag energy in electric automobiles for conversion into supplemental electric power for the vehicles. The device was able to capture the energy that was lost at the time of braking by making use of drag force. The project entails estimating the potential of mounting a turbine attached to a generator inside the front portion of the vehicle, which would spin as the vehicle is in motion and generate electricity that can be stored or used. This technology will help to increase the mileage of the vehicle using drag energy and will ensure the use of electric vehicles over combustion engine automobiles in the market and will hence decrease the atmospheric pollution and global warming.

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