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Design and Development of Hydrogen Booster

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Abstract

Practically, it is impossible to substitute internal combustion engine which has become an integral part of the transportation and agriculture sectors. The fossil fuel resources are limited and depleting at very fast. Therefore, in future our energy system will have to be renewable and sustainable, efficient and cost effective, convenient and safe. In order to cope with the environmental concerned there have been many studies and trials on various types of automobile engines. As indicated by recent studies hydrogen fuelled vehicles appeared to be more eco-friendly in abundance. However the problems associated with hydrogen fuelled engine are pre-ignition, backfiring, rapid rate of pressure rise and knocking which need to be overcome so that hydrogen fuelled driven engine could be further develop and commercialize. This review paper is basically deliberating the various problems associated with the use of hydrogen driven engines in automobile sectors and suggestions to make this technology commercially viable.

Keywords: Fuel, Cope, Deliberating

1. Introduction

Energy production is primarily met by non-renewable sources like gasoline. Consumption of fossil fuel is gradually increasing as a result of population growth and the improvements in the living standard. During the next 25-30 years, increased population will result in an abrupt increase in the energy consumption. This will result in increased oil prices and shortage in supply. Over many years, Hydrocarbons fuels have played an important role in power generation. Hydrogen is one of the best alternative fuels since it does not produce emissions like carbon dioxide, carbon monoxide, oxides of nitrogen and hydrocarbons etc. The hydrogen has different features from other hydrocarbons fuel such as wide flammability limits, high flame speed, qualitative mixture control and high diffusivity. The use of hydrogen as a fuel in an internal combustion engine started with spark engine. Many researchers have tried to make use of intake port-fuelled spark ignition engines. The current research has focused on direct injection spark ignition engine due to their high volumetric efficiency and potential to avoid pre-ignition and backfiring problem. Hydrogen fuel enhancement (HHO BOOSTER) is the process of using a mixture of hydrogen and conventional hydrocarbon fuel. A hho generator, which is also known as an Electrolyser is a cell or multiple cells which breaks waterdown into hydrogen and oxygen gasses by using electrolysis. The gas produced is called hydroxy, browns gas or HHO. HHO is 2 parts hydrogen and 1 part oxygen. After adding the water, an electrolyte is added. Once the battery starts supplying direct current, the water starts disintegrating into its constituent's viz. hydrogen and oxygen gas, with HHO being released simultaneously. This HHO then travels into the air intake valve, at the end of which it combines with gasoline and air in the combustion chamber. This is followed by combustion of HHO, which converts it back to wate The HHO gas is supplied to the engine via intake manifold or carb. The gas then helps your gasoline burn more efficiently, while producing its own combustion. That added

combustion of the hydrogen gives you more power, and ultimately requires less gasoline to run your engine, resulting, in better gas mileage. HHO gas acts as a catalyst to better burn your gasoline and is increasing your engine efficiency.

2. Objective

1. To develop and test dual fuel(hydrogen) internal combustion engine, with minimum design changes
2. To improve the fuel efficiency of engine, to counter the depleting fossil fuel reserves and its increasing prices
3. To reduce emission from the engine,eg NOx, etc

2.1 Objective:

1. To study the details and design of hho booster.
2. To study the controlling devices required for hydrogen suplly.
3. To study the increase mileage of the vehicles.
4. To fabricate and design the model.

2.2 Scope of the Project:

The main advantage of this technology, is the increase in fuel mileage. As a result, for the same amount of fuel, you get more mileage, more mileage means more money in your pocket, more money in your pocket means a happier person. Since hydrogen burns hotter than gas or diesel it burns all the excess fuel that use to go out your tail pipes. This in itself helps to increase your fuel mileage

Another advantage of hydrogen on demand technology is there is no need for any modification to your engine. So the usual expense of modifying the engine can be avoided. Without doing any modification to your car or truck engine they can not void your warrantee.

By using this hydrogen on demand, the engine will become more eco-friendly, because more pure oxygen instead of toxic carbon dioxide is expelled through your tail pipes. It will reduce the engine temperature while prolonging the life of your engine.

We all know that the fuel price is rising rapidly and that the need for better mileage is essential. This is where the importance of hydrogen as a supplementary fuel in automobiles comes into play. This will help to increase fuel mileage, thus creating better mileage.

3. Research Methodology

3.1. Fuel cell:

A **fuel cell** is an electrochemical cell that converts the chemical energy from a fuel into electricity through an electrochemical reaction of hydrogen fuel with oxygen or another oxidizing agent. Fuel cells are different from batteries in requiring a continuous source of fuel and oxygen (usually from air) to sustain the chemical reaction, whereas in a battery the chemical energy comes from chemicals already present in the battery. Fuel cells can produce electricity continuously for as long as fuel and oxygen are supplied.

3.2. History of fuel cells:

A **fuel cell** is an electrochemical cell that converts the chemical energy from a fuel into electricity through an electrochemical reaction of hydrogen fuel with oxygen or another oxidizing agent. Fuel cells are different from batteries in requiring a continuous source of fuel and oxygen (usually from air) to sustain the chemical reaction, whereas in a battery the chemical energy comes from chemicals already present in the battery. Fuel cells can produce electricity continuously for as long as fuel and oxygen are

supplied.

The first fuel cells were invented in 1838. The first commercial use of fuel cells came more than a century later in NASA space programs to generate power for satellites and space capsules. Since then, fuel cells have been used in many other applications. Fuel cells are used for primary and backup power for commercial, industrial and residential buildings and in remote or inaccessible areas. They are also used to power fuel cell vehicles, including forklifts, automobiles, buses, boats, motorcycles and submarines.

4. Electrolysis Equations

The number of hydrogen molecules produced is thus twice the number of oxygen molecules. Assuming equal temperature and pressure for both gases, the produced hydrogen gas has therefore twice the volume of the produced oxygen gas. The number of electrons pushed through the water is twice the number of generated hydrogen molecules and four times the number of generated oxygen molecules. Reduction will occur at the cathode. At this electrode hydrogen gas and hydroxide ions are formed. The electrons required for this reduction will come from the power source.

$4H_2O + 4\ e^- \rightarrow 2\ H_2 + 4\ OH^-$

Oxidation will occur at the anode, producing oxygen gas and hydrogen ions. The electrons that are produced will return to the power source:

$2H_2O \rightarrow O_2 + 4\ H^+ + 4\ e^-$

Adding the two half-reactions together gives us a net reaction of:

$6\ H_2O \rightarrow 2\ H_2 + O_2 + 4\ H^+ + 4\ OH^-$

The H^+ and OH^- that are produced will combine to form 4 H_2O.

$6\ H_2O \rightarrow 2\ H_2 + O_2 + 4\ H_2O$

Finally we can simplify our overall equation to:

$2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$

5. Figures and Tables

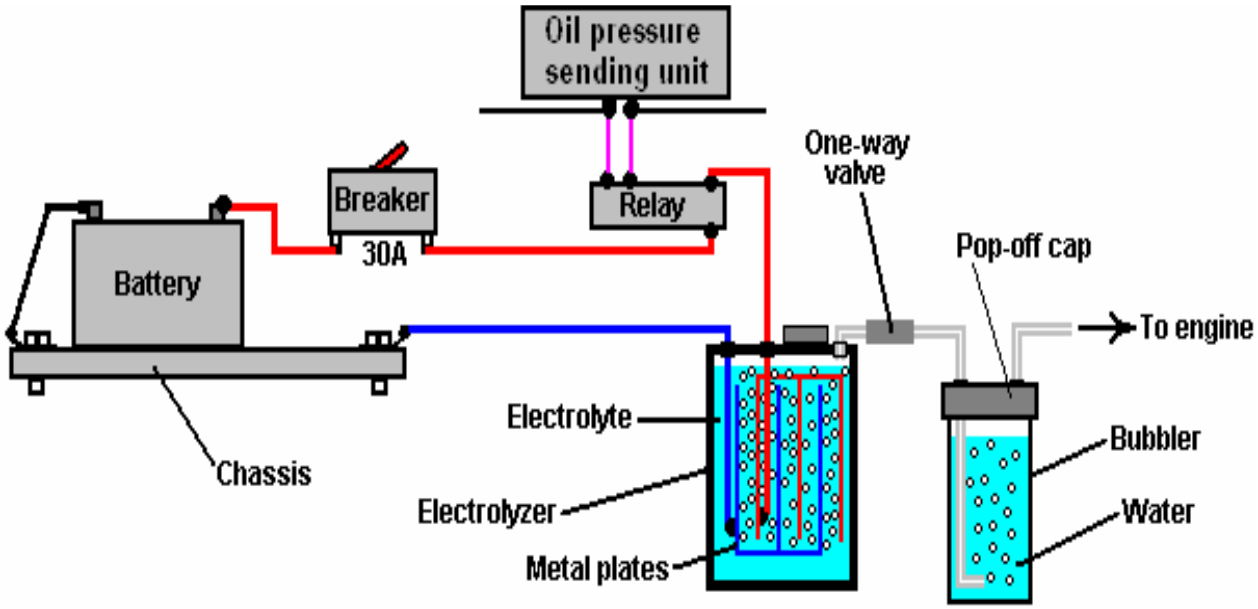

Fig. 1. Design Of Hho Booster

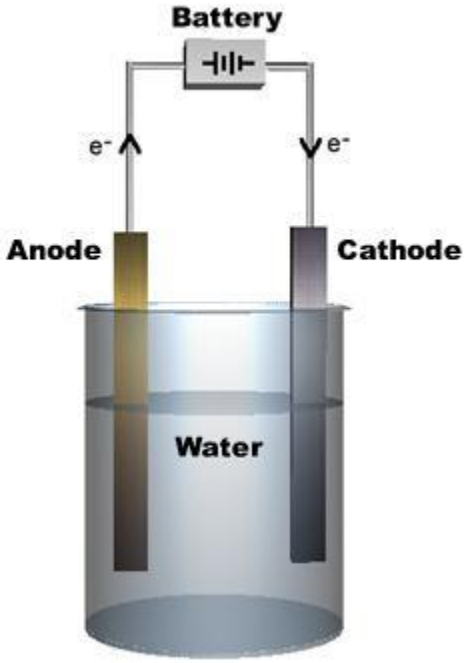

Fig. 2. Electrolysis of water

6. Chart

Comparison of property Table - The properties of hydrogen

Properties		petrol	hydrogen
Autoignition temperature (K)		530	585
Minimum ignition energy (mJ)		-	0.02
Flammability limits (volume % in air		0.7-5	4-75
Stoichinometric air-fuel ratio on mass basis		14.5	34.3
Limits of flammability (equivalence ratio)		-	0.1-7.1
Density at 16 0C and 1.01 bar (kg/m3)		833-881	0.0838
Net heating value (MJ/kg		42.5	119.93
Flame velocity (cm/s)		30	265-325
Quenching gap in NTP air (cm)		-	0.064
Diffusivity in air (cm2 /s)		-	0.63
Research octane number		30	130
Motor octane number		-	-

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