Design, Development and Manufacturing of Water Fueled Vehicle

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Abstract- *Fossil fuels like petrol, diesel etc. are non-renewable energy resources which emit hazardous gases like carbon monoxide, nitrous oxide, hydrocarbons which pollute the environment. In today's scenario, the prime requirement is to find an alternate for fossil fuel. Hence to fulfill the need, water can be used as a substitute for the same. Water is one of the free recourses and by applying the electrolysis technique it can be split into hydrogen and oxygen which is known as HHO and in general "Free Energy".*

In this work, a portable kit has been design and fabricated so that it can be easily mounted on vehicle for maximum HHO gas productivity per input power. The separated hydrogen will be sent directly to the engine through carburetor as a fuel and further hydrogen gas will be generated in form of energy as per consumption of hydrogen this eliminates storing of hydrogen. As hydrogen is highly flammable, in order to prevent explosion flame arrestor is introduce along the pipeline with kit which will stop flame to pass further. Moisture trapper has been placed to remove vapor content in generated hydrogen which may affect efficiency of engine further various tests will be carried out like gas pressure test, leakage test, flow rate test to run engine more efficiently. The emissions of harmful and toxic gases are reduced up to some percentage as smoke consists of hydrogen which will be economical and eco friendly option to automobile industries.

Keywords- free energy, HHO, harmful gases, eco-friendly, economical.

I. INTRODUCTION

The increasing demand for petroleum fuel associated with limited non-renewable stored quantities has resulted in a huge increase in crude oil prices. In the last few years, ordinary people experienced this by paying more at the pumps. Consequently we have seen a shift toward automobiles that consume less fuel. This has encouraged researchers to seek an alternative fuel that can be used in engines without the need for a dramatic change in the vehicle design. It has been shown that using pressurized hydrogen gas as a fuel in internal combustion engines (IC engines) has many advantages such as more engine power and lower pollutant concentrations in exhaust gases. As part of this, advancement studies on improving the performance of the internal combustion engine [3] [5]. Research findings on the FC are presented in this work. An auxiliary circuit, with the FC being its main part, will be designed and tested after installation on an actual engine [2]. Many advantages will be gained after installing the device behind the carburetor of the engine. These include but are not limited to the following: a relatively efficient mixing of the elements (hydrogen and air) inside the intake manifold, improves increase stability of the engine and reduced emission. The scope of this work is to introduce some of the hydrogen advantages while maintaining the original specifications of the engine. This may be attained by introducing an HHO cell to the fuel supply system, so that a fuel mixture of air and HHO gas is obtained [8] [9].

A compact unit for generating HHO gas will design to fit the engine specifications and to be installed beside of the engine. Hydrogen is a colorless, odorless and non-toxic. It is the lightest element in all elements. It is mostly found in its molecular form combined with another chemical as a compound [11]. An example is water, where it is combined together with oxygen, and methane, combined here with carbon. Different techniques are used for production of HHO gas. Such like that electrolysis, catalysts and electrodes are used. The energy of the hydrogen bond is 436 KJ/Mol [7].

II. PROBLEM DEFINITION

With high demand for more efficient engines, our mission is to design and create a device that will increase engine efficiency without jeopardizing its performance. Such device is an HHO Generator.

This generator uses electric current (electrolysis) to produce hydrogen from water; the hydrogen will be introduced into the combustion chamber of an engine through the intake manifold. Building this generator comes with some challenges [13]. Our gasoline vehicles are a major cause of global warming, collectively, cars and trucks account for nearly one-fifth of all US emissions, emitting around 24

pounds of carbon dioxide and other global-warming gases for every gallon of gas [14].

About five pounds comes from the extraction, production, and delivery of the fuel, while the great bulk of heat-trapping emissions more than 19 pounds per gallon comes right out of a car's tailpipe. In total, the US transportation sector which includes cars, trucks, planes, trains, ships, and freight produces nearly thirty percent of all US global warming emissions, more than almost any other sector [15].

Unfortunately, oil-related emissions may rise in the coming years as the oil industry extracts and refines "unconventional" oils, such as tar sands and tight oil. Using less oil and avoiding unnecessary emission from the oil we do use is the real solution. We need to make sure that the amount of energy put into the cell to split the water molecules is less than the amount of output energy of the generator. In order to overcome this challenge we will need to make it as efficient as possible. This includes coming up with a creative design to get as much hydrogen out with the least amount of current running through the cell. More concerns include implementing very conductive wires and plates into our system. Taking these aspects into consideration will make the "Hydrogen fuel generator kit" a productive addition to any internal combustion engine.

III. DESIGN METHODOLOGY

The Housing/container: The generator housing holds the electrolyte and the electrode. It is made from polypropylene material with 4mm thickness. It has height of 230mm length 255mm and width of 155mm.

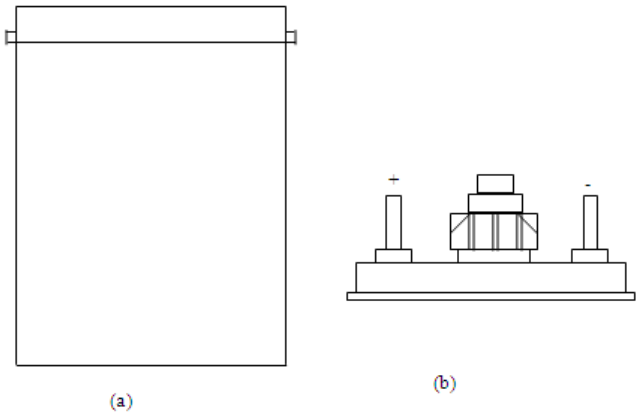

Figure 1. (a) Electrolyte container and (b) The container cover

The Electrodes:

The electrodes will be connected between the electrolyte and the battery terminals. They conduct current from the battery to the electrolyte. Oxidation and reduction reactions take place at the electrodes. Height of the electrode plates is 210mm width 155mm and thickness 2mm.

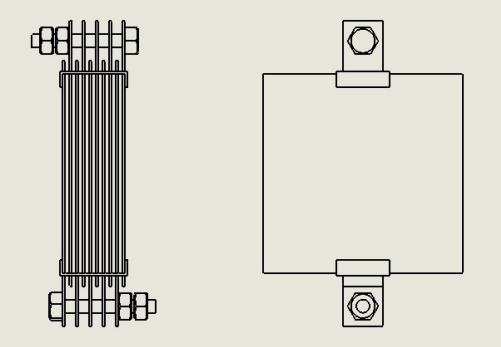

Figure 2. Stainless steel plate assembly

Connecting bolts:

The two connecting bolts are used to stack the electrodes in the electrolyte. In centre one bolt is used for supporting the whole assembly.

The Electrolyte:

The electrolyte is formed from seven liters of distilled water and 70gramms of sodium hydroxide mixed together. The solution is stirred properly and allowed to cool. The electrolyte is poured into the housing after the electrode stack has been lowered into the housing.

The Battery:

The battery produces the electromotive force to drive the free charged electrons (ions) towards their respective electrodes for oxidation – reduction reactions. The battery is a 12V 9Amp.

Connecting wires:

As we are dealing with 30 amps we are using 16sq mm wire with current capacity 70amps.

Rotameter:

The rotameter is connected to the kit. The outlet of the kit is connected to the inlet of rotameter. Body of rotameter is acrylic and range of measuring flow rate is 50-500cc/min with least count of 25cc/min and is able to measure 50% hydrogen and 50% oxygen.

Figure 3. Rotameter

Pressure gauge:

pressure gauge is used to measure pressure of gas extracted from system its body material is of cast iron and 4 inch diameter with range of 0-2 bar with least count of 0.25bar and connection type is bottom entry.

Figure 4. Pressure gauge.

Pump:

The 12V DC Vacuum pump of 5LPM capacity and maximum pressure of 2000mm of Hg is used for extracting hydrogen from hydrogen kit and creating pressure difference.

Figure 5. Pump

Flashback Arrestor:

Flashback arrestor is used to quench the flame by reducing flame velocity even lower than minimum fuel velocity of gas, thereby stops the propagation of flame into or through pipe back to kit and also helps in preventing back firing (The uncontrolled ignition occurring at hydrogen fueled engine can caused by flame existing in engine cylinder) of engine.

Type of flash arrestor used is inline deflagrated as hydrogen gas comes under group B consisting of flammable gases, type of mounting selected is flange type with ferrun connection for connecting pipes.

Figure 6. Flashback arrestor

IV. WORKING OF HYDROGEN

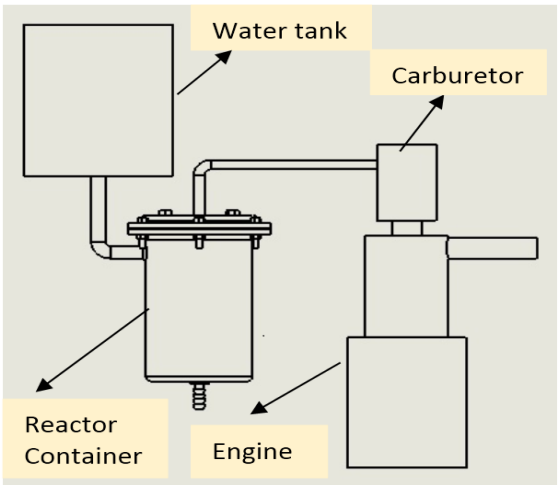

Figure 7. Setup of hydrogen generator kit.

Hydrogen fuel generator kit is a device used to produce hydrogen gas using electrolysis process. It is a small closed container of length 255mm, width 155 mm and height 230mm made up of polypropylene material and consists of

eight stainless steel plates of SS316L grade arranged alternately positive and negative plates by supporting bolt at center. Entire stake of plates are attached to top cover of kit by means of electrodes. The negative plates are drilled with holes for increasing current concentration and distribution of heat eventually. The plate assembly is immersed in electrolyte solution of 7 liters water and 70 grams of sodium hydroxide.One end of negative plates are connected directly to 65Amps battery and one end of positive plates is connected to resistor and other ends two ends are connected thereby completing circuit. Outlet pipe of kit is connected to flow meter to measure the flow rate of extracted gases. To test the hydrogen generation outlet of kit is connected to 12v dc vacuum pump whose outlet is further connected to flashback arrestor which supplies hydrogen entire connecting pipes are sealed with Teflon tapes and time for which hydrogen is generated is revealed by stopwatch.

Engine connection: while assembling kit to engine, the 65 amps battery is connected to hydrogen generator kit with resistors in between to lower the current to 40 Amps. The outlet pipe of kit is connected to pump which is further connected to flashback arrestor for preventing back firing and extracted hydrogen is supplied to engine through carburetor.

IV. RESULTS

Results obtained from conducted experiment are as follows:

Flow rate of hydrogen obtained: 150cc/min
DC current supplied: 40Amps.
Battery voltage: 12V
Resistance(R): V/I
=12/40
=0.3Ω.
Time for generation: 30sec with 24 Amps battery.

V. CONCLUSION

Hydrogen gas can replace gasoline in small domestic electric power generators especially where the demand for utility power is far more than what is being produced. This hydrogen gas generator can easily be replicated, thus making the shift from fossil fuel to sustainable fuel is easy.

The combustion heat released is about 24% greater than in the case of gasoline fuelled engine and by about 43% greater than in case of hydrogen air mixture outside cylinder formation. The hydrogen admission after intake valve closing allows also the cooling of cylinder by air, the air is subsequently used for combustion preventing the uncontrolled ignition and returning of flame in intake system.

The hydrogen properties provides high efficiency engine ruing at partial loads when the qualitative load adjustment can be use are much higher burning rate, flammability lower limit and lower ignition energy.

Indicated specific fuel consumption decreases with 10% for hydrogen as compare to gasoline engine.

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