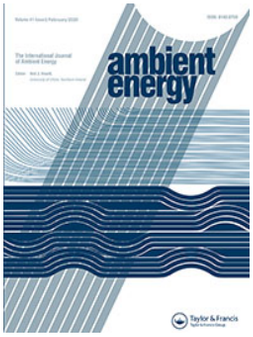

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Internal combustion engine efficiency enhancer by using hydrogen

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ABSTRACT

Most cars work by burning a liquid fuel with oxygen. Fuel is squirted into a chamber with air, it evaporates into a gaseous mixture, it lights, the burning gases expand, which in turn produces motive power. The car begins to move. The Problem is that becomes more expensive. With these rising costs of gasoline and diesel fuel, we decided to try using hydrogen as a means of alternative power for the car. With a hydrogen generator, the idea is to replace some of the gasoline with hydrogen. Gaseous hydrogen burns readily and produces loads of power. The idea is that the extra boost (not replacement) in gasoline power from the hydrogen would cause a gasoline-burning engine to back off on using so much gasoline. This in turn should result in less gas being burned. This paper brings about hydrogen fuel generator, whose fuel generated can be used as alternate source of fuel.

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KEYWORDS
Water; hydrogen; oxygen; alternative fuel; gasoline; IC engines; efficiency; hydrogen generator

1. Introduction

The entire surface transport of India is based on petroleum fuel, but its availability is of growing concern. The production of domestic crude has been declining and the transport system has been increasingly dependent on imported crude oil to meet its needs. There is a growing concern that the world may run out of petroleum based fuel resources. All these make it imperative that the search for alternative fuels is taken in right earnest (Balat 2008).

Alternative fuels also known as non-conventional fuels, or advanced fuels are any materials or substances that can be used as fuels other than conventional fuels. Conventional fuels include fossil fuels, petroleum oil, coal, propane, and natural gas and nuclear materials such as uranium. The main purpose of fuel is to store energy, which should be in a stable form and can be easily transported to the place of production. Almost all fuels are chemical fuels. We as a user use this fuel to perform mechanical work, such as powering an engine.

Hydrogen energy is a potential primary source of fuel for automobiles, as well as a potential source of energy for heating buildings and generating electricity. An electric car stores its energy on board, or it may generate energy using a fuel cell or generator (Griessen and Riesterer 1988). A fuel cell is a specialised form of battery that combines hydrogen with oxygen in a chemical reaction that produces electricity and water vapour. Unlike an electric cell or battery, a fuel cell does not run down or require recharging; it operates as long as the fuel and an oxidiser are supplied continuously from outside the cell. A fuel-cell power plant is up to 55% efficient (Balat 2008), compared to a regular internal-combustion engine, which is only up to 30% efficient (Kelly, Gibson, and Ouwerkerk 2008).

Hydrogen is one of two natural elements that syndicate to make water. Hydrogen is not an energy source, but an energy carrier because it takes a great deal of energy to extract it from water. It is useful as a compact energy source in fuel cells and batteries (Xu et al. 2007). Many companies are working hard to develop technologies that can efficiently exploit the potential of hydrogen energy.

2. Apparatus required

- Stainless steel light switch covers, stainless steel bolts, $1/16'' \times 2'' \times 12''$ stainless steel peace,
- Rubber hose, wire, PCV pipe.
- Baking soda for the water-
- 10-amp regulator (Figure 1)

3. Method of construction

3.1. Procedure

- Building a Hydrogen Generator is so simple. Think about this, one time a month you add some fresh distilled water into the water reserve tank and double the gas mileage. I have seen people make a hydrogen generator out of a old plastic peanut butter jar. The biggest thing to remember is that your creating a gas, i.e. gases can be explosive.
- To keep it safe and simple, mount the [PCV Hydrogen Generator] in the front bumper cover or on the inside of the front fender well. Then mount the water reserve tank under the hood of the car.
- To build the generator use the drawing below for reference. To start take 5–10 stainless steel light switch covers and stack them on top of each other with a rubber bushing between each one. Run a stainless steel bolt through the top and bottom bolting a $1/16 \times 2$ peace of stainless steel one on each side, one on the top and one on the bottom (Figures 2 and 3).The essential connections that has to made inside the car is been shown below (Figures 4 and 5)

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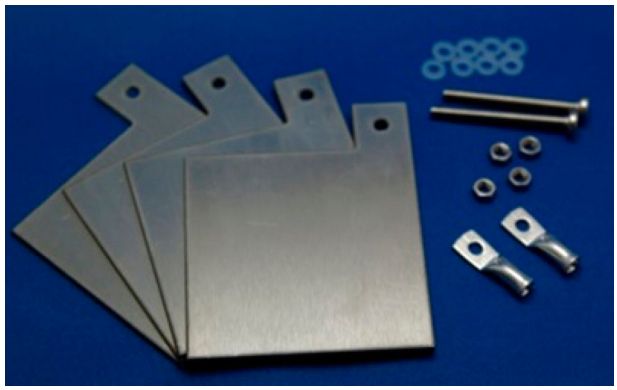
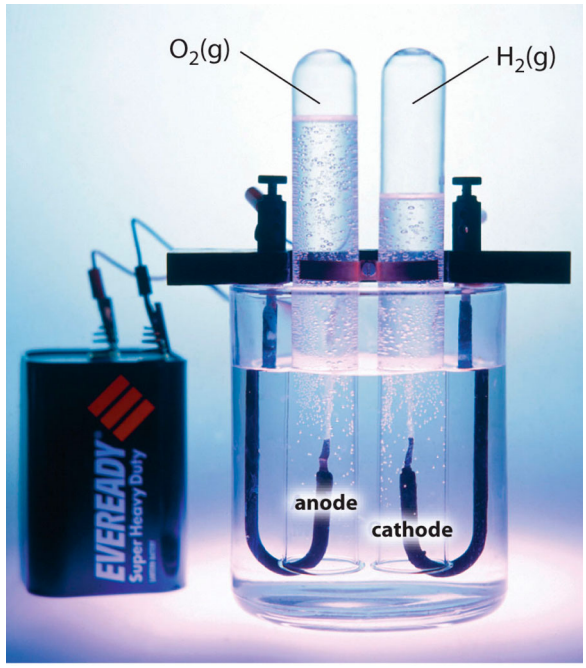


Figure 1. Stainless steels used for generator construction.

- We will need two 1/2″ [L] hose fittings a 7″–12″ peace of 6″ PCV pipe with two solid caps one for each side. [PCV pipe adhesive] Must Drill and install the hose fittings one on the top and one on the bottom side [they both run to the water reserve tank] Then drill out two holes for the positive and negative stainless steel bolts that mount on the top PCV cap cover. Drill, cut and adjust the dimensioned stainless steel material that is bolted on the light switch covers and then bolt it to the bolts installed on the top cap.
- Must try to centre it out so that everything fit inside the PCV with both caps on without touching the sides. Last wire in 12 volts to the top stainless steel bolts so that when your key is turned on so is the 12 volts. Last drill out 3 holes in the water tank, two are for the generator, and one is for the hose that run to your engines air intake after the air cleaner.

4. Principle of working

A hydrogen generator works through a process called electrolysis, which is the conversion of water into its constituent components: pure hydrogen and oxygen (Bogdanovic and Schwickardi 1997). This is done by sending electricity through specially designed pieces of metal suspended in water. The 'tension' caused by the electricity causes the water molecules to shear apart, and this results in the production of pure oxygen and hydrogen gas bubbles (Züttel et al. 2003). In other words, when water, with an electrolyte present, has an electrical current run through it, the water wants to break into its component parts. Those component parts are of course two parts hydrogen and one-part oxygen, which are all gases. The engine that the generator is hooked up to creates a vacuum that sucks the hydrogen into it, and the hydrogen is then used to fuel internal combustion which drives the engine just like gasoline powered engines (Steinfeld 2002). An added plus to the electrolysis process is not only is pure hydrogen gas being produced, but pure oxygen gas comes out, too. This oxygen is collected along with the hydrogen



anode: $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$

cathode: $2H^+(aq) + 2e^- \rightarrow H_2(g)$

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

Figure 3. Process of electrolysis in hydrogen generator (Dymova, Eliseeva, and Bakum 1974).

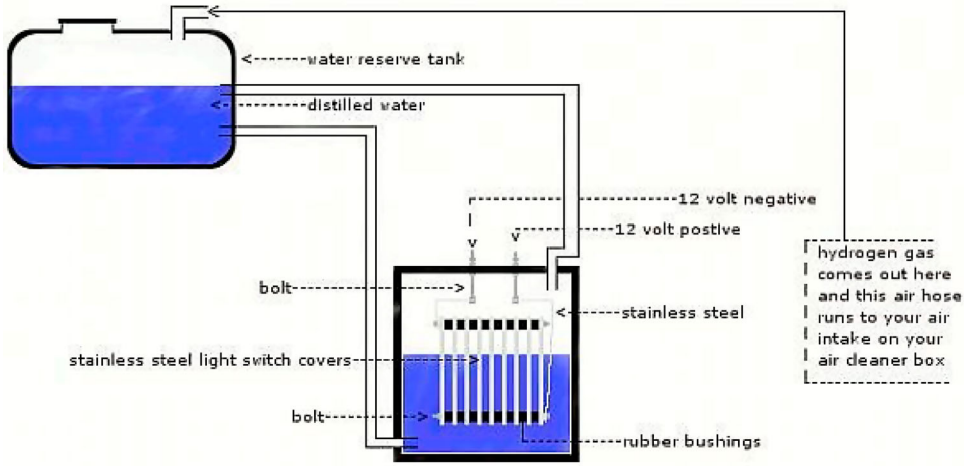


Figure 2. Layout of hydrogen generator – construction diagram (Bogdanovic et al. 2000).

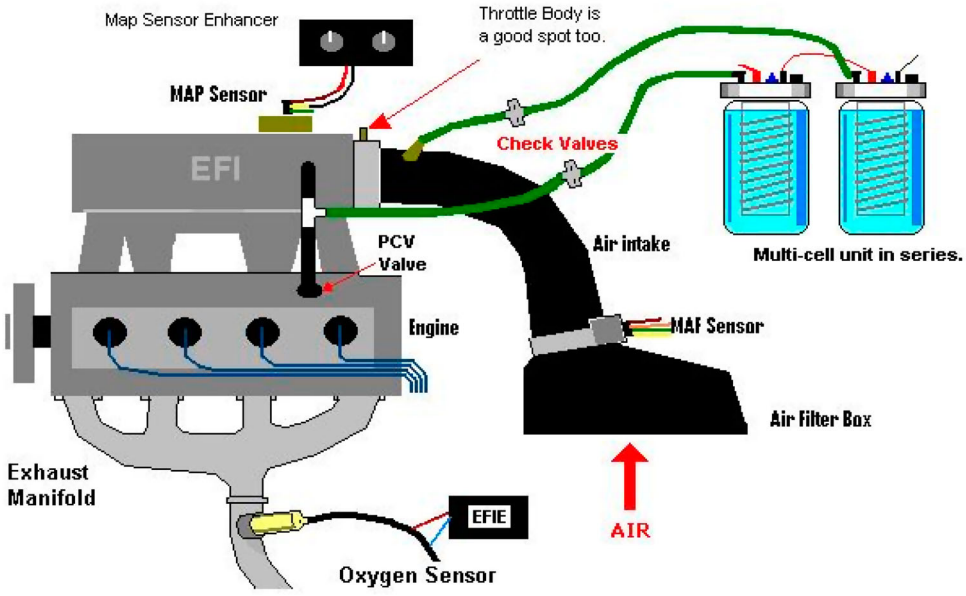


Figure 4. The essential connections that has to made inside the car (Leung, March, and Motz 1976).

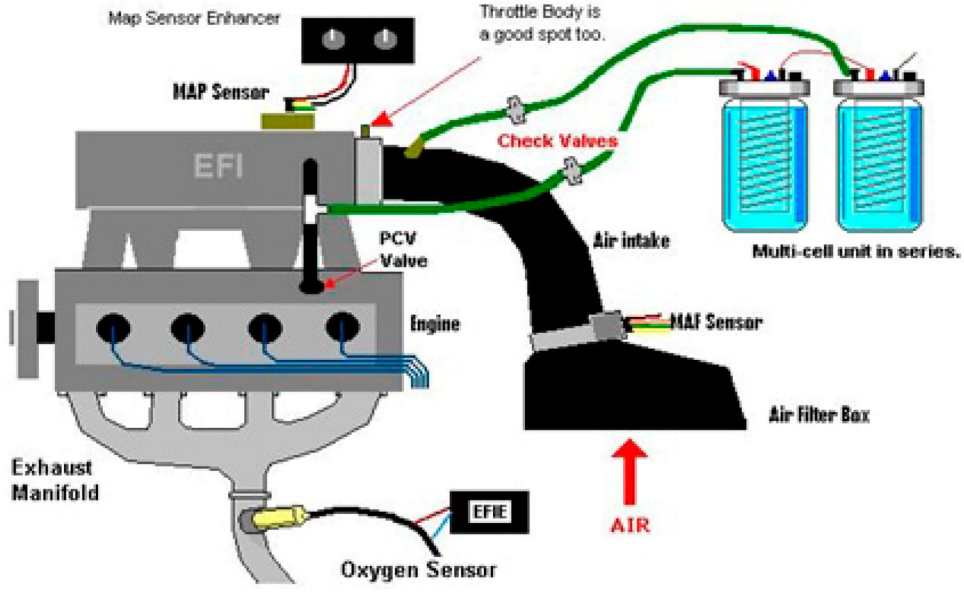


Figure 5. The essential connections that has to made inside the car in turbo-diesel engine (Leung, March, and Motz 1976).

and goes into the engine also (Figure 6).

$$2H_2O + \text{Energy} \rightarrow 2H_2 + O_2$$

Whether the hydrogen generator is using water or extracting and reforming hydrogen from other chemicals, the basic principle of the generator remains the same. The source liquid or chemical is placed in a container with two metal plates. The plates are then 'charged' (either through the introduction of electricity or through a chemical reaction) causing the elements of the source to separate into H2 and a by-product that is not used by the generator. The H2 is then removed from the container.

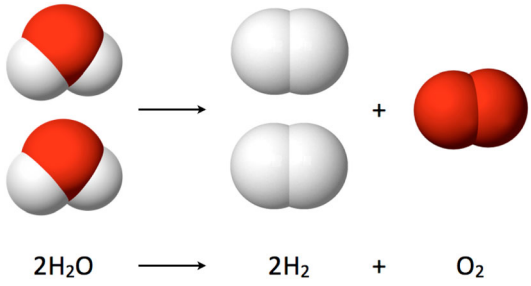


Figure 6. Water splitting into hydrogen and oxygen (Wikipedia, 2003).

5. Calculations

Faraday's First Law:

$$V\text{theoretical (in } m^3) = (R\,I\,T\,t)/(F\,p\,z)$$

where, R = 8.3414 (in Joule / mol-Kelvin); I = current (in amps); T = temp (in Kelvin); t = time (in seconds); F = Faraday's constant = 96485 Coulombs per mol; p = ambient pressure (pascals); z = num of excess electrons.

- 237.1 KJ is required to convert 1 Mole of water (18 g) to H2/O2
- To convert 1 Mole of water to gas via electrolysis will requires 237.1 KJ of energy
- 1 litre of H2O produces 55.55 Moles of H2 (1358.3l) and 27.775 Moles (679.15l) of O2 (for a total volume of 2037.45l of H2/O2)
- To convert 1 litre of H2O to H2 and O2 by electrolysis will require 3.65 8 KWh
- The addition of 14.4 lpm of H2/O2 should (according to the scientific reports) increase our engine's horsepower by 14.8–15%
- We're assuming a 20 HP requirement for cruise speed so once we add the 14.4 lpm of H2/O2 the engine will output an additional $20 \times 0.15 =$ three horsepower.

The electrical connection is very simple. The device uses 12 volts of electricity from your car battery only when your engine is running. This is for safety purposes to prevent hydrogen production when the engine is off. The device is fuse-protected and draws very little current.

6. Conclusion

This is an innovative method by which hydrogen can be used as alternate fuel for cars. The problem of petroleum demand will be faced challengingly by the introduction of hydrogen generators in cars. The experiment that has been tried is hoped to get highest possible efficiency, as per the requirement.

Disclosure statement

No potential conflict of interest was reported by the authors.

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