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01/31/99 - Gunnerman Patent

The following is a copy of a patent which claims to reveal how to run an internal combustion engine on a mix of as much as 70% water and 30% combustible liquid fuel.

The document also reports on the use of metal catalysts as well as the use of a surfactant to reduce the surface tension in both the water and the combustible fuel which would allow them to freely mix.

As Dan York points out, a good explanation of surface tension is when you put a drop of water on a table and it beads without pooling into a flat puddle. Surface Tension is what holds it into the spherical shape. With the addition of a surfactant (detergent), the surface tension is reduced and the water flows out flat onto the table. This is how laundry soaps can allow water to freely penetrate into clothing for a 'cleaner clean'. Surface tension is also what allows a needle to float on water.

The combustible fuel (gasoline, etc.) is exploded by the high voltage spark, which helps to crack the water molecule into hydrogen and oxygen which are in turn exploded to not only give a cleaner burn but also to add considerable thrust to the piston.

The document and associate history is kindly being brought to light by a Mr. Richard Felix so that people can experiment with it in their own engines.

Some of us plan to try it in a single cylinder lawnmower engine to see if it works as decribed. If it does, this might be a means to not only reduce your fuel costs in your vehicle (and it works on diesel) but also to run a small engine to economically drive a generator to provide electrical power for your house.

It's not free energy but its a great start if it can be independently proven to work as described. As per the directive of Mr. Felix, please feel free to copy, mirror, or reprint this document for the widest possible distribution in order to allow mass experimentation and practical use.

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5,156,114 - AQUEOUS FUEL FOR INTERNAL COMBUSTION ENGINE AND METHOD OF COMBUSTION

Inventor: Rudolph W. Gunnerman

4100 Folsom Blvd

Apt. 9D

Sacramento, Cal. 95814

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Related U.S.; Application Data

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Apr. 23, 1991, abandoned, which is a continuation-in-part of Ser. No. 440,224 Nov. 22, 1989.

Int. Cl. F02P 23/02, F02M 31/04; CI0L 1/02

U.S. CL. 123/1A; 123 A; 123/143 D - 123/556; 123/DIG. 12

Field of Search : 123/1 A. DIG. 12, 25R, R. 123/25 E,3,143 B, 556, 670, 25 A, 25 B, 25 F, 44/30l; 431/4

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Primary Examiner -- Tony M. Arganbright.

Attorney Agent, or Firm -- Christie, Parker A Hale

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ABSTRACT

An aqueous fuel for an internal combustion engine is provided. The fuel comprises water from about 20 per cent to about 80 percent by volume of the total volume of said fuel, and a carbonaceous fuel selected from the class consisting-of ethanol, methanol, gasoline, kerosine fuel, diesel fuel, carbon-containing gaseous or liquid fuel, or mixtures thereof. A method for combusting an aqueous mix in an internal combustion engine is provided.

The method produces approximately as much power as the same volume of gasoline. The method comprises introducing air and aqueous fuel into a fuel introduction system for the engine. The fuel comprises water from about 20 percent to about 80 percent by volume of the total volume of the fuel, and a carbonaceous fuel from ethanol, methanol, gasoline, kerosine fuel, diesel fuel, carbon containing gaseous or liquid fuel, or mixtures thereof, and introducing and combusting said air/fuel mixture in a combustion chamber or chambers in the presence of a hydrogen producing catalyst to operate the engine.

113 Claims. No Drawings

U8005156114A=Bar Code Number.

United States Patent

Patent Number - 5,156,114

Gunnerman Date of Patent Oct. 20 1992

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AQUEOUS FUEL FOR INTERNAL COMBUSTION ENGINE AND METHOD OF COMBUSTION

CROSS REFERENCE TO CO-PENDING APPLICATIONS

This application is a continuation in part of patent application Ser. No. 07/689,988, filed Apr. 3, 1991, now abandoned, which is a continuation in part of application Ser.No. 07/440,224, filed Nov. 2,1989 and related to application No.07/714683, filed Jan.13,1991.

FIELD OF THE INVENTION

This invention relates to a novel aqueous fuel for an internal combustion engine and to a novel method of combusting such fuel in an internal combustion engine as well as to a novel fuel mixture which results from the introduction of the aqueous fuel into the combustion chamber of an internal combustiom chamber in the presence of a hydrogen-producing catalyst.

BACKGROUND OF THE INVENTION

There is a need for new fuels to replace diesel and gasoline for use in internal combustion engines, especially engines used in motor vehicles. Internal combustion engines operating on gasoline and diesel fuel produce unacceptably high amounts of pollutants which are injurious to human health, and may damage the earth's atmosphere. The adverse effect of such pollutants upon health and the atmosphere have been the subject or great public discussion. Undesirable pollutants result from combustion of carbonaceous fuel with combustion air that contains nitrogen. The relatively large amounts of air used to combust conventional fuels is therefore, a primary reason for unsatisfactory levels of pollutants, emitted by vehicles with internal combustion engines.

SUMMARY OF THE INVENTION

A novel fuel and fuel mixture, and novel method of combustion, have been discovered which will reduce pollutants produced by internal combustion engines operated with conventional carbonaceous fuels such as gasoline, diesel fuel, kerosene fuels, alcohol fuels such as ethanol and methanol,and mixtures therof.

The new fuel mixture is also much less expensive than carbonaceous fuel such as gasoline or diesel fuel because its primary ingredient is water. The term "internal combustion engine" as used herein is intended to refer to and encompass any engine in which carbonaceous fuel is combusted with oxygen in one or more combustion chambers of the engine.

Presently known such engines include piston displacement engines, rotary engines and turbine (jet) engines. The novel aqueous fuel of the present invention has less than the potential energy of carbonaceous fuels but is nonetheless capable of developing at least as much power.

For example, an aqueous fuel of the invention comprising water and gasoline has about 1/2 the potential energy (BTU's) of gasoline, but when used to operate an internal combustion engine, it will produce approximately as much power as compared with the same amount of gasoline.

This is indeed surprising and is believed to be due to the novel fuel mixture that results from the release of hydrogen and oxygen and the combination of hydrogen when the novel aqueous fuel is introduced to a combustion clamber of an internal combustion engine and combusted with relatively small amounts of combustion air in the presence of a hydrogen-producing catalyst by the novel method of the present invention.

In its broadest aspects, the aqueous fuel of the present invention comprises substantial amounts of water, e.g., up to about 70 to about 80 percent by volume of the total volume of aqueous fuel, and a gaseous or liquid carbonaceous fuel such as gasoline, ethanol, methanol, diesel fuel, kerosene type fuel; other carbon-containing fuels, such as butane, natural gas etc., or mixtures thereof.

In utilizing this find with the novel method of the present invention, aqueous fuel and combustion air are introduced into the engine's fuel introduction system, for receiving, and mixing fuel and combustion air and introducing the fuel/air mixture into the combustion chamber(s). Such systems may include a conventional carburetor or fuel injection system.

Although it is not necessary for the practice of the invention, when using an engine with a carburetor, the combustion air may be preheated to from or about 350 degrees F. to about 400F. as it enters the carburetor. When using an engine with a fuel injection system, the combustion air may be preheated from about 122 degrees F. to about 158 degrees F. as it enters the fuel injection system.

The air/fuel mixture is introduced into the combustion chamber or chambers and combusted in the presence of a hydrogen producing catalyst which facilitates the dissociation of water in the aqueous fuel into hydrogen and oxygen so that the hydrogen is combusted with the carbonaceous fuel to operate the engine.

The term "hydrogen-producing catalyst" is used herein in its broadest sense. A catalyst as generally defined as a substance that causes or accelerates activity between two or more forces without itself being affected. In the present invention it is known that without this substance present in the combustion chamber, as described herein, combustion of the aqueous fuel DOES NOT TAKE PLACE in such a way as to produce the desired degree of power to operate the internal combustion engine.

Without intending to he bound by theory, it is believed that upon generation of an electric spark in a combustion chamber with a wet atmosphere in the presence of poles formed of hydrogen-producing catalyst,the electrical discharge electrifies the mass of water present in liquid or gaseous form, e.g., steam vapor, to enable the electric charge to travel to the negatively charged catalytic poles to effect discharge of the electric charge.

Dissociation of water molecules appears to occur upon exposure of the mass of water molecules to the electric charge in combination with the heat of combustion resulting from combustion of the carbonaceous material component or the aqueous fuel during the compression stroke which along with combustion of released hydrogen, provides the power to operate the engine.

Although in the presently preferred embodiment it is preferred to use two catalytic poles of hydrogen producing catalyst, one, or more than two poles, also may be used to disperse the electric charge. In addition, although the normal spark or standard motor vehicle spark plug system generating about 25,000 to 28,000 volts may be used, it is presently preferred to generate a botter spark, e.g., generated by about 35,00O volts.

Electric spark generating systems are available of up to 90,000 volts and it appears that higher voltages result in better dissociation of water molecules in the combustion chamber.

DETAILED DESCRIPTION OF THE PREPERRED EMBODIMENT

As indicated previously, one of the advantages of the invention is that internal combustion engines may be operated with novel fuels and fuel mixtures that require significantly less combustion air for combustion of the fuel in the engine's combustion chamber.

For example, gasoline used as fuel for an internal combustion engine employing a carburetor generally requires an air to fuel ratio of 14-16:1 to produce satisfactory power output to operate an engine and power a motor vehicle. Alcohol, such as pure ethanol, may utilize an air to fuel ratio or 8:1 or 9:1 for satisfactory performance of the same engine.

In contrast to such conventional fuels, the aqueous fuel of the present invention utilizes a lesser, controlled amount of combustion air. It has been determined that it is critical for the practice of the invention to employ an air to fuel ratio of not greater than 5:1 for equivalent satisfactory performance of an internal combustion engine.

The preferred air to fuel ratio in accordance with the invention is from 0.5-1:1 to about 2:1; with an optimum air to fuel ratio in the range of 0.5: 1 to 1.5:1 and, most optimally 1:1. The reason that the aqueous fuel and the fuel mixture of the present invention cau produce satisfactory internal combustion engine results is that in practicing the invention, hydrogen and oxygen are released in the combustion chamber.

The hydrogen and oxygen result from dissociation of water molecules and the hydrogen is combusted along with the carbonaceous fuel of the aqueous mixture. The result is that comparable engine power output is achieved with less carbonaceous fuel and less combustion air than can be achieved using conventional combustion or the same carbonaceous fuel with greater amounts of combustion air.

It is further noted that with the aqueous fuel of the present invention the water component vaporizes as steam in the combustion chamber. Steam expands to a greater extent than air and the combustion chamber can be suitably filled with less combustion air. Thus, the water component of the fuel transforms to steam whicb expands in the combustion clamber and replaces a portion of the combustion air used in combusting conventional fuels in the engine's combustion chamber.

The expansion of the steam together with the combustion of the hydrogen released by dissociation of the water molecule results in generation of the required power output necessary for satisfactory operation of the engine. It has been previously pointed out that the amount of combustion air provided in the combustion chamber for combustion with the aqueous fuel of the invention must be critically controlled so that an air to fuel ratio of not greater than 5:1 is present during combustion.

It has been determined that if too much air, i.e., greater than a ratio of air to fuel of 5:1 is introduced with the aqueous fuel into the combustion chamber, incomplete combustion of the carbonaceous fuel results because of tbe excess of oxygen in the combustion chamber.

Excess oxygen over that required to combust the carbonaceous fuel results when the ratio of air to fuel is too high due to a combination of the amount of oxygen released from dissociation of the water molecule and the additional oxygen present in an excessive amount of combustion air.

Incomplete combustion of the carbonaceous fuel results in unsatisfactory performance or the engine as well as excess emission of undesirable pollutants. By reducing the amount of combustion air required for combustion in the combustion chamber, less nitrogen is present in the combustion chamber to combine with oxygen and form undesirable NOX pollutants emitted during engine operation.

Thus, one important advantage of the invention is the considerable reduction in NOX and other undesirable emission pollutants over that which are produced by conventionally operated internal combustion engines using conventional carbonaceous fuels such as, gasoline, diesal fuel etc. in internal combiustiom engines.

It is also noted that since hydrogen and oxygen are present in the fuel mixture to be combusted,in the combustion chamber of an internal combustion engine, in accordance with the Invention, circumstances may arise in which too little water in the aqueous fuel would be unsatisfactory.

For example, where the carbonaceous fuel has a low inherent energy output, i.e. low potential energy of BTU output per unit volume, greater amounts of water may be desirable because the release of hydrogen and oxygen by dissociation of water molecules and combustion of the hydrogen will usefully increase the total energy output of the carbonaceous fuel and water mixture.

For this reason, a lower limit of between 20 and 25% water, eg., greater than 20% water, is established as the useful, practical, minimum amount of water in the aqueous fuel mixture of the present invention so as to accommodate a greater variety of carbonaceous fuels within the scope of the invention.

The upper limit of 70% to 80% water is established because a minimum amount of gaseous or liquid carbonaceous fuel is needed to initiate the reaction, triggered by a spark generated in the combustion chamber that dissociates the water molecules in the combustion chamber.

It has been determined that from 30,000 BTU energy/gal. of fuel, to 60,000 BTU energy/gal. of fuel is preferred for the water dissociation reaction.

The aqueous fuel of the present invention comprises water from greater than about 20 percent to about 70 to 80 percent by volume of the total volume of the aqueous fuel and preferably, a volatile liquid carbonaceous fuel, such as a fuel selected from the group consisting of alcohols, e.g., ethanol or methanol gasoline. diesel fuel, kerosene type fuel or mixtures thereof.

Alcohols such as as ethanol and methanol generally contain small percentages of water when produced commercially and, of course, include oxygen and hydrogen in the molecular structure. Commercial grades of ethanol and methanol are marketed in terms of a proof number, such as for example, 100 proof ethanol.

One half the proof number is generally an indication of the amount of ethanol present, i.e., 100 poof ethanol contains 50 vol percent ethyl alcohol and 50 percent water; I8O proof ethanol contains 90 percent of ethyl alcohol and 10 percent of water, etc..

The aqueous fuel of the present invention is believed to be usable in all internal combustion engines, including conventional gasoline or diesel powered internal combustion engines for use in autombiles, trucks and the like, using conventional carburetors or fuel injection systems as well as rotary engines and turbine jet engines. The invention is believed to be usable in any engine in which volatile liquid carbonaceous fuel is combusted with oxygen (02,) in one or more combustion chambers of the engine.

Few modifications are necessary to make such engines workable with the fuel of the present invention. For example, installation of a hydrogen-producing catalyst in the combustion chamber or chambers of the engine, such as described elsewhere herein, to act as a catalyst in the dissociation of water molecules to yield hydrogen and oxygen must be made.

In addition, suitable means to supply and control the input, quantity and flow, of combustion air and fuel to the combustion chamber(s)is importaint for optimum engine operation. It is noted in this regard that the air-fuel ratio is a significant factor in effecting combustion in the chamber(s).

It is also desirable, from a practical point of view, to make the fuel supply and fuel storage system of rust proof materials. A higher voltage electric system than generally used in internal combustion engines of motor vehicles operated with conventional carbonaceous fuels, eg., gasoline, is also preferred.

Systems to provide a "hotter spark" are available commercially. such as from Chrysler Motor Company. As a further modification to optimize use of the invention, it is desirable to employ a computer assisted electronically controlled, system to supply fuel to the fuel injectors during the intake stroke of the internal combustion engine.

The dissociation of water molecules per se, is well known. For example, the thermodynamics and physical chemistry of water/steam dissociation are described in the text entitled "Chemistry of Dissociated Water Vapor and Related System" by M. Vinugopalan and R.A, Jones. 1968. published by John Wiley & Sons, Inc.; "Physical Chemistry for Colleges", by E.B. Mellard, 1941, pp, 340-344 published by McGraw-Hill Book Company, Inc.. and "Advanced Inorganic Chemistry"; by F. Albert Cotton and Geoffrey Wilkinson,1980, pp 215-228.

The disclosures of which are expressly incorporated herein by reference. Although not required for the practice of the invention, a heater to preheat the combustion air for the engine and a heat exchanger to use the hot exhaust gases from the engine to preheat the combustion air after the engine is operating, at which time the heater is shut off, may also be installed.

? Although the presently preferred embodiment of the invention does not require preheated combustion air/and or fuel, combustion air for the engine may be preheated before it is introduced into a carburtor or fuel injection system. When using an engine with a carburetor, the combustion air may be preheated to from about 350 deg. F, to about 400F, as it enters the carburetor.

When using an engine with a fuel injection system, the combustion air may be preheated from about 122 deg. F to about 158 deg. F, as it enters the fuel injection system. In such cases, the aqueous fuel of the present invention is introduced into the carburetor or fuel injection system and is mixed with a controlled amount of combustion air.

The aqueous fuel is preferably introduced into the carburetor or fuel injection system at ambient temperatures. In the preferred embodiment, introduced into the carburetor or fuel injection system at ambient temperatures and the air/fuel mixture is then intoduced into the combustion chamber or chambers where a spark from a spark plug ignites the air/fuel mixture in the conventional manner when the piston of the combustion chamber reaches the combustion stage of the combustion cycle.

The presence of a hydrogen producing catalyst in the combustion chamber is believed to act as a catalyst for the dissociatian of water molecules in the aqueous fuel when the spark plug ignites the air/fuel mixture. The hydrogen and oxygen released by disaociation are also ignited during combustion to increase the amount of energy delivered by the fuel.

It has been observed in experiments using 100 proof alcohol as the engine fuel that the engine produced the same power output, i.e., watts per hour, as is produced with the same volume of gasoline. This is indeed surprising in view of the fact that the I00 proof ethanol has a theoretical energy potential of about 48,000 BTU's per gallon, with a usable potential of about 35000 to 37,500 BTU's per gallon, as compared to gasoline, which has an energy potential of about 123,000 BTU's per gallon, nearly three times as much.

The fact that the lower BTU ethanol is able to generate as much power as a higher BTU gasoline suggests; that additional power is attributable to the liberation, i.e., dissociation and combustion of hydrogen and oxygen from the water, inasmuch as 100 proof ethanol has been found to be a satisfactory fuel in using the method of the present invention, it is apparent that other suitable fuels may be made by blending by use of other alcohols and by blending alcohols with gasoline, kerosene type fuels or diesel fuel, depending on whether the fuel is to be used in a gasoline, turbine or diesel powered engine.

Experimental work also indiciates that 84 proof (42 percent water) ethanol may also be used as a fuel and it is believed that aqueous fuels containing as much 70 to 80 percent water may be used.

THE ENGINE WITH CARBURETOR

To demonstrate one embodiment of the present invention an engine was selected which also had the capacity to measure a predetermined workload.

The engine selected was a one-cylinder, eight horsepower internal combustion engine connected to a 4.000 watt per hour a/c generator. The engine/generator was manufactured by the Gemerac Corporation of Waukesha, Wisconsin under the trade name Generac,Model No. 8905-0(S4002).

The engine/generator is rated to have a maximum continuous a/c power capacity of 4,000 watts (4.0KW) single phase. The engine specifications are as follows: Engine Manufacturer-Tecumseh, Manufacturer's Model No.HM80 (Type 155305-H), Rated Horsepower-8HP @ 3600 rpm, Displacement-19.4 cubic inches (318.3 cc), Cylinder Block Material-Aluminum with cast iron sleeve, Type of Governor-Mechanical, Fixed Speed-Governed Speed Setting-3720 rpm at No-Load.

(Rated a/c frequency and voltage 120/240 volts at 62 hertz) are obtained at 3600 rpm. The no-load setting of 3720 rpm provides 124/249 volts at 62 hertz. A slightly high no-load helps ensure that engine speed, voltage and frequency do not drop excessively under heavier electrical loading.)

Type of Air Cleaner-Pleated Paper Element

Type or Starter-Manual,Recoil Rope

Exhaust Muffler-Spark Arrestor Type

Ignition System-Solid State with Flywheel Magneto

Spark Plug-Champion RJ-17LM (or equivalent)

Set Spark Plug Gap to-0.030inch (0.76 mm)

Spark Plug Torque--15 foot-pounds

Crankcase Oil Capacity-l 1/2 Pints (24 ounces)

Recommended Oil--Use oil classified "For Service SC,SD, or SE"

Primary Recommended Oil-SAE IOW-30 Multiple Viscosity Oil

Acceptable Substitute- SAE 30 Oil

Fuel Tank Capacity-1 gallon

Recommended Fuel-Primary-Cleam, Fresh UNLEADED Gasoline

Acceptable Substitute-Clean, Fresh, Leaded Regular Gasoline

A heat exchanger was installed on the engine to use the hot exhaust gases from the engine to preheat the air for combustion. A platinum bar was installed at the bottom surface of the engine head forming the top of the combustion chamber.

The platinum bar weighed one ounce and measuured 2-5/16 inches in length, 3/4 inches in width and 1/16 inch in thickness. The platinum bar was secured to the inside of the head with three stainless steel screws.

A second fuel tank having a capacity of two liters was secured to the existing one-liter fuel tank. A T-coupling was inserted into the existing fuelline of the motor for communication with the fuel line for each fuel tank.

A valve was inserted between the T-coupling and the fuel lines for each fuel tank so that either tank could be used separately to feed fuel to the carburetor or to mix fuels in the fuel line leading to the carburetor.

TEST RUNS

A series of tests were performed to determine if 100 proof ethanol (50%, ethanol by volume, balance water)could be used in the motor which was modified as described above, and if so, to compare the performance of the 100 proof ethanol with the same amount of gasoline

Two liters of unleaded gasoline were poured into the second fuel tank with the valve for the second tank in the closed position. Three and eight tenths liters of 100 proof ethanol were poured into the one gallon fuel tank with the valve in the closed position. The valve for the gasoline tank was opened so that the engine could be initially started on gasoline.

Within three minutes of starting the motor, the combustion air entering into the carburetor was measured at 180 deg. F. At this point, the fuel valve under the ethanol tank was opened and the valve under the gasoline tank was closed. At that point, the temperature of the air entering the carburetor had risen to 200 deg F..

Ethanol was now the primary fuel in the motor which exhibited a certain amount of roughness during operation until the choke mechanism was adjusted by reducing the air intake in the engine by approximately 90 percent.

Immediately thereafter, two 1800 watt heat guns, having a rated beat output of 400 deg. F, were actuated and used to heat the combustion air as it entered the carburetor. The temperature of the air from the heat guns measured 390 to 395 deg F.

After the engine ran on ethanol for approximately 20 minutes, the heat measurement in the incoming combustion air stabilized between 347 F. and 352 F. The engine was run on the 100 proof ethanol fuel for 40 additional minutes, for a total of one hour, until two liters of ethanol had been used. The valve under the ethanol tank was then closed and the engine was turned off by opening the choke.

Eighteen hundred milliliters of ethanol were left remaining in the tank. The choke was then reset to the 90 percent closed position, and the engine was started once again. The engine responded immediately and ran as smoothly on IO0 proof alcohol as it did during the one-bour operation.

The engine was stopped and started in the same manner as on three separate occasions thereafter with the same results.

While operating the engine on 100 proof ethanol the power output of the generator was measured and indicated that the ethanol produced 36,OOO watts of power during a one hour period using two liters of ethanol having energy potential of about 48,000 BTU's per gallon.

After the engine bad stopped running on ethanol, it was operated again with the two liters of gasoline in the gasoline tank. Forty seven minutes into the test, the engine stopped because it ran out of gasoline.

Measurements taken on the generator indicated that, when the engine was operated on gasoline, it was producing power at a rate of 36,00O watts per hour for 47 minutes, using two liters of gasoline having an energy potential of about 123,000 BTU's per galon.

Comparing these power measurements indicates that two liters of 100 proof ethanol produced the same amount of power as two liters of gasoline. This is surprising inasmuch as the gasoline has about 2.5 times as many BTU's as the same amount, of 100 proof ethanol.

This indicates that thr extra power from the ethanol must be due to the liberation and combustion of hydrogen and oxygen from the relatively large amounts of water in the fuel.

Although gasoline was used as the starter fuel to preheat the engine and, thus generate hot exhaust gases to preheat the combustion air, the use of the gasoline as the starter fuel for preheating is not necessary and could be replaced with an electrical heat pump to preheat the combustion air until the beat exchanger can take over and preheat the combustion air, wbereupon the electrical heat pump would turn off.

The above tests comparing the use of the 100 proof ethanol and gasoline were repeated on three subsequent occasions. each with the same results. A second series of tests, were run which were identical to the above, except for the use of 84 proof ethanol (42 percent ethyl alcohol and 58 percent water) in place of the 1O0 proof ethanol.

However. after running about 30 seconds on the 84 proof ethanol, the engine stopped abruptly and released a fair amount of oil under high pressure from the main bearing in tbe main engine. The engine was restarted and abruptly stopped again after operating for about 20 seconds. The above stoppage appears to have been due to preignition of the hydrogen and/or oxygen during the up-stroke period of the piston which caused pressure build-up in the crank cmse which in turn forced oil under pressure through the main bearing. The pressure inside the combustion chamber appears to have been relieved through the piston rings into the crankcase, and then relieved through the main bearing.

The premature ignition of the hydrogen and/or oxygen was probably caused by generating s larger amount of oxygen and hydrogen which did not occur when using 100 proof ethanol having a lesser amount of water.

The preignition problem is believed to be curable by using an engine having a shorter piston stroke to reduce the dwell time of the fuel, including hydrogen and oxygen in the combustion chamber, or by adjusting the carburetor of the electronically controlled fuel injection system to help reduce dwell time to avoid generating excessive amount of hydrogen and oxygen.

The engine used in the experiment had a relatively long piston stroke of 6 inches. For the conditions described above, the piston stroke should be no more than about 1 1/2 inches or less to avoid the preignition problem in that particular engine.

ENGINE WITH ELECTRONICALLY CONTROLLED FULL INJECTION SYSTEM

A series of tests were run on an engine having an electronically controlled fuel injection systom to determine if that would solve the preignition problem discussed above. The engine used for this purpose was a 3-cylinder turbo charged electronically controlled internal combustion engine from a 1987 Chevrolet Sprint which had been driven about 37,000 miles.

The head was removed from the motor block and cleaned to remove carbon deposits. Three platinum plates were attached to the inside of each head so as not to interfere with valves moving inside the heads during operation.

Each platinum plate was 1 centimeter in length and width and was 1/32 of an inch in thickness. Each platinum plate was attached to a head with one stainless steel screw through the center of each piece.

Carbon deposits were cleaned off cach piston head and he engine was reassembled using new gaskets. The combustion air intake hose which exits from the turbo and leads to the injector module was divided in the middle and attached to a heat exchanger to cool the combustion air delivered to the injector.

The heat exchanger was bypassed by using two Y-junctions on either side of the heat exchanger and by putting a butterfly valve an the side closest to the turbo so that the hot air stream could be diverted around the heat exchanger and introduced directly into the injector module.

All pollution abatement equipment was removed from the engine but the alternator was kept in place.

The transmission was reattached to the engine because the starter mount is attached to the transmission. The transmission was not used during the testing. This engine was inserted into a Chevrolet Sprint car baving a tailpipe and muffler system so that the engine was able to run properly. The catalytic converter was left in the exhaust train but the inside of the converter was removed as it was not needed.

Two one-gallon plastic fuel tanks ware hooked up to the fuel pump by a T-section having manual valves an the fuel to the fuel pumped could be quickly changed by opening or closing the valves.

TEST RUNS

A series of test runs were performed to determine how the engine as modified above would run using a variety of fuels. The first test utilized 200 proof methanol is a starter fluid. The engine started and operated when the fuel pressure was raised to 60 to 75 lbs..

When using gasoline, the fuel pressure is generally set at 3.5 to 5 lbs.. While the engine was running on the 200 proof-methanol, the fuel was changed to 100 proof dcnatured ethanol and the motor continued operating smoothly at 3500 revolutions per minute(rpm) After about two minutes the test was stopped and the engine shut down because the fuel hoses were bulging and became unsafe.

These hoses were replaced with high pressure hoses and the plastic couplings and the T's were also replaced with copper couplings and T's. A new pressure guage was attached. During the testing, it was noted that the fuel mixture needed more combustion and that the computerized settings of the engine could not be adjusted to provide the additional air. To overcome this, the air intake valve was opened.

After these modifications, a new series of tests were performed using 200 proof metbanol-in one of two fuel tanks. The engine started on the 200 proof methanol and the rpm setting was adjusted to 3500. The engine was allowed to run for a few minutes. During that time, the fuel pressure was adjusted and it was noted that 65 lbs. of pressure appeared to be adequate.

A thermocouple was inserted close to the injector module and provided a reading of 65 deg. C. after about 5 minutes. A fuel mixture comprising 500 ml of distilled water and 500 ml of 200 proof methanol were put into the second fuel tank this fuel and was used to operate the engine.

Without changing the air flow, the temperature of the combustion air rose from 65 deg.C to 75 C. after about 1 minute. The RPM reading dropped to 3100 rpm. The engine ran very smoothly and was turned off and restarted without difficulty.

The next step in the test was to determine how variations in the water content of the fuel effected engine performance. Using 199 proof denatured ethanol as starter fuel, the engine started immediately. The fuel pressure setting was reduced from 65 lbs to 50 lbs, the combustion air measured 65 deg C., the RPM's measured 350O, and the engine ran smooohly.

The fuel was then changed into 160 proof denatured ethanol. The fuel pressure was maintained at 50 lbs. The combustion air temperature was measured at 67 deg.C., the rpm's decreased to 3300, and the engine ran smoothly.

After 10 minutes, the fuel was changed to 140 proof denatured ethanol. The combustion air temperature rose to 73 deg C., the rpm's rose to 3300, and the engine ran smoothly.

After 10 minuies the fuel was changed to 120 proof denatured alcohol. The combustion air temperature increased to 73 deg C., the rpm's decreased to 3300, and the engine ran smoothly.

After 10 minutes, the fuel was changed to 100 proof denatured ethanol. The combustion air temperature increased to 74 deg.C, the rpm's decreased to 3100, and the engine ran smoothly.

After 10 minutes, the fuel was changed to 90 proof denatured ethanol. The combustion air temperature remained at 74 deg.C.,the rpm's reduced to 3100, and the engine ran smoothly.

After 10 minutes, the fuel was changed to 8O proof denatured ethanol. The combustion air temperature raised to 76 deg. C. and the rpm's reduced to 2900. At that point, an infrequent backfire was noted in the engine.

100 proof denatured alcohol was then used as the primary fuel and the bypass to the heat exchanger was closed. The combustion air temperature rose to 160 deg. C and during the next minutes increased to 170 deg. C. The rpm's increased to 4000 rpm and the engine ran smoothly.

Another series of tests were run with the engine adjusted to operate at 3500 rpm's and with the beat exchanger removed so that neither the fuel or combustion air were preheated and thus were ambient temperatures. The engine was started with 200 proof ethanol as the fuel and as soon as the intake air temperature at the injector module had risen to about 50 deg.C, the fuel was changed to 100 proof ethanol and the engine ran smoothly. The intake air temperature rose to 70 deg.C where it stabilized. The engine was turned off, restarted and continued to run smoothly.

By adjusting and opening the air intake, the rpm could be increased to over 4000. By slightly closing the some air intake, the RPM could be reduced to 1500. At both ranges of rpm, the engine ran smoothly and was turned off and restarted without difficulty and continued to run smoothly.

The rpm of an engine using the method and fuel of the present invention may be regulated by regulating the amount of air flow into the combustion chamber. In a conventional gasoline powered engine, the engine rpm is regulated by regulating the amount of gasoline that is introduced into the combustion chambers.

It is evident that the invention involves the use an aqueous fuel which may comprise large amounts of water in proportion to volatile carbonaceous fuel.

A particularly effective aqueous fuel comprises a mixture of approximately 70% water and 30% carbonaceous fuel. The thermal energy of the carbonaceous fuel e.g., gasoline is reduced from the fuels high energy value, approximately 120,000 BTU's per volume gallon in the case of gasoline, to a BTU content of approximately 35,000 BTUs per volume gallon for the 70% water, 30% gasoline mixture.

This BTU content of the water/gasoline mixture is sufficient to maintain a reaction in the combustion chamber of an internal combustion engine, such that the water molecule is dissociated and the hydrogen molecule (H2) is separated from the oxygen molecule (02) and the so produced hydrogen gas is utilized as a primary power source to move the pistons inside an internal combustion engine upon combustion.

The invention is applicable with a variety of volatile carbonaceous fuels, including diesel oil or kerosene, and those fuels can be also mixed with up to 80% water (e.g., diesel or kerosene) to achieve the same reaction to dissociate hydrogen and oxygen to release hydrogen gas to power an internal combustion entine in the presence of a hydrogen producing catalyst.

For this reaction to take effect, it is necessary to equip each combustion cavity inside the internal combustion engine with at least one, or preferably two, and maybe more, poles of hydrogen producing catalyst, with a melting point above the temperature of combustion.

Useful catalysts include Nickel, Platinum, Platinum-Nickel alloys, Nickel-stainless steel, noble metals, Re, W, and alloys thereof, which may be utilized as a hydrogen producing catalyst in the form of catalytic metal poles.

Combustion and dissociation is initiated by a spark which may be created by a conventional electric spark generation system. such as is used with conventional motor vehicle engines.

As to further examples of the invention, using fuel and combustion air at ambient temperatures I took 3 liters of unleaded gasoline (87 octane) with a BTU content of about 120,000 BTU's per gallon and 7 liters of top water.

I added 10 ml of surfactant (detergent) into this mixture in a first test to enhance mixing or the water with the gasoline. This procedure was followed to produce additiomal mixtures with 25 ml and 40ml of surfactant to obtain the water/gasoline mixture. The same procedure was also followed with using tap water which was filtered through a deionizaitlon unit and charcoal filter to remove the chlorine and other impurities present in the water.

Each of the above described mixtures was then tested in a 4 cylinder. 2.5 liter internal combustion engine equipped with injectors, which were attached to a fuel rail. The fuel used during those tests was disbursed to the fuel rail through a Bosch multi-port pressure measuring device. The engine was also equipped with a fuel carburetor.

The carburetor is only used for the air intake into the engine as the air/fuel ratios were substantially lower and differ with the various fuels used; for example, starting at 0.75:1 with the 50/50 water/alcohol mixture and from 1:1 to 3:1 for the 70% water/30% gasoline mixture.

Normally, a gasoline engine using gasoline as fuel utilizes an air fuel ratio of 14:1. Such an engine is equipped with a cylinder but is changed to accept two I/2 inch diameter nickel bolts or screws, as the hydrogen-producing catalyst, with the screw part being of 1/4 inch diameter to practice the invention.

The nickel bolts were placed 1/2 inch apart on top of the piston. In another modification I placed a flat piece of aluminum (6 inches by 12-inches) inside and on top of the engine head.

I drilled and tapped three 3/4 inch holes into the cover of the engine head in a horizontal position approximately 3 3/4 inches apart. I screwed some copper adapters into these holes. The adapters are connected with each other by a 3/4 inch copper pipe which was fitted into the muffler.

This device carries the exhaust gas from the engine and I have found that it is sufficient to take out water vapors (steam) from the head, otherwise the water vapor will accumulate in the engine and crankcase oil which is not desirable.

Each of the above mentioned fuel mixtures were tested while the engine was in neutral so as not to move the car and were found to be capable of self starting the engine by just by turning the ignition key of the car. It was not necessary to use a secondary fuel to start the engine.

The 2.5 liter engine utilized in those tests was in a standard 2.5 liter Chrysler turbo injection engine with the turbo and all smog and pollution abatement equipment removed. This engine also had a factory installed 3-speed automatic transmission with a gear ratio of 1:3.09.

The same test series as mantioned above was also performed utilizing the same internal combustion engine and car, with approximately from 20% to 25% diesel and 75% to 80% water, with the sume results.

Additional tests were conducted with from 20% to 25% kerosene fuel and from 75% to 80% water where like results were also obtained.

In another test series, I used a 70% water/30% gasoline emulsified mixture as the only fuel to power the engine in a test 'City Car', which I developed for testing purposes. This car is a 4 door, 5 passenger frontwheel drive car with a net weight of 2,500 pounds.

In tests I was able to drive this car with the above mentioned fuels from 0 to 60 miles per hour in about 6 seconds. I tested the car to a top speed of 75 miles per hour but the car could be driven substantially faster.

As discussed above, I have also determined that it is important to control the air to fuel mixture to obtain optimum results. In one test, I ran a 14:1 air fuel ratio, the same as conventinally used with gasoline, and this resulted in an incomplete combustion within the engine and large amount of water and fuel mixture exiting the tail pipe.

The same occurred using an air to fuel mixture of 7:1. These tests were conducted using a 70% water and 30% gasoline mixture, water and diesel at a 75% to 25% mixture and water and kerosene at 75% to 25% mixture. The incomplete combustion began to subside to satisfactory levels with air to fuel ratios of 3:1 or less.

Outer limits and optimum properties are easily determined for any given aqueous fuel mixture using the procedure described above but the air to fuel ratio should not exceed 5:1.

I have also found that a wetting agent or surfactant may be desirable. One such agent which has proved to be useful has a trade name of Aqua-mate2 manufactured or distributed by Hydrotex in Dallas, Texas.

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(Contact and price information follows;

Hydrotex

1165 Empire Central Place

Dallas, TX 75247

(214) 638-7400

Four 2 gallon bottles of AquaMate2 cost $251.84 as quoted by Carol to Jerry Decker on 01/28/99. Carol says any purchases over $400.00 get free shipping.

Jerry asked if they had larger quantities as in 55 gallon drums and Carol responded no, because the surfactant will separate into its components in the larger container.

We will probably buy one case for our own experiments here at KeelyNet if anyone might be interested in buying a gallon or so from our case and pay for shipping to their address.

You will note also that all soaps and detergents are surfactants which means you could quite possibly experiment with any good detergent....I will try this and report back...>>> JWD)

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Obviously, other wetting agents available commercially that help disperse carbonaceous fuels in water are also usable.

I additionally conducted tests on all three above described fuels using 50% water and 50% carbonaceous fuel which was adequately dispersed in the water. These tests also allowed the engine to run very satisfactorily.

Another car test is in progress using 50% water and 50% alcohol with an energy content of 35,000BTU's per gallon. Test results of 20 miles per gallon of actual driving have been achieved. With proper fuel management in the engine, efficiency can be effectively increased significantly upwards to 30 miles per gallon or more.

The benefits of the invention are substantial since about a 70% reduction of air pollutants is obtained with a total elimination of NOX. There is also a 70% reduction of the fuel price to drive a vehicle through reduction of the amount of gasoline used.

Furthermore, there are other substantial advantages; such as possible reduction or elimination of need for oil imports. Other gaseous or liquid carbonaceous fuels may be used, including gaseous fuels such as methane, ethane, butane or natural gas and the like which could be liquified and substituted for ethanol and methanol as used in the present invention, or used in gaseous form.

The present invention could also be used in jet engines, which is another form of internal combustion engine.

While the embodiments of the invention chosen herein for purposes of the disclosure are at present considered to be preferred, it is to be understood that the invention is intended to cover all changes and modifications of all embodiments which fall within the spirit and scope of the invention.

(Claims are not included in this document..>>> JWD)

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Additional information

This was posted to the newsgroup sci.hydrogen;

I have been researching the process of splitting water (H2O) into its components, Hydrogen and Oxygen, to be re-mixed and burned as fuel since '66.

I have noticed many questions from novices regarding auto conversion to hydrogen. Here are a few bits of info that should help. Hopefully, you won't have to pay any "non-profit" groups just for information on this low -polluting fuel [when burned with air, 78% Nitrogen, there is Nitrogen Oxide emissions (smog)].

The conversion of a vehicle to hydrogen is relatively simple and inexpensive, using an older car before fuel injection. It is very similar to a propane conversion, costing about $500.

The main parts needed are an Impco model CA300 type carburetor, an Impco low pressure regulator, a hydrogen storage tank, and the hydrogen, (try Linde Co).

Because hydrogen burns very hot (it will burn a hole through a normal piston) some use plastic polymer coated pistons or sodium filled valves (expensive). Most solve this problem by mixing in some of the water as (steam) vapor to cool the combustion at the expense of loss of power.

Since hydrogen has 2.5 times the power of gasoline, it doesn't matter much. You can still keep up with a supercharged race car... Because of the rapid combustion, the ignition gap has to be very small, like .001 inch.

One of the vehicles ERDA reviewed way back in '74 used oxygen instead of air, to burn the hydrogen. The Perris Smogless Automobile Association from UCLA was using a Model "A" Ford as one of their hydrogen fueled test engines that carried a tank of compressed hydrogen and a tank of compressed oxygen.

This was mixed together in an "oxybureter" (a closed carburater)and then ignited in the cylinders, as is gasoline. The exhaust was pure hydrogen and oxygen.

This exhaust was rerouted back to the fuel tank to be used again as fuel. Unfortunately, many took this to be a perpetual motion device, and dismissed it without any real consideration. It performed beautifully, as did their next Hydrogen-Oxygen powered the vehicle, without pollution, and did not have the relatively weak power compared with an electric vehicle, such as the Fuel Cell type vehicles use. No matter how efficient the Fuel Cell, they still use an electric motor.

In the last 20 years, I have seen little change published regarding hydrogen power processes. New "electrolysers" are being patented using the same old electrolysis processes, using higher pressures & temperature, and achieving more efficient electric power with newer, expensive electrolytes.

A few novel approaches noted included forcing electron leakage to seperate molecules by high voltage, or using "resonant cavities" to boost and re-boost the power to achieve the necessary decomposition energy for water.

Most of these processes use the same principle of using electrochemical energy to decompose the water, taking a long time to do it, and still dealing with clumsy storage processes. While these may or may not work (the patent attorneys don't care), the processes require constant input energy, and also take too long to generate onboard fuel.

There is an ongoing debate that a hydrogen-oxygen engine as a closed system could not work because it is a violation of one of the laws of thermodynamics - it could not put out more energy than was put into it.

In other words, it would take more energy to split the water into its components than it would get out of the hydrogen oxygen combustion.

One needs to step out of the bounds of chemistry to justify this self-sustaining chain reaction process. Remember that old concept of E=MC squared?

Matter is Energy! Hydrogen and oxygen molecules are energy "packets". Water molecules are being used up as energy, which balances an energy equation, when the mass=energy is factored in.

A Water-Splitting chain reaction is needed, decomposing water into Hydrogen and oxygen to be used as a non-polluting fuel - if not already discovered and put away until the fossil fuels are used up.

My first attempt at a web page still under construction describes a process to achieve a water-splitting chain reaction.

http://home.pacbell.net/coop88.waterasfuel3.htm

To skip the preliminaries, click on "water splitting" to the red lined part. Sorry I haven't completed my sub/sup scripts in the formulas. BCNU, Coop

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From another inventor who has been working on it since 1968 and achieved what I think is major success (8 amps in for hydrogen production, then 15 amps out with a generator attached to a lawnmower engine that burns the hydrogen with air)..he is working on his own web page with full details....he is the closest I know to Dad Garretts success in Dallas in 1935.......he says;

I use the mixture and run it into the intake with atmospheric air. I know this creates some oxides of nitrogen, but so does gasoline and nobody seems to give a damn about that, so neither do I!

I have built steam engines powered by hydroxy. I have had the idea to use the vacuum-forming capabilities of hydroxy to let the atmosphere expand in the cylinders of a rankin-cycle steam engine instead of steam--but I have never built the machinery.

If you compress pure hydroxy--it forms water. No good.

If you inject the mixture into a cylinder and then close the intake valve and continue to crank for 20 degrees or so--it expands the mixture and sort of dries it out.

I detonate at about 20 to 45 degrees past tdc (top dead center of the piston stroke) and I get a hell-of-a-blast-power-stroke. Because the hydrogen goes off so fast, you don't need to have it "burn" for the entire 180 degrees as in a gasoline or diesel engine.

I use the exhaust stroke open for 180 degrees. This sort of makes the engine run like a two-stroke--modified.

When you start using water as fuel, you have to sort of throw out the rule book. The rules change.

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