US 20090188809A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2009/0188809 A1

(43) Pub. Date: Jul. 30, 2009

Noel

(54) **HYDROXYL GAS GENERATION SYSTEM FOR ENHANCING THE PERFORMANCE OF A COMBUSTION ENGINE**

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(21) Appl. No.: **12/022,754**

(22) Filed: **Jan. 30, 2008**

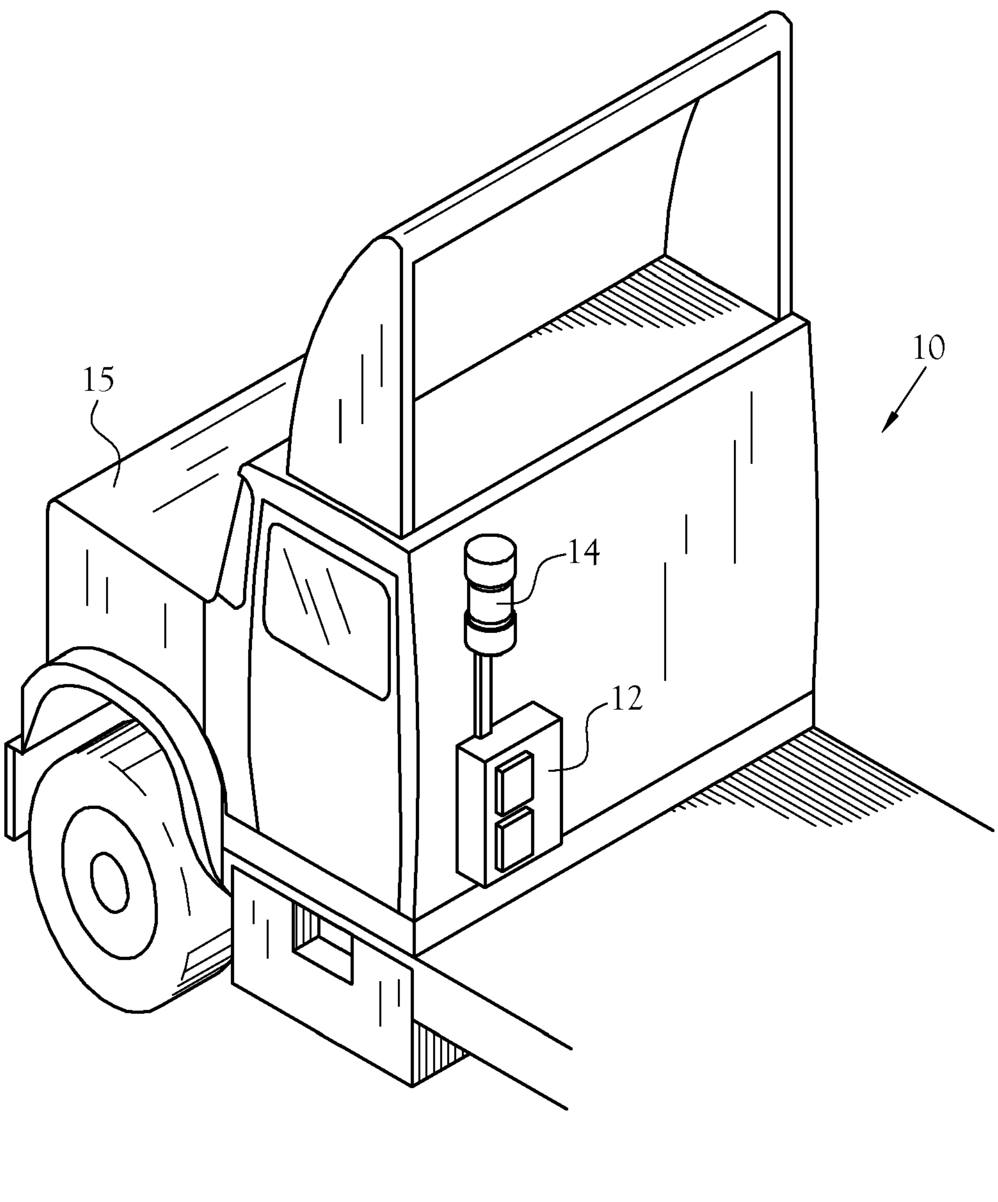
Publication Classification

(51) **Int. Cl.**
C25B 1/02 (2006.01)

(52) **U.S. Cl.** **205/335**

(57) **ABSTRACT**

Described is a hydroxyl gas generation system for generating a hydroxyl gas by way of electrolysis, for limiting the corrosion of electrodes used in the electrolysis, and for making the hydroxyl gas available to be drawn into the air intake of a combustion engine. The hydroxyl gas generation system generates an electrolytic reaction by passing an electrical current between the electrodes by way of an electrolytic solution, the electrolytic reaction generating the hydroxyl gas. To limit the corrosion of the electrodes, the polarity of the voltage applied to the electrodes is periodically alternated. Additionally, the electrodes are constructed of or plated with platinum, a material that is substantially impermeable to the electrolytic solution.



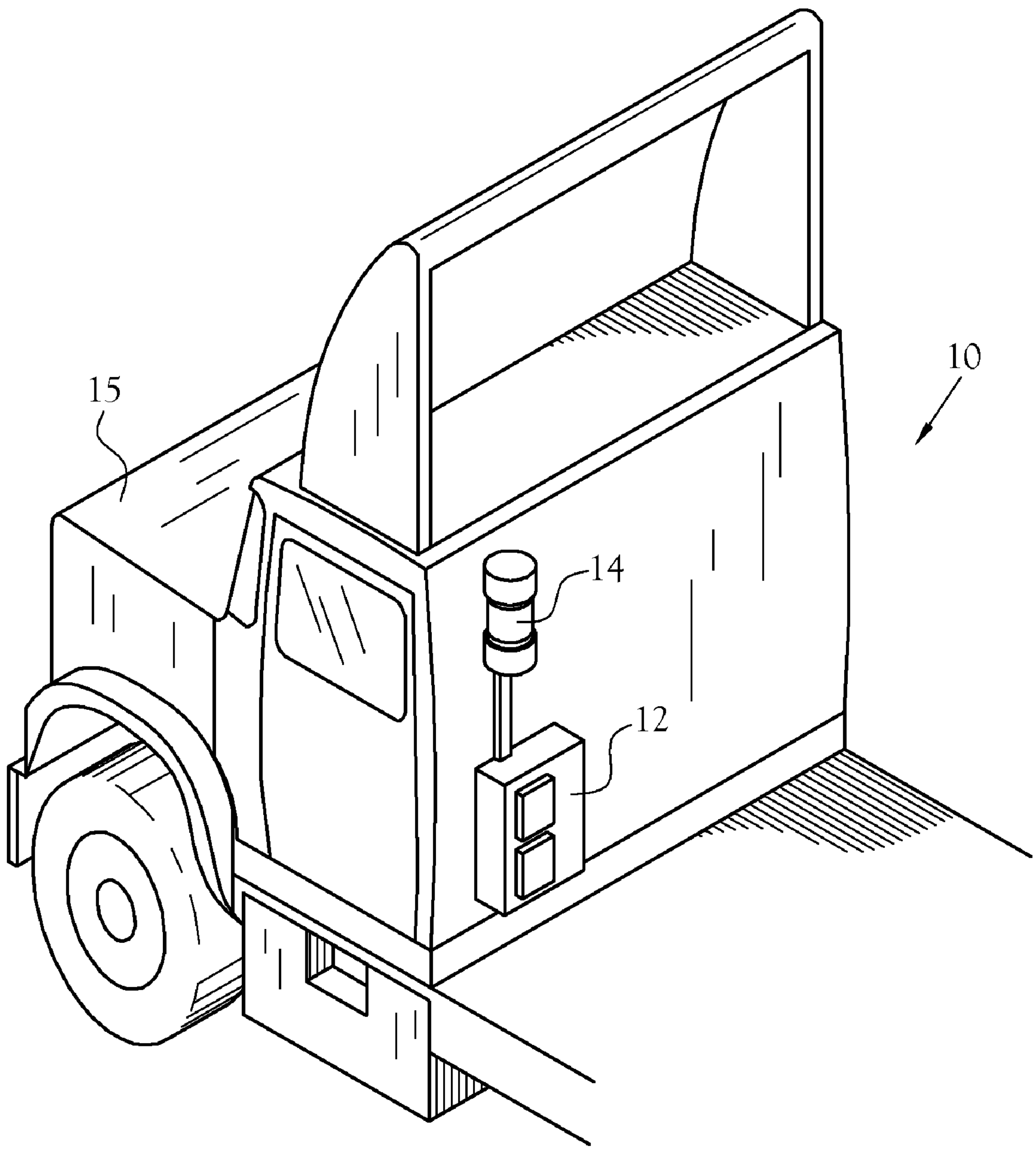


Fig.1

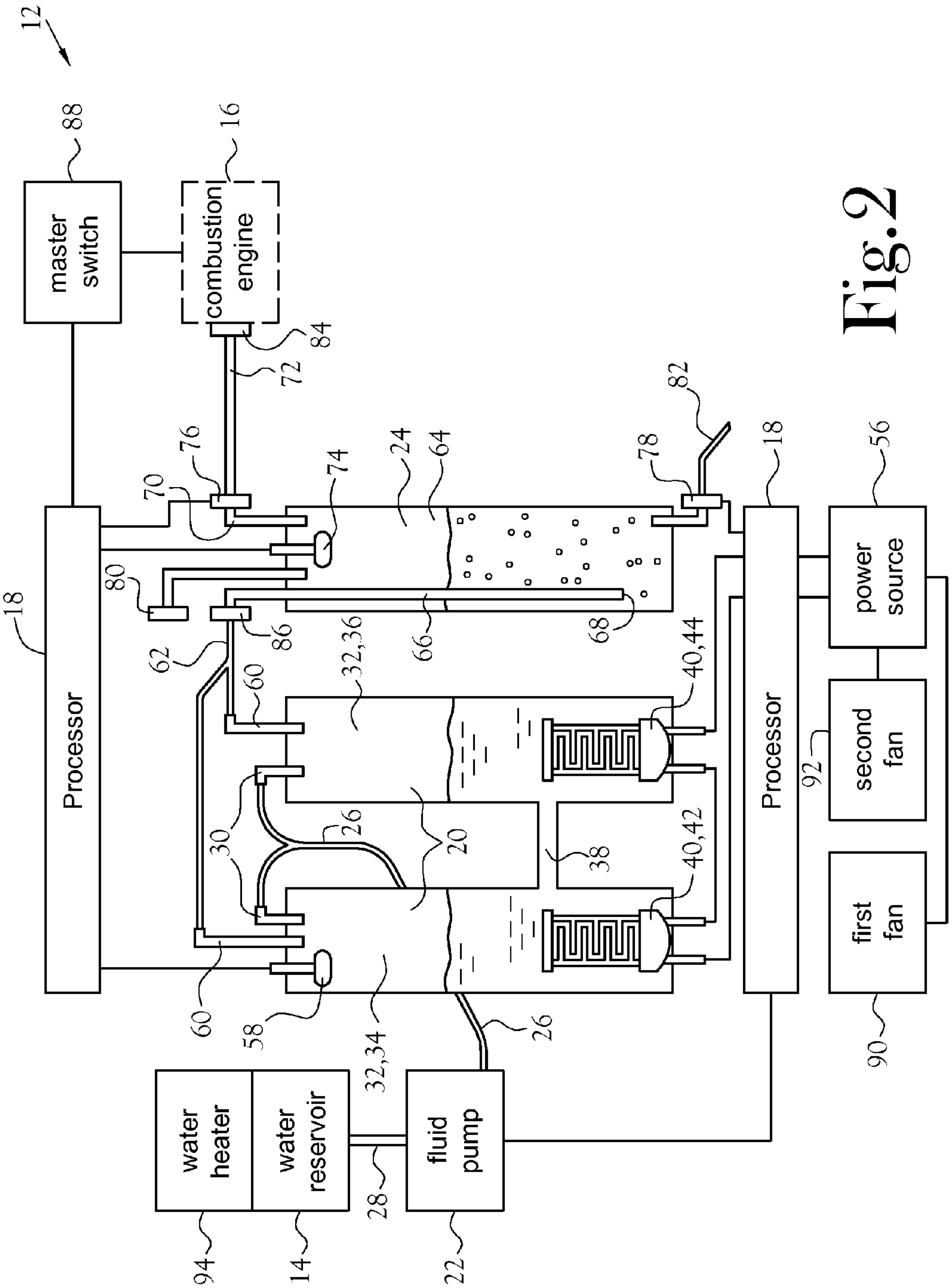

12
master switch
88
combustion engine
16
84
72
Processor
18
76
70
74
24
64
80
86
62
60
32,36
66
68
78
82
18
Processor
power source
56
second fan
92
first fan
90
40,44
40,42
30
26
20
38
58
60
32,34
26
fluid pump
22
water heater
94
water reservoir
14
28

Fig.2

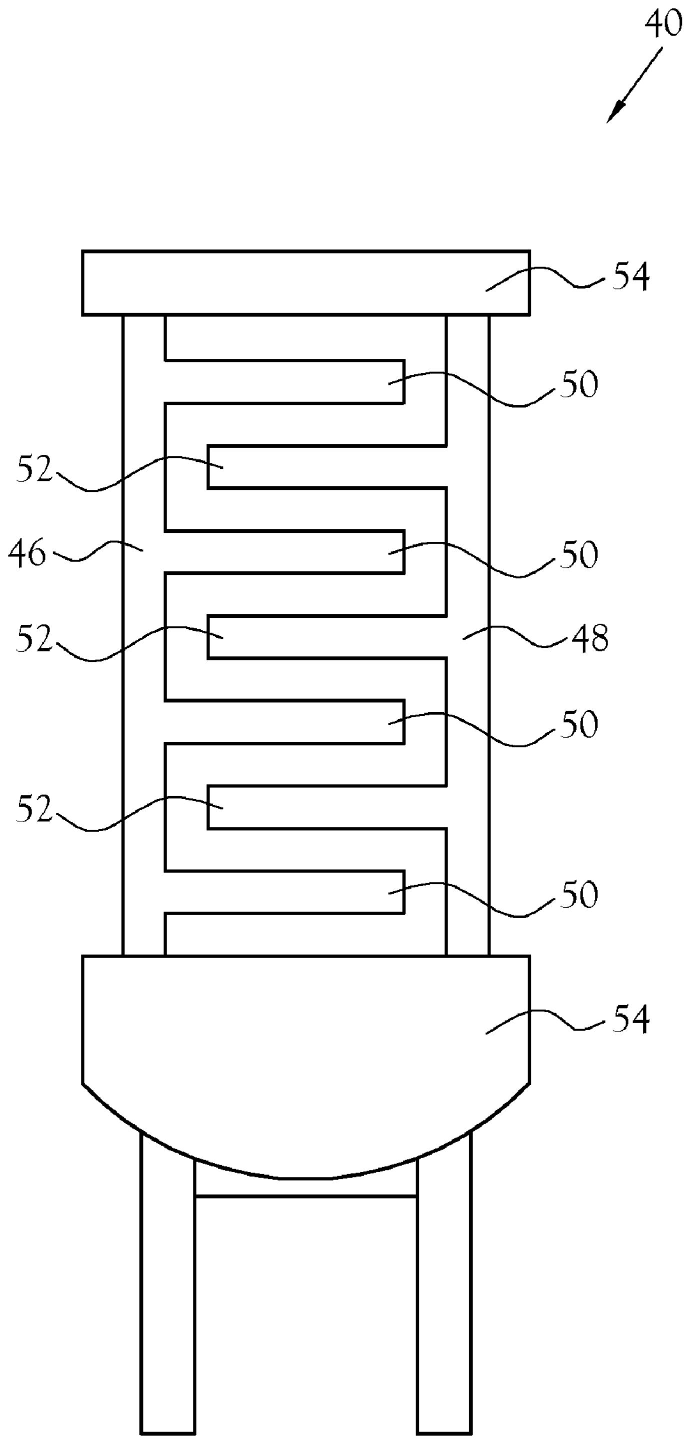


Fig.3

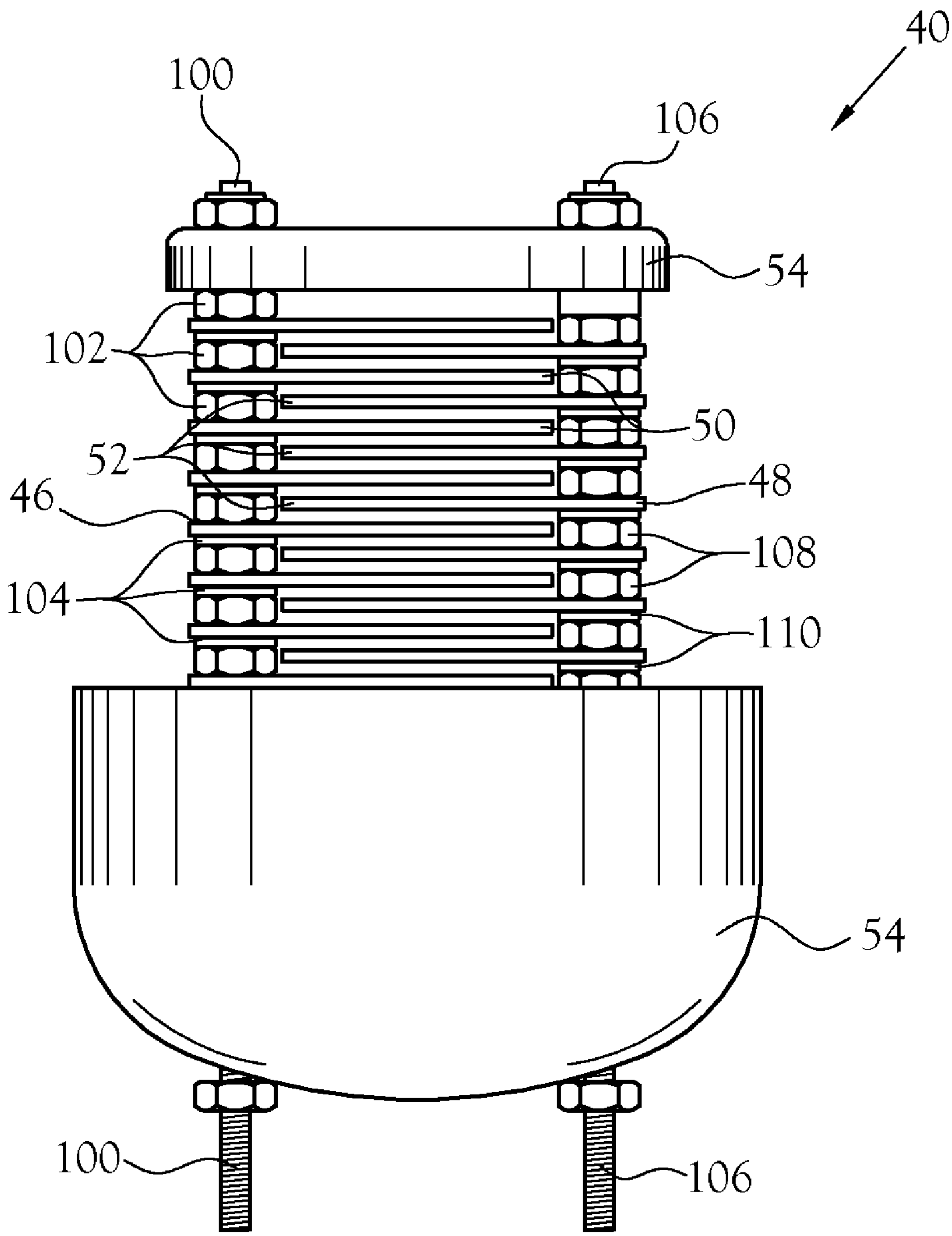


Fig.4

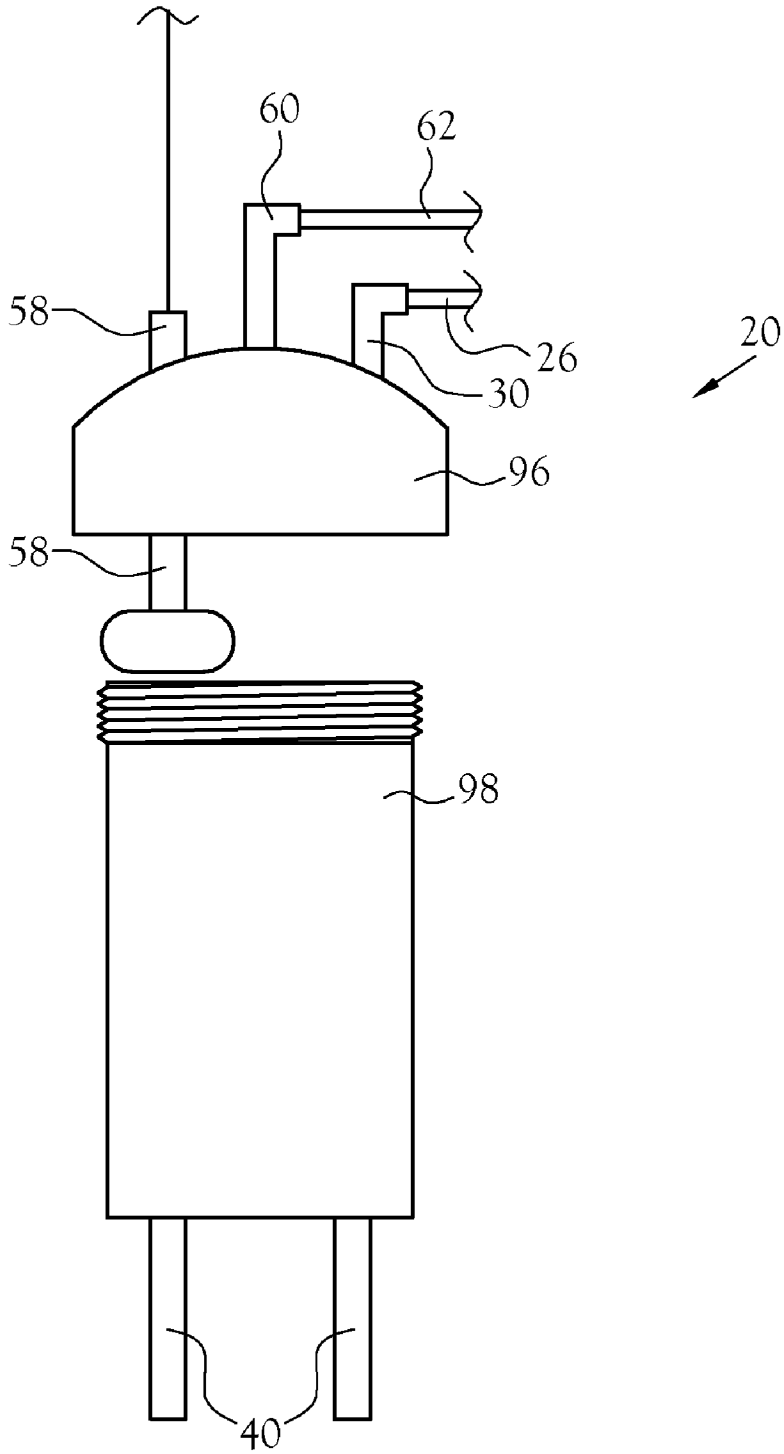


Fig.5

HYDROXYL GAS GENERATION SYSTEM FOR ENHANCING THE PERFORMANCE OF A COMBUSTION ENGINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] This invention pertains to a system for generating a hydroxyl gas and making the hydroxyl gas available to a combustion engine. More particularly, this invention pertains to a system for generating an electrolytic reaction and for limiting corrosion of the electrical components used therefore.

[0005] 2. Description of the Related Art

[0006] It is a common desire to have a combustion engine that performs optimally and burns less fuel. Such an engine reduces air pollution and increases the gas mileage of an employing vehicle. It has been shown that adding hydrogen to the air intake of a combustion engine enhances the flame velocity, permitting the engine to operate with a leaner air-to-gasoline mixture than otherwise possible. Consequently, conventional hydrogen injecting systems have been developed to generate hydrogen and to inject the hydrogen into a combustion engine by way of the air intake of the engine. The conventional systems generate the hydrogen by generating an electrolytic reaction. More specifically, the conventional hydrogen injecting systems include electrodes, namely an anode and a cathode, disposed within an alkali solution such that electric current passes from the anode, through the solution, and to the cathode, causing a reduction reaction that generates a hydrogen gas. The generated hydrogen is routed to the air intake of the combustion engine such that the engine operates more efficiently as discussed above.

[0007] The conventional hydrogen injecting systems are limited in that the electrolytic reaction causes the electrodes to have a high corrosion rate. More specifically, during electrolysis, substantially more oxygen accumulates at the anode than at the cathode to the extent that severe oxidation occurs at the anode with respect to the cathode. Because of the anode's high rate of corrosion, the electrodes must be regularly replaced, or the desired functionality of the hydrogen injecting system is compromised. Regularly replacing the electrodes is expensive and is disruptive and inconvenient for a user of the conventional hydrogen injecting system. Consequently, a hydrogen injecting system that reduces the corrosion rate of its electrodes is desired.

BRIEF SUMMARY OF THE INVENTION

[0008] In accordance with the various features of the present invention there is provided a hydroxyl gas generation system for generating a hydroxyl gas by way of electrolysis, for limiting the corrosion of electrodes used in the electrolysis, and for making the hydroxyl gas available to be drawn into the air intake of a combustion engine. The hydroxyl gas generation system includes an electrolytic cell and a processor. The electrolytic cell includes an electrolysis chamber and an electrode structure. The electrode structure defines an open circuit and is disposed within the electrolysis chamber. The electrolysis chamber contains an electrolytic solution such that the electrolytic solution completes the open circuit defined by the electrode structure. The processor is in electrical communication with the electrode structure and a power source. The processor applies a voltage to the electrode structure such that an electrical current passes through the electrolytic solution, generating an electrolytic reaction that produces the hydroxyl gas within the electrolysis chamber. The hydroxyl gas is drawn from the electrolysis chamber into the air intake of the combustion engine.

[0009] The processor alternates the polarity of the voltage applied to the electrode structure such that the corrosion of the electrode structure causes by the electrolytic reaction is substantially uniform. More specifically, the electrode structure includes a first electrode and a second electrode. The first electrode is in electrical communication with the second electrode by way of the electrolytic solution. Consequently, when the first electrode is the anode, the second electrode is the cathode. Similarly, when the first electrode is the cathode, the second electrode is the anode. When the processor alternates the polarity of the voltage applied to the electrode structure, the first electrode alternates between being the anode and the cathode. Accordingly, the second electrode alternates between being the cathode and the anode. Because, during an electrolytic reaction, the electrode that is the anode corrodes at a faster rate than the electrode that is the cathode, alternating the polarity of the voltage applied to the electrode structure as discussed limits the corrosion of the electrode that would otherwise be solely the anode. Additionally, in one embodiment, the electrodes of the electrode structure are coated with platinum, a material that is substantially impermeable to the electrolytic solution, such that the corrosion of the electrodes is further limited.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0010] The above-mentioned features of the invention will become more clearly understood from the following detailed description of the invention read together with the drawings in which:

[0011] FIG. **1** illustrates one embodiment of the hydroxyl gas generation system secured to the cab of truck having a combustion engine;

[0012] FIG. **2** is pictorial block diagram of one embodiment of the hydroxyl gas generation system in accordance with the various features of the present invention;

[0013] FIG. **3** illustrates the electrode structure of FIG. **2**;

[0014] FIG. **4** illustrates an alternate embodiment of the electrode structure of FIG. **3**; and

[0015] FIG. **5** illustrates an alternate embodiment of the electrolysis cell of FIG. **2**.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The present invention provides a hydroxyl gas generation system for generating a hydroxyl gas by way of electrolysis, for limiting the corrosion of electrodes used in the electrolysis, and for making the hydroxyl gas available to be drawn into the air intake of a combustion engine. The hydroxyl gas generation system generates an electrolytic reaction by passing an electrical current between the electrodes by way of an electrolytic solution, the electrolytic reaction generating the hydroxyl gas. To limit the corrosion of the electrodes, the polarity of the voltage applied to the electrodes is periodically alternated. Additionally, the electrodes are constructed of or plated with platinum, a material that is substantially impermeable to the electrolytic solution. One embodiment of the hydroxyl gas generation system constructed in accordance with the various features of the present invention is illustrated generally at **10** in FIG. **1**.

[0017] The hydroxyl gas generation system **10** includes a hydroxyl gas generator **12** and a water reservoir **14**. The hydroxyl gas generator **12** generates a hydroxyl gas, and the water reservoir **14** houses distilled water. The hydroxyl gas generator **12** is in fluidic communication with the water reservoir **14** such that the hydroxyl gas generator **12** receives water housed by the water reservoir **14** and uses the water in generating a subsequently discussed electrolytic reaction. In the illustrated embodiment, the hydroxyl gas generator **12** and the water reservoir **14** are mounted to the cab of a truck **15** having a combustion engine. More specifically, in the illustrated embodiment, the hydroxyl gas generator **12** and the water reservoir **14** are mounted to the load locks of the truck **15**. It should be noted that the hydroxyl gas generator **12** and the water reservoir **14** can be secured to any vehicle, machine, or other mechanism having a combustion engine without departing from the scope or spirit of the present invention. It should also be noted that the hydroxyl gas generator **12** and the water reservoir **14** need not be mounted to the vehicle, machine, or other mechanism having a combustion engine to remain within the scope and spirit of the present invention. In the illustrated embodiment, the water reservoir **14** is adapted to house a particular amount of distilled water such that the depletion of the water housed by the water reservoir **14** coincides with the recommended time for an oil change for the truck. More specifically, the rate at which the water is used by the hydroxyl gas generator **12** is calculated such that the approximate amount of water used between oil changes is known. Accordingly, at the time the oil is changed in the truck, the water reservoir **14** is filled or refilled. Consequently, maintenance of the hydroxyl gas generation system **10** is made more convenient. It should be noted that the size of the water reservoir **14** need not be such that the depletion of the water housed by the water reservoir **14** coincides with periodic maintenance requirements of the combustion engine to remain within the scope or spirit of the present invention.

[0018] FIG. **2** is a pictorial block diagram of one embodiment of the hydroxyl gas generator **12** in accordance with the various features of the present invention. The hydroxyl gas generator **12** is in fluidic communication with the water reservoir **14** and in gaseous communication with a combustion engine **16**. The hydroxyl generator **12** includes a processor **18**, an electrolytic cell **20**, a fluid pump **22**, and a bubbler **24**. The processor **18** is in electrical communication the fluid pump **22**, which is in fluidic communication with the electrolytic cell **20** by way of a first fluid conduit **26**. The processor **18** activates the fluid pump **22** such that the fluid pump **22** draws water from the water reservoir **14** by way of a second fluid conduit **28** and pumps the water into the electrolytic cell **20** by way of the first fluid conduit **26**. The electrolytic cell **20** includes an electrolysis chamber **32**, which is hermetically sealed and receives water from the first fluid conduit **26**. In the illustrated embodiment, the electrolytic cell **20** includes an electrolytic cell fluid port **30**, which is a fluidic interface between the first fluid conduit **26** and the electrolysis chamber **32**. Within the electrolysis chamber **32** is an electrolytic substance that mixes with the water received by the electrolysis chamber **32** to create an electrolytic solution within the electrolysis chamber **32**, the electrolytic solution being more electrically conductive than the water. In one embodiment, the electrolytic solution is an alkali solution. More specifically, in one embodiment, the electrolytic substance is potassium hydroxide. The electrolytic solution partially fills the electrolysis chamber **32**. In the illustrated embodiment, the electrolytic cell **20** includes a first electrolysis chamber **34** and a second electrolysis chamber **36**. Additionally, in the illustrated embodiment, the first electrolysis chamber **34** and the second electrolysis chamber **36** are fluidically connected by an electrolysis chamber conduit **38** such that the electrolytic solution level within the first electrolysis chamber **34** is even with the electrolytic solution level within the second electrolysis chamber **36**. It should be noted that the electrolytic cell **20** can include a single electrolysis chamber **32** without departing from the scope or spirit of the present invention. It should also be noted that when the electrolytic cell **20** includes more than one electrolysis chamber **32**, the electrolysis chambers need not be fluidically connected to remain within the scope or spirit of the present invention.

[0019] An electrode structure **40** is disposed within each electrolysis chamber **32**. The electrode structure **40** defines an open circuit and is submerged within the electrolytic solution such that the electrolytic solution completes the open circuit. The electrode structure **40** is in electrical communication with the processor **18**, which applies a voltage to the electrode structure **40**. More specifically, the processor **18** is in electrical communication with a power source **56** and routes the power provided by the power source **56** to the electrode structure **40**. In one embodiment, the power source **56** is a twelve-volt power source, such as the battery of a vehicle. Accordingly, in one embodiment, the processor **18** includes a step-down transformer such that the processor **18** applies, for example, seven volts to the electrode structure **40**.

[0020] FIG. **3** illustrates one embodiment of the electrode structure **40** in accordance with the various features of the present invention. The electrode structure **40** includes a first electrode **46** and a second electrode **48**. In the illustrated embodiment, the first electrode **46** includes a first plurality of electrical contacts **50**, and the second electrode **48** includes a second plurality of electrical contacts **52**. The first plurality of electrical contacts **50** are mutually spaced apart, the second plurality of electrical contacts **52** are mutually spaced apart, and the first electrode **46** is positioned with respect to the second electrode **48** such that the first plurality of electrical contacts **50** overlap with the second plurality of electrical contacts **52**, but none of the first plurality of electrical contacts **50** physically or electrically contact any of the second plurality of electrical contacts **52**. Stated differently, the first electrode **46** and the second electrode **48** define an open circuit. The first electrode **46** and the second electrode **48** are secured in position by a non-conductive structure **54**. Because the electrode structure **40** is submerged within the electrolytic solution such that the solution completes the open circuit, when the processor **18** applies a voltage to the electrode structure **40**, an electrical current passes between the first electrode **46** and the second electrode **48** such that the electrical current passes through the electrolytic solution. The amperage of the electrical current, for a given voltage, is governed by the chemical properties of the solution. For example, when the electrolytic solution is a mixture of distilled water and potassium hydroxide having a concentration of 2.8 grams of potassium hydroxide to 700 milliliters of water, and when 7 volts is applied to the electrode structure **40**, the electrode structure **40** draws 30 amps of electrical current. The electrical current passing through the electrolytic solution initiates and maintains an electrolytic reaction, which breaks oxygen molecules and hydrogen molecules from the electrolytic solution. The oxygen and hydrogen separate from the electrolytic solution in the form of the hydroxyl gas, which rises above the electrolytic solution. Accordingly, the generated hydroxyl gas is within the electrolysis chamber **32**.

[0021] FIG. **4** illustrates an alternate embodiment of the electrode structure **40**. In the alternate embodiment, the first electrode **46** and the second electrode **48** are constructed of selected components such as respective bolts, pluralities of nuts, pluralities of washers, and pluralities of conductive plates. More specifically, the first electrode **46** includes a first bolt **100**, a first plurality of nuts **102**, a first plurality of washers **104**, and the first plurality of electrical contacts **50**, which, in the alternate embodiment, is a plurality of conductive plates. The first bolt **100** extends the length of the first electrode **46** and receives the first plurality of nuts **102**, the first plurality of washers **104**, and the first plurality of electrical contacts **50** such that the first plurality of electrical contacts **50** is configured as discussed above. Similarly, the second electrode **48** includes a second bolt **106**, a second plurality of nuts **108**, a second plurality of washers **110**, and the second plurality of electrical contacts **52**, which, in the alternate embodiment, is a plurality of conductive plates. The second bolt **106** extends the length of the second electrode **48** and receives the second plurality of nuts **108**, the second plurality of washers **110**, and the second plurality of electrical contacts **52** such that the second plurality of electrical contacts **52** is configured as discussed above. The first bolt **100** and the second bolt **106** are secured to the non-conductive structure **54** such that configuration of the first electrode **46** with respect to the second electrode **48** is that discussed above. Fabricating the first electrode **46** and the second electrode **48** using separate components, such as shown in FIG. **4**, facilitates coating selective components of the electrode structure **40** with an impermeable material such as platinum.

[0022] Considering again FIG. **2**, the electrolytic cell **20** includes a first electrode structure **42** disposed within the first electrolysis chamber **34** and a second electrode structure **44** disposed within the second electrolysis chamber **36**. It should be noted that the electrolytic cell **20** can have a single electrode structure **40** without departing from the scope or spirit of the present invention. In the illustrated embodiment, the first electrode structure **42** and the second electrode structure **44** are wired in series with regard to the processor **18**. In one embodiment of the illustrated embodiment, the processor **18** applies 7 volts to the first electrode structure **42** and the second electrode structure **44** such that 3.5 volts are driven into each electrode structure **40**. It should be noted that when the electrolytic cell **20** includes more than one electrode structure **40**, the electrode structures can be wired in a way other than in series, such as in parallel, without departing from the scope or spirit of the present invention. In accordance with the above-discussion, when the processor **18** applies a voltage to the first electrode structure **42** and the second electrode structure **44**, an electrolytic reaction is generated within the first electrolysis chamber **34** and the second electrolysis chamber **36**, respectively. The electrolytic reaction generates the hydroxyl gas within the first electrolysis chamber **34** and the second electrolysis chamber **36**.

[0023] The electrolytic solution is a caustic solution that corrodes the first electrode **46** and the second electrode **48**. Additionally, during the electrolytic reaction, a proportionately excessive amount of oxygen accumulates at the anode of the electrode structure **40** with respect to the cathode of the electrode structure **40**. The anode can be either the first electrode **46** or the second electrode **48**, depending on which electrode is positively charged and which electrode is negatively charged. The excessive accumulation of oxygen at the anode causes an oxidation at the anode that causes the anode to corrode at a faster rate than the cathode. The disproportionate corrosion rates among the first electrode **46** and the second electrode **48** limit the potential operational lifespan of the electrode structure **40**. More specifically, due to the corrosion rate of the anode, the electrode structure **40** must be replaced before the cathode is corroded beyond operational use. To prevent the disproportional corrosion rate among the first electrode **42** and the second electrode **44**, and thus extend the operational lifespan of the electrode structure **40**, the processor **18** alternates the polarity of the voltage applied to the electrode structure **40**. More specifically, at times, the processor **18** applies voltage to the electrode structure **40** such that the first electrode **46** is the anode and the second electrode **48** is the cathode. At other times, the processor **18** applies voltage to the electrode structure **40** such that the first electrode **46** is the cathode and the second electrode **48** is the anode. In one embodiment, the processor **18** alternates the polarity of the voltage applied to the electrode structure **40** periodically. For example, in one embodiment, the processor **18** alternates the polarity of the voltage applied to the electrode structure **40** after every twenty-four hours of use. Alternating the polarity of the voltage applied to the electrode structure **40** distributes the excessive accumulation of oxygen at the anode between the first electrode **46** and the second electrode **48** such that the corrosion rate among the first electrode **46** and the second electrode **48** is substantially uniform. To further reduce the corrosion rate of the first electrode **46** and the second electrode **48**, in one embodiment, the first electrode **46** and the second electrode **48** are constructed of platinum, a substance that is substantially impermeable to the caustic electrolytic solution. Alternatively, in another embodiment, the first electrode **46** and the second electrode **48** are plated with platinum. Consequently, when the first electrode **46** and the second electrode **48** are constructed of or plated with platinum, corrosion of the first electrode **46** and the second electrode **48** is substantially limited.

[0024] In the illustrated embodiment of FIG. **2**, the electrolytic cell **20** includes an electrolytic cell float switch **58** in electrical communication with the processor **18**. The electrolytic cell float switch **58** defines a solution level threshold, which indicates the amount of electrolytic solution within the electrolysis chamber **32**. When the amount of electrolytic solution within the electrolysis chamber **32** is greater than the solution level threshold, the electrode structure **40** is submerged within the electrolytic solution to the extent the electrolytic cell **20** operates in accordance with the above-discussion. When the amount of electrolytic solution within the electrolysis chamber **32** decreases to a level below the solution level threshold, the electrolytic float switch **58** generates a low solution level signal, which is received by the processor **18**. When the processor **18** receives the low solution level signal, the processor **18** causes the fluid pump **22** to draw water from the water reservoir **14** and pump water into the electrolysis chamber **32**. When the processor **18** ceases to receive to the low solution level signal, the processor **18** causes the fluid pump **22** to stop drawing water from the water reservoir **14** and stop pumping water into the electrolysis chamber **32**. Stated differently, the processor **18** causes the fluid pump **22** to draw water from the water reservoir **14** and pump the water into the electrolysis chamber **32** until the level of solution within the electrolysis chamber **32** is greater than the solution level threshold. Consequently, the electrolytic cell float switch **58** maintains the amount of electrolytic solution within the electrolysis chamber **32** such that the electrolytic cell **20** operates in accordance with the above-discussion. It should be noted that when the amount of electrolytic solution within the electrolytic chamber **32** decreases due to electrolysis, it is the amount of water, not the amount of the electrolytic substance mixed with the water (e.g. the potassium hydroxide), that decreases. Consequently, to maintain the proper amount of electrolytic solution within the electrolysis chamber **32**, additional amounts of the electrolytic substance is not added to the electrolysis chamber **32**, only additional amounts of water.

[0025] The electrolytic cell **20** includes an electrolytic cell gas port **60**, which is a gaseous interface between the electrolysis chamber **32** and a first gas conduit **62**. The hydroxyl gas generated by the electrolytic cell **20** is drawn from the electrolysis chamber **32** and into the first gas conduit **62**. The bubbler **24** includes a hermetically sealed bubbler chamber **64** and a bubbler input **66**. The first gas conduit **62** is interfaced with the bubbler chamber **64** by way of the bubbler input **66** such that the hydroxyl gas drawn from the electrolysis chamber **32** is drawn into the bubbler chamber **64**. More specifically, the bubbler chamber **64** is partially filled with water. An end **68** of the bubbler input **66** is positioned beneath the surface of the water such that the hydroxyl gas drawn into the bubbler chamber **64** bubbles through the water. When the hydroxyl gas bubbles through the water, the water removes any electrolytic solution from the hydroxyl gas that may be mixed with the gas. Additionally, the water within the bubbler chamber **64** cools the hydroxyl gas before it is drawn from the hydroxyl gas generation system **10**.

[0026] The bubbler **24** includes a bubbler gas port **70**, which interfaces the bubbler chamber **64** with a second gas conduit **72**. The second gas conduit **72** is in gaseous communication with the air intake of the combustion engine **16** such that the hydroxyl gas drawn from the bubbler chamber **64** is drawn into the air intake of the combustion engine **16**. Because the hydroxyl gas is drawn into the air intake of the combustion engine, the engine runs cleaner and more efficiently in accordance with the above-discussion.

[0027] In the illustrated embodiment, the bubbler **24** includes a bubbler float switch **74**, a bubbler gas port valve **76**, a water release valve **78**, and an air intake valve **80**. The bubbler float switch **74**, the bubbler gas port valve **76**, and the water release valve **78** are in electrical communication with the processor **18**. The bubbler float switch **74** defines a water level threshold, which indicates the amount of water within the bubbler chamber **64**. When the water level within the bubbler chamber **64** is sufficiently low such that the water does not reach the bubbler gas port **70**, the water is below the water level threshold. When the water level within the bubbler chamber **64** increases, due to the above-discussed bubbling, to the extent that the water level within the bubbler chamber **64** is greater than the water level threshold, the bubbler float switch **74** generates a high water level signal, which is received by the processor **18**. When the processor **18** receives the high water level signal, the processor **18** causes the bubbler gas port valve **76**, which is otherwise open, to close and the water release valve **78**, which is otherwise closed, to open. When the processor **18** closes the bubbler gas port valve **76** and opens the water release valve **78**, water within the bubbler chamber **64** is prevented from passing through the bubbler gas port **70**, passes through the water release valve **78**, and is carried away from the bubbler **24** by way of a second fluid conduit **82**, which is in fluidic communication with the water release valve **78**. When water is released from the bubbler chamber **64** by way of the water release valve **78**, a vacuum greater than that generated by the combustion engine **16** drawing hydroxyl gas is generated within the bubbler chamber **64**. The air intake valve **80** is a pressure valve that opens in response to the vacuum generated by the release of water from within the bubbler chamber **64** such that the vacuum is relieved. In one embodiment, the air intake valve **80** is a 12-pound valve, and the vacuum generated by the combustion engine **16** drawing hydroxyl gas has a magnitude of 3 pounds. When the processor **18** ceases to receive to the high water level signal, the processor **18** causes the bubbler gas port valve **76** to open and the water release valve **78** to close. Stated differently, the processor **18** causes the bubbler gas port valve **76** to prevent water from passing through the bubbler gas port **70** and the water release valve **78** to release water from the bubbler chamber **64** until the water level within the bubbler chamber **64** drops below the water level threshold. Consequently, the bubbler float switch **74** maintains the water level within the bubbler chamber **64** such that the water does not reach the bubbler gas port **70** and, consequently, does not reach the air intake of the combustion engine **16**.

[0028] In the illustrated embodiment, the hydroxyl gas generation system **10** includes a check valve **84** at the second gas conduit **72** where the second gas conduit **72** interfaces with the air intake of the combustion engine **16**. The check valve **84** is a pressure valve that is open when the hydroxyl gas is being drawn from the bubbler **24** and into the combustion engine **16**. Otherwise, the check valve **84** is closed. Consequently, the check valve **84** prevents contaminants from the combustion engine **16** from entering the hydroxyl gas generation system **10** when, for example, the air filter of the combustion engine become severely clogged. Additionally, in the event the hydroxyl gas becomes ignited by the combustion engine **16**, the check valve **84** prevents the ignited gas from entering the hydroxyl gas generation system **10**. Similarly, the bubbler **24** includes a bubbler check valve **86** at the bubbler input **66**. The bubbler check valve **86** is a pressure valve that is open when the hydroxyl gas is being drawn into the bubbler **24** and is otherwise closed. Consequently, the bubbler check valve **86** prevents the water within the bubbler chamber **64** from being drawn into the electrolytic cell **20**. Additionally, in the event the hydroxyl gas within the bubbler chamber **64** becomes ignited, the bubbler check valve **86**, as well as the water within the bubbler chamber **64**, prevent the ignited gas from entering the electrolytic cell **20** by way of the first gas conduit **62**.

[0029] In the illustrated embodiment, the hydroxyl gas generation system **10** includes a master switch **88** in electrical communication with the processor **18** and the ignition switch of the combustion engine **16**. When the combustion engine **16** is operating, the master switch **88** generates an activation signal, which is received by the processor **18**. When the combustion engine **16** is not operating, the master switch **88** generates a deactivation signal, which is received by the processor **18**. When the processor **18** receives the activation signal, it activates the hydroxyl gas generation system **10**, and when the processor **18** receives the deactivation signal, it deactivates the hydroxyl gas generation system **10**. As a result, the hydroxyl gas generation system **10** only operates when the combustion engine **16** operates. Additionally, when the processor **18** detects that the voltage provided by the power source **56** drops below a low voltage threshold, such as 10 volts, the processor **18** deactivates the hydroxyl gas generation system **10**. Similarly, when the voltage provided by the power source **56** rises above a high voltage threshold, such as due to the alternator, the processor **18** deactivates the hydroxyl gas generation system **10**. Additionally, in one embodiment, the processor **18** includes an onboard thermostat. When the temperature of the processor **18** rises above a high temperature threshold, the processor **18** deactivates the hydroxyl gas generation system **10**.

[0030] In the illustrated embodiment, the hydroxyl gas generation system **10** includes a first fan **90** and a second fan **92** in electrical communication with the power source **56**. The first fan **90** and the second fan **92** circulate air through the hydroxyl gas generator **12** such that the hydroxyl gas generator **12** does not overheat.

[0031] In the illustrated embodiment, the hydroxyl gas generation system **10** includes a water heater **94** for heating the water housed by the water reservoir **14**. More specifically, the water heater **94** includes a thermostat for measuring the temperature of the water within the water reservoir **14** such that the water heater **94** heats the water to the extent that the water within the water reservoir **14** does not freeze. Additionally, in one embodiment, electrical heat tape is secured to the second fluid conduit **28**. The heat tape heats the second fluid conduit **28** to the extent that the water within the second fluid conduit **28** does not freeze.

[0032] FIG. **5** illustrates an alternate embodiment of the electrolytic cell **20** in accordance with the various features of the present invention. In the alternate embodiment, the electrolytic cell **20** includes a first member **96** and a second member **98**. The first member **96** includes the electrolytic cell fluid port **30**, the electrolytic cell gas port **60**, and the electrolytic cell float switch **58**. The second member **98** includes the electrode structure **40**. Additionally, the first member **96** includes a female threaded portion, and the second member **98** includes a male threaded portion, whereby the female threaded portion and the male threaded portion cooperate such that the first member **96** is releasably secured to the second member **98**. When the first member **96** is secured to the second member **98**, the first member **96** and the second member **98** define the electrolysis chamber **32**. As a result, the electrolysis cell **20** of the alternate embodiment permits the electrode structure **40** to be replaced without disconnecting the electrolytic cell fluid port **30** from the first fluid conduit **26** or disconnecting the electrolytic cell gas port **60** from the first gas conduit **62** or disconnect the electrolytic cell float switch **58** from the processor **18**. More specifically, to remove the electrode structure **40**, the electrode structure **40** is disconnected from the processor **18** and the second member **98** is removed from the first member **96**. A replacement second member **98**, which includes the replacement electrode structure **40**, is then secured to the first member **96**.

[0033] From the foregoing description, those skilled in the art will recognize that a hydroxyl gas generation system for generating a hydroxyl gas by way of electrolysis and for making the hydroxyl gas available to be drawn into the air intake of a combustion engine offering advantages over the prior art has been provided. The hydroxyl gas generation system generates an electrolytic reaction by passing an electrical current between the electrodes by way of an electrolytic solution, the electrolytic reaction generating the hydroxyl gas. To limit the corrosion of the electrodes, the polarity of the voltage applied to the electrodes is periodically alternated. Additionally, the electrodes are constructed of or plated with platinum, a material that is substantially impermeable to the electrolytic solution.

[0034] While the present invention has been illustrated by description of several embodiments and while the illustrative embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The invention in its broader aspects is therefore not limited to the specific details, representative apparatus and methods, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of applicant's general inventive concept.

Having thus described the aforementioned invention, what is claimed is:

1. A hydroxyl gas generation system for enhancing the performance of a combustion engine, said hydroxyl gas generation system comprising:

an electrolytic cell having an electrolysis chamber and an electrode structure disposed within the electrolysis chamber, the electrolysis chamber being adapted to contain an electrolytic solution, the electrode structure defining an open circuit, the electrolytic solution completing the open circuit defined by the electrode structure when the electrolysis chamber contains the electrolytic solution; and

a processor in electrical communication with the electrode structure, said processor applies a voltage to the electrode structure such that the electrode structure generates an electrolytic reaction when the electrolysis chamber contains the electrolytic solution, the electrolytic reaction producing a hydroxyl gas within the electrolysis chamber, said processor alternates the polarity of the voltage applied to the electrode structure such that corrosion of the electrode structure is substantially uniform, said electrolytic cell being in gaseous communication with the combustion engine such that the hydroxyl gas is drawn from the electrolysis chamber and to the combustion engine.

2. The hydroxyl gas generation system of claim **1** wherein the electrode structure includes a first electrode and a second electrode, the first electrode and the second electrode defining the open circuit.

3. The hydroxyl gas generation system of claim **2** wherein said processor applies a voltage to the first electrode and the second electrode, said processor alternates the polarity of the voltage applied to the first electrode and the second electrode such that the first electrode and the second electrode corrode at a substantially uniform rate.

4. The hydroxyl gas generation system of claim **2** wherein the first electrode and the second electrode are at least partially constructed of platinum.

5. The hydroxyl gas generation system of claim **1** further comprising a bubbler in gaseous communication with the electrolytic cell, said bubbler having a bubbler chamber adapted to contain water, the bubbler chamber receives the hydroxyl gas from said electrolytic cell, said bubbler bubbles the hydroxyl gas through the water when the bubbler chamber contains the water, bubbling the hydroxyl gas through the water removes any electrolytic solution from the hydroxyl gas, the hydroxyl gas is drawn from the bubbler chamber and to the combustion engine.

6. The hydroxyl gas generation system of claim **1** wherein said electrolytic cell includes an electrolytic cell float switch in electrical communication with said processor, the electrolytic cell float switch generates a low solution level signal when the amount of solution within the electrolysis chamber drops below a threshold defined by the electrolytic cell float switch, said processor receives the low solution level signal.

7. The hydroxyl gas generation system of claim **6** further comprising a water reservoir and a fluid pump, said water reservoir being adapted to house water and being in fluidic communication with said fluid pump, said fluid pump being in fluidic communication with said electrolytic cell and in electrical communication with said processor, said processor causes said fluid pump to draw water from said water reservoir and pump water into the electrolysis chamber of said electrolytic cell when said processor receives the low solution level signal.

8. The hydroxyl gas generation system of claim **7** wherein said water reservoir is adapted to house a calculated amount of water, the calculated amount of water being such that the depletion of the water housed by said water reservoir coincides with periodic maintenance requirements of the combustion engine.

9. The hydroxyl gas generation system of claim **1** wherein said processor is in electrical communication with a power source.

10. The hydroxyl gas generation system of claim **1** wherein said electrolysis cell includes a first member and a second member, the second member being adapted to be releasably secured to the first member such that the first member and the second member define the electrolysis chamber when secured, the electrode structure being disposed at the second member.

11. The hydroxyl gas generation system of claim **10** wherein the first member and the second member have respective cooperating threaded members such that the second member is adapted to be releasably secured to the first member.

12. A hydroxyl gas generation system for enhancing the performance of a combustion engine, said hydroxyl gas generation system comprising:

an electrolysis chamber adapted to contain an electrolytic solution, said electrolysis chamber having a gas port;

an electrode structure disposed within said electrolysis chamber, said electrode structure having a first electrode and a second electrode, the first electrode and the second electrode defining an open circuit, the electrolytic solution completing the open circuit defined by said electrode structure when said electrolysis chamber contains the electrolytic solution; and

a processor in electrical communication with said electrode structure and a power source, said processor applying a voltage to said electrode structure such that an electrical current passes between the first electrode and the second electrode by way of the electrolytic solution, the electrical current passing through the electrolytic solution generates an electrolytic reaction that generates a hydroxyl gas within the electrolysis chamber, said processor alternating the polarity of the voltage applied to the electrode structure such that the first electrode alternates between being the anode and the cathode and such that the second electrode correspondingly alternates between being the anode and the cathode, the combustion engine draws the hydroxyl gas from the electrolysis chamber by way of the gas port.

13. The hydroxyl gas generation system of claim **12** whereby the first electrode and the second electrode are at least partially constructed of platinum.

14. The hydroxyl gas generation system of claim **13** whereby the first electrode and the second electrode are platinum plated.

15. The hydroxyl gas generation system of claim **12** further comprising a bubbler in gaseous communication with said electrolysis chamber, said bubbler receives the hydroxyl gas from said electrolysis chamber and bubbles the hydroxyl gas through water contained by said bubbler, the bubbled hydroxyl gas is drawn from said bubbler to the combustion engine.

16. The hydroxyl gas generation system of claim **12** further comprising a water reservoir and a fluid pump, said water reservoir being adapted to house water and being in fluidic communication with said fluid pump, said fluid pump being in fluidic communication with said electrolysis chamber and in electrical communication with said processor, said processor detecting when the electrolytic solution within said electrolysis chamber drops below a low solution threshold, said processor activating said fluid pump such that said fluid pump draws water from said water reservoir and pumps the water into the electrolysis chamber until the electrolytic solution within the electrolysis chamber satisfies the low solution threshold when said processor determines that the electrolytic solution within said electrolysis chamber drops below a solution threshold.

17. The hydroxyl gas generation system of claim **12** further comprising a master switch in electrical communication with said processor and the combustion engine, said processor activating said hydroxyl gas generation system when the combustion engine is activated, said processor deactivating said hydroxyl gas generation system when the combustion engine is deactivated.

18. A hydroxyl gas generation system for enhancing the performance of a combustion engine, said hydroxyl gas generation system comprising:

an electrolytic cell having an electrolysis chamber and an electrode structure disposed within the electrolysis chamber, the electrode structure defining an open circuit, the electrolysis chamber containing an electrolytic solution such that the electrolytic solution completes the open circuit, said electrolytic cell having a float switch defining a low solution threshold, the low solution threshold indicating the amount of electrolytic solution within the electrolysis chamber;

a processor in electrical communication with the electrode structure, the float switch, and a power source, said processor applying a voltage to the electrode structure such that an electrical current passes through the electrolytic solution, an electrolytic reaction occurring when the electrical current passes through the electrolytic solution such that a hydroxyl gas is produced within the electrolysis chamber, said processor alternating the polarity of the voltage applied to the electrode structure such that the corrosion rate of the electrode structure is substantially uniform;

a water reservoir adapted to house water;

a fluid pump in fluidic communication with said water reservoir and in electrical communication with said processor, said processor activates said fluid pump when the float switch indicates that the electrolytic solution within the electrolysis chamber is below the low solution threshold, the fluid pump draws water from the water reservoir and pumps the water to the electrolysis chamber when said fluid pump is activated;

a bubbler in gaseous communication with said electrolytic cell, said bubbler draws the hydroxyl gas from the electrolysis chamber and bubbles the hydroxyl gas through water such that the hydroxyl gas is purified of any electrolytic solution, the combustion engine draws the purified hydroxyl gas from said bubbler to the air intake of the combustion engine.

19. The hydroxyl gas generation system of claim **18** wherein the electrode structure includes a first electrode and a second electrode, said processor applying the voltage to the electrode structure such that the electrical current passes between the first electrode and the second electrode by way of the electrolytic solution, said processor alternating the polarity of the voltage applied to the electrode structure such that the first electrode alternates between being the anode and the cathode and such that the second electrode correspondingly alternates between being the cathode and the anode.

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