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(54) WATER ELECTROLYZER SYSTEM AND METHOD

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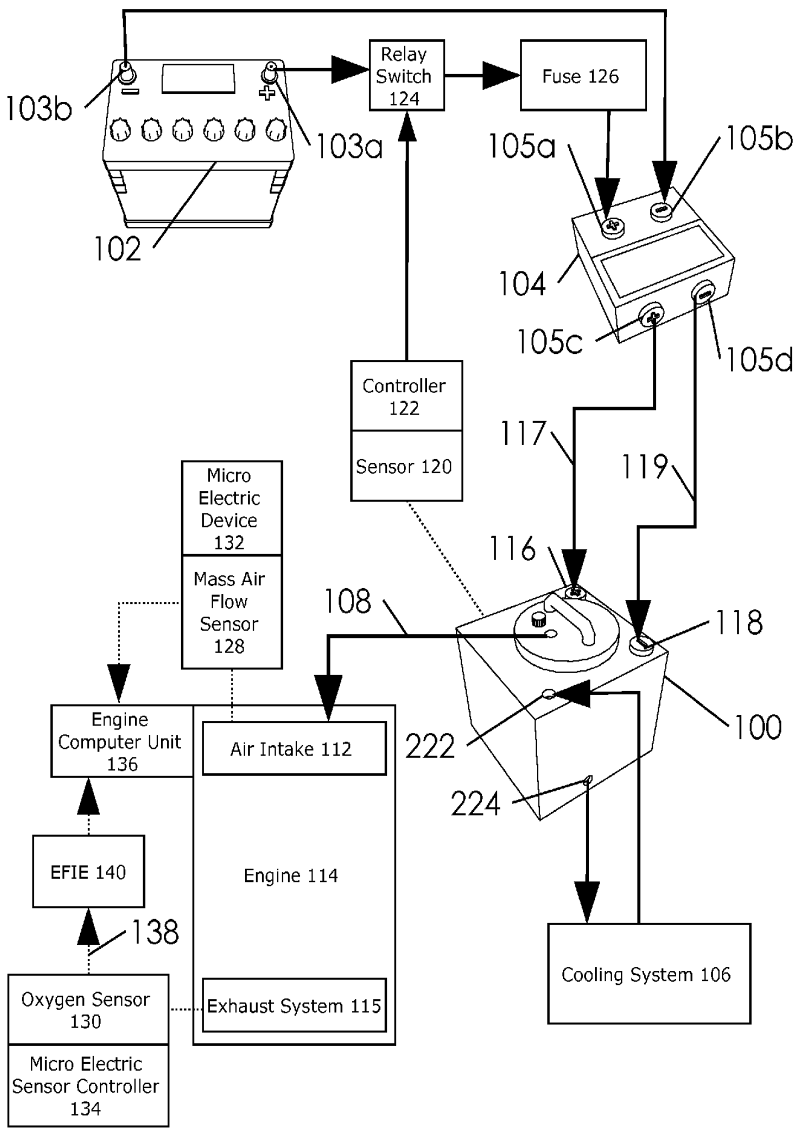
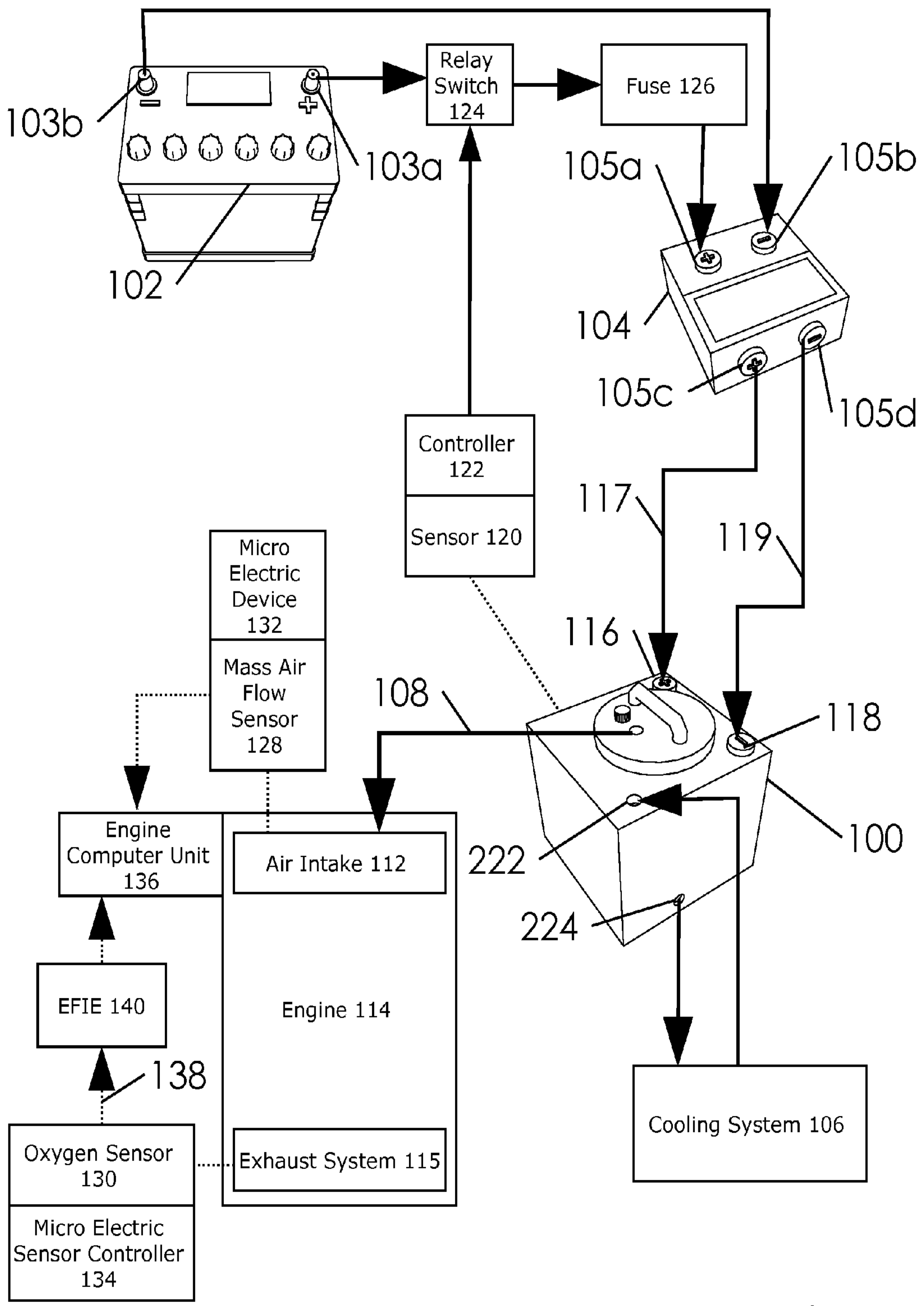
(57) ABSTRACT

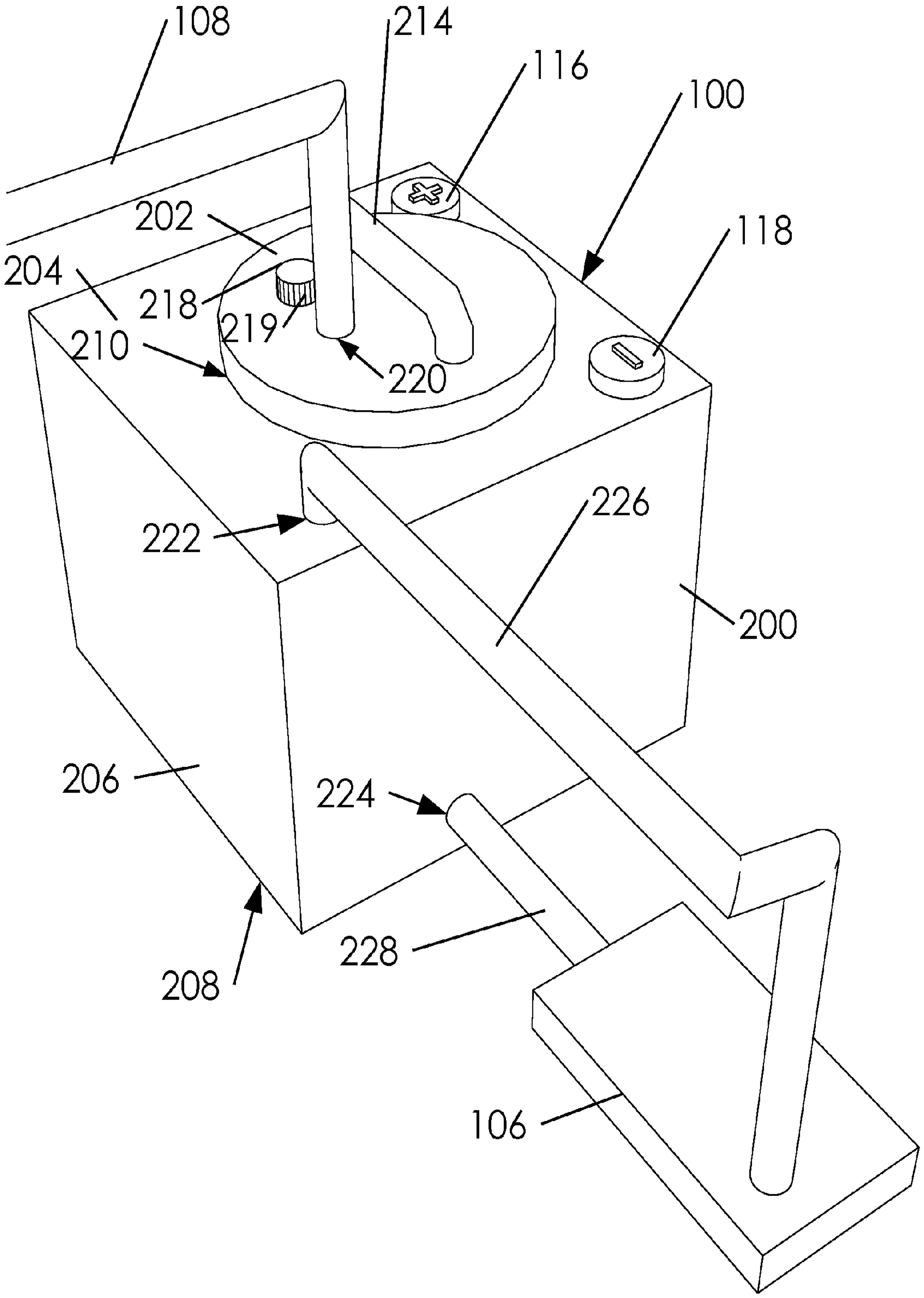
A water electrolyzer comprises a reservoir of water, one or more cells, a source of pulse width modulated direct current electricity, a positive terminal, a negative terminal, and a cooling system. Said electrode cells are submerged in said reservoir of water. Said source of pulse width modulated direct current electricity attaches to said positive terminal and said negative terminal of said water electrolyzer. Said electrode cells each comprise a cathode having a positive terminal and an anode having a negative terminal. Said cathode and said anode comprise different materials. Said positive terminal attaches to said electrode cells with one or more positive lines. Said negative terminal attaches to said electrode cells with one or more negative lines. Said cooling system is capable of cooling said reservoir of water. Said water electrolyzer produces and can deliver one or more gases through a fluid connection with an engine.





103b
103a
102
Relay Switch 124
Fuse 126
105a
105b
104
105c
105d
117
119
Controller 122
Sensor 120
Micro Electric Device 132
Mass Air Flow Sensor 128
116
108
118
100
222
224
Engine Computer Unit 136
Air Intake 112
Engine 114
EFIE 140
138
Oxygen Sensor 130
Micro Electric Sensor Controller 134
Exhaust System 115
Cooling System 106

Fig. 1


108
214
116
100
118
202
204
218
219
210
220
222
226
200
206
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228
208
106

Fig. 2

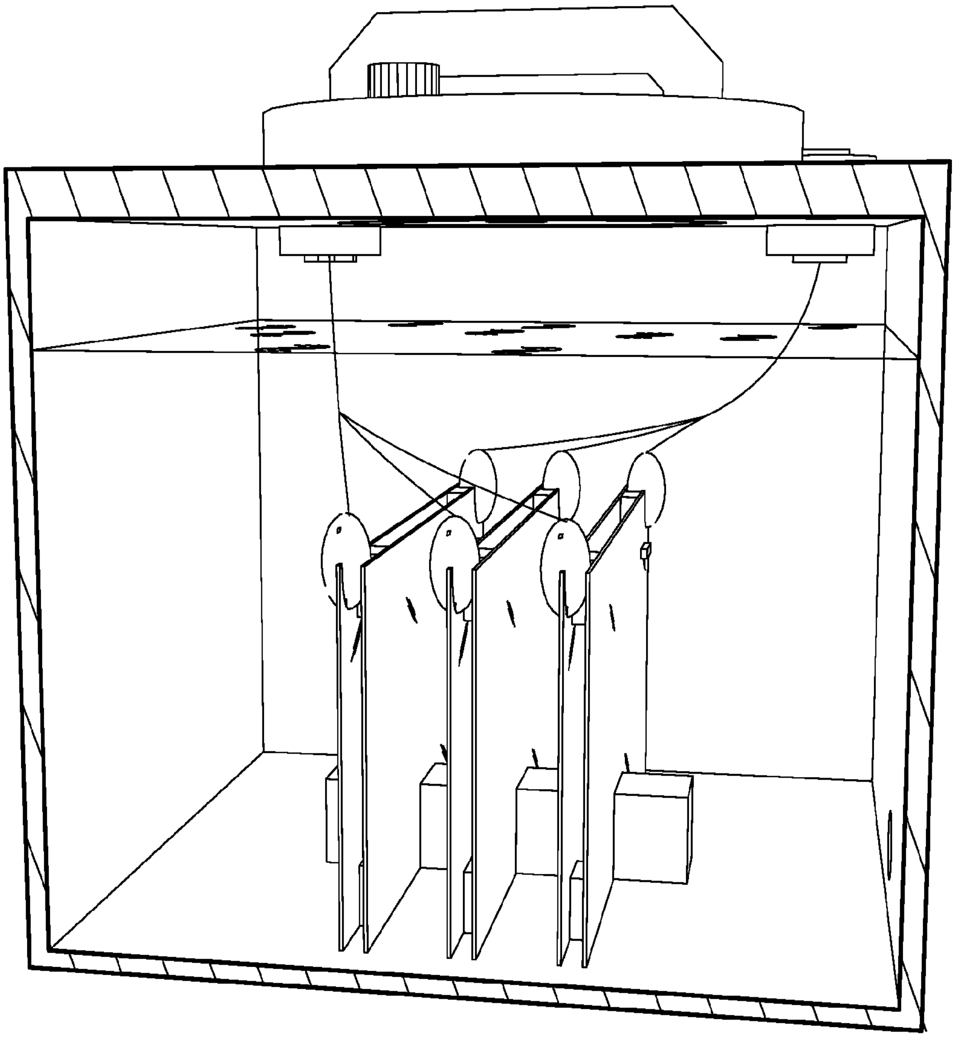

Fig. 3A

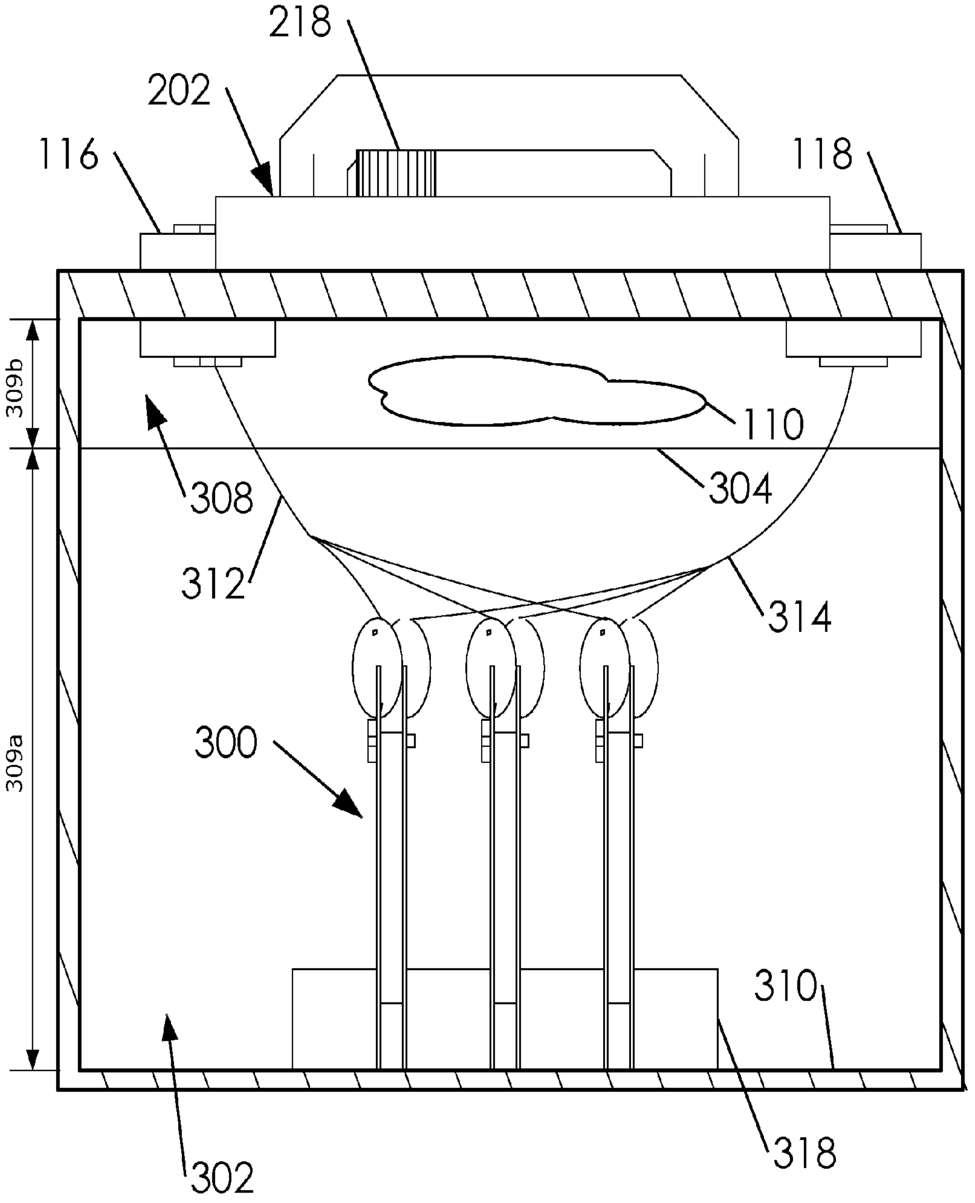

Fig. 3B

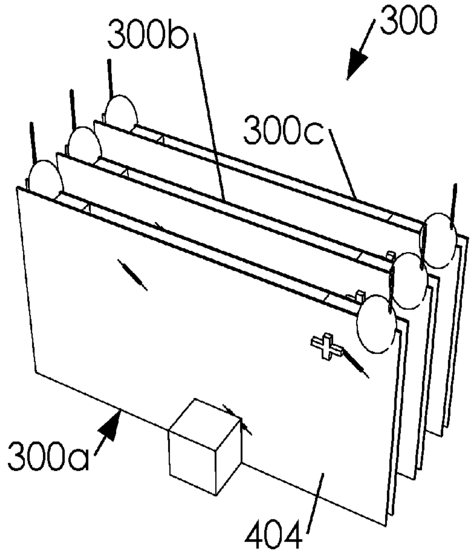

Fig. 4A

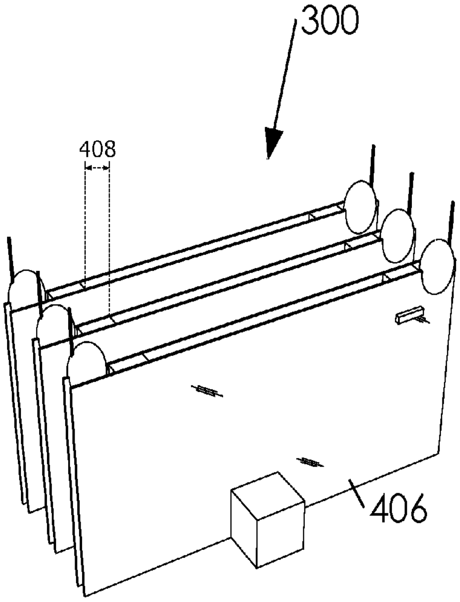

Fig. 4B

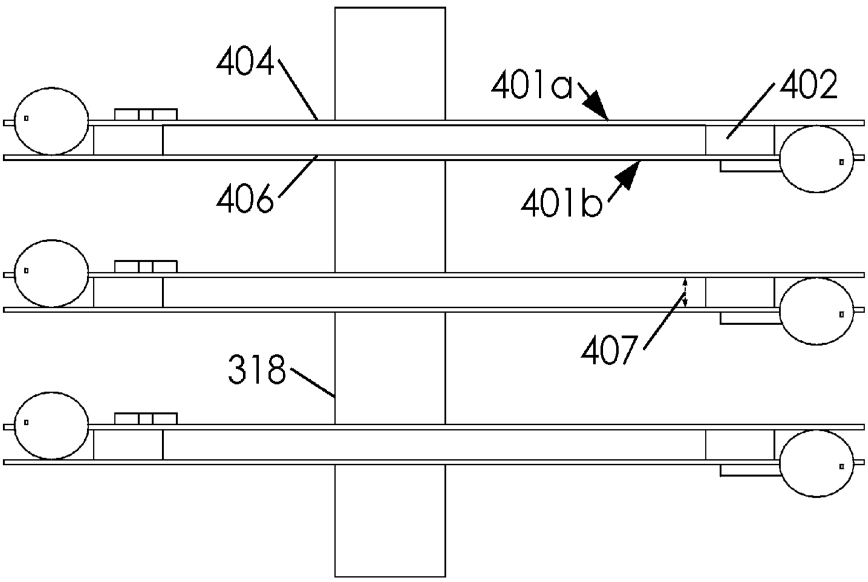

Fig. 4C

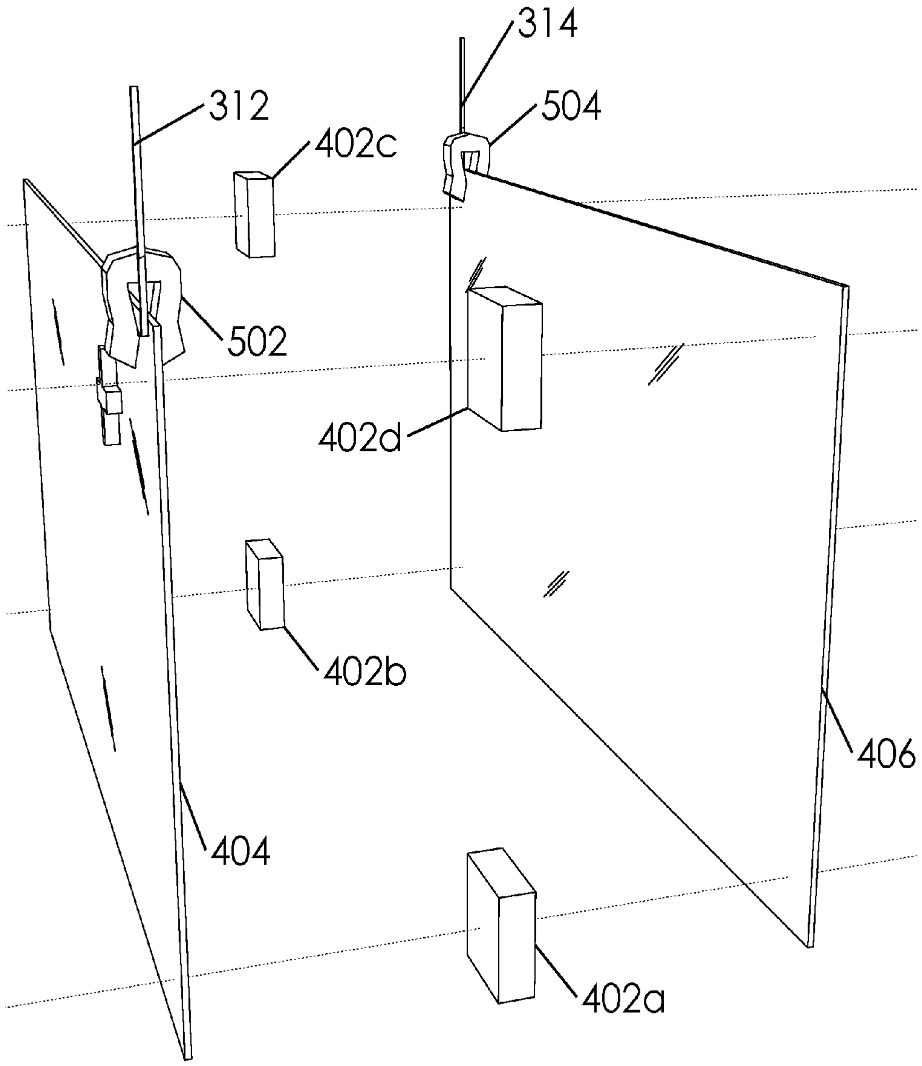

Fig. 5

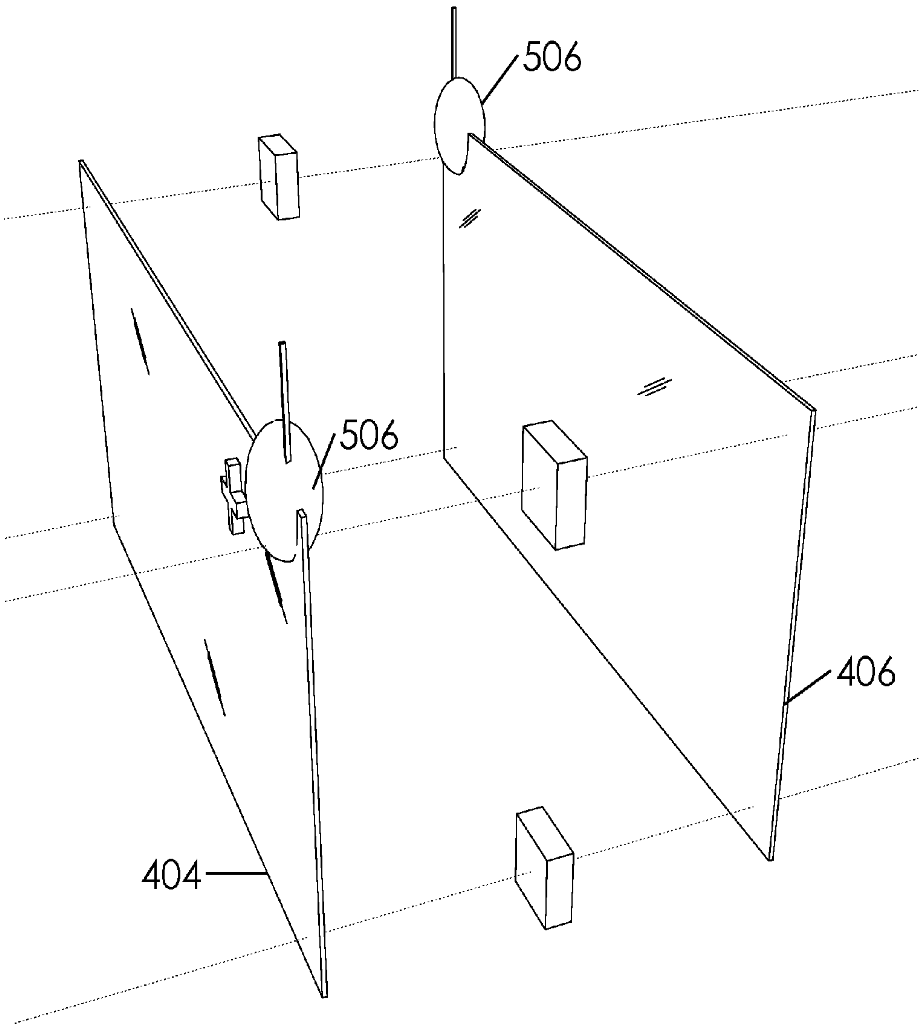

Fig. 5B

WATER ELECTROLYZER SYSTEM AND METHOD

[0001] Applicant hereby states that a basis for special status comprises greenhouse gas reduction as well as other "green technologies" as will be apparent upon reading this application. As is set out infra, Applicant has a working system and method for greenhouse gas reduction with a water electrolyzer by introducing oxyhydrogen into an engine. Accordingly the Applicant hereby petitions for acceptance into the Green Technology Pilot Program.

BACKGROUND

[0002] This disclosure relates generally to a water electrolyzer system and water electrolysis method for internal combustion engines. The term "electrolyzer" refers to an apparatus capable of decomposing a chemical compound by electrolysis. For purposes of this disclosure, said chemical compound undergoing electrolysis will be water. It is understood that generally available water (tap water, bottled water, distilled, or similar) is not strictly H_2O, but a compound comprising a variety of elements in addition to hydrogen and oxygen. Nonetheless, "water" is intended to refer to said generally available water which may or may not be strictly H_2O.

[0003] Water is the most abundant compound on the surface of the earth. The water molecule is comprised of two hydrogen atoms, one oxygen atom and other trace elements of both positive and negative charges. It is the trace elements that provide the capacity of water to be a conductor of electricity. The electrolysis process is frequently utilized for the generation of gases by a decomposition process where electrodes of opposite charge (comprising a negative charged electrode, or "cathode", and a positive charged electrode, or "anode") are immersed in an electrically conductive electrolyte with an electrical charge running between the electrodes. In one embodiment, opposite current charge causes the HHO molecule to change its structure where the positive charged hydrogen atom is off-gassed at the negative charged electrode and the negative charged oxygen atom is off-gassed at the positive charged electrode. In one embodiment, elements can recombine to comprise a monoatomic and/or a diatomic hydrogen and/or oxygen compound sometimes called oxyhydrogen (also known as "hydroxyl"). In one embodiment, oxyhydrogen can comprise a mixture of hydrogen (H_2) and oxygen (O_2) gases, typically in a 2:1 molar ratio. In one embodiment, a ratio of 4:1 or 5:1 hydrogen:oxygen is required to avoid an oxidizing flame.

[0004] Water electrolyzer systems for use in internal combustion engines and other industrial processes are well known. Early pioneers used electrolysis to separate and collect the gases for individual use. Mr. Raymond Henes and Mr. William Rhodes (U.S. Pat. No. 3,262,872) (hereafter "Henes") disclosed the use of a single duct feed system of a mixed atomic hydrogen and oxygen as a fuel source. Henes' fuel was used as a source for welding/torch applications, but demonstrated use of hydrolysis of water as an energy source.

[0005] Likewise, Mr. Yull Brown (U.S. Pat. No. 4,014,777) further explored the electrolysis process as claimed a new combine gas formed name Brown's gas. Only later was electrolysis of water explored as a fuel gas. For example, Mr. Stanley A. Meyer (U.S. Pat. Nos. 4,936,961 and 5,293,857), explored the use of pulsating and electric field to liberate the gases of hydrogen and oxygen from water to be collected as a fuel gas. Meyer refers to a fuel cell water capacitor. Further, Meyer concentrated on an electrical control device to adjust the frequency to facilitate the electrolysis process.

[0006] Naturally, safety of water hydrolysis should be a central concern. Among the prior disclosures, most assume the electrolyzer produces a mixed gas on a safe, reliable consistent process.

[0007] Mr. Bill Ross (U.S. Pat. No. 6,209,493) discloses a system using an electrolysis cell for generating one or more combustible gases from an electrolytic solution. Ross discusses many control devices, but does not disclose the main operating parameters of voltage and current (Amperage). Further, Ross fails to disclose the conductive strength of electrolyte and the effects of current draw from direct current sources. As typical of many prior disclosures, current systems have very little spare amperage capacity. Consequently, overuse of a direct current supply can cause severe electrical systems.

[0008] In one embodiment, it can be advantageous to control a power source coming into a water electrolyzer. Defining workable parameters on said power source is a goal of many prior art examples, but their approaches fall short.

[0009] Mr. Harvath (U.S. Pat. No. 3,954,592) discloses an electrical supply means to apply pulses of electrical energy between an anode and a cathode of one or more cells. Likewise, Mr. John R. Hallenbeck (U.S. Pat. No. 7,762,218) discloses a power source comprising an electrometric net energy radiator having a frequency between 620 Hertz and 100,000 Hertz. Neither Harvath nor Hallenbeck overcome shortcomings regarding materials and cooling issues associated with water electrolysis. As discussed infra.

[0010] Hallenbeck (see supra) discloses a cell with two electrodes, one made of nickel oxide-hydroxide and another formed from a metal selected from the group consisting of nickel, tin, iron, lead, and combinations thereof. Accordingly, cells comprising electrodes of differing materials have been disclosed in the prior art. Nonetheless, Hallenbeck falls short in practice.

[0011] First of all, Hallenbeck does not provide a means of preserving a cathode during water electrolysis. Use of differing materials for said two electrodes does not preserve a cell during electrolysis. Further provisions must be provided to protect said cells and to operate said water electrolyzer in a safe reliable manner, as will be disclosed and claimed infra.

[0012] A side product in many water electrolyzer embodiments is the production of steam. Dealing with this side effect is an important matter.

[0013] Mr. Chou (U.S. Pat. No. 6,740,436) discloses a water cooling system. However Chou's cooling system requires a source of ice water to function. This approach leaves much to be desired since ice water is cumbersome and difficult to keep replenished in a motor vehicle. Likewise, Mr. Webster (U.S. Pat. No. 4,344,831) discloses a cooling system but does not introduce a means for controlling said cooling system when an electrolyte reaches a heat threshold where a steam (or other side effect) will be produced. Mr. Klein (U.S. Pat. No. 6,866,756) discloses a heat sink means for removing an excess heat generated by the electrolyzer. Said heat sink means leaves much to be desired however. First, it does not respond to heat production within said electrolyzer to the point of cutting off functionality of said electrolyzer when heat gets out of control. Further, it does not sense when steam production conditions have been reached.

[0014] Mr. Huang (U.S. Pat. No. 7,921,831) discloses a heat dissipation unit and one or more filters for separating water vapor. Huang, however, only filters said water vapor it does not prevent it from being produced within said water electrolyzer. Accordingly, Huang allows said water electrolyzer to reach high temperatures without controlling said temperature of said water electrolyzer.

[0015] None of these cooling systems present the advantages disclosed in this application infra.

[0016] Construction and methods of use of one or more cells within a water electrolyzer is a critical matter. Much effort has been spent devising a perfect material combination for said water electrolyzers. Typical of many different water electrolyzers, Mr. Mosher (U.S. Pat. No. 4,023,545) discloses a water electrolyzer with electrode cells comprising an anode and a cathode. However, like many water electrolyzers, Mosher does not provide different materials for said anode and said cathode.

[0017] Cells comprising electrodes of different materials are know as well, but do not use advantageous material combinations. Hallenbeck (see supra) discloses a cell with two electrodes, one made of nickel oxide-hydroxide and another formed from a metal selected from the group consisting of nickel, tin, iron, lead, and combinations thereof. Mr. Kucherov (U.S. Pat. No. 5,632,870) discloses an anode and a cathode comprising different materials; wherein, said cathode comprises a material consisting of Ni, Fe, Pd, Pt and Ir. Hallenbeck and Kucherov, however, fall short in practice since neither provides a means of preserving a cathode during water electrolysis. In practice, these electrodes undergo rapid decay during electrolysis. Further provisions must be provided to protect said cells and to operate said water electrolyzer in a safe reliable manner, as will be disclosed and claimed infra

[0018] Prior disclosures fail to disclose a means of maintaining the integrity of an electrolyzer through a longer period of use. Further, they leave much to be desired in safely operating an electrolyzer in proximity to an internal combustion engine.

[0019] Prior disclosures, when put into practice, have many shortcomings which this disclosure seeks to address. Prior embodiments comprise an electrolysis process which can draw too much current (thereby eliminating efficiency gains), fail to address overheating issues (which can damage engines and electrolyzers alike), and can dissolve electrode materials and wiring (leading to a loss of operation requiring major maintenance).

[0020] Simply put: prior embodiments of water electrolyzers fail to safely and consistently provide fuel gas for internal combustion engines. Therefore, they fail to provide the benefit of reducing exhaust emissions of greenhouse gases and improving efficiency of internal combustion engines over long periods of operation. It is therefore desired to fulfill the promise of electrolysis of water with internal combustion engines.

[0021] None of the above inventions and patents, taken either singularly or in combination, is seen to describe the instant disclosure as claimed. Accordingly, an improved water electrolyzer system and water electrolysis method for internal combustion engines would be advantageous.

SUMMARY

[0022] Two water electrolyzer systems and a water electrolysis method for internal combustion engines are disclosed.

[0023] In one embodiment, said water electrolyzer comprises a casing, a reservoir of water, one or more electrode cells, a source of pulse width modulated direct current electricity, a positive terminal, a negative terminal, and a cooling system. Said casing holds said reservoir of water and said one or more cells. Said electrode cells are submerged in said reservoir of water. Said reservoir of water comprises an electrolyte. Said source of pulse width modulated direct current electricity comprises a positive current and a negative current. Said source of pulse width modulated direct current electricity attaches to said water electrolyzer by attaching said positive current to said positive terminal and said negative current to said negative terminal of said water electrolyzer. Said electrode cells each comprise a cathode and an anode. Said cathode comprises a positive charge. Said cathode comprises a titanium (Ti) metal plate comprising a ruthenium (Ru) coating. Said cathode and said anode are arranged parallel to one another with one or more spacers between them. Said one or more spacers are nonconductive. Said positive terminal of said water electrolyzer attaches to said cathodes of said electrode cells with one or more positive lines. Said negative terminal of said water electrolyzer attaches to said anodes of said electrode cells with one or more negative lines. Said cooling system is capable of cooling said reservoir of water. Said water electrolyzer produces one or more gases. Said water electrolyzer is in fluid connection with an engine. Said water electrolyzer is capable of delivering said gases to said engine, and an inlet and an outlet in said casing. A portion of said reservoir of water is capable of circulating through said cooling system. Said cooling system comprises a circulation pump, heat exchanger and a cooling fan.

[0024] In another embodiment, said water electrolyzer comprises a casing, a reservoir of water, one or more electrode cells, a source of pulse width modulated direct current electricity, a positive terminal, a negative terminal, and a cooling system. Said casing holds said reservoir of water and said one or more cells. Said electrode cells are submerged in said reservoir of water. Said source of pulse width modulated direct current electricity comprises a positive current and a negative current. Said source of pulse width modulated direct current electricity attaches to said water electrolyzer by attaching said positive current to said positive terminal and said negative current to said negative terminal of said water electrolyzer. Said electrode cells each comprise a cathode and an anode. Said cathode and said anode comprise different materials. Said positive terminal of said water electrolyzer attaches to said cathodes of said electrode cells with one or more positive lines. Said negative terminal of said water electrolyzer attaches to said anodes of said electrode cells with one or more negative lines. Said cooling system is capable of cooling said reservoir of water. Said water electrolyzer produces one or more gases. Said water electrolyzer is in fluid connection with an engine, and said water electrolyzer is capable of delivering said gases to said engine.

[0025] Said water electrolysis method comprises submerging one or more electrode cells in a reservoir of water within a water electrolyzer; applying a source of pulse width modulated direct current electricity to said electrode cells; generating one or more gases within said water electrolyzer; attaching said water electrolyzer to an engine with a fluid connection; feeding said gases from said water electrolyzer into said engine; and, regulating a temperature of said reservoir of water with a cooling system. Said water electrolyzer comprises a casing. Said casing comprises an airtight vessel.

Said water electrolyzer comprises a positive terminal and a negative terminal. Said reservoir of water comprises an electrolyte. Said source of pulse width modulated direct current electricity comprises a positive current and a negative current. Said source of pulse width modulated direct current electricity attaches to said water electrolyzer by attaching said positive current to said positive terminal and said negative current to said negative terminal of said water electrolyzer. Said electrode cells each comprise a cathode and an anode. Said positive terminal of said water electrolyzer attaches to said cathodes of said electrode cells with one or more positive lines. Said negative terminal of said water electrolyzer attaches to said anodes of said electrode cells with one or more negative lines. Said cathode and said anode comprise different materials. Said cathode and said anode are held apart by one or more spacers. Said spacers comprise a nonconductive material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] FIG. **1** illustrates a flow diagram of a water electrolyzer system and water electrolysis method for internal combustion engines.

[0027] FIG. **2** illustrates a perspective front overview of water electrolyzer with cooling system.

[0028] FIGS. **3**A and **3**B illustrate a perspective side cross-section view and an elevated side cross-section view of water electrolyzer showing interior portion and one or more electrode cells.

[0029] FIGS. **4**A, **4**B and **4**C illustrate a perspective front view, perspective rear view and elevated top view of electrode cells.

[0030] FIG. **5**A illustrates a perspective exploded side view of one of electrode cells.

[0031] FIG. **5**B illustrates a perspective exploded side view of one of electrode cells with an epoxy coating on first clip and second clip.

DETAILED DESCRIPTION OF THE DRAWINGS

[0032] Described herein is a water electrolyzer system and water electrolysis method for internal combustion engines. The following description is presented to enable any person skilled in the art to make and use the invention as claimed and is provided in the context of the particular examples discussed below, variations of which will be readily apparent to those skilled in the art. In the interest of clarity, not all features of an actual implementation are described in this specification. It will be appreciated that in the development of any such actual implementation (as in any development project), design decisions must be made to achieve the designers' specific goals (e.g., compliance with system- and business-related constraints), and that these goals will vary from one implementation to another. It will also be appreciated that such development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill in the field of the appropriate art having the benefit of this disclosure. Accordingly, the claims appended hereto are not intended to be limited by the disclosed embodiments, but are to be accorded their widest scope consistent with the principles and features disclosed herein.

[0033] FIG. **1** illustrates a flow diagram of a water electrolyzer system and water electrolysis method for internal combustion engines. In one embodiment, said water electrolyzer system and water electrolysis method for internal combustion engines can comprise a water electrolyzer **100**, a battery **102**, a PWM **104**, a cooling system **106** and a feed line **108**. In one embodiment, water electrolyzer **100** can be capable of decomposing a chemical compound by electrolysis. In one embodiment, said chemical compound undergoing electrolysis will be water. In one embodiment, said water can comprise tap water, bottled water, distilled, deionized water, or similar. The term "water" is not strictly H_2O, but a compound comprising a variety of elements in addition to hydrogen and oxygen. For example, in one embodiment, water molecules can comprise two hydrogen atoms, one oxygen atom and other trace elements of both positive and negative charges.

[0034] In one embodiment, water electrolyzer **100** can produce one or more gases **110** (not illustrated here). In one embodiment, gases **110** can comprise hydrogen (H_2) and oxygen (O_2). In one embodiment, gases **110** can be sent through feed line **108** into an air intake system **112** of an engine **114**. In one embodiment, engine **114** can comprise an internal combustion engine (or "ICE"). In one embodiment, engine **114** can comprise a gas engine, a diesel engine, or similar. In one embodiment, engine **114** can comprise an exhaust system **115** capable of releasing exhaust from engine **114** as is common in the art.

[0035] In one embodiment, water electrolyzer **100** can comprise a positive terminal **116** and a negative terminal **118**. In one embodiment, positive terminal **116** and negative terminal **118** are capable of receiving a wire carrying a corresponding charge, as is well-known in the art. In one embodiment, a positive current **117** can be attached to positive terminal **116** and a negative current **119** can be attached to negative terminal **118**. In one embodiment, PWM **104** can provide positive current **117** and negative current **119** to water electrolyzer **100**. In one embodiment, PWM **104** can comprise a source of pulse width modulated direct current electricity. In one embodiment, PWM **104** is capable of altering a frequency and a pulse width modulation of a current in order to keep an average current at a set point independent of a supply voltage

[0036] In one embodiment, water electrolyzer **100** can comprise a sensor **120** and a controller **122**. In one embodiment, sensor **120** is capable of measuring an internal temperature of water electrolyzer **100** and reporting said internal measurement to controller **122**. In one embodiment, controller **122** can send an off signal when said internal measurement reaches a threshold temperature. In one embodiment, said "off signal" from controller **122** can cause current from battery **102** to stop flowing toward water electrolyzer **100**. In one embodiment, controller **122** can engage cooling system **106** to further regulate said internal temperature of said water electrolyzer **100**.

[0037] In one embodiment, water electrolyzer **100** can receive a source of direct current. In one embodiment, said source of direct current can comprise a power output from an alternator. In one embodiment, said alternator can be attached to an engine or generator. In another embodiment, said source of direct current can comprise battery **102**. In one embodiment, water electrolyzer **100** can receive a pulsed direct circuit from battery **102**. In one embodiment, said pulsed direct circuit can pass through a relay switch **124**. In one embodiment, relay switch **124** can control said pulsed direct circuit and thereby trigger an on-off operation of water electrolyzer **100**. In one embodiment, said pulsed direct circuit can be protected by a fuse **126**. In one embodiment, fuse **126** can prevent an over leap of electric current and thereby prevent damage to PWM **104**. In one embodiment, PWM **104** can comprise an advanced (brand) pulse width modulator unit. In one embodiment, fuse **126** can comprise a 15 amperage fuse. In one embodiment, water electrolyzer **100** can operate on 5-15 amps.

[0038] In one embodiment, PWM **104** can comprise a "Pulse Width Modulator". In one embodiment, PWM **104** can comprise an electronic device between battery **102** and water electrolyzer **100** capable of providing a pulse width modulated direct current electricity. In one embodiment, said pulse width modulated direct current electricity can comprise a current comprising constant pulse width. In one embodiment, battery **102** and PWM **104** can provide a source of pulse width modulated direct current electricity.

[0039] In one embodiment, battery **102** can comprise a positive terminal **103***a* and a negative terminal **103***b*. In one embodiment, PWM **104** can comprise a positive input terminal **105***a*, a negative input terminal **105***b*, a positive output terminal **105***c*, and a negative output terminal **105***d*. In one embodiment, negative terminal **103***b* of battery **102** can be attached to negative input terminal **105***b* of PWM **104**. In one embodiment, positive terminal **103***a* can be attached to positive input terminal **105***a*. The PWM **104** receives a positive and negative charged direct current from battery **102**. In one embodiment, battery **102** can comprise a **12** volt source. In one embodiment, PWM **104** can alter a frequency and a pulse width in said pulsed direct circuit. In one embodiment, PWM **104** can keep an average current at a set point, independent of the supply voltage or load. Internal components of PWM **104** can include resistors, capacitors, transistors and other components. In one embodiment, said frequency is set between 50 Hertz to 80 Hertz. In one embodiment, said pulsed direct circuit is conducted by wire to water electrolyzer **100**. In one embodiment, positive output terminal **105***c* of PWM **104** can attach to positive terminal **116**.

[0040] In one embodiment, negative output terminal **105***d* can attach to negative terminal **118**. In one embodiment, said pulsed direct circuit can comprise battery **102** connected to PWM **104**, and PWM **104** connected to water electrolyzer **100**.

[0041] In one embodiment, water electrolyzer **100** can produce gases **110**. In one embodiment, gases **110** are fed through feed line **108** to air intake system **112** of engine **114**. In one embodiment, gases **110** can comprise a mixture of hydrogen, oxygen and other elements. In one embodiment, gases **110** can comprise oxyhydrogen (also known as "hydroxyl"), as discussed supra.

[0042] In many embodiments, modern internal combustion engines have a fuel management system controlled by many sensors that relay information to an engine computer. Said fuel management systems can control operational parameters, such as an air-to-fuel ratio, of engine **114**. Said fuel management systems can comprise a mass air flow sensor **128** and an oxygen sensor **130**. In one embodiment, mass air flow sensor **128** is connected to a micro electric device **132**. In one embodiment, oxygen sensor **130** is connected to a micro electric device **132**. In one embodiment, items **128-134** can be connected to an engine computer unit **136**, as discussed infra.

[0043] In one embodiment, said air-to-fuel ratio can comprise a mass ratio of air and fuel present in engine **114**. In one embodiment, said air-to-fuel ratio can comprise a stoichemical mixture of 14.7 to 1. In one embodiment, engine **114** can control a volume of air coming into air intake **112**. The term "air" refers to the mixture of gases that surround engine **114**. Generally, air can comprise 79% Nitrogen and 21% Oxygen. Traditionally, air is provided to engine **114** through air intake **112**, and engine **114** burns hydrocarbon fuel within air.

[0044] In one embodiment, engine **114** can regulate said stoichemical mixture in order to balance for optimum efficiencies and performance. For example, in one embodiment, micro electric device **132** can monitor mass air flow sensor **128** to ensure a proper amount of air is provided to air intake **112** to ensure engine **114** has said stoichemical mixture. In one embodiment, said stoichemical mixture is the working point that modern management systems use to control fuel usage. For example, in one embodiment, Otto cycle engines (spark plug non diesel) can comprise said stoichemical mixture of air-to-fuel ratio is 14.7 to 1. In one embodiment, a mixture less than 14.7 to 1 comprises a "rich mixture" and a mixture greater than 14.7 to 1 comprises a "lean mixture."

[0045] In one embodiment, adding said gases **110** into air intake system **112**, greater efficiencies of combustion can be achieved by engine **114**. In one embodiment, adding gases **110** (such as oxyhydrogen) to air intake **112** said stoichemical mixture can be altered. In one embodiment, adding gases **110** to air intake **112** can increase said air-to-fuel ratio and thereby create said lean mixture. When the gas mixture is added to an air intake system of an internal combustion engine, a combustion efficiency can be increased resulting in reduced usage of hydrocarbon fuel and reduced exhaust emissions of greenhouse gases.

[0046] Changing said stoichemical mixture can cause issues within many embodiments of engine **114**. In many embodiments, engine **114** can comprise an engine computer unit **136** comprising a data connection with micro electric device **132** and/or micro electric sensor controller **134**. In one embodiment, engine computer unit **136** can control said stoichemical mixture by monitoring mass air flow sensor **128** and/or oxygen sensor **130** and altering a volume of air coming into air intake **112**. In one embodiment, oxygen sensor **130** can measure an amount of oxygen (and other chemicals) present in exhaust system **115**. In one embodiment, oxygen sensor **130** can produce a signal **138** between 0.0-1.0 volts representing a range of oxygen output readings. In one embodiment, where said stoichemical mixture is optimum, oxygen sensor **130** can produce signal **138** of 500 millivolts. In one embodiment, where signal **138** falls below 500 millivolts, said stoichemical mixture can be interpreted as being said lean mixture. Likewise, in one embodiment, where signal **138** reads above 500 millivolts, said stoichemical mixture can be interpreted as being said rich mixture. In one embodiment, where oxygen sensor **130** reads as said lean mixture, engine computer unit **136** can be programed to react by increasing a fuel injection process within said engine **114** in order to said stoichemical mixture. In so doing, an increase in said fuel injection process can cause engine **114** to use more fuel (such as gasoline and/or diesel) and thereby drop in efficiency. A problem arises, therefore, where introducing gases **110** into engine **114** can causes oxygen sensor **130** to read said lean mixture.

[0047] In one embodiment, said water electrolyzer system and water electrolysis method for internal combustion engines can comprise modifying one or more signals from oxygen sensor **130** and/or mass air flow sensor **128** to indicate a balanced stoichemical mixture in exhaust system **115** when an original signal indicates a lean mixture. That is, in one embodiment, said water electrolyzer system and water electrolysis method for internal combustion engines can comprise ensuring that said engine **114** does not run inefficiently when gases **110** are added into air intake **112**. Accordingly, in one embodiment, signal **138** from oxygen sensor **130** can be modified by installing an electronic fuel injection enhancer **140** between oxygen sensor **130** and engine computer unit **136**. In one embodiment, electronic fuel injection enhancer **140** can comprise a digital device capable of modifying said signal **138** such that engine computer unit **136** does not alter said fuel injection process. For example, in one embodiment, electronic fuel injection enhancer **140** can reduce signal **138** from **500** millivolts to **350** millivolts. In one embodiment, reducing signal **138** can cause engine **114** to run in said lean mixture which can accommodate the introduction of gases **110** (such as oxyhydrogen) into engine **114**.

[0048] FIG. **2** illustrates a perspective front overview of water electrolyzer **100** with cooling system **106**. In one embodiment, water electrolyzer **100** can comprise a nonconductive material.

[0049] In one embodiment, said nonconductive material can comprise seamless polyethylene construction. In one embodiment, water electrolyzer **100** can comprise a casing **200** and a hand hole cover **202**. In one embodiment, casing **200** can comprise an air sealed housing releaseably sealed with hand hole cover **202**. Water electrolyzer **100** can comprise a top **204**, a side portion **206** and a bottom **208**.

[0050] In one embodiment, hand hole cover **202** can comprise a removable gasket capable of attaching to an aperture **210** in top **204** of water electrolyzer **100**. In one embodiment, hand hole cover **202** can be removed from water electrolyzer **100** to expose an interior portion **212** (illustrated infra) of water electrolyzer **100**. In one embodiment, interior portion **212** can be accessed through aperture **210** when hand hole cover **202** is removed. In one embodiment, hand hole cover **202** can comprise a handle **214**. In one embodiment, hand hole cover **202** can attach to casing **200** by a threading by screwing hand hole cover **202** into casing **200** or by tension by wedging hand hole cover **202** into casing **200**.

[0051] In one embodiment, hand hole cover **202** can comprise a cap assembly **218**. In one embodiment, cap assembly **218** can be in fluid connection with interior portion **212** of water electrolyzer **100**. In one embodiment, cap assembly **218** can comprise a cap **219**. In one embodiment, cap **219** can close cap assembly **218** and thereby keep said fluid connection with interior portion **212** closed. In one embodiment, hand hole cover **202** can comprise an outlet fitting **220**. In one embodiment, outlet fitting **220** can be in fluid connection with interior portion **212** of gases **110**. In one embodiment, feed line **108** can connect to outlet fitting **220**. In one embodiment, water electrolyzer **100**, air intake system **112** and engine **114** can be in fluid connection through outlet fitting **220** and feed line **108**.

[0052] In one embodiment, water electrolyzer **100** can comprise a first fitting **222** and a second fitting **224**. In one embodiment, cooling system **106** can comprise a first tubing **226** and a second tubing **228**. In one embodiment, second fitting **224** can be in said side portion **206** near bottom **208** of water electrolyzer **100**. In one embodiment, first fitting **222** can be in top **204** of water electrolyzer **100**. In one embodiment, first tubing **226** can attach to first fitting **222**. In one embodiment, second tubing **228** can attach to second fitting **224**. In one embodiment, cooling system **106** can comprise a closed loop system capable of circulating a portion of reservoir of water **302** from within interior portion **212** through cooling system **106** and back into interior portion **212**. In one embodiment, water can pass through second fitting **224**, through second tubing **228**, through cooling system **106**, through first tubing **226** and into first fitting **222**. In one embodiment, a domed liquid level sight (not illustrated) and sensor **120** can be provided for maintenance of water electrolyzer **100**.

[0053] FIGS. **3**A and **3**B illustrate a perspective side cross-section view and an elevated side cross-section view of water electrolyzer **100** showing interior portion **212** and one or more electrode cells **300**. In one embodiment, electrode cells **300** can be installed within a reservoir of water **302** within water electrolyzer **100**. In one embodiment, reservoir of water **302** can comprise a water surface **304**. In one embodiment, reservoir of water **302** can comprise an electrolyte **306**. In one embodiment, interior portion **212** can comprise a headspace **308** above water surface **304**. In one embodiment, gases **110** can collect in headspace **308**. In one embodiment, reservoir of water **302** can comprise a height **309***a* and headspace **308** can comprise a height **309***b*. In one embodiment, height **309***a* can comprise 80% of interior portion **212**.

[0054] In one embodiment, an amount of hydrogen and oxygen gas produced by water electrolyzer **100** can be proportionally correlated to the capacitance of electrolyte **306**. In one embodiment, electrolyte **306** can comprise a distilled water. In one embodiment, distilled water comprises a proper material selection for electrolyte **306** since distilled water can be capable of controlling an electrical current.

[0055] In one embodiment, hand hole cover **202** can be removed from water electrolyzer **100** to access electrode cells **300**. In one embodiment, electrode cells **300** can be installed by removing hand hole cover **202**, inserting electrode cells **300** through aperture **210** and into water electrolyzer **100**, attaching electrode cells **300** to a bottom portion **310** of interior portion **212** of water electrolyzer **100**.

[0056] In one embodiment, cap assembly **218** can be opened to remove or add water to reservoir of water **302**, electrolyte **306**, gases **110** or other materials as necessary. In one embodiment, gases **110** can travel through outlet fitting **220** and feed line **108** to air intake system **112**, as discussed supra.

[0057] In one embodiment, a byproduct of the electrolysis process can comprise an excessive increase of temperature within water electrolyzer **100**. In one embodiment, said water electrolyzer system and water electrolysis method for internal combustion engines can require said temperature of reservoir of water **302** to remain within a temperature control range between 42-150 degrees Fahrenheit. In one embodiment, cooling system **106** can be used to maintain said temperature control range by circulating a portion of reservoir of water **302** through cooling system **106**. In one embodiment, cooling system **106** can comprise a recirculation pump, radiator, and cooling fan. In one embodiment, an additional reservoir can be used for descaling solution for cleaning said electrode cells **300**. In one embodiment, cooling system **106** can communicate with sensor **120** and controller **122** to regulate said temperature control range by reporting a temperature reading from within water electrolyzer **100** to cooling system **106** and engaging cooling system **106** to regulate said temperature control range. In one embodiment, controller **122** can shut of relay switch **124** if temperature exceeds said temperature control range.

[0058] In one embodiment, water electrolyzer **100** can comprise one or more lines **311** comprising one or more positive lines **312** and one or more negative lines **314**. In one embodiment, positive lines **312** can connect positive terminal **116** to a portion of electrode cells **300**, and negative lines **314** can connect negative terminal **118** to a portion of electrode cells **300**, as discussed infra. In one embodiment, positive lines **312** and negative lines **314** can connect to cell **300** in series or in parallel configurations. In one embodiment, positive lines **312** and negative lines **314** can comprise a stranded copper wire. In one embodiment, positive lines **312** and negative lines **314** can comprise a **12** gauge wire.

[0059] In one embodiment, positive terminal **116** and negative terminal **118** can each comprise a portion which extends outside of water electrolyzer **100** and a portion which extends into said interior portion **212** of water electrolyzer **100**. In one embodiment, positive current **117** and negative current **119** can each connect to said portion which extends outside of water electrolyzer **100** of positive terminal **116** and negative terminal **118**, respectively. In one embodiment, positive lines **312** and negative lines **314** can each connect to said portion which extends into said interior portion **212** of water electrolyzer **100** of positive terminal **116** and negative terminal **118**, respectively.

[0060] In one embodiment, water electrolyzer **100** is capable of regulating a water temperature of reservoir of water **302**. In one embodiment, where said water temperature gets too hot, water electrolyzer **100** can produce a steam. In one embodiment, said steam is not a preferred byproduct of water electrolyzer **100**. In one embodiment, controller **122** can engage said cooling system **106** to cool said reservoir of water **302**. In one embodiment, controller **122** can engage cooling system **106** when sensor **120** measures said water temperature above a threshold level.

[0061] In one embodiment, electrode cells **300** can be separated by one or more blocks **318**. In one embodiment, blocks **318** can comprise a nonconductive material (such as nylon). In one embodiment, blocks **318** can support electrode cells **300**.

[0062] FIGS. **4**A, **4**B and **4**C illustrate a perspective front view, perspective rear view and elevated top view of electrode cells **300**. As shown in FIGS. **3**A-**4**C, electrode cells **300** can comprise three electrode cells; however, electrode cells **300** there is no theoretical limit to the number of electrode cells **300** that can be used within water electrolyzer **100**. For purposes of this disclosure, three are used to illustrate use and functionality of water electrolyzer **100**. In one embodiment, electrode cells **300** can comprise a first electrode cell **300***a*, a second electrode cell **300***b* and a third electrode cell **300***c*. Each of electrode cells **300** can comprise a front portion **401***a* and a back portion **401***b*. In one embodiment, each of electrode cells **300** can comprise one or more spacers **402**, a first plate **404** and a second plate **406**. In one embodiment, first plate **404** and second plate **406** can be attached on opposing sides of spacer **402**. In one embodiment, first plate **404** and second plate **406** can be parallel to one another. In one embodiment, spacers **402** can comprise a non-conductive material. In one embodiment, spacers **402** can comprise a thickness **407**. In one embodiment, thickness **407** can comprise an eighth of an inch (⅛"). In one embodiment, thickness **407** can comprise a sixteenth of an inch (1/16"). In one embodiment, as thickness **407** in increased, a larger amount of current is necessary for cell **300** to function. However, in one embodiment, as thickness **407** is decreased said electrodes of cell **300** are more likely to touch and thereby short cell **300**. Thus, in one embodiment, thickness **407** can be large enough to facilitate a minimal amount of current without said electrodes touching.

[0063] In one embodiment, a plurality of cells **300** can be arranged in with a spacing **408** between them. In one embodiment, spacing **408** can comprise one inch (1").

[0064] FIG. **5**A illustrates a perspective exploded side view of one of electrode cells **300**. Spacers **402** can comprise a spacer **402***a*, a spacer **402***b*, a spacer **402***c* and a spacer **402***d*. In one embodiment, spacers **402** can be arranged around one or more corner portions of electrode cells **300**. In one embodiment, spacers **402** can comprise a plurality of spacers **402** capable of holding first plate **404** and second plate **406** apart. In one embodiment, first plate **404** and second plate **406** can attach to spacers **402** with an adhesive. In another embodiment, first plate **404** and second plate **406** can be held together and around spacer **402** by wrapping a nonconductive strap around electrode cells **300**. In one embodiment, positive lines **312** can attach to first plate **404** by clipping a portion of positive lines **312** to first plate **404** with a first clip **502**. Likewise, in one embodiment, negative lines **314** can attach to second plate **406** by clipping a portion of negative lines **314** to second plate **406** with a second clip **504**. In one embodiment, first clip **502** can comprise a material similar to first plate **404**. Likewise, in one embodiment, second clip **504** can comprise a material similar to second plate **406**.

[0065] FIG. **5**B illustrates a perspective exploded side view of one of electrode cells **300** with an epoxy coating **506** on first clip **502** and second clip **504**. In one embodiment, epoxy coating **506** can comprise a sealant. In one embodiment, epoxy coating **506** can comprise a material capable of preventing electric current contact with electrolyte **306**. In one embodiment, a first portion of epoxy coating **506** coats a portion of positive lines **312** at first plate **404**. In one embodiment, a second portion of epoxy coating **506** coats a portion of negative lines **314** at second plate **406**.

[0066] In one embodiment, first clip **502** and second clip **504** can each be covered with epoxy coating **506** to prevent current from flowing through first clip **502** or second clip **504** between first plate **404** and second plate **406**. In one embodiment, epoxy coating **506** can comprise a waterproof epoxy sealant. In one embodiment, said waterproof epoxy sealant can prevent an electrical contact with reservoir of water **302** or electrolyte **306**.

[0067] In one embodiment, first plate **404** can comprise a positive charge. In one embodiment, first plate **404** can comprise a cathode. In one embodiment, second plate **406** can comprise a negative charge. In one embodiment, second plate **406** can comprise an anode. In one embodiment, first plate **404** can comprise a metal plate. In one embodiment, first plate **404** said metal plate can comprise titanium (Ti). In one embodiment, first plate **404** said metal plate can comprise a material chosen from the refractory group consisting of Ti, V, Cr, Zr, Nb, Mo, Hf and Ta and combinations thereof. In one embodiment, said metal plate can comprise a coating. In one embodiment, said coating can comprise a ruthenium (Ru) material. In one embodiment, said coating can comprise a material from the group consisting of Ru, Rh, Pd, Os, Lr, Pi, Ag, Au and combinations thereof. In one embodiment, said coating can comprise a noble metal. In one embodiment, second plate **406** can comprise a plate consisting of either graphite material or stainless steel. In one embodiment, first plate **404** and second plate **406** can be arranged in parallel with said spacers **402** between one another.

[0068] Various changes in the details of the illustrated operational methods are possible without departing from the scope of the following claims. Some embodiments may combine the activities described herein as being separate steps. Similarly, one or more of the described steps may be omitted, depending upon the specific operational environment the method is being implemented in. It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments may be used in combination with each other. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein."

1. A water electrolyzer comprising:
a casing, a reservoir of water, one or more electrode cells, a source of pulse width modulated direct current electricity, a positive terminal, a negative terminal, and a cooling system; wherein,
said casing holds said reservoir of water and said one or more cells,
said electrode cells are submerged in said reservoir of water,
said reservoir of water comprises an electrolyte,
said source of pulse width modulated direct current electricity comprises a positive current and a negative current,
said source of pulse width modulated direct current electricity attaches to said water electrolyzer by attaching said positive current to said positive terminal and said negative current to said negative terminal of said water electrolyzer,
said electrode cells each comprise a cathode and an anode,
said cathode comprises a positive charge,
said cathode comprises a titanium (Ti) metal plate comprising a ruthenium (Ru) coating,
said cathode and said anode are arranged parallel to one another with one or more spacers between them,
said one or more spacers are nonconductive,
said positive terminal of said water electrolyzer attaches to said cathodes of said electrode cells with one or more positive lines,
said negative terminal of said water electrolyzer attaches to said anodes of said electrode cells with one or more negative lines,
said cooling system is capable of cooling said reservoir of water,
said water electrolyzer produces one or more gases,
said water electrolyzer is in fluid connection with an engine,
said water electrolyzer is capable of delivering said gases to said engine, and
an inlet and an outlet in said casing; further wherein,
a portion of said reservoir of water is capable of circulating through said cooling system; and,
said cooling system comprises a circulation pump, heat exchanger and a cooling fan.

2. A water electrolyzer comprising:
a casing, a reservoir of water, one or more electrode cells, a source of pulse width modulated direct current electricity, a positive terminal, a negative terminal, and a cooling system; wherein,
said casing holds said reservoir of water and said one or more cells,
said electrode cells are submerged in said reservoir of water,
said source of pulse width modulated direct current electricity comprises a positive current and a negative current,
said source of pulse width modulated direct current electricity attaches to said water electrolyzer by attaching said positive current to said positive terminal and said negative current to said negative terminal of said water electrolyzer,
said electrode cells each comprise a cathode and an anode,
said cathode and said anode comprise different materials,
said positive terminal of said water electrolyzer attaches to said cathodes of said electrode cells with one or more positive lines,
said negative terminal of said water electrolyzer attaches to said anodes of said electrode cells with one or more negative lines,
said cooling system is capable of cooling said reservoir of water,
said water electrolyzer produces one or more gases,
said water electrolyzer is in fluid connection with an engine, and
said water electrolyzer is capable of delivering said gases to said engine.

3. The water electrolyzer of claim **2** wherein
said source of pulse width modulated direct current electricity comprises a positive output terminal and negative output terminal of a pulse width modulator; wherein
said pulse width modulator is attached to a source of direct current.

4. The water electrolyzer of claim **3** wherein said source of direct current can comprise a battery.

5. The water electrolyzer of claim **2** wherein
said water electrolyzer comprises a casing and
said casing comprises a nonconductive airtight vessel.

6. The water electrolyzer of claim **2** further comprising an inlet and an outlet in said casing; wherein,
a portion of said reservoir of water is capable of circulating through said cooling system; and,
said cooling system comprises a circulation pump, heat exchanger and a cooling fan.

7. The water electrolyzer of claim **2** further comprising a sensor and a controller; wherein,
said sensor is capable of
measuring an internal temperature of said water electrolyzer and
reporting said internal temperature to said controller; and
said controller is capable of
comparing said internal temperature to a temperature control range and
cutting off said source of direct current electricity from said water electrolyzer if said internal temperature is outside of said temperature control range.

8. The water electrolyzer of claim **2** wherein
said cathode comprises a metal plate having a positive charge, and
said cathode comprises titanium (Ti) material.

9. The water electrolyzer of claim **8** wherein
said metal plate comprises a coating and
said coating comprises a ruthenium (Ru) material.

10. The water electrolyzer of claim **2** wherein
said cathode comprises a metal plate having a positive charge;
said metal plate comprises a material chosen from a refractory group consisting of Ti, V, Cr, Zr, Nb, Mo, Hf and Ta and combinations thereof; and
said metal plate comprises a coating comprising a material from a group consisting of Ru, Rh, Pd, Os, Lr, Pi, Ag, Au and combinations thereof

11. The water electrolyzer of claim **2** wherein said anode comprises a plate comprising a material chosen from a group consisting of graphite and stainless steel.

12. The water electrolyzer of claim **2** further comprising a sealant; wherein,
said sealant is capable of preventing electric current contact with electrolyte;
a first portion of said sealant coats said positive lines at said positive terminal of said electrode cells; and
a second portion of said sealant coats said negative lines at said negative terminal said electrode cells.

13. The water electrolyzer of claim **12** wherein said sealant comprises an epoxy coating.

14. The water electrolyzer of claim **2** further comprising one or more spacers; wherein,
said cathode and said anode are arranged parallel to one another with said spacers between them, and
said spacers are nonconductive.

15. The water electrolyzer of claim **2** wherein said electrode cells comprise one or more cells arranged parallel to one another and within said water electrolyzer.

16. The water electrolyzer of claim **2** wherein said reservoir of water comprises an electrolyte.

17. The water electrolyzer of claim **16** wherein said electrolyte comprises a distilled water.

18. A water electrolysis method comprising:
submerging one or more electrode cells in a reservoir of water within a water electrolyzer;
applying a source of pulse width modulated direct current electricity to said electrode cells;
generating one or more gases within said water electrolyzer;
attaching said water electrolyzer to an engine with a fluid connection;
feeding said gases from said water electrolyzer into said engine; and, regulating a temperature of said reservoir of water with a cooling system; wherein,
said water electrolyzer comprises a casing,
said casing comprises an airtight vessel,
said water electrolyzer comprises a positive terminal and a negative terminal,
said reservoir of water comprises an electrolyte,
said source of pulse width modulated direct current electricity comprises a positive current and a negative current,
said source of pulse width modulated direct current electricity attaches to said water electrolyzer by attaching said positive current to said positive terminal and said negative current to said negative terminal of said water electrolyzer,
said electrode cells each comprise a cathode and an anode,
said positive terminal of said water electrolyzer attaches to said cathodes of said electrode cells with one or more positive lines,
said negative terminal of said water electrolyzer attaches to said anodes of said electrode cells with one or more negative lines,
said cathode and said anode comprise different materials,
said cathode and said anode are held apart by one or more spacers, and
said spacers comprise a nonconductive material.

19. The water electrolysis method of claim **18** wherein
said source of pulse width modulated direct current electricity comprises a positive output terminal and negative output terminal of a pulse width modulator and
said pulse width modulator is attached to a source of direct current.

20. The water electrolysis method of claim **18** further comprising:
modifying one or more signals from an oxygen sensor of said engine to indicate a balanced stoichemical mixture in an exhaust system of said engine when an original signal indicates a lean mixture.

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