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(54) Title: METHODS AND SYSTEMS FOR DISSOCIATION OF WATER MOLECULES USING INERTIAL-KINETIC ELECTRO-MAGNETIC RESONANCE

(57) Abstract: Apparatuses and methods are provided for producing hydrogen (H₂) and oxygen (O₂) from water (H₂O). The apparatuses may comprise a dissociation chamber for dissociation water to hydrogen ions and oxygen ions, a separation apparatus for separating the hydrogen ions from the oxygen ions, a device for the de-ionization of hydrogen ions and oxygen ions to H₂ and O₂, and a combustion chamber for reacting H₂ and O₂ to generate H₂O in an exothermic process. In the dissociation chamber, water may be dissociated with the aid of interpenetrating magnetic and/or electromagnetic fields. In the separation apparatus, hydrogen ions may be separated from oxygen ions with the aid of a Ranque-Hilsch vortex and an electrostatic field.



WO 2010/059751 A2

METHODS AND SYSTEMS FOR DISSOCIATION OF WATER MOLECULES USING INERTIAL-KINETIC ELECTRO-MAGNETIC RESONANCE

CROSS REFERENCE

[0001] This application claims the benefit of U.S. Provisional Patent Application Serial No. 61/115,859, filed November 18, 2008, which is entirely incorporated herein by reference.

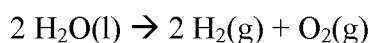
FIELD OF THE INVENTION

[0002] This invention relates to dissociating water into hydrogen and oxygen, more particularly to dissociating water into hydrogen and oxygen with the aid of electromagnetic resonance.

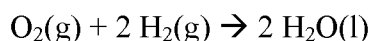
BACKGROUND OF THE INVENTION

[0003] A hydrogen-based energy economy could provide significant advantages over the current carbon-based economy. Specifically, a hydrogen-based economy allows for reduced production of greenhouse gases (such as, *e.g.*, CO₂) and reduced reliance on foreign resources. The benefits of a hydrogen-based economy may be maximized when renewable resources derived from solar, wind, and thermal energy (*e.g.*, geothermal energy) are used for hydrogen production.

[0004] Hydrogen can be generated from water via the dissociation of water via the following endothermic reaction:



H₂ may be subsequently stored and used as fuel in various combustion engines, such as automobiles and electric turbines for generating electricity. For instance, H₂ and O₂ may be reacted to form water via the following exothermic reaction:



The energy obtained from this reaction can be used to generate steam, which may subsequently be used to drive a turbine to generate electricity.

[0005] There are techniques available in the art for facilitating the dissociation of water. In electrolysis, for instance, an electric current is used to dissociate water into hydrogen and oxygen gases. Unfortunately, current electrolysis techniques can be energy intensive and inefficient, preventing hydrogen from becoming a dominant resource for mainstream energy

usage. Accordingly, there is a need in the art for improved methods for dissociating water into hydrogen (H₂) and oxygen (O₂).

SUMMARY OF THE INVENTION

[0006] The invention provides an apparatus and method for high efficiency dissociation of water into ionized hydrogen (*e.g.*, H⁺, H₂⁺⁺) and oxygen (2O⁻, O₂⁻). The ionized hydrogen and oxygen can be de-ionized to form hydrogen (H₂) and oxygen (O₂). In some embodiments, the hydrogen and oxygen can be reacted to reform water. The water can be in a chemically and biologically purified form, while deriving energy for continuing the purified water production. In other embodiments, the hydrogen and oxygen can be combusted to reform water and drive energy production in a conventional steam turbine per the following equation: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$.

[0007] The apparatus (or device) for dissociating water and producing hydrogen and oxygen can be utilized in parallel for production of a large quantity of hydrogen (H₂). The apparatus can be of any size. In an embodiment, the apparatus can be about the size of a breadbox. In some embodiments, the apparatus is of an appropriate size that can be readily used in vehicles to provide energy. In some embodiments of the invention, the energy or water production capability of the apparatus can be scaled appropriately for the amount of power or water to be produced, respectively.

[0008] The apparatus can comprise a resonance dissociation chamber and a Ranque-Hilsch vortex. The resonance dissociation chamber may comprise one or more magnetic fields. In an embodiment, the resonance dissociation chamber comprises interpenetrating magnetic and/or electromagnetic fields. The Ranque-Hilsch vortex can be combined with an electrostatic field.

[0009] In embodiments, high temperature steam can be fed to a resonance dissociation chamber that produces ionized hydrogen and ionized oxygen by utilizing multiple magnetic and electromagnetic fields and a kinetic vortex. The magnetic and/or electromagnetic fields can be interpenetrating magnetic and/or electromagnetic fields. Ionized species can be subsequently separated using a modified Ranque-Hilsch vortex and electrostatic fields. In an embodiment, the ionized species can be subsequently de-ionized by a modified electron exchange membrane to produce hydrogen (H₂) and oxygen (O₂). Hydrogen and oxygen can be combusted to produce water and energy. In an embodiment, water may be recycled to generate hydrogen and oxygen via the resonance dissociation chamber.

[0010] The apparatus can be comprised of both hardware and software. Various components may be unique to this invention, making use of recent developments in hardware processing speed and methods in software design.

[0011] In an aspect of the invention, a system for producing hydrogen (H_2) and oxygen (O_2) is provided. The system comprises at least one steam production vessel, a dissociation reactor having a series of interpenetrating magnetic and/or electromagnetic fields downstream from the at least one steam production vessel, and a separation chamber for creating a Ranque-Hilsch vortex and an electrostatic field, the separation chamber downstream of the reactor.

[0012] In another aspect of the invention, a system for generating electricity is provided. The system comprises at least one steam production vessel and a dissociation chamber comprising a series of interpenetrating magnetic fields downstream of the at least one steam production vessel. A separation apparatus (or chamber) is disposed downstream of the dissociation chamber, the separation apparatus configured to create a Ranque-Hilsch vortex and an electrostatic field. The system further comprises a de-ionizing filter downstream of the separation apparatus and a combustion chamber downstream of the de-ionizing filter.

[0013] In yet another aspect of the invention, a system for purifying water is provided. The system comprises one or more steam production vessels. The system further comprises a dissociation apparatus disposed downstream of the one or more steam production vessels, the dissociation apparatus configured to dissociate water into hydrogen ions and oxygen ions with the aid of a series of interpenetrating magnetic and/or electromagnetic fields, the dissociation apparatus configured to create a Ranque-Hilsch vortex and an electrostatic field for separating hydrogen ions and oxygen ions. A de-ionizing apparatus (or filter) is disposed downstream of the dissociation apparatus, the de-ionizing apparatus configured to generate hydrogen (H_2) and oxygen (O_2) from hydrogen ions and oxygen ions from the dissociation apparatus. The system further comprises a combustion chamber downstream of the de-ionizing apparatus and a condensation chamber downstream of the combustion chamber.

[0014] In still another aspect of the invention, a method for producing hydrogen (H_2) and oxygen (O_2) is provided. The method comprises providing water (H_2O) to a dissociation reactor (also "dissociation chamber" herein) having a series of interpenetrating magnetic and/or electromagnetic fields. In an embodiment, the water provided to the dissociation reactor is steam. Next, hydrogen ions and oxygen ions are generated in the dissociation reactor. The hydrogen ions and oxygen ions are then directed to a separation apparatus configured to separate the hydrogen ions from the oxygen ions. Next, the hydrogen ions and

oxygen ions are directed to a de-ionizing apparatus configured to generate hydrogen (H_2) and oxygen (O_2) from the hydrogen ions and oxygen ions.

BRIEF DESCRIPTION OF THE FIGURES

[0015] FIG. 1 is a schematic representation of an apparatus described herein, in accordance with an embodiment of the invention;

[0016] FIG. 2 is a flowchart illustrating energy input and outputs to an apparatus described herein, in accordance with an embodiment of the invention;

[0017] FIG. 3 is a schematic representation of an inertial-kinetic electro-magnetic resonance reactor, in accordance with an embodiment of the invention; and

[0018] FIG. 4 is a schematic representation of various components of an inertial-kinetic electro-magnetic resonance reactor, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] The invention provides for the rapid and high efficiency dissociation of water molecules into hydrogen and oxygen ions. The hydrogen and oxygen ions can be de-ionized to H_2 and O_2 , thereby extracting electricity, burned together to produce heat, and then condensed to provide chemically and biologically pure water.

[0020] Water is comprised of two hydrogen atoms and a single oxygen atom joined by two hydrogen-oxygen covalent bonds. The molecular arrangement of the hydrogen atoms about the oxygen atom creates a polar molecule (or a molecule having a dipole moment). The polar or dipole nature of water allows not only for hydrogen bonding to occur, but for a magnetic field to control the orientation of a water molecule. The magnetic field may be used to impart energy to the water molecule. When placed in a magnetic field, a water molecule will align with the field to an extent inversely proportional to its own kinetic energy and relative to the strength of the magnetic field. The force exerted to align the molecule is known as magnetic torquing, and its effect causes the molecule to precess about the direction of the magnetic field at a frequency relative to the magnetic torque applied and dependent upon the molecule's frequency components.

[0021] Apparatuses and methods of various embodiments of the invention provide for dissociation of water molecules to form ionized hydrogen (e.g., H^+ , H_2^+) and ionized oxygen (e.g., O^{2-} , O_2^-), for the separation of ionized hydrogen and ionized oxygen, for the de-ionization of the ionized hydrogen and ionized oxygen to form H_2 and O_2 , respectively, and for the production of energy by the conversion of hydrogen and oxygen to water.

[0022] Various aspects of the invention make use of the polar nature of water to dissociate water into ionized hydrogen and oxygen using a magnetic field. The two ionized species are subsequently separated using an electrostatic field in conjunction with a Ranque-Hilsch vortex. In certain embodiments, a modified electron exchange membrane de-ionizes the separated hydrogen ions and oxygen ions. The apparatus for dissociation of water and de-ionization to hydrogen and oxygen may be collectively referred to as an inertial-kinetic electro-magnetic resonance (IKEMR) reactor. In some embodiments, the IKEMR reactor may comprise a separate dissociation chamber (or reactor) for dissociating H₂O and a separate device or apparatus downstream of the dissociation chamber for separating hydrogen ions and oxygen ions into separate streams of hydrogen ions and oxygen ions. In a preferable embodiment, the IKEMR reactor dissociates water to ionized hydrogen and oxygen and also separates the ionized species. A modified electron exchange membrane may subsequently de-ionize the species to form hydrogen gas and oxygen gas. In some embodiments of the invention, the hydrogen gas and oxygen gas may be combusted to produce water and energy, which may be used to provide energy to the IKEMR reactor.

Dissociation of Water to Ionized Hydrogen and Ionized Oxygen

[0023] As shown in Figure 1, water may be used to produce ionized hydrogen and ionized oxygen. Liquid state water may be filtered and pumped into an input reservoir for storage. Water from the input reservoir may be pumped into a pressure vessel to be heated and converted into high pressure steam using a series of pressure vessels and heat exchangers. At any time, each of the vessels may be in one of four phases (or stages): a “Fill Phase”, “Heat Phase”, “Run Phase”, or “Backwash Phase”. The phases may be cycled through sequentially in each of the vessels, controlled by valves, which may be much in the way a four-stroke combustion engine works (*i.e.*, in a four-stroke Otto-type engine, the engine goes through adiabatic compression, heat addition at constant volume, adiabatic expansion, and rejection of heat at constant volume). Water may be fed into a vessel during the Fill Phase. In the Fill Phase water may be fed unpressurized. While that is happening, water previously fed into a second vessel can be heated during its Heat Phase. While those are happening, water in a third vessel, which has gone through its Fill and Heat Phases, can be boiled to form pressurized steam during its Run Phase. The steam can be fed into the dissociation process. A fourth vessel, having finished its Run Phase, may then enter its Backwash Phase, where residual pollutants and contaminants, left by the distillation of the water during the Heating and Run Phases, are cleaned out. If brackish or sea water is used as the source water, minerals existing in sea water can be claimed or removed from the residue.

By combusting the hydrogen and oxygen product of the dissociation process, high temperature water vapor can be formed and can be condensed in the heat exchangers to provide heat for the Heat Phase and then either outputted as purified water or fed back into a vessel in its Fill Phase.

[0024] With reference to FIG. 1, in some embodiments, high pressure and high temperature steam may be fed from a vessel in its Run Phase into a dissociation chamber (or dissociation apparatus) comprising multiple magnetic and/or electromagnetic fields, and further comprising a modified Ranque-Hilsch tube, that can collectively use magnetic torquing and vortex kinetics to dissociate water into segregated (or separate) streams of ionized hydrogen (*e.g.*, H^+) and ionized oxygen (*e.g.*, O^{2-}). In an embodiment, the multiple magnetic and/or electromagnetic fields may be interpenetrating magnetic and/or electromagnetic fields. The dissociation chamber can also be referred to as the IKEMR reactor or the resonance dissociation reactor.

[0025] In some embodiments of the invention, the dissociation chamber is controlled using high-speed processors and specialized software.

Deionization of Species to Hydrogen and Oxygen

[0026] As shown in FIG. 1, the ionized hydrogen and oxygen species can be de-ionized using a charge filter. The charge filter can also be referred to as a modified electron exchange membrane. In an embodiment, the charge filter may operate like a proton exchange membrane (PEM). The charge filter may allow for the extraction of electrons from ionized oxygen, resulting in oxygen gas (O_2). Concurrently, electrons can be donated to ionized hydrogen, resulting in hydrogen gas (H_2).

[0027] In some embodiments of the invention, the modified electron exchange membrane is controlled by specialized software and hardware, such as high-speed processors.

Reaction of Hydrogen and Oxygen

[0028] FIG. 1 shows a combustion chamber for combustion of hydrogen and oxygen to drive the production of electricity by a turbine generator. The combustion chamber can be a standard apparatus used to burn hydrogen and oxygen and consequently drive electricity production by a turbine generator.

[0029] In some embodiments of the invention, the combustion chamber is controlled by specialized software and hardware, such as high-speed processors.

[0030] A portion of the heat produced by combustion of hydrogen and oxygen may be used to heat the water that is fed to the IKEMR reactor. In other embodiments of the

invention, the electricity produced by the turbine generator may be used to power the electronics of the IKEMR reactor and the hardware used to control the IKEMR reactor.

Controller

[0031] FIG. 1 shows a controller comprised of at least one high-speed solid-state processor and specialized software for controlling any or all of the following: a) the valve and pressure vessel system; b) the dissociation chamber; c) the charge filter; and d) the combustion chamber and turbine generator. The controller may be configured to control various process parameters, such as flow rates, pressures and temperatures.

[0032] In some embodiments of the invention, the controller may be used to tune oscillating magnetic fields to frequencies based on a mean velocity of molecules in a vortex and/or a minimum duration of molecules in a dynamic field. The controller may adjust the periodicity of the molecules to be sufficiently small so as to limit charge dissipation.

[0033] The controller may be used to micro-adjust oscillation frequencies used in the dissociation of water to form ionized hydrogen and ionized oxygen. The oscillation frequencies may be adjusted to maintain peak current loading corresponding to peak adsorption of energy by water molecules.

[0034] The controller may also be used to adjust radio frequency generators used in catalyzing the dissociation of water.

Additional Components

[0035] With continued reference to FIG. 1, additional components of the apparatus may include a backwash reservoir for storage of distillation residue, an input reservoir, and a condenser for cooling water formed after combustion of hydrogen (H_2) and oxygen (O_2) for the formation of purified hot water.

Energy Inputs and Outputs

[0036] With reference to FIG. 2, an external heat source and electricity source may be used to initiate the dissociation and deionization of water to hydrogen (H_2) and oxygen (O_2). An external heat source may be used to produce high-pressure steam from the input water source. An external electricity source may be used to power the resonance dissociation reactor to dissociate water to ionized hydrogen (*e.g.*, H^+) and ionized oxygen (*e.g.*, O^{2-}). The resonance dissociation reactor can produce ionic hydrogen and ionic oxygen at high pressure. Ionic hydrogen and ionic oxygen can be fed to a modified electron exchange membrane for de-ionization.

[0037] Energy can be produced by the de-ionization of hydrogen and oxygen by a modified electron exchange membrane. Hydrogen and oxygen produced during the de-

ionization process can be stored for later use by, *e.g.*, consumers. Alternatively, the hydrogen and oxygen can be combusted to produce heat and electricity.

[0038] With continued reference to FIG. 2, the combustion of hydrogen and oxygen may provide energy for steam production. In addition, the de-ionization of ionized hydrogen and ionized oxygen may provide energy, which may be used to dissociate H₂O in the IKEMR reactor.

IKEMR reactor

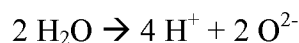
[0039] With reference to FIG. 3, the IKEMR reactor can dissociate water to ionized hydrogen and ionized oxygen. A magnetic field can create dipole-aligned water molecules that can accept energy at the hydrogen-oxygen bond resonance frequency or a sub-harmonic thereof. An oscillating electromagnetic field can cause resonance catastrophe, resulting in the dissociation of water into hydrogen ions (*e.g.*, H⁺) and oxygen ions (*e.g.*, O²⁻). An electrostatic field and a modified Ranque-Hilsch vortex can be used to separate the ionized hydrogen from ionized oxygen with minimum post-dissociation collisions.

[0040] With reference to FIG. 4, the dissociation of water to ionized hydrogen and ionized oxygen is shown in greater detail. Ionized hydrogen and ionized oxygen can be produced from high pressure steam by utilizing one or more of electromagnetic fields, magnetic fields and kinetic vortexes. In an embodiment, the magnetic fields and/or electromagnetic fields may be interpenetrating magnetic fields and/or electromagnetic fields. High-pressure steam may be fed transversely to a funnel-type device or apparatus and exposed to a magnetic field. High-pressure steam may then progress through the funnel in a spiral manner and experience magnetic torquing. Steam may exit the funnel through multiple concentric ports at the end of the funnel and may be subsequently directed to a plurality of specialized channels surrounded by modified static magnets capable of imparting a tendency for water molecule alignment, resulting in further magnetic torquing.

[0041] With continued reference to FIG. 4, a plurality of magnetically torqued and magnetically aligned streams of steam may be directed toward a modified Ranque-Hilsch tube in a plurality of offset right angles, thereby creating a vortex. While in the modified Ranque-Hilsch tube, an oscillating electromagnetic field created by a plurality of electromagnetic field generators can impart additional magnetic torquing on the streams of the steam that have been magnetically torqued and magnetically aligned. A radio frequency (RF) generator may be used for the dissociation of water to ionized hydrogen and ionized oxygen. The RF generator may couple RF energy to the water molecules, thereby facilitating

the dissociation of H₂O into hydrogen ions and oxygen ions. The radio frequency generator may be tuned to a fundamental resonant frequency of molecular water (H₂O).

[0042] A wavefront of magnetically torqued water molecules may be created by convergence of the plurality of streams in the Ranque-Hilsch tube. The convergence of magnetically torqued water molecules support each other and amplify the degree of magnetic torque experienced. The magnetic torquing of water molecules induces a current in the molecule. The excitation occurs repeatedly at a sub-harmonic frequency of the molecular resonance that successively builds a charge across each water molecule which, eventually, catalyzed by induced, tuned radio frequency waves, momentarily exceeds the hydrogen-oxygen bond energy, causing a resonance catastrophe where the hydrogen atom releases its electron. This leads to a break in the O-H bond, forming ionized hydrogen and ionized oxygen. The process in the IKEMR reactor may be summarized by the following equation.



While H⁺ AND O²⁻ have been shown in the reaction above, it will be appreciated that other excited species of hydrogen and oxygen may be formed in the IKEMR reactor. For example, O₂⁻ may be formed in the reactor. As another example, H₂⁺ may be formed in the IKEMR reactor. As yet another example, hydrogen radicals may be formed in the IKEMR reactor. As still another example, oxygen radicals may be formed in the IKEMR reactor.

Separation of Ionized Hydrogen and Ionized Oxygen

[0043] FIG. 4 shows the separation of ionized hydrogen and ionized oxygen using a modified Ranque-Hilsch tube. The modified Ranque-Hilsch tube, in conjunction with an electrostatic field, can achieve separation by causing ionized hydrogen to migrate toward the center of the modified Ranque-Hilsch tube and the ionized oxygen to migrate toward the walls (or outer periphery) of the modified Ranque-Hilsch tube with a minimum of molecular collisions. The orientation of the steady state fields can have the tendency to constrain the spin of the dipole molecules to a surface of the wavefront. Having dimensionally minimized the randomness of the molecular motion and spin, at the optimal spin rate, due to the orbital motion of the lighter hydrogen atoms around the heavier oxygen atoms, upon dissociation there may be imparted a centrifugal force that is sufficient to propel the hydrogen ions at high speed towards the center of the vortex where they collide with each other, absorbing electrons from the electrostatic field. The separated hydrogen and oxygen can exit the modified Ranque-Hilsch tube through separate channels oriented at the center and outer edges of the modified Ranque-Hilsch tube, respectively. The migration directions can be a result of

different densities of the ionized hydrogen as compared to ionized oxygen and/or the charge difference between ionized hydrogen and ionized oxygen.

Resonance Catastrophe

[0044] The covalent bonds of the water molecule, which are approximately 110 kcal, have a characteristic resonance frequency and therefore have periodic motion. Any system in periodic motion can be acted upon by an external force, appropriately tuned to that resonance frequency, such that the system will continuously absorb energy from the external force to a point that it can no longer maintain the integrity of its periodic motion. This can result in a resonance catastrophe and effective disintegration (or dissociation) of the system. Resonance catastrophe of water can produce ionized hydrogen and oxygen atoms. Efficient formation of ionized hydrogen and ionized oxygen can occur in the absence of hydrogen bonding.

Hydrogen bonding can reduce the efficiency of ionized hydrogen and ionized oxygen production. The effect of hydrogen bonding can be reduced when water is in a vacuum or in gas form. Water can be heated to a gaseous state, motion-coordinated and brought in alignment by a combination of a specialized device and magnetic and/or electromagnetic fields. In various embodiments, the specialized device has a generally conical shape. In an embodiment, the specialized device is in the shape of a funnel. In an embodiment, the magnetic and/or electromagnetic fields may be interpenetrating magnetic and/or electromagnetic fields.

[0045] Passing a conductor through a magnetic field can induce a current in the conductor. The water molecule has a dipole moment. In certain circumstances, water may be a conductor of electricity. Passage of rotating water molecules through an oscillating magnetic field can induce a current across the water molecules, such that a potential electromotive force (EMF) can be generated across each molecule, independent of its actual orientation. During high velocity motion in a vortex, through the presence of a dominant steady state field, interaction between the water molecules may be constrained primarily to two dimensions, and may serve to distribute the aggregate charge in a continuously building wavefront. Due to an interpenetrating steady state field, this charge is not translated into further spin, but may be absorbed over time in quanta by the electrons of the hydrogen bond, energizing them in a way that is free from the energy dissipation that is typically caused by the hydrogen bonding of liquid water.

[0046] This process, repeated at a high enough rate and tuned to a dominant sub-harmonic partial of the primary resonance frequency of the hydrogen atoms in the water molecule, can systematically build a charge across each molecule. Charge induction, through

dynamo-type action of spinning molecules (having dipole moments) passing through oscillating magnetic fields, can act to raise the excitation state of bonding electrons nearest the charge centers through their energy levels until the resonance kinetics within the molecule temporarily exceed the lowest atomic bond threshold (that of the hydrogen atoms), thereby causing release of ionized hydrogen atoms in a resonance catastrophe.

[0047] To facilitate this process, a chamber or reactor with oscillating fields and a vortex may be constructed and tuned in a way to induce a modified Ranque-Hilsch effect. The chamber may also include one or more perpendicular (with respect to a longitudinal axis of the chamber) steady state fields to constrain molecular spin and an electrostatic field oriented to direct the positively charged ions to the center of the vortex.

[0048] Thus, periodically adding energy of magnetic torquing to the molecules by passing them through a series of tuned and oscillating magnetic fields at a rate harmonically synchronous with a repeated charge induction, after a certain amount of time, may cause a threshold of the molecular bond energy holding the hydrogen and oxygen atoms in the water molecules together to be momentarily exceeded, resulting in dissociation of the water molecules into ionized hydrogen and ionized oxygen atoms.

Example

[0049] An objective of the process is to impart energy to the water vapor molecules utilizing their dipole nature as they move through a reactor in such a way as to build a charge across the water molecules over time. A first alignment phase does not necessarily result in the molecules lining up in a North-South orientation. The process can continuously torque the molecules in the same direction as they spin through a static field.

[0050] In a tuned phase, an effective electric charge across each water molecule may be induced over a period of time in a number of synchronized steps until the aggregated charge can momentarily exceed a bond threshold energy between the hydrogen and oxygen atoms of a water molecule. This does not necessarily require that the molecules be stimulated continuously at a particular resonance (or resonant) frequency. A timing of stimuli can correspond to a resonant sub-harmonic in such a way that magnetic torquing of the water molecules can have an additive electrical effect. Oscillating magnetic fields can be tuned to frequencies that take into account both the mean velocity (which can be correlated to their kinetic energy) of the water molecules in the vortex and their minimum duration in each of the dynamic fields, which are aligned so as to sequentially build the electric charge across the molecules during their transit through the reactor with a periodicity small enough to limit charge dissipation. Oscillation frequencies can be continuously micro-adjusted to maintain

peak current loading on field drivers, which can be at their peak when charge absorption by the molecules is at its highest, thereby minimizing the number of stages required in the reactor. The radio frequency (RF) generators that can augment the process can be tuned to fundamentals of the molecular resonance.

[0051] The electrostatic field can be applied at the leading edge of the dissociation (resonance catastrophe) wavefront to assist the vortex kinetics to attract lighter, positively charged H^+ ions towards the center of the Ranque-Hilsch vortex with a minimum of molecular collisions and push the heavier, negatively charged oxygen ions (*e.g.*, O^{2-}) to the outer walls of the reactor chamber, where they can be forced out of the reactor in separate channels.

[0052] It should be understood from the foregoing that, while particular implementations have been illustrated and described, various modifications can be made thereto and are contemplated herein. It is also not intended that the invention be limited by the specific examples provided within the specification. While the invention has been described with reference to the aforementioned specification, the descriptions and illustrations of embodiments of the invention herein are not meant to be construed in a limiting sense. Furthermore, it shall be understood that all aspects of the invention are not limited to the specific depictions, configurations or relative proportions set forth herein which depend upon a variety of conditions and variables. Various modifications in form and detail of the embodiments of the invention will be apparent to a person skilled in the art. It is therefore contemplated that the invention shall also cover any such modifications, variations and equivalents.

CLAIMS

1. A system for producing hydrogen (H_2), comprising:
 - at least one steam production vessel;
 - a dissociation reactor having a series of interpenetrating magnetic and/or electromagnetic fields downstream of the at least one steam production vessel; and
 - a separation chamber for creating a Ranque-Hilsch vortex and an electrostatic field, the separation chamber downstream of the reactor.
2. The system of Claim 1, further comprising a charge filter downstream of the separation chamber, the charge filter configured to accept hydrogen ions and oxygen ions from the separation chamber.
3. The system of Claim 2, further comprising a combustion chamber downstream of the charge filter, the combustion chamber configured to accept hydrogen (H_2) and oxygen (O_2) from the charge filter, the combustion chamber configured to react H_2 and O_2 to yield H_2O .
4. The system of Claim 1, wherein the separation chamber is configured to separate hydrogen ions and oxygen ions.
5. The system of Claim 4, wherein the separation chamber is configured to radially separate hydrogen ions and oxygen ions.
6. A system for generating electricity, comprising:
 - at least one steam production vessel;
 - a dissociation chamber comprising a series of interpenetrating magnetic fields downstream of the at least one steam production vessel;
 - a separation apparatus downstream of the dissociation chamber, the separation apparatus configured to create a Ranque-Hilsch vortex and an electrostatic field;
 - a de-ionizing filter downstream of the separation apparatus; and

a combustion chamber downstream of the de-ionizing filter.

7. A system for purifying water, comprising:

one or more steam production vessels;

a dissociation apparatus downstream of the one or more steam production vessels, the dissociation apparatus configured to dissociate water with the aid of a series of interpenetrating magnetic and/or electromagnetic fields, the dissociation apparatus configured to create a Ranque-Hilsch vortex and an electrostatic field for separating hydrogen ions and oxygen ions;

a de-ionizing apparatus downstream of the dissociation apparatus, the de-ionizing apparatus configured to generate hydrogen (H₂) and oxygen (O₂) from hydrogen ions and oxygen ions;

a combustion chamber downstream of the de-ionizing apparatus; and

a condensation chamber downstream of the combustion chamber.

8. A method for producing hydrogen (H₂) and oxygen (O₂), comprising:

providing water to a dissociation reactor having a series of interpenetrating magnetic and/or electromagnetic fields;

generating hydrogen ions and oxygen ions in the dissociation reactor;

directing the hydrogen ions and oxygen ions to a separation apparatus configured to separate the hydrogen ions from the oxygen ions; and

directing the hydrogen ions and oxygen ions to a de-ionizing apparatus configured to generate hydrogen (H₂) and oxygen (O₂).

9. The method of Claim 8, wherein providing water to the reactor comprises providing steam to the reactor.

10. The method of Claim 8, wherein the separation apparatus is configured to separate the hydrogen ions from the oxygen ions with the aid of a Ranque-Hilsch vortex and an electrostatic field.
11. The method of Claim 8, wherein the de-ionizing apparatus is a modified electron exchange membrane.

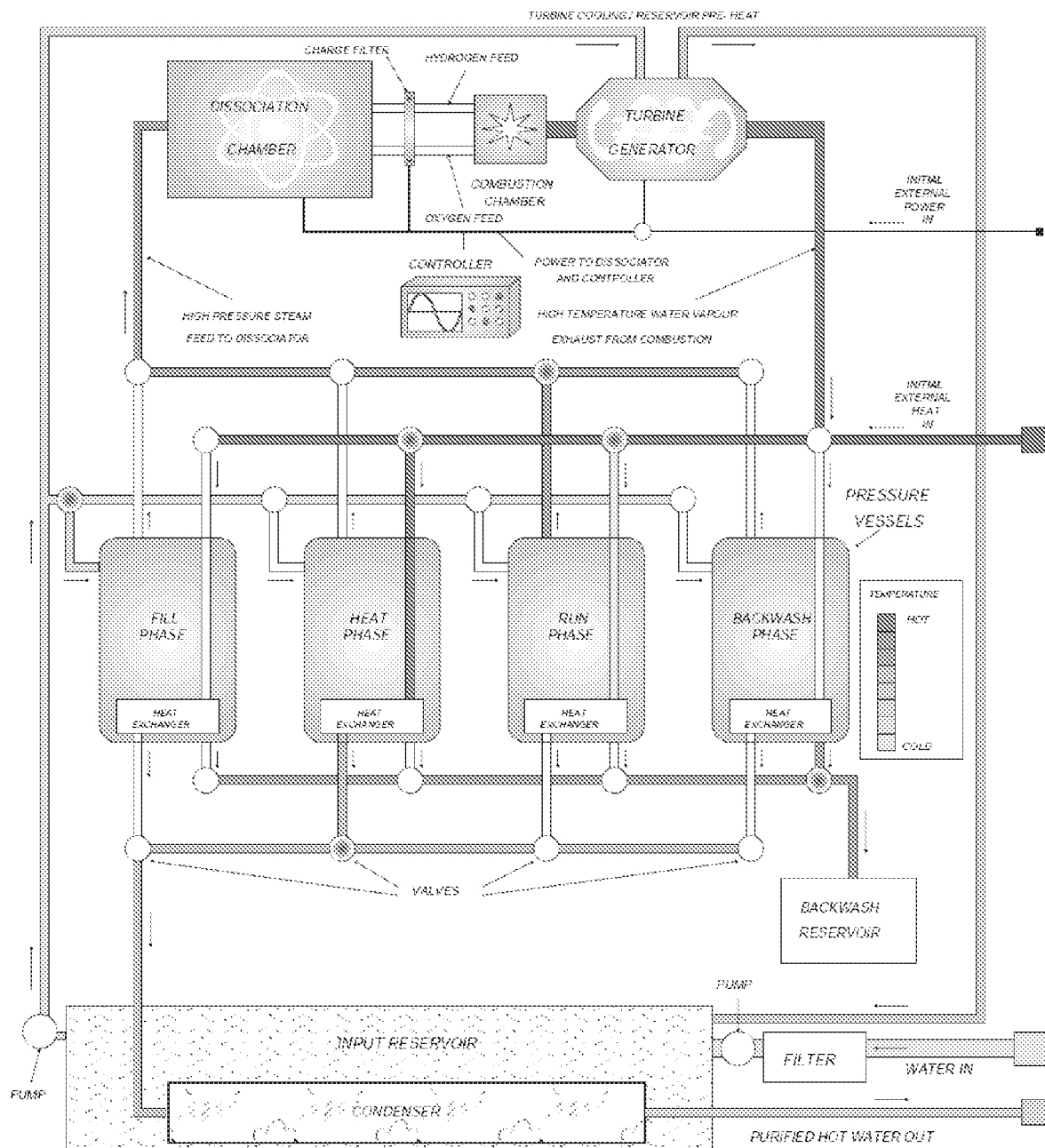
$1/4$ 

FIG. 1

2/4

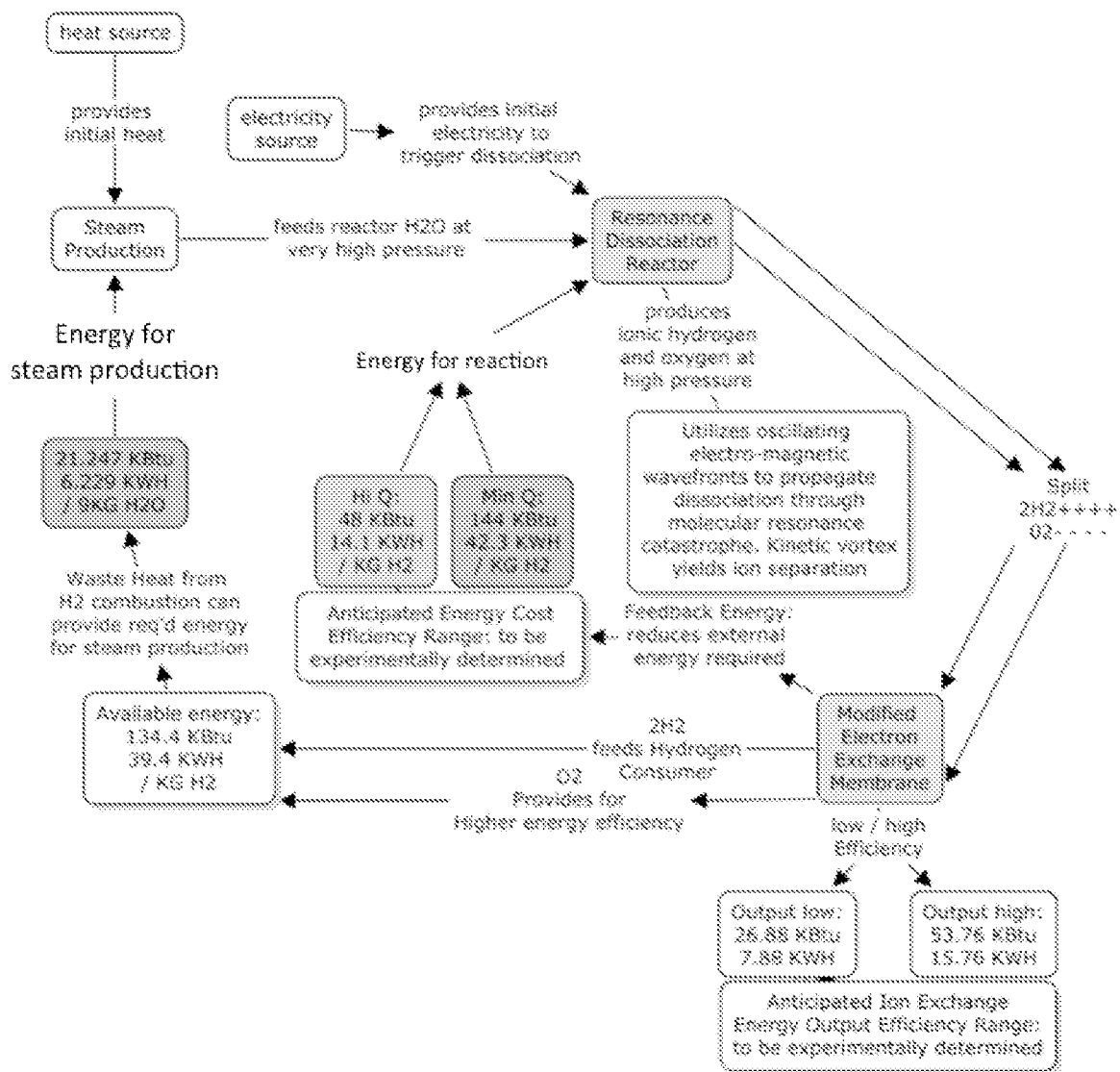


FIG. 2

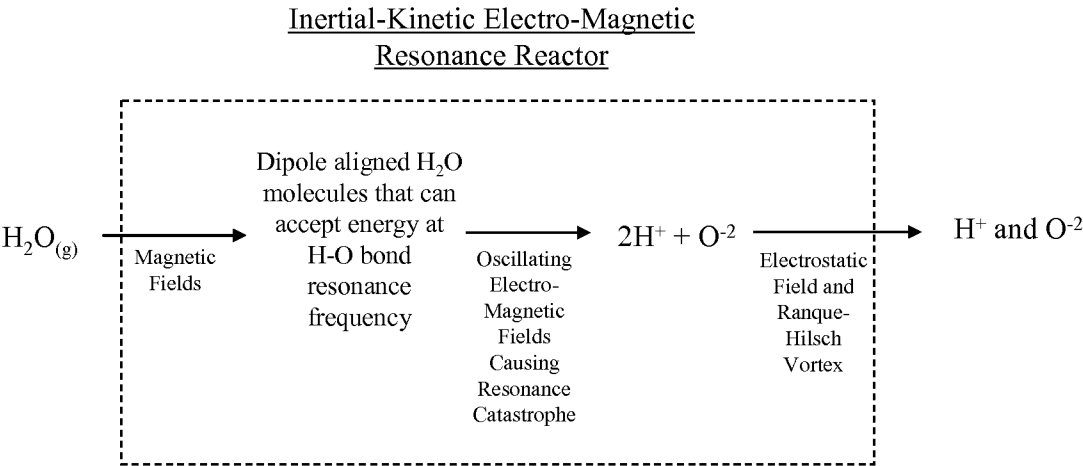


FIG. 3

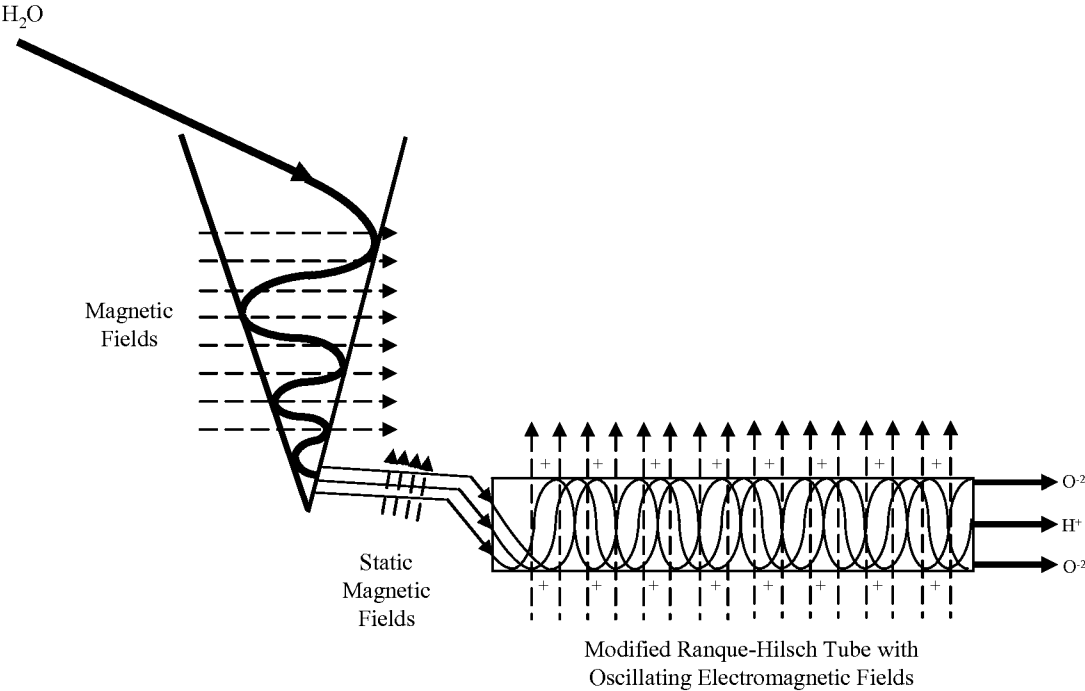


FIG. 4