moving parts and are relatively simple in operation. Generally, a fuel and gas mixture is drawn into a combustion chamber via open valves, which are then shut, and the mixture is reacted, producing thrust. The valves then open and fresh fuel and gas displace the exhaust gases, and the process is repeated. Some engines use no valves, but rely instead on engine geometry to achieve the same effect. The repeated reactions cause a pulsatile force.

Power can also be generated through the use of an electrochemical power system, which can generate power in the form of electrical power and/or thermal energy. Such electrochemical power systems typically include electrodes and reactants that cause an electron flow, which is then harnessed.

Summary

In an aspect, the present disclosure refers to a power system that generates at least one of direct electrical energy and thermal energy comprising:

at least one vessel;

reactants comprising:

a) at least one source nascent H2O;

b) at least one source atomic hydrogen;

c) at least one of a conductor and a conductive matrix; and

at least one set of electrodes to confine the reactants,

a source of electrical power to deliver a short burst of high-current electrical energy to the reactants between the electrodes to produce reaction products and a plasma;

at least one regeneration system to regenerate one or more of the initial reactants from the reaction products;

a reloading system to position regenerated reactants between the electrodes; and

at least one direct plasma to electricity converter and at least one thermal to electric power converter.

The present disclosure describes in detail many systems for generating various forms of power. In one example, the present disclosure is directed to an electrochemical power system that generates at least one of electricity and thermal energy comprising a vessel, the vessel comprising

at least one cathode,

at least one anode;

at least one bipolar plate, and

reactants comprising at least two components chosen from:

a) at least one source of H_2O;

b) a source of oxygen;

c) at least one source of catalyst or a catalyst comprising at least one of the group chosen from nH, O, O_2, OH, OH-, and nascent H_2O, wherein n is an integer, and

d) at least one source of atomic hydrogen or atomic hydrogen;

one or more reactants to form at least one of the source of catalyst, the catalyst, the source of atomic hydrogen, and the atomic hydrogen, and

one or more reactants to initiate the catalysis of atomic hydrogen,

the electrochemical power system further comprising an electrolysis system and an anode regeneration system.

In another example, the present disclosure is directed to a power system that generates at least one of direct electrical energy and thermal energy comprising:

at least one vessel;

reactants comprising:

a) at least one source of catalyst or a catalyst comprising nascent H_2O;

b) at least one source of atomic hydrogen or atomic hydrogen;

c) at least one of a conductor and a conductive matrix; and

at least one set of electrodes to confine the hydrino reactants,

a source of electrical power to deliver a short burst of high-current electrical energy;

a reloading system;

at least one system to regenerate the initial reactants from the reaction products, and

at least one direct plasma to electricity converter and at least one thermal to electric power converter.

In a further example, the present disclosure is directed to an electrochemical power system comprising a vessel, the vessel comprising

at least one cathode,

at least one anode;

at least one electrolyte;

at least two reactants chosen from:

a) at least one source of catalyst or a catalyst comprising nascent H_2O;

b) at least one source of atomic hydrogen or atomic hydrogen;

c) at least one of a source of a conductor, a source of a conductive matrix, a conductor, and a conductive matrix; and

at least one current source to produce a current comprising at least one of a high ion and electron current chosen from an internal current source and an external current source;

wherein the electrochemical power system generates at least one of electricity and thermal energy.

In an additional example, the present disclosure is directed to a water arc plasma power system comprising: at least one closed reaction vessel; reactants comprising at least one of source of H_2O and H_2O; at least one set of electrodes, a source of electrical power to deliver an initial high breakdown voltage of the H_2O and provide a subsequent high current, and a heat exchanger system, wherein the power system generates arc plasma, light, and thermal energy.

In further examples, the present disclosure is directed to a mechanical power system comprising:

at least one piston cylinder of an internal combustion-type engine;

a fuel comprising:

a) at least one source of catalyst or a catalyst comprising nascent H_2O;

b) at least one source of atomic hydrogen or atomic hydrogen;

c) at least one of a conductor and a conductive matrix;

at least one fuel inlet with at least one valve;

at least one exhaust outlet with at least one valve;

at least one piston;

at least one crankshaft;

a high current source, and

at least two electrodes that confine and conduct a high current through the fuel.

Certain examples of the present disclosure are directed to a power generation

system comprising: an electrical power source of at least about 2,000 A/cm^2; a plurality of electrodes electrically coupled to the electrical power source; a fuel loading region configured to receive a solid fuel, wherein the plurality of electrodes is configured to deliver electrical power to the solid fuel to produce a plasma; and a plasma power converter positioned to receive at least a portion of the plasma. Other examples are directed to a power generation system, comprising; a plurality of electrodes, a fuel loading region located between the plurality of electrodes and configured to receive a conductive fuel, wherein the plurality of electrodes are configured to apply a current to the conductive fuel sufficient to ignite the conductive fuel and generate at least one of plasma and thermal power, a delivery mechanism for moving the conductive fuel into the fuel loading region; and a plasma-to-electric power converter configured to convert the plasma into a non-plasma form of power or a thermal to electric or mechanical converter to convert the thermal power into a nonthermal form of power comprising electricity or mechanical power. Further examples are directed to a method of generating power, comprising; delivering an amount of fuel to a fuel loading region, wherein the fuel loading region is located among a plurality of electrodes, igniting the fuel by flowing a current of at least about 2,000 A/cm^2 through the fuel by applying the current to the plurality of electrodes to produce at least one of plasma, light, and heat; receiving at least a portion of the plasma in a plasma-to-electric converter; converting the plasma to a different form of power using the plasma-to-electric converter; and outputting the different form of power.

Additional examples are directed to a power generation system, comprising: an electrical power source of at least about 5,000 kW; a plurality of spaced apart electrodes, wherein the plurality of electrodes at least partially surround a fuel, are electrically connected to the electrical power source, are configured to receive a current to ignite the fuel, and at least one of the plurality of electrodes is moveable, a delivery mechanism for moving the fuel; and a plasma-to-electric power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power. Additionally provided in the present disclosure is a power generation system, comprising: an electrical power source of at least about 2,000 A/cm^2;a plurality of spaced apart electrodes, wherein the plurality of electrodes at least partially surround a fuel, are electrically connected to the electrical power source, are configured to receive a current to ignite the fuel, and at least one of the plurality of electrodes is moveable; a delivery mechanism for moving the fuel; and a plasma-to-electric power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power.

Another examples is directed to a power generation system, comprising: an electrical power source of at least about 5,000 kW; a plurality of spaced apart electrodes, wherein at least one of the plurality of electrodes includes a compression mechanism; a fuel

loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes so that the compression mechanism of the at least one electrode is oriented towards the fuel loading region, and wherein the plurality of electrodes are electrically connected to the electrical power source and configured to supply power to the fuel received in the fuel loading region to ignite the fuel; a delivery mechanism for moving the fuel into the fuel loading region; and a plasma power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power. Other examples of the present disclosure are directed to a power generation system, comprising: an electrical power source of at least about 2,000 A/cm^2, a plurality of spaced apart electrodes, wherein at least one of the plurality of electrodes includes a compression mechanism; a fuel loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes so that the compression mechanism of the at least one electrode is oriented towards the fuel loading region, and wherein the plurality of electrodes are electrically connected to the electrical power source and configured to supply power to the fuel received in the fuel loading region to ignite the fuel; a delivery mechanism for moving the fuel into the fuel loading region; and a plasma power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power.

Examples of the present disclosure are also directed to power generation system, comprising; a plurality of electrodes; a fuel loading region surrounded by the plurality of electrodes and configured to receive a fuel, wherein the plurality of electrodes is configured to ignite the fuel located in the fuel loading region, a delivery mechanism for moving the fuel into the fuel loading region; a plasma power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power; a removal system for removing a byproduct of the ignited fuel; and a regeneration system operably coupled to the removal system for recycling the removed byproduct of the ignited fuel into recycled fuel. Certain examples of the present disclosure are also directed to a power generation system, comprising: an electrical power source configured to output a current of at least about 2,000 A/cm^2; a plurality of spaced apart electrodes electrically connected to the electrical power source, a fuel loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes, and wherein the plurality of electrodes is configured to supply power to the fuel to ignite the fuel when received in the fuel loading region; a delivery mechanism for moving the fuel into the fuel loading region; a plasma-to-electric power converter configured to convert plasma generated from the ignition of the fuel into electrical power; one or more output power terminals operably coupled to the plasma-to-electric power converter; and a power storage device.

Additional examples of the present disclosure are directed to a power generation system, comprising: an electrical power source of at least 5,000 kW ; a plurality of spaced

apart electrodes electrically connected to the electrical power source; a fuel loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes, and wherein the plurality of electrodes is configured to supply power to the fuel to ignite the fuel when received in the fuel loading region; a delivery mechanism for moving the fuel into the fuel loading region, a plasma power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power; a sensor configured to measure at least one parameter associated with the power generation system; and a controller configured to control at least a process associated with the power generation system. Further examples are directed to a power generation system, comprising: an electrical power source of at least 2,000 A/cm^2; a plurality of spaced apart electrodes electrically connected to the electrical power source; a fuel loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes, and wherein the plurality of electrodes is configured to supply power to the fuel to ignite the fuel when received in the fuel loading region; a delivery mechanism for moving the fuel into the fuel loading region; a plasma power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power, a sensor configured to measure at least one parameter associated with the power generation system; and a controller configured to control at least a process associated with the power generation system.

Certain examples of the present disclosure are directed to a power generation system, comprising: an electrical power source of at least about 5,000 kW; a plurality of spaced apart electrodes electrically connected to the electrical power source; a fuel loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes, and wherein the plurality of electrodes is configured to supply power to the fuel to ignite the fuel when received in the fuel loading region, and wherein a pressure in the fuel loading region is a partial vacuum; a delivery mechanism for moving the fuel into the fuel loading region; and a plasma-to-electric power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power. Other examples are directed to a power generation system, comprising: an electrical power source of at least about 2,000 A/cm^2; a plurality of spaced apart electrodes electrically connected to the electrical power source; a fuel loading region configured to receive a fuel, wherein the fuel loading region is surrounded by the plurality of electrodes, and wherein the plurality of electrodes is configured to supply power to the fuel to ignite the fuel when received in the fuel loading region, and wherein a pressure in the fuel loading region is a partial vacuum; a delivery mechanism for moving the fuel into the fuel loading region; and a plasma-to-electric power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power.

Further examples are directed to a power generation cell, comprising: an outlet

port coupled to a vacuum pump; a plurality of electrodes electrically coupled to an electrical power source of at least 5,000 kW; a fuel loading region configured to receive a water-based fuel comprising a majority H_2O, wherein the plurality of electrodes is configured to deliver power to the water-based fuel to produce at least one of an arc plasma and thermal power; and a power converter configured to convert at least a portion of at least one of the arc plasma and the thermal power into electrical power. Also disclosed is a power generation system, comprising: an electrical power source of at least 5,000 A/cm^2; a plurality of electrodes electrically coupled to the electrical power source; a fuel loading region configured to receive a water-based fuel comprising a majority H_2O, wherein the plurality of electrodes is configured to deliver power to the water-based fuel to produce at least one of an arc plasma and thermal power; and a power converter configured to convert at least a portion of at least one of the arc plasma and the thermal power into electrical power.

Additional examples are directed to a method of generating power, comprising: loading a fuel into a fuel loading region, wherein the fuel loading region includes a plurality of electrodes; applying a current of at least about 2,000 A/cm^2 to the plurality of electrodes to ignite the fuel to produce at least one of an arc plasma and thermal power, performing at least one of passing the arc plasma through a plasma-to-electric converter to generate electrical power; and passing the thermal power through a thermal -to-electric converter to generate electrical power; and outputting at least a portion of the generated electrical power. Also discl osed is a power generation system, comprising: an el ectri cal power source of at least 5,000 kW; a plurality of electrodes electrically coupled to the power source, wherein the plurality of electrodes is configured to deliver electrical power to a water-based fuel comprising a majority H_2O to produce a thermal power; and a heat exchanger configured to convert at least a portion of the thermal power into electrical power. In addition, another example is directed to a power generation system, comprising: an electrical power source of at least 5,000 kW; a plurality of spaced apart electrodes, wherein at least one of the plurality of electrodes includes a compression mechanism; a fuel loading region configured to receive a water-based fuel comprising a majority H_2O, wherein the fuel loading region is surrounded by the plurality of electrodes so that the compression mechanism of the at least one electrode is oriented towards the fuel loading region, and wherein the plurality of electrodes are electrically connected to the electrical power source and configured to supply power to the water-based fuel received in the fuel loading region to ignite the fuel, a delivery mechanism for moving the water-based fuel into the fuel loading region; and a plasma power converter configured to convert plasma generated from the ignition of the fuel into a non-plasma form of power.

Certain examples of the present disclosure are directed to a system for producing mechanical power comprising: an electrical power source of at least about 5,000 A; an

ignition chamber configured to produce at least one of plasma and thermal power; a fuel delivery device configured to deliver a solid fuel to the ignition chamber, a pair of electrodes coupled to the electrical power source and configured to supply power to the solid fuel to produce the at least one of plasma and thermal power; and a piston located within the ignition chamber and configured to move relative to the ignition chamber to output mechanical power.

Additional examples are directed to a system for producing mechanical power, comprising: an electrical power source of at least about 5,000 A; an ignition chamber configured to produce at least one of plasma and thermal power, wherein the ignition chamber includes an outlet port; a fuel delivery device configured to deliver a solid fuel to the ignition chamber to produce at least one of the plasma and the thermal power; a pair of electrodes coupled to the electrical power source and configured to supply power to the ignition chamber, and a turbine in fluid communication with the outlet port and configured to rotate to output mechanical power.

Further examples are directed to a system for producing mechanical power, comprising: an electrical power source of at least about 5,000 A; an impeller configured to rotate to output mechanical power, wherein the impeller includes a hollow region configured to produce at least one of plasma and thermal power and the hollow region includes an intake port configured to receive a working fluid; a fuel delivery device configured to deliver a solid fuel to the hollow region; and a pair of electrodes coupled to the electrical power source and configured to supply power to the hollow region to ignite the solid fuel and produce at least one of the plasma and the thermal power.

Additional examples are directed to a system for producing mechanical power, comprising: an electrical power source of at least about 5,000 A; a moveable element configured to rotate to output mechanical power, wherein the moveable element at least partially defines an ignition chamber configured to produce at least one of plasma and thermal power; a fuel delivery device configured to deliver a solid fuel to the ignition chamber; and a pair of electrodes coupled to the electrical power source and configured to supply power to the solid fuel to produce at least one of the plasma and the thermal power.

Further examples are directed to a system for producing mechanical power comprising: an electrical power source of at least about 5,000 A, a plurality of ignition chambers, wherein each of the plurality of ignition chambers is configured to produce at least one of plasma and thermal power; a fuel delivery device configured to deliver a solid fuel to the plurality of ignition chambers; and a plurality of electrodes coupled to the electrical power source, wherein at least one of the plurality of electrodes is associated with at least one of the plurality of ignition chambers and configured to supply electrical power to the solid fuel to produce at least one of the plasma and the thermal power.

Examples of the present disclosure are directed to a system for producing mechanical power comprising: an electrical power source of at least about 5,000 A; an ignition chamber configured to produce at least one of arc plasma and thermal power; a fuel delivery device configured to deliver a water-based fuel to the ignition chamber; a pair of electrodes coupled to the electrical power source and configured to supply power to the fuel to produce at least one of the arc plasma and the thermal power; and a piston fluidly coupled to the ignition chamber and configured to move relative to the ignition chamber to output mechanical power.

In addition, the present disclosure in directed to a system for producing mechanical power comprising: an electrical power source of at least about 5,000 A; an ignition chamber configured to produce at least one of arc plasma and thermal power, wherein the ignition chamber includes an outlet port; a fuel delivery device configured to deliver a water-based fuel to the ignition chamber, a pair of electrodes coupled to the electrical power source and configured to supply power to the fuel to produce at least one of the arc plasma and the thermal power; and a turbine in fluid communication with the outlet port and configured to rotate to output mechanical power.

Examples are also directed to a system for producing mechanical power, comprising: an electrical power source of at least about 5,000 A; an impeller configured to rotate to output mechanical power, wherein the impeller includes a hollow region configured to produce at least one of arc plasma and thermal power and the hollow region includes an intake port configured to receive a working fluid; a fuel delivery device configured to deliver a water-based fuel to the hollow region; and a pair of electrodes coupled to the electrical power source and configured to supply electrical power to the hollow region to ignite the water-based fuel and produce at least one of the arc plasma and thermal power.

The present disclosure is also directed to a system for producing mechanical power, comprising: an electrical power source of at least about 5,000 A; a plurality of ignition chambers, wherein each of the plurality of ignition chambers is configured to produce at least one of arc plasma and thermal power; a fuel delivery device configured to deliver a water-based fuel to the plurality of ignition chambers; and a plurality of electrodes coupled to the electrical power source, wherein at least one of the plurality of electrodes is associated with at least one of the plurality of ignition chambers and configured to supply electrical power to the water-based fuel to produce at least one of the arc plasma and the thermal power.

Also provided herein is an ignition chamber, comprising: a shell defining a hollow chamber configured to create at least one of plasma, arc plasma, and thermal power; a fuel receptacle in fluid communication with the hollow chamber, wherein the fuel receptacle is electrically coupled to a pair of electrodes; and a moveable element in fluid communication with the hollow chamber. Additionally disclosed is an ignition chamber, comprising: a shell

defining a hollow chamber; an injection device in fluid communication with the hollow chamber, wherein the injection device is configured to inject a fuel into the hollow chamber, a pair of electrodes electrically coupled to the hollow chamber and configured to supply electrical power to the fuel sufficient to produce at least one of at least one of plasma, arc plasma, and thermal power in the hollow chamber, and a moveable element in fluid communication with the hollow chamber.

Examples of the present disclosure are directed to a method for producing mechanical power comprising: delivering a solid fuel to an ignition chamber; passing a current of at least about 5,000 A through the solid fuel and applying a voltage of less than about 10 V to the solid fuel to ignite the solid fuel and produce at least one of plasma and thermal power; mixing at least one of the plasma and the thermal power with a working fluid; and directing the working fluid toward a moveable element to move the moveable element and output mechanical power.

Further examples of the present disclosure are directed to a method for producing mechanical power, comprising: delivering a water-based fuel to an ignition chamber; passing a current of at least about 5,000 A through the water-based fuel and applying a voltage of at least about 2 kV to the water-based fuel to ignite the water-based fuel to produce at least one of arc plasma and thermal power; mixing at least one of the arc plasma and the thermal power with a working fluid; and directing the working fluid toward a moveable element to move the moveable element and output mechanical power.

A method for producing mechanical power is also disclosed comprising: supplying a solid fuel to an ignition chamber; supplying at least about 5,000 A to an electrode electrically coupled to the solid fuel; igniting the solid fuel to produce at least one of plasma and thermal power in the ignition chamber, and converting at least some of at least one of the plasma and the thermal power into mechanical power. An additional method for producing mechanical power is disclosed comprising: supplying a water-based fuel to an ignition chamber; supplying at least about 5,000 A to an electrode electrically coupled to the water-based fuel; igniting the water-based fuel to form at least one of arc plasma and thermal power in the ignition chamber, and converting at least some of at least one of the arc plasma and the thermal power into mechanical power.

An additional example of the present disclosure is directed to a machine configured for land-based transportation, comprising: an electrical power source of at least about 5,000 A; an ignition chamber configured to produce at least one of at least one of plasma, arc plasma, and thermal power; a fuel delivery device configured to deliver a fuel to the ignition chamber; a pair of electrodes coupled to the electrical power source and configured to supply power to the fuel to produce the at least one of the plasma the arc plasma, and the thermal power; a moveable element fluidly coupled to the ignition chamber

and configured to move relative to the ignition chamber; and a drive-shaft mechanically coupled to the moveable element and configured to provide mechanical power to a transportation element.

An additional example of the present disclosure is directed to a machine configured for aviation transport, comprising: an electrical power source of at least about 5,000 A; an ignition chamber configured to produce at least one of at least one of plasma, arc plasma, and thermal power; a fuel delivery device configured to deliver a fuel to the ignition chamber; a pair of electrodes coupled to the electrical power source and configured to supply power to the fuel to produce the at least one of the plasma, the arc plasma, and thermal power; a moveable element fluidly coupled to the ignition chamber and configured to move relative to the ignition chamber; and an aviation element mechanically coupled to the moveable element and configured to provide propulsion in an aviation environment.

Examples of the present disclosure are also directed to a machine configured for marine transport, comprising: an electrical power source of at least about 5,000 A, an ignition chamber configured to produce at least one of at least one of plasma, arc plasma, and thermal power; a fuel delivery device configured to deliver a fuel to the ignition chamber; a pair of electrodes coupled to the electrical power source and configured to supply power to the fuel to produce the at least one of the plasma, the arc plasma, and the thermal power; a moveable element fluidly coupled to the ignition chamber and configured to move relative to the ignition chamber; and a marine element mechanically coupled to the moveable element and configured to provide propulsion in a marine environment.

Additional examples of the present disclosure re directed to work machines comprising: an electrical power source of at least about 5,000 A; an ignition chamber configured to produce at least one of at least one of plasma, arc plasma, and thermal power; a fuel delivery device configured to deliver a fuel to the ignition chamber, a pair of electrodes coupled to the electrical power source and configured to supply power to the fuel to produce the at least one of the plasma, the arc plasma, and the thermal power; a moveable element fluidly coupled to the ignition chamber and configured to move relative to the ignition chamber, and a work element mechanically coupled to the moveable element and configured to provide mechanical power.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic drawing of a CIHT cell in accordance with an embodiment of the present disclosure.

FIGURE 2 is a schematic drawing of a CIHT cell dipolar plate in accordance with an embodiment of the present disclosure.