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AN ENGINE

Technical Field

- 5 The present invention relates to engines and in particular, steam engines.

Background of the Invention

10 Prior art engines generate mechanical energy from heat energy. For instance, in a typical motor vehicle, petrol is combusted in a cylinder and piston arrangement in order to provide mechanical energy.

15 A problem with such engines is that they require relatively expensive fossil fuels such as petrol to operate. The waste products produced by combusting petrol also tends to be harmful to both humans and the environment.

20 Steam-driven engines have sought to provide a cheaper and more environmentally friendly alternative to petrol-driven engines. However, a problem exists in being able to efficiently harness the power generated by the expansion of steam within a piston-cylinder arrangement on an ongoing basis.

Summary of the Invention

25 The present invention seeks to provide a method and apparatus for alleviating at least one of the above-mentioned problems in the prior art.

The present invention involves several different broad forms. Embodiments of the invention may include one or any combination of the different broad forms herein described.

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In a first broad form, the present invention provides a system for controllably generating mechanical power from a piston engine without combusting fuel, wherein the system includes:

a piston slidably engagable with a cylinder so as to define a chamber being variable between a relative minimum volume, and, a relative maximum volume;

5 a means of supplying water vapour into the chamber when the chamber substantially has the relative minimum volume; and

a means of supplying Hydrogen into the chamber when the chamber substantially has the relative minimum volume; and

10 a means of supplying heated air into the chamber into the chamber when the chamber substantially has the relative minimum volume.

Preferably, the water vapour supply means includes a water receptacle for storing a first supply of water, and, a water vapour nozzle via which water vapour may be supplied into the chamber from the water receptacle to the chamber. Preferably the water vapour may form within the
15 chamber when water, under pressure, is injected into the relative minimum volume of the chamber. Typically, water vapour which is supplied into the chamber is pre-heated to approximately boiling point.

Preferably, the Hydrogen may be produced by the process of electrolysis. Preferably, the
20 present invention includes an air-tight container having a second supply of water disposed therein. Typically, the container may include a glass material. Also typically the second supply of water may be warm. Preferably, a cathode and an anode are connected to negative and positive terminals of a power supply respectively and are inserted into the second supply of water within the container. An electric current is able to be passed through the second
25 supply of water whereby Hydrogen gas may be formed at the cathode and oxygen from the water forms at the anode. Preferably, a valve connects the container with the chamber so as to allow for a controlled supply of Hydrogen to enter into the chamber during operation of the present invention.

30 Preferably, the present invention includes a releasably sealable reservoir adapted for temporarily storing heated air before the heated air is released into the chamber. Preferably, the releasably sealable reservoir includes a valve and a means for automating

activation of the valve between an open and closed position. Typically, the valve may include an electro-magnetic valve. Typically, automated control of the electro-magnetic valve may be effected by way of a pre-programmed micro-controller which may be interfaced with the electro-magnetic valve.

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Also preferably, the present invention includes a means of generating the heated air which is to be mixed with water vapour and Hydrogen in the chamber. Typically, the present invention includes an air inlet nozzle via which air may be supplied into the chamber. Preferably, the air supplied into the chamber is substantially free of water.

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Typically, the means of generating heated air includes the piston and cylinder arrangement which may be adapted to compress relatively unheated air disposed within the chamber, thereby heating the air. Preferably when air is compressed within the chamber, the compressed, and heated air is forced into the releasably sealable reservoir by the upstroke motion of the piston relative to the cylinder piston. Preferably, the reservoir valve may be automatically opened at the time that air within the chamber is being compressed, thereby allowing the heated air to be forced into the reservoir. The heated air reservoir valve may thereafter be automatically closed once the heated air has been substantially forced into the reservoir, thereby providing temporary storage for the heated air.

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Preferably, the present invention may further include a heating element disposed in the releasably sealable reservoir whereby the heating element may further raise, or at least maintain, the temperature of air stored in the reservoir. Typically, the heating element includes a resistance wire having an electric current passed through it. Also typically, the heated air may have a temperature of at least about 500° Centigrade. In certain embodiments of the present invention, the releasably sealable heated air reservoir may be located adjacent to the water receptacle such that the temperature of the water stored within the water receptacle may be raised by heat flow from the heated air reservoir.

30 Preferably, the present invention includes a recirculating means for recirculating water from the chamber to the water receptacle, said recirculating means including an exhaust valve disposed on the chamber via which water within the chamber is able to be evacuated

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from the chamber. Water which has been exhausted from the chamber via the exhaust may, during the course of transport from the exhaust valve to the water receptacle, undergo condensation.

- 5 Preferably, the present invention includes a pressure sensor adapted to detect when the water vapour has substantially ceased expanding within the chamber. More preferably, the sensor output may serve as a trigger for opening the exhaust valve when expansion of water vapour has substantially ceased. For instance, the sensor output may be interfaced with the exhaust valve via the micro-controller.

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Typically, the exhaust valve is opened when the piston is less than half-way through the completion of its downstroke. Advantageously, the sensor assists in effecting timely actuation of the exhaust valve so as to alleviate the occurrence of contraction of air, water vapour, and/or a decrease in temperature when the water vapour has ceased expanding
15 within the chamber.

Preferably, the present invention includes a means of thermally insulating the engine. For instance, this may include a thermal casing adapted to enclose the chamber.

- 20 In a second broad form, the present invention includes a method of controllably generating mechanical power from a piston engine without combusting fuel, said piston engine including a piston slidably engagable with a cylinder so as to define a chamber being variable between a relative minimum volume, and, a relative maximum volume, said method including the steps of:

- 25 (i) supplying water vapour into the chamber when the chamber substantially has the relative minimum volume;
(ii) supplying Hydrogen into the chamber when the chamber substantially has the relative minimum volume;
(iii) thereafter supplying heated air into the chamber when the chamber
30 substantially has the relative minimum volume;

whereby, interaction of the heated air with the water vapour and Hydrogen within the chamber results in expansion of Hydrogen and water vapour within the chamber.

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Preferably, the present invention includes an initial step of generating heated air within the chamber. More preferably, this step precedes step (i) described above. Also preferably, this step includes introducing relatively unheated, and substantially water-free air into the chamber via an air inlet valve disposed on the chamber, before water vapour is supplied
5 into the chamber, and, typically when the piston is moving through a first downstroke. Typically, the relatively unheated air supplied into the chamber is compressed by the return upstroke motion of the piston within the cylinder, thereby compressing and heating the air. Preferably, the heated air is forced into the releasably sealable reservoir as air in the cylinder is being compressed by the piston. Typically, the releasably sealable reservoir
10 includes a sub-compartment of the chamber.

Preferably, the present invention includes the step of producing a supply of Hydrogen. Typically this step commences before step (i) such that a suitable amount of Hydrogen is produced. Typically, this step is ongoing such that a constant supply of Hydrogen gas may
15 be available.

More preferably, the step of producing the Hydrogen, includes the step of conducting electrolysis of water in a container. Preferably, the present invention includes a container having a second supply of water disposed therein. Typically, the container may include a
20 glass material. Also typically the second supply of water may be warm. Preferably, a cathode and an anode are connected to negative and positive terminals of a power supply respectively and are inserted into the second supply of water within the container. An electric current is able to be passed through the second supply of water whereby Hydrogen gas forms at the cathode and oxygen from the water forms at the anode. Preferably, a
25 valve connects the container with the chamber so as to allow for a controlled supply of Hydrogen to enter into the chamber during operation of the present invention.

Preferably, the step of supplying the water vapour in to the cylinder occurs at the commencement of a second downstroke of the piston relative to the cylinder.
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Preferably, step (ii) above occurs substantially instantaneously after the commencement of step (i) described above.

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Preferably, the present invention includes the further step of evacuating exhausted water vapour from the chamber via the exhaust valve during a second upstroke of the piston relative to the cylinder. Typically this step also involves the use of a micro-controller to automatically activate the opening of the exhaust valve.

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Brief Description of the Drawings

The present invention will become more fully understood from the following detailed description of a preferred but non-limiting embodiment thereof, described in connection with the accompanying drawings, wherein:

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- Figure 1 depicts a first embodiment of the present invention wherein substantially water-free air has been supplied into a chamber formed by a cooperatively engaged piston and cylinder and the first downstroke of the piston has been completed.

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- Figure 2 depicts the first embodiment of the present invention wherein the air in the chamber has been compressed by an up-stroke of the piston, and the compressed air has been releasably stored into a releasably sealable reservoir at the top of the chamber.

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- Figure 3 depicts the first embodiment of the present invention wherein water vapour and Hydrogen is supplied into the chamber. The heated air is thereafter supplied into the chamber from the releasably sealable reservoir to expand Hydrogen and the water vapour thereby driving a piston downstroke.

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- Figure 4 depicts the first embodiment of the present invention wherein the downstroke described in Fig. 3, and, the following return upstroke have been completed whereby the exhaust valve has been opened to allow exhausting of water.

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Best Modes for Carrying out the Invention

Figures 1 to 4 show a first embodiment of an engine (1) including a piston (7) slidably engaged with a cylinder (12) to define a chamber (6) of variable volume. A connecting rod (8) extends from the piston (7) and is rotatably engaged with a crankshaft (11) via a cam profile (10).

The first embodiment also includes a water reservoir (15) for storing a supply of water, a water vapour nozzle (5) through which water vapour is able to be supplied into the chamber (6) from the water reservoir (15), an air inlet valve (2) through which substantially water-free air is able to be supplied into the chamber (6), and an exhaust valve (4) through which the contents of the chamber (6) may be evacuated. The air inlet valve (2) and the exhaust valve (4) are electronically actuated.

A heated-air reservoir (3) is also disposed on the cylinder (12) as shown in Fig. 1 for releasably storing heated air.

The water receptacle (15) is located adjacent to the heated-air reservoir (3) as shown in Figs. 1 to 4, and is used to contain a supply of water. The relative proximity of the heated-air reservoir (3) to the water receptacle (15) allows at least some heat transfer to occur from the heated air reservoir (3) to the water receptacle (15) so as to assist in partially pre-heating the water prior to being supplied in to the chamber (6). In certain other embodiments of the present invention, an independent heating element is disposed in the water receptacle and adapted to function in much the same manner as a heating element is used in an electric kettle to boil water. In the first embodiment, the water temperature is at least about boiling point before being supplied into the chamber.

The embodiment (1) also includes a means of producing Hydrogen. Specifically, the process of electrolysis is used to extract Hydrogen gas from a second supply of water (18) disposed in an air-tight container (17). The container is mounted on an upper surface of the cylinder (12) and allows for Hydrogen produced therein to be controllably fed into the chamber (6) from the container (17) via an interconnecting valve (19). The container (17)

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in which the second supply of water (18) is held is made of glass. The second supply of water (18) is warm. A graphite cathode (14) and an anode (14') are connected to negative and positive terminals of a power supply (20) respectively and are inserted into the second supply of water (18) within the container (17). In this embodiment, the power supply
5 includes a 12 Volt battery. When an electric current is passed through the second supply of water (18) Hydrogen gas forms at the cathode (14) and oxygen from the water forms at the anode (14'). As the Hydrogen is formed, It accumulates in the space above the water (18) within the container (17). Pressure is applied to the Hydrogen in the container (17) to cause the evacuation of Hydrogen into the chamber via the valve (19).

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The piston (7) is slidably engaged with the cylinder (12) such that it may be varied between at least a first position and a second position. When the piston (7) is arranged in the first position, the chamber (6) volume is at a relative minimum as shown in Fig. 2. When the piston (7) is arranged in the second position, the chamber (6) is at a relative
15 maximum volume as shown in Fig. 1.

In the first embodiment, the movement of the piston (7) in a direction from the first to the second position is referred to as the downstroke, and, the movement of the piston (7) in a direction from the second position to the first position is referred to as the upstroke. The
20 first embodiment of the invention involves a 4-stroke cycle, including 2 downstrokes and 2 corresponding upstrokes, which will be described in further detail as follows.

Figure 1 shows the piston (7) arranged in the second position relative to the cylinder (12) following the completion of the first downstroke. During the first downstroke, the air inlet
25 valve (2) is opened and substantially water-free air is supplied into the chamber (6). At this time, the exhaust valve (4), and water inlet valve (5) are closed. The downward movement of the piston (7) relative to the cylinder (12) creates a vacuum within the chamber (6) which assists in the inward flow of air into the chamber (6). In other embodiments of the present invention, it is conceivable that air may also be forced into the cylinder (12) with
30 the assistance of a pump or a fan. The air inlet valve (6) remains opened until the piston (7) has moved completely through the first downstroke and into the second position (7), and thereafter, the air inlet valve (6) is closed to prevent any further air from entering the

chamber (6).

Figure 2 shows the piston (7) arranged in the first position relative to the cylinder (12) after the completion of the first return up-stroke. A person skilled in the art would appreciate that the rotation of the cam profile (10) causes the connecting rod (8) to force the piston (7) from the second position in to the first position. During the up-stroke, the air within the chamber (6) undergoes compression which causes the air to become heated. The temperature of the compressed air is at least about 500 degrees centigrade although it would be appreciated by a person skilled in the art that the temperature of the compressed air may vary in alternative embodiments. A heating element (16) is also disposed within the heated-air reservoir (3) to enable further heating of the heated air stored therein. In this embodiment, the heating element (16) includes resistive wire through which a current is able to be passed.

Whilst the first up-stroke is taking place, the heated-air reservoir valve (9) is opened to allow the heated air to fill the receptacle as it is being compressed between the piston (7) and the cylinder (12). The heated-air reservoir valve (9) is thereafter closed to releasably seal in the heated air as shown in Figure 2. The micro-controller device is interfaced with the heated-air reservoir valve (9) (which in this embodiment is an electro-magnetically actuated valve). The timing of the opening and closing of the valve (9) is pre-programmed into the micro-controller.

Upon commencement of the second downstroke, the air inlet valve (2), exhaust valve (4), and the heated-air reservoir valve (9) remain closed in order to substantially prevent air from entering the chamber (6). As the piston (7) is in the first position and the second downstroke commences, water contained in the water receptacle (15) is supplied into the chamber (6) via the water vapour nozzle (5). As the piston (7) proceeds further into the second downstroke, the water is vapourised within the chamber (6) as depicted in Fig. 3. Approximately 3 cubic centimetres of water is used to fill a one litre vacuum of the expanded chamber (6). Substantially instantaneously after the water vapour has been supplied into the chamber (6), the Hydrogen produced in the container (17) is also injected into the chamber via the valve (19).

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Approximately 10 milliseconds after the water vapour is injected in to the chamber, and whilst the piston (7) is moving through the second downstroke, the heated-air reservoir valve (9) is opened and the heated air is supplied into the chamber (6). The water vapour and extracted Hydrogen within the chamber (6) expands upon interaction with the heated
5 air, thereby forcing the piston (7) futher into the second downstroke, or power stroke, and the connecting rod (8) causes rotation of the crankshaft (11) via the cam profile (10).

A pressure sensor (13) is used to monitor when the water vapour has substantially ceased expanding within the chamber (6). In the first embodiment, cessation of expansion
10 substantially coincides with the piston (7) being disposed in an intermediate position between the first and second position as the piston (7) is proceeding through the second downstroke. The piston (7) is shown in the intermedieate position relative to the cylinder (12) in Fig. 3. A pressure sensor (13) is mounted within the cylinder (12), and is interfaced with the exhaust valve (4) via the micro-controller device such that when the sensor detects
15 that the water vapour has substantially ceased expanding, the micro-controller relays a control signal to the exhaust valve to actuate opening of the exhaust valve (4).

The expanded vapour within the chamber is evacuated via the opened exhaust valve (4) as the piston (7) is completing the second downstroke, and the following second upstroke. As
20 the second upstroke is completed, the exhausted water vapour condenses and is recirculated from the exhaust valve (4) to the water inlet (5) for re-use. Figure 4 depicts the engine (1) after the completion of the second upstroke. In alternative embodiments, the water may be circulated around the engine (1) to also serve as a coolant.

25 It would be further appreciated by a person skilled in the art that thermal insulation is employed in the first embodiment as a means of alleviating water loss.

In the first embodiment, the relative minimum volume of the chamber (6) is calibrated to be approximately equal to the sum of the heated-air reservoir (3) volume and the volume of
30 water which is injected in to the chamber (6).

It would be appreciated by a person skilled in the art that when air heats, it tends to expand

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and become lighter. This process is analogous to the way in which a hot air balloon operates. The weight of the balloon and cargo are substantially neglected.

In view of this, the air that is compressed and heated during the first upstroke of the piston relative to the cylinder will tend to have many times the cubic capacity that it had prior to heating. Air during quick compression, heats at a much faster rate than the rate at which the same air cools during decompression. In order to ascertain that the opposite effect to quick compression heating is negated during the cycle that creates the vacuum and hence the vapour, a turbo charger air in-take system is used. Such a system typically involves the use of a fan or turbine to drive more air in to the cylinder for compression.

It would be appreciated by a person skilled in the art that an existing petrol or diesel engine is able to be modified/retro-fitted to provide a further embodiment. Amongst other things, the spark plugs in a common engine would normally be replaced by a plurality of heated air storage chambers similar to the above-described first embodiment, and, the length of the piston(s) in the existing petrol or diesel engine would ordinarily need to be adjusted to increase the compression ratio.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described without departing from the scope of the invention. All such variations and modification which become apparent to persons skilled in the art, should be considered to fall within the spirit and scope of the invention as broadly hereinbefore described. It is to be understood that the invention includes all such variations and modifications. The invention also includes all of the steps and features, referred or indicated in the specification, individually or collectively, and any and all combinations of any two or more of said steps or features.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that that prior art forms part of the common general knowledge.

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CLAIMS:

1. A system for controllably generating mechanical power from a piston engine without combusting fuel, wherein the system includes:

- 5 a piston slidably engagable with a cylinder so as to define a chamber being variable between a relative minimum volume, and, a relative maximum volume;
a means of supplying water vapour into the chamber when the chamber substantially has the relative minimum volume; and
a means of supplying Hydrogen into the chamber when the chamber
10 substantially has the relative minimum volume; and
a means of supplying heated air into the chamber when the chamber substantially has the relative minimum volume.

2. A system as claimed in claim 1 including a water vapour supply means.

15 3. A system as claimed in claim 2 wherein the water vapour supply means includes:
a water receptacle for storing a first supply of water; and
a water vapour nozzle via which water vapour may be supplied into the chamber from the water receptacle to the chamber.

20 4. A system as claimed in any one of the preceding claims including a means of producing Hydrogen.

5. A system as claimed in claim 4 wherein the means of producing Hydrogen includes
25 a means of extracting Hydrogen from water by the process of electrolysis.

6. A system as claimed in any one of the preceding claims wherein the water vapour supplied into the chamber is pre-heated to at least about boiling point.

30 7. A system as claimed in any one of the preceding claims including a releasably sealable reservoir adapted for storing heated air.

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8. A system as claimed in claim 7 wherein the releasably sealable reservoir includes a valve and a control means for automating activation of the valve between an open and closed position.

5 9. A system as claimed in claim 8 wherein the means of automating activation of the valve includes a micro-controller which is interfaced with the valve.

10. A system as claimed in any one of claims 8 or 9 wherein the valve includes an electro-magnetic valve.

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11. A system as claimed in any one of the preceding claims including a means of generating the heated air.

12. A system as claimed in claim 11 wherein the means of generating the heated air
15 includes the piston and cylinder for compressing air within the chamber, thereby heating the air.

13. A system as claimed in claim 12 including an air inlet nozzle disposed on the cylinder via which air may be supplied into the chamber from an external air supply prior
20 to compression between the piston and the cylinder.

14. A system as claimed in any one of claims 11 to 13 wherein the air supplied into the chamber is substantially free of water.

25 15. A system as claimed in any one of the preceding claims including a recirculating means for recirculating water from the chamber to the means of supplying water vapour into the chamber.

30 16. A system as claimed in claim 15 wherein the recirculating means includes an exhaust valve disposed on the chamber via which the contents of the chamber is able to be evacuated from the chamber.

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17. A system as claimed in any one of the preceding claims including a pressure sensor for use in detecting when water vapour within the chamber has substantially ceased expanding.

18. A system as claimed in claim 17 wherein the output of the sensor is adapted to trigger opening of the exhaust valve.

19. A system as claimed in any one of the preceding claims including a means of thermally insulating the engine.

20. A method of controllably generating mechanical power from a piston engine without combusting fuel, said piston engine including a piston slidably engagable with a cylinder so as to define a chamber being variable between a relative minimum volume, and, a relative maximum volume, said method including the steps of:

- (i) supplying water vapour into the chamber when the chamber substantially has the relative minimum volume;
- (ii) supplying Hydrogen into the chamber when the chamber substantially has the relative minimum volume;
- (iii) thereafter supplying heated air into the chamber when the chamber has the relative minimum volume;

whereby, interaction of the heated air with the water vapour and Hydrogen within the chamber results in expansion of Hydrogen and water vapour within the chamber, thereby driving a piston downstroke.

21. A method as claimed in claim 21 including a step preceding step (i) of claim 20 wherein heated air is formed within the chamber.

22. A method as claimed in claim 21 wherein relatively unheated air is supplied into the chamber from an external air supply via an air inlet valve prior to formation of the heated air.

23. A method as claimed in claim 22 wherein the relatively unheated air is substantially

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free of water.

24. A method as claimed in any one of claims 22 or 23 wherein the relatively unheated air is supplied in to the chamber from the external air supply at the commencement of a
5 downstroke of the piston relative to the cylinder.

25. A method as claimed in any one of claims 22 to 24 wherein the heated air is formed within the chamber by the piston moving through an upstroke in the cylinder thereby compressing the relatively unheated air contained therein.

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26. A method as claimed in claim 25 wherein as the heated air is formed by compression between the piston and cylinder during the upstroke, the heated air is forced into a releasably sealable reservoir via an opened valve disposed on the reservoir, and, thereafter the valve is closed to temporarily trap the heated air within the reservoir.

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27. A method as claimed in any one of claims 20 to 26 wherein the step of supplying water vapour into the chamber includes supplying water into the chamber at the commencement of a downstroke of the piston in the cylinder.

28. A method as claimed in any one of claims 20 to 27 wherein the step of supplying Hydrogen into the chamber includes a preceding step of producing Hydrogen.

29. A method as claimed in claim 28 wherein the step of producing Hydrogen includes the step of effecting electrolysis of water.

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30. A method as claimed in any one of claims 20 to 29 wherein step (iii) of claim 20 occurs within approximately 10 milliseconds of step (i) commencing.

31. A method as claimed in any one of claims 20 to 30 including the step of evacuating
30 exhausted water vapour from the chamber via the exhaust valve when water vapour within the chamber has substantially ceased expanding.

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32. A method as claimed in claim 31 wherein a pressure sensor is used to detect when the water vapour within the chamber has ceased expanding.

33. A method as claimed in any one of claim 20 to 32 including the use of a micro-processor to automate operation of at least one of the following:

- the exhaust valve;
- the air inlet valve;
- the water vapour inlet valve.