US 20250264078A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0264078 A1**

Cho et al. (43) **Pub. Date: Aug. 21, 2025**

(54) **WATER MANAGEMENT SYSTEM FOR A HYDROGEN ENGINE**

(71) Applicants: **HYUNDAI MOTOR COMPANY**, Seoul (KR); **KIA CORPORATION**, Seoul (KR); **Hyundam Industrial Co., Ltd.**, Asan-si (KR)

(72) Inventors: **Seong Cheol Cho**, Seoul (KR); **Ju Tae Song**, Hwaseong-si (KR); **Seung Hwan Kim**, Pyeongtaek-si (KR); **Hyun Jeong Lim**, Hwaseong-si (KR); **Sung Won Lee**, Hwaseong-si (KR); **Seon Woo Boo**, Hwaseong-si (KR); **Yong Taek Hwang**, Cheonan-si (KR); **Bu Hyeon Cho**, Cheonan-si (KR); **Seung Hwan Lee**, Cheonan-si (KR)

(73) Assignees: **HYUNDAI MOTOR COMPANY**, Seoul (KR); **KIA CORPORATION**, Seoul (KR); **Hyundam Industrial Co., Ltd.**, Asan-si (KR)

(21) Appl. No.: **18/959,120**

(22) Filed: **Nov. 25, 2024**

(30) **Foreign Application Priority Data**

Feb. 19, 2024 (KR) 10-2024-0023159

Publication Classification

(51) **Int. Cl.**
F02M 25/022 (2006.01)

(52) **U.S. Cl.**
CPC ***F02M 25/0222*** (2013.01); ***F02M 25/0221*** (2013.01)

(57) **ABSTRACT**

A water management system for a hydrogen engine can reduce the volume of a water tank for storing therein cooling water to be injected to the hydrogen engine, and eliminate the need to refill the water tank. The water management system includes a water tank including a main space portion configured to store therein water for cooling the hydrogen engine and a sub space portion into which exhaust gas generated in the hydrogen engine is supplied. The water management system also includes: a water pump, provided in the water tank, to supply water stored in the main space portion of the water tank to the hydrogen engine; and an exhaust line, provided between the hydrogen engine and the water tank, and configured to deliver exhaust gas, containing water vapor, discharged from the hydrogen engine to the sub space portion of the water tank.

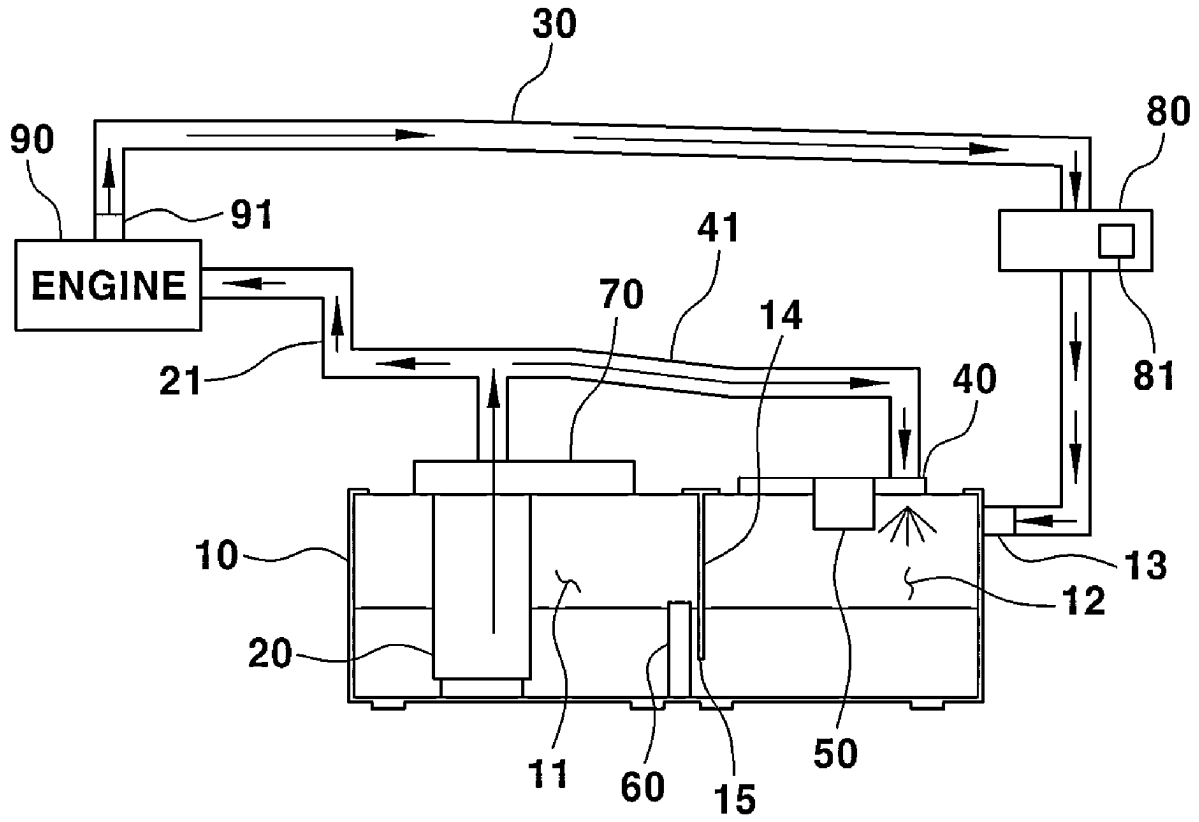


FIG. 1

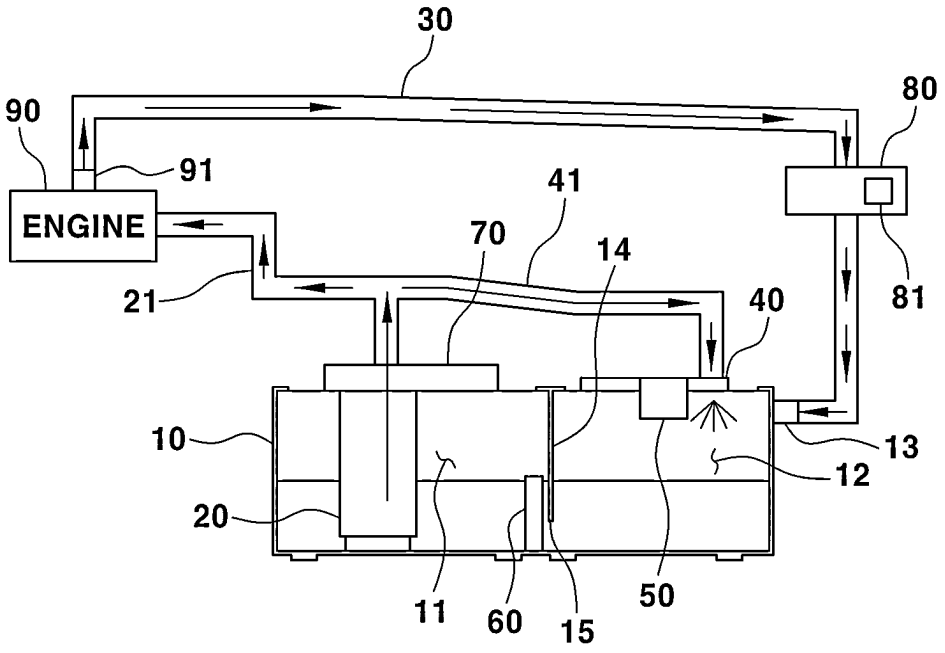


FIG. 2

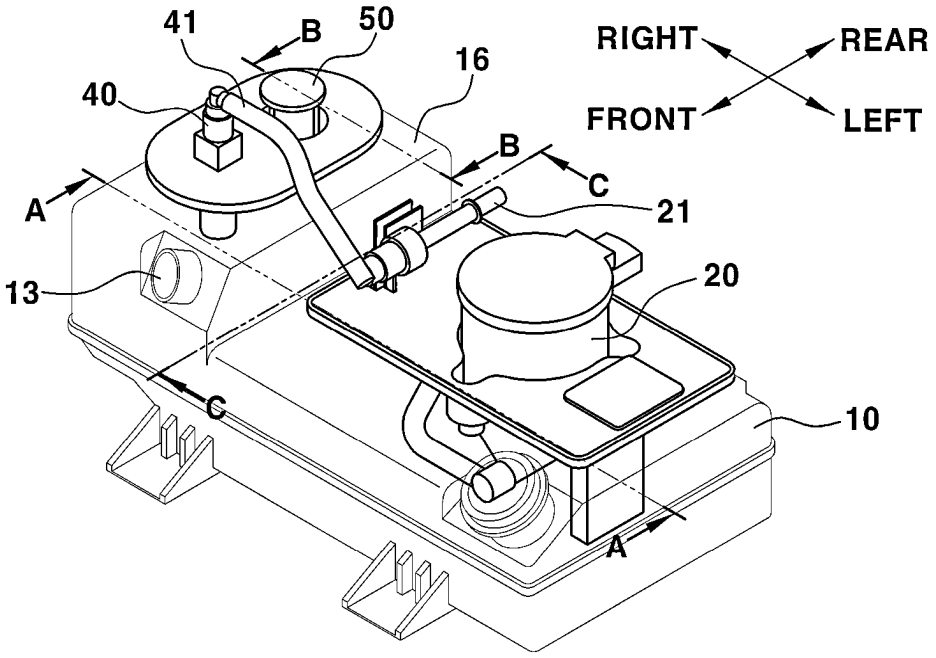


FIG. 3

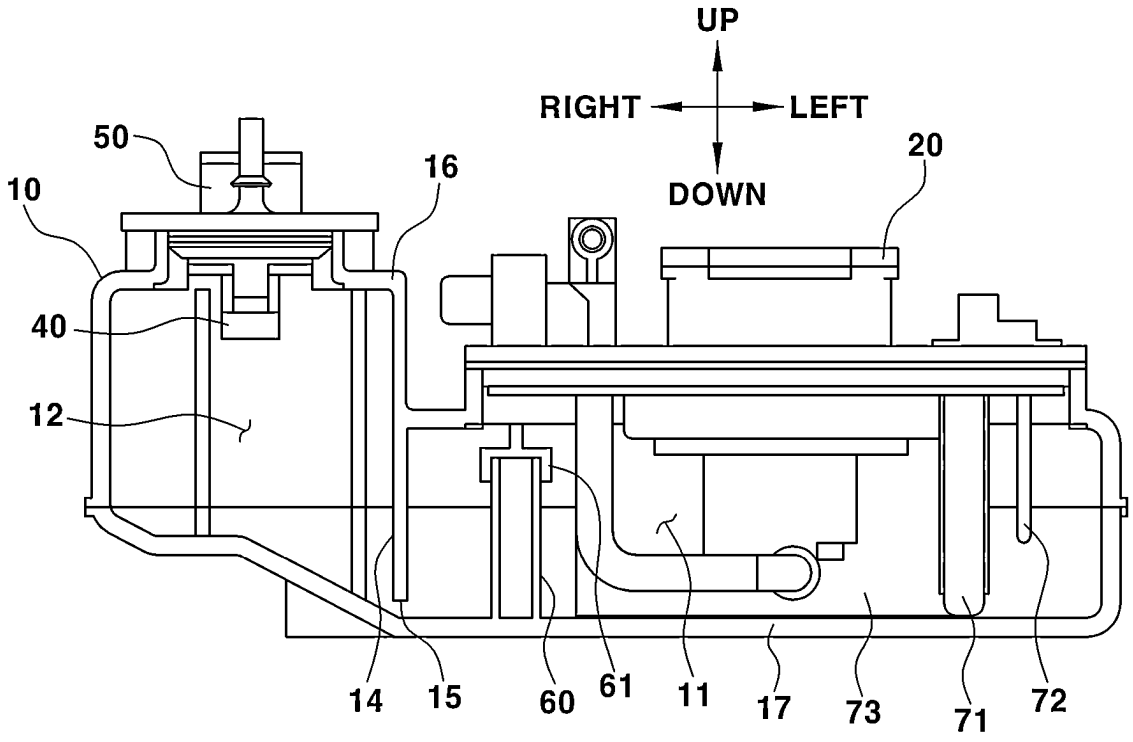


FIG. 4

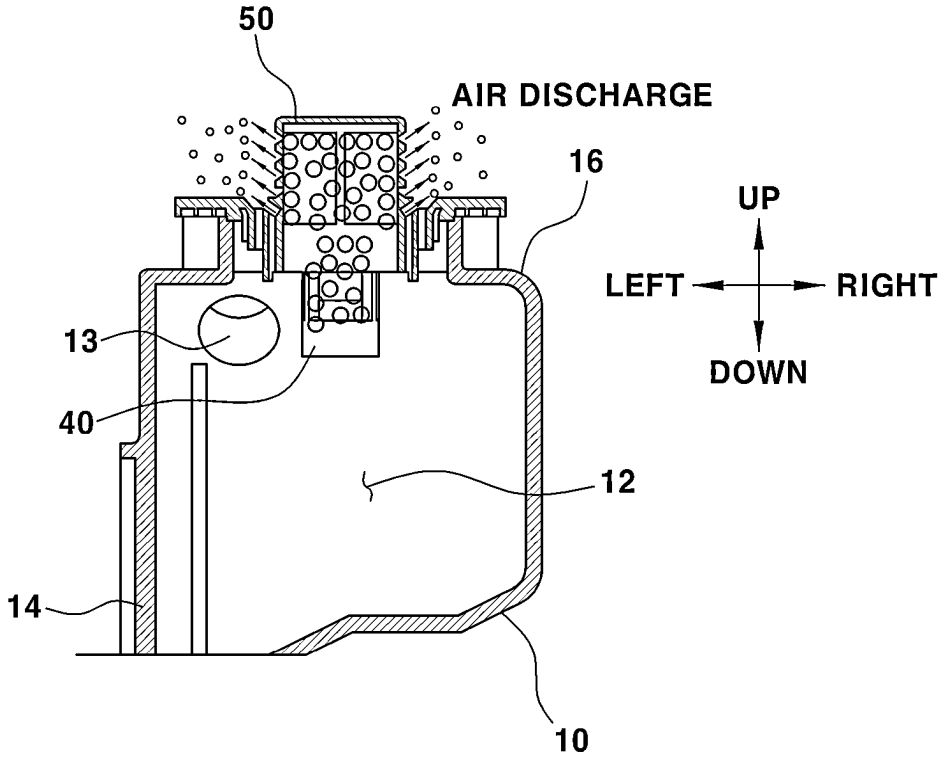


FIG. 5

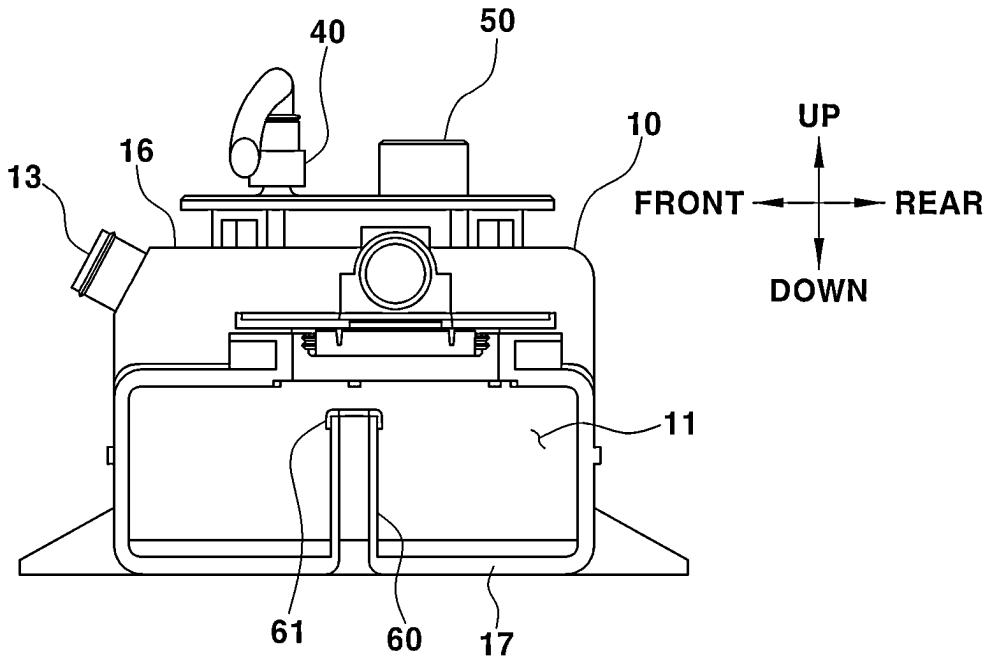


FIG. 6

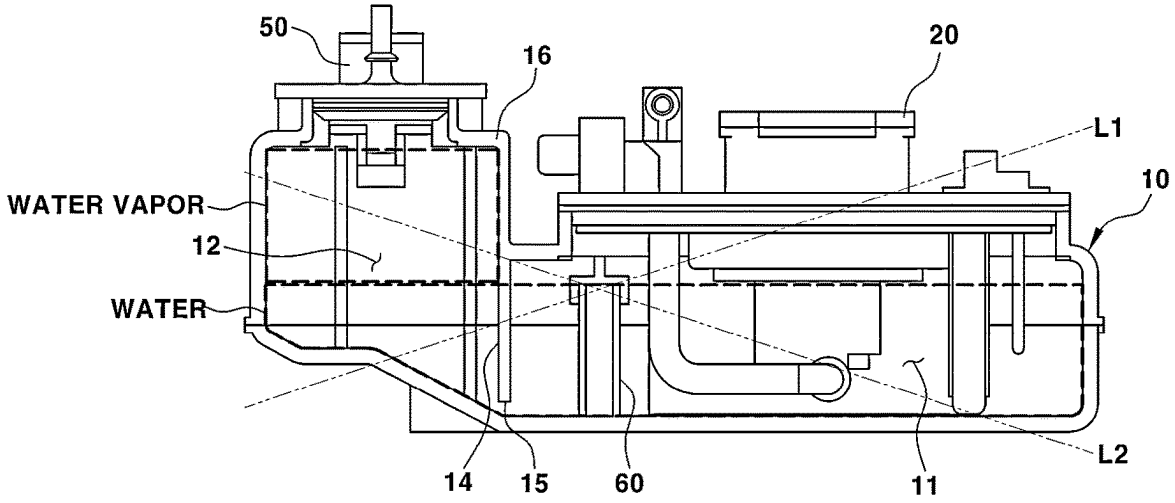

50
16
20
L1
10
WATER VAPOR
12
WATER
14
15
60
11
L2

FIG. 7

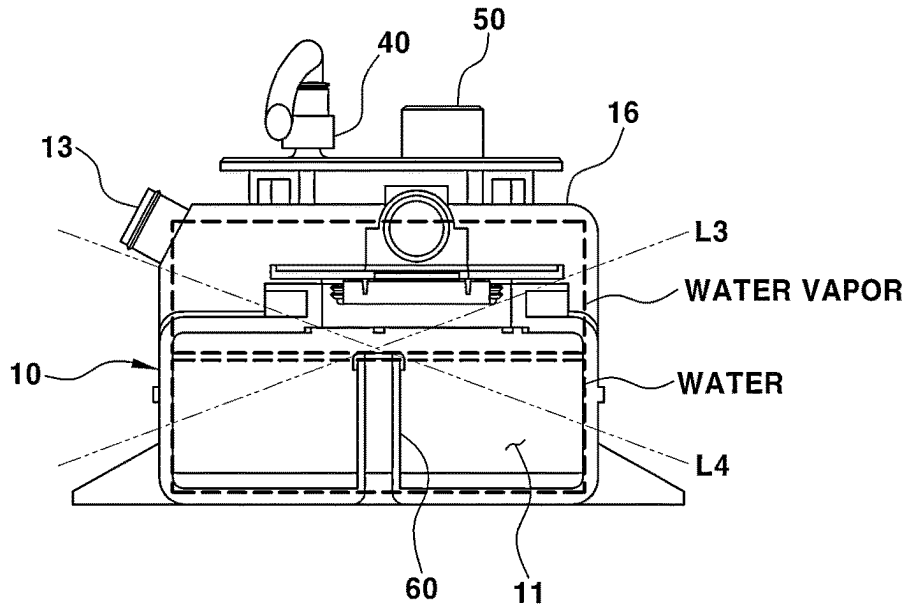
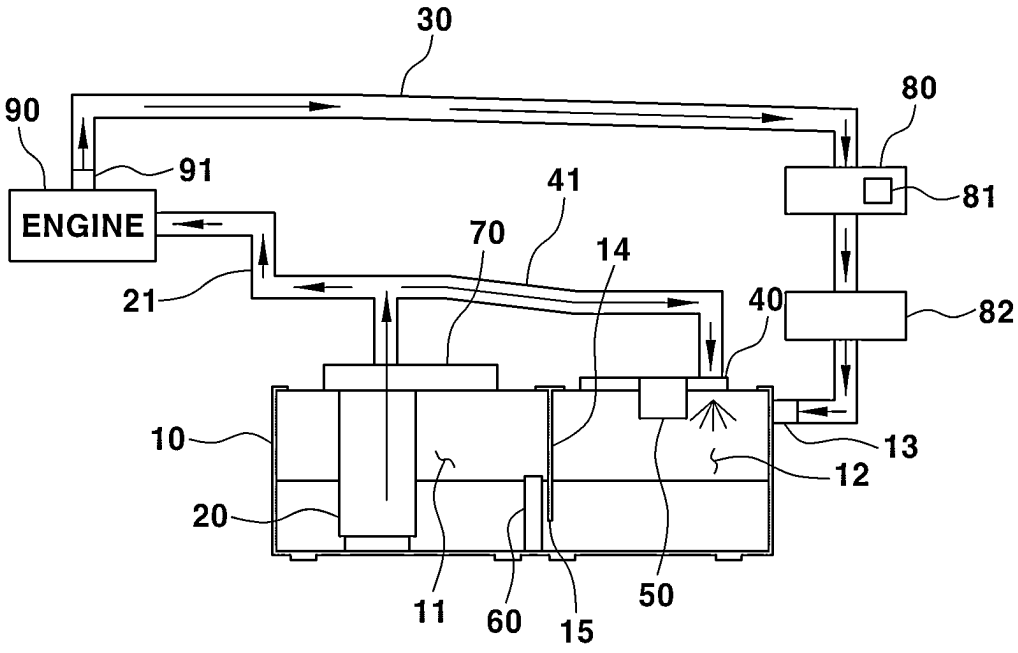

50
40
16
13
L3
WATER VAPOR
10
WATER
L4
60
11

FIG. 8



WATER MANAGEMENT SYSTEM FOR A HYDROGEN ENGINE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims, under 35 U.S.C. § 119(a), the benefit of and priority to Korean Patent Application No. 10-2024-0023159, filed on Feb. 19, 2024, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a water management system for a hydrogen engine. More particularly, it relates to a water management system for a hydrogen engine capable of reducing the volume of a water tank configured to store therein cooling water.

BACKGROUND

[0003] Recently, due to the cost issue of hydrogen fuel cells, interest in development of hydrogen engines capable of utilizing existing internal combustion engines is growing. Hydrogen engines use hydrogen as fuel and the structure thereof is the same as that of the existing internal combustion engines.

[0004] Vehicles equipped with the hydrogen engine have the great advantage of not causing air pollution, but have a significant disadvantage compared to hydrogen fuel cell vehicles in terms of range. For this reason, hydrogen engine vehicles have adopted thereto a water injection system configured to inject water to the hydrogen engine, increasing the efficiency of the hydrogen engine.

[0005] A conventional water injection system reduces the temperature within a combustion chamber of the hydrogen engine through water injection, preventing engine knocking and improving power performance and fuel efficiency of the vehicle.

[0006] However, the conventional water injection system requires a large-volume water tank to store water and a periodic refill of the water tank, which has the disadvantage of reducing vehicle's package freedom and user convenience.

[0007] The above information disclosed in this Background section is provided only to enhance understanding of the background of the present disclosure, and therefore it may contain information that does not form the prior art that is already known to a person of ordinary skill in the art.

SUMMARY

[0008] The present disclosure has been made in an effort to solve the above-described problems associated with the prior art, and an object of the present disclosure is to provide a water management system for a hydrogen engine capable of reducing the volume of a water tank configured to store therein cooling water that is to be supplied to the hydrogen engine, and eliminating the need to refill the water tank.

[0009] The object of the present disclosure is not limited to the foregoing, and other objects not mentioned herein should be clearly understood by those of ordinary skill in the art to which the present disclosure pertains based on the description below.

[0010] In one aspect of the present disclosure, a water management system for a hydrogen engine includes: a water tank including a main space portion configured to store therein water for cooling the hydrogen engine and a sub space portion into which exhaust gas generated in the hydrogen engine is supplied. The water management system further includes: a water pump, provided in the water tank and configured to supply the water stored in the main space portion of the water tank to the hydrogen engine, and an exhaust line provided between the hydrogen engine and the water tank. The exhaust line is configured to deliver exhaust gas, containing water vapor, discharged from the hydrogen engine to the sub space portion of the water tank.

[0011] In an embodiment, the water tank may be provided therein with a partition wall configured to separate the main space portion and the sub space portion from each other. Moreover, a gap through which water moves is provided between a lower surface portion of the partition wall and a lower wall portion of the water tank. Furthermore, excluding the gap, the sub space portion and the main space portion may be completely separated from each other by the partition wall.

[0012] In another embodiment, the water tank may be provided with an exhaust inlet connected to the exhaust line, and the exhaust inlet may be adjacent to the sub space portion. Moreover, an expanded portion may be disposed at an upper wall portion of the water tank, and the sub space portion may be expanded upward more than the main space portion by the expanded portion. Here, the exhaust inlet may be disposed at an upper side portion of the expanded portion.

[0013] In still another embodiment, the water tank may be provided with a cooling nozzle configured to spray the water onto the exhaust gas introduced into the sub space portion. The cooling nozzle may be connected to the water pump via an injection line and may be supplied with the water stored in the main space portion through the injection line. The water pump may be connected to the hydrogen engine via a water supply line, and the injection line may be connected to the cooling nozzle by being branched off from the water supply line.

[0014] In yet another embodiment, the water tank may be provided with a moisture separation filter configured to filter moisture contained in exhaust gas in the sub space portion. The moisture separation filter may discharge air contained in the exhaust gas in the sub space portion out of the water tank.

[0015] In still yet another embodiment, the water tank may be provided with a drain port configured to discharge water that exceeds a determined capacity of the water tank. The drain port may extend vertically upward from a lower wall portion of the water tank, and may be placed in the main space portion.

[0016] In a further embodiment, the exhaust line may further include an exhaust cooler configured to cool the exhaust gas transferred to the sub space portion.

[0017] Other aspects and embodiments of the present disclosure are discussed below.

[0018] It is to be understood that the term "vehicle" or "vehicular" or other similar terms as used herein are inclusive of motor vehicles in general, such as passenger automobiles including sport utility vehicles (SUV), buses, trucks, various commercial vehicles, watercraft including a variety of boats and ships, aircraft, and the like, and include hybrid vehicles, electric vehicles, plug-in hybrid electric vehicles, hydrogen-powered vehicles, and other alternative fuel vehicles (e.g., fuels derived from resources other than petroleum). As referred to herein, a hybrid vehicle is a

vehicle that has two or more sources of power, for example, a vehicle powered by both gasoline and electricity.

[0019] The above and other features of the present disclosure are discussed below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The above and other features of the present disclosure are now described in detail with reference to certain embodiments thereof illustrated in the accompanying drawings which are given hereinbelow by way of illustration only, and thus are not limitative of the present disclosure, and wherein:

[0021] FIG. **1** is a view schematically illustrating the configuration of a water management system for a hydrogen engine according to an embodiment of the present disclosure;

[0022] FIG. **2** is a perspective view illustrating a water tank of a water management system according to an embodiment of the present disclosure;

[0023] FIG. **3** is a cross sectional view seen from A-A in FIG. **2**;

[0024] FIG. **4** is a cross sectional view seen from B-B in FIG. **2**;

[0025] FIG. **5** is a cross sectional view seen from C-C in FIG. **2**;

[0026] FIG. **6** and FIG. **7** are views illustrating an example of the water surface in a water tank when a vehicle travels on an incline; and

[0027] FIG. **8** is a view illustrating a water management system for a hydrogen engine according to a different embodiment of the present disclosure.

[0028] It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the present disclosure. The specific design features of the present disclosure, including, for example, specific dimensions, orientations, locations, and shapes, should be determined in part by the particular intended application and usage environment.

[0029] In the figures, the reference numbers refer to the same or equivalent parts of the present disclosure throughout the several figures of the drawing.

DETAILED DESCRIPTION

[0030] Hereinafter, embodiments of the present disclosure are described with reference to the accompanying drawings. The matters described in the attached drawings may be different from those actually implemented in order to facilitate description of the embodiments of the present disclosure.

[0031] The present disclosure relates to a water management system for a hydrogen engine that uses hydrogen as fuel, wherein the water management system recovers water discharged from the hydrogen engine and uses the same as cooling water for the hydrogen engine.

[0032] In other words, according to the present disclosure, the water discharged from the hydrogen engine is recovered and supplied to the hydrogen engine, thereby reducing the volume of a tank that stores therein water for cooling the hydrogen engine. Thus, there is no need to refill the tank with water.

[0033] According to an embodiment of the present disclosure, as illustrated in FIG. **1**, the water management system for a hydrogen engine includes: a water tank **10** configured to store therein water for cooling a hydrogen engine **90**, and a water pump **20** configured to supply the water stored in the water tank **10** to the hydrogen engine **90**.

[0034] In one embodiment, an exhaust line **30** for the flow and transfer of exhaust gas is disposed between the hydrogen engine **90** and the water tank **10**. Opposite ends of the exhaust line **30** are connected to an exhaust outlet **91** of the hydrogen engine **90** and an exhaust inlet **13** of the water tank **10**, respectively. The exhaust line **30** may deliver and supply exhaust gas generated through hydrogen combustion in the hydrogen engine **90** to the water tank **10**.

[0035] Because the hydrogen engine **90** uses hydrogen as fuel, the exhaust gas contains a large amount of water vapor. In other words, the high-temperature exhaust gas discharged from the hydrogen engine **90** has a relatively high water vapor content.

[0036] The exhaust line **30** is provided with an exhaust system **80** configured to process the exhaust gas from the hydrogen engine **90**. Although not specifically illustrated, the exhaust system **80** includes an exhaust purification module **81** configured to purify the exhaust gas. The exhaust purification module **81** may include a catalytic converter configured to purify the exhaust gas discharged from the hydrogen engine **90**. With this structure, contaminants in the exhaust gas are removed while the exhaust gas passes through the exhaust purification module **81**, and then the exhaust gas becomes water vapor.

[0037] In other words, the exhaust gas from the hydrogen engine **90** is converted to water vapor while passing through the exhaust system **80**, and becomes water vapor before reaching the exhaust inlet **13** of the water tank **10**. Accordingly, the exhaust gas purified by the exhaust purification module **81** (i.e., water vapor) is supplied and introduced into the water tank **10**.

[0038] Referring to FIG. **2** and FIG. **3**, the water tank **10** has an internal space where water for cooling the engine is stored, and the internal space is divided into a main space portion **11** and a sub space portion **12**.

[0039] The main space portion **11** stores therein water that is supplied to the hydrogen engine **90** through the water pump **20**. The main space portion **11** has disposed therein the water pump **20**, and the water pump **20** is mounted in the water tank **10** to pump the water stored in the main space portion **11**.

[0040] The sub space portion **12** receives the exhaust gas generated from the hydrogen engine **90**. Specifically, the sub space portion **12** receives the exhaust gas purified while passing through the exhaust system **80** (i.e., water vapor).

[0041] In another embodiment, the water tank **10** is provided therein with a partition wall **14** to divide the internal space in the water tank **10** into the main space portion **11** and the sub space portion **12**. The partition wall **14** has a structure extending downward from an upper wall portion of the water tank **10**. Here, an upper surface portion of the partition wall **14** is integrated with the upper wall portion of the water tank **10**, and a lower surface portion of the partition wall **14** is separated from a lower wall portion **17** of the water tank **10**.

[0042] In one embodiment, a gap **15** is provided between the lower surface portion of the partition wall **14** and the lower wall portion **17** of the water tank **10**. The gap **15** serves as a passage through which water condensed in the sub space portion **12** moves to the main space portion **11**.

The sub space portion **12** and the main space portion **11** are separated from each other by the partition wall **14** and are connected to each other through the gap **15**. In other words, excluding the gap **15**, the sub space portion **12** and the main space portion **11** are completely separated from each other by the partition wall **14**. The gap **15** allows fluid communication between the main space portion **11** and the sub space portion **12**.

[0043] In an embodiment of the present disclosure, the upper and side surface portions of the partition wall **14** may be integrated with the upper and side wall portions of the water tank **10** or may be air-tightly joined to the upper and side wall portions of the water tank **10**.

[0044] The partition wall **14** provided in the water tank **10** may block water vapor in the sub space portion **12** from moving and being introduced into the main space portion **11** and also may suppress the flow of water in the water tank **10** when the vehicle is traveling, preventing the water in the water tank **10** from moving to and flowing back into the exhaust inlet **13**.

[0045] As illustrated in FIG. **1**, the exhaust gas discharged from the exhaust outlet **91** of the hydrogen engine **90** is transferred and delivered to the exhaust inlet **13** of the water tank **10** through the exhaust line **30**. The exhaust gas is then introduced into the sub space portion **12** through the exhaust inlet **13**. To this end, the exhaust inlet **13** is, as illustrated in FIG. **4**, provided in the water tank **10** by being adjacent to the sub space portion **12**. The exhaust inlet **13** is in direct communication with the sub space portion **12**.

[0046] So as to block the water vapor introduced into the sub space portion **12** (i.e., purified exhaust gas) from moving to the main space portion **11**, the water tank **10** includes the partition wall **14** and also includes the exhaust inlet **13** at an upper side portion of the water tank **10**. In order to more effectively block the water vapor in the sub space portion **12** from moving into the main space portion **11**, the water tank **10** further includes an expanded portion **16**.

[0047] Referring to FIG. **3**, the expanded portion **16** protrudes to be stepped from the upper wall portion of the water tank **10**. Here, the upper wall portion of the water tank **10** is bent upward at a position wherein the partition wall **14** is provided. The water tank **10** expands the internal space therein by further including the expanded portion **16**. More specifically, with the water tank **10** further including the expanded portion **16**, the sub space portion **12** expands upward and has a space expanded and extended higher than the main space portion **11**. In other words, with the water tank **10** further including the expanded portion **16**, the sub space portion **12** further includes the internal space in the expanded portion **16**.

[0048] Here, the exhaust inlet **13** is disposed at a front of the sub space portion **12** with respect to a front-rear direction of a vehicle in which the water tank **10** and the hydrogen engine **90** are mounted. The sub space portion **12** is disposed at a right side of the main space portion **11** with respect to the partition wall **14**. Moreover, the exhaust inlet **13** is disposed at a left side portion of the sub space portion **12** with respect to a left-right direction of the vehicle. To be more specific, the exhaust inlet **13** is disposed at an upper side portion of the expanded portion **16** provided above the sub space portion **12**, and is disposed at a left side portion of the upper side portion of the expanded portion **16**.

[0049] Accordingly, the exhaust inlet **13** is disposed adjacent to the partition wall **14** at a front position of the sub space portion **12**. More specifically, the exhaust inlet **13** is disposed at the left side portion at a front position of the expanded portion **16**, provided above the sub space portion **12**, and is disposed adjacent to the partition wall **14**.

[0050] With this structure, the exhaust inlet **13** is not submerged in water in the water tank **10** even when the water tank **10** is tilted to one side, such as when a vehicle travels on an incline (see FIG. **6** and FIG. **7**). Moreover, the water stored in the water tank **10** may be prevented from flowing back into the exhaust line **30** through the exhaust inlet **13**. Furthermore, because the exhaust inlet **13** is disposed at the upper side portion of the expanded portion **16**, water vapor introduced into the sub space portion **12** through the exhaust inlet **13** may be more effectively prevented from moving to the main space portion **11**.

[0051] In one embodiment, the lower wall portion **17** of the water tank **10** may be inclined upward from a point where the partition wall **14** is disposed. Here, the lower wall portion **17** of the water tank **10** has an inclined structure at the sub space portion **12** side. Therefore, the lower wall portion **17** of the water tank **10** extends further upward than the gap **15** under the partition wall **14**, preventing the water in the main space portion **11** from moving to the sub space portion **12** through the gap **15**.

[0052] Furthermore, in order to quickly condense water vapor introduced into the water tank **10** (i.e., purified exhaust gas), the water tank **10** is provided with a cooling nozzle **40**.

[0053] As illustrated in FIG. **1** through FIG. **3**, the cooling nozzle **40** is mounted to the water tank **10** to spray water to the sub space portion **12**, including the internal space in the expanded portion **16**, and to the water vapor introduced into the sub space portion **12**. The cooling nozzle **40** is mounted at the upper wall portion of the water tank **10** to spray water to the sub space portion **12**. Here, the cooling nozzle **40** is disposed at an upper side portion of the sub space portion **12** to spray water toward the exhaust inlet **13** for discharging exhaust gas to the upper side portion of the sub space portion **12** (i.e., the internal space in the expanded portion **16**).

[0054] In other words, the cooling nozzle **40** is mounted to the water tank **10** by being disposed at the upper side portion of the sub space portion **12**, and may turn the water supplied from the water pump **20** into mist and spray the same to the sub space portion **12**. The cooling nozzle **40** may also be called a mist nozzle.

[0055] The cooling nozzle **40** may spray low-temperature water onto high-temperature water vapor introduced into the sub space portion **12** of the water tank **10**, rapidly cooling the water vapor and converting the same into water. Therefore, the water vapor introduced into the sub space portion **12** through the exhaust inlet **13** is quickly condensed in the sub space portion **12** and converted into a liquid phase, and then is moved to the main space portion **11** through the gap under the partition wall **14**.

[0056] As the water vapor introduced into the water tank **10** is quickly cooled and condensed, water generation speeds up, and thus water may be continuously supplied to the hydrogen engine **90** without having to refill the water tank **10** with water. More specifically, by quickly condensing water vapor in the sub space portion **12** using the cooling nozzle **40**, problems due to insufficient water recovery compared to water discharge from the water tank **10** may be prevented. Moreover, as the water vapor introduced into the

sub space portion **12** is quickly condensed, the increase in internal pressure of the water tank **10** due to the influx of water vapor may be reduced.

[0057] Furthermore, in order to make the water vapor to be smoothly introduced into the sub space portion **12**, the water tank **10** is provided with a moisture separation filter **50**.

[0058] The moisture separation filter **50** is to filter moisture contained in the water vapor and is configured to discharge air introduced into the water tank **10** to the outside and leave moisture in the water tank **10**. In other words, the moisture separation filter **50** is configured to separate moisture in the water vapor introduced into the sub space portion **12** of the water tank **10** from air and discharge only the air to the outside.

[0059] To this end, the moisture separation filter **50** is mounted at the upper wall portion of the water tank **10** so as to be disposed above the sub space portion **12**. As illustrated in FIG. **4**, the moisture separation filter **50** discharges air from the water vapor introduced into the sub space **12** to the outside of the water tank **10**, filters out the moisture, and leaves the moisture in the sub space portion **12**. In other words, the moisture separation filter **50** discharges the remaining except moisture in the components contained in the water vapor to the outside.

[0060] More specifically, for the moisture and air contained in the water vaper, the moisture separation filter **50** may block discharge of the moisture, which has a relatively large particle size, while allowing discharge of the air, which has a small particle size. The moisture separation filter **50** may include an upper side portion protruding out of the water tank **10**, and the upper side portion forms an air outlet configured to discharge air.

[0061] The moisture separation filter **50** discharges only air from the water vapor introduced into the water tank **10** to the outside, preventing the increase in the internal pressure of the water tank **10** due to the inflow of water vapor. As a result, the moisture separation filter **50** may allow smooth inflow of water vapor into the water tank **10** and increase the water recovery rate to the water tank **10**.

[0062] As illustrated in FIG. **1** and FIG. **2**, the cooling nozzle **40** receives water from the main space portion **11** through the injection line **41**. The injection line **41** branches off from the water supply line **21** connected to the water pump **20** and is connected to the cooling nozzle **40**. In other words, the injection line **41** is connected to the water pump **20** via the water supply line **21**, and delivers and provides water supplied from the water pump **20** to the cooling nozzle **40**.

[0063] The water pump **20** is connected to the hydrogen engine **90** via the water supply line **21** and supplies water to the hydrogen engine **90**. When the water pump **20** discharges water from the main space portion **11** to the water supply line **21**, water is also supplied to the injection line **41**. The injection line **41** delivers water supplied from the water pump **20** to the cooling nozzle **40**, and the cooling nozzle **40** sprays the water, which is supplied to the cooling nozzle **40** through the injection line **41**, onto the water vapor introduced into the sub space portion **12**. The cooling nozzle **40** is provided at the upper wall portion of the water tank **10** to directly spray water onto the water vapor, introduced into the sub space portion **12** through the exhaust inlet **13**.

[0064] As illustrated in FIG. **3** and FIG. **5**, the water tank **10** may include a drain port **60** configured to discharge water within the water tank **10**. When water introduced into the water tank **10** exceeds a determined capacity of the water tank **10**, the drain port **60** discharges the water in the water tank **10**. The drain port **60** discharges water that exceeds the determined capacity of the water tank **10**. Here, the determined capacity of the water tank **10** is smaller than the maximum capacity of the water tank **10**. The determined capacity of the water tank **10** may also be set to be smaller than the maximum capacity of the main space portion **11**.

[0065] The drain port **60** extends vertically upward from the lower wall portion **17** of the water tank **10** and has a pipe structure with open opposite ends. The drain port **60** protrudes and extends from the lower wall portion **17** of the water tank **10** to a predetermined height, so that when the water surface of the water tank **10** exceeds the top of the drain port **60**, the water in the water tank **10** is discharged to the outside. The drain port **60** is disposed in the main space portion **11**, and has a height smaller than the vertical height of the main space portion **11** by a predetermined value or more. As illustrated in FIG. **6** and FIG. **7**, the drain port **60** may be located at the center of the water tank **10** with respect to a horizontal direction, and may be disposed between the partition wall **14** and the water pump **20**. Furthermore, at the top of the drain port **60**, there may be provided a screen filter **61** configured to prevent foreign substances from entering from the outside.

[0066] In FIG. **6** and FIG. **7**, lines L**1**, L**2**, L**3**, L**4** indicate the water surface in the water tank **10** as an example when the vehicle is traveling on an incline. When the water tank **10** is tilted to one side due to the vehicle traveling on an incline, the water surface in the water tank **10** is also tilted as indicated by the lines L**1**, L**2**, L**3**, L**4**. Here, the water surface may reach the cooling nozzle **40** and the exhaust inlet **13** as the water moves to one side of the water tank **10**. However, the water is discharged to the outside through the drain port **60**, preventing the cooling nozzle **40** and the exhaust inlet **13** from being submerged in water even when the vehicle travels on an incline.

[0067] Moreover, due to the difference in density between water vapor and water, water is stored in the lower space in the water tank **10**, and water vapor is introduced into the upper space in the water tank **10** (particularly, the upper space in the sub space portion **12**). More specifically, there exist both water vapor and water in the sub space portion **12**, but only water exists in the main space portion **11**.

[0068] Furthermore, the water tank **10** may be provided with a heater **71**, a temperature sensor **72**, and a pump filter **73**. Water temperature information measured by the temperature sensor **72** is transmitted to a controller **70**. The heater **71** is configured to heat water stored in the water tank **10** and may be controlled by the controller **70**. The controller **70** may remove ice in the water tank **10** by operating the heater **71** based on the information received from the temperature sensor **72**. The controller **70** may perform overall control of the water management system of the present disclosure. The controller **70** may be provided at the top of the water tank **10**. The pump filter **73** is configured to prevent foreign substances from entering the water sucked by the water pump **20**, and may be provided at an inlet side of the water pump **20**.

[0069] As illustrated in the embodiment of FIG. **8**, at forward of the exhaust inlet **13**, a cooler **82** configured to cool water vapor may further be provided. The cooler **82** may be provided in the exhaust line **30** by being disposed rearward of the exhaust system **80**. The cooler **82** is con-

figured to cool the water vapor delivered to the sub space portion **12** of the water tank **10** (i.e., purified exhaust gas). Therefore, as the cooler **82** is provided forward of the exhaust inlet **13**, the water vapor introduced into the sub space portion **12** may be more quickly condensed.

[0070] As is apparent from the above description, the present disclosure provides the following effects.

[0071] First, water vapor in exhaust gas is recovered and condensed to generate water, reducing the volume of a water tank for storing water that is to be supplied and injected to the hydrogen engine, and eliminating the need to periodically refill the water tank. Accordingly, vehicle's package freedom and user convenience may be improved, and making it possible to reduce vehicle weight and increase marketability.

[0072] Second, water is injected to the hydrogen engine to reduce the temperature within the combustion chamber of the hydrogen engine, preventing engine knocking and improving power performance and fuel efficiency of the vehicle.

[0073] Effects of the present disclosure are not limited to what has been described above, and other effects not mentioned herein should be clearly recognized by those having ordinary skill in the art based on the above description.

[0074] Terms or words used in this specification and claims described below should not be construed as being limited to conventional or dictionary meanings. In addition, the scope of the present disclosure is not limited to the above-described embodiments, and various modifications and improvements by those having ordinary skill in the art using the basic concept of the present disclosure as defined in the claims below should also be included in the scope of the present disclosure.

What is claimed is:

1. A water management system for a hydrogen engine, the water management system comprising:

a water tank comprising:

a main space portion configured to store therein water for cooling the hydrogen engine, and

a sub space portion into which exhaust gas generated in the hydrogen engine is supplied;

a water pump provided in the water tank and configured to supply the water stored in the main space portion of the water tank to the hydrogen engine; and

an exhaust line provided between the hydrogen engine and the water tank and configured to deliver exhaust gas, containing water vapor, discharged from the hydrogen engine to the sub space portion of the water tank.

2. The water management system of claim **1**, wherein the water tank is provided therein with a partition wall configured to separate the main space portion and the sub space portion from each other.

3. The water management system of claim **2**, wherein a gap through which water moves is provided between a lower surface portion of the partition wall and a lower wall portion of the water tank.

4. The water management system of claim **3**, wherein, excluding the gap, the sub space portion and the main space portion are separated from each other by the partition wall.

5. The water management system of claim **2**, wherein the water tank is provided with an exhaust inlet connected to the exhaust line, and the exhaust inlet is adjacent to the sub space portion.

6. The water management system of claim **5**, wherein the exhaust inlet is disposed at a front of the sub space portion with respect to a front-rear direction of a vehicle in which the water tank is mounted.

7. The water management system of claim **5**, wherein the sub space portion is disposed at a right side of the main space portion with respect to the partition wall, and the exhaust inlet is disposed adjacent to the partition wall at a front of the sub space portion.

8. The water management system of claim **5**, wherein an expanded portion is disposed at an upper wall portion of the water tank, and wherein the sub space portion is expanded upward more than the main space portion by the expanded portion.

9. The water management system of claim **8**, wherein the exhaust inlet is disposed at an upper side portion of the expanded portion.

10. The water management system of claim **5**, wherein the water tank is provided with a cooling nozzle configured to spray water onto exhaust gas introduced into the sub space portion.

11. The water management system of claim **10**, wherein the cooling nozzle is disposed at an upper side portion of the sub space portion to spray the water toward the exhaust inlet configured to discharge the exhaust gas to the upper side portion of the sub space portion.

12. The water management system of claim **10**, wherein the cooling nozzle is connected to the water pump via an injection line, and the cooling nozzle is supplied with the water stored in the main space portion through the injection line.

13. The water management system of claim **12**, wherein the water pump is connected to the hydrogen engine via a water supply line, and the injection line is connected to the cooling nozzle by being branched off from the water supply line.

14. The water management system of claim **1**, wherein the water tank is provided with a moisture separation filter configured to filter moisture contained in the exhaust gas in the sub space portion, and wherein the moisture separation filter is configured to discharge air contained in the exhaust gas in the sub space portion out of the water tank.

15. The water management system of claim **1**, wherein the water tank is provided with a drain port configured to discharge water that exceeds a determined capacity of the water tank.

16. The water management system of claim **15**, wherein the drain port extends upward from a lower wall portion of the water tank and is placed in the main space portion.

17. The water management system of claim **1**, wherein the exhaust line further comprises an exhaust cooler configured to cool the exhaust gas transferred to the sub space portion.

* * * * *