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(54) WATER HEATER

(57) A water heater. The water heater comprises: an outer machine (1), a refrigerant being provided in the outer machine (1); and heat storage devices (2), each heat storage device (2) comprising an air inlet pipe (20) and a liquid outlet pipe (21) communicated with the outer machine (1). The outer machine (1) can make the refrigerant flow from the air inlet pipe (20) to the heat storage devices (2) and flow out from the liquid outlet pipe (21), so that the heat storage device (2) can store heat. The number of the heat storage devices (2) is at least two, the at least two heat storage devices (2) are connected in parallel, the liquid outlet pipe (21) of any heat storage device (2) is provided with a valve (22), and the valve (22) is used for adjusting the flow rate of the refrigerant passing through the heat storage device (2).

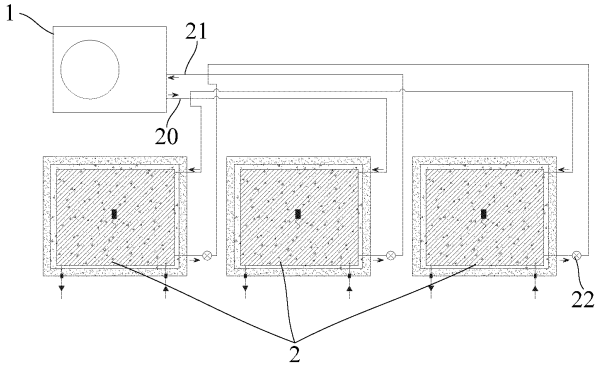

Fig. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Chinese Patent Application No. 201920737073.7, filed on May 22, 2019 by HEFEI MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD. and MIDEA GROUP CO., LTD. The entire contents of the above patent application are incorporated herein as reference.

FIELD

[0002] The present application relates to a field of household appliances, and more particularly, to a water heater.

BACKGROUND

[0003] At present, a household water heater mainly includes a gas water heater, an electric water heater and an air energy water heater. The air energy water heater is attracting more and more attention due to its high energy efficiency. Generally, the air energy water heater includes an air energy water heater of a static heating type, an air energy water heater of a circulating type, etc. The household water heater generally is the air energy water heater of the static heating type. The air energy water heater of the static heating type uses a water tank with a certain volume, generally 150L/200L for the household water heater. The heat is stored in the water tank in the form of sensible heat. When a user needs water, hot water can be discharged from the water tank. However, a household heat pump product generally will occupy the area of the house due to its large-volume water tank, and bacteria will grow when it is not used for a long time. It is necessary to drain the whole tank of water and fill the whole tank with new cold water, thus resulting in a waste of resources.

SUMMARY

[0004] The present application is intended to solve at least one of the technical problems existing in the prior or related art.

[0005] Therefore, the present application provides a water heater.

[0006] To this end, the present application provides a water heater, including: an outdoor unit provided with a refrigerant therein; a heat storage device including a gas input pipe and a liquid output pipe communicated with the outdoor unit, the outdoor unit being configured to cause the refrigerant to flow from the gas input pipe to the heat storage device and to flow out from the liquid output pipe, to allow the heat storage device to store heat. At least two heat storage devices are provided, the at least two heat storage devices are connected in parallel, the liquid output pipe of any heat storage device is provided with a valve, and the valve is configured to adjust a flow rate of the refrigerant passing through the heat storage device.

[0007] The water heater provided in the present application includes the outdoor unit and the heat storage device, and the outdoor unit and the heat storage device are communicated through the gas input pipe and the liquid output pipe. The outdoor unit can compress the refrigerant into a high-temperature and high-pressure state, and the compressed refrigerant flows from the outdoor unit to the heat storage device through the gas input pipe, and exchanges heat with a phase change material in the heat storage device, so that the heat is stored in the heat storage device to be used by a user at any time. After the heat exchange, the refrigerant flows through the liquid output pipe of the heat storage device back to the outdoor unit, and proceeds to the next cycle. At least two heat storage devices are provided, and the at least two heat storage devices are connected in parallel. The liquid output pipe of any heat storage device is provided with the valve, i.e. the liquid output pipe of each heat storage device is provided with one valve correspondingly. The valve is configured to regulate the flow rate of the refrigerant flowing to the heat storage device corresponding to the valve, thus controlling a heating speed of the outdoor unit on the heat storage device. Therefore, the heating of a specific heat storage device is achieved. An opening degree of the valve can be adjusted to achieve the separate heating of one heat storage device, the heating speed is fast, and the purpose of rapid heating is achieved, so as to meet a rapid water demand of the user. In the whole process, the heat storage device does not need to store water or only stores a small amount of stagnant water, so that the function of living water is realized, thus significantly reducing the volume of the heat storage device. Moreover, the outdoor unit and the heat storage device are installed separately, which can realize the indoor heat storage and water without noise, thus improving the user's usage comfort. The heat storage device may also be installed in an exposed or hidden manner, thus saving the user's usage space.

[0008] Specifically, the compressor is configured to compress a gas, and a gas discharge port of the compressor is always for a high-temperature gaseous refrigerant. In this technical solution, the gaseous refrigerant discharged from the compressor is condensed into a liquid state after passing through the heat storage device, the liquid refrigerant enters the evaporator after being depressurized through a throttling device in the outdoor unit, and then evaporates and absorbs heat in the evaporator to change into the gaseous refrigerant, and the gaseous refrigerant enters the compressor again.

[0009] The water heater provided by the present application may also include the following additional features.

[0010] In some embodiments, any heat storage device is provided with a water input pipe and a water output pipe.

[0011] In this technical solution, the water input pipe and the water output pipe are arranged on any heat storage device. A water flow enters from the water input pipe, passes through the heat storage device and exchanges heat with the heat storage device, and hot water flows out from the water output pipe. Since any heat storage device is provided with the water input pipe and the water output pipe, at least two heat storage devices may be placed in different spaces, and multiple heat storage devices may be heated by one outdoor unit, so as to be used by the user in the different spaces.

[0012] In some embodiments, the heat storage device further includes: a housing filled with a phase change material therein; a heat exchanger arranged in the housing. The heat exchanger includes a heat exchange flow path and a heat exchange water path, and the phase change material is filled between the heat exchange flow path and the heat exchange water path. The heat exchange water path is communicated with the water input pipe and the water output pipe, and the heat exchange flow path is communicated with the outdoor unit through the gas input pipe and the liquid output pipe. The refrigerant can flow from the outdoor unit through the gas input pipe to the heat exchange flow path.

[0013] In this technical solution, the heat storage device further includes the housing and the heat exchanger arranged in the housing, the heat exchange flow path and the heat exchange water path are arranged in the heat exchanger, and the phase change material is filled between the heat exchange water path and the heat exchange flow path, so as to realize the heat exchange between the refrigerant and the water. The heat exchange flow path is communicated with the outdoor unit, the refrigerant passes through the heat exchange flow path and exchanges heat with the phase change material, and the heat is stored in the phase change material. The heat exchange water path is communicated with the water input pipe and the water output pipe, and the water flow enters the heat exchange water path from the water input pipe, exchanges heat with the phase change material, then changes into the hot water and flows out from the water output pipe, thus meeting the water demand of the user.

[0014] Specifically, the outdoor unit and the heat exchange flow path are communicated through the gas input pipe and the liquid output pipe, to allow the refrigerant to flow, so that the refrigerant exchanges heat with the phase change material in the housing.

[0015] In some embodiments, an inner wall of the housing is coated with a heat insulation structure for insulating the phase change material from the housing, so as to prevent the heat from being dissipated through the housing.

[0016] In some embodiments, the heat storage device further includes a temperature detection structure, which is arranged in the housing and configured to detect a temperature of the phase change material.

[0017] In this technical solution, the heat storage device further includes the temperature detection structure arranged in the housing. In some embodiments, the temperature detection structure is embedded in the phase change material for detecting the temperature of the phase change material, determining the heat remained in the phase change material, and judging whether a heat storage action is completed or whether the phase change material needs to be heated according to the temperature in the phase change material. Specifically, the temperature detection structure is a temperature sensitive package.

[0018] In some embodiments, the water heater further includes a control device, which is communicated with the temperature detection structure and the valve, and is configured to adjust the opening degree of the valve according to the temperature detection structure.

[0019] In this technical solution, the water heater further includes the control device, and the control device is communicated with the temperature detection structure and the valve so as to adjust the opening degree of the valve according to the temperature detection structure, thereby controlling the heating speed of the outdoor unit on the heat storage device.

[0020] Specifically, in a heating mode, when the heat storage device needs to be heated, the outdoor unit starts to operate, and a high-temperature and high-pressure gaseous refrigerant enters the heat exchanger of the heat storage device from the gas input pipe, condenses and releases heat in the heat storage device, then flows out from the liquid output pipe and returns to the outdoor unit after being throttled by the valve. During the heating process, the temperature detection structure detects the temperature of the phase change material. When the temperature of the phase change material reaches a preset temperature, it indicates that the heat storage device has completed the heat storage, and the opening degree of the valve corresponding to the heat storage device is reduced to a certain one. When all the heat storage devices have completed the heat storage, the outdoor unit stops operating.

[0021] Specifically, in a rapid heating mode, when a specific heat storage device needs to be heated rapidly, the compressor of the outdoor unit operates at a high frequency, the opening degree of the valve corresponding to this heat storage device is set to the maximum, and the opening degrees of the valves corresponding to other heat storage devices are each reduced to a certain one, so that most of the refrigerant circulating in a system circulates in this heat storage device to achieve the purpose of rapid heating.

[0022] In some embodiments, the heat exchange flow path and the heat exchange water path are intersected.

[0023] In this technical solution, the heat exchange flow path and the heat exchange water path are intersected, which improves the heat exchange efficiency, so that the heat transferred from the heat exchange flow path to the phase change material can be quickly transferred to the heat exchange water path, so as to allow a

cold water flowing through the heat exchange water path to be quickly heated, thus meeting a real-time water demand of the user.

[0024] In some embodiments, the heat exchanger is a fin heat exchanger or a plate heat exchanger.

[0025] In this technical solution, the heat exchanger is the fin heat exchanger or the plate heat exchanger, thereby improving the heat exchange efficiency of the heat exchanger.

[0026] In some embodiments, a phase change temperature of the phase change material is larger than or equal to 45°C and less than or equal to 80°C.

[0027] In this technical solution, the phase change temperature of the phase change material is larger than or equal to 45°C and less than or equal to 80°C. Compared with a water-storage heat-pump water heater, under the premise of providing the same volume of hot water, the volume of the water heater provided by the present application is reduced by more than 45% in comparison with the water-storage heat-pump water heater.

[0028] In some embodiments, the outdoor unit further includes: a casing communicated with the heat exchange flow path through the gas input pipe and the liquid output pipe; a compressor arranged in the casing and communicated with the liquid input and output pipe; an evaporator arranged in the casing and communicated with the compressor and the gas output and input pipe respectively. The compressor can compress the refrigerant and causes the refrigerant to flow from the compressor to the heat storage device through the gas input pipe, and to flow from the liquid output pipe to the compressor through the evaporator, so that the heat storage device stores heat.

[0029] In this technical solution, the outdoor unit further includes the casing as well as the compressor and the evaporator arranged in the casing. Specifically, the compressor compresses the refrigerant, and the refrigerant is compressed into a high-temperature and high-pressure gaseous state in the compressor and then enters the heat storage device, flows from the liquid output pipe to the evaporator after exchanging heat in the heat storage device, evaporates in the evaporator and then returns to the compressor. In the heat exchange flow path, the refrigerant exchanges heat with the phase change material, and the heat is stored in the heat storage device. After the heat exchange, the refrigerant flows back to the compressor from the heat storage device through the liquid output pipe and proceeds to the next cycle. In some embodiments, the outdoor unit further includes a four-way valve, a condenser, a fan, a throttling element, and a control module.

[0030] In some embodiments, the valve is an electronic expansion valve.

[0031] In this technical solution, the valve is the electronic expansion valve, and the flow rate of the refrigerant passing through the heat storage device can be controlled by controlling the opening degree of the electronic expansion valve, thereby controlling the heating speed on the heat storage device.

[0032] The additional aspects and advantages of the present application will become apparent in the following description, or be learned through the practice of the present application.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] The above and/or additional aspects and advantages of the present application will become apparent and easy to understand from descriptions of embodiments in connection with following drawings, in which:

Fig. 1 illustrates a schematic view of a water heater according to an embodiment of the present application;
Fig. 2 illustrates a schematic view of a heat storage device according to embodiment of the present application.

[0034] Reference numerals and part names in Fig. 1 and Fig. 2 have a following correspondence:

1 outdoor unit, 2 heat storage device, 20 gas input pipe, 21 liquid output pipe, 22 valve, 23 water input pipe, 24 water output pipe, 25 housing, 26 phase change material, 27 temperature detection structure.

DETAILED DESCRIPTION

[0035] In order to clearly understand the above objects, features and advantages of the present application, the present application is described in further detail below in conjunction with the accompanying drawings and specific embodiments. It should be noted that the embodiments of the present application and the features in the embodiments may be combined with each other, provided that there is no conflict.

[0036] While many specific details are set forth in the following description to facilitate a full understanding of the present application, the present application may also be implemented in other ways than those described herein, and therefore the protection scope of the present application is not limited by the specific embodiments disclosed below.

[0037] A water heater according to embodiments of the present application will be described with reference to Fig. 1 and Fig. 2.

[0038] According to an embodiment of a first aspect of the present application, a water heater is provided.

[0039] In view of this, the present application proposes a water heater, including: an outdoor unit 1 with a refrigerant provided therein; a heat storage device 2 including a gas input pipe 20 and a liquid output pipe 21 communicated with the outdoor unit 1. The outdoor unit 1 can cause the refrigerant to flow through the gas input pipe 20 to the heat storage device 2 and out of the liquid output pipe 21, so that the heat storage device 2 stores heat.

At least two heat storage devices 2 are provided, and the at least two heat storage devices 2 are connected in parallel. The liquid output pipe 21 of any heat storage device 2 is provided with a valve 22, and the valve 22 is configured to regulate a flow rate of the refrigerant passing through the heat storage device 2.

[0040] As shown in Fig. 1, the water heater provided in the present application includes the outdoor unit 1 and the heat storage device 2, and the outdoor unit 1 and the heat storage device 2 are communicated through the gas input pipe 20 and the liquid output pipe 21. The outdoor unit 1 can compress the refrigerant into a high-temperature and high-pressure state, and the compressed refrigerant flows from the outdoor unit 1 to the heat storage device 2 through the gas input pipe 20, and exchanges heat with a phase change material 26 in the heat storage device 2, so that the heat is stored in the heat storage device 2 to be used by a user at any time. After the heat exchange, the refrigerant flows through the liquid output pipe 21 of the heat storage device 2 back to the outdoor unit 1, and proceeds to the next cycle. At least two heat storage devices 2 are provided, and the at least two heat storage devices 2 are connected in parallel. The liquid output pipe 21 of any heat storage device 2 is provided with the valve 22, i.e. the liquid output pipe 21 of each heat storage device 2 is provided with one valve 22 correspondingly. The valve 22 is configured to regulate the flow rate of the refrigerant flowing to the heat storage device 2 corresponding to the valve 22, thus controlling a heating speed of the outdoor unit 1 on the heat storage device 2. Therefore, the heating of a specific heat storage device 2 is achieved. An opening degree of the valve 22 can be adjusted to achieve the separate heating of one heat storage device 2, the heating speed is fast, and the purpose of rapid heating is achieved, so as to meet a rapid water demand of the user. In the whole process, the heat storage device 2 does not need to store water or only stores a small amount of stagnant water, so that the function of living water is realized, thus significantly reducing the volume of the heat storage device 2. Moreover, the outdoor unit 1 and the heat storage device 2 are installed separately, which can realize the indoor heat storage and water without noise, thus improving the user's usage comfort. The heat storage device 2 may also be installed in an exposed or hidden manner, thus saving the user's usage space.

[0041] Specifically, the compressor is configured to compress a gas, and a gas discharge port of the compressor is always for a high-temperature gaseous refrigerant. In this technical solution, the gaseous refrigerant discharged from the compressor is condensed into a liquid state after passing through the heat storage device 2, the liquid refrigerant enters the evaporator after being depressurized through a throttling device in the outdoor unit, and then evaporates and absorbs heat in the evaporator to change into the gaseous refrigerant, and the gaseous refrigerant enters the compressor again.

[0042] In some embodiments, any heat storage device 2 is provided with a water input pipe 23 and a water output pipe 24.

[0043] As shown in Fig. 2, in this technical solution, the water input pipe 23 and the water output pipe 24 are arranged on any heat storage device 2. A water flow enters from the water input pipe 23, passes through the heat storage device 2 and exchanges heat with the heat storage device 2, and a hot water flows out from the water output pipe 24. Since any heat storage device 2 is provided with the water input pipe 23 and the water output pipe 24, at least two heat storage devices 2 may be placed in different spaces, and multiple heat storage devices 2 may be heated by one outdoor unit 1, so as to be used by the user in the different spaces.

[0044] In some embodiments, the heat storage device 2 further includes: a housing 25 filled with the phase change material 26 therein; a heat exchanger (not shown in the drawings) arranged in the housing 25. The heat exchanger includes a heat exchange flow path and a heat exchange water path, and the phase change material 26 is filled between the heat exchange flow path and the heat exchange water path. The heat exchange water path is communicated with the water input pipe 23 and the water output pipe 24, and the heat exchange flow path is communicated with the outdoor unit 1 through the gas input pipe 20 and the liquid output pipe 21. The refrigerant can flow from the outdoor unit 1 through the gas input pipe 20 to the heat exchange flow path.

[0045] As shown in Fig. 2, in this technical solution, the heat storage device 2 further includes the housing 25 and the heat exchanger arranged in the housing 25, the heat exchange flow path and the heat exchange water path are arranged in the heat exchanger, and the phase change material 26 is filled between the heat exchange water path and the heat exchange flow path, so as to realize the heat exchange between the refrigerant and the water. The heat exchange flow path is communicated with the outdoor unit 1, the refrigerant passes through the heat exchange flow path and exchanges heat with the phase change material 26, and the heat is stored in the phase change material 26. The heat exchange water path is communicated with the water input pipe 23 and the water output pipe 24, and the water flow enters the heat exchange water path from the water input pipe 23 in a direction of an arrow on the water input pipe 23 in Fig. 2, exchanges heat with the phase change material 26, then changes into the hot water and flows out from the water output pipe 24 in a direction of an arrow on the water output pipe 24 in Fig. 2, thus meeting the water demand of the user.

[0046] Specifically, the outdoor unit 1 and the heat exchange flow path are communicated through the gas input pipe 20 and the liquid output pipe 21, to allow the refrigerant to flow, so that the refrigerant exchanges heat with the phase change material 26 in the housing 25. A flow direction of the refrigerant is shown by arrows on the gas input pipe 20 and the liquid output pipe 21 in Fig. 1.

[0047] In some embodiments, an inner wall of the

housing 25 is coated with a heat insulation structure for insulating the phase change material 26 from the housing 25, so as to prevent the heat from being dissipated through the housing 25.

[0048] In some embodiments, the heat storage device 2 further includes a temperature detection structure 27, which is arranged in the housing 25 and configured to detect a temperature of the phase change material 26.

[0049] In this technical solution, the heat storage device 2 further includes the temperature detection structure 27 arranged in the housing 25. In some embodiments, the temperature detection structure 27 is embedded in the phase change material 26 for detecting the temperature of the phase change material 26, determining the heat remained in the phase change material 26, and judging whether a heat storage action is completed or whether the phase change material 26 needs to be heated according to the temperature in the phase change material 26. Specifically, the temperature detection structure 27 is a temperature sensitive package.

[0050] In some embodiments, the water heater further includes a control device, which is communicated with the temperature detection structure 27 and the valve 22, and is configured to adjust the opening degree of the valve 22 according to the temperature detection structure 27.

[0051] In this technical solution, the water heater further includes the control device, and the control device is communicated with the temperature detection structure 27 and the valve 22 so as to adjust the opening degree of the valve 22 according to the temperature detection structure 27, thereby controlling the heating speed of the outdoor unit 1 on the heat storage device 2.

[0052] Specifically, in a heating mode, when the heat storage device 2 needs to be heated, the outdoor unit 1 starts to operate, and a high-temperature and high-pressure gaseous refrigerant enters the heat exchanger of the heat storage device 2 from the gas input pipe 20, condenses and releases heat in the heat storage device 2, then flows out from the liquid output pipe 21 and returns to the outdoor unit 1 after being throttled by the valve 22. During the heating process, the temperature detection structure 27 detects the temperature of the phase change material 26. When the temperature of the phase change material 26 reaches a preset temperature, it indicates that the heat storage device 2 has completed the heat storage, and the opening degree of the valve 22 corresponding to the heat storage device 2 is reduced to a certain one. When all the heat storage devices 2 have completed the heat storage, the outdoor unit 1 stops operating.

[0053] Specifically, in a rapid heating mode, when a specific heat storage device 2 needs to be heated rapidly, the compressor of the outdoor unit 1 operates at a high frequency, the opening degree of the valve 22 corresponding to this heat storage device 2 is set to the maximum, and the opening degrees of the valves 22 corresponding to other heat storage devices 2 are each reduced to a certain one, so that most of the refrigerant circulating in a system circulates in this heat storage device 2 to achieve the purpose of rapid heating.

[0054] In some embodiments, the heat exchange flow path and the heat exchange water path are intersected.

[0055] In this technical solution, the heat exchange flow path and the heat exchange water path are intersected, which improves the heat exchange efficiency, so that the heat transferred from the heat exchange flow path to the phase change material 26 can be quickly transferred to the heat exchange water path, so as to allow a cold water flowing through the heat exchange water path to be quickly heated, thus meeting a real-time water demand of the user.

[0056] In some embodiments, the heat exchanger is a fin heat exchanger or a plate heat exchanger.

[0057] In this technical solution, the heat exchanger is the fin heat exchanger or the plate heat exchanger, thereby improving the heat exchange efficiency of the heat exchanger.

[0058] In some embodiments, a phase change temperature of the phase change material 26 is larger than or equal to 45°C and less than or equal to 80°C.

[0059] In this technical solution, the phase change temperature of the phase change material 26 is larger than or equal to 45°C and less than or equal to 80°C. Compared with a water-storage heat-pump water heater, under the premise of providing the same volume of hot water, the volume of the water heater provided by the present application is reduced by more than 45% in comparison with the water-storage heat-pump water heater.

[0060] In some embodiments, the outdoor unit 1 further includes: a casing (not shown in the drawings) communicated with the heat exchange flow path through the gas input pipe 20 and the liquid output pipe 21; a compressor (not shown in the drawings) arranged in the casing and communicated with the gas input pipe 20; an evaporator (not shown in the drawings) arranged in the casing and communicated with the compressor and the liquid output pipe 21 respectively. The compressor can compress the refrigerant and causes the refrigerant to flow from the compressor to the heat storage device 2 through the gas input pipe 20, and to flow from the liquid output pipe 21 to the compressor through the evaporator, so that the heat storage device 2 stores heat.

[0061] In this technical solution, the outdoor unit 1 further includes the casing as well as the compressor and the evaporator arranged in the casing. Specifically, the compressor compresses the refrigerant, and the refrigerant is compressed into a high-temperature and high-pressure gaseous state in the compressor and then enters the heat storage device 2, flows from the liquid output pipe 21 to the evaporator after exchanging heat in the heat storage device 2, evaporates in the evaporator and then returns to the compressor. In the heat exchange flow path, the refrigerant exchanges heat with the phase change material 26, and the heat is stored in the heat storage device 2. After the heat exchange, the refrigerant

flows back to the compressor from the heat storage device 2 through the liquid output pipe 21 and proceeds to the next cycle. In some embodiments, the outdoor unit 1 further includes a four-way valve, a condenser, a fan, a throttling element, and a control module.

[0062] In some embodiments, the valve 22 is an electronic expansion valve.

[0063] In this technical solution, the valve 22 is the electronic expansion valve, and the flow rate of the refrigerant passing through the heat storage device 2 can be controlled by controlling the opening degree of the electronic expansion valve, thereby controlling the heating speed on the heat storage device 2.

[0064] Specifically, the water heater includes the outdoor unit 1 and two or more heat storage devices 2 with the phase change material 26 arranged therein. The outdoor unit 1 includes the compressor, the evaporator, the condenser, the throttling part, the fan and the control module. The compressor absorbs low-grade heat energy in the air during operation, for the heat storage of the heat storage device 2, and the heat is stored in the heat storage device 2. The phase change material 26 is uniformly filled in the heat storage device 2, and has the phase change temperature of 45~80°C. Compared with the water-storage heat-pump water heater, the volume is reduced by more than 45%, under the premise of providing the same volume of hot water. The heat exchanger is arranged in each heat storage device 2. The heat exchanger may be a tube-fin heat exchanger or the plate heat exchanger or another structure. The heat exchanger acts as a condenser during the heat storage process. The heat exchange flow path and the heat exchange water path are arranged in the heat exchanger and intersected with each other. Each heat storage device 2 is provided with the water input pipe 23 and the water output pipe 24, the water input pipe 23 and the water output pipe 24 are connected to the heat exchanger of the heat storage device 2, the cold water enters the heat storage device 2 from the water input pipe 23, passes through the heat exchanger and exchanges heat with the internal phase change material 26 to absorb heat, and the hot water with the raised temperature reaches a water terminal from the water output pipe 24. The temperature sensitive package is arranged in the heat storage device 2, and the temperature sensitive package detects the temperature of the phase change material 26 in real time, and judges whether the heat storage device 2 has completed the heat storage.

[0065] Specifically, the outdoor unit 1 is connected to the heat storage device 2 through a pipeline, and the heat exchanger in the heat storage device 2 is provided with the gas input pipe 20 and the liquid output pipe 21. The liquid output pipe 21 is provided with the electronic expansion valve, for adjusting the flow rate of the refrigerant in each heat storage device 2 and controlling the heating speed of the outdoor unit 1 on the heat storage device 2.

[0066] In the present application, unless otherwise specifically defined, "a plurality of' means two or more than two. The terms "installed", "interconnected", "connected" and "fixed" shall be broadly understood. For example, they may be fixed connections, or detachable connections or integrated connections; they may also be direct connections or indirect connections through intermediate medium. For those skilled in the art, the specific meaning of the above terms in the present application may be understood according to specific circumstances.

[0067] Reference throughout this specification to terms "an embodiment," "some embodiments," "a specific embodiment" means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present application. In this specification, exemplary descriptions of aforesaid terms are not necessarily referring to the same embodiment or example. Moreover, the particular features, structures, materials, or characteristics described may be combined in any suitable manner in one or more embodiments or examples.

[0068] The above descriptions only refer to the preferred embodiments of the present application and do not intend to limit the present application. For those skilled in the art, the present application may have various modifications and variations. Any modifications, alternatives and improvements, which are made without departing from the spirit and principle of the present application, should fall in the scope of the present application.

Claims

1. A water heater, comprising:

   an outdoor unit provided with a refrigerant therein;

   a heat storage device comprising a gas input pipe and a liquid output pipe communicated with the outdoor unit, the outdoor unit being configured to cause the refrigerant to flow from the gas input pipe to the heat storage device and to flow out from the liquid output pipe, to allow the heat storage device to store heat,

   wherein at least two heat storage devices are provided, the at least two heat storage devices are connected in parallel, the liquid output pipe of any heat storage device is provided with a valve, and the valve is configured to adjust a flow rate of the refrigerant passing through the heat storage device.

2. The water heater according to claim 1, wherein any heat storage device is provided with a water input pipe and a water output pipe.

3. The water heater according to claim 2, wherein the

heat storage device further comprises:

a housing with a phase change material filled therein;
a heat exchanger arranged in the housing, and comprising a heat exchange flow path and a heat exchange water path, the phase change material being filled between the heat exchange flow path and the heat exchange water path, the heat exchange water path being communicated with the water input pipe and the water output pipe, the heat exchange flow path being communicated with the outdoor unit through the gas input pipe and the liquid output pipe, the refrigerant being configured to flow from the outdoor unit to the heat exchange flow path through the gas input pipe.

4. The water heater according to claim 3, wherein the heat storage device further comprises:
a temperature detection structure arranged in the housing and configured to detect a temperature of the phase change material.

5. The water heater according to claim 4, further comprising:
a control device communicated with the temperature detection structure and the valve, and configured to adjust an opening degree of the valve according to the temperature detection structure.

6. The water heater according to any one of claims 3-5, wherein the heat exchange flow path and the heat exchange water path are intersected.

7. The water heater according to any one of claims 3-6, wherein the heat exchanger is a fin heat exchanger or a plate heat exchanger.

8. The water heater according to any one of claims 3-7, wherein a phase change temperature of the phase change material is larger than or equal to 45°C and less than or equal to 80°C.

9. The water heater according to any one of claims 3-8, wherein the outdoor unit further comprises:

a casing communicated with the heat exchange flow path through the gas input pipe and the liquid output pipe;
a compressor arranged in the casing and communicated with the gas input pipe;
an evaporator arranged in the casing, and communicated with the compressor and the liquid output pipe respectively,
wherein the compressor is configured to compress the refrigerant and cause the refrigerant to flow from the compressor to the heat storage device through the gas input pipe, and to flow from the liquid output pipe to the compressor through the evaporator, to allow the heat storage device to store heat.

10. The water heater according to any one of claims 1-9, wherein the valve is an electronic expansion valve.

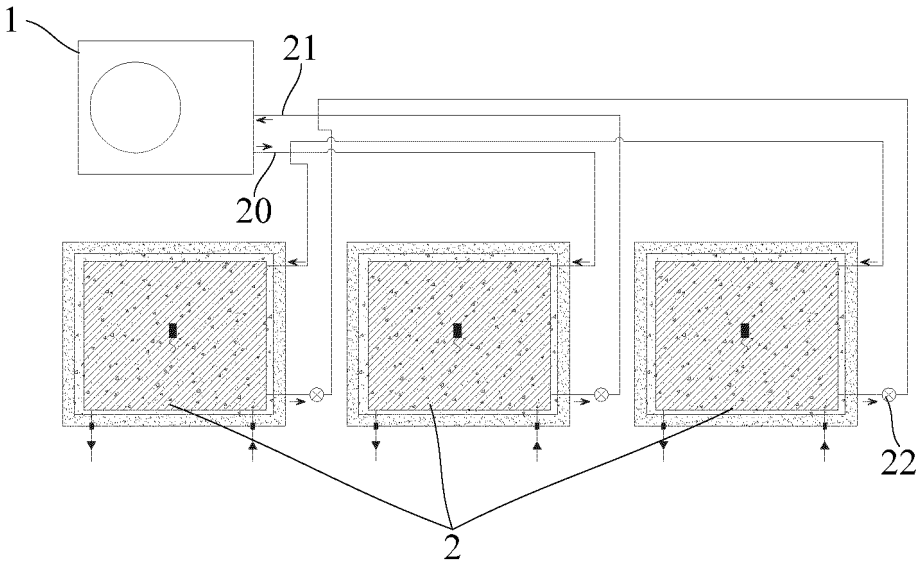

Fig. 1

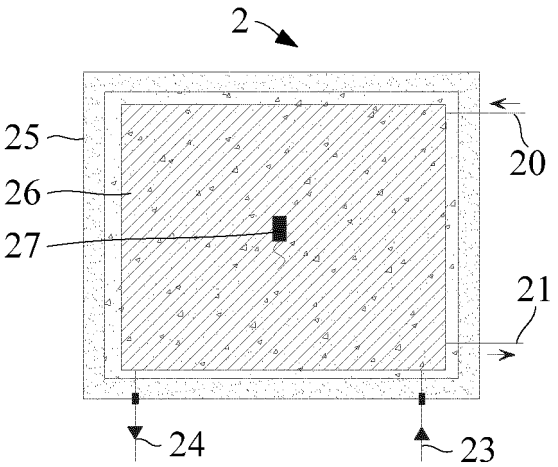

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/077159

A. CLASSIFICATION OF SUBJECT MATTER

F24H 4/02(2006.01)i; F24H 9/20(2006.01)i; F24H 1/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24FH

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN; CNABS; CNTXT; CNKI: 热水器, 蓄热, 并联, HEATER, ACCUMULAT+, REFRIGRANT, STOREGE, COMPRESSOR, PARALLEL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 108954823 A (HEFEI MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD. et al.) 07 December 2018 (2018-12-07) description, pages 6-9, and figures 1-4	1-10
Y	CN 108507198 A (CHANGZHOU UNIVERSITY) 07 September 2018 (2018-09-07) description, page 4, and figure 1	1-10
Y	CN 108507170 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 07 September 2018 (2018-09-07) description, page 8, and figure 1	8
PX	CN 209857384 U (HEFEI MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD. et al.) 27 December 2019 (2019-12-27) claims 1-10	1-10
A	CN 201652845 U (HIMIN SOLAR CO., LTD.) 24 November 2010 (2010-11-24) entire document	1-10
A	WO 2017085812 A1 (MITSUBISHI ELECTRIC CORP.) 26 May 2017 (2017-05-26) entire document	1-10
A	WO 2015198424 A1 (MITSUBISHI ELECTRIC CORP.) 30 December 2015 (2015-12-30) entire document	1-10

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 March 2020	**01 April 2020**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	
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Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/077159

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	108954823	A	07 December 2018	None			
CN	108507198	A	07 September 2018	CN	108507198	B	11 October 2019
CN	108507170	A	07 September 2018	None			
CN	209857384	U	27 December 2019	None			
CN	201652845	U	24 November 2010	None			
WO	2017085812	A1	26 May 2017	GB	2559496	A	08 August 2018
				GB	201804721	D0	09 May 2018
				JP	6509368	B2	08 May 2019
WO	2015198424	A1	30 December 2015	EP	3163206	A4	24 January 2018
				JP	6172392	B2	02 August 2017
				EP	3163206	B1	18 September 2019
				EP	3163206	A1	03 May 2017

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201920737073 **[0001]**