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(54) **Cooling appliance**

(57) A cooling appliance is provided. The cooling appliance (1) includes a storage chamber (26) capable of being evacuated, a pipeline (23) for connecting the storage chamber (26) and an evacuation device (22) in a fluid communication manner, and an evaporator (18). The pipeline (23) passes through the evaporator (18) or is located near an edge of the evaporator (18). The cooling appliance is characterized in that the pipeline (23) and the evaporator (18) are disposed at an interval. Therefore, heat exchange between the pipeline and the evaporator is reduced, thereby reducing or preventing ice blockage in the pipeline.

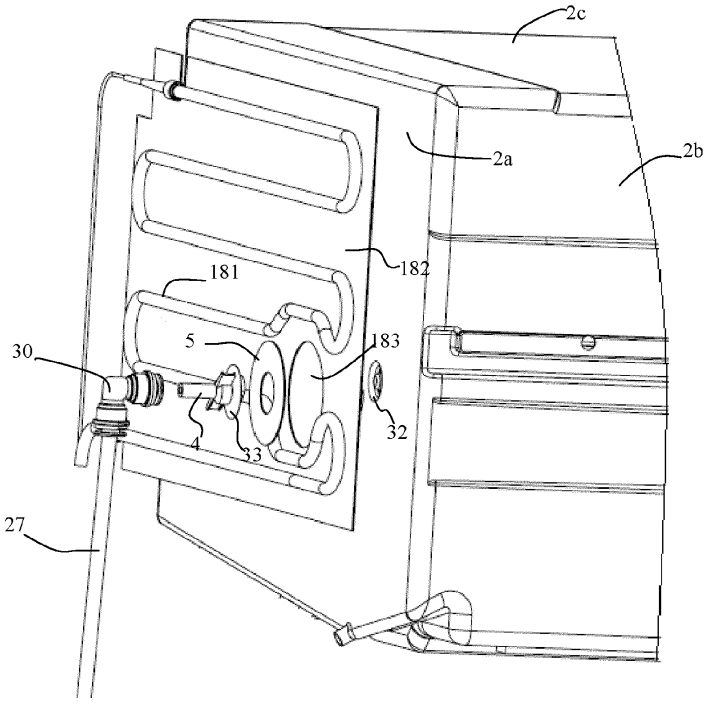

FIG. 2

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Description

BACKGROUND OF THE INVENTION

Field of Invention

[0001] The present invention relates to a cooling appliance, and in particular, to a cooling appliance with a storage chamber capable of maintaining a low pressure state.

Related Art

[0002] A cooling appliance capable of preserving an item in a low pressure environment is already known in the prior art. Such a cooling appliance generally has a storage chamber capable of being evacuated. By evacuating gas from the storage chamber, air content in the storage chamber is reduced, so as to weaken an oxidation process of food, thereby extending the preservation time and quality of the food. Although the storage chamber generally cannot reach an absolute vacuum state, the low pressure storage chamber in this technical field is also commonly known as a "vacuum chamber".

[0003] A Chinese patent application No. CN101865584 A discloses a cooling appliance with this low pressure storage chamber. The cooling appliance includes a low pressure storage box located in a thermal insulation compartment, a vacuum pump located outside the compartment and a pipeline for connecting the low pressure storage box and the vacuum pump in a fluid communication manner. The pipeline is at least partially buried in a layer of a thermal insulation material between a liner and a shell of a cabinet body. The pipeline includes a connector that passes through a back wall of the compartment and extends into the compartment. The connector is provided with a separator for separating a connection hole in the liner and the thermal insulation material, so as to prevent a thermal insulation foaming agent from leaking through the connection hole in a foaming process. An evaporator for cooling the compartment is disposed near the back wall of the compartment. Since the temperature when the evaporator works is very low (far lower than zero degrees Celsius), the temperature of the pipeline near the evaporator (especially the part of the connector) is also very low.

[0004] In another aspect, in a process of gas evacuation by the vacuum pump, the gas evacuated from the storage chamber sometimes contains moisture. After the vacuum pump stops evacuating gas, the moisture clings to an inner wall of the pipeline. When the temperature of the pipeline is very low, water located in the pipeline freezes, so that the pipeline may be blocked, gas in the storage chamber cannot be evacuated, and the vacuum pump may also be damaged.

SUMMARY OF THE INVENTION

[0005] One objective of the present invention is to solve at least one of the above technical problems, thereby providing a cooling appliance that may improve the reliability and the service life of a low pressure storage system.

[0006] Therefore, one aspect of the present invention relates to a cooling appliance. The cooling appliance includes a storage chamber capable of being evacuated, a pipeline for connecting the storage chamber and an evacuation device in a fluid communication manner, and an evaporator. The pipeline passes through the evaporator or is located near an edge of the evaporator. The cooling appliance is **characterized in that** the pipeline and the evaporator are disposed at an interval.

[0007] Since the pipeline and the evaporator for cooling a compartment are spaced apart, a thermal transfer speed between the evaporator and the pipeline may be slowed down, so that the temperature in the pipeline may be kept above a certain level for a longer time, thereby reducing or preventing ice blockage in the pipeline. Therefore, it may be expected to improve the reliability and the service life of the low pressure storage system, and this may be realized on the precondition that existing distribution positions of the evaporator and the evacuation pipeline are not evidently changed.

[0008] Another independent feature, or a feature combined with another feature, which is considered as a characteristic of the present invention, is illustrated in the appended claims in the following.

[0009] According to a special exemplary embodiment of the present invention, the pipeline and the evaporator are thermally isolated, which evidently slows down the thermal transfer speed between the pipeline and the evaporator, so that the temperature of the pipeline may be kept above the freezing temperature of water.

[0010] In an exemplary embodiment, the evaporator has a through hole for passing the pipeline there-through, and a barrier unit is disposed between the pipeline and the through hole for reducing heat exchange between them. This is especially advantageous for slowing down or preventing heat exchange between the pipeline and the evaporator.

[0011] In an exemplary embodiment, the barrier unit includes a thermal insulation foam material.

[0012] In an exemplary embodiment, the pipeline includes a connector fixed on a liner wall located near the evaporator. A gasket is disposed between the connector and the liner wall. The gasket is made of a bad conductor of heat and separates the evaporator and the connector.

[0013] In an exemplary embodiment, the pipeline includes a connector fixed on a liner wall located near the evaporator. A gasket is disposed between the connector and the liner wall. The gasket separates the evaporator and the connector so as to form at least a part of the barrier unit.

[0014] In an exemplary embodiment, a spacing is pro-

vided and a thermal insulation foam material is filled between the gasket and an edge of the through hole.

[0015] Another aspect of the present invention relates to a cooling appliance, which includes a storage chamber capable of being evacuated, a pipeline for connecting the storage chamber and an evacuation device in a fluid communication manner. The pipeline includes a connector passing through and being fixed on a wall, and an evaporator located near the wall. The cooling appliance is **characterized in that** the connector and the evaporator are disposed at an interval.

[0016] In an exemplary embodiment, the connector and the evaporator are thermally isolated.

[0017] In an exemplary embodiment, the evaporator has a through hole for passing the connector therethrough, and a barrier unit is disposed between the connector and the through hole for reducing thermal conduction between them.

[0018] In an exemplary embodiment, the barrier unit includes a gasket located between the connector and the wall, and the gasket is at least partially exposed between the connector and the through hole.

[0019] In an exemplary embodiment, the gasket includes a via hole for passing the connector there-through. A spacing is provided between the via hole and a pipe body of the connector. Consequently, the heat transferred by the gasket into the connector is further reduced, which is advantageous for the connector to keep a higher temperature therein.

[0020] Another aspect of the present invention relates to a cooling appliance, which includes a storage chamber capable of being evacuated, a pipeline for connecting the storage chamber and an evacuation device in a fluid communication manner, and an evaporator. The pipeline includes a pipe section passing through the evaporator. The cooling appliance is **characterized in that** the temperature in the pipe section is higher than the freezing temperature of water.

[0021] By preventing the coldest part of the pipeline from freezing, the phenomenon of ice blockage in the pipeline may be effectively reduced.

[0022] In an exemplary embodiment, the pipe section and the evaporator are spaced apart and are thermally isolated.

[0023] In an exemplary embodiment, the pipe section includes a connector fixed on a wall located near the evaporator.

[0024] In an exemplary embodiment, a heater for heating the pipe section is included.

[0025] The constitution of the present invention and other invention objectives and beneficial effects thereof are more obvious and comprehensible by describing the exemplary embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] As a part of the specification and being used for further understanding the present invention, the following accompanying drawings illustrate the specific implementation manners of the present invention, and are used, together with the specification, to explain the principle of the present invention, wherein:

FIG. 1 is a schematic partial sectional view of a cooling appliance according to an exemplary embodiment of the present invention;

FIG. 2 is a schematic partially-combined diagram of a cooling appliance according to an exemplary embodiment of the present invention; and

FIG. 3 is a partial sectional view of a cooling appliance according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Refer to the accompanying drawings. Firstly specifically refer to FIG. 1. A cooling appliance 1 includes a cabinet body 24 defining at least one compartment 20 for storing an item to be cooled. A front opening of the compartment 20 is closed or opened by a door 25 connected to the cabinet body 24.

[0028] The cabinet body 24 includes a liner 2 defining the compartment 20 and a shell 3 constituting an outer wall of the cabinet body 24. The liner 2 includes a back wall 2a, two opposite side walls 2b, a top wall 2c and a bottom wall 2d. The liner 2 and the shell 3 are separated by a certain distance, so that an insulation space 17 is formed between the liner 2 and the shell 3. The insulation space 17 has a thermal insulation layer 29 therein for reducing heat exchange between the compartment 20 and the outside. The thermal insulation layer 29 may be formed through a foaming procedure publicly known in the field.

[0029] The cooling appliance 1 includes a cooling system. In this embodiment, the cooling system is a compression cooling cycle, which includes cooling function components, such as a compressor, an evaporator, a condenser, and a capillary. This cooling system is publicly known, and therefore, it is not described herein again.

[0030] The compartment 20 may accommodate at least one low pressure storage unit 21 defining a storage chamber 26 capable of being evacuated. By evacuating at least a part of the air in the storage chamber 26 and keeping the storage chamber 26 in a low pressure state, oxygen content in the storage chamber 26 may be reduced, thereby extending the preservation time of food.

[0031] Therefore, the cooling appliance 1 includes an evacuation system capable of evacuating gas in the storage unit 21 and reducing the oxygen content in the storage chamber 26. According to an exemplary embodiment, the evacuation system includes a vacuum pump 22 and a pipeline 23 for connecting the vacuum pump

22 and the storage chamber 26 in a fluid communication manner. When the vacuum pump 22 runs, gas in the storage chamber 26 is evacuated via the pipeline 23.

[0032] The vacuum pump 22 may be disposed in a mechanical chamber 28 of the cabinet body 24. The mechanical chamber 28 is disposed at the bottom of the cabinet body 24, and accommodates the cooling function components, such as the compressor and the condenser.

[0033] It should be understood that the vacuum pump 22 may also be disposed at another proper position of the cabinet body 24, for example, it may be disposed on the top of the cabinet body. In another embodiment, it is also possible that the vacuum pump 22 is disposed outside the cooling appliance 1 or the vacuum pump 22 is taken as an accessory independent of the cooling appliance 1.

[0034] An end of the pipeline 23 connects the vacuum pump 22, and another end thereof passes through the liner 2, extends into the compartment 20 and connects the storage unit 21. The storage chamber 26 and the vacuum pump 22 are connected through the pipeline 23 in a fluid communication manner.

[0035] As shown in FIG. 1, FIG. 2 and FIG. 3, the pipeline 23 includes a first pipe section 27, at least a part of which extends in the insulation space 17, and a connector 4 passing through the back wall 2a of the liner 2 and being fixed on the liner 2. The part of the pipeline 23, which is located in the insulation space 17, is buried in the thermal insulation layer 29 after the foaming procedure. Another connector may be disposed on the low pressure storage unit 21 to connect the connector 4, or to connect the low pressure storage unit 21 after connecting a pipe section located in the compartment 20.

[0036] The first pipe section 27 and the connector 4 may be connected by a quick coupler 30. The quick coupler 30 has two approximately perpendicular connection ports to respectively connect the first pipe section 27 and the connector 4. The connector 4 is approximately parallel to the horizontal plane.

[0037] The connector 4 includes a pipe body 35 defining a fluid path and a protection umbrella 33 extending outward from an outer peripheral surface of the pipe body 35. The protection umbrella 33 is used to cover a connection hole 32 in the liner 2, so as to prevent a thermal insulation foaming agent from leaking through the connection hole 32 in the foaming procedure. A specific structure of the connector 4 and a method for fixing the connector 4 on the liner 2 may be obtained with reference to another patent application No. 200910030543.7 filed by the same applicant, which are not described herein again.

[0038] An evaporator 18 for cooling the compartment 20 is disposed near the back wall 2a of the liner 2. In this embodiment, the evaporator 18 is board-shaped and includes a cooling pipeline 181 and a heat-conducting board 182 for improving the heat exchange efficiency. The heat-conducting board 182 may be made of a good conductor of heat, for example, aluminum.

[0039] The evaporator 18 is attached to the liner 2, so that sufficient heat exchange with the compartment 20 is performed and the temperature in the compartment 20 is lowered. The evaporator 18 is attached to a side of the back wall 2a, which faces the insulation space 17. It should be understood that the present invention is not limited thereto. In another embodiment, the evaporator 18 may also be disposed in the compartment 20. It is also acceptable that the evaporator 18 is not attached on a liner wall, but keeps a distance from the liner wall. Besides, the present invention is also applicable to evaporators of other types.

[0040] The evaporator 18 covers most of the back wall 2a. The pipeline 23 passes through the evaporator 18 and the liner 2, and extends into the compartment 20. Therefore, the evaporator 18 includes a through hole 183 for passing the pipeline 23 there-through. The dimension of the through hole 183 is apparently larger than the outer dimension of the connector 4 fixed on the liner 2, so that the connector 4 and the heat-conducting board 182 are separated, that is, the two do not contact. This may reduce heat exchange between the evaporator 18 and the connector 4, so that the temperature in the connector 4 is higher than the freezing temperature of water. Preferably, the diameter of the through hole 183 is about twice the maximum outer diameter (the outer diameter of the protection umbrella 33) of the connector 4.

[0041] The temperature of the pipe section closest to the evaporator is kept above the freezing temperature of water, so that even if the pipe section has water detained therein, the water does not freeze, thereby largely reducing the possibility of ice blockage in the pipeline 23.

[0042] A gasket 5 is disposed between the connector 4 and the back wall 2a, and the gasket 5 is located in the through hole 183. The gasket 5 includes a via hole 34, and the inner diameter of the via hole 34 is larger than the outer dimension of the pipe body 35 of the connector 4, so that the pipe body 35 and an inner edge of the via hole 34 do not contact after the connector 4 passes through the via hole 34.

[0043] The protection umbrella 33 of the connector 4 is pressed against the gasket 5 and is deformed to closely contact the gasket 5, thereby preventing the foaming agent from entering the connection hole 32. Since the liner 2 is of low strength, the gasket 5 may function to strengthen and fix the connector 4.

[0044] The gasket 5 is preferably not made of a good conductor of heat. In this embodiment, the gasket 5 is made of plastic. Consequently, the gasket 5 located between the connector 4 and the heat-conducting board 182 may function to slow down heat exchange between the two.

[0045] In a radial direction, the gasket 5 and the through hole 183 may have a certain gap therebetween. Therefore, in the foaming procedure of the cabinet body 24, the thermal insulation foaming agent enters the gap, which evidently enhances the thermal insulation effect.

[0046] In a replacement embodiment, the gasket 5 contacts an edge of the through hole 183, and the heat exchange between the connector 4 and the heat-conducting board 182 is blocked by the gasket 5.

[0047] When the fixing of the connector 4 does not need the strengthening function of the gasket 5, a barrier unit for thermally isolating the connector 4 and the heat-conducting board 182 may be constituted only by a part of the thermal insulation layer 29. At this time, the connector 4 and the heat-conducting board 182 are thermally isolated by the thermal insulation layer 29.

[0048] In the above embodiments, the pipeline extends into the compartment from the back wall of the liner. In another embodiment, it is also possible that the pipeline enters the compartment from another wall of the liner, keeps a distance from the evaporator located near the wall, and is thermally isolated there-from.

[0049] In the above embodiments, the pipeline passes through the evaporator and the liner, and extends into the compartment. In another embodiment, the pipeline may also extend into the compartment from near an edge of the evaporator.

[0050] In the above embodiments, it is mainly by reducing the heat exchange between the pipeline and the evaporator that the temperature of the pipeline is kept above the freezing temperature of water. In a replacement embodiment, a heater for providing heat for the pipeline and a corresponding controller may also be disposed, so as to keep the temperature of the pipeline above a preset temperature.

Claims

1. A cooling appliance (1), comprising: a storage chamber (26) capable of being evacuated; a pipeline (23) for connecting the storage chamber (26) and an evacuation device (22) in a fluid communication manner; and an evaporator (18), wherein the pipeline (23) passes through the evaporator (18) or is located near an edge of the evaporator (18), **characterized in that** the pipeline (23) and the evaporator (18) are disposed at an interval.

2. The cooling appliance (1) according to claim 1, **characterized in that** the pipeline (23) and the evaporator (18) are thermally isolated.

3. The cooling appliance (1) according to claim 1, **characterized in that** the evaporator (18) has a through hole (183) for passing the pipeline (23) there-through, and a barrier unit is disposed between the through hole (183) and the pipeline (23) for reducing heat exchange between them.

4. The cooling appliance (1) according to claim 3, **characterized in that** the barrier unit comprises a thermal insulation foam material.

5. The cooling appliance (1) according to claim 3, **characterized in that** the pipeline (23) comprises a connector (4) fixed on a liner wall (2a) located near the evaporator (18), a gasket (5) is disposed between the connector (4) and the liner wall (2a), and the gasket (5) separates the evaporator (18) and the connector so as to form at least a part of the barrier unit.

6. The cooling appliance (1) according to claim 5, **characterized in that** the gasket (5) comprises a via hole (34), the connector (4) passes through the via hole (34), and a spacing is provided between the via hole (34) and a pipe body (35) of the connector (4).

7. The cooling appliance (1) according to claim 5 or 6, **characterized in that** a spacing is provided and a thermal insulation foam material is filled between the gasket (5) and an edge of the through hole (183).

8. A cooling appliance (1), comprising: a storage chamber (26) capable of being evacuated; a pipeline (23) for connecting the storage chamber (26) and an evacuation device (22) in a fluid communication manner, wherein the pipeline (23) comprises a connector (4) passing through and being fixed on a wall (2a); and an evaporator (18) located near the wall (2a), **characterized in that** the connector (4) and the evaporator (18) are disposed at an interval.

9. The cooling appliance (1) according to claim 8, **characterized in that** the connector (4) and the evaporator (18) are thermally isolated.

10. The cooling appliance (1) according to claim 8 or 9, **characterized in that** the evaporator (18) has a through hole (183) for passing the connector (4) there-through, and a barrier unit is disposed between the connector (4) and the through hole (183) for reducing heat exchange between them.

11. The cooling appliance (1) according to claim 10, **characterized in that** the barrier unit comprises a gasket (5) located between the connector (4) and the wall (2a), and the gasket (5) is at least partially exposed between the connector (4) and the through hole (183).

12. The cooling appliance (1) according to claim 11, **characterized in that** the gasket (5) comprises a via hole (34), the connector (4) passes through the via hole (34), and a spacing is provided between the via hole (34) and a pipe body (35) of the connector (4).

13. A cooling appliance (1), comprising: a storage chamber (26) capable of being evacuated; a pipeline (23) for connecting the storage chamber (26) and an evacuation device (22) in a fluid communication

manner; and an evaporator (18), wherein the pipeline (23) comprises a pipe section passing through the evaporator (18), **characterized in that** a temperature in the pipe section (4) is above a freezing temperature of water.

14. The cooling appliance (1) according to claim 13, **characterized in that** the pipe section and the evaporator (18) are spaced apart and thermally isolated.

15. The cooling appliance (1) according to claim 13 or 14, **characterized in that** the pipe section comprises a connector (4) fixed on a wall (2a) located near the evaporator (18).

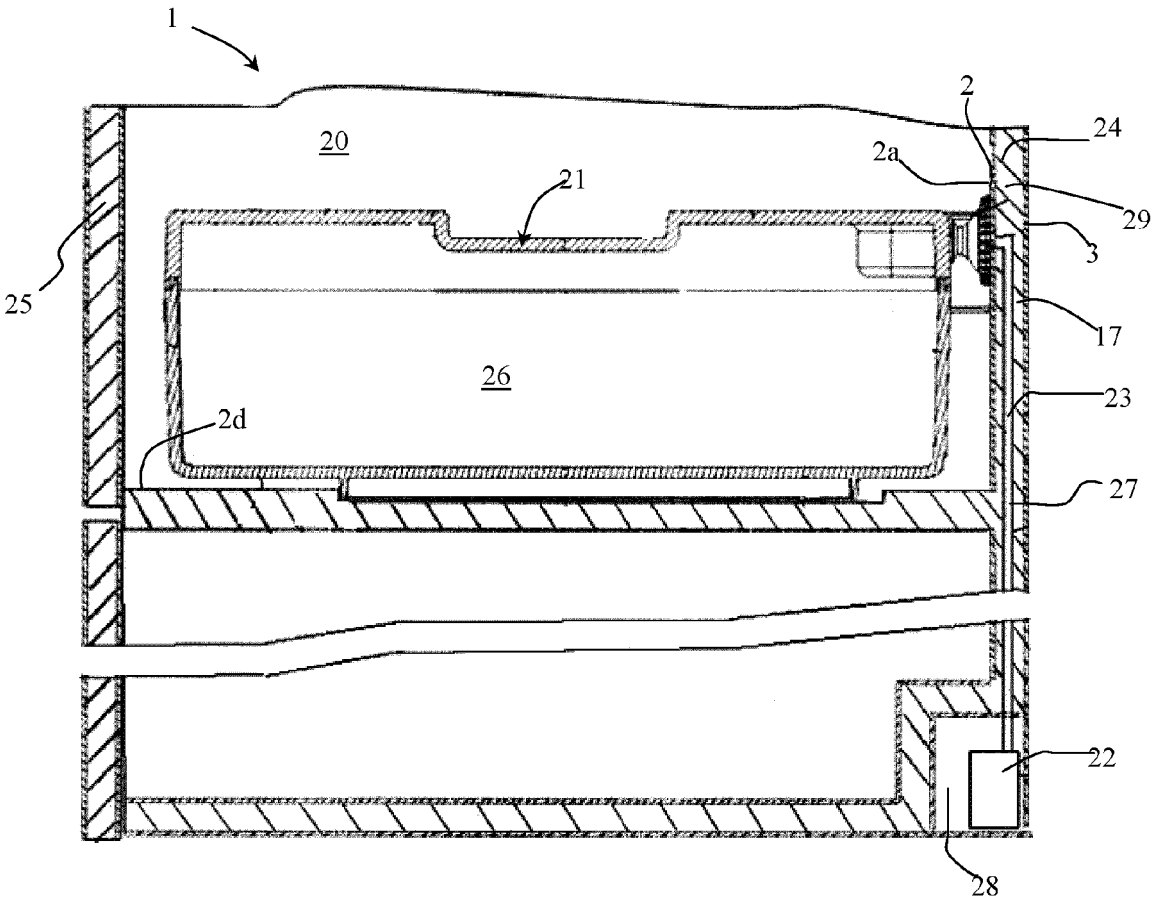

FIG. 1

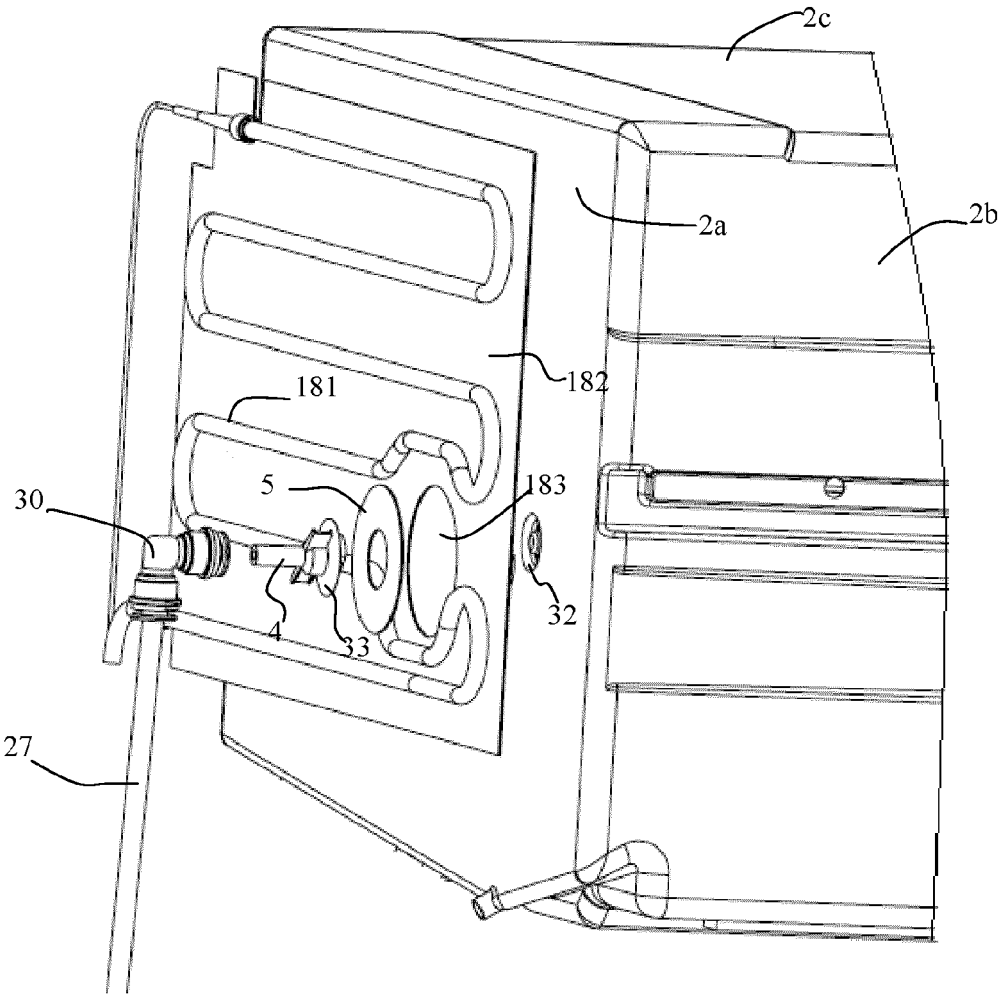

FIG. 2

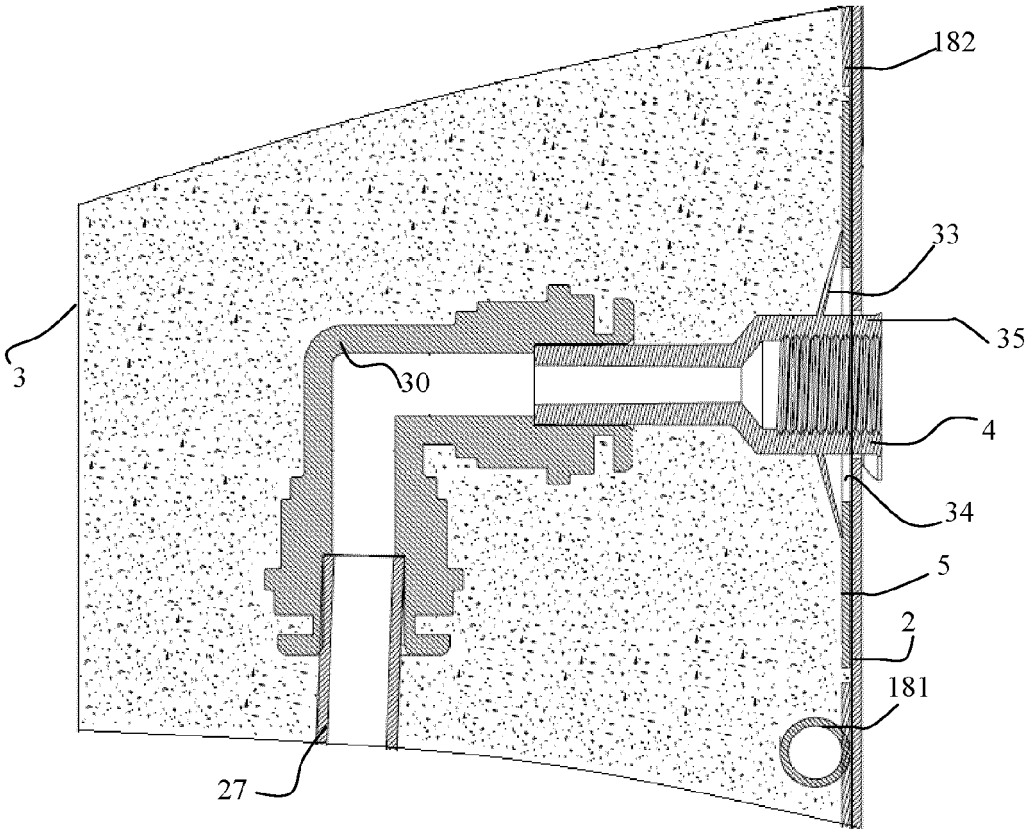

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 101865584 A **[0003]**
- WO 200910030543 A **[0037]**