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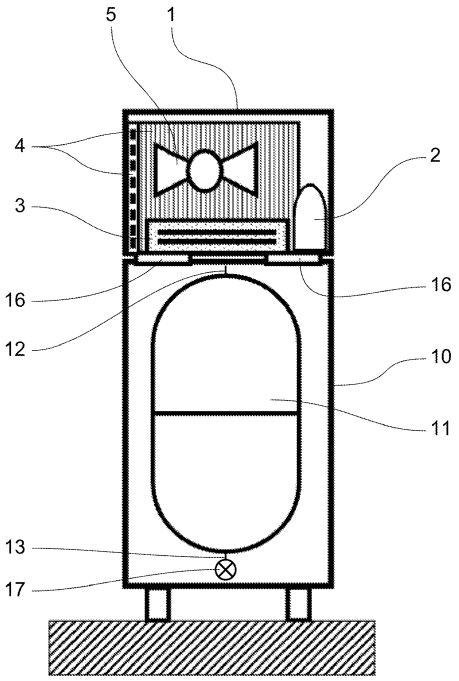
(54) Heat pump hot water supply apparatus

(57) A heat pump hot water supply apparatus comprising a heat pump unit 1 having a water refrigerant heat exchanger 3 which heats low temperature water, a hot water reservoir tank unit 10 having a hot water reservoir tank in which high temperature water heated by the water refrigerant heat exchanger 3 is stored, a water pipe 13 which sends low temperature water in a lower portion of the hot water reservoir tank to the water refrigerant heat exchanger 3, and a boiling pipe 12 which sends high temperature water heated by the water refrigerant heat exchanger 3 to an upper portion of the hot water reservoir tank, wherein the heat pump unit 1 is placed on a ceiling surface of the hot water reservoir tank unit 10, and the boiling pipe 12 is shorter than the water pipe 13. The heat pump hot water supply apparatus can be installed in an environment having a small installation space such as a detached house or an apartment in an urban area. A radiation loss from a connecting pipe can be reduced, material cost of the connecting pipe can be reduced, and the number of man-hours of a piping operation at the site of installation can be reduced.

Fig.1



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Description

Technical Field

[0001] The present invention relates to a structure of a heat pump hot water supply apparatus.

Background Technique

[0002] An example of a conventional heat pump hot water supply apparatus of the kind will be described below.

[0003] Fig. 7 shows a general structure of a conventional heat pump unit.

[0004] As shown in Fig. 7, in the heat pump unit, an air heat exchanger 4 and a blast fan 5 constituting a blast circuit are disposed on the left side of a compressor 2, a water refrigerant heat exchanger 3 and a pipe connecting tool 6 on the side of a heat pump are disposed on the right side of the compressor 2, and the blast circuit, the compressor 2 and the water refrigerant heat exchanger 3 are disposed in a widthwise direction of the heat pump unit (see patent document 1 for example).

[0005] Fig. 8 shows a general structure of a conventional heat pump hot water supply apparatus.

[0006] As shown in Fig. 8, a heat pump unit 1 and a hot water reservoir tank unit 10 are disposed on a floor, and the heat pump unit 1 and the hot water reservoir tank unit 10 are connected with each other through a connecting pipe 20 and a connecting pipe 21 (see patent document 2 for example).

Prior Art Documents

[0007]

[Patent Document 1] Japanese Patent Application Laid-open No.2006-308282
[Patent Document 2] Japanese Patent Application Laid-open No.2007-218528

[0008] According to the configuration of the conventional heat pump hot water supply apparatus, installation spaces of the heat pump unit 1, the hot water reservoir tank unit 10 and the connecting pipes 20 and 21 which connect water circuits thereof with each other are required on the floor. In a detached house or an apartment in a narrow area in an urban area, the installation space is not sufficient, and the heat pump hot water supply apparatus can not be installed, or if the heat pump hot water supply apparatus is installed, living space is affected. Therefore, a heat pump hot water supply apparatus which can be installed on a small floor is required.

[0009] Especially when installation places of the hot water reservoir tank unit 10 and the heat pump unit 1 are separated from each other, there are problems that since the lengths of the connecting pipes are increased, radiation loss from the connecting pipes is increased, performance of the hot water supply apparatus is deteriorated, a material cost of the pipes is increased, and the number of man-hours of a piping operation at the site of installation is increased.

[0010] The configuration of the conventional heat pump unit has problems that a width of the heat pump unit is increased, and the heat pump unit can not be installed in a pipe shaft room and a meter box in an apartment.

Disclosure of the Invention

[0011] The present invention is for solving the conventional problems, and it is an object of the invention to provide a heat pump hot water supply apparatus which can be installed in an environment having a small installation space in a detached house or an apartment in a narrow area in an urban area, which can reduce the radiation loss from the connecting pipe, in which material cost of the connecting pipe can be reduced, and the number of man-hours of a piping operation at the site of installation can be reduced.

[0012] To solve the conventional problem, the present invention provides a heat pump hot water supply apparatus comprising a heat pump unit having a water refrigerant heat exchanger which heats low temperature water, a hot water reservoir tank unit having a hot water reservoir tank in which high temperature water heated by the water refrigerant heat exchanger is stored, a water pipe through which low temperature water in a lower portion of the hot water reservoir tank is sent to the water refrigerant heat exchanger, and a boiling pipe through which high temperature water heated by the water refrigerant heat exchanger is sent to an upper portion of the hot water reservoir tank, wherein the heat pump unit is placed on a ceiling surface of the hot water reservoir tank unit, and the boiling pipe is shorter than the water pipe. The installation spaces for the heat pump unit and the connecting pipe can be constituted within a ceiling surface of the hot water reservoir tank unit. As compared with the conventional heat pump hot water supply apparatus which was constituted on a floor, its installation space can largely be saved.

[0013] According to the invention, it is possible to provide a heat pump hot water supply apparatus in which the radiation loss from the connecting pipe can be reduced while realizing space-saving of installation of the heat pump hot water supply apparatus in an environment having a small installation space in a detached house or an apartment in a narrow area in an urban area, radiation loss from the connecting pipe can be reduced, material cost of the connecting pipe can be reduced, and the number of man-hours of a piping operation at the site of installation can be reduced.

Brief Description of the Drawings

[0014]

Fig. 1 is a schematic front sectional view of a heat pump hot water supply apparatus according to a first embodiment of the present invention;
Fig. 2 is a schematic side sectional view of the heat pump hot water supply apparatus;
Fig. 3 is a schematic plan sectional view of a heat pump unit according to a second embodiment of the invention;
Fig. 4 is a schematic front sectional view of an installed heat pump hot water supply apparatus according to the third embodiment of the invention;
Fig. 5 is a schematic side sectional view of the installed heat pump hot water supply apparatus;
Fig. 6 is a schematic plan sectional view of the installed heat pump hot water supply apparatus;
Fig. 7 is a schematic plan sectional view of a conventional heat pump unit; and
Fig. 8 is a schematic front view of an installed conventional heat pump hot water supply apparatus.

Mode for Carrying Out the Invention

[0015] A first aspect of the invention provides heat pump hot water supply apparatus comprising a heat pump unit having a water refrigerant heat exchanger which heats low temperature water, a hot water reservoir tank unit having a hot water reservoir tank in which high temperature water heated by the water refrigerant heat exchanger is stored, a water pipe through which low temperature water in a lower portion of the hot water reservoir tank is sent to the water refrigerant heat exchanger, and a boiling pipe through which high temperature water heated by the water refrigerant heat exchanger is sent to an upper portion of the hot water reservoir tank, wherein the heat pump unit is placed on a ceiling surface of the hot water reservoir tank unit, and the boiling pipe is shorter than the water pipe. Since the radiation area of the boiling pipe can be made small, radiation loss from a boiling side pipe can be reduced, and performance of the heat pump hot water supply apparatus can be enhanced.

[0016] According to a second aspect of the invention, widths of the heat pump unit and the hot water reservoir tank unit are 800 mm or less. Conventionally, only the hot water reservoir tank unit can be accommodated in narrow spaces in a pipe shaft and a meter box of an apartment having a door of 900 mm to 1200 mm width, but according to the second aspect, the hot water reservoir tank unit and the heat pump unit can be accommodated in the same narrow space in a state where they are vertically connected with each other.

[0017] According to a third aspect of the invention, a connecting unit which connects the ceiling surface of the hot water reservoir tank unit and a bottom surface of the heat pump unit with each other is disposed on the ceiling surface of the hot water reservoir tank unit. Since the bottom of the heat pump unit and the ceiling surface of the hot water reservoir tank unit are connected with each other, the heat pump unit and the hot water reservoir tank unit can integrally be formed as one unit.

[0018] Further, installation spaces for the heat pump unit, the high temperature-side connecting pipe and the low temperature-side connecting pipe can be constituted within the ceiling surface of the hot water reservoir tank unit. Conventionally, the heat pump unit, the high temperature-side connecting pipe and the low temperature-side connecting pipe occupied a floor, but according to the third aspect, these members are eliminated from the floor, and the installation space for the heat pump hot water supply apparatus can be saved.

[0019] The pipes can be connected before installation, and the heat pump unit and the hot water reservoir tank unit can previously be integrally formed as one unit. Therefore, especially when the heat pump hot water supply apparatus is installed in a narrow space in a pipe shaft room or a meter box in an apartment where the piping operation is difficult, the heat pump hot water supply apparatus can be installed extremely easily.

[0020] According to a fourth aspect of the invention, a high temperature-side pipe connecting tool to which the boiling pipe is connected, and a low temperature-side pipe connecting tool to which the water pipe is connected are disposed on the ceiling surface of the hot water reservoir tank unit. The high temperature-side pipe connecting tool and the low temperature-side pipe connecting tool of the hot water reservoir tank unit can be disposed near the heat pump unit.

[0021] According to a fifth aspect of the invention, a high temperature-side pipe connecting tool and a low temperature-side pipe connecting tool connected to a water circuit of the water refrigerant heat exchanger are provided on a back surface of the heat pump unit, the high temperature-side pipe connecting tool of the hot water reservoir tank unit and the high temperature-side pipe connecting tool of the heat pump unit are connected with each other through a high temperature-side connecting pipe, and the low temperature-side pipe connecting tool of the hot water reservoir tank unit and the low temperature-side pipe connecting tool of the heat pump unit are connected with each other through a low temperature-side connecting pipe. The high temperature-side connecting pipe and the low temperature-side pipe connecting tool can largely be shortened, and the radiation area at the high temperature-side connecting pipe can be reduced. Therefore, the radiation loss can be reduced, and the connecting pipe can be shortened. Thus, the material cost of the connecting pipe can be reduced, and number of man-hours can also be reduced.

[0022] According to a sixth aspect of the invention, an outwardly swelling convex portion is provided on a back surface of the heat pump unit. Since the convex portion is provided, a new space is generated, and parts such as a refrigerant pipe and water refrigerant heat exchanger can be accommodated in this space. It was necessary to secure a space of 100 mm or more as an air suction space, the space of the back surface was a dead space. This dead space can effectively utilized as a space for

accommodating parts. The refrigerant pipe accommodation space, the high temperature-side pipe connecting tool, the low temperature-side pipe connecting tool, the pipe cover and the operation space for connecting pipe which were conventionally constituted in the widthwise direction are disposed in the backward direction in this aspect. According to this configuration, a space in the widthwise direction can largely be reduced.

[0023] According to a seventh aspect of the invention, the width of the heat pump unit is equal to or less than the width of the hot water reservoir tank unit. The width of the heat pump hot water supply apparatus is further reduced, and the heat pump hot water supply apparatus can be installed in a narrow space in a pipe shaft room or a meter box in an apartment where the piping operation is difficult.

[0024] More specifically, even in a narrow space in the pipe shaft or a meter box of an apartment formed from a door having a width in a range of 900 mm to a value less than 1200 mm where only a hot water reservoir tank unit can conventionally be accommodated, the hot water reservoir tank unit and the heat pump unit can be accommodated in a state where they are integrally formed as one unit.

[0025] Embodiments of the present invention will be described with reference to the drawings. The invention is not limited to the embodiments.

(First Embodiment)

[0026] Fig. 1 is a schematic front sectional view of a heat pump hot water supply apparatus according to a first embodiment of the invention. Fig. 2 is a schematic side sectional view of the heat pump hot water supply apparatus.

[0027] In Figs. 1 and 2, two connecting units 16 are provided on a ceiling surface of a hot water reservoir tank unit 10.

[0028] A refrigerant compressor 2, a water refrigerant heat exchanger 3, air heat exchangers 4, and a blast fan 5 are provided in a heat pump unit 1. The refrigerant compressor 2, the water refrigerant heat exchanger 3 and the air heat exchangers 4 are connected with each other through refrigerant pipes. A refrigerant compressed in the refrigerant compressor 2 dissipates heat in the water refrigerant heat exchanger 3 and then, is decompressed by a pressure reducing device (not shown), heat of the refrigerant is absorbed by the air heat exchanger 4, and the refrigerant is gasified, and sucked into the refrigerant compressor 2. The blast fan 5 facilitates heat exchange in the air heat exchanger 4.

[0029] A high temperature-side pipe connecting tool 6 and a low temperature-side pipe connecting tool 7 are provided on a back surface of the heat pump unit 1. The high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are connected to a water circuit of the water refrigerant heat exchanger 3. Low temperature water flows from the low temperature-side pipe connecting tool 7 to the water refrigerant heat exchanger 3, high temperature water heated by the water refrigerant heat exchanger 3 flows out from the high temperature-side pipe connecting tool 6.

[0030] A hot water reservoir tank 11 is provided in the hot water reservoir tank unit 10. A high temperature-side pipe connecting tool 14 and a low temperature-side pipe connecting tool 15 are provided on a ceiling surface of the hot water reservoir tank unit 10.

[0031] A lower portion of the hot water reservoir tank 11 and the low temperature-side pipe connecting tool 15 are connected with each other through a water pipe 13. A boiling circulation pump 17 is provided at the water pipe 13. An upper portion of the hot water reservoir tank 11 and the high temperature-side pipe connecting tool 14 are connected with each other through a boiling pipe 12.

[0032] A high temperature-side connecting pipe 20 connects the high temperature-side pipe connecting tool 6 of the heat pump unit 1 and the high temperature-side pipe connecting tool 14 of the hot water reservoir tank unit 10 with each other. A low temperature-side connecting pipe 21 connects the low temperature-side pipe connecting tool 7 of the heat pump unit 1 and the low temperature-side pipe connecting tool 15 of the hot water reservoir tank unit 10 with each other.

[0033] Low temperature water is guided by the boiling circulation pump 17 from a bottom of the hot water reservoir tank 11 into the water circuit of the water refrigerant heat exchanger 3 through the water pipe 13 and the low temperature-side connecting pipe 21. High temperature water heated by the water refrigerant heat exchanger 3 is guided from a top of the hot water reservoir tank 11 into the hot water reservoir tank 11 through the high temperature-side connecting pipe 20 and the boiling pipe 12. The hot water reservoir tank 11 guides low temperature water from a bottom thereof, guides high temperature water from a top thereof, and water in the hot water reservoir tank 11 is not stirred, thereby constituting a lamination type tank.

[0034] The heat pump unit 1 is disposed on the ceiling surface of the hot water reservoir tank unit 10, and a bottom of the heat pump unit 1 and the ceiling surface of the hot water reservoir tank unit 10 are connected with each other through the connecting units 16.

[0035] In the heat pump hot water supply apparatus having the above-described configuration, operation and effect thereof will be described below.

[0036] Since the heat pump unit 1 is disposed on the ceiling surface of the hot water reservoir tank unit 10, a floor installation space for the heat pump unit 1 becomes unnecessary. The high temperature-side connecting pipe 20 connects the high temperature-side pipe connecting tool 14 provided on the ceiling surface of the hot water reservoir tank unit 10 and the high temperature-side pipe connecting tool 6 provided on the back surface of the heat pump unit 1 with each other. The low temperature-side connecting pipe 21 connects the low temper-

ature-side pipe connecting tool 15 provided on the ceiling surface of the hot water reservoir tank unit 10 and the low temperature-side pipe connecting tool 7 provided on the back surface of the heat pump unit 1 with each other. The high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 are disposed in a space above the ceiling surface of the hot water reservoir tank unit 10 and on the side of the back surface of the heat pump unit 1, and the floor installation space becomes unnecessary.

[0037] The high temperature-side pipe connecting tool 14 and the low temperature-side pipe connecting tool 15 of the hot water reservoir tank unit 10, and the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 of the heat pump unit 1 are constituted within the ceiling surface of the hot water reservoir tank unit 10 as viewed from above, a distance between respective connecting tools is reduced, and lengths of the high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 can be shortened.

[0038] The high temperature-side pipe connecting tool 6 of the heat pump unit 1, the high temperature-side pipe connecting tool 14 of the hot water reservoir tank unit 10, and the top of the hot water reservoir tank 11 which is an inlet of high temperature water in the hot water reservoir tank 11 come close to each other, and lengths of the high temperature-side connecting pipe 20 and the boiling pipe 12 through which high temperature water flows can be shortened, and the radiation loss can be reduced.

[0039] As described above, in the first embodiment, the connecting unit 16 is provided on the ceiling surface of the hot water reservoir tank unit 10, the heat pump unit 1 is disposed on the ceiling surface of the hot water reservoir tank unit 10, the bottom of the heat pump unit 1 and the ceiling surface of the hot water reservoir tank unit 10 are connected with each other through the connecting units 16. According to this configuration, installation spaces of the heat pump unit 1, the high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 can be constituted within the installation space (within a range of the ceiling surface) of the hot water reservoir tank unit 10.

[0040] According to this configuration, installation spaces on a floor which were conventionally occupied by the heat pump unit 1, the high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 become unnecessary, and a space is largely saved when the heat pump hot water supply apparatus is installed. The high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 can be made as connecting units formed from metal pipes for connecting the hot water reservoir tank unit 10 and the heat pump unit 1 with each other.

[0041] The high temperature-side pipe connecting tool 14 and the low temperature-side pipe connecting tool 15 are provided on the ceiling surface of the hot water reservoir tank unit 10, and the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are provided on the back surface of the heat pump unit 1 which is connected to the ceiling surface of the hot water reservoir tank unit 10. According to this configuration, the high temperature-side pipe connecting tool 6, the high temperature-side pipe connecting tool 14, and the top of the hot water reservoir tank 11 which is the inlet of high temperature water in the hot water reservoir tank 11 come close to each other.

[0042] Therefore, the lengths of the high temperature-side connecting pipe 20 and the boiling pipe 12 through which heated high temperature water flows can be shortened, the radiation area can be reduced, a radiation amount is suppressed, and the performance of the hot water supply apparatus can be enhanced.

[0043] Since the lengths of the high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 can be shortened, the pipe material cost can be reduced, and the number of man-hours of the operation can be reduced. The connecting operation of the high temperature-side connecting pipe 20 and the low temperature-side connecting pipe 21 can be carried out before the heat pump unit 1 and the hot water reservoir tank unit 10 are installed, and the heat pump unit 1 and the hot water reservoir tank unit 10 can integrally be formed together before they are installed. Therefore, it becomes extremely easy to install them in a narrow space such as a shaft room and a meter box in an apartment where the connecting operation of pipes is difficult.

(Second Embodiment)

[0044] Fig. 3 is a schematic plan sectional view of a heat pump unit of a heat pump hot water supply apparatus according to a second embodiment of the invention. The heat pump unit 1 of the second embodiment can be used instead of the heat pump unit described with reference to Figs. 1 and 2. In the second embodiment, the same members as those of the first embodiment are designated with the same symbols, and explanation thereof will be omitted. In the second embodiment, although the hot water reservoir tank unit 10 is not illustrated, the heat pump unit 1 of the second embodiment is constituted within a ceiling surface of the hot water reservoir tank unit 10 as viewed from above as described with reference to Figs. 1 and 2.

[0045] As shown in Fig. 3, a back surface of the heat pump unit 1 is swelled and formed into a convex shape, and a new space generated by this convex shape is used as a refrigerant accommodation space 9. This refrigerant accommodation space 9 may be used as a space for accommodating the water refrigerant heat exchanger 3 therein. The high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are disposed on the back surface. The high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are covered with a pipe cover 8.

[0046] More specifically, the refrigerant compressor 2

is provided on one side in the heat pump unit 1 in its widthwise direction, the refrigerant accommodation space 9 is formed on the side of a back surface of the refrigerant compressor 2, and the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 project toward the back surface as compared with a position of the air heat exchanger 4. Since the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 project toward the back surface as compared with the air heat exchanger 4, when the heat pump unit 1 is disposed along two intersecting wall surfaces 41, an air suction space 43 is formed on the side of a back surface of the air heat exchanger 4. When the air heat exchanger 4 is formed into an L-shape as viewed from above as shown in Fig. 3, a portion of the air heat exchanger 4 is located on the other side in the heat pump unit 1 in the widthwise direction. Therefore, the heat pump unit 1 is disposed such that the air suction space 42 is provided on the other side of the heat pump unit 1. A symbol 40 represents air flow caused by the blast fan 5.

[0047] In the heat pump unit 1 having the above-described configuration, operation and effect thereof will be described below.

[0048] Conventionally, the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 were disposed in the widthwise direction (side surface) of the heat pump unit 1. In the present invention, they are disposed on the back surface of the heat pump unit 1. Therefore, the space in the heat pump unit 1 in its widthwise direction which is required for installing the heat pump unit 1 can largely be reduced. When the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are disposed on the back surface of the heat pump unit 1, the refrigerant accommodation space 9 is provided on the back surface of the refrigerant compressor 2. According to this configuration, the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 can project toward the back surface as compared with the position of the air heat exchanger 4, and the air suction space 42 can reliably be secured on the back surface of the heat pump unit 1. Since the high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are disposed on the back surface of the heat pump unit 1, the pipe cover 8 is also disposed on the side of the back surface of the heat pump unit 1. Therefore, a space in the heat pump unit 1 in its widthwise direction can be reduced. An operation space for piping operation of the connecting pipes can be secured in a backward position.

[0049] More specifically, sizes of doors used for pipe shaft rooms were checked, and it was found that most popular widths of the doors were three widths, i.e., 600 mm, 900 mm and 1200 mm.

[0050] Therefore, conventionally, a heat pump hot water supply apparatus was installed in an apartment such that only the hot water reservoir tank was accommodated in the pipe shaft room, and the heat pump unit 1 was installed on a balcony or a shared corridor.

[0051] This is because that in order to install the heat pump unit 1 in the pipe shaft room, it is necessary to reduce a widthwise space required for installing the heat pump unit 1, and it is also necessary to eliminate the deterioration in performance which is caused by reduction in temperature in the pipe shaft room by cold air generated from the heat pump unit 1.

[0052] In addition to the width of the heat pump unit 1, it is necessary to secure the width of the door. More specifically, it is necessary to secure 100 mm or more as the air suction space 42, and a space of 300 mm or more for the piping operation of the connecting pipes, and if a width of the heat pump unit is 820 mm, a total required width is 1220 mm (820 mm + 100 mm 300 mm) .

[0053] Therefore, the condition of the width of the door, i.e., 900 mm could not be satisfied.

[0054] In the heat pump hot water supply apparatus and its installation structure, conventionally, the refrigerant accommodation space 9, the high temperature-side pipe connecting tool 6, the low temperature-side pipe connecting tool 7 and the pipe cover 8 were constituted in the widthwise direction. In this embodiment, the refrigerant accommodation space 9, the high temperature-side pipe connecting tool 6, the low temperature-side pipe connecting tool 7 and the pipe cover 8 as well as the piping operation space of the connecting pipes of 300 mm are disposed in the backward direction. Therefore, the width of the heat pump unit 1 can be 800 mm or less, and this size is less than the width of the hot water reservoir tank unit 10.

[0055] Thus, a total size of the width 800 mm of the heat pump unit 1 and the width 100 mm of the air suction space 42 becomes 900 mm, this is the size required in the widthwise direction, and they can be accommodated in the pipe shaft having the door of 900 mm width. This is because that the width in the pipe shaft room usually becomes larger than a width of the door due to a structural reason.

(Third Embodiment)

[0056] Figs. 4 to 6 show an installation example of the heat pump hot water supply apparatus of the invention into the pipe shaft room.

[0057] Fig. 4 is a schematic front sectional view of a heat pump hot water supply apparatus installed in the pipe shaft room according to a third embodiment of the invention. Fig. 5 is a schematic side sectional view of the heat pump hot water supply apparatus installed in the pipe shaft room according to the third embodiment of the invention. Fig. 6 is a schematic plan sectional view of the heat pump hot water supply apparatus installed in the pipe shaft room according to the third embodiment of the invention. Since configurations of the heat pump unit 1 and the hot water reservoir tank unit 10 are the same as those in the embodiments shown in Figs. 1 and 2, the

same elements are designated with the same symbols, and explanation thereof will be omitted. The heat pump unit in the embodiment shown in Fig. 3 may be applied to the third embodiment.

[0058] Figs. 4, 5 and 6 show a pipe shaft room 31 having a door 34, and a width of the door 34 is 900 mm. A width of the heat pump unit 1 is 800 mm or less, and this width is equal to or less than that of the hot water reservoir tank unit 10. It is preferable that a width of the hot water reservoir tank unit is also 800 mm or less. The high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are disposed behind the heat pump unit 1. The heat pump unit 1 is connected to an upper surface of the hot water reservoir tank unit 10, and the heat pump unit 1 is disposed in a state where the heat pump unit 1 is adjacent to the door 34 in the pipe shaft room 31.

[0059] The air suction space 42 is adjoined to the heat pump unit 1, and a pipe installing area 35 in which a water supply pipe, a drain pipe and a meter are accommodated is formed behind the air suction space 42.

[0060] A soft thermal insulation seal material 38 is annularly provided on a front surface of the heat pump unit 1, and the heat pump unit 1 is in intimate contact with an inner wall surface of the door 34 through the thermal insulation seal material 38.

[0061] An air suction port 32 is provided below the door 34, and an air blowoff port 33 is provided above the door 34. The air blowoff port 33 includes a wind-direction changing plate 33a such that air is blown horizontally or slightly upwardly.

[0062] Operation and effect of the heat pump hot water supply apparatus which was installed as described above will be described below.

[0063] First, when the heat pump hot water supply apparatus is operated, air sucked from the air suction port 32 located below the door 34 passes through the air heat exchanger 4 as shown with the symbols 40, and the air is blown outside of the pipe shaft room 31 from the air blowoff port 33 located above the door 34.

[0064] The air blowoff port 33 includes the wind-direction changing plate 33a such that air is blown horizontally or slightly upwardly so that cold air does not flow downward. The soft thermal insulation seal material 38 is annularly provided on the front surface of the heat pump unit 1 so that cold air does not leak into the pipe shaft room 31 in association with the inner wall surface of the door 34. The thermal insulation seal material 38 may be fixed to the inner wall surface of the door 34 of the pipe shaft room 31.

[0065] In the third embodiment, the width of the heat pump unit 1 is 800 mm or less, and is equal to or less than the width of the hot water reservoir tank unit 10. The high temperature-side pipe connecting tool 6 and the low temperature-side pipe connecting tool 7 are disposed behind the heat pump unit 1, and the heat pump unit 1 is connected to the upper surface of the hot water reservoir tank unit 10.

[0066] According to this configuration, the soft thermal insulation seal material 38 is annularly provided on the front surface of the heat pump unit 1, and the wind-direction changing plate 33a is provided at the air blowoff port 33 so that air is blown horizontally or slightly upwardly. Therefore, it is possible to prevent cold air from entering into the pipe shaft room 31, to prevent the temperature of air in the pipe shaft room 31 from being reduced, and to prevent deterioration in performance of the heat pump hot water supply apparatus. It is possible to prevent dew condensation from being formed on a wall 30 of a building, a pipe or a device such as a meter by cold air. It is possible to prevent cold air from blowing against a pedestrian in a passage.

[0067] As described above, the heat pump hot water supply apparatus of the present invention can be installed in a narrow space. The heat pump unit of the invention can also be applied as an outdoor unit of an air conditioner.

Claims

1. A heat pump hot water supply apparatus comprising a heat pump unit having a water refrigerant heat exchanger which heats low temperature water, a hot water reservoir tank unit having a hot water reservoir tank in which high temperature water heated by the water refrigerant heat exchanger is stored, a water pipe through which low temperature water in a lower portion of the hot water reservoir tank is sent to the water refrigerant heat exchanger, and a boiling pipe through which high temperature water heated by the water refrigerant heat exchanger is sent to an upper portion of the hot water reservoir tank, wherein the heat pump unit is placed on a ceiling surface of the hot water reservoir tank unit, and the boiling pipe is shorter than the water pipe.

2. The heat pump hot water supply apparatus according to claim 1, wherein widths of the heat pump unit and the hot water reservoir tank unit are 800 mm or less.

3. The heat pump hot water supply apparatus according to claim 1 or 2, wherein a connecting unit which connects the ceiling surface of the hot water reservoir tank unit and a bottom surface of the heat pump unit with each other is disposed on the ceiling surface of the hot water reservoir tank unit.

4. The heat pump hot water supply apparatus according to any one of claims 1 to 3, wherein a high temperature-side pipe connecting tool to which the boiling pipe is connected, and a low temperature-side pipe connecting tool to which the water pipe is connected are disposed on the ceiling surface of the hot water reservoir tank unit.

5. The heat pump hot water supply apparatus according to claim 4, wherein a high temperature-side pipe connecting tool and a low temperature-side pipe connecting tool connected to a water circuit of the water refrigerant heat exchanger are provided on a back surface of the heat pump unit, the high temperature-side pipe connecting tool of the hot water reservoir tank unit and the high temperature-side pipe connecting tool of the heat pump unit are connected with each other through a high temperature-side connecting pipe, and the low temperature-side pipe connecting tool of the hot water reservoir tank unit and the low temperature-side pipe connecting tool of the heat pump unit are connected with each other through a low temperature-side connecting pipe.

6. The heat pump hot water supply apparatus according to claim 1, wherein an outwardly swelling convex portion is provided on a back surface of the heat pump unit.

7. The heat pump hot water supply apparatus according to any one of claims 1 to 6, wherein the width of the heat pump unit is equal to or less than the width of the hot water reservoir tank unit.

Fig.1

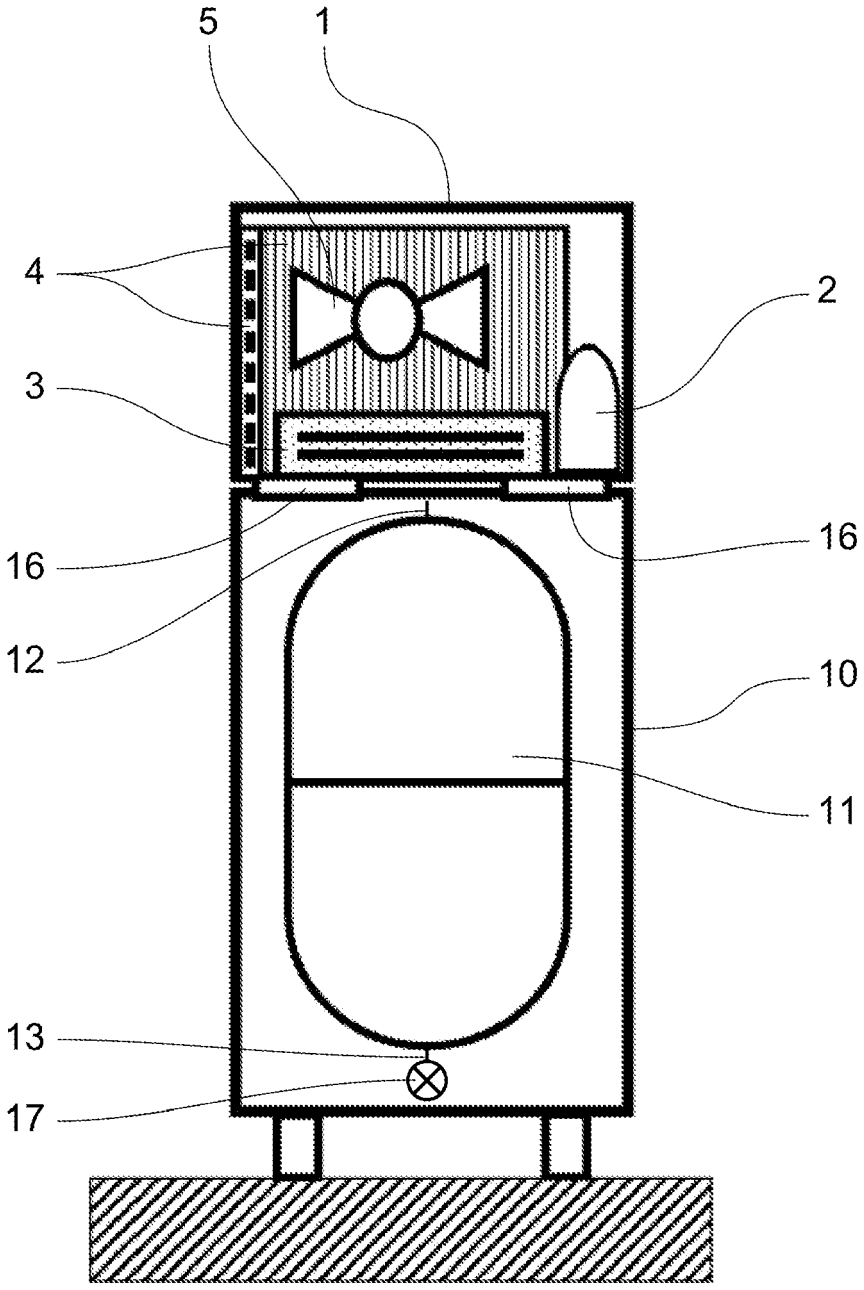


Fig.2

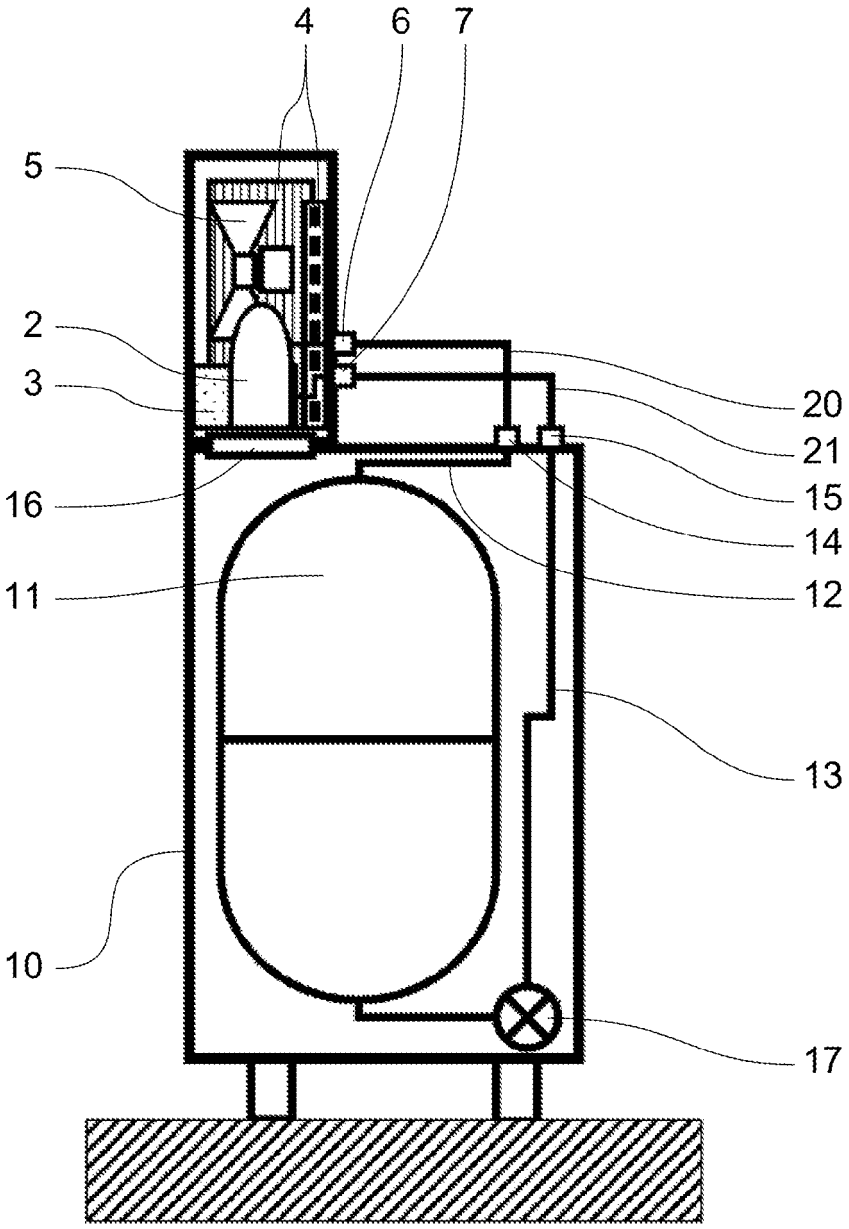


Fig.3

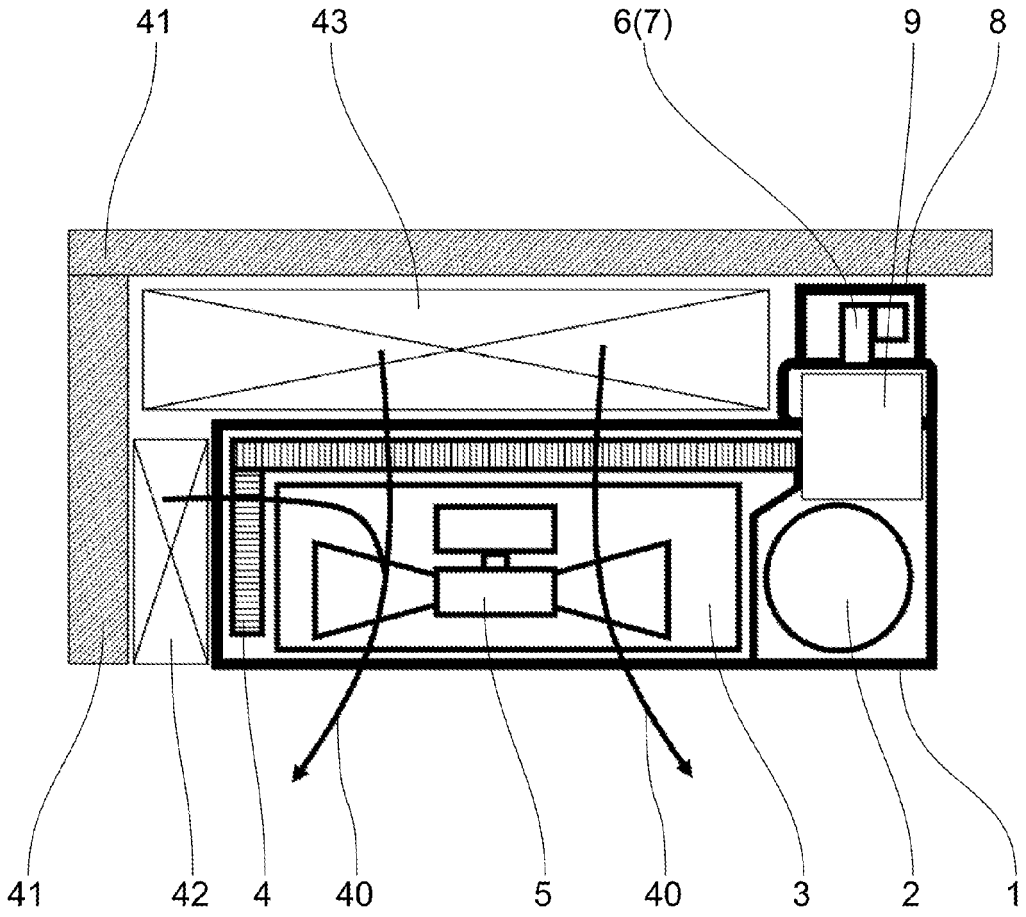


Fig.4

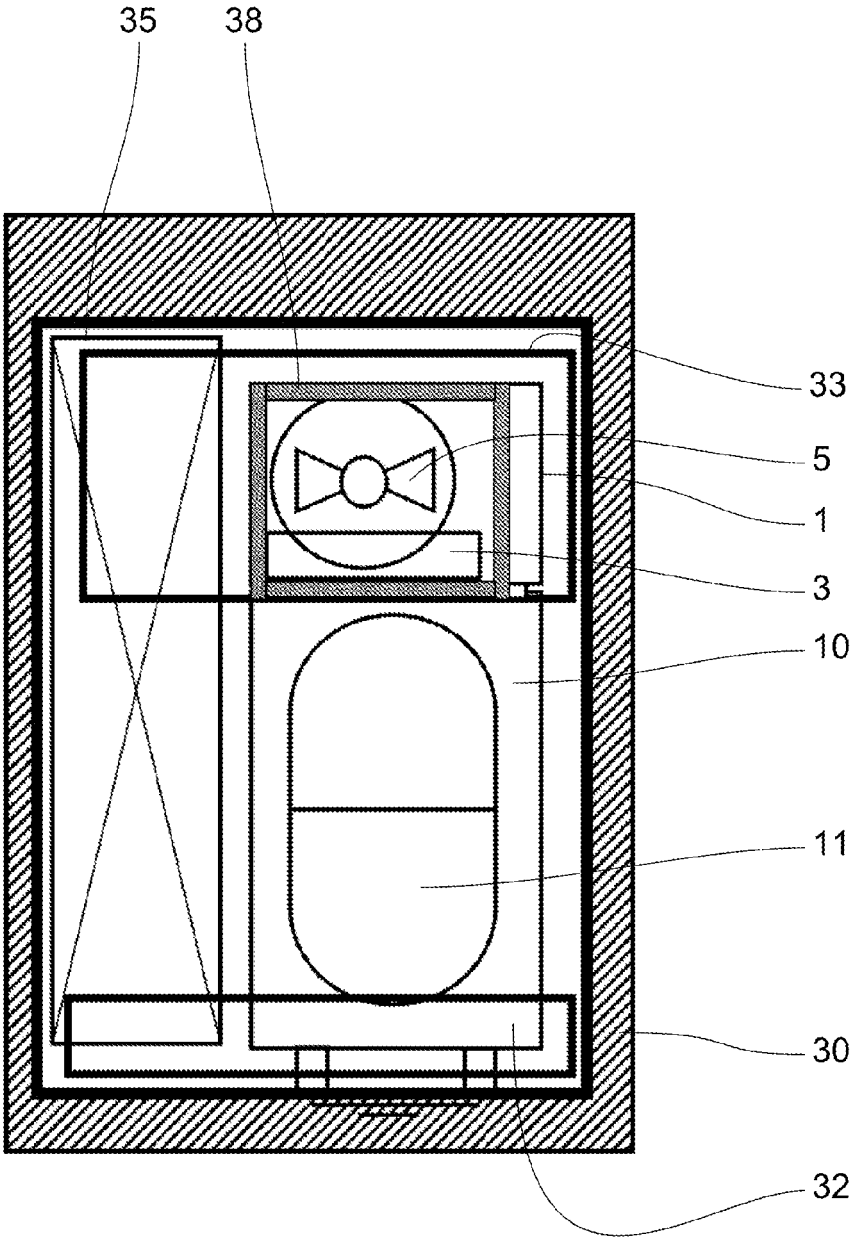


Fig.5

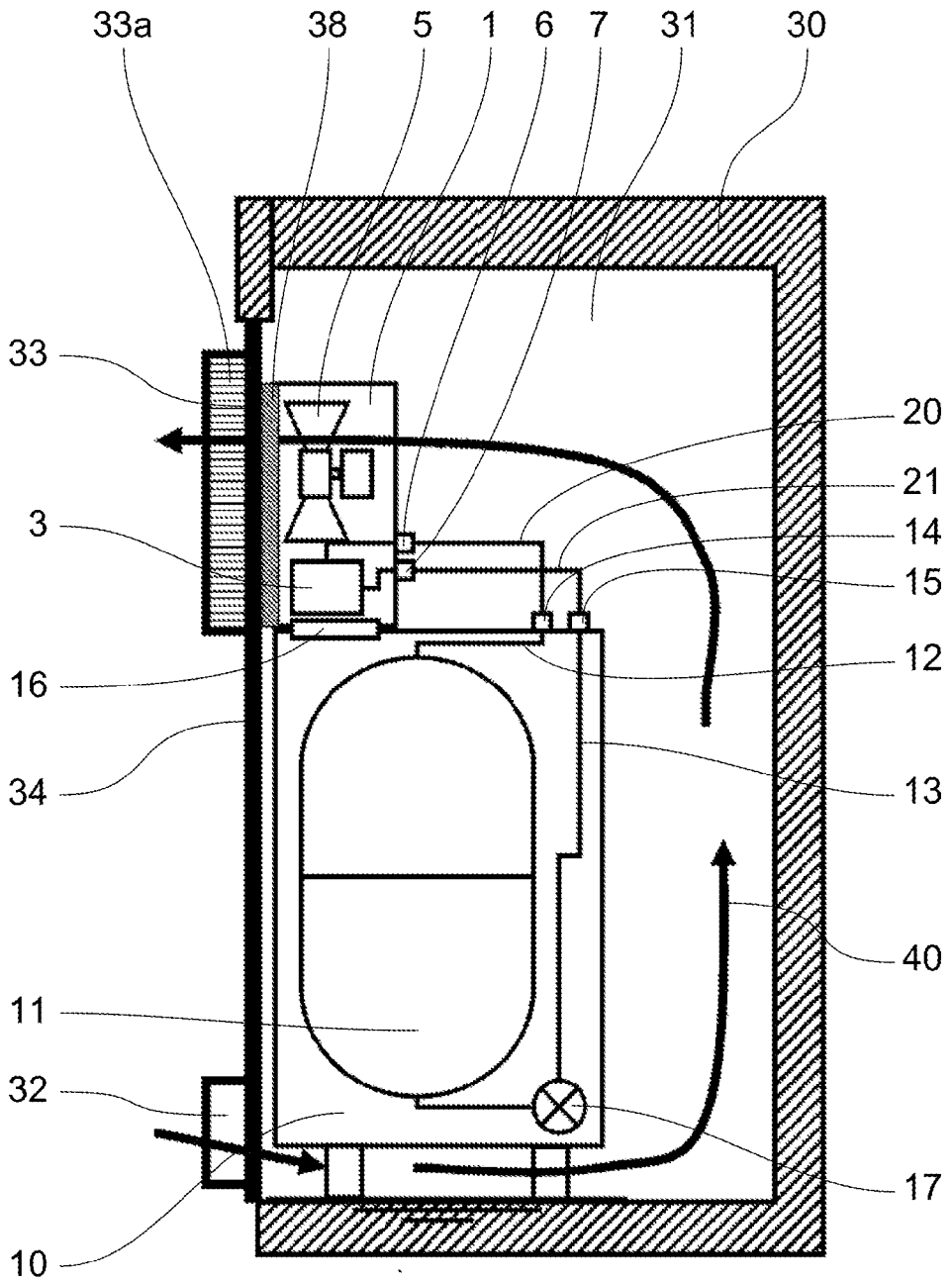


Fig.6

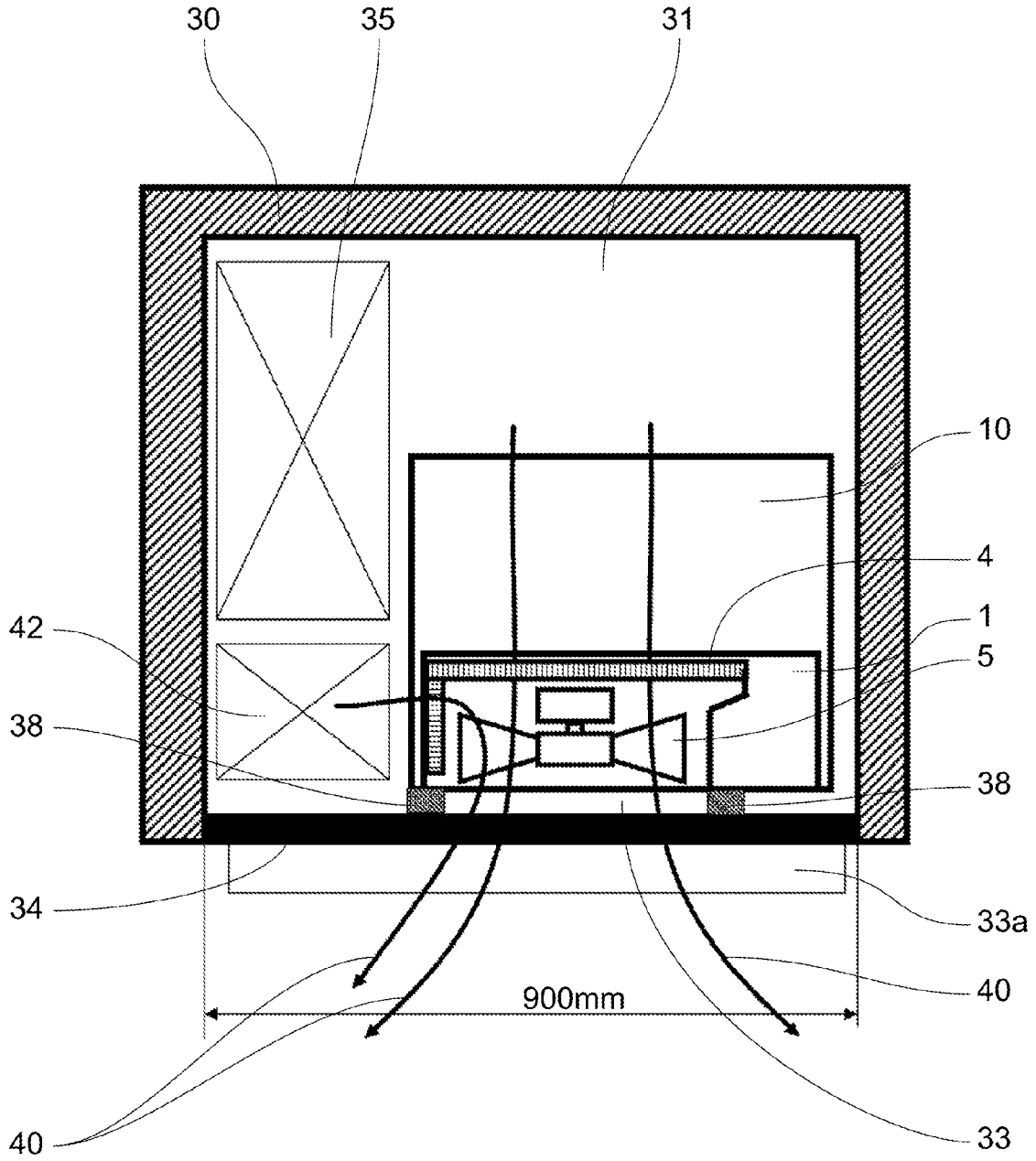


Fig.7

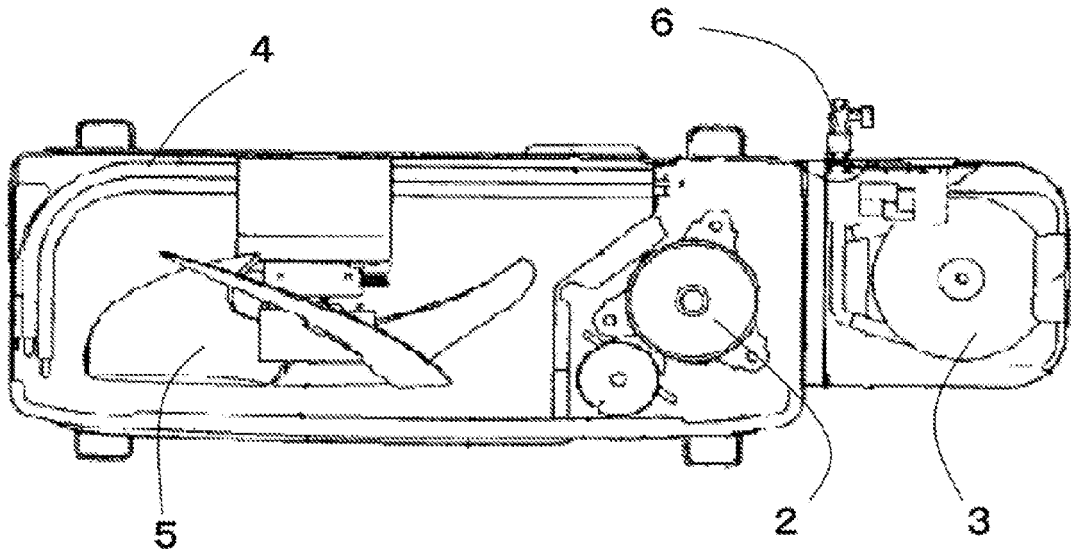
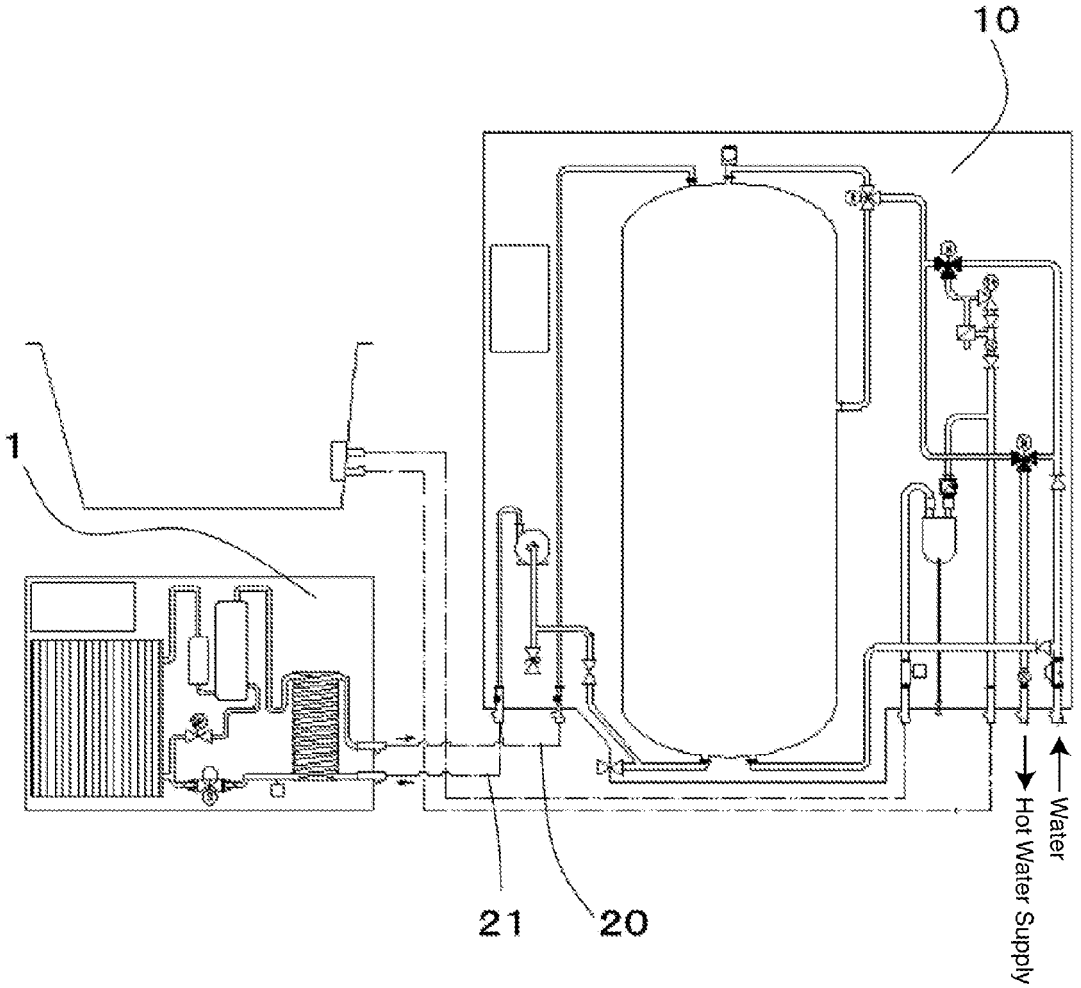


Fig.8



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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