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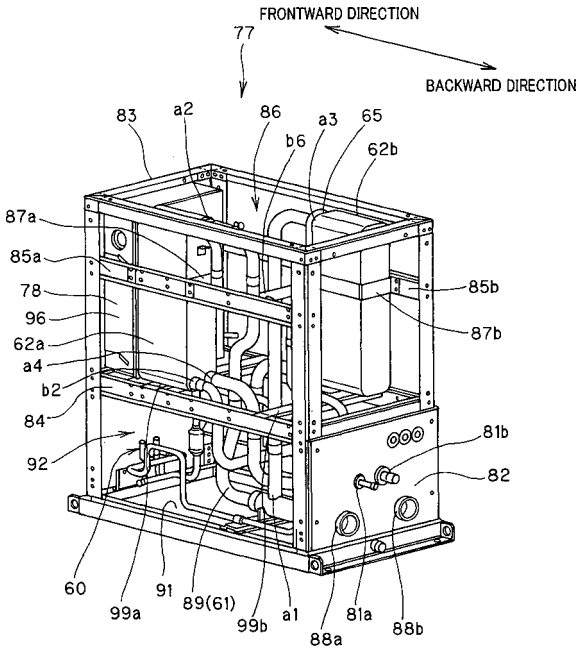
(54) Chiller unit

(57) In a chiller unit (12) having a chiller unit main body (77) that is disposed to be juxtaposed with an outdoor unit and performs heat-exchange between refrigerant supplied from the outdoor unit and water medium supplied from the outside to generate cold or hot water, a refrigerant pipe and a water medium pipe connected to the plate type heat exchanger (62,62b) are led out to the back surface side of the chiller unit main body (77), a refrigerant pipe of the chiller unit main body (77) and a refrigerant pipe of the outdoor unit are connectable to each other at the back surface side concerned, an electrical component box (78) wounded by a heat insulating member is disposed at the front surface side of the chiller unit main body (77) and an electrically-operated valve (60) for controlling a flow rate of refrigerant is disposed below the electrical component box (78).

FIG.6



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a chiller unit having a heat exchanger for performing heat exchange between refrigerant and water medium.

2. Description of the Related Art

[0002] A chiller unit having a chiller unit body connected to a refrigeration cycle is generally known (see JP-A-2004-251486, for example). This type of chiller unit is equipped with a plate type heat exchanger for heat-exchanging refrigerant and water medium to generate cold/hot water. The chiller unit and an outdoor unit are arranged side by side (juxtaposed with each other) on an earthquake-resistant table. A refrigerant pipe extending from the outdoor unit is connected to a refrigerant pipe of the plate type heat exchanger and also a water supply pipe extending from the outside is connected to a water pipe of the plate type heat exchanger on the earthquake-resistant table.

[0003] In the construction of the chiller unit described above, the lead-out direction of the refrigerant pipe and the water pipe extending from the chiller unit and the lead-out direction of the refrigerant pipe extending from the outdoor unit are not unified (i.e.,. are not disorderly set), but they are disorderly set. Therefore, it has been difficult to perform a connection work for connecting the refrigerant pipe of the chiller unit and the refrigerant pipe of the outdoor unit and a connection work for connecting the water pipe extending from the chiller unit and the water supply pipe extending from the outside. Furthermore, an electrically-operated valve for controlling the flow rate of refrigerant is connected to the refrigerant pipe of the chiller unit, and much dew condensation occurs in the plate type heat exchanger and the refrigerant pipe of the chiller unit , so that a shielding member or the like which covers the electrically-operated valve is required to prevent dew condensation water from impinging against the electrically-operated valve.

[0004] Furthermore, the arrangement position of an electrical component box of the chiller unit and the arrangement position of an electrical component box of the outdoor unit are irregular (random). Accordingly, when the outdoor unit and the chiller unit are arranged side by side, the electrical component box of the chiller unit and the electrical component box of the outdoor unit may be arranged to be oriented to different directions. Therefore, when a maintenance work is simultaneously executed on the chiller unit and the outdoor unit, the chiller unit and the outdoor unit cannot be accessed from the same direction, which may disturb the maintenance performance.

[0005] Furthermore, in this type of chiller unit, air may be trapped in a water pipe (water medium pipe) which is designed (laid down) like the shape of a Japanese shrine-gate (Shinto's shrine gate) . Accordingly, in order to release air trapped in the water medium pipe, it is general that a special mechanism is provided in the water medium pipe and air trapped in the water medium pipe is released by using the mechanism. When air is released, a worker or the like is required to perform a work of releasing air trapped in the water medium pipe, which also disturbs the maintenance performance.

SUMMARY OF THE INVENTION

[0006] The present invention has been implemented in view of the foregoing problems, and has an object of the present invention to provide a chiller unit that is disposed at a side of an outdoor unit and enhanced in maintenance performance, and also in which dew condensation water can be prevented from spattering to an electrically-operated valve in the chiller unit.

[0007] Furthermore, the present invention has another object to provide a chiller unit that can be more enhanced in maintenance performance without using any work of releasing air in a water medium pipe.

[0008] In order to attain the above objects, according to a first aspect of the present invention, there is provided a chiller unit having a chiller unit main body comprising: a plate type heat exchanger unit for performing heat exchange between refrigerant supplied from an outdoor unit through a refrigerant pipe and water medium supplied from the outside through a water refrigerant pipe to generate cold or hot water; an electrical component box that includes electronic equipment and is disposed at the front surface side of the chiller unit main body and surrounded by a heat insulating member; and an electrically-operated valve that is disposed below the electrical component box and controls a flow rate of refrigerant flowing through the refrigerant pipe of the chiller unit main body, wherein the refrigerant pipe and the water medium pipe connected to the plate type heat exchanger unit are lead out to the back surface side of the chiller unit main body, and a refrigerant pipe of the chiller unit main body is connectable to the refrigerant pipe from the outdoor unit at the back surface side.

[0009] In the chiller unit, the outdoor unit and the chiller unit main body are arranged side by side and the width in the depth direction of the chiller unit main body and the width in the width direction of the outdoor unit are set to be substantially equal to each other.

[0010] In the chiller unit, the chiller unit main body and the outdoor unit are mounted on a vibration-proof table.

[0011] According to a second aspect of the present invention, there is provided a chiller unit having a chiller unit main body comprising: a housing having an upper stage portion and a lower stage portion; a plate type heat exchanger unit for performing heat exchange between refrigerant supplied from an outdoor unit through a refrigerant pipe and water medium supplied from the out-

side through a water medium pipe to generate cold or hot water; and a pipe group connected to the refrigerant pipe from the outdoor unit and the water medium pipe from the outside to supply the refrigerant and the water medium to the plate type heat exchanger unit, wherein the pipe group supplies the refrigerant and the water medium to the plate type heat exchanger unit while splitting the flow of each of the refrigerant and the water medium, the pipe group is collectively disposed in the lower stage portion of the chiller unit main body, and the pipe group is connected to the plate type heat exchanger unit so that the pipe group is located to be equal to or lower than the top portion of the plate type heat exchanger unit in height.

[0012] In the chiller unit, the chiller unit main body has a support table substantially at the center portion in the height direction thereof, and the plate type heat exchanger unit is mounted on the support table and also secured to a side portion of the chiller unit main body through a support plate.

[0013] In the chiller unit, the plate type heat exchanger unit comprises a plurality of plate type heat exchangers that are arranged so as to be spaced from one another and secured to confronting side portions of the chiller unit main body so that the weight balance of the whole chiller unit is kept.

[0014] In the chiller unit, a through hole through which the water medium pipe is led out from the chiller unit main body is provided at the lower portion of the back surface of the chiller unit main body.

[0015] According to a third aspect of the present invention, there is provided a chiller unit having a chiller unit main body that is disposed to be juxtaposed with an outdoor unit and performs heat-exchange between refrigerant supplied from the outdoor unit and water medium supplied from the outside to generate cold or hot water, a refrigerant pipe and a water medium pipe connected to the plate type heat exchanger are led out to the back surface side of the chiller unit main body, a refrigerant pipe of the chiller unit main body and a refrigerant pipe of the outdoor unit are connectable to each other at the back surface side concerned, an electrical component box wounded by a heat insulating member is disposed at the front surface side of the chiller unit main body and an electrically-operated valve for controlling a flow rate of refrigerant is disposed below the electrical component box.

[0016] According to the present invention, the lead-out directions of the refrigerant pipes of the chiller unit and the outdoor unit are unified (regulated) by leading out the refrigerant pipes from the back surface side of the chiller unit and the outdoor unit, and also the lead-out directions of the refrigerant pipe and the water medium pipe are unified (regulated) by leading out the water medium pipe from the back surface side of the chiller unit. Accordingly, the connection work of the refrigerant pipes between the outdoor unit and the chiller unit can be facilitated, and thus the maintenance performance is enhanced. Furthermore, the electrical component box which is an existing member serves as a roof to prevent dew condensation water from dropping to the electrically-operated valve, so that it is unnecessary to provide an additional member such as an enclosure member or the like. Still Furthermore, the outdoor unit and the chiller unit have the respective electrical component boxes at the front surface sides thereof, and thus the worker can access both the electrical component boxes from the same side and at the same time, so that the maintenance performance can be enhanced. Still furthermore, according to this invention, air release from the watermediumpipe through which watermedium flows is not necessary, so that the maintenance performance is more enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a refrigerant circuit diagram showing a refrigeration unit having a chiller unit according to a first embodiment;
Fig. 2 is a front view showing the chiller unit and an outdoor unit which are arranged side by side;
Fig. 3 is a back view showing the chiller unit and the outdoor unit which are arranged side by side;
Fig. 4 is a top view showing the chiller unit and the outdoor unit which are arranged side by side;
Fig. 5 is a perspective view showing the chiller unit which is taken from a side at which an electrical component box is disposed;
Fig. 6 is a perspective view showing the chiller unit from a side at which the electrical component box is not disposed;
Fig. 7 is a top view of a flow-out side water medium pipe in the neighborhood of a flow switch;
Fig. 8 is a VIII-VIII cross-sectional view of Fig. 7;
Fig. 9 is a front view showing the flow switch which is secured to the flow-out side water medium pipe;
Fig. 10 is a refrigerant circuit of a refrigeration unit having a chiller unit according to a second embodiment;
Fig. 11 is a perspective view taken from a side at which an electrical component box of the chiller unit is disposed; and
Fig. 12 is a perspective view taken from a side at which the electrical component box of the chiller unit is not disposed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Embodiments according to the present invention will be described with reference to the accompanying drawings.

[0019] Fig. 1 is a refrigerant circuit diagram showing a refrigeration unit 10 having a chiller unit 12 according to a first embodiment.

[0020] As shown in Fig. 1, the refrigeration unit 10 has

an outdoor unit 11 and a chiller unit 12, and an outdoor refrigerant pipe 14A of the outdoor unit 11 and a chiller-side refrigerant pipe 14B of the chiller unit 12 are joined to each other through closing valves 52, 53, thereby forming a refrigeration cycle 10A. In the following description, the outdoor refrigerant pipe 14A and the chiller-side refrigerant pipe 14B are generically referred to as "refrigerant pipe 14" unless there are specifically distinguished from each other.

[0021] A compressor 16 is disposed in the outdoor refrigerant pipe 14A of the outdoor unit 11. The compressor 16 is driven through a V belt 27 by a gas engine 30. An accumulator 17 is disposed at the suction side of the compressor 16, and a four-way valve 18 is disposed through an oil separator 17A at the discharge side of the compressor 16. An outdoor heat exchanger 19, an outdoor expansion valve 24 and a dry core 25 are successively connected to the four-way valve 18 in this order. Furthermore, a refrigerant-system bypass pipe 26 so as to bypass the outdoor expansion valve 24, and the refrigerant-system bypass pipe 26 is provided with a check valve 26A for preventing back flow of refrigerant. An outdoor fan 20 is disposed adjacently to the outdoor heat exchanger 19 so as to blow air to the outdoor heat exchanger 19. Reference numeral 29 represents a relief valve for releasing the pressure of the refrigerant at the discharge side of the compressor 16 to the suction side of the compressor 16.

[0022] The gas engine 30 for driving the compressor 16 is supplied with air-fuel mixture from an engine fuel supply device 31. In the engine fuel supply device 31, two fuel cutoff valves 33, a zero governor 34, a fuel adjusting valve 35 and an actuator 36 are successively disposed in a fuel supply pipe 32, and the side end portion of the actuator 36 of the fuel supply pipe 32 is connected to the gas engine 30. An air cleaner 36A is connected to the fuel supply pipe 32.

[0023] An engine oil supply device 37 is connected to the gas engine 30. In the engine oil supply device 37, an oil supply pump 40 is disposed in the oil supply pipe 38, and engine oil is timely supplied to the gas engine 30. The engine oil supply device 37 is provided with a sub oil pan 37A and an oil level switch 37B.

[0024] Furthermore, the outdoor unit 11 is provided with an engine cooling device 41 for withdrawing heat of the gas engine 30 by circulating cooling water through the gas engine 30, and the engine cooling device 41 is provided with an electrically-operated cooler three-way valve 43 which is connected through a pipe to a cooling water pipe through which cooling water flows.

[0025] A circulating pump 44 and an exhaust gas heat exchanger 45 are successively connected to one of the outlets of the electrically-operated cooler three-way valve 43, and a passage through which cooling water passing through the gas engine 30 is returned to the gas engine 30 is formed by a pipe route for connecting the electrically-operated cooler three-way valve 43, the circulating pump 44 and the exhaust gas heat exchanger 45. Here, the exhaust gas heat exchanger 45 is a heat exchanger for performing the heat exchange between the exhaust gas from the gas engine 30 and the cooling water, and an exhaust muffler 46 and an exhaust top 47 for processing exhaust gas are connected to the exhaust gas heat exchanger 45.

[0026] The inlet of a cooling water electrically-operated three-way valve 48 is connected to the other outlet of the electrically-operated cooler three-way valve 43. One end of a exhaust heat withdrawing heat exchanger 49 is connected to one outlet of the cooling water electrically-operated three-way valve 48 through a pipe, and one end of a radiator 50 is connected to the other end of the cooling water electrically-operated three-way valve 48 through a pipe. Here, the exhaust heat withdrawing heat exchanger 49 is a heat exchanger for performing the heat exchange between the refrigerant in the outdoor refrigerant pipe 14A and the cooling water in the cooling water pipe 42. In this embodiment, a plate type heat exchanger is applied as the heat exchanger concerned. The radiator 50 cools the cooling water passing through the radiator 50, and it is disposed adjacently to the outdoor fan 20 so that air is blown from the outdoor fan 20 to the radiator 50. Reference numeral 51 represents a cooling water reserve tank for pooling cooling water to be timely supplied to the cooling water pipe 42.

[0027] The chiller unit 12 performs the heat exchange between water medium passing through the water medium pipe 61 and flowing into the chiller unit 12 and refrigerant of the chiller-side refrigerant pipe 14B connected to the outdoor refrigerant pipe 14A to generate cold water or hot water. The chiller unit 12 is equipped with plate type heat exchangers 62a, 62b for performing the heat exchange between the refrigerant and the water medium.

[0028] The water medium pipe 61 has a flow-in side water medium pipe 89 through which water medium to flow into the plate type heat exchangers 62a, 62b flows, and a flow-out side water medium pipe 90 through which water medium to flow out from the plate type heat exchangers 62a, 62b flows. The flow-in side water medium pipe 89 is branched at a branch point a, and one of the branched pipes is connected to the plate type heat exchanger 62a at a connection portion a2 while the other pipe is connected to the plate type heat exchanger 62b at a connection portion a3. Furthermore, the flow-out side watermediumpipe 90 connected to the connection portion a4 of the plate type heat exchanger 62a and the flow-out side water medium pipe 90 connected to the connection portion a5 of the plate type heat exchanger 62b join together at a confluent point a6, and lead out.

[0029] Two electrically-operated valves 60 for controlling the flow rate (amount) of the refrigerant flowing through the chiller-side refrigerant pipe 14B are connected to the chiller-side refrigerant pipe 14B. The chiller-side refrigerant pipe 14B connected to the electrically-operated valve 60 is branched at a branch point b1, and then one of the branched pipes is connected to the plate type

heat exchanger 62a at a connection portion b2 while the other pipe is connected to the plate type heat exchanger 62b at a connection portion b3. Furthermore, the chiller-side refrigerant pipe 14B connected to the connection portion b4 of the plate type heat exchanger 62a and the chiller-side refrigerant pipe 14B connected to the connection portion b5 of the plate type heat exchanger 62b are connected to each other at a branch point b6.

[0030] As described above, in the chiller unit 12 of this embodiment, the two plate type heat exchangers 62a, 62b are provided in parallel to the water medium pipe 61, and also the two plate type heat exchangers 62a, 62b are provided in parallel to the chiller-side refrigerant pipe 14B. Therefore, the temperature of the refrigerant flowing in the plate type heat exchanger 62a and the temperature of the refrigerant flowing into the plate type heat exchanger 62b can be set to be substantially equal to each other, and also the water media flowing in the two plate type heat exchangers 62a and 62b in parallel can be cooled or heated substantially at the same temperature, whereby cold water or hot water can be generated at a desired temperature with high precision.

[0031] Figs. 2 to 4 show a state that the outdoor unit 11 and the chiller unit 12 are disposed outdoors, and are front view, back view and top views of the outdoor unit 11 and the chiller unit 12.

[0032] In this embodiment, as shown in Figs. 2 to 4, the outdoor unit 11 and the chiller unit 12 are disposed and fixed on a dedicated vibration-proof table while arranged side by side. As shown in Figs. 2 and 3, the vibration-proof table 70 has a first plate 71 on which the outdoor unit 11 and the chiller unit 12 are mounted and fixed, and a second plate 72 disposed at the lower side of the first plate 71. A cushioning member 73 is interposed between the first plate 71 and the second plate 72, and vibration occurring when the outdoor unit 11 is operated is absorbed by the cushioning member 73. This construction prevents the outdoor unit 11 and the chiller unit 12 from being adversely affected by the vibration occurring under the operation of the outdoor unit 11.

[0033] Furthermore, the outdoor unit 11 and the chiller unit 12 are mounted side by side on the dedicated vibration-proof table 70. Therefore, a worker or the like can easily perform the installation work by securing the outdoor unit 11 and the chiller unit 12 at predetermined positions of the vibration-proof table 70, and thus the working efficiency can be enhanced.

[0034] Furthermore, as shown in Figs. 2 and 4, an electrical component box 74 containing electrical equipment for controlling each equipment of the outdoor unit is provided at the front surface side of the outdoor unit main body 74 of the outdoor unit 11, and the worker or the like can easily access the electrical component box 74 by detaching a front panel 75 provided at the front side of the electrical component box 74. Likewise, an electrical component box 78 containing electrical equipment for controlling each equipment of the chiller unit 12 is provided at the front surface side of the chiller unit main body 77 (Figs. 5 and 6), and the worker or the like can easily access the electrical component box 78 by detaching a front panel (Fig. 2)provided in front of the electrical component box 78.

[0035] The control electrical devices mounted in the electrical component box 74 and the control electrical devices mounted in the electrical component box 78 are connected to one another through wires (not shown) so that signal communication can be performed. These control electrical devices operate in cooperation and control the respective devices of the outdoor unit 11 and the chiller unit 12.

[0036] Here, the electrical component boxes 74, 78 have the electrical devices, and thus maintenance occurs relatively frequently, so that these electrical component boxes 74 and 78 are required to be easily accessible. Furthermore, the control electrical devices of the electrical component boxes 74, 78 operate in cooperation with each other, and the electrical component boxes 74 and 78 are required to be simultaneously subjected to maintenance. In this embodiment, the outdoor unit 11 and the chiller unit 12 are arranged side by side on the vibration-proof table 70, and also the electrical component box 74 is disposed at the front surface side of the outdoor unit main body 76 while the electrical component box 78 is disposed at the front surface side of the chiller unit 12. The worker or the like can easily access the electrical component boxes 74 and 78 by detaching the front panel 75 of the outdoor unit 1 and the front panel 79 of the chiller unit 12, and also the maintenance can be simultaneously executed on the electrical component boxes 74 and 78.

[0037] According to this embodiment, when the maintenance is executed on the electrical component box 78 of the chiller unit 12 and the electrical component box 74 of the outdoor unit 11, the worker or the like can access these electrical component boxes 74 and 78 from the same side, and thus the maintenance performance can be enhanced.

[0038] Furthermore, as shown in Fig. 3, refrigerant-pipe through holes 80a, 80b through which the refrigerant pipes penetrate are formed in the back surface of the outdoor unit main body 76, and also refrigerant-pipe through holes 81a and 81b through which the refrigerant pipes penetrate are formed in the back panel 82 of the chiller unit main body 77. The refrigerant pipe 14 led out from the outdoor unit main body 76 through the refrigerant-pipe through holes 80a, 80b extends to the neighborhoods of the refrigerant-pipe through holes 81a and 81b, and led into the chiller unit main body 77 through the refrigerant-pipe through holes 81a and 81b, whereby the outdoor refrigerant pipe 14A (Fig. 1) and the chiller-side refrigerant pipe 14B (Fig. 1) are connected to each other. As described above, according to this embodiment, the refrigerant pipe 14 exposed to the outside is located at the back sides of the outdoor unit main body 76 and the chiller unit main body 77. Therefore, when the outdoor unit 11 and the chiller unit 12 mounted on

the vibration-proof table 70 are viewed from the front side, the refrigerant pipe 14 is hardly viewed, and thus the exterior appearance is enhanced.

[0039] Furthermore, in this embodiment, the refrigerant pipe 14 may be led out from the back surface sides of the outdoor unit 11 and the chiller unit 12. That is, in this embodiment, the lead-out directions of the outdoor unit 11 and the chiller unit 12 may be unified (regulated). In this case, the connection work of the refrigerant pipe 14 between the outdoor unit 11 and the chiller unit 12 can be facilitated, and the maintenance performance can be enhanced. In addition, in the chiller unit 12, water-medium-pipe through holes 88a, 88b are formed in the back panel 82 as shown in Figs. 3 and 6, and the water medium pipe 61 is led in and out at the back side of the chiller unit 12 through the water-medium-pipe through holes 88a and 88b. Accordingly, the lead-in and lead-out directions of the refrigerant pipe 14 and the water medium pipe 61 are unified, and the connection work of connecting the water medium pipe 61 to the water supply pipe extending from the outside can be facilitated.

[0040] Still furthermore, according to this embodiment, as shown in Fig. 4, the width H1 in the depth direction of the outdoor unit 11 and the width H2 in the depth direction of the chiller unit 12 are set to be substantially equal to each other, whereby the sense of unity between the outdoor unit 11 and the chiller unit 12 is enhanced and the exterior appearance is enhanced. In addition, the refrigerant pipe 14 between the refrigerant-pipe through holes 80a, 80b and the refrigerant-pipe through holes 81a, 81b can be formed to be substantially linear, so that the processing of the refrigerant pipes 14 can be facilitated and the cost can be reduced.

[0041] Fig. 5 is a perspective view showing the chiller unit main body 77 when viewed from a side at which the electrical component box 78 is disposed, and Fig. 6 is a perspective view showing the chiller unit main body 77 when viewed from a side at which the electrical component box 78 is not disposed. In Figs. 5 and 6, the side panels constituting the side surface of the chiller unit main body 77 and the top panel constituting the upper surface of the chiller unit main body 77 are detached from the chiller unit main body 77. A back panel 82 as a part of the panel provided to the back surface of the chiller unit main body 77 are secured to the chiller unit main body 77 for convenience of description.

[0042] As shown in Figs. 5 and 6, the chiller unit main body 77 is formed substantially in a rectangular parallelepiped shape, and has a frame 83 constituting the respective side portions of the chiller unit main body 77. The frame 83 has a center lateral frame 84 which is provided at the substantially center position in the height direction of the chiller unit main body 77 so as to extend in the horizontal direction, and two partition plates 99a, 99b (support table) extending in the horizontal direction are fixed to the center lateral frame 84. The inside of the chiller unit main body 77 is partitioned into upper and lower stages by the partition plates 99a, 99b. Upper lateral frames 85a, 85b are respectively provided above the center lateral frame 84 at the side portions of the chiller unit main body 77 so as to be bridged between vertically-extending frames.

[0043] The electrical component box 78 described above and plate type heat exchangers 62a and 62b are provided in the upper chamber (upper stage portion) formed at the upper stage of the chiller unit main body 77 which is partitioned by the partition plates 99a, 99b. The plate type heat exchangers 62a, 62b are fixed through support plates 87a, 87b (in Fig. 5, the support plate 87a is not illustrated) to the upper lateral frames 85a, 85b provided to the sides of the chiller unit main body 77 while mounted and supported on the partition plate 99a and 99b, and are firmly secured so that no displacement occurs in the horizontal and vertical directions.

[0044] Here, when the plate type heat exchangers 62a and 62b which are heavier in weight than the other equipment are provided in the upper stage chamber 86, there is a risk that the center of gravity of the chiller unit main body 77 is shifted to a higher position as compared with the case where the plate type heat exchangers 62a and 62b are provided in the low stage chamber 92 (lower stage portion), so that the safety of the chiller unit main body 77 itself may be lost. In view of the foregoing risk, according to this embodiment, the plate type heat exchangers 62a and 62b are arranged in the upper stage chamber 86 in consideration of the total weight balance of the chiller unit main body 77. That is, the plate type heat exchanger 62a is fixed at the front side of the upper lateral frame 85a disposed at one side portion of the chiller unit main body 77, and the plate type heat exchanger 62b is fixed at the back side of the upper lateral frame 85b disposed at the other side of the chiller unit main body 77 so that the plate type heat exchangers 62a and 62b are spaced from each other to face each other diagonally (or located at the counter sides) in the upper stage chamber 86 so that the weight balance of the chiller unit main body 77 is kept). Accordingly, in the upper stage chamber 86, the plate type heat exchangers 62a and 62b are prevented from being arranged in an unbalanced style, so that the center of gravity of the chiller unit main body 77 can be prevented from being displaced and thus the safety of the chiller unit main body can be secured. Accordingly, when the chiller unit main body 77 is transported to an installation place or mounted on the vibration-proof table 70, the chiller unit 12 can be moved while stabilized, and thus the work can be facilitated.

[0045] The water medium pipe 61 and the chiller-side refrigerant pipe 14B are connected to the plate type heat exchangers 62a, 62b, and the construction of the water medium pipes 61 will be first described.

[0046] As shown in Fig. 6, the water-medium-pipe through holes 88a and 88b through which the water medium pipe 61 penetrates are formed at the lower portion of the back panel 82, and the water medium pipe 61 penetrates through the water-medium-pipe through holes

88a and 88b. When the water medium pipe 61 is made to penetrate through the water-medium-pipe through holes 88a and 88b, the water medium pipe 61 comes into contact with the edges of the water-medium-pipe through holes 88a and 88b, and thus it is kept to be supported by the edges of the water-medium-pipe through holes 88a and 88b. Here, the water medium pipe 61 is a pipe through which water medium flows, and it is larger in diameter and heavier in weight than the refrigerant pipe 14. However, by forming the water-medium-pipe through holes 88a and 88b at the lower portion of the back panel 82, the load imposed from the water medium pipe 61 to the back panel 82 can be reduced.

[0047] In this embodiment, the flow-in side water medium pipe 89 through which water medium to flow into the plate type heat exchangers 62a and 62b flows penetrates through the water-medium-pipe through hole 88a at the left side of Fig. 6 out of the two water-medium-pipe through holes 88a and 88b, and the flow-out side water medium pipe 90 through which water medium to flow out from the plate type heat exchangers 62a and 62b flows penetrates through the water-medium-pipe through hole 88b at the right side of Fig. 6.

[0048] As shown in Fig. 6, the flow-in side water-medium pipe 89 introduced in the chiller unit main body 77 through the water-medium-pipe through hole 88a extends horizontally along the lower surface 91 of the chiller unit main body 77 by a predetermined distance as shown in Fig. 6, and then is branched, at a branch point a1, into a pipe through which water medium to flow into the plate type heat exchanger 62a and a pipe through which water medium to flow into the plate type heat exchanger 62b flows. The respective branched pipes are connected to the connection portions a2, a3 formed at the upper portion of the plate type heat exchangers 62a, 62b. In this case, as shown in Figs. 5 and 6, the respective pipes are set not to extend to higher positions than the connection portions a2 and a3. That is, the flow-in side water medium pipes 89 corresponding to the connection pipes to be connected to the plate type heat exchangers 62a and 62b are not located at positions higher than the top portions of the plate type heat exchangers 62a and 62b.

[0049] In the chiller unit 12 in which the plate type heat exchangers 62a and 62b are provided in parallel to the water medium pipe 61 as in the case of the embodiment, it is required that the same flow amount of water medium flows into the respective plate type heat exchangers 62a and 62b. In order to satisfy this requirement, the distance from the branch point of the water medium pipe 61 to each of the plate type heat exchangers 62a, 62b is adjusted to be as long as possible so that the same flow amount of water medium flows into the plate type heat exchangers 62a and 62b. In this embodiment, as described above, the plate type heat exchangers 62a and 62b are provided in the upper stage chamber, and thus the distance between the branch point a1 of the lower stage chamber 92 and the connection portion a2, a3 of the plate type heat exchanger 62a, 62b can be set to a large value. Therefore, after the flow-in side water medium pipe 89 is branched in the lower stage chamber 92, and then the shape of the flow-in side water medium pipe 89 from the branch point till the connection point to the plate type heat exchanger 62a, 62b can be set to be substantially linear while the distance of the flow-in side water medium pipe 89 is set to be long. Accordingly, it is unnecessary to make the flow-in side water medium pipe 89 long in length by making the water medium pipe 61 meander in a Japanese shrine-gate shape, and thus places at which air is trapped can be excluded from the passage of the flow-in side water medium pipe 8, and the work of releasing air is unnecessary, so that the maintenance performance can be enhanced.

[0050] Particularly, in this embodiment, the flow-in side water medium pipe 89 serving as a flow dividing pipe is set so as not to extend to a position higher than the connection portions a2, a3 of the plate type heat exchangers 62a, 62b. Therefore, it is unnecessary that the flow-in side water medium pipe 89 is designed like the shape of a Japanese shrine-gate to connect the flow-in side water medium pipe 89 to the connection portions a2, a3, and thus air can be prevented from being trapped at the portion formed like the shape of the Japanese shrine-gate in the flow-in side water medium pipe 89.

[0051] Furthermore, in this embodiment, the plate type heat exchangers 62a, 62b are provided at the upper stage chamber 86, and thus the space can be secured in the lower stage chamber 92. The pipes for the flow division such as the flow-in side water medium pipe 89, etc. are collectively provided in the lower stage chamber 92, so that the space can be effectively used.

[0052] The flow-out side water medium pipes 90 through which water medium flowing out from the plate type heat exchangers 62a, 62b are led out from the connection portion a4 (Fig. 6) and the connection portion a5 (Fig. 5) which are formed at the lower side of the plate type heat exchangers 62a, 62b, and then join together at a predetermined position (joint point a6, Fig. 5) of the lower stage chamber 92 in which the space is secured. Furthermore, the jointed flow-out side water medium pipe 90 is formed to extend substantially horizontally along the lower surface 91 to the water-medium-pipe through hole 88b, passed through the water-medium-pipe through hole 88b and then led out to the outside of the chiller unit 77. Here, in this embodiment, the plate type heat exchangers 62a, 62b are disposed in the upper stage chamber 86, so that the large space can be secured in the lower stage chamber 92. Accordingly, the flow-out side water medium pipes 90 can be smoothly joined to each other by effectively using the space of the lower stage chamber 92 without extending the flow-out side watermediumpipes 90 to a predetermined position to join together by making the flow-out side water medium pipes 90 meander.

[0053] As in the flow-in side water medium pipe 89, the flow-out side water medium pipes 90 serving as the connection pipes connected to the plate type heat ex-

changers 62a and 62b are set so as not to be located at positions higher than the plate type heat exchangers 62a and 62b. With this construction, as in the case of the flow-in side water medium pipe 89, it is unnecessary that the flow-out side water medium pipes 90 are designed like the shape of the Japanese shrine-gate to connect the flow-out side water medium pipes 89 to the connection portions a4, a5, and thus air can be prevented from being trapped at the portion formed like the shape of the Japanese shrine-gate in the flow-out side water medium pipes 90.

[0054] Fig. 7 is a top view showing the portion of the flow-out side water medium pipe 90 which extends substantially horizontally along the lower surface 91 to the water-medium-pipe through hole 88b, Fig. 8 is a cross-sectional view taken along a line of VIII-VIII of Fig. 7, and Fig. 9 is a front view showing the state that a flow switch 93 described later is secured to the flow-out side water medium pipe 90.

[0055] As shown in Figs. 7 an 8, the diameter H3 of the flow-out side water medium pipe 90 at the surrounding portion of the joint point a6 is set to be larger than the diameter H4 of the flow-out side water medium pipe 90 at the portion which is located at the upstream side of the H3 portion with respect to the joint point a6. Accordingly, water media from the plate type heat exchangers 62a and 62b join together at the joint point a6, and volume-increased water medium can smoothly flow through the flow-out side water medium pipe 90. Furthermore, as shown in Figs. 7 an 8, a penetration pipe 90b having a larger diameter than the diameter H3 penetrates through the water-medium-pipe through hole 88b while supported by the surrounding portion of the through hole 88b, and the tip of the flow-out side water medium pipe 90 is screwed into the penetration pipe 90b. With this construction, the worker or the like can easily lead the flow-out side water medium pipes 90 to the outside of the chiller unit main body 77 by executing the work of screwing the tip of the flow-out side water medium pipe 90 into the penetration pipe 90b.

[0056] As shown in Figs. 5, 7 and 8, the portion of the flow-out side water medium pipe 90 which extends substantially horizontally along the lower surface 91 is provided with a paddle type flow switch 93. The flow switch 93 detects whether water medium flows through the flow-out side water medium pipe 90, thereby determining whether the water medium in the pipe freezes or not. As shown in Figs. 8 and 9, the flow switch 93 is provided with a paddle 94 extending into the inside of the flow-out side water medium pipe 90. The water medium impinges against the paddle 94 while the water medium flows through the flow-out side water medium pipe 90, whereby the paddle 94 is displaced to the downstream side of the water medium, and a contact point (not shown) provided to the flow switch 93 is connected, whereby a signal indicating the flow of the water medium is transmitted to the control electrical equipment of the electrical component box 78.

[0057] The flow switch 93 is tightly screwed into and fixed to the screw port 90a provided at the upper portion of the flow-out side water medium pipe 90 with no clearance so as to prevent leakage of water medium from the fixing place of the flow switch 93. This paddle 94 is formed of a thin member having a substantially rectangular shape in front view (Fig. 9), and the paddle 94 extends vertically downwardly in the flow-out side water medium pipe 90, and surely impinges against the water medium flowing in the pipe. The shape of the paddle 94 of Fig. 9 is an example, and the shape and length of the paddle 94 may be properly changed in accordance with the application.

[0058] Here, when the flow switch 93 is actuated with high precision, it is desired that the paddle 94 is arranged vertically to the flow direction of the water medium. In this embodiment, as described above, the flow switch 93 is provided to the flow-out side water medium pipe 90 extending substantially horizontally, and thus the paddle 94 extending vertically downwardly in accordance with the gravitational force is perpendicular to the direction of the water medium flowing in the pipe, whereby the paddle type flow switch 93 can be actuated with high precision.

[0059] Furthermore, in this embodiment, the plate type heat exchangers 62a, 62b are provided in the upper stage chamber 86, thereby securing the space in the lower stage chamber 92, ad the flow switch 93 is provided in the lower stage chamber 92 in which the space concerned is secured. Therefore, maintenance can be done on the flow switch 93 by actively using the space, and thus the maintenance performance of the flow switch 93 is enhanced.

[0060] The freezing of the water medium which is excessively cooled by the plate type heat exchangers 62a and 62b successively starts from the water medium pipe 61 at the flow-out side of the water medium from the plate type heat exchangers 62a and 62b, that is, from the flow-out side water medium pipe 90. According to this embodiment, in view of this phenomenon, the flow switch 93 is provided to the water medium pipe 61, particularly to the flow-out side water medium pipe 90, and when freezing occurs in the water medium, the freezing can be rapidly detected by the flow switch 93.

[0061] When water medium in the water medium pipe 61 is frozen and thus does not flow in the water medium pipe 61 in the chiller unit 12, so that the flow switch 93 detects the freezing of the water medium in the pipe, the operation of the chiller unit 12 is temporarily stopped. Accordingly, the chiller unit 12 is prevented from being operated under the state that the water medium in the water medium pipe 61 is frozen, so that the water medium pipe 61, a pump (not shown) for making water medium flow through the water medium pipe 61, etc. can be prevented from being damaged.

[0062] As described above, the chiller unit 12 of this embodiment and the outdoor unit 11 are arranged side by side on the vibration-proof table 70, and vibration occurring in connection with the actuation of the outdoor

unit 11 is slightly transmitted to the chiller unit 12. Here, the flow switch 93 detects on the basis of the displacement of the paddle 94 whether water medium flows or not. In order to enhance the detection precision, it is required that the transmission of the vibration to the paddle 94 is suppressed as much as possible. In view of this requirement, according to this embodiment, as shown in Figs. 5, 7 and 8, a support frame 91a (Figs. 5 and 8) is fixed to the lower surface 91, a fixing member 95 for fixing the flow-out side water medium pipe 90 and the support frame 91a is provided to the support frame 91a, and the flow switch 93 is provided to the flow-out side water medium pipe 90 in the neighborhood of the fixing member 95. Accordingly, the flow switch 93 is provided at the portion of the flow-out side water medium pipe 90 which is fixed by the fixing member 95 so that the vibration at this portion is suppressed at the maximum level. Accordingly, the transmission of the vibration to the flow switch 93 can be suppressed, and the detection precision of the flow switch 93 can be enhanced, so that the flow of the water medium can be substantially accurately detected.

[0063] Reference numeral 95b represents the fixing member for fixing the flow-out side water medium pipe 90 to the lower surface 91 in the neighborhood of the water-medium pipe through hole 88b.

[0064] Next, the construction of the chiller side refrigerant pipe 14B will be described.

[0065] As shown in Fig. 6, refrigerant pipe through holes 81a and 81b penetrating through the chiller-side refrigerant pipe 14B are formed in the back panel 82, and the refrigerant pipe 14 penetrates through the refrigerant pipe through holes 81a, 81b (see Fig. 3 as well as Fig. 60. When penetrating through the refrigerant pipe through holes 81a, 81b, the chiller-side refrigerant pipe 14B comes into contact with the edges of the refrigerant pipe through holes 81a, 81b, and is set to be supported by the edges of the refrigerant pipe through holes 81a, 81b.

[0066] As shown in Fig. 6, the chiller-side refrigerant pipe 14B which is made to penetrate through the refrigerant pipe through hole 81a and introduced into the chiller unit main body 77 extends substantially horizontally along the lower surface, and then is connected to an electrically-operated valve 60 provided at the front side of the lower stage chamber 92. The electrically-operated valve 60 is a valve for controlling the flow rate (amount) of refrigerant flowing in the chiller-side refrigerant pipe 14B. The electrically-operated valve 60 is connected to electronic equipment for control in the electrical component box 78 through a wire (not shown) so that signals can be communicated therebetween, and the opening/closing state of the electrically-operated valve is controlled by the electronic equipment for control.

[0067] As shown in Figs. 5 and 6, the electrically-operated valve 60 is disposed below the electrical component box 78. The electrical component box 78 is wound by a heat insulating member 96 so that the effect of the temperature at the outside of the electrical component box 78 is prevented from being transmitted to the electrical equipment provided in the electrical component box 78. Therefore, the electrical equipment in the electrical component box 78 can be prevented from being adversely affected by the outside temperature, and also the temperature of the surface of the electrical component box 78 is also prevented from being extremely lower than the temperature of the surrounding of the electrical component box 78, so that dew condensation water is prevented fromadhering to the surface of the electrical component box 78. In this embodiment, the electrically-operated valve 60 is disposed below the electrical component box 78 for which adhesion of dew condensation water is prevented. Accordingly, the electrical component box 78 serves as a roof, so that dew condensation water occurring in the chiller unit main body 77 can be prevented from dropping to the electrically-operated valve 60. Particularly, it is unnecessary to provide a special member such as a roof having a mechanism for preventing dew condensation water, an enclosure member for covering the electrically-operated valve 60 or the like in order to prevent dew condensation water from dropping to the electrically-operated valve 60, and the dropping of dew condensation water is prevented by using existing equipment, so that the cost can be reduced.

[0068] Furthermore, the physical distance between the electrically-operated valve 60 and the electrical component box 78 connected to the electrically-operated valve 60 through a wire is nearer, and thus the distance of the wire between the electrically-operated valve 60 and the electrical component box 78 can be shortened. Therefore, the cost can be reduced and also loose or slack of the wire can be prevented, so that the state of the wire can be prevented from being complex.

[0069] The chiller-side refrigerant pipe 14B led out from the electrically-operated valve 60 is branched at a branch point b1 (Fig. 5) in the lower stage chamber 92 in which the space is secured, and the branched pipes are connected to the connection portion b2 (Fig. 6) and the connection portion b3 (Fig. 5) which are formed at the lower portions of the plate type heat exchangers 62a and 62b respectively. That is, the chiller-side refrigerant pipes 14B used for diversion of refrigerant are collectively disposed at the lower stage 92. In this embodiment, as described above, the plate type heat exchangers 62a and 62b are provided in the upper stage chamber 86, and thus the chiller-side refrigerant pipe 14B can be branched by using the space formed in the lower stage chamber 92 while the flow rate of the refrigerant flowing through the chiller-side refrigerant pipe 14B is kept adjustable. The chiller-side refrigerant pipes 14B which are connected to the connection portion b4 (Fig. 5) and the connection portion b5 (Fig. 6) of the plate type heat exchangers 62a and 62b respectively join together at the branch point b6 (Fig. 5), and then extend to the refrigerant pipe through hole 81b. As in the case of the water medium pipes 61, the chiller-side refrigerant pipes 14B are collectively disposed in the space formed in the lower stage

chamber 92, and also arranged so as not to extend to positions higher than the top portions of the plate type heat exchangers 62a and 62b.

[0070] As described above, according to this embodiment, the outdoor unit 11 and the chiller unit 12 are arranged side by side, and the electrical component box 74 is disposed at the front surface side of the outdoor unit main body 76 while the electrical component box 78 is disposed at the front surface side of the chiller unit 12. Therefore, the worker can easily access the electrical component boxes 74 and 78 and simultaneously do maintenance on the electrical component boxes 74 and 78 by detaching the front panel 75 of the outdoor unit 11 and the front panel 79 of the chiller unit 12. Therefore, the outdoor 11 and the chiller 12 can be smoothly subjected to maintenance in cooperation with each other, and thus the maintenance performance can be enhanced.

[0071] Furthermore, according to this embodiment, when maintenance is done on both the electrical component box 78 of the chiller unit 12 and the electrical component box 74 of the outdoor unit 11 at the same time, the worker can access the electrical component boxes 74 and 78 from the same direction, and thus the maintenance performance can be enhanced.

[0072] Still furthermore, the refrigerant pipe 14 is led out from the respective back sides of the outdoor unit 11 and the chiller unit 12. That is, in this embodiment, the lead-out direction of the refrigerant pipe 14 is unified between the outdoor unit 11 and the chiller unit 12. Therefore, the connection work of the refrigerant pipe between the outdoor unit 11 and the chiller unit 12 is facilitated, and the maintenance performance is enhanced. At the same time, in the chiller unit 12, as shown in Fig. 3, the water medium pipe through holes 88a and 88b are formed in the back panel 82, the water medium pipe 61 is led out from the back side through the water medium pipe through holes 88a and 88b, the lead-out directions of the refrigerant pipe 14 and the water medium pipe 61 are unified, and the connection work between the water medium pipe 61 and the water supply pipe extending from the outside is facilitated.

[0073] According to this embodiment, the electrically-operated valve 60 is disposed below the electrical component box 78 in which adhesion of dew condensation water is prevented by winding the heat insulating member 96 around the electrical component box 78. Therefore, dew condensation water occurring in the chiller unit main body 77 can be prevented from dropping to the electrically-operated valve 60 by the electrical component box 78 serving as a roof. Particularly, it is unnecessary to provide a special member such as a roof having a mechanism for preventing dew condensation water, an enclosure member for covering the electrically-operated valve 60 or the like in order to prevent dew condensation water from dropping to the electrically-operated valve 60, and the dropping of dew condensation water is prevented by using existing equipment, so that the cost can be reduced.

[0074] Furthermore, according to this embodiment, the width H1 in the depth direction of the outdoor unit 11 and the width H2 in the depth direction of the chiller unit 12 are set to be substantially equal to each other as shown in Fig. 4. Accordingly, the sensation of unity between the outdoor unit 11 and the chiller unit 12 is enhanced, and the exterior appearance is enhanced.

[0075] In this embodiment, the chiller unit 12 and the outdoor unit 11 are arranged side by side on the vibration-proof table 70. This construction suppresses the adverse effect on the outdoor unit 11 and the chiller unit 12 which is caused by vibration occurring under operation of the outdoor unit 1.

[0076] As described above, in this embodiment, the two plate type heat exchangers 62a and 62b are fixed in the upper stage chamber 86 of the chiller unit main body so as to be spaced from each other, and refrigerant flowing in the chiller-side refrigerant pipe 14B and water medium flowing in the water medium pipe 61 are split to the plate type heat exchangers 62a and 62b. Furthermore, in the lower stage chamber 92 in which the space is secured, the water medium pipe 61 is branched and the branched pipes are arranged so as not to extend to portions higher than the top portions of the plate type heat exchangers 62a and 62b.

[0077] Here, with respect to the chiller unit 12 in which the plate type heat exchangers 62a and 62b are arranged in parallel with respect to the water medium pipe 61 as described with reference to this embodiment, the same flow rate (amount) of water medium is required to flow into each of the plate type heat exchangers 62a and 62b. In order to satisfy this requirement, it is required that the distance from the branch point in the water medium pipe 61 to the plate type heat exchangers 62a, 62b is set to be as long as possible and the apparatus is adjusted so that the same flow rate (amount) of water medium flows into each of the plate type heat exchangers 62a and 62b. In consideration of this point, in the chiller unit 12 of the related art, the water medium pipe 61 is arranged in a great meandering shape so that the distance from the branch point of the water medium pipe 61 to the plate type heat exchanger 62a, 62b is set to be long. In this case, air is trapped at the meandering portions, and an air releasing work for releasing air is required.

[0078] However, in this embodiment, the plate type heat exchangers 62a and 62b are provided in the upper stage chamber as described above, and thus the large space is secured in the lower stage chamber 92. The flow-in side water medium pipe 89 is branched in the thus-secured space, and also the distance between the branch point and the upper portion of the plate type heat exchanger 62a, 62b (the connection portion between the water medium pipe 61 and the plate type heat exchanger 62a, 62b) can be kept long. Therefore, under the state that the flow-in side water medium pipe 89 is branched in the lower stage chamber 92 and then the long distance is secured, the shape of the flow-in side water medium

pipe 89 from the branch point to the connection portion thereof with the plate type heat exchanger 62a, 62b can be set to a substantially linear shape. Accordingly, it is unnecessary to arrange the water medium pipe 61 in a meandering shape, and portions at which air is trapped in the passage of the flow-in side water medium pipe 89 can be excluded. Therefore, the air releasing work is not required and the maintenance performance can be enhanced.

[0079] Furthermore, in this embodiment, the plate type heat exchangers 62a, 62b are fixed to the upper lateral frames 85a and 85b through the support plates 87a and 87b (in Fig. 5, the support plate 87a is not shown) while mounted and supported on the partition plates 99a, 99b (support table). Therefore, the plate type heat exchangers 62a and 62b are firmly secured to the chiller unit main body 77 under the state that no wobbling occurs in the vertical and horizontal directions.

[0080] Still furthermore, in this embodiment, the plate type heat exchangers 62a and 62b are arranged in the upper stage chamber 86 in consideration of the overall weight balance of the chiller unit main body 77. That is, the plate type heat exchanger 62a is fixed to the front surface side of the upper lateral frame 85a disposed at one side portion of the chiller unit main body 77, and the plate type heat exchanger 62b is fixed to the back surface side of the upper lateral frame 85b disposed at the other side portion while facing the plate type heat exchanger 62a. Accordingly, In the upper stage chamber 86, the plate type heat exchangers 62a and 62b are prevented from being arranged with being displaced to some place, and thus the center of gravity of the chiller unit main body 77 is prevented from being displaced, so that stability of the chiller unit main body is secured. Accordingly, the chiller unit 12 can be moved under a stable and the work can be facilitated particularly when the chiller unit main body 77 is transported to a place where it is installed or when the chiller unit main body 77 is mounted on the vibration-proof table 70.

[0081] Still furthermore, in this embodiment, the water medium pipe through holes 88a and 88b through which the water medium pipe 61 penetrates are formed at the lower portion of the back panel 82, and the water medium pipe 61 penetrates through the water medium pipe through holes 88a and 88b. When the water medium pipe 61 penetrates through the water medium pipe through holes 88a and 88b, the water medium pipe 61 comes into contact with the edges of the water medium pipe through holes 88a and 88b, and is supported by these edges. Here, the water medium pipe 61 is a pipe through which water medium flows, and it is designed to be larger in diameter and heavier in weight than the refrigerant pipe 14. The water medium pipe through holes 88a and 88b are formed at the lower portion of the back panel 82, whereby the load imposed on the back panel 82 from the water medium pipe 61 can be reduced.

[0082] In the above-described embodiment, the chiller unit 12 has the two electrically-operated valves and the two plate type heat exchangers. However, the numbers of the electrically-operated valve and the plate type heat exchangers are not limited to those of the above embodiment, and these numbers may be set to three or more. In the following description, an embodiment of the chiller unit 12 having three electrically-operated valves and three plate type heat exchangers will be described.

[0083] In the description of this embodiment, the same constituent elements as the first embodiment are represented by the same reference numerals, and the description thereof is omitted.

[0084] Fig. 10 is a refrigerant circuit diagram showing a refrigerating machine 10 having the chiller unit 12 according to this embodiment.

[0085] In the chiller unit 12 of this embodiment, three electrically-operated valves 60 are provided in parallel with respect to the chiller-side refrigerant pipe 14B as shown in Fig. 10. Furthermore, three plate type heat exchangers 62c, 62d, 62e are provided in parallel with respect to the chiller-side refrigerant pipe 14B and the water medium pipe 61, and a larger amount of cold water or hot water can be generated as compared with the first embodiment.

[0086] Specifically, after the flow-in side water medium pipe 89 is branched at the branch point c1, the respective branched pipes are connected to the connection portion c2 of the plate type heat exchanger 62c, the connection portion c3 of the plat type heat exchanger 62d and the connection portion c4 of the plate type heat exchanger 62e. Furthermore, the flow-out side branch pipes 90 connected to the connection portion c5 of the plate type heat exchanger 62c, the connection portion c6 of the plate type heat exchanger 62d and the connection portion c7 of the plate type heat exchanger 62e join together at the joint point c8, and then are led out to the outside of the chiller unit 12.

[0087] The chiller-side refrigerant pipe 14B connected to the electrically-operated valve 60 is branched at the branch point d1, and then the respective branched pipes are connected to the connection portion d2 of the plate type heat exchanger 62c and the connection portion d4 of the plate type heat exchanger 62d. Furthermore, the chiller-side refrigerant pipes 14B connected to the connection portion d5 of the plate type ht exchanger 62c, the connection portion d6 of the plate type heat exchanger 62d and the connection portion d7 of the plate type heat exchanger 62e join together at the branch point d8, and then are connected to the outdoor refrigerant pipe 14A.

[0088] Fig. 11 is a perspective view showing the chiller unit main body 77 when the chiller unit main body 77 is viewed from a side at which the electrical component box 78 is disposed, and Fig. 12 is a perspective view showing the chiller unit main body 77 when the chiller unit main body 77 is disposed at a side at which the electrical component box 78 is disposed. The chiller unit 12 of this embodiment is juxtaposed with the outdoor unit 11 on the vibration-proof table 70 (see Figs. 2 and 3), and the electrical component box 78 is provided at the front surface

side. Therefore, as in the case of the first embodiment, the worker can simultaneously and easily access the electrical component box 74 of the outdoor unit 11 and the electrical component box 78 of the chiller unit 12.

[0089] As shown in Figs. 11 and 12, in this embodiment, all the plate type heat exchangers 62a, 62b and 62c are disposed in the upper stage chamber 86. These plate type heat exchangers 62a, 62b and 62c are firmly fixed to the upper lateral frames 85a and 85b through the support plate 98 while mounted and fixed on the partition plate 99a. Furthermore, in this embodiment, the flow switch 93 may not be provided.

[0090] This embodiment achieves the same effect as the first embodiment. Specifically, the branch point of the flow-in side water medium pipe 89 is provided in the lower stage chamber 92, and the respective branched flow-in side water medium pipes 89 are arranged to extend substantially linearly and connect to the connection portions c2, c3, c4 of the upper portions of the plate type heat exchangers 62c, 62d and 62e while the distance from the branch point to each plate type heat exchanger is kept long. Therefore, any portion at which air is trapped in the passage of the water medium pipe 61 can be excluded while the apparatus can be adjusted so that the same amount of water medium flows into the plate type heat exchangers 62c, 62d and 62e. Accordingly, the air releasing work for releasing air is not required, and the maintenance performance can be enhanced. Furthermore, the three electrically-operated valves 60 are disposed below the electrical component box 78, and thus dew condensation water can be prevented from dropping to the electrically-operated valve 60 while the existing electrical component box 78 serves as a roof.

[0091] The present invention is not limited to the above embodiments, and various modification and applications may be made without departing from the subject matter of the present invention.

[0092] For example, in the above embodiments, the chiller unit 12 is equipped with two or three plate type heat exchangers. However, the number of the plate type heat exchangers is not limited to these values, and it may be properly changed in accordance with the amount (volume) of cold water or hot water to be generated.

[0093] Furthermore, in this embodiment, the inside of the chiller unit main body 77 is separated into the upper stage chamber 86 and the lower stage chamber 92 by the partition plate 99a. However, it is unnecessary that the inside of the chiller unit main body 77 is separated into the upper and lower stage chambers 86 and 92. That is, the plate type heat exchangers 62 may be provided at the upper portion of the chiller unit main body 77.

Claims

1. A chiller unit having a chiller unit main body comprising:

a plate type heat exchanger unit for performing heat exchange between refrigerant supplied from an outdoor unit through a refrigerant pipe and water medium supplied from the outside through a water refrigerant pipe to generate cold or hot water;

an electrical component box that includes electronic equipment and is disposed at the front surface side of the chiller unit main body and surrounded by a heat insulating member; and

an electrically-operated valve that is disposed below the electrical component box and controls a flow rate of refrigerant flowing through the refrigerant pipe of the chiller unit main body,

wherein the refrigerant pipe and the water medium pipe connected to the plate type heat exchanger unit are lead out to the back surface side of the chiller unit main body, and a refrigerant pipe of the chiller unit main body is connectable to the refrigerant pipe from the outdoor unit at the back surface side.

2. The chiller unit according to claim 1, wherein the outdoor unit and the chiller unit main body are arranged side by side and the width in the depth direction of the chiller unit main body and the width in the width direction of the outdoor unit are set to be substantially equal to each other.

3. The chiller unit according to claim 1, wherein the chiller unit main body and the outdoor unit are mounted on a vibration-proof table.

4. A chiller unit having a chiller unit main body comprising:

a housing having an upper stage portion and a lower stage portion;

a plate type heat exchanger unit for performing heat exchange between refrigerant supplied from an outdoor unit through a refrigerant pipe and water medium supplied from the outside through a water medium pipe to generate cold or hot water; and

a pipe group connected to the refrigerant pipe from the outdoor unit and the water medium pipe from the outside to supply the refrigerant and the water medium to the plate type heat exchanger unit, wherein the pipe group supplies the refrigerant and the water medium to the plate type heat exchanger unit while splitting the flow of each of the refrigerant and the water medium, the pipe group is collectively disposed in the lower stage portion of the chiller unit main body, and the pipe group is connected to the plate type heat exchanger unit so that the pipe group is located to be equal to or lower than the top portion of the plate type heat exchanger unit in

height.

5. The chiller unit according to claim 4, wherein the chiller unit main body has a support table substantially at the center portion in the height direction thereof, and the plate type heat exchanger unit is mounted on the support table and also secured to a side portion of the chiller unit main body through a support plate.

6. The chiller unit according to claim 4, wherein the plate type heat exchanger unit comprises a plurality of plate type heat exchangers that are arranged so as to be spaced from one another and secured to counter-side portions of the chiller unit main body so that the weight balance of the whole chiller unit is kept.

7. The chiller unit according to claim 4, wherein a through hole through which the water medium pipe is led out from the chiller unit main body is provided at the lower portion of the back surface of the chiller unit main body.

8. A chiller unit having a chiller unit main body that is disposed to be juxtaposed with an outdoor unit and performs heat-exchange between refrigerant supplied from the outdoor unit and water medium supplied from the outside to generate cold or hot water, wherein a refrigerant pipe and a water medium pipe connected to the plate type heat exchanger are led out to the back surface side of the chiller unit main body, a refrigerant pipe of the chiller unit main body and a refrigerant pipe of the outdoor unit are connectable to each other at the back surface side concerned, an electrical component box wounded by a heat insulating member is disposed at the front surface side of the chiller unit main body and an electrically-operated valve for controlling a flow rate of refrigerant is disposed below the electrical component box.

FIG. 1

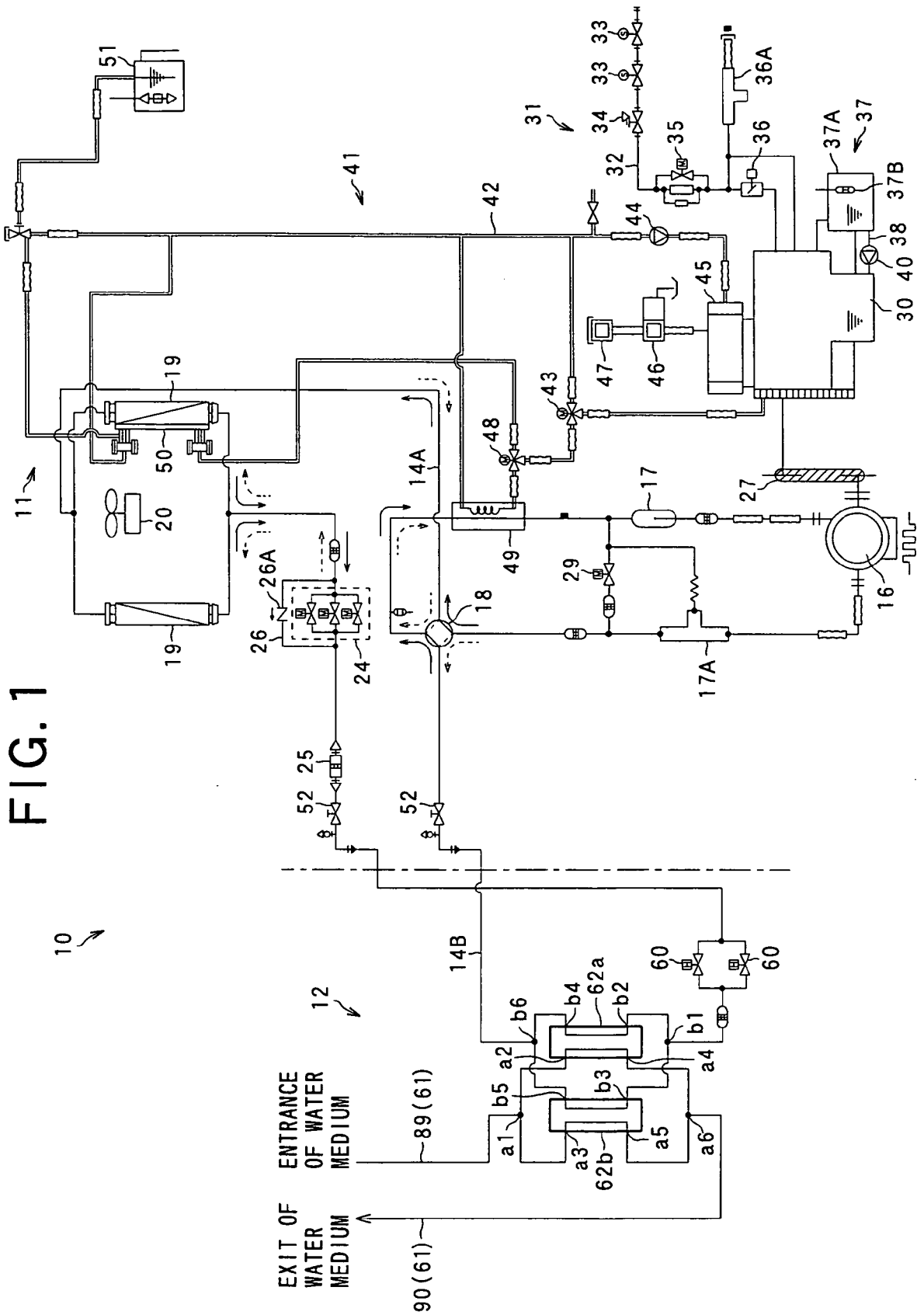

10
11
12
14A
14B
16
17
17A
18
19
20
24
25
26
26A
27
29
30
31
32
33
34
35
36
36A
37
37A
37B
38
40
41
42
43
44
45
46
47
48
49
50
51
52
60
62a
62b
a1
a2
a3
a4
a5
a6
b1
b2
b3
b4
b5
b6
89(61)
90(61)
ENTRANCE OF WATER MEDIUM
EXIT OF WATER MEDIUM

FIG.2

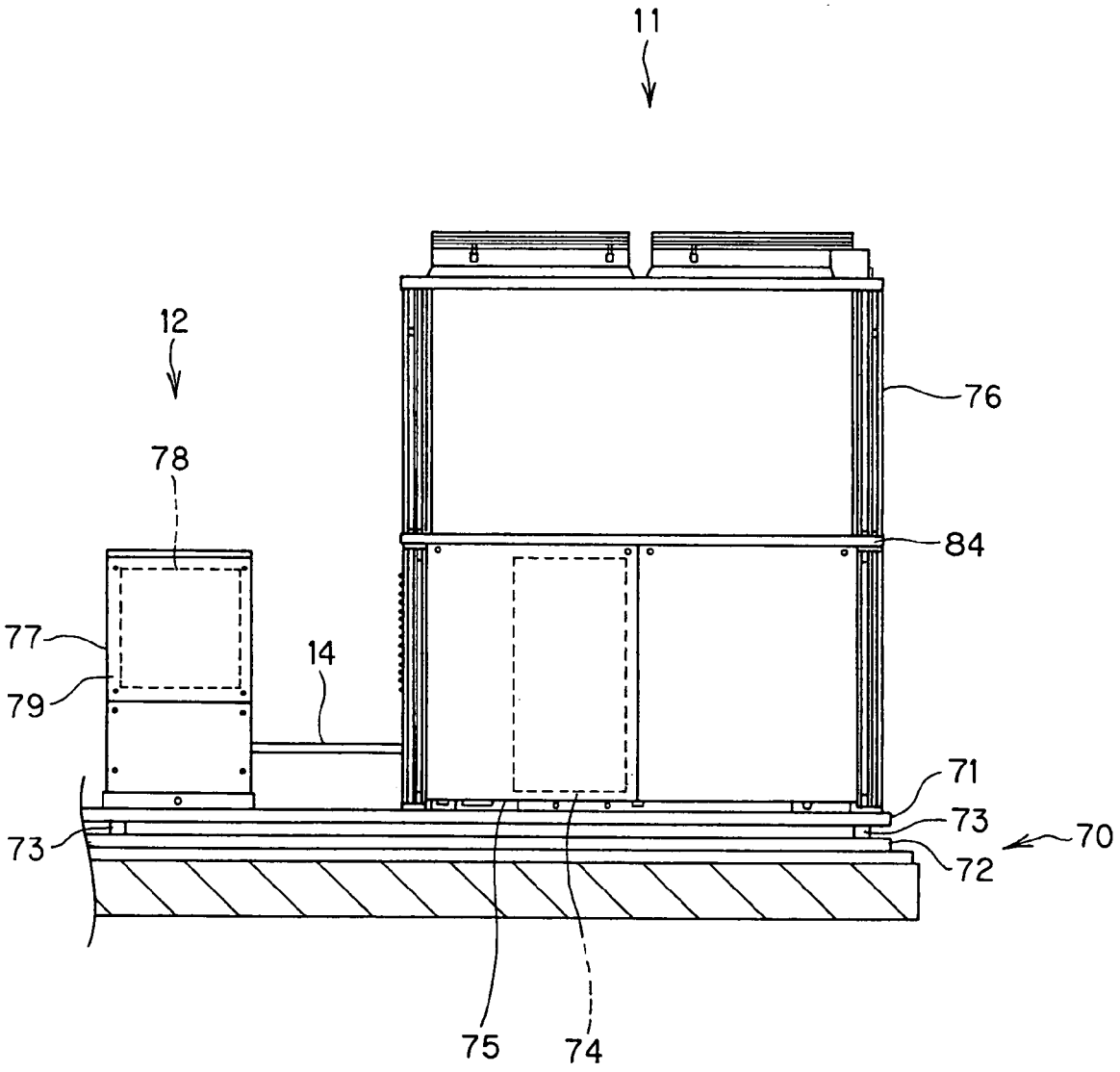


FIG.3

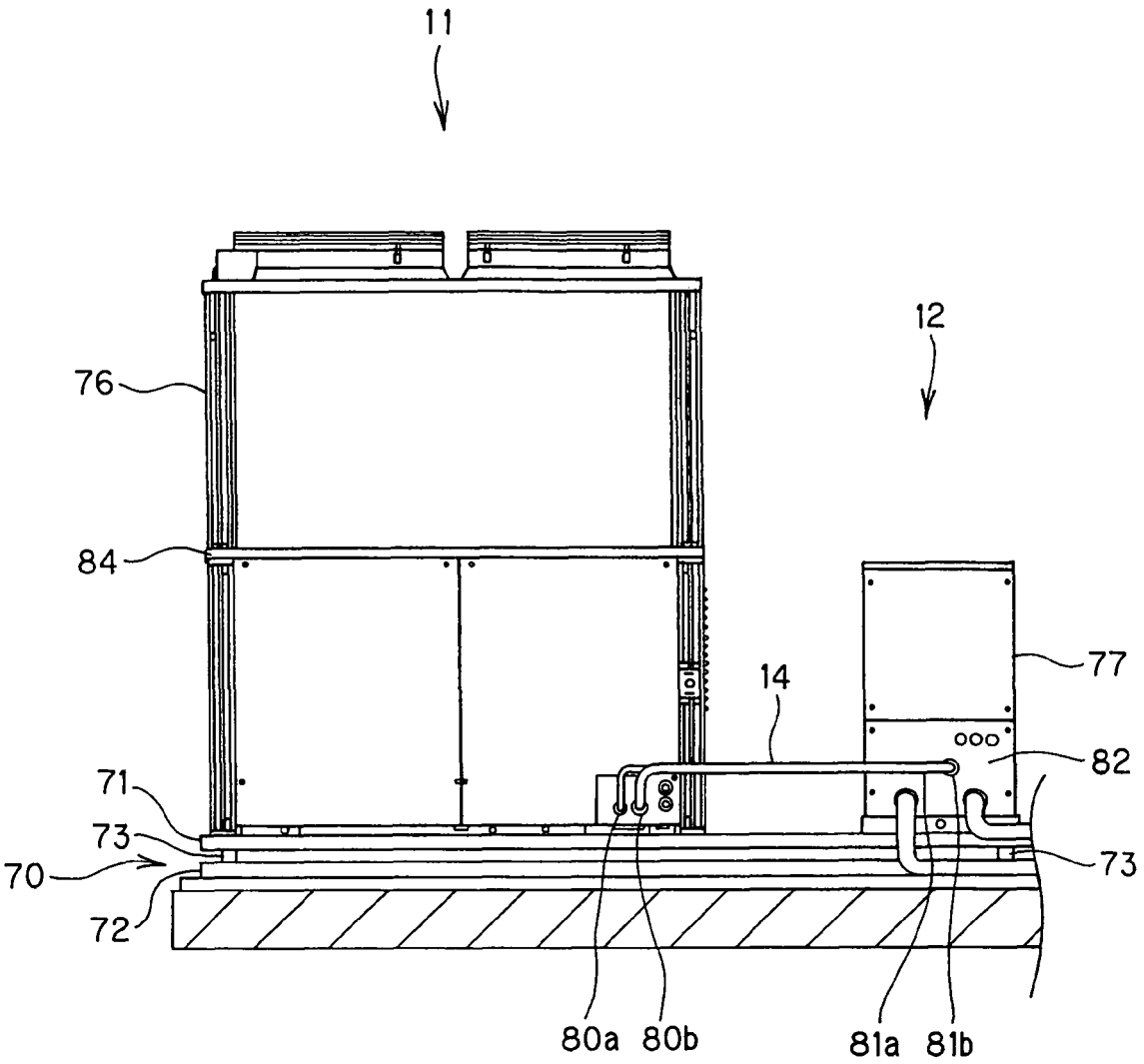


FIG.4

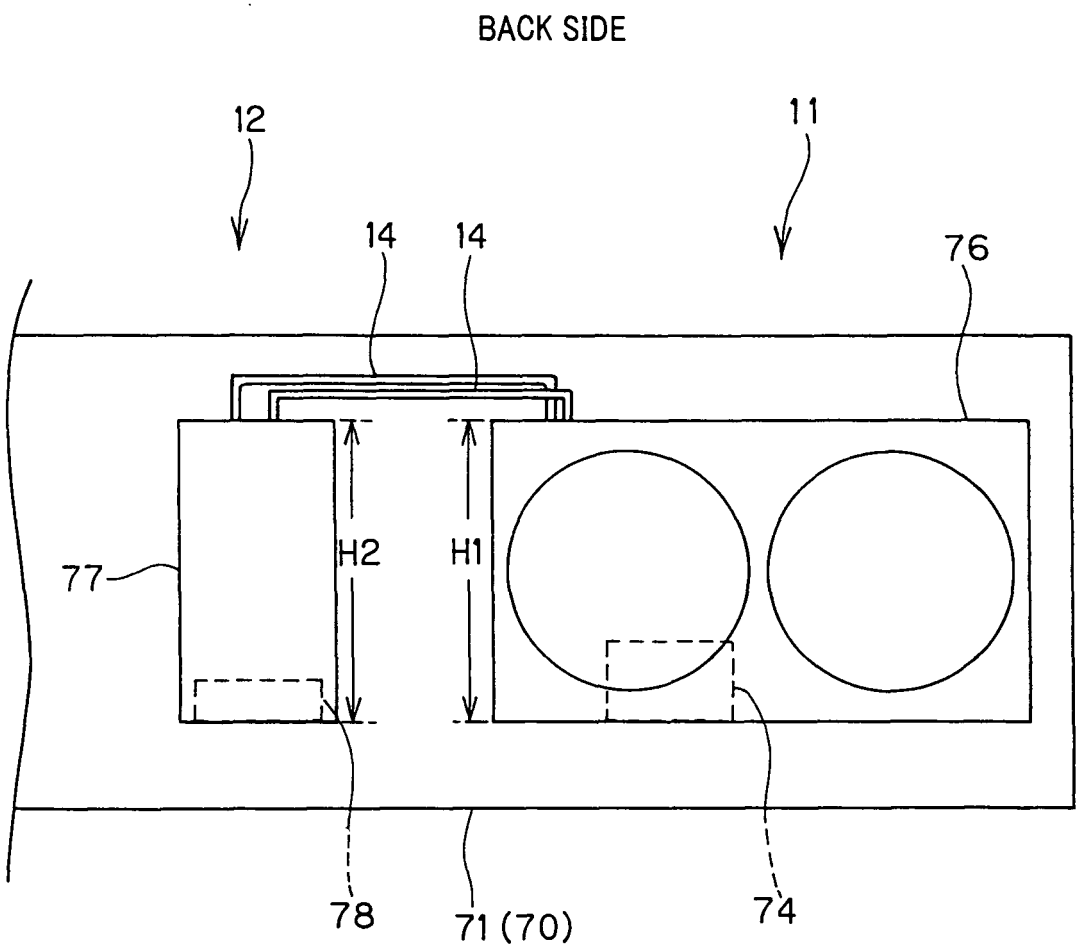


FIG.5

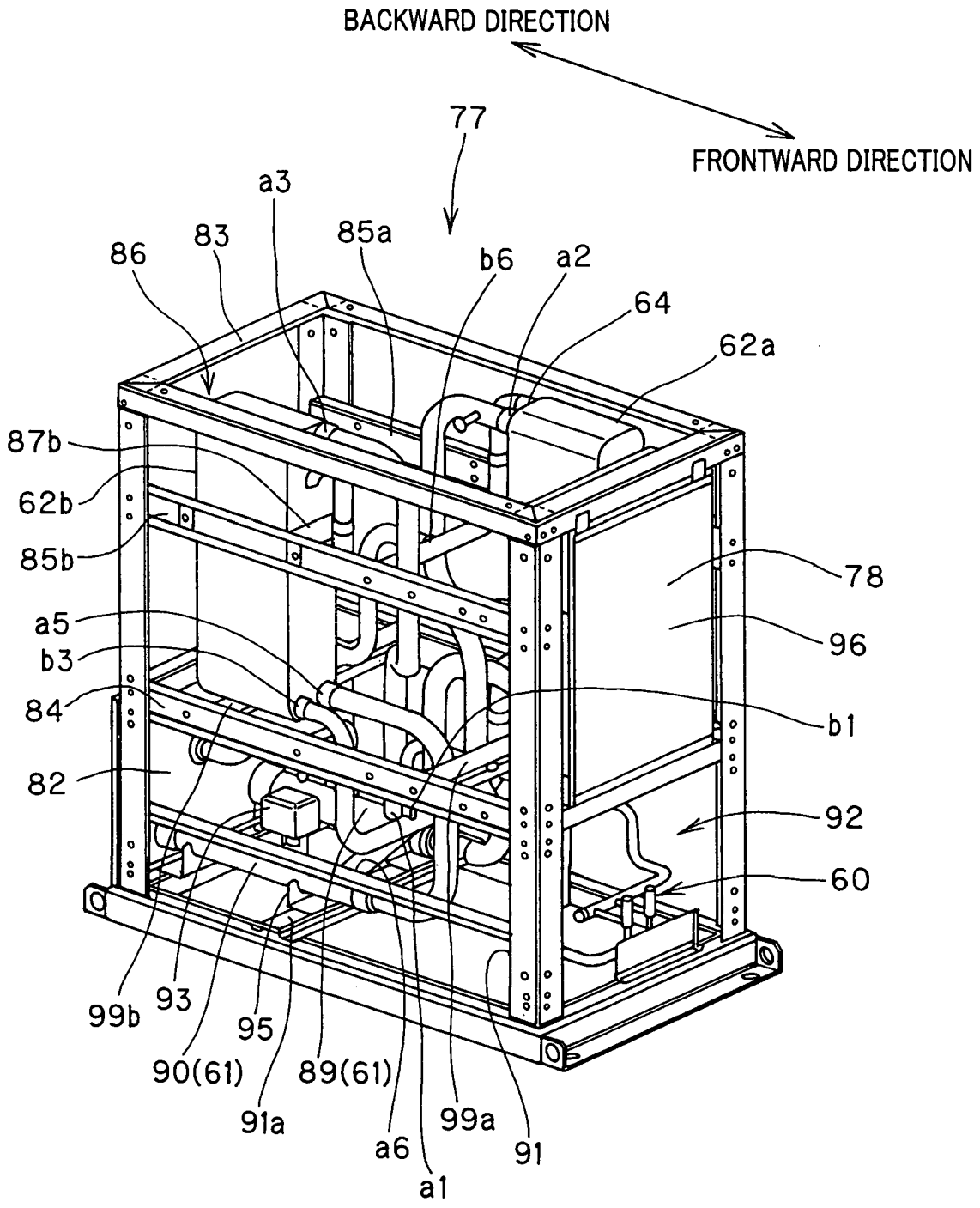

BACKWARD DIRECTION
FRONTWARD DIRECTION
77
a3
83
85a
86
b6
a2
64
62a
87b
62b
85b
78
a5
96
b3
84
b1
82
92
60
99b
93
95
90(61)
89(61)
91a
a6
99a
91
a1

FIG.6

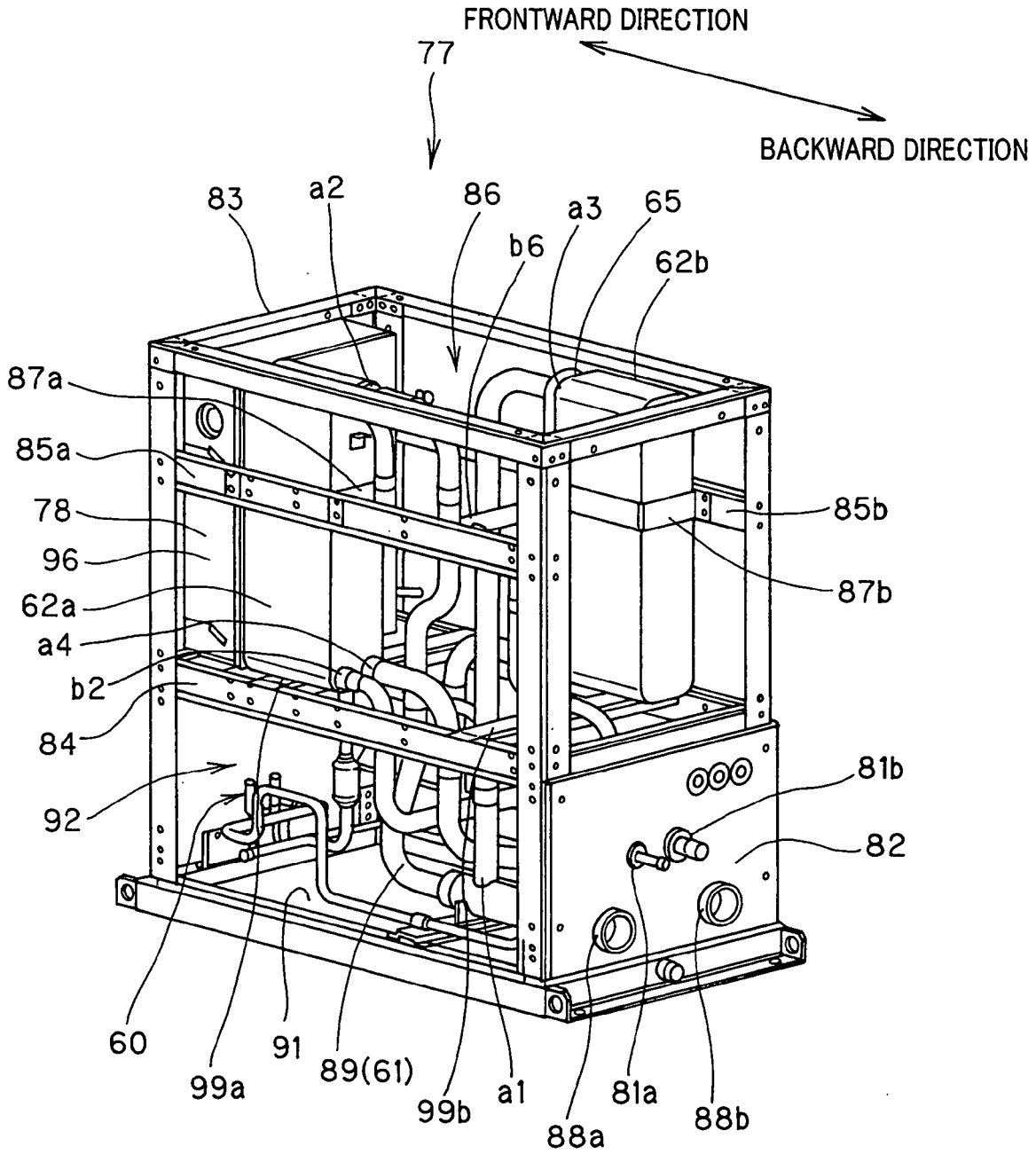

FRONTWARD DIRECTION
77
BACKWARD DIRECTION
83
a2
86
a3
65
b6
62b
87a
85a
78
96
62a
a4
b2
84
92
85b
87b
81b
82
60
91
89(61)
99a
99b
a1
81a
88a
88b

FIG.7

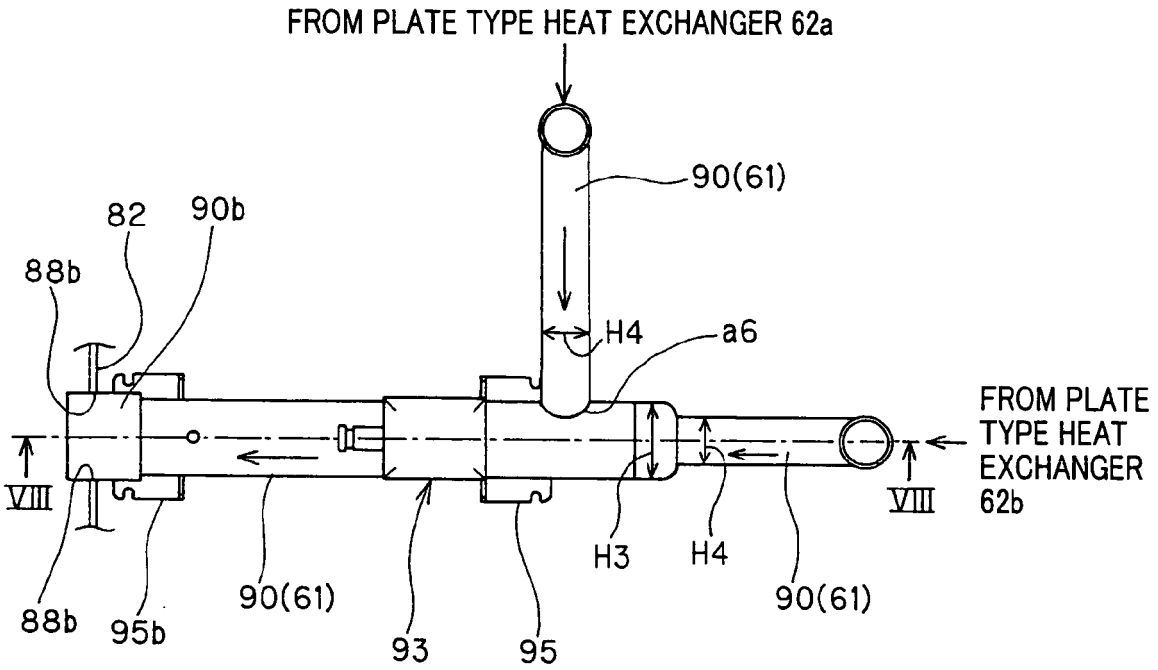

FROM PLATE TYPE HEAT EXCHANGER 62a
90(61)
82
90b
88b
H4
a6
FROM PLATE TYPE HEAT EXCHANGER 62b
VIII
VIII
H3
H4
88b
95b
90(61)
93
95
90(61)

FIG.8

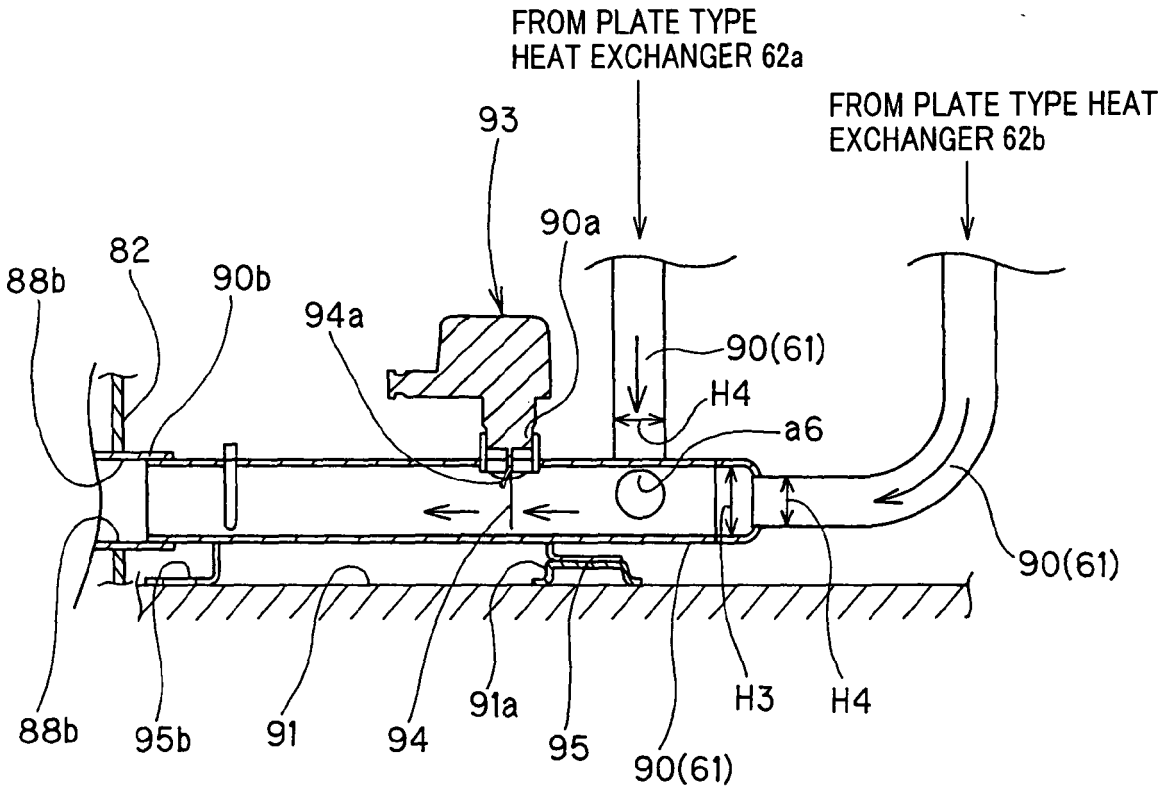

FROM PLATE TYPE
HEAT EXCHANGER 62a
FROM PLATE TYPE HEAT
EXCHANGER 62b
93
90a
82
88b
90b
94a
90(61)
H4
a6
90(61)
88b
95b
91
94
91a
95
H3
H4
90(61)

FIG.9

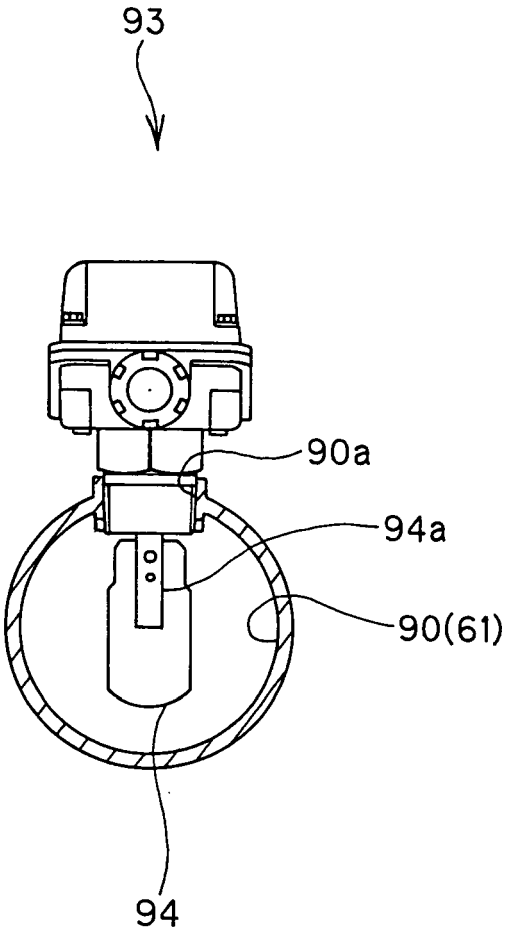


FIG.10

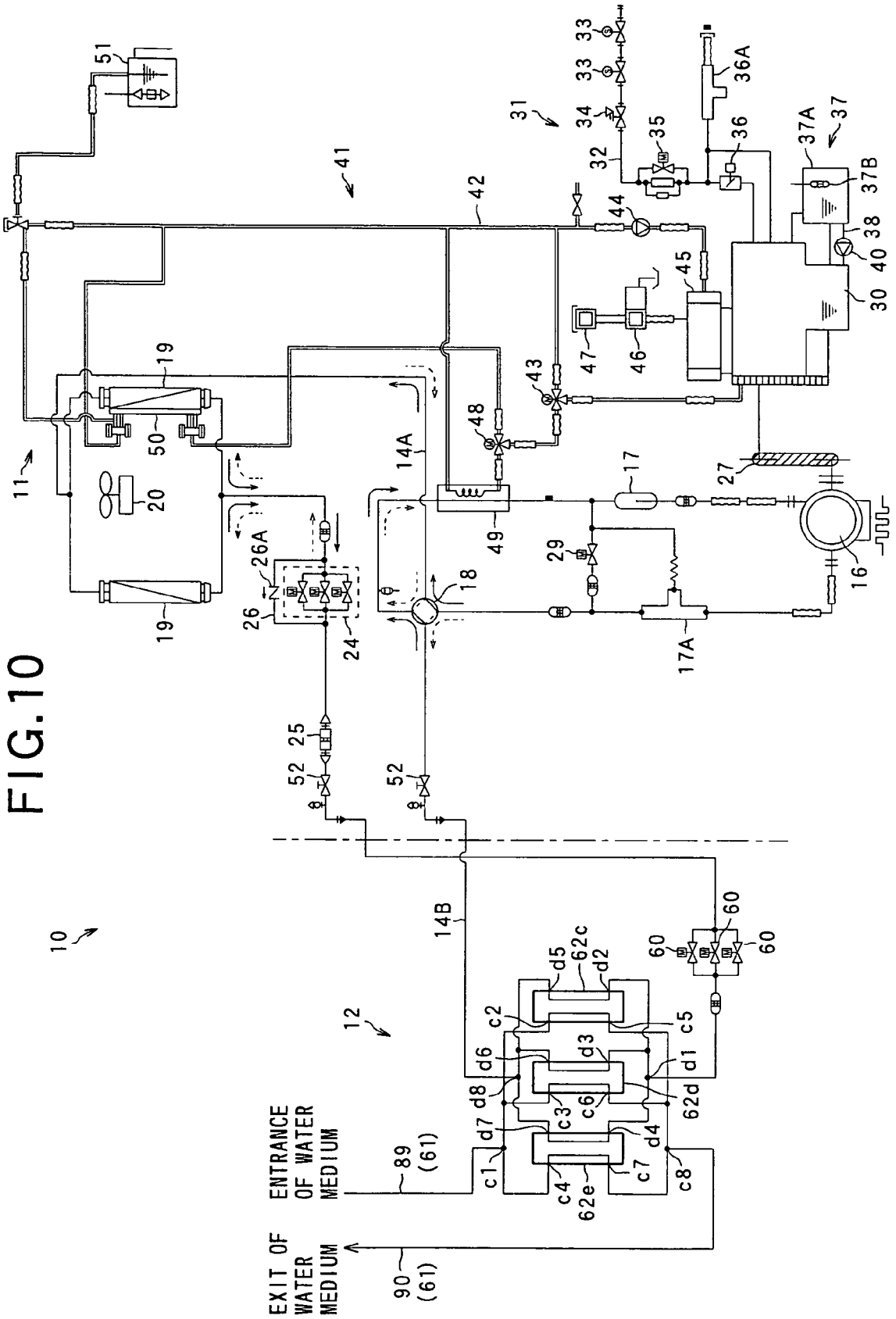

10
11
12
14A
14B
16
17
17A
18
19
20
24
25
26
26A
27
29
30
31
32
33
34
35
36
36A
37
37A
37B
38
40
41
42
43
44
45
46
47
48
49
50
51
52
60
62c
62d
62e
89
(61)
90
(61)
ENTRANCE OF WATER MEDIUM
EXIT OF WATER MEDIUM
c1
c2
c3
c4
c5
c6
c7
c8
d1
d2
d3
d4
d5
d6
d7
d8

FIG.11

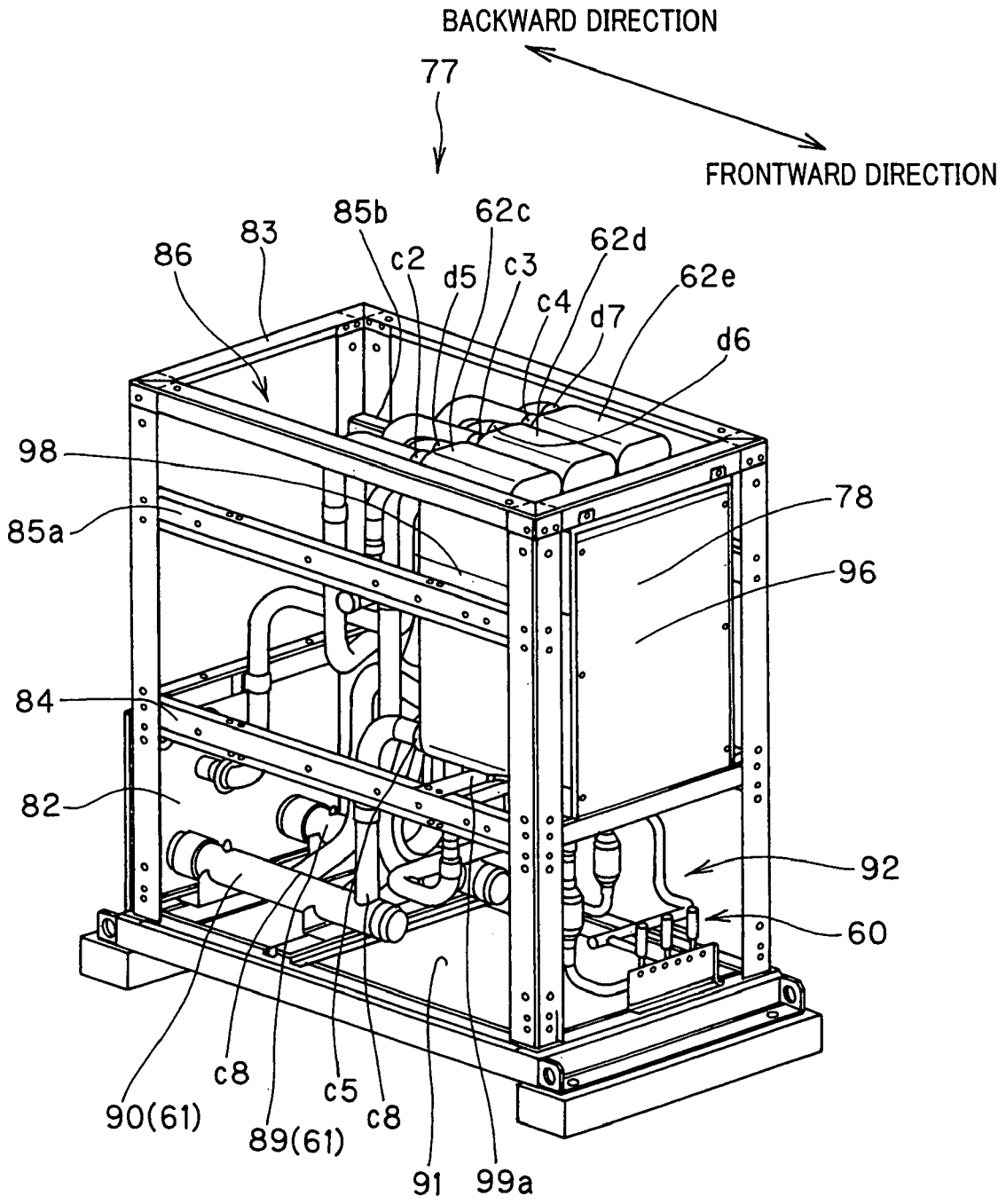
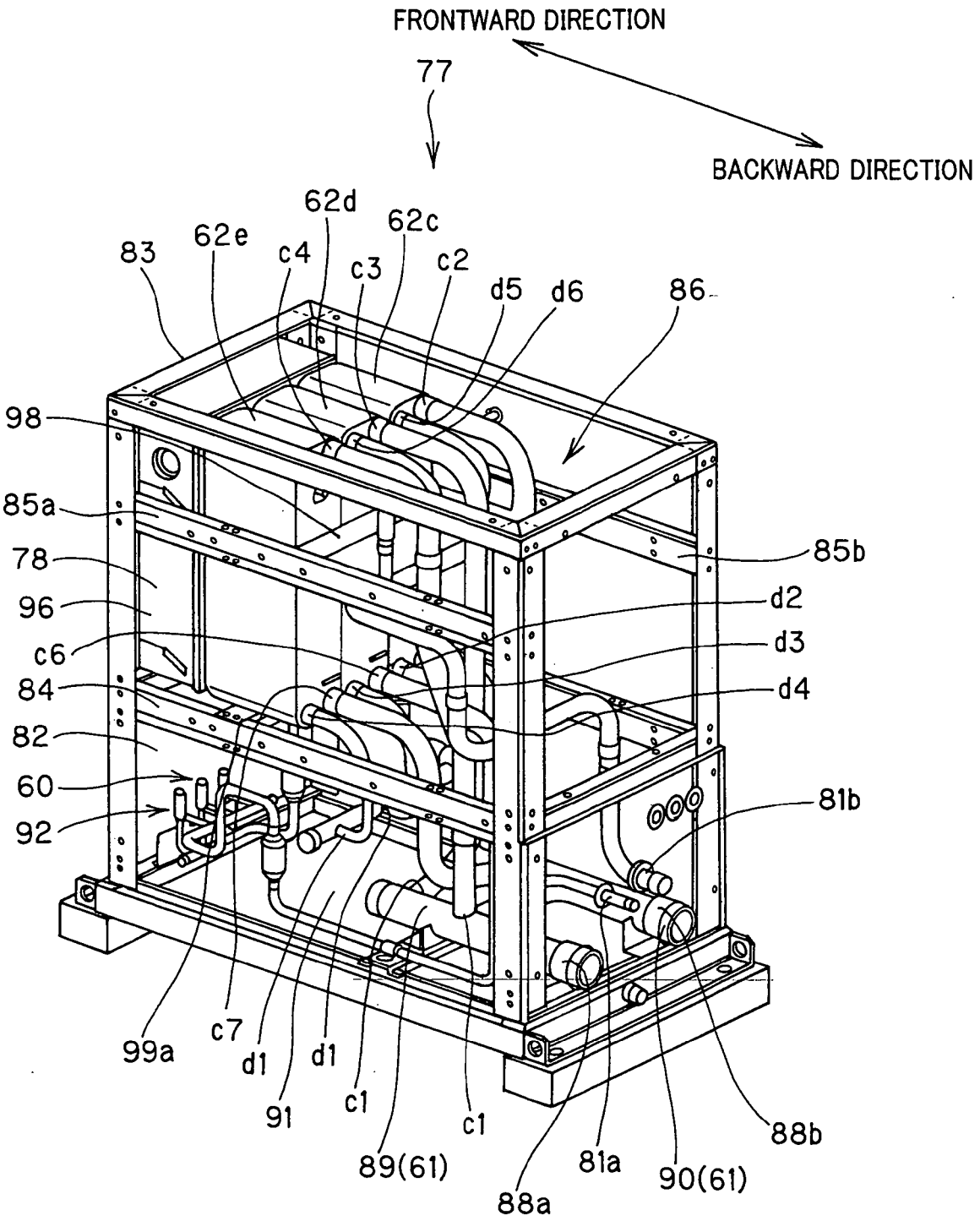

BACKWARD DIRECTION
77
FRONTWARD DIRECTION
85b
62c
83
62d
86
c2
d5
c3
62e
c4
d7
d6
98
78
85a
96
84
82
92
60
c8
c5
90(61)
89(61)
c8
91
99a

FIG.12


FRONTWARD DIRECTION
77
BACKWARD DIRECTION
62d
62c
62e
c4
c3
c2
83
d5
d6
86
98
85a
78
96
c6
84
82
60
92
85b
d2
d3
d4
81b
99a
c7
d1
d1
91
c1
c1
89(61)
88a
81a
90(61)
88b

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2004251486 A **[0002]**