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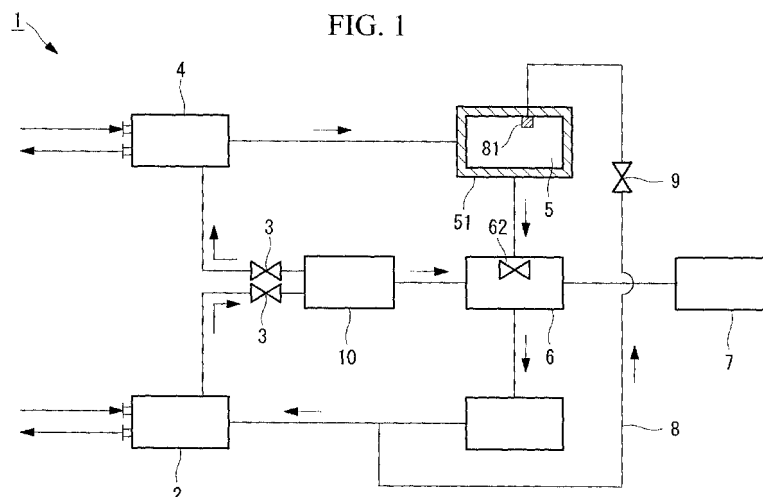
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(54) **HEAT PUMP DEVICE**

(57) A heat pump apparatus that can easily prevent noise generated during partial-load operation is provided. The heat pump apparatus includes a centrifugal compressor (6) configured to compress a refrigerant; a condenser (2) configured to condense the compressed refrigerant; an expansion valve (3) configured to adiabatically expand the condensed refrigerant; an evaporator (4) configured to vaporize the adiabatically-expanded refrigerant; a container (5) into which the vaporized refrigerant flows and from which the refrigerant that flowed in flows out to the centrifugal compressor (6); a sound-insulating member (51) configured to cover the container (5) and prevent sound generated inside the container (5) from leaking outside; a bypass channel (8) configured to guide part of the refrigerant from an area between the centrifugal compressor (6) and the condenser (2) to the container (5); and a flow control valve (9) configured to control the flow rate of the refrigerant flowing through the bypass channel (8).

erant flows and from which the refrigerant that flowed in flows out to the centrifugal compressor (6); a sound-insulating member (51) configured to cover the container (5) and prevent sound generated inside the container (5) from leaking outside; a bypass channel (8) configured to guide part of the refrigerant from an area between the centrifugal compressor (6) and the condenser (2) to the container (5); and a flow control valve (9) configured to control the flow rate of the refrigerant flowing through the bypass channel (8).



Description

{Technical Field}

[0001] The present invention relates to a heat pump apparatus and, more specifically, relates to a heat pump apparatus using a centrifugal chiller.

{Background Art}

[0002] In general, features of heat pump apparatuses using centrifugal chillers are their high operating efficiency during rated operation and quietness, with a low level of noise.

[0003] However, centrifugal compressors used in centrifugal chillers are known to enter a state known as surging in which stable operation cannot be carried out when the compressor is operating at a specific level of performance, i.e., with an air volume smaller than a specific value, due to the characteristics of the compressor. When the heat pump apparatus is operated in a partial-load state to prevent the occurrence of surging, operation at a condition below the lower limit of the capacity at which surging does not occur at the centrifugal compressor (which is a condition at which surging occurs) can be carried out, the air volume for the lower limit must be ensured at the centrifugal compressor by bypassing part of the refrigerant discharged from the centrifugal compressor directly to the suction side of the centrifugal compressor.

[0004] In this way, the occurrence of surging can be prevented at the centrifugal compressor, and the heat pump apparatus can operate according to the required partial-load (for example, refer to PTL 1).

{Citation List}

{Patent Literature}

[0005] {PTL 1} Japanese Unexamined Patent Application, Publication No. 2006-284034

{Summary of Invention}

{Technical Problem}

[0006] When such partial-load operation is carried out, the high-temperature, high-pressure refrigerant discharged from the centrifugal compressor flows through a bypass channel into a low-pressure pipe connected to the suction side of the centrifugal compressor or an evaporator. At this time, there is a problem that significant noise is generated.

[0007] When the evaporator is a plate-type heat exchanger, the bypass pipe is directly returned in a T-shape to the suction pipe of the centrifugal compressor. When a high-pressure refrigerant flows into a pipe whose internal pressure is low (low-pressure pipe), such as a suction pipe, the high-pressure refrigerant suddenly expands.

Consequently, there is a problem in that the flow rate of the refrigerant inside the low-pressure pipe increases, and noise generated when the refrigerant strikes the wall of the merging pipe increases.

5 There is a problem in that, since the level of such noise and vibration is significantly high, a satisfactory sound-insulating effect cannot be achieved even when sound-insulating is carried out.

10 **[0008]** On the other hand, when the evaporator is a shell-and-tube type heat exchanger and part of the refrigerant discharged from the centrifugal compressor is directly returned to the evaporator, the noise generated when inflow refrigerant gas strikes the inner surface of the evaporator is lowered since the size of the evaporator is sufficiently large and the flow rate of the refrigerant is sufficiently reduced. However, since the fluid noise of the refrigerant gas resonates in the evaporator, the evaporator itself becomes a noise source. Therefore, the entire evaporator needs to be covered to prevent noise generated in such a manner, and thus, the cost of sound-insulating increases.

20 **[0009]** The present invention has been conceived in light of the problems described above, and an object thereof is to provide a heat pump apparatus that easily prevents noise generated during partial-load operation.

{Solution to Problem}

30 **[0010]** The present invention provides the following solutions to achieve the object described above.

The heat pump apparatus according to an aspect of the present invention includes a centrifugal compressor configured to compress a refrigerant; a condenser configured to condense the compressed refrigerant; an expansion valve configured to adiabatically expand the condensed refrigerant; an evaporator configured to vaporize the adiabatically-expanded refrigerant; a container into which the vaporized refrigerant flows and from which the refrigerant that has flowed in flows out to the centrifugal compressor; a sound-insulating member configured to cover the container and prevent sound generated inside the container from leaking outside; a bypass channel configured to guide part of the refrigerant from an area between the centrifugal compressor and the condenser to the container; and a flow control valve configured to control the flow rate of the refrigerant flowing through the bypass channel.

45 **[0011]** According to an aspect of the present invention, when the heat pump apparatus carries out partial-load operation and part of the refrigerant discharged from the centrifugal compressor is guided through the bypass channel to the container, the sound generated when the refrigerant flows into the container can be prevented.

50 **[0012]** That is, since part of the bypassed refrigerant flows into the container of which the periphery is covered with the sound-insulating member, the sound generated when the bypassed refrigerant flows in can be easily prevented from leaking outside.

[0013] For example, when part of the bypassed refrigerant flows into the shell-and-tube type evaporator, the area to be covered with the sound-insulating member can be reduced compared with that of a method covering the entire evaporator with the sound-insulating member, and, thus, sound-insulating can be easily achieved.

[0014] Furthermore, compared with when part of the bypassed refrigerant directly flows into a pipe connecting the evaporator and the centrifugal compressor, the sound generated when the bypassed refrigerant merges can be reduced by letting the bypassed refrigerant flow into the container having a cross-sectional area larger than that of the bypass channel.

[0015] In the above-described aspect, it is desirable that a silencing part configured to prevent the generation of sound due to an inflow refrigerant be provided in an area of the container where the refrigerant flows in from the bypass channel.

[0016] According to the configuration described above, since the silencing part is provided, the noise generated when the bypassed refrigerant flows into the container can be further reduced.

An example of the silencing part is a cylindrical member through which the bypassed refrigerant flows, protruding inward from the container, and a plurality of through-holes may be formed in the sidewall of the cylinder.

[0017] In the above-described aspect, it is desirable that the container have a substantially cylindrical shape with both ends closed, and the cross-sectional diameter of the substantially cylindrical shape be approximately ten times or more larger than the cross-sectional diameter of the bypass channel.

[0018] According to the above-described configuration, by setting the cross-sectional diameter of the container at least ten times larger than that of the bypass channel, the sound generated when the bypassed refrigerant flows into the container can be more reliably prevented from leaking outside.

{Advantageous Effects of Invention}

[0019] The heat pump apparatus according to the present invention is advantageous in that, since part of the refrigerant discharged from the centrifugal compressor is guided to the container through the bypass channel, noise generated during partial-load operation can be easily prevented.

{Brief Description of Drawings}

[0020]

{Fig. 1}

Fig. 1 is a schematic view of the circuit configuration of the heat pump apparatus according to an embodiment of the present invention.

{Fig. 2}

Fig. 2 is a front view of the internal arrangement of

the heat pump apparatus illustrated in Fig. 1.

{Fig. 3}

Fig. 3 is a right side view of the internal arrangement of the heat pump apparatus illustrated in Fig. 2.

{Fig. 4}

Fig. 4 is a schematic view of a connecting part between a sound-insulating tank and a bypass channel.

{Description of Embodiments}

[0021] A heat pump apparatus according to an embodiment of the present invention will be described below with reference to Figs. 1 to 4.

Fig. 1 is a schematic view of the circuit configuration of the heat pump apparatus according to this embodiment. A heat pump apparatus 1 is a substantially rectangular cuboid and receives heat-source water to supply warm water.

As illustrated in Fig. 1, the heat pump apparatus 1 is mainly constituted of a condenser 2, an expansion valve 3, an evaporator 4, a sound-insulating tank (container) 5, a centrifugal compressor 6, an inverter 7, a bypass channel 8, and a flow control valve 9.

[0022] Fig. 2 is a front view of the internal arrangement of the heat pump apparatus illustrated in Fig. 1. Fig. 3 is a right side view of the internal arrangement of the heat pump apparatus illustrated in Fig. 2.

[0023] The condenser 2 is a plate-type heat exchanger formed in a substantially rectangular cuboid shape and cools and condenses a high-temperature, high-pressure refrigerant discharged from the centrifugal compressor 6. That is, the condenser 2 performs heat exchange between the refrigerant and warm water, liquefies the refrigerant, and heats the warm water. One of the ends of the condenser 2 is connected to a discharge part of the centrifugal compressor 6 via an oil-mist separating tank 12 in such a manner that the refrigerant can flow therefrom, and the other end is connected to the expansion valve 3 via an economizer 10 in such a manner that the refrigerant can flow thereto.

[0024] As illustrated in Fig. 3, the condenser 2 is disposed in parallel with the evaporator 4.

On one of the side surfaces at one end of the condenser 2, a warm-water inlet 21 into which warm water flows before being heated by the condenser 2 is provided in the bottom area, and a warm-water outlet 22 from which warm water flows out after being heated by the condenser 2 is provided in the top area.

[0025] The economizer 10 is a heat exchanger that is formed in a substantially cylindrical shape and further cools the refrigerant that has flowed out from the condenser 2. One of the ends of the economizer 10 is connected to the condenser 2 in such a manner that the refrigerant can flow therefrom, and the other end is connected to the expansion valve 3 in such a manner that the refrigerant can flow thereto.

[0026] This embodiment will be described as applied to an example in which heat exchange is performed at

the economizer 10 between a low-temperature, low-pressure refrigerant acquired by adiabatically expanding part of the refrigerant that has flowed from the condenser 2 and a refrigerant supplied to the expansion valve 3. In this case, the refrigerant used for cooling the expansion valve 3 flows into the centrifugal compressor 6.

The configuration of the economizer 10 is not particularly limited, and a known configuration thereof may be employed.

[0027] The expansion valve 3 adiabatically expands the refrigerant supplied to the condenser 2 via the economizer 10 and reduces the pressure of the refrigerant. One of the ends of the expansion valve 3 is connected to the economizer 10 in such a manner that the refrigerant can flow therefrom, and the other end is connected to the evaporator 4 in such a manner that the refrigerant can flow thereto.

Here, the expansion valve 3 is not particularly limited, and any known one may be used.

[0028] The evaporator 4 is a plate-type heat exchanger that is formed in a substantially rectangular cuboid shape and evaporates the refrigerant adiabatically expanded by the expansion valve 3. That is, the evaporator 4 applies heat from the heat-source water to the refrigerant and vaporizes the refrigerant by performing heat exchange between the refrigerant and the heat-source water. One of the ends of the evaporator 4 is connected to the expansion valve 3 in such a manner that the refrigerant can flow therefrom, and the other end is connected to a suction part of the centrifugal compressor 6 via a sound-insulating tank 5.

[0029] On one of the side surfaces at one end of the evaporator 4, a heat-source-water inlet 41 in to which heat-source water flows before heat is absorbed therefrom by the evaporator 4 is provided in the top area, and a heat-source-water outlet 42 from which heat-source water flows out after heat is absorbed therefrom by the evaporator 4 is provided in the bottom area.

[0030] A control panel 11 has a collection of operating devices, etc. for controlling various types of equipment in the heat pump apparatus 1 and has a substantially rectangular cuboid case that accommodates the operating devices, etc.

[0031] The sound-insulating tank 5 is a container formed in a substantially cylindrical shape that receives the refrigerant from the bypass channel 8 and prevents sound generated when the refrigerant flows in from the bypass channel 8 from leaking outside. Furthermore, the sound-insulating tank 5 receives the refrigerant from the evaporator 4 and functions as an accumulator that sends gas refrigerant to the centrifugal compressor 6.

[0032] A sound-insulating member 51, which is made of a sound absorbent material, is disposed around the sound-insulating tank 5.

The sound absorbent material, constituting the sound-insulating member 51 is not particularly limited, and any known sound absorbent material may be used.

[0033] One of the ends of the sound-insulating tank 5

is connected to the evaporator 4 in such a manner that the refrigerant can flow therefrom, and the other end is connected to the centrifugal compressor 6 in such a manner that the refrigerant can flow thereto. Furthermore, the sound-insulating tank 5 is connected to an end of the bypass channel 8 in such a manner that the refrigerant can flow.

The sound-insulating tank 5 is not particularly limited, and any known one may be used.

[0034] The centrifugal compressor 6 takes in the refrigerant vaporized at the evaporator 4 through the sound-insulating tank 5 and discharges the refrigerant, after compression, to the condenser 2 through the oil-mist separating tank 12. The suction part of the centrifugal compressor 6 to which the refrigerant flows in is connected to the evaporator 4 via the sound-insulating tank 5, and the discharge part from which the refrigerant flows out is connected to the condenser 2 via the oil-mist separating tank 12.

[0035] The centrifugal compressor 6 is integrated with an electric motor 61 that supplies a rotational driving force and a suction vane 62 that controls the amount of air intake. The electric motor 61 is rotationally driven by electrical power supplied from the inverter 7 such that the rotational speed is controlled.

The suction vane 62 is mounted on a compressor intake part to increase or decrease the amount of refrigerant gas taken in by the compressor by changing the degree of opening.

The centrifugal compressor 6, the electric motor 61, and the suction vane 62 are not particularly limited, and any known ones may be used.

[0036] The inverter 7 supplies electrical power to the electric motor 61, and also controls the rotational speed of the electric motor 61, and has a case that is substantially rectangular cuboid.

The inverter 7 is not particularly limited, and any known one may be used.

[0037] The oil-mist separating tank 12 formed in a substantially cylindrical shape separates lubricants contained in the refrigerant discharged from the centrifugal compressor 6 and lubricant mist from the refrigerant. One of the ends of the oil-mist separating tank 12 is connected to the discharge part of the centrifugal compressor 6 in such a manner that the refrigerant can flow therefrom, and the other end is connected to the condenser 2.

Furthermore, the oil-mist separating tank 12 supplies the lubricant separated from the refrigerant to an oil tank 13. Here, the oil-mist separating tank 12 is not particularly limited, and any known one may be used.

[0038] The oil tank 13, formed in a substantially cylindrical shape retains the lubricant used for lubricating the centrifugal compressor 6, and also supplies the lubricant to the centrifugal compressor 6, and receives the lubricant discharged from the centrifugal compressor 6. The oil tank 13 is connected to the centrifugal compressor 6 such that the lubricant can be supplied to and received from the centrifugal compressor 6 and such that the lu-

bricant is supplied from the oil-mist separating tank 12.

[0039] The bypass channel 8 is a channel that directly sends part of the refrigerant discharged from the centrifugal compressor 6 to the sound-insulating tank 5 during partial-load operation of the heat pump apparatus 1. It is desirable that the cross-sectional diameter of the bypass channel 8 be at least ten times larger than that of the cross-sectional diameter of the sound-insulating tank 5.

[0040] As illustrated in Fig. 1, one of the ends of the bypass channel 8 is connected to the channel connecting the oil-mist separating tank 12 and the condenser 2, and the other end is connected to the sound-insulating tank 5. Furthermore, a silencing part 81 shaped such that the bypass channel 8 protrudes inward from the sound-insulating tank 5 is provided in the area where the bypass channel 8 is connected to the sound-insulating tank 5.

[0041] Fig. 4 is a schematic view of the connecting part between the sound-insulating tank 5 and the bypass channel 8.

As illustrated in Fig. 4, the silencing part 81 is a cylindrical member extending inward from the inner surface of the sound-insulating tank 5 and suppresses sound generated when the refrigerant flows into the sound-insulating tank 5 from the bypass channel 8.

A plurality of through-holes 82 is formed in the side surface of the silencing part 81.

[0042] As illustrated in Fig. 1, the flow control valve 9 is a valve that controls the flow of the refrigerant in the bypass channel 8.

For example, during rated operation of the heat pump apparatus 1, the flow control valve 9 is closed. In contrast, during partial-load operation of the heat pump apparatus 1, the flow control valve 9 is open, and part of the refrigerant discharged from the centrifugal compressor 6 is guided through the bypass channel 8 to the sound-insulating tank 5.

[0043] Next, warm water supply during rated operation of the heat pump apparatus 1, having the above-described configuration, will be described with reference to Fig. 1, etc.

[0044] When warm water is supplied from the heat pump apparatus 1, electrical power is supplied from an external unit to the inverter 7 to rotationally drive the electric motor 61 with the inverter 7, and the centrifugal compressor 6 compresses the refrigerant.

[0045] The high-temperature, high-pressure gas refrigerant compressed by the centrifugal compressor 6 is discharged from the discharge part of the centrifugal compressor 6 and flows into the oil-mist separating tank 12. At the oil-mist separating tank 12, lubricant mist contained in the refrigerant is separated from the refrigerant. The lubricant mist separated from the refrigerant flows out from the oil-mist separating tank 12 into the condenser 2.

[0046] At the condenser 2, heat exchange is performed between the high-temperature refrigerant and warm water supplied from an external unit. The high-temperature refrigerant is condensed and liquefied by releasing heat

to the warm water. On the other hand, the warm water absorbs heat from the high-temperature refrigerant, is subjected to a temperature rise, and flows out from the condenser 2 into an external unit.

[0047] The refrigerant liquefied at the condenser 2 flows out from the condenser 2 into the economizer 10. Part of the inflow refrigerant branches off at the economizer 10, and a low-temperature, low-pressure refrigerant is generated through adiabatic expansion. Then, heat exchange is performed between the branched-off low-temperature refrigerant and the remaining refrigerant to further cool the remaining refrigerant.

After the branched-off refrigerant is used to cool the remaining refrigerant, it flows into the suction part of the centrifugal compressor 6.

[0048] The refrigerant cooled by the economizer 10 flows to the expansion valve 3 and is adiabatically expanded to a low-temperature, low-pressure liquid refrigerant while passing through the expansion valve 3. The adiabatically-expanded refrigerant flows into the evaporator 4.

[0049] At the evaporator 4, heat exchange is performed between the low-temperature refrigerant and heat-source water supplied from an external unit. The low-temperature refrigerant is vaporized to gas by absorbing heat from the heat-source water. In contrast, the heat-source water becomes heat-source water with a reduced temperature by releasing heat to the low-temperature refrigerant and flows out from the evaporator 4.

[0050] The vaporized gas refrigerant flows out from the evaporator 4 into the sound-insulating tank 5. At the sound-insulating tank 5, the liquid refrigerant that has flowed out from the evaporator 4 together with the gas refrigerant is separated from the gas refrigerant, and only the gas refrigerant flows out from the sound-insulating tank 5.

[0051] The gas refrigerant from which the liquid refrigerant has been separated at the sound-insulating tank 5 flows into the suction part of the centrifugal compressor 6, is compressed at the centrifugal compressor 6, and is discharged from the discharge part of the centrifugal compressor 6 again as a high-pressure refrigerant, and the cycle described above is repeated.

[0052] Next, the heat pump apparatus 1 in a state in which partial-load operation is carried out will be described.

First, when the load associated with the heat pump apparatus 1 is reduced, the rotational speed of the electric motor 61 is reduced by the inverter 7, and the airflow capacity of the centrifugal compressor 6 is reduced by closing the suction vane 62. Here, the airflow capacity of the centrifugal compressor 6 is reduced in such a manner that the operational point associated with the centrifugal compressor 6 does not enter the surging region.

[0053] When the load associated with the heat pump apparatus 1 is reduced even more, the closed flow control valve 9 opens. As a result, part of the refrigerant that has been discharged from the centrifugal compressor 6 and

that has flown into the condenser 2 through the oil-mist separating tank 12 flows into the bypass channel 8. The refrigerant that flowed into the bypass channel 8 flows into the sound-insulating tank 5 and merges with the refrigerant from the evaporator 4.

[0054] Accordingly, the flow rate of the refrigerant flowing into the condenser 2 and the evaporator 4 is reduced even more to reduce the load associated with the heat pump apparatus 1 even more.

[0055] With the configuration described above, partial-load operation of the heat pump apparatus 1 is carried out, and part of the refrigerant discharged from the centrifugal compressor 6 is guided through the bypass channel 8 to the sound-insulating tank 5 covered with the sound-insulating member 51 so as to easily prevent sound that is generated when the bypassed refrigerant flows into the sound-insulating tank 5 from leaking outside.

[0056] For example, when part of the bypassed refrigerant flows into a shell-and-tube type evaporator, the area that needs to be covered by the sound-insulating member 51 is small compared with that of a method of covering the entire evaporator with the sound-insulating member 51. Therefore, sound can be easily prevented.

[0057] Furthermore, compared with when part of the bypassed refrigerant directly flows into the pipe connecting the evaporator 4 and the centrifugal compressor 6, when the bypassed refrigerant flows into the sound-insulating tank 5 having a cross-sectional area greater than that of the bypass channel 8, the sound generated when the bypassed refrigerant merges can be reduced.

[0058] Furthermore, since the silencing part 81 is disposed in the area where the bypassed refrigerant flows into the sound-insulating tank 5, the noise generated when the bypassed refrigerant flows into the sound-insulating tank 5 can be reduced even more.

[0059] Since the cross-sectional diameter of the sound-insulating tank 5 is at least ten times larger than that of the bypass channel 8, sound generated when the bypassed refrigerant flows into the sound-insulating tank 5 can be even more reliably prevented from leaking outside.

{Reference Signs List}

[0060]

- 1 heat pump apparatus
- 2 condenser
- 3 expansion valve
- 4 evaporator
- 5 sound-insulating tank (container)
- 6 centrifugal compressor

- 7 inverter
- 8 bypass channel
- 9 flow control valve
- 51 sound-insulating member
- 81 silencing part

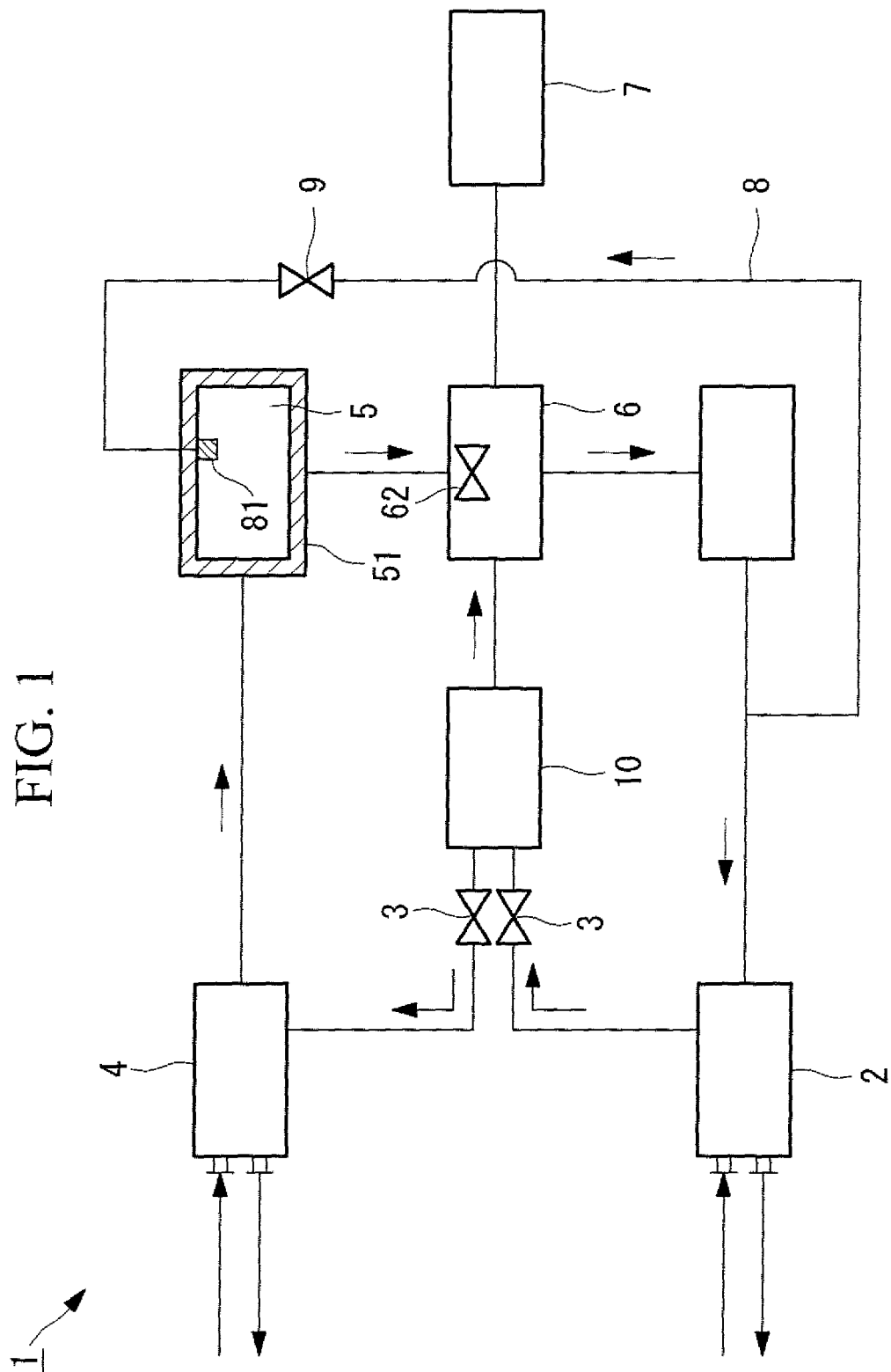
Claims

1. A heat pump apparatus comprising:

a centrifugal compressor configured to compress a refrigerant;
 a condenser configured to condense the compressed refrigerant;
 an expansion valve configured to adiabatically expand the condensed refrigerant;
 an evaporator configured to vaporize the adiabatically-expanded refrigerant;
 a container into which the vaporized refrigerant flows and from which the flown-in refrigerant flows out to the centrifugal compressor;
 a sound-insulating member configured to cover the container and prevent sound generated inside the container from leaking outside;
 a bypass channel configured to guide part of the refrigerant from an area between the centrifugal compressor and the condenser to the container; and
 a flow control valve configured to control the flow rate of the refrigerant flowing through the bypass channel.

2. The heat pump apparatus according to Claim 1, wherein a silencing part configured to prevent the generation of sound due to the refrigerant flowing in is provided in an area of the container where the refrigerant flows in from the bypass channel.

3. The heat pump apparatus according to Claim 1, wherein the container has a substantially cylindrical shape with both ends closed, and wherein the cross-sectional diameter of the substantially cylindrical shape is approximately ten times or more larger than the cross-sectional diameter of the bypass channel.



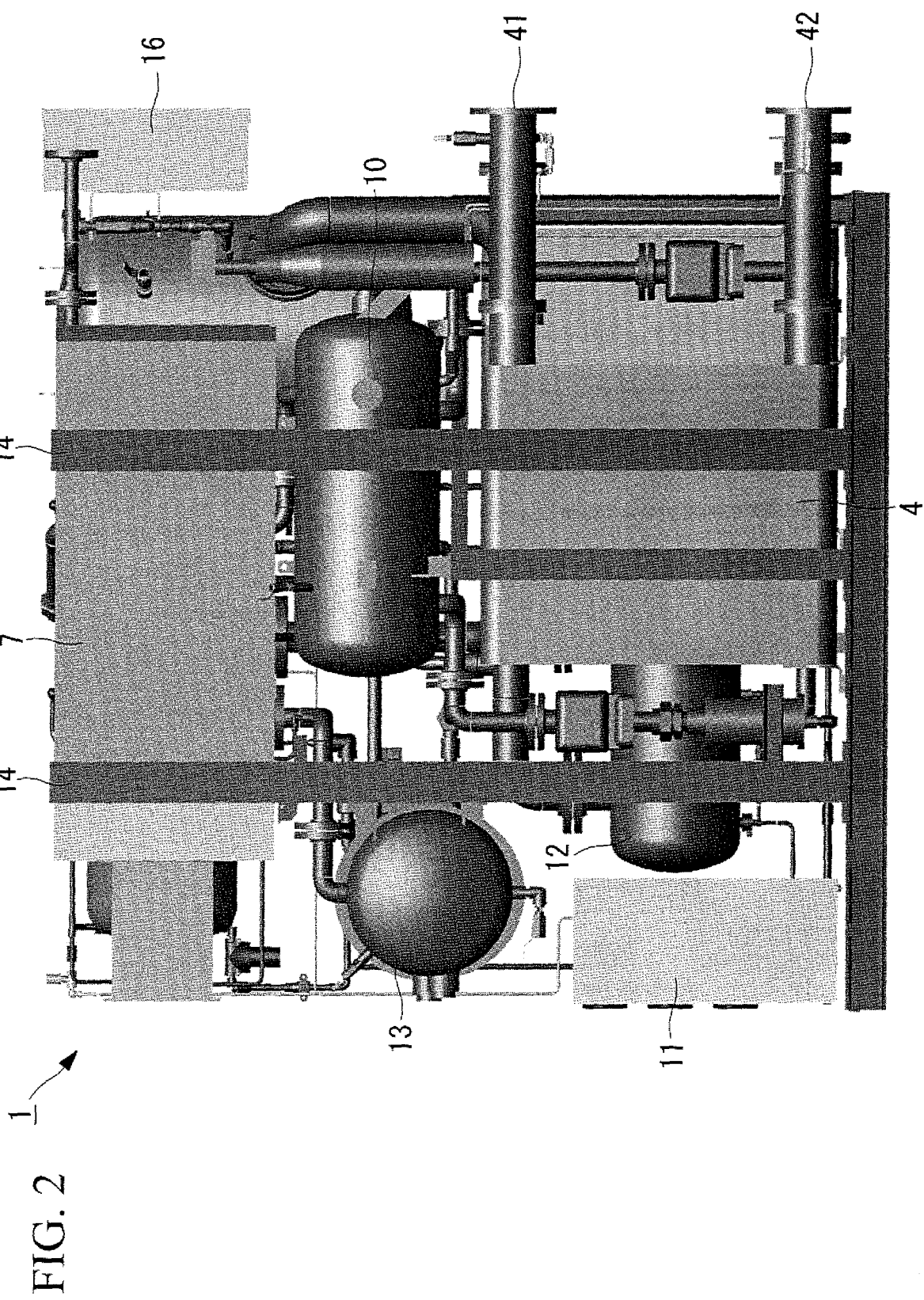


FIG. 3

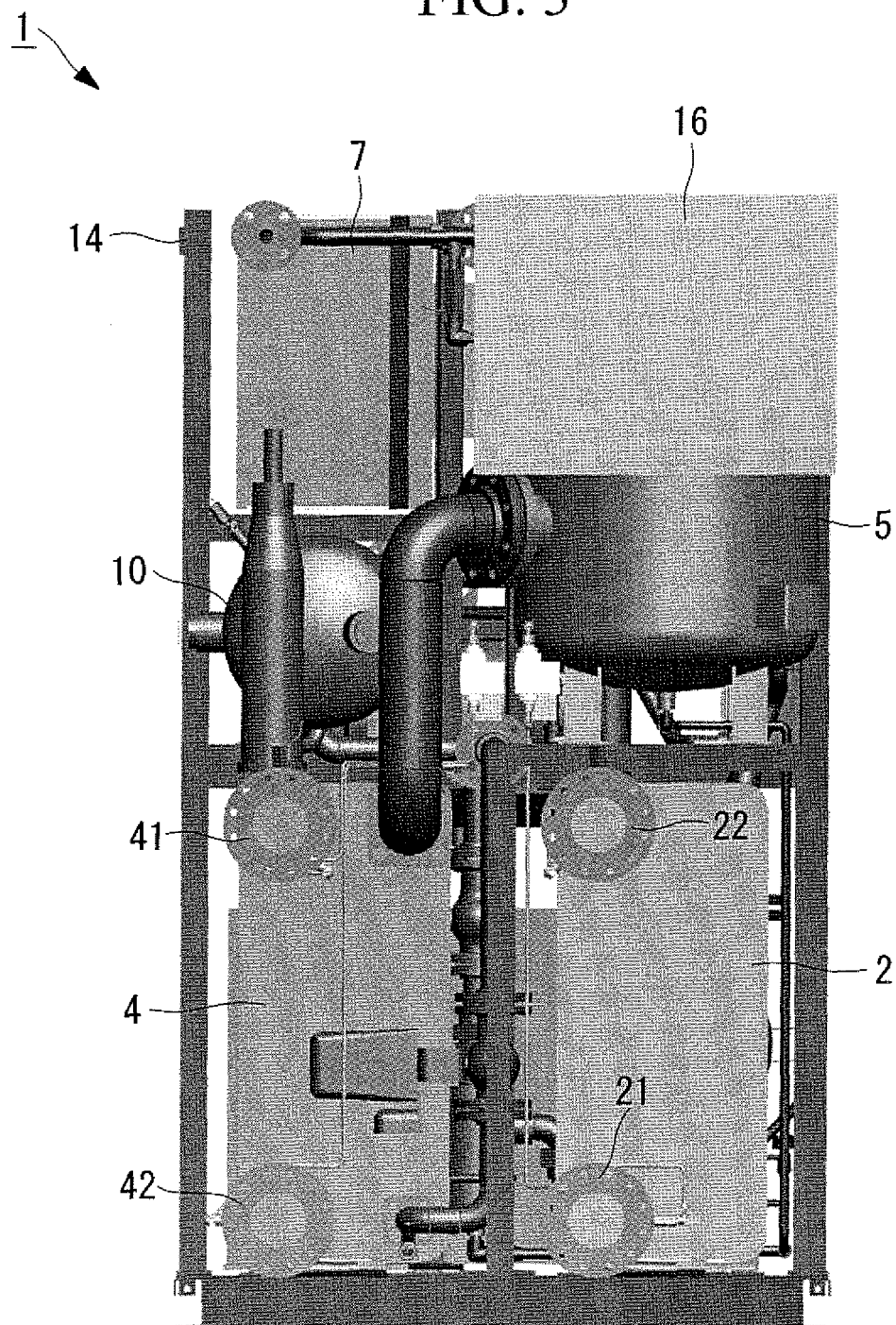
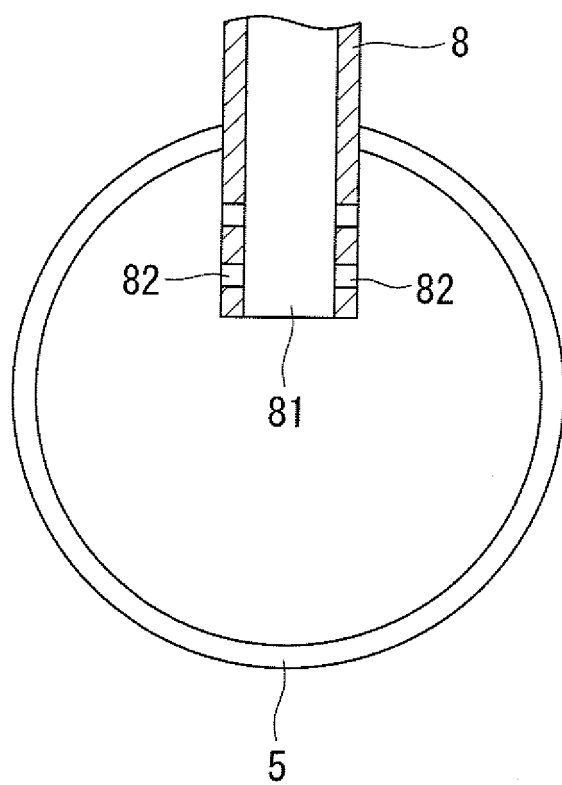


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/055543

A. CLASSIFICATION OF SUBJECT MATTER

F25B43/00 (2006.01) i, F25B1/053 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25B43/00, F25B1/053

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-225140 A (Mitsubishi Heavy Industries, Ltd.), 06 September 2007 (06.09.2007), paragraphs [0048] to [0068]; fig. 1 to 3 (Family: none)	1-3
Y	JP 5-133566 A (Matsushita Electric Industrial Co., Ltd.), 28 May 1993 (28.05.1993), paragraphs [0013] to [0015]; fig. 1 (Family: none)	1-3
Y	JP 2002-90004 A (Fujitsu General Ltd.), 27 March 2002 (27.03.2002), paragraph [0002] (Family: none)	1-3

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

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Date of the actual completion of the international search
15 April, 2010 (15.04.10)Date of mailing of the international search report
27 April, 2010 (27.04.10)Name and mailing address of the ISA/
Japanese Patent Office

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Facsimile No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/055543

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	JP 2003-222412 A (Daikin Industries, Ltd.), 08 August 2003 (08.08.2003), paragraphs [0043] to [0083]; fig. 1 to 4 (Family: none)	2

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REFERENCES CITED IN THE DESCRIPTION

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