(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 354 032 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
17.04.2024 Bulletin 2024/16

(21) Application number: **21945039.2**

(22) Date of filing: **08.06.2021**

(51) International Patent Classification (IPC):
F24F 7/08 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24F 7/08

(86) International application number:
PCT/JP2021/021729

(87) International publication number:
WO 2022/259361 (15.12.2022 Gazette 2022/50)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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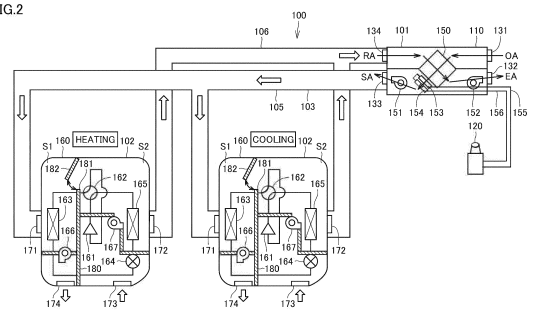
(54) AIR CONDITIONING SYSTEM

(57) An air conditioning system (100) includes: an outdoor-air processing unit (101); at least one air conditioner (102); and a duct (103). The outdoor-air processing unit (101) includes an outdoor-side flow inlet (131), an outdoor-side flow outlet (132), an indoor-side flow outlet (133), and an indoor-side flow inlet (134). A housing (160) includes a supply-side air inlet (171) and a supply-side air outlet (172). The duct (103) includes a supply duct (105) and an exhaust duct (106). The supply duct (105) connects the indoor-side flow outlet (133) and the supply-side air inlet (171). The exhaust duct (106) connects the indoor-side flow inlet (134) and the supply-side air outlet (172). The air conditioner (102) is integrally formed by housing a compressor (161), a condenser, an expansion valve (164), and an evaporator in the housing (160).

FIG.2



EP 4 354 032 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an air conditioning system.

BACKGROUND ART

[0002] There has been conventionally known an air conditioning apparatus that takes in outdoor air and supplies the outdoor air into a room. For example, Japanese Patent Laying-Open No. H01-310242 (PTL 1) describes an air-cooled heat pump-type air conditioning apparatus. In the air-cooled heat pump-type air conditioning apparatus, an introduction air path and an air supply air path branch off from an outdoor air introduction duct. A used-side heat exchanger is arranged in the introduction air path. An outdoor unit is arranged in the air supply air path. The outdoor unit is connected to an indoor unit by a refrigerant pipe.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent Laying-Open No. H01-310242

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] In the air-cooled heat pump-type air conditioning apparatus described in the publication above, the outdoor unit and the indoor unit are separate from each other. Therefore, the refrigerant pipe that connects the outdoor unit and the indoor unit is long. Thus, an amount of refrigerant present in the refrigerant pipe that connects the outdoor unit and the indoor unit is large. This causes a problem of exceeding a permissible amount of refrigerant when using slightly flammable refrigerant or flammable refrigerant.

[0005] The present disclosure has been made in light of the above-described problem, and an object thereof is to provide an air conditioning system that allows a reduction in an amount of refrigerant in an air conditioner.

SOLUTION TO PROBLEM

[0006] An air conditioning system according to the present disclosure includes: an outdoor-air processing unit; at least one air conditioner; and a duct configured to connect the outdoor-air processing unit and the air conditioner. The outdoor-air processing unit includes an outdoor-side flow inlet, an outdoor-side flow outlet, an indoor-side flow outlet communicating with the outdoor-side flow inlet, and an indoor-side flow inlet communicating with the outdoor-side flow outlet. The air conditioner includes a housing, a compressor, a condenser, an expansion valve, and an evaporator. The housing includes a supply-side air inlet and a supply-side air outlet. The duct includes a supply duct and an exhaust duct. The supply duct connects the indoor-side flow outlet and the supply-side air inlet. The exhaust duct connects the indoor-side flow inlet and the supply-side air outlet. The air conditioner is integrally formed by housing the compressor, the condenser, the expansion valve, and the evaporator in the housing.

ADVANTAGEOUS EFFECTS OF INVENTION

[0007] In the air conditioning system according to the present disclosure, the air conditioner is integrally formed by housing the compressor, the condenser, the evaporator, and the expansion valve in the housing. Therefore, an amount of refrigerant in the air conditioner can be reduced.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

Fig. 1 schematically shows a configuration of an air conditioning system according to a first embodiment.
Fig. 2 schematically shows internal configurations of an air conditioner and an outdoor-air processing unit according to the first embodiment.
Fig. 3 schematically shows a configuration of an air conditioning system according to a second embodiment.

DESCRIPTION OF EMBODIMENTS

[0009] Embodiments will be described hereinafter with reference to the drawings. In the following description, the same or corresponding portions are denoted by the same reference characters and redundant description will not be repeated.

First Embodiment

[0010] A configuration of an air conditioning system 100 according to a first embodiment will be described with reference to Figs. 1 and 2.

[0011] Air conditioning system 100 according to the first embodiment is mainly used in a medium-sized or large-sized building 200. The reason why air conditioning system 100 according to the first embodiment is mainly used in medium-sized or large-sized building 200 is that an outdoor-air processing unit (outdoor-air processing air conditioner) connected by a duct is placed in medium-sized or large-sized building 200. The outdoor-air processing unit is an apparatus that suctions outdoor air, adjusts a temperature and a humidity of the outdoor air by heat exchange and substance exchange with return

air from a room, and supplies the outdoor air into the room. It should be noted that air conditioning system 100 according to the first embodiment can also be used in small-sized building 200 as long as an outdoor-air processing unit is placed therein.

[0012] Fig. 1 schematically shows a configuration of air conditioning system 100 according to the first embodiment. As shown in Fig. 1, air conditioning system 100 includes an outdoor-air processing unit 101, at least one air conditioner 102 and a duct 103. In air conditioning system 100, air that is temporarily processed in outdoor-air processing unit 101 is sent to air conditioner 102 through duct 103. The air sent to air conditioner 102 is further temperature-adjusted in air conditioner 102 and supplied into the room. Indoor air suctioned into air conditioner 102 is temperature-adjusted in air conditioner 102. Heat generated in air conditioner 102 during the temperature adjustment is discharged to outdoor-air processing unit 101 through duct 103.

[0013] Outdoor-air processing unit 101 is an apparatus that takes in outdoor air, and adjusts a temperature, a humidity and the like of the outdoor air to come close to a temperature and a humidity of indoor air by using a heat exchanger, a heat exchange ventilator, a humidifier and the like. Outdoor-air processing unit 101 includes a heat exchange ventilator 110 and an outdoor unit 120. Heat exchange ventilator 110 is connected to outdoor unit 120. In the first embodiment, heat exchange ventilator 110 is connected to dedicated outdoor unit 120. Outdoor unit 120 is placed on, for example, a balcony or the like on each floor of building 200. When there is space for placing and aligning outdoor units 120 on a rooftop of building 200, all of outdoor units 120 can also be placed on the rooftop. Heat exchange ventilator 110 may be formed integrally with outdoor unit 120 and placed on the rooftop (outside).

[0014] Air conditioner 102 includes a refrigeration cycle circuit. Air conditioner 102 is an integral air conditioner in which a supply-side heat exchanger 163 and a discharge-side heat exchanger 165 are housed in one housing 160 (see Fig. 2).

[0015] Duct 103 is configured to connect outdoor-air processing unit 101 and air conditioner 102. Duct 103 includes a flow path configured to allow the air to flow between outdoor-air processing unit 101 and air conditioner 102. Duct 103 includes a supply duct 105 and an exhaust duct 106. Air conditioner 102 is connected to outdoor-air processing unit 101 by supply duct 105 and exhaust duct 106.

[0016] In addition, in the first embodiment, air conditioning system 100 includes a carbon dioxide concentration sensor 104. Carbon dioxide concentration sensor 104 is configured to detect a concentration of carbon dioxide (CO_2) in the room. Based on the concentration of carbon dioxide (CO_2) detected by carbon dioxide concentration sensor 104, outdoor-air processing unit 101 is controlled by a not-shown controller.

[0017] Fig. 2 schematically shows internal configurations of outdoor-air processing unit 101 and air conditioner 102 according to the first embodiment. As shown in Fig. 2, outdoor-air processing unit 101 includes an outdoor-side flow inlet 131, an outdoor-side flow outlet 132, an indoor-side flow outlet 133, and an indoor-side flow inlet 134. Heat exchange ventilator 110 is provided with outdoor-side flow inlet 131, outdoor-side flow outlet 132, indoor-side flow outlet 133, and indoor-side flow inlet 134.

[0018] Outdoor air OA flows into outdoor-air processing unit 101 through outdoor-side flow inlet 131. Indoor air RA is discharged through outdoor-side flow outlet 132 as exhaust air EA. Indoor-side flow outlet 133 communicates with outdoor-side flow inlet 131. Supply air SA is supplied to supply duct 105 through indoor-side flow outlet 133. Indoor-side flow inlet 134 communicates with outdoor-side flow outlet 132. Indoor air RA flows into indoor-side flow inlet 134 from exhaust duct 106.

[0019] Heat exchange ventilator 110 includes a heat substance exchange element 150, a supply-side blower 151, a discharge-side blower 152, a heat exchanger for dehumidification 153, and a heat exchanger for reheating 154. Heat substance exchange element 150 is configured to perform heat exchange between outdoor air OA and indoor air RA. Supply-side blower 151 is configured to supply air from heat exchange ventilator 110 to supply duct 105. Discharge-side blower 152 is configured to discharge air from heat exchange ventilator 110 to the outside. Heat exchanger for dehumidification 153 is a heat exchanger for dehumidifying outdoor air. Heat exchanger for dehumidification 153 is connected to outdoor unit 120 by a connection pipe 155. Heat exchanger for reheating 154 is a heat exchanger for heating outdoor air. Heat exchanger for reheating 154 is connected to outdoor unit 120 by a connection pipe 156. Heat exchanger for dehumidification 153 and heat exchanger for reheating 154 are placed on the inlet side of supply-side blower 151.

[0020] In heat exchange ventilator 110, two air paths are provided to be adjacent to each other. Heat substance exchange element 150 is arranged to extend over the two air paths. The two air paths intersect with each other in heat substance exchange element 150. Heat substance exchange element 150 is sandwiched between supply-side blower 151 and discharge-side blower 152. Supply-side blower 151 is arranged in one of the two air paths. Discharge-side blower 152 is arranged in the other of the two air paths. Heat exchanger for dehumidification 153 and heat exchanger for reheating 154 are arranged between heat substance exchange element 150 and supply-side blower 151. Heat exchanger for dehumidification 153 is arranged between heat substance exchange element 150 and heat exchanger for reheating 154.

[0021] Outdoor unit 120 includes a compressor, a heat exchanger, an expansion valve and the like, all of which are not shown. The compressor, the heat exchanger and the expansion valve form the refrigeration cycle circuit, together with heat exchanger for dehumidification 153 and heat exchanger for reheating 154.

[0022] Although the configuration in which the two heat exchangers (heat exchanger for dehumidification 153 and heat exchanger for reheating 154) are placed on the inlet side of supply-side blower 151 has been described as an example of the heat exchangers in the above description, the present disclosure is not limited thereto. A plurality of heat exchangers may be arranged at a plurality of locations. Although the heat exchange ventilator is used as heat substance exchange element 150 in the first embodiment, the present disclosure is not limited thereto. A rotary (rotor-type) dehumidifier may be used.

[0023] Air conditioner 102 includes a housing 160, a compressor 161, a four-way valve 162, a supply-side heat exchanger 163, an expansion valve 164, a discharge-side heat exchanger 165, a blower for supply 166, and a blower for discharge 167. Supply-side heat exchanger 163 functions as a condenser during heating operation, and functions as an evaporator during cooling operation. Discharge-side heat exchanger 165 functions as an evaporator during the heating operation, and functions as a condenser during the cooling operation. Air conditioner 102 is integrally formed by housing compressor 161, the condenser, expansion valve 164, and the evaporator in housing 160. Compressor 161, the condenser, expansion valve 164, and the evaporator are housed in one housing 160.

[0024] Housing 160 includes a supply-side air inlet 171, a supply-side air outlet 172, a discharge-side air inlet 173, and a discharge-side air outlet 174. Supply duct 105 connects indoor-side flow outlet 133 and supply-side air inlet 171. Supply air SA is supplied from outdoor-air processing unit 101 to supply-side air inlet 171 through supply duct 105. Exhaust duct 106 connects indoor-side flow inlet 134 and supply-side air outlet 172. Indoor air RA is supplied from supply-side air outlet 172 to outdoor-air processing unit 101 through exhaust duct 106. The air is suctioned into housing 160 through discharge-side air inlet 173. The temperature-adjusted air is blown out into the room through discharge-side air outlet 174.

[0025] Housing 160 includes a partitioning member 180. Partitioning member 180 is configured to partition housing 160 into an air supply-side space S1 and an air discharge-side space S2. Supply-side heat exchanger 163 is arranged in air supply-side space S1. Air supply-side space S1 communicates with supply-side air inlet 171. Discharge-side heat exchanger 165 is arranged in air discharge-side space S2. Air discharge-side space S2 communicates with supply-side air outlet 172.

[0026] Partitioning member 180 includes a main body portion 181 and a damper 182. Damper 182 is configured to be movable with respect to main body portion 181. Damper 182 is configured to pivot about one end attached to housing 160, such that the other end is separated from main body portion 181. Damper 182 is arranged at one ends of air supply-side space S1 and air discharge-side space S2. When damper 182 moves to be separated from main body portion 181, air supply-side space S1 and air discharge-side space S2 are bypassed. As a result, the air in air supply-side space S1 and the air in air discharge-side space S2 are mixed. The function of this bypass configuration can also be implemented by duct 103 outside air conditioner 102, not inside air conditioner 102.

[0027] In the first embodiment, air conditioning system 100 is placed on each floor of building 200. In air conditioning system 100 according to the first embodiment, a plurality of air conditioners 102 are placed. Specifically, two air conditioners 102 are placed in air conditioning system 100 on each floor of building 200. The duct is configured to connect outdoor-air processing unit 101 and the plurality of air conditioners 102. Only one air conditioner 102 may be placed.

[0028] Next, the operation of air conditioning system 100 according to the first embodiment will be described with reference to Fig. 2. First, outdoor air taken in by outdoor-air processing unit 101 passes through heat substance exchange element 150, heat exchanger for dehumidification 153 and heat exchanger for reheating 154 in heat exchange ventilator 110 in this order, and is supplied to air conditioner 102 through supply duct 105 by supply-side blower 151.

[0029] A case in which the operation of air conditioner 102 on the left side in Fig. 2 is heating and the operation of air conditioner 102 on the right side in Fig. 2 is cooling will now be described. During the heating operation, four-way valve 162 is connected such that supply-side heat exchanger 163 functions as a condenser and discharge-side heat exchanger 165 functions as an evaporator. The refrigerant discharged from compressor 161 flows through four-way valve 162, supply-side heat exchanger 163, expansion valve 164, discharge-side heat exchanger 165, and again four-way valve 162, and returns to compressor 161. At this time, a part of the air in air discharge-side space S2 is bypassed to air supply-side space S1 through a gap between main body portion 181 and damper 182 of partitioning member 180.

[0030] During the cooling operation, four-way valve 162 is connected such that discharge-side heat exchanger 165 functions as a condenser and supply-side heat exchanger 163 functions as an evaporator. The refrigerant discharged from compressor 161 flows through four-way valve 162, discharge-side heat exchanger 165, expansion valve 164, supply-side heat exchanger 163, and again four-way valve 162, and returns to compressor 161. At this time, a part of the air in air discharge-side space S2 is bypassed to air supply-side space S1 through the gap between main body portion 181 and damper 182 of partitioning member 180.

[0031] The operation of outdoor-air processing unit 101 is, for example, controlled to stop when the concentration of carbon dioxide (CO_2) detected by carbon dioxide concentration sensor 104 is equal to or lower than a reference value, and to operate when the concentration of carbon dioxide (CO_2) detected by carbon dioxide concentration sensor 104 is equal to or higher than the reference value.

[0032] Next, the function and effect of air conditioning system 100 according to the first embodiment will be described.

[0033] In air conditioning system 100 according to the first embodiment, air conditioner 102 is integrally formed by housing compressor 161, the condenser, expansion valve 164, and the evaporator in housing 160. Therefore, an amount of refrigerant in air conditioner 102 can be reduced. That is, since air conditioner 102 is integrally formed in air conditioning system 100 according to the first embodiment, an amount of refrigerant present in a refrigerant pipe can be reduced, as compared with the case in which air conditioner 102 includes the refrigerant pipe that connects the outdoor unit and the indoor unit. Thus, the amount of refrigerant in air conditioner 102 can be reduced.

[0034] In addition, air conditioning system 100 includes duct 103 that connects outdoor-air processing unit 101 and air conditioner 102. Duct 103 used in outdoor-air processing unit 101 can also be used in air conditioner 102. In addition, the heat generated in housing 160 of air conditioner 102 can be discharged through duct 103.

[0035] In air conditioning system 100 according to the first embodiment, when damper 182 moves to be separated from main body portion 181, air supply-side space S1 and air discharge-side space S2 are bypassed. Therefore, a part of the air in air discharge-side space S2 can be bypassed to air supply-side space S1 through the gap between main body portion 181 and damper 182 of partitioning member 180. Thus, the temperature of the air can be efficiently adjusted, without wastefully releasing the already air-conditioned air to the outdoor air.

[0036] In air conditioning system 100 according to the first embodiment, duct 103 is configured to connect outdoor-air processing unit 101 and the plurality of air conditioners 102. Therefore, the number of ducts 103 can be reduced, as compared with the case in which duct 103 connects outdoor-air processing unit 101 and one air conditioner 102.

Second Embodiment

[0037] Unless otherwise explained, an air conditioning system 100 according to a second embodiment has the same configuration, operation, and function and effect as those of air conditioning system 100 according to the first embodiment.

[0038] Fig. 3 schematically shows a configuration of air conditioning system 100 according to the second embodiment. In air conditioning system 100 according to the second embodiment, outdoor-air processing unit 101 is placed on a floor different from a floor where at least any one of a plurality of air conditioners 102 is placed. Specifically, outdoor units 120 of outdoor-air processing unit 101 are placed on a rooftop in a centralized manner. Outdoor-air processing unit 101 is a large-sized apparatus and only one outdoor-air processing unit 101 is placed in a machine room or the like on the top floor. Outdoor-air processing unit 101 may be of rooftop-mounted type. The plurality of air conditioners 102 are placed not only on the same floor as the floor where outdoor-air processing unit 101 is placed, but also on different floors. In air conditioning system 100 according to the second embodiment, two of the plurality of air conditioners 102 are placed on the same floor.

[0039] One supply duct 105 and one exhaust duct 106 connect outdoor-air processing unit 101 to air conditioners 102 placed not only on the same floor but also on the different floors. Therefore, the duct work in the vertical direction occurs. Instead, duct 103 placed on each floor and connected to outdoor-air processing unit 101 becomes unnecessary. As a result, the total duct configuration can be simplified.

[0040] Duct 103 includes a bypass duct 107. Bypass duct 107 includes a flow path that bypasses supply duct 105 and exhaust duct 106. Bypass duct 107 bypasses the air from the air discharge side to the air supply side. Bypass duct 107 is connected to the outside of each of the plurality of air conditioners 102. Bypass duct 107 includes a bypass valve 190. Bypass valve 190 is configured to be capable of opening and closing the flow path of bypass duct 107. When the flow path of bypass valve 190 is opened, air supply-side space S1 and air discharge-side space S2 are bypassed.

[0041] Next, the function and effect of air conditioning system 100 according to the second embodiment will be described.

[0042] In air conditioning system 100 according to the second embodiment, when the flow path of bypass valve 190 of bypass duct 107 that bypasses supply duct 105 and the exhaust duct is opened, air supply-side space S1 and air discharge-side space S2 are bypassed. Therefore, a part of the air in air discharge-side space S2 can be bypassed to air supply-side space S1 by bypass duct 107. As a result, the temperature of the air can be efficiently adjusted. In addition, damper 182 for bypassing from the air discharge side to the air supply side as shown in Fig. 2 in the first embodiment becomes unnecessary, and thus, the internal structure of air conditioner 102 can be simplified.

[0043] In air conditioning system 100 according to the second embodiment, outdoor-air processing unit 101 is placed on a floor different from a floor where at least any one of the plurality of air conditioners 102 is placed. Therefore, the number of ducts 103 that connect outdoor-air processing unit 101 and the plurality of air conditioners 102 can be reduced, as compared with the case in which outdoor-air processing unit 101 is placed only on the same floor as the floor where the plurality of air conditioners 102 are placed.

[0044] The embodiments described above can be combined as appropriate.

[0045] It should be understood that the embodiments disclosed herein are illustrative and non-restrictive in every respect. The scope of the present disclosure is defined by the terms of the claims, rather than the de-

scription above, and is intended to include any modifications within the scope and meaning equivalent to the terms of the claims.

REFERENCE SIGNS LIST

[0046] 100 air conditioning system; 101 outdoor-air processing unit; 102 air conditioner; 103 duct; 104 carbon dioxide concentration sensor; 105 supply duct; 106 exhaust duct; 107 bypass duct; 110 heat exchange ventilator; 120 outdoor unit; 131 outdoor-side flow inlet; 132 outdoor-side flow outlet; 133 indoor-side flow outlet; 134 indoor-side flow inlet; 160 housing; 161 compressor; 162 four-way valve; 163 supply-side heat exchanger; 164 expansion valve; 165 discharge-side heat exchanger; 166 blower for supply; 167 blower for discharge; 171 supply-side air inlet; 172 supply-side air outlet; 180 partitioning member; 181 main body portion; 182 damper; 190 bypass valve; S1 air supply-side space; S2 air discharge-side space.

Claims

1. An air conditioning system comprising:

an outdoor-air processing unit;
at least one air conditioner; and
a duct configured to connect the outdoor-air processing unit and the air conditioner, wherein
the outdoor-air processing unit includes an outdoor-side flow inlet, an outdoor-side flow outlet, an indoor-side flow outlet communicating with the outdoor-side flow inlet, and an indoor-side flow inlet communicating with the outdoor-side flow outlet,
the air conditioner includes a housing, a compressor, a condenser, an expansion valve, and an evaporator,
the housing includes a supply-side air inlet and a supply-side air outlet,
the duct includes a supply duct and an exhaust duct,
the supply duct connects the indoor-side flow outlet and the supply-side air inlet,
the exhaust duct connects the indoor-side flow inlet and the supply-side air outlet, and
the air conditioner is integrally formed by housing the compressor, the condenser, the expansion valve, and the evaporator in the housing.

2. The air conditioning system according to claim 1, wherein

the housing includes a partitioning member configured to partition the housing into an air supply-side space communicating with the supply-side air inlet, and an air discharge-side space communicating with the supply-side air outlet,
the partitioning member includes a main body portion and a damper configured to be movable with respect to the main body portion, and
when the damper moves to be separated from the main body portion, the air supply-side space and the air discharge-side space are bypassed.

3. The air conditioning system according to claim 1, wherein

the duct includes a bypass duct including a flow path that bypasses the supply duct and the exhaust duct,
the housing includes a partitioning member configured to partition the housing into an air supply-side space communicating with the supply-side air inlet, and an air discharge-side space communicating with the supply-side air outlet,
the bypass duct includes a bypass valve configured to be capable of opening and closing the flow path of the bypass duct, and
when the flow path of the bypass valve is opened, the air supply-side space and the air discharge-side space are bypassed.

4. The air conditioning system according to any one of claims 1 to 3, wherein

the air conditioner includes a plurality of air conditioners, and
the duct is configured to connect the outdoor-air processing unit and the plurality of air conditioners.

5. The air conditioning system according to claim 4, wherein
the outdoor-air processing unit is placed on a floor different from a floor where at least any one of the plurality of air conditioners is placed.

FIG.1

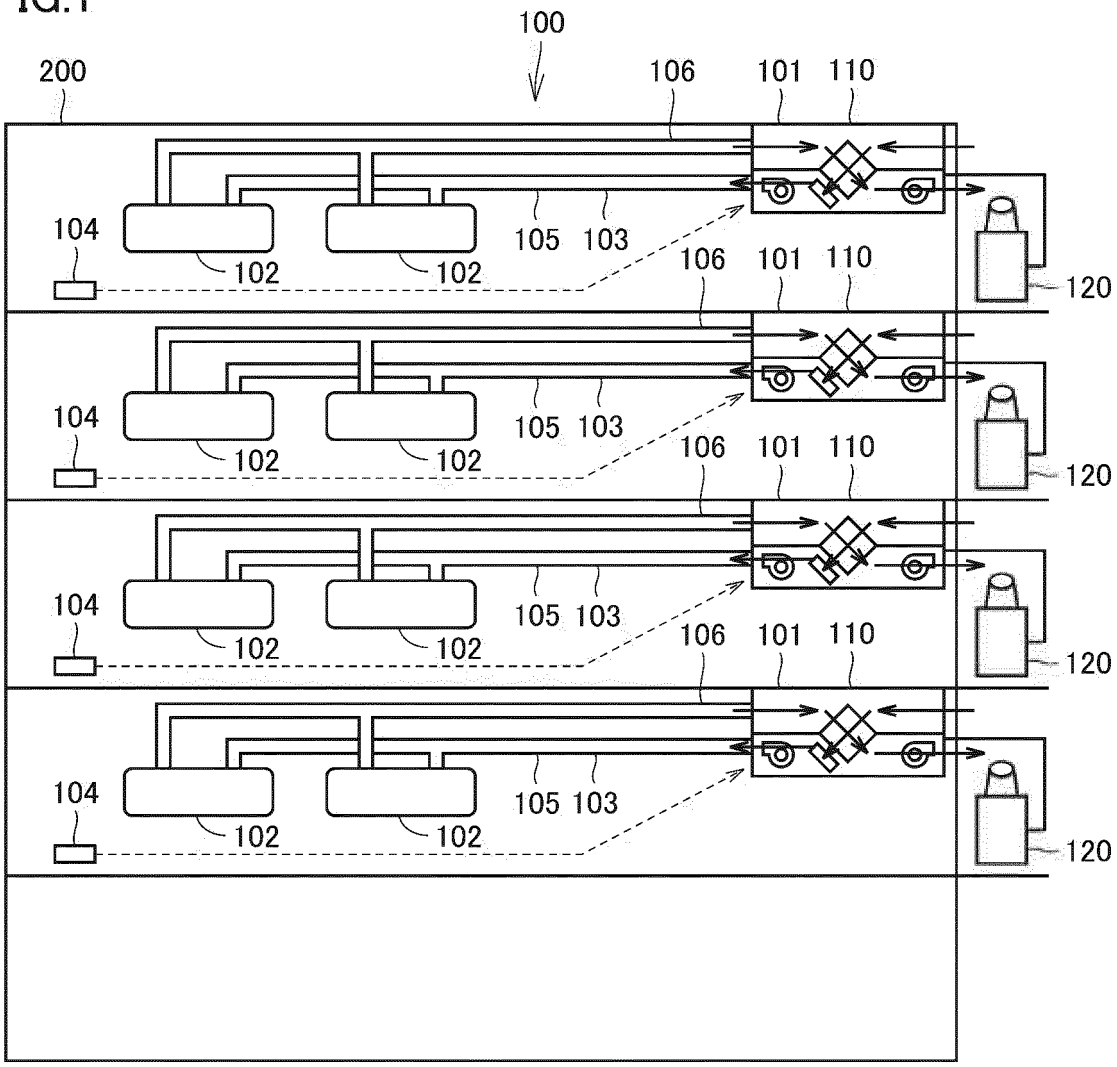


FIG.2

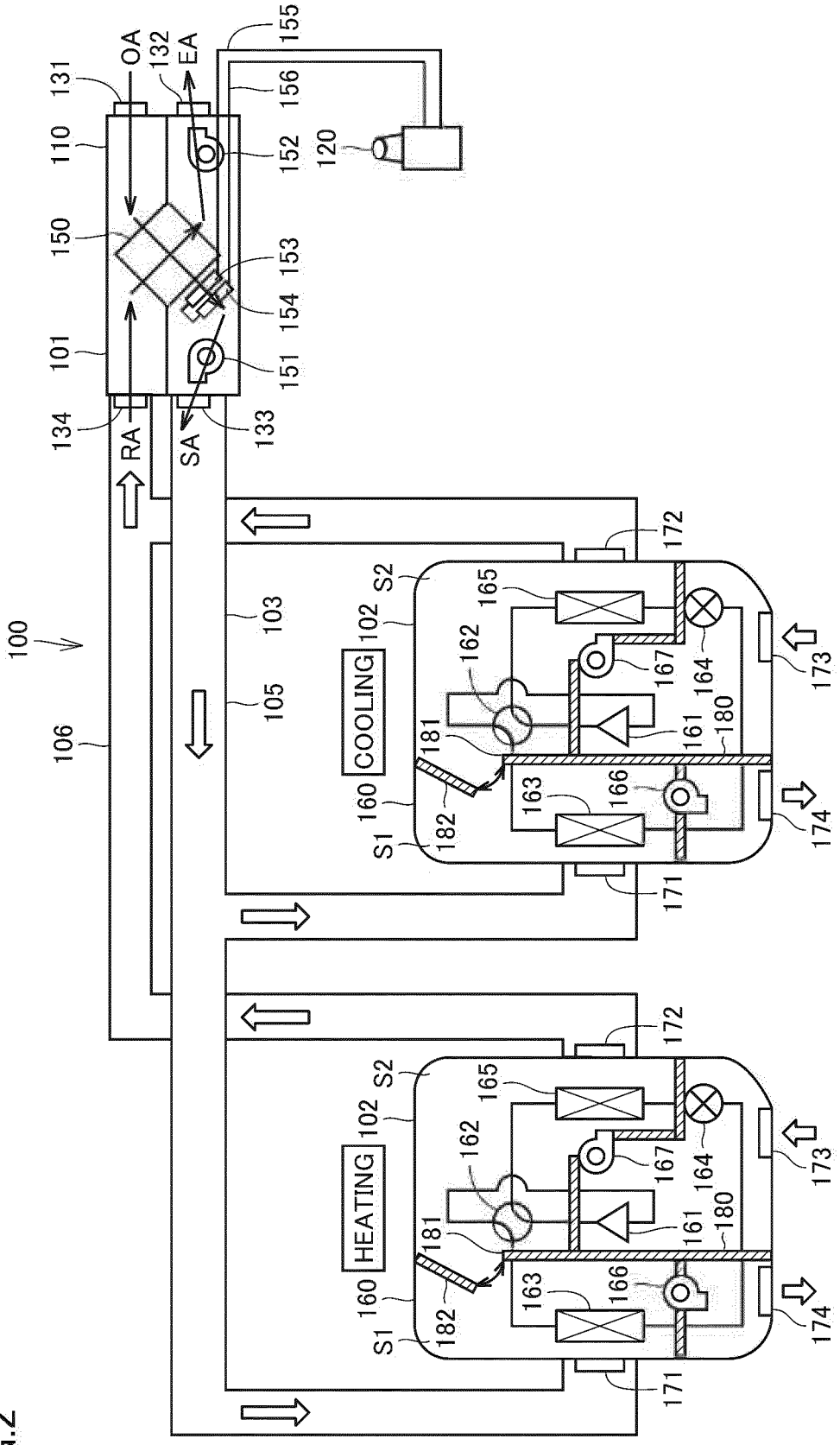

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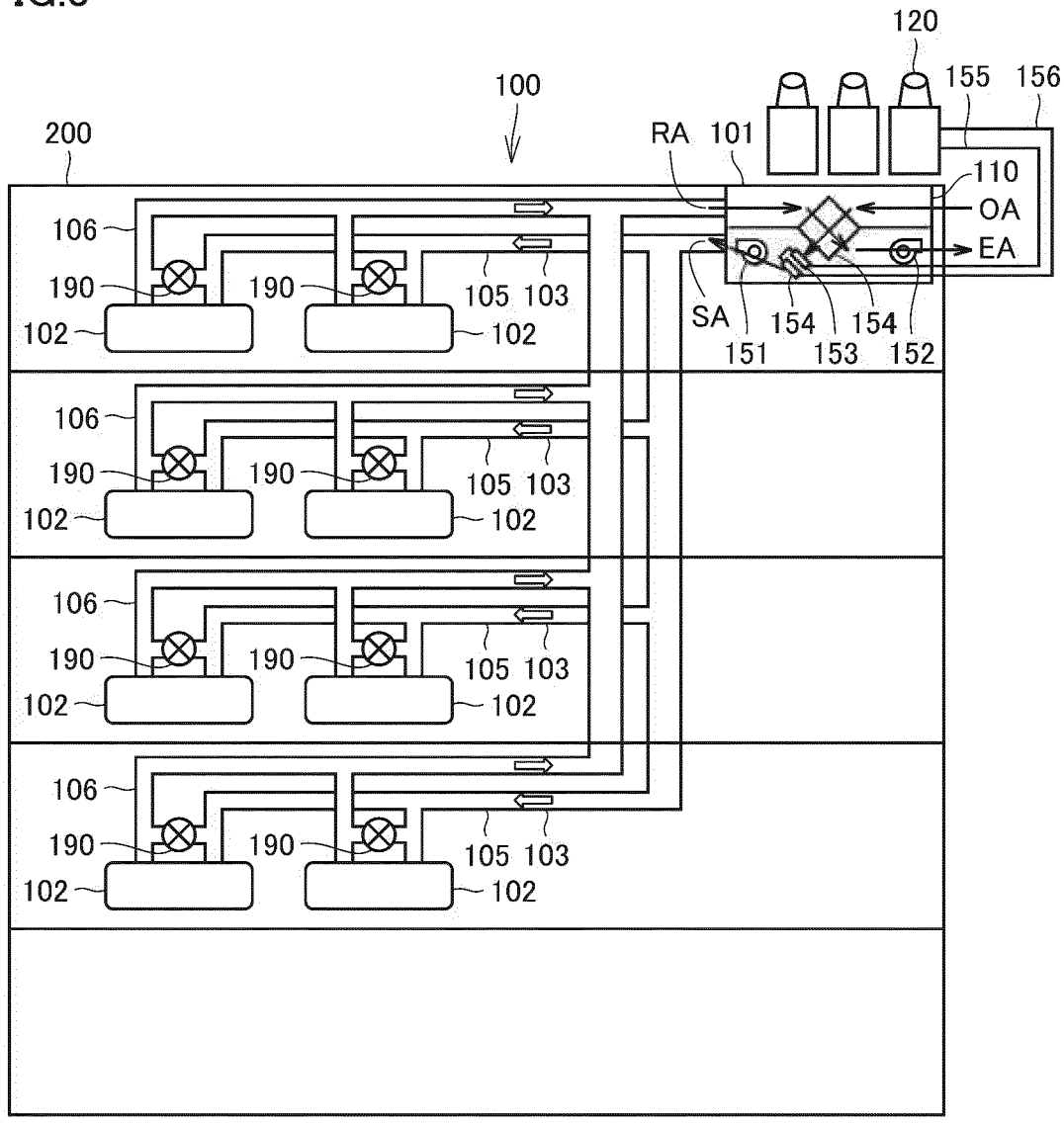
FIG.3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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/021729

A. CLASSIFICATION OF SUBJECT MATTER
F24F 7/08(2006.01)i
FI: F24F7/08 101Z
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)
F24F7/08

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

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 4-76327 A (DAIKIN IND LTD) 11 March 1992 (1992-03-11) page 2, lower right column, line 9 to page 4, lower right column, line 9	1-5
Y	JP 2004-93012 A (KIMURA KOHKI CO LTD) 25 March 2004 (2004-03-25) paragraphs [0005]-[0014]	1-5
Y	JP 2008-45794 A (DAIKIN IND LTD) 28 February 2008 (2008-02-28) paragraphs [0039]-[0088]	2-5
Y	JP 2005-155978 A (DAIKIN IND LTD) 16 June 2005 (2005-06-16) paragraphs [0026]-[0054]	3-5
Y	JP 2003-302086 A (SHIMIZU CORP) 24 October 2003 (2003-10-24) paragraphs [0010]-[0023]	5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 August 2021 (10.08.2021)	24 August 2021 (24.08.2021)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application no.
PCT/JP2021/021729

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 4-76327 A	11 Mar. 1992	(Family: none)	
JP 2004-93012 A	25 Mar. 2004	(Family: none)	
JP 2008-45794 A	28 Feb. 2008	WO 2008/018361 A1 EP 2053317 A1 paragraphs [0062]-[0111] CN 101501404 A KR 10-2009-0039797 A	
JP 2005-155978 A	16 Jun. 2005	CN 2725768 Y	
JP 2003-302086 A	24 Oct. 2003	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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