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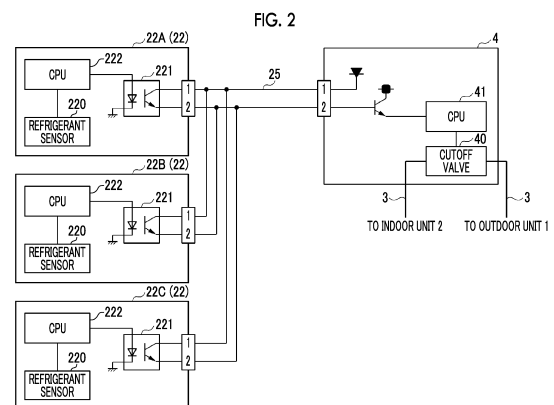
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(54) **AIR CONDITIONING SYSTEM AND METHOD FOR CONTROLLING AIR CONDITIONING SYSTEM**

(57) This air conditioning system (100) comprises: refrigerant piping (3) for channeling refrigerant between an outdoor unit (1) and a plurality of indoor units (2); detection devices (22) provided in air-conditioned areas respectively handled by the plurality of indoor units (2), the detection devices (22) each having a refrigerant sensor (220) for detecting leakage of the refrigerant into the corresponding air-conditioned area, and a relay (221) for closing a leakage notification circuit (25) if the refrigerant sensor (220) detects leakage of the refrigerant; and a cutoff valve device (4) having a cutoff valve (40) provided to the refrigerant piping (3), and a control unit (41) for closing the cutoff valve device (40) when the leakage notification circuit (25) is closed, the control unit (41) being connected to the leakage notification circuit (25).



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Description

Technical Field

[0001] The present disclosure relates to an air conditioning system and a method for controlling an air conditioning system.

[0002] Priority is claimed to Japanese Patent Application No. 2022-066729, filed April 14, 2022, the contents of which are incorporated herein by reference.

Background Art

[0003] In a case where a slightly flammable refrigerant is used in an amount equal to or greater than a certain amount as a refrigerant that circulates between an outdoor unit and an indoor unit, depending on an area of a space (room) in which the indoor unit is installed, it is necessary to provide a safety device such as a cutoff valve that cuts off the circulation of the refrigerant.

[0004] For example, PTL 1 discloses a system in which an indoor unit transmits a signal for instructing a cutoff valve device having a cutoff valve to close the cutoff valve in a case where a refrigerant detector detects leakage of a refrigerant.

Citation List

Patent Literature

[0005] [PTL 1] Japanese Unexamined Patent Application Publication No. 2021-85643

Summary of Invention

Technical Problem

[0006] There is an air conditioning system in which a plurality of indoor units are connected to one outdoor unit. There are various types of indoor units from 1 horsepower to 10 horsepower, but it is inefficient to use one cutoff valve device that can be used for an indoor unit of 10 horsepower for each indoor unit of 1 horsepower. For this reason, it is desirable to use one cutoff valve device for the plurality of indoor units.

[0007] Meanwhile, in the system in the related art in which the indoor unit instructs the cutoff valve device to close the cutoff valve, it is necessary to add a circuit for communication with the cutoff valve device to a substrate of each indoor unit. In this case, a manufacturing cost of the indoor unit increases, or there is a disadvantage such as not being able to use an existing indoor unit.

[0008] An object of the present disclosure is to provide an air conditioning system and a method for controlling an air conditioning system capable of detecting leakage of a refrigerant with a simple configuration.

Solution to Problem

[0009] According to an aspect of the present disclosure, an air conditioning system includes an outdoor unit, a plurality of indoor units, refrigerant piping that circulates a refrigerant between the outdoor unit and the indoor unit, a detection device that is provided in an air-conditioned area for which each of the plurality of indoor units is responsible and that has a refrigerant sensor that detects leakage of the refrigerant into the air-conditioned area and a relay that closes a leakage notification circuit when the refrigerant sensor detects the leakage of the refrigerant, and a cutoff valve device that has a cutoff valve provided in the refrigerant piping and a control unit that is connected to the leakage notification circuit and that closes the cutoff valve when the leakage notification circuit is closed.

[0010] According to an aspect of the present disclosure, a method for controlling an air conditioning system is a method for controlling an air conditioning system including an outdoor unit, a plurality of indoor units, and refrigerant piping that circulates a refrigerant between the outdoor unit and the indoor unit, the method includes a step of detecting leakage of the refrigerant into an air-conditioned area for which each of the plurality of indoor units is responsible, via a refrigerant sensor provided in the air-conditioned area, a step of closing a leakage notification circuit via a relay when the refrigerant sensor detects the leakage of the refrigerant, and a step of closing a cutoff valve provided in the refrigerant piping when the leakage notification circuit is closed.

Advantageous Effects of Invention

[0011] According to the above aspect, it is possible to detect leakage of a refrigerant with a simple configuration.

Brief Description of Drawings

[0012]

Fig. 1 is a diagram showing an overall configuration of an air conditioning system according to a first embodiment.

Fig. 2 is a diagram showing a functional configuration of a detection device and a cutoff valve device according to the first embodiment.

Fig. 3 is a sequence diagram showing an example of processing of the air conditioning system according to the first embodiment.

Fig. 4 is a sequence diagram showing an example of processing of an air conditioning system according to other embodiments.

Description of Embodiments

<First Embodiment>

[0013] Hereinafter, an air conditioning system 100 according to the present embodiment will be described in detail with reference to Figs. 1 to 3.

(Overall Configuration of Air Conditioning System)

[0014] Fig. 1 is a diagram showing an overall configuration of an air conditioning system according to a first embodiment.

[0015] As shown in Fig. 1, the air conditioning system 100 includes an outdoor unit 1, a plurality of indoor units 2 (2A to 2C), refrigerant piping 3, a plurality of remote controllers (remote control) 21 (21A to 21C), a plurality of detection devices 22 (22A to 22C), and a cutoff valve device 4.

[0016] The outdoor unit 1 includes a compressor, a heat exchanger, and the like (not shown), and sends a refrigerant to each indoor unit 2 via the refrigerant piping 3. In addition, the outdoor unit 1 and the indoor unit 2 are connected to be capable of communicating with each other via an indoor and outdoor communication line 24.

[0017] The indoor units 2 (2A to 2C) perform air conditioning such that the temperature or the like of air-conditioned areas A to C for which the indoor units 2 (2A to 2C) are responsible approaches the air conditioning setting designated by the user. In addition, the indoor unit 2 according to the present embodiment stops the operation of the indoor unit 2 in a case where the leakage of the refrigerant is detected. In addition, although an example in which the air conditioning system 100 has three indoor units 2 is shown in Fig. 1, the present disclosure is not limited thereto. In other embodiments, the air conditioning system 100 may have four or more indoor units 2.

[0018] The refrigerant piping 3 circulates the refrigerant between the outdoor unit 1 and the plurality of indoor units 2.

[0019] The cutoff valve device 4 is provided between pieces of the refrigerant piping 3 between the outdoor unit 1 and the plurality of indoor units 2. The cutoff valve device 4 closes the cutoff valve to cut off the circulation of the refrigerant in the refrigerant piping 3 in a case where the detection device 22 (to be described later) detects the leakage of the refrigerant.

[0020] In addition, each of the air-conditioned areas A to C of the indoor units 2 (2A to 2C) is provided with the remote control 21 (21A to 21C) and the detection device 22 (22A to 22C). The indoor unit 2, the remote control 21, and the detection device 22 are connected to be capable of communicating with each other via a remote control communication line 23 (23A to 23C). For example, the remote control 21 and the detection device 22 are attached to a wall surface or the like in the vicinity of the indoor unit 2.

[0021] The remote control 21 transmits the air conditioning setting (temperature or the like) designated by the user to the indoor unit 2 via the remote control communication line 23.

[0022] The detection device 22 detects the leakage of the refrigerant into the air-conditioned area where the detection device 22 is installed. In addition, the detection device 22 and the cutoff valve device 4 are connected to each other via a leakage notification circuit 25 that is openable and closable via the detection device 22. In a case where the leakage of the refrigerant is detected, the detection device 22 closes the leakage notification circuit 25 to energize the leakage notification circuit 25 to notify the cutoff valve device 4 of the leakage.

(Functional Configuration of Detection Device)

[0023] Fig. 2 is a diagram showing a functional configuration of a detection device and a cutoff valve device according to the first embodiment.

[0024] As shown in Fig. 2, each of the detection devices 22 (22A to 22C) includes a refrigerant sensor 220, a relay 221, and a CPU 222.

[0025] The refrigerant sensor 220 detects the leakage of the refrigerant into the air-conditioned area.

[0026] The relay 221 is a semiconductor relay such as a photocoupler, or a mechanical relay. In the present embodiment, an example in which the relay 221 is a photocoupler will be described. The relay 221 is switched between on and off under the control of the CPU 222. The relay 221 is turned on when a current flows under the control of the CPU 222, and closes the leakage notification circuit 25 between the detection device 22 and the cutoff valve device 4 to energize the leakage notification circuit 25. In addition, the relay 221 is turned off when the current does not flow, and opens the leakage notification circuit 25 to de-energize the leakage notification circuit 25.

[0027] The CPU 222 performs control to turn on the relay 221 in a case where the refrigerant sensor 220 detects the leakage of the refrigerant.

(Functional Configuration of Cutoff Valve Device)

[0028] As shown in Fig. 2, the cutoff valve device 4 includes a cutoff valve 40 and a CPU 41 (control unit).

[0029] The cutoff valve 40 is opened and closed according to a control signal of the CPU 41 to permit or cut off the circulation of the refrigerant in the refrigerant piping 3.

[0030] The CPU 41 outputs the control signal for closing the cutoff valve 40 in a case where the leakage notification circuit 25 between any of the plurality of detection devices 22A to 22C is closed (energized).

(Flow of Processing of Air Conditioning System)

[0031] Fig. 3 is a sequence diagram showing an ex-

ample of processing of the air conditioning system according to the first embodiment.

[0032] Here, a flow of processing when the air conditioning system 100 detects the leakage of the refrigerant will be described with reference to Fig. 3. In the example of Fig. 3, it is assumed that the refrigerant has leaked into the air-conditioned area A of the indoor unit 2A.

[0033] First, the refrigerant sensor 220 of the detection device 22A detects that the refrigerant has leaked into the air-conditioned area A (step S100). In this case, the CPU 222 of the detection device 22A turns on the relay 221 to close the leakage notification circuit 25 (step S101).

[0034] When the CPU 41 of the cutoff valve device 4 detects that the leakage notification circuit 25 between the detection device 22A and the cutoff valve device 4 is closed (step S102), the CPU 41 closes the cutoff valve 40 to cut off the circulation of the refrigerant (step S103). Accordingly, further leakage of the refrigerant is suppressed.

[0035] In addition, the CPU 222 of the detection device 22A transmits a leakage detection signal indicating that the leakage of the refrigerant has been detected to the remote control 21A installed in the same air-conditioned area A as the detection device 22A after step S101 or in parallel with step S101 (step S104).

[0036] When the remote control 21A receives the leakage detection signal from the detection device 22A, the remote control 21A outputs an alarm (step S105). The remote control 21A outputs, for example, an alarm via sound and light.

[0037] In addition, the remote control 21A transmits the leakage detection signal to the indoor unit 2A installed in the same air-conditioned area A as the remote control 21A after step S105 or in parallel with step S105 (step S106).

[0038] When the indoor unit 2A receives the leakage detection signal from the remote control 21A, the indoor unit 2A transmits the leakage detection signal to the other indoor units 2B and 2C via the indoor and outdoor communication line 24 (step S107), and stops the operation (step S108).

[0039] When the indoor units 2B and 2C receive the leakage detection signal from the indoor unit 2A, the indoor units 2B and 2C stop the operation (step S109).

[0040] In this way, the indoor unit 2A can notify the other indoor units 2B and 2C that the leakage of the refrigerant is detected in the air-conditioned area A and the circulation of the refrigerant is cut off. Accordingly, the indoor units 2B and 2C can appropriately stop the operation even in a case where the refrigerant leaks in the air-conditioned area A outside the air-conditioned areas for which the indoor units 2B and 2C are responsible.

(Operations and Effects)

[0041] As described above, the air conditioning system 100 according to the present embodiment includes the

detection device 22 having the relay 221 that closes the leakage notification circuit 25 in a case where the refrigerant sensor 220 detects the leakage of the refrigerant into the air-conditioned area, and the cutoff valve device 4 that closes the cutoff valve 40 in a case where the leakage notification circuit 25 is closed.

[0042] In this way, the air conditioning system 100 can notify the cutoff valve device 4 of the presence or absence of the leakage of the refrigerant with a simple configuration in which the relay 221 of the detection device 22 switches between on and off of the leakage notification circuit 25. In addition, since the detection device 22 itself can notify the cutoff valve device 4 that the leakage of the refrigerant has been detected, it is not necessary to add a communication circuit or the like for notifying the cutoff valve device 4 of the leakage of the refrigerant to the substrate of the indoor unit 2. Therefore, the air conditioning system 100 can be configured to be reasonable by using the existing indoor unit 2. In addition, since the simple configuration is adopted in which only the leakage notification circuit 25 is provided between the detection device 22 and the cutoff valve device 4, it is possible to connect any number of the indoor units 2 to one outdoor unit 1 and one cutoff valve device 4.

[0043] In addition, the air conditioning system 100 further includes the remote control 21 that is connected to be capable of communicating with both the indoor unit 2 and the detection device 22 which are installed in the same air-conditioned area. The remote control 21 transmits the leakage detection signal to the indoor unit 2 in a case where the detection device 22 detects the leakage of the refrigerant into the air-conditioned area. In addition, the indoor unit 2 stops the operation in a case where the leakage detection signal is received from the remote control 21.

[0044] In this way, the air conditioning system 100 can promptly stop the operation of the indoor unit 2 in a case where the leakage of the refrigerant is detected. In addition, as the remote control communication line 23 for transmitting and receiving the leakage detection signal between the indoor unit 2 and the detection device 22, the existing one can be used.

[0045] In addition, in a case where the indoor unit 2 receives the leakage detection signal from the remote control 21, the indoor unit 2 transmits the leakage detection signal to the other indoor unit 2 via the indoor and outdoor communication line 24. In addition, the indoor unit 2 stops the operation in a case where the leakage detection signal is received from the other indoor unit 2.

[0046] In this way, each indoor unit 2 can appropriately stop the operation even in a case where the refrigerant leaks in the air-conditioned area outside the air-conditioned area for which each indoor unit 2 is responsible.

[0047] In addition, the remote control 21 outputs an alarm in a case where the detection device 22 detects the leakage of the refrigerant.

[0048] In this way, the remote control 21 can transmit that the refrigerant leaks to the person in the air-conditioned area.

tioned area where the remote control 21 is provided.

<Other Embodiments>

[0049] Fig. 4 is a sequence diagram showing an example of processing of an air conditioning system according to other embodiments.

[0050] In the above-described embodiment, an example has been described in which the detection device 22 transmits the leakage detection signal to the indoor unit 2 via the remote control 21. However, the present disclosure is not limited thereto. For example, in other embodiments, as shown in Fig. 4, the detection device 22 may be configured to detect that the leakage notification circuit 25 of another air-conditioned area is closed.

[0051] Fig. 4 shows an example of processing executed by the indoor unit 2B, the remote control 21B, and the detection device 22B of the air-conditioned area B in a case where the leakage of the refrigerant is detected in the air-conditioned area A. Since the processing of the remote control 21A and the detection device 22A in the air-conditioned area A and the processing of the cutoff valve device 4 are the same as those in the first embodiment, the description thereof will be omitted. In addition, in the example of Fig. 4, when the detection device 22A detects the leakage of the refrigerant, the indoor unit 2A of the air-conditioned area A omits processing of transmitting the leakage detection signal to the other indoor units 2B and 2C (step S107 of Fig. 3) and stops the operation.

[0052] In addition, the detection device 22B of the air-conditioned area B always monitors whether the leakage notification circuit 25 of the other air-conditioned areas A and C is opened or closed. When the detection device 22B detects that the leakage notification circuit 25 of the air-conditioned area A is closed (step S200), the detection device 22B transmits the leakage detection signal to the remote control 21B (step S201). At this time, the detection device 22B may generate and transmit a signal (the other area leakage detection signal) different from that in a case where the detection device 22B detects the leakage of the refrigerant, so that the fact that the leakage of the refrigerant is detected in the other air-conditioned area A can be identified.

[0053] When the remote control 21B receives the other area leakage detection signal from the detection device 22B, the remote control 21B transmits the other area leakage detection signal to the indoor unit 2B (step S202).

[0054] When the indoor unit 2B receives the other area leakage detection signal from the remote control 21B, the indoor unit 2B stops the operation (step S203).

[0055] Although not shown, the same processing is also executed on the indoor unit 2C, the remote control 21C, and the detection device 22C of the air-conditioned area C as on each device of the air-conditioned area B.

[0056] In this way, the air conditioning system 100 can make it unnecessary to transmit and receive the leakage

detection signal between the indoor units 2. In addition, each indoor unit 2 can quickly detect the presence or absence of the leakage of the refrigerant in the other air-conditioned area from the state of the leakage notification circuit 25 and appropriately stop the operation.

[0057] As described above, some embodiments according to the present disclosure have been described, but all of these embodiments are presented as examples and are not intended to limit the scope of disclosure. These embodiments can be implemented in various other embodiments, and various omissions, replacements, and changes can be made without departing from the gist of the present disclosure. These embodiments and variations thereof are included in the scope and equivalent of the disclosure described in the claims as well as in the scope and abstract of the present disclosure.

<Additional Notes>

[0058] For example, the above-described embodiments are understood as follows.

[0059]

(1) According to a first aspect, an air conditioning system 100 includes an outdoor unit 1, a plurality of indoor units 2, refrigerant piping 3 that circulates a refrigerant between the outdoor unit 1 and the indoor unit 2, a detection device 22 that is provided in an air-conditioned area for which each of the plurality of indoor units 2 is responsible and that has a refrigerant sensor 220 that detects leakage of the refrigerant into the air-conditioned area and a relay 221 that closes a leakage notification circuit 25 when the refrigerant sensor 220 detects the leakage of the refrigerant, and a cutoff valve device 4 that has a cutoff valve 40 provided in the refrigerant piping 3 and a control unit 41 that is connected to the leakage notification circuit 25 and that closes the cutoff valve 40 when the leakage notification circuit 25 is closed.

[0060] In this way, the air conditioning system 100 can notify the cutoff valve device 4 of the presence or absence of the leakage of the refrigerant with a simple configuration in which the relay 221 of the detection device 22 switches between on and off of the leakage notification circuit 25. In addition, since the detection device 22 itself can notify the cutoff valve device 4 that the leakage of the refrigerant has been detected, it is not necessary to add a communication circuit or the like for notifying the cutoff valve device 4 of the leakage of the refrigerant to the substrate of the indoor unit 2. Therefore, the air conditioning system 100 can be configured to be reasonable by using the existing indoor unit 2. In addition, since the simple configuration is adopted in which only the leakage notification circuit 25 is provided between the detection device 22 and the cutoff valve device 4, it is possible to connect any number of the indoor units 2 to one outdoor

unit 1 and one cutoff valve device 4.

[0061] (2) According to a second aspect, the air conditioning system 100 according to the first aspect further includes a remote controller 21 that is provided in each of a plurality of the air-conditioned areas and that is connected to be capable of communicating with both the indoor unit 2 and the detection device 22 which are installed in the air-conditioned area, in which the remote controller 21 transmits a leakage detection signal to the indoor unit 2 when the detection device 22 detects the leakage of the refrigerant, and the indoor unit 2 stops an operation when the leakage detection signal is received.

[0062] In this way, the air conditioning system 100 can promptly stop the operation of the indoor unit 2 in a case where the leakage of the refrigerant is detected. In addition, as the remote control communication line 23 for transmitting and receiving the leakage detection signal between the indoor unit 2 and the detection device 22, the existing one can be used.

[0063] (3) According to a third aspect, in the air conditioning system 100 according to the second aspect, the indoor unit 2 transmits the leakage detection signal to another indoor unit 2 via a communication line 24 that connects each of the plurality of indoor units 2 such that the plurality of indoor units 2 are capable of communicating with each other, when the leakage detection signal is received from the remote controller 21.

[0064] In this way, each indoor unit 2 can appropriately stop the operation even in a case where the refrigerant leaks in the air-conditioned area outside the air-conditioned area for which each indoor unit 2 is responsible.

[0065] (4) According to a fourth aspect, in the air conditioning system 100 according to the second aspect, the detection device 22 detects leakage of the refrigerant in another air-conditioned area when a leakage notification circuit 25 of another detection device 22 is closed, and the remote controller 21 transmits the leakage detection signal to the indoor unit 2 when the detection device 22 detects the leakage of the refrigerant in the other air-conditioned area.

[0066] In this way, the air conditioning system 100 can make it unnecessary to transmit and receive the leakage detection signal between the indoor units 2. In addition, each indoor unit 2 can quickly detect the presence or absence of the leakage of the refrigerant in the other air-conditioned area from the state of the leakage notification circuit 25 and appropriately stop the operation.

[0067] (5) According to a fifth aspect, in the air conditioning system 100 according to any one of the second to fourth aspects, the remote controller 21 outputs an alarm when the detection device 22 detects the leakage of the refrigerant.

[0068] In this way, the remote control 21 can transmit that the refrigerant leaks to the person in the air-conditioned area where the remote control 21 is provided.

[0069] (6) According to a sixth aspect, a method for controlling an air conditioning system 100 including an outdoor unit 1, a plurality of indoor units 2, and refrigerant

piping 3 that circulates a refrigerant between the outdoor unit 1 and the indoor unit 2 includes a step of detecting leakage of the refrigerant into an air-conditioned area for which each of the plurality of indoor units 2 is responsible, via a refrigerant sensor 220 provided in the air-conditioned area, a step of closing a leakage notification circuit 25 via a relay 221 when the refrigerant sensor 220 detects the leakage of the refrigerant, and a step of closing a cutoff valve 40 provided in the refrigerant piping 3 when the leakage notification circuit 25 is closed.

Industrial Applicability

[0070] According to the above aspect, it is possible to detect leakage of a refrigerant with a simple configuration.

Reference Signs List

[0071]

100: air conditioning system

1: outdoor unit

2, 2A, 2B, 2C: indoor unit

21, 21A, 21B, 21C: remote controller (remote control)

22, 22A, 22B, 22C: detection device

220: refrigerant sensor

221: relay

222: CPU

23, 23A, 23B, 23C: remote control communication line

24: indoor and outdoor communication line (communication line)

25: leakage notification circuit

3: refrigerant piping

4: cutoff valve device

40: cutoff valve

41: CPU (control unit)

Claims

1. An air conditioning system comprising:

an outdoor unit;
a plurality of indoor units;
refrigerant piping that circulates a refrigerant between the outdoor unit and the indoor unit;
a detection device that is provided in an air-conditioned area for which each of the plurality of indoor units is responsible and that has a refrigerant sensor that detects leakage of the refrigerant into the air-conditioned area and a relay that closes a leakage notification circuit when the refrigerant sensor detects the leakage of the refrigerant; and
a cutoff valve device that has a cutoff valve

provided in the refrigerant piping and a control unit that is connected to the leakage notification circuit and that closes the cutoff valve when the leakage notification circuit is closed.

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2. The air conditioning system according to Claim 1, further comprising:

a remote controller that is provided in each of a plurality of the air-conditioned areas and that is connected to be capable of communicating with both the indoor unit and the detection device which are installed in the air-conditioned area, wherein the remote controller transmits a leakage detection signal to the indoor unit when the detection device detects the leakage of the refrigerant, and the indoor unit stops an operation when the leakage detection signal is received.

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3. The air conditioning system according to Claim 2, wherein the indoor unit transmits the leakage detection signal to another indoor unit via a communication line that connects each of the plurality of indoor units such that the plurality of indoor units are capable of communicating with each other, when the leakage detection signal is received from the remote controller.

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4. The air conditioning system according to Claim 2,

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wherein the detection device detects leakage of the refrigerant in another air-conditioned area when a leakage notification circuit of another detection device is closed, and the remote controller transmits the leakage detection signal to the indoor unit when the detection device detects the leakage of the refrigerant in the other air-conditioned area.

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5. The air conditioning system according to any one of Claims 2 to 4, wherein the remote controller outputs an alarm when the detection device detects the leakage of the refrigerant.

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6. A method for controlling an air conditioning system including an outdoor unit, a plurality of indoor units, and refrigerant piping that circulates a refrigerant between the outdoor unit and the indoor unit, the method comprising:

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a step of detecting leakage of the refrigerant into an air-conditioned area for which each of the plurality of indoor units is responsible, via a refrigerant sensor provided in the air-conditioned area; and a step of closing a leakage notification circuit via

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a relay when the refrigerant sensor detects the leakage of the refrigerant; and a step of closing a cutoff valve provided in the refrigerant piping when the leakage notification circuit is closed.

FIG. 1

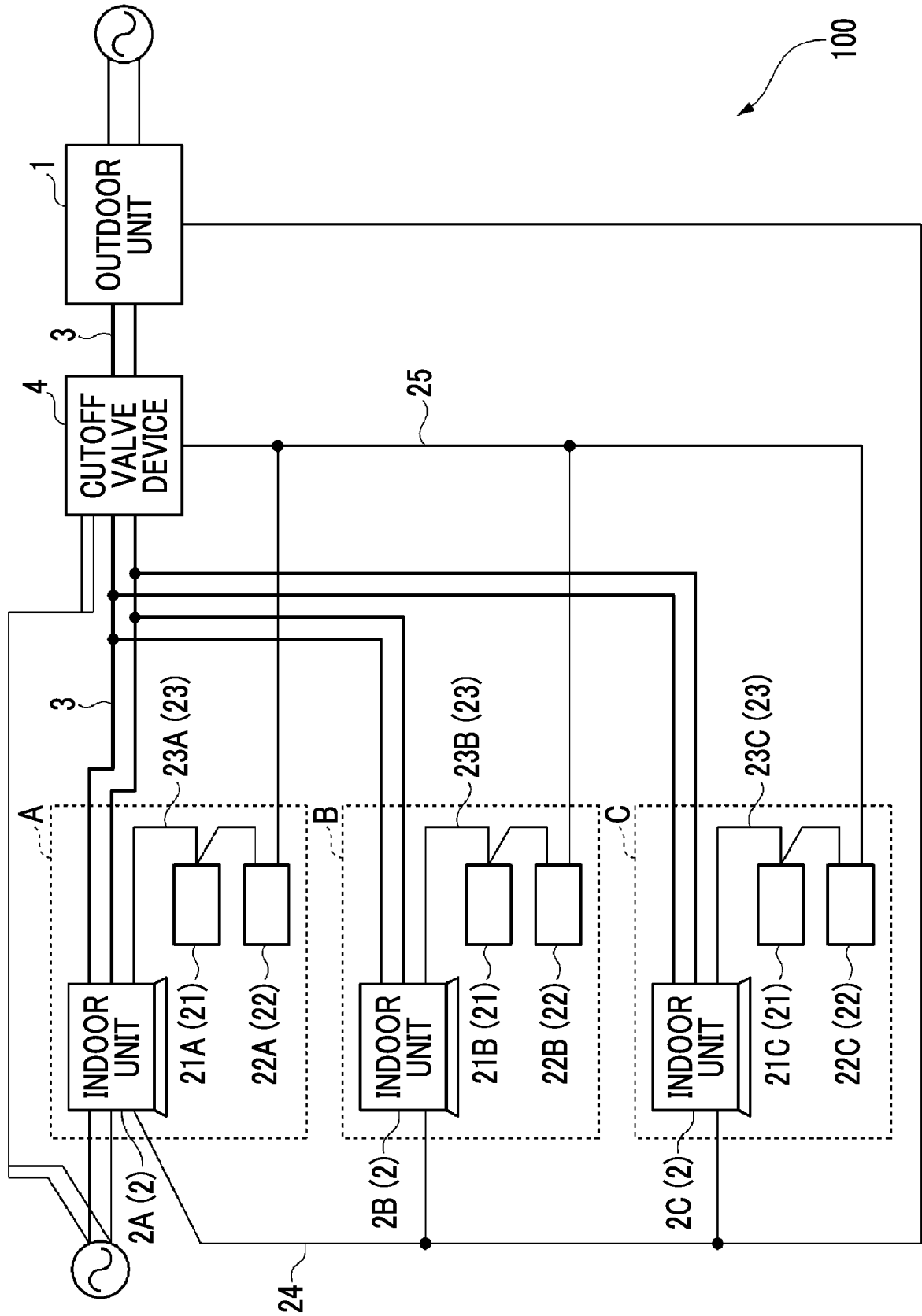


FIG. 2

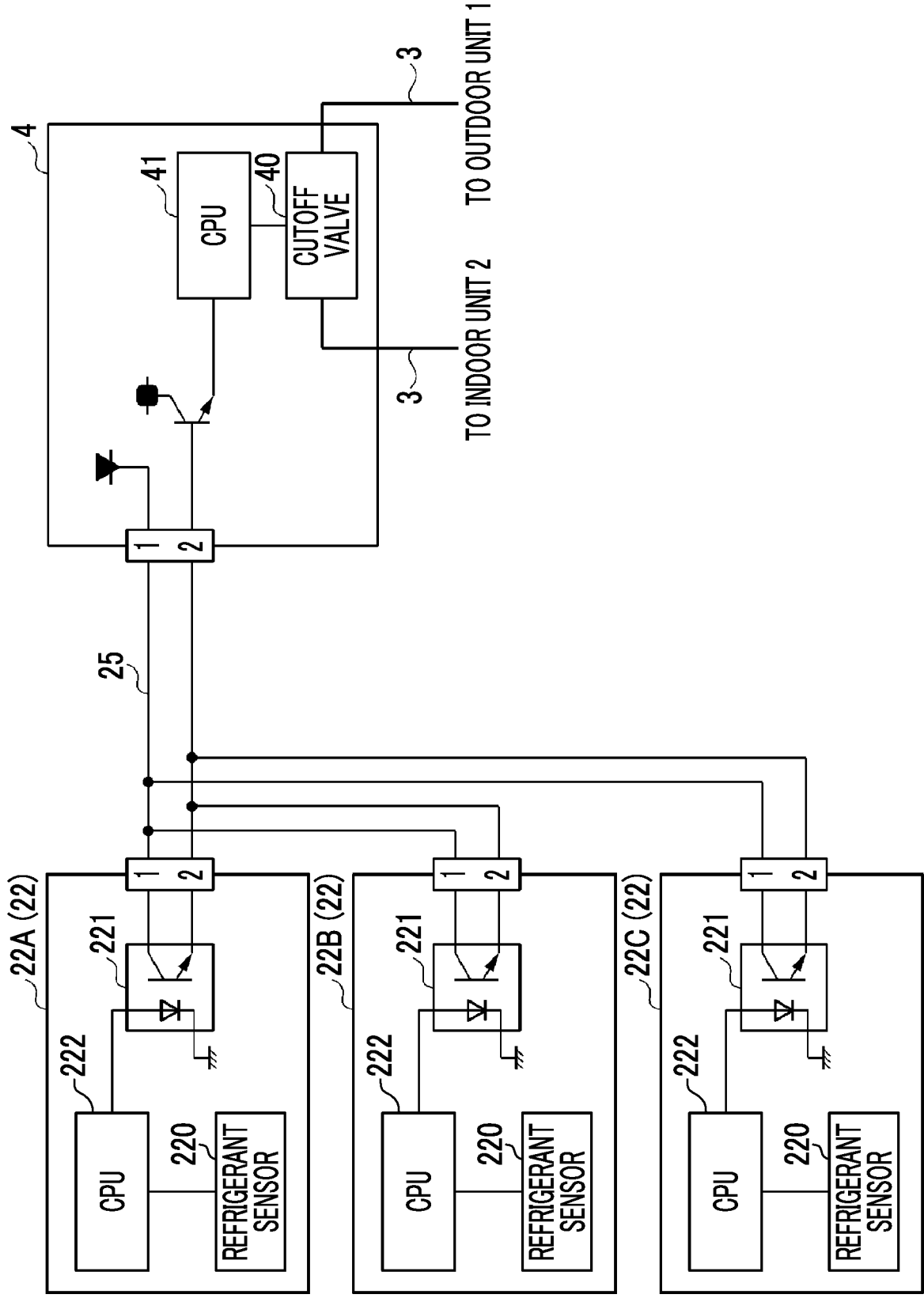


FIG. 3

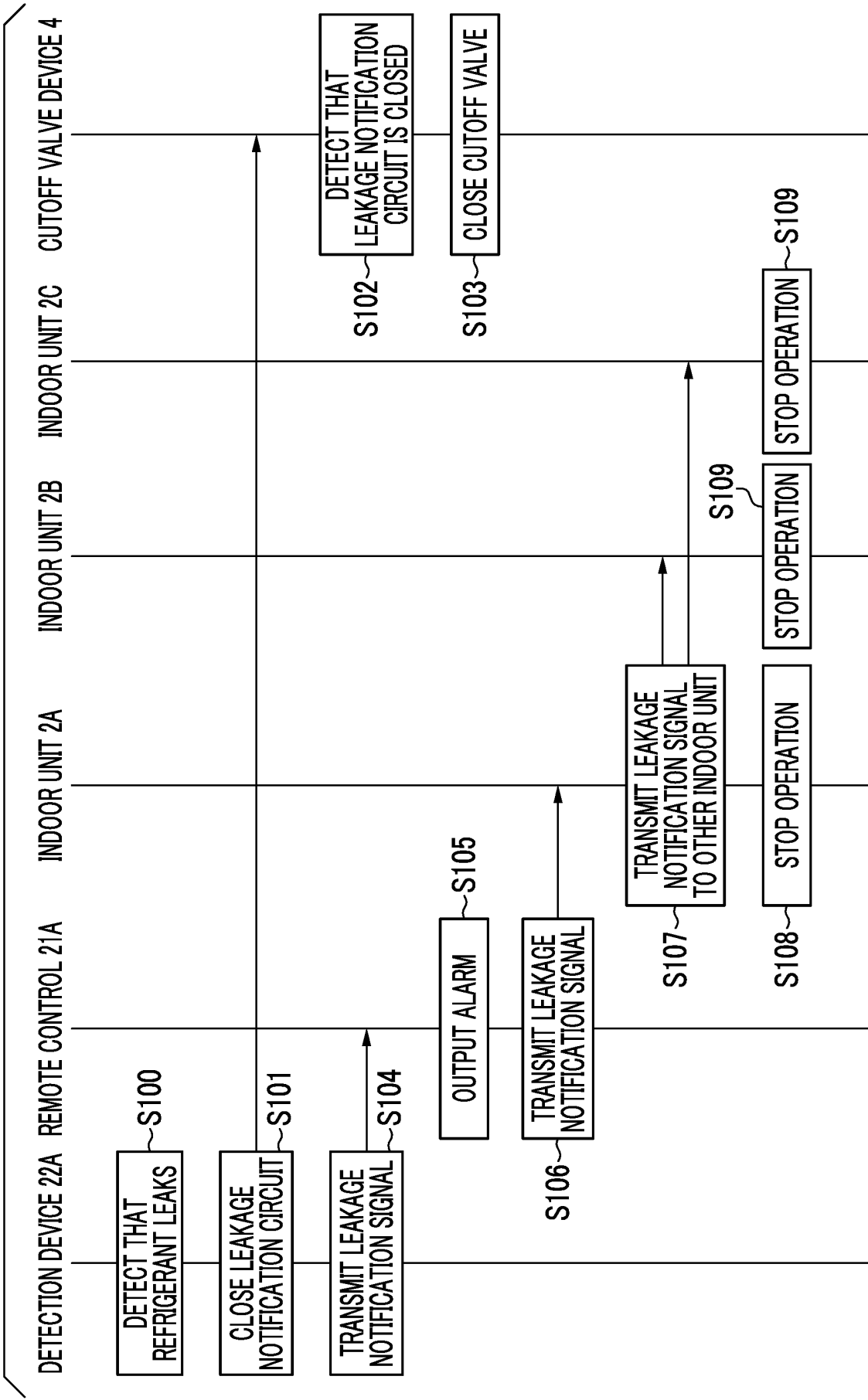
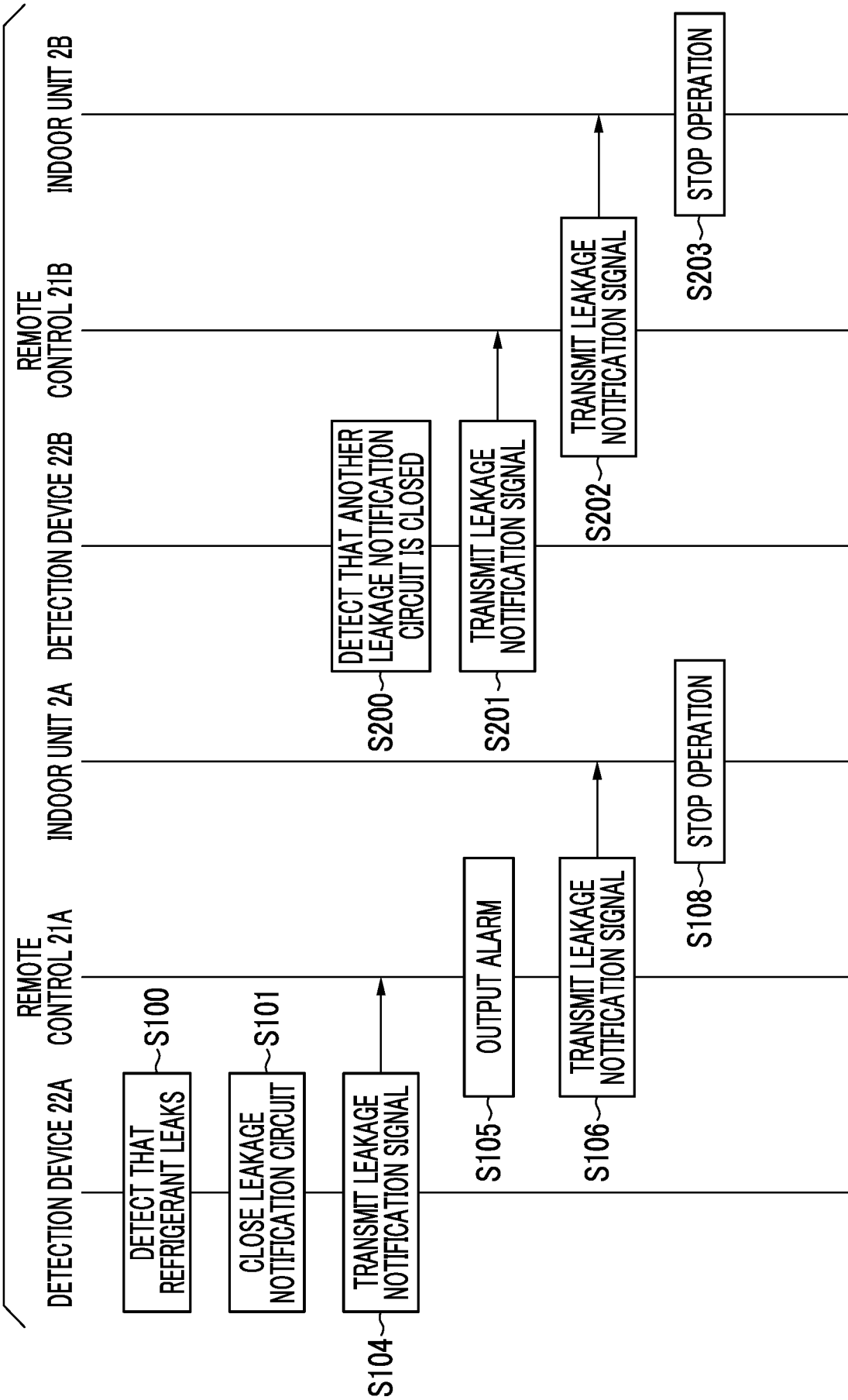


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/011453

A. CLASSIFICATION OF SUBJECT MATTER <i>F24F 11/36</i> (2018.01)i; <i>F24F 11/526</i> (2018.01)i; <i>F25B 41/24</i> (2021.01)i; <i>F25B 49/02</i> (2006.01)i FI: F24F11/36; F24F11/526; F25B49/02 520M; F25B41/24 According to International Patent Classification (IPC) or to both national classification and IPC	International application No. PCT/JP2023/011453	
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) F24F11/00-11/89; F25B41/24; F25B49/02		
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 1971-2023 Registered utility model specifications of Japan 1996-2023 Published registered utility model applications of Japan 1994-2023		
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	WO 2017/002215 A1 (MITSUBISHI ELECTRIC CORPORATION) 05 January 2017 (2017-01-05) paragraphs [0010]-[0031], fig. 1-4	1-6
Y	WO 2021/157395 A1 (DAIKIN IND LTD) 12 August 2021 (2021-08-12) paragraphs [0027]-[0092], fig. 1-7	1-6
Y	JP 2018-091550 A (MITSUBISHI ELECTRIC CORPORATION) 14 June 2018 (2018-06-14) paragraphs [0023]-[0064], [0091]-[0121], fig. 1-4, 7-8	1-5
Y	WO 2017/163321 A1 (MITSUBISHI ELECTRIC CORPORATION) 28 September 2017 (2017-09-28) paragraph [0055], fig. 5	3, 5
☐ 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 31 May 2023	Date of mailing of the international search report 13 June 2023	
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INTERNATIONAL SEARCH REPORT
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International application No.
PCT/JP2023/011453

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