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(54) **REFRIGERANT CYCLE SYSTEM**

(57) The degree of freedom when a refrigerant cycle system is constructed in a building or the like is increased. A refrigerant cycle system (1) according to the present disclosure includes a refrigerant cycle, a first power feed unit (30a), a second power feed unit (30b), a first transmission line (41), and a second transmission line (42). The power feed unit feeds auxiliary power to a utilization unit of which a power source has been interrupted. The

first transmission line (41) connects a heat source unit (10) and the first power feed unit (30a) to each other. The second transmission line (42) connects the first power feed unit (30a) and the second power feed unit (30b) to each other. The second power feed unit (30b) is connected to the heat source unit (10) via the first power feed unit (30a).

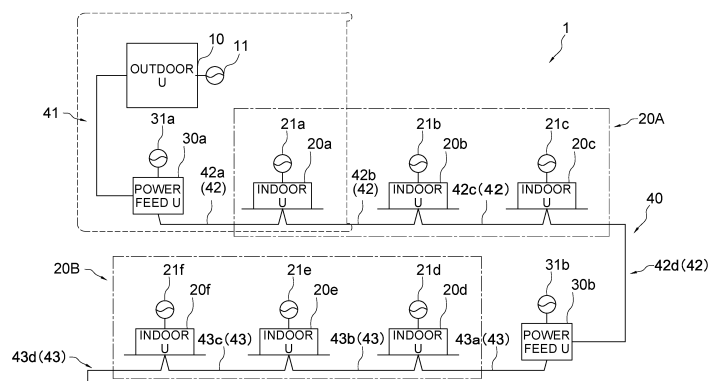


FIG. 1

Description

Technical Field

5 [0001] The present disclosure relates to a refrigerant cycle system.

Background Art

10 [0002] Conventionally, there is a refrigerant cycle including a plurality of indoor units and a plurality of power feed units for one outdoor unit. As indicated in NPL 1 ("Mitsubishi Electric Building-air-conditioning Multi-air-conditioner System Design and Construction Manual", Mitsubishi Electric Corporation, issued in July, 2013, p. 146, see the drawing), an outdoor unit, indoor units, and power feed units are connected in parallel via communication lines.

Summary of Invention

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Technical Problem

[0003] The degree of freedom when a refrigerant cycle system is constructed in a building or the like is increased.

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Solution to Problem

[0004] A refrigerant cycle system according to a first aspect includes a refrigerant cycle, a first power feed unit, a second power feed unit, a first transmission line, and a second transmission line. The refrigerant cycle includes a heat source unit, a first utilization unit group, and a second utilization unit group. When a power source of each utilization unit of the first utilization unit group has been interrupted, the first power feed unit feeds auxiliary power to the utilization unit of which the power source has been interrupted. The first power feed unit is a unit that differs from the heat source unit. When a power source of each utilization unit of the second utilization unit group has been interrupted, the second power feed unit feeds auxiliary power to the utilization unit of which the power source has been interrupted. The second power feed unit is a unit that differs from the heat source unit. The first transmission line connects the heat source unit and the first power feed unit to each other. The second transmission line connects the first power feed unit and the second power feed unit to each other. The second power feed unit is connected to the heat source unit via the first power feed unit.

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[0005] Thus, the degree of freedom when the refrigerant cycle system is constructed in a building or the like is increased.

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[0006] A refrigerant cycle system according to a second aspect is the system according to the first aspect in which the heat source unit, the first power feed unit, and the second power feed unit are connected in series by the first transmission line and the second transmission line.

Brief Description of Drawings

[0007]

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[Fig. 1] Fig. 1 is a schematic diagram illustrating a configuration of a refrigerant cycle system.

[Fig. 2] Fig. 2 is a schematic diagram illustrating the configuration of the refrigerant cycle system.

[Fig. 3] Fig. 3 is a flowchart presenting a flow of processing of the refrigerant cycle system.

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Description of Embodiments

[0008] A refrigerant cycle system 1 according to an embodiment of the present disclosure is described below. The embodiment described below is a specific example, and it is not intended that the embodiment limits the technical scope, and the embodiment may be properly modified in a range not departing from the gist.

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(1) General Configuration

[0009] Fig. 1 is a schematic diagram illustrating an example of a configuration of the refrigerant cycle system 1 according to the present embodiment. The refrigerant cycle system 1 illustrated in Fig. 1 mainly includes an outdoor unit 10, a first indoor unit group 20A including a plurality of indoor units, a second indoor unit group 20B including a plurality of indoor units, a first power feed unit 30a, a second power feed unit 30b, and a transmission line 40. The first indoor unit group 20A includes three indoor units 20a, 20b, and 20c. The second indoor unit group 20B includes three indoor units 20d, 20e, and 20f.

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[0010] The outdoor unit 10 and the respective indoor units 20a, 20b, 20c, 20d, 20e, and 20f included in the refrigerant cycle system 1 are connected to one another by a refrigerant pipe 2 (see Fig. 2) to constitute a refrigerant cycle. The outdoor unit 10, the respective indoor units 20a, 20b, 20c, 20d, 20e, and 20f, the first power feed unit 30a, and the second power feed unit 30b included in the refrigerant cycle system 1 are connected to one another by the transmission line 40. Thus, the respective units can communicate with one another.

[0011] The number of indoor units connectable to one outdoor unit is determined depending on the capacity, performance, and the like of the outdoor unit. The number of indoor units connectable to the outdoor unit 10 according to the present embodiment is, for example, 16; however, the number is not limited thereto. The arrangement of the power feed units is not limited to the arrangement illustrated in Fig. 1. The number of power feed units is not limited to the number in the arrangement. According to the present disclosure, it is sufficient that the refrigerant cycle system 1 includes at least one outdoor unit, one or more indoor unit groups each including one or more indoor units, and one or more power feed units.

[0012] The refrigerant pipe 2 is branched using a branch pipe and connects the outdoor unit 10 and the respective indoor units 20a, 20b, 20c, 20d, 20e, and 20f to one another. Refrigerant flows in the refrigerant pipe 2. In this case, the type of refrigerant is not limited.

(2) Specific Configuration of Refrigerant Cycle System 1

[0013] The outdoor unit 10, the indoor unit 20a, and the first power feed unit 30a included in the refrigerant cycle system 1 are described below with reference to Fig. 2. In this case, the refrigerant cycle system illustrated in Fig. 2 is part illustrated in an enlarged manner (part surrounded by a broken line) of the refrigerant cycle system 1 illustrated in Fig. 1 for the convenience of description. Description is given according to the present embodiment based on an assumption that the respective indoor units 20b, 20c, 20d, 20e, and 20f included in the refrigerant cycle system 1 have configurations similar to that of the indoor unit 20a illustrated in Fig. 2, and the second power feed unit 30b included in the refrigerant cycle system 1 has a configuration similar to that of the first power feed unit 30a illustrated in Fig. 2. Each configuration is a specific example and of course may be properly modified within a scope not departing from the gist, and each unit of course may differ from the other units.

(2-1) Outdoor Unit 10

[0014] As illustrated in Fig. 2, the outdoor unit 10 serving as a heat source unit is connected to a power source 11 that is a commercial power source and that serves as a main power source of the outdoor unit 10. The outdoor unit 10 includes an outdoor heat exchanger 12, an outdoor fan 13, a compressor 14, an outdoor control unit 15, and a communication unit 16. The outdoor heat exchanger 12 condenses or evaporates refrigerant flowing through the refrigerant pipe 2 to perform heat exchange. The outdoor fan 13 sends air to the outdoor heat exchanger 12 to cause the refrigerant to exchange heat with air. The compressor 14 compresses and circulates the refrigerant in the refrigerant pipe 2. The outdoor control unit 15 controls the entire outdoor unit 10 and refrigerant cycle system 1. The communication unit 16 communicates with the other units.

[0015] The respective configurations included in the outdoor unit 10 function when power is fed from the power source 11 through a power source line.

(2-2) Indoor Unit 20a

[0016] The indoor unit 20a serving as a utilization unit is connected to a power source 21a that is a commercial power source and that serves as a main power source of the indoor unit 20a. The indoor unit 20a includes an indoor heat exchanger 22a, an indoor fan 23a, an expansion valve 24a, an indoor control unit 25a, a communication unit 26a, and an interruption detection unit 27a. The indoor heat exchanger 22a condenses or evaporates refrigerant flowing through the refrigerant pipe 2 to perform heat exchange. The indoor fan 23a sends air to the indoor heat exchanger 22a to cause the refrigerant to exchange heat with air. The expansion valve 24a adjusts the amount of refrigerant flowing through the refrigerant pipe 2. The indoor control unit 25a controls the entire indoor unit 20a. The communication unit 26a communicates with the other units. When detecting that the feed of power from the power source 21a has been interrupted, the interruption detection unit 27a transmits an interruption signal to the outdoor control unit 15 of the outdoor unit 10. The interruption signal includes a signal for notifying that the main power source has been interrupted, and identification information on the indoor unit of which the main power source has been interrupted. The identification information on the indoor unit is information unique to each indoor unit. The identification information on each of the indoor units is stored in the outdoor control unit 15 of the outdoor unit 10.

[0017] In a case where the feed of power from the power source 21a has not been interrupted, the respective configurations included in the indoor unit 20a function when power is fed from the power source 21a through a power source line.

(2-3) First Power Feed Unit 30a

[0018] The first power feed unit 30a is connected to a power source 31a that is a commercial power source and that serves as a main power source of the first power feed unit 30a. The first power feed unit 30a includes a power feed control unit 32a that controls the entire power feed unit 30a, and a communication unit 33a that communicates with the other units.

[0019] The respective configurations included in the first power feed unit 30a function when power is fed from the power source 31a through a power source line.

[0020] The number of indoor units to which a power feed unit can simultaneously feed power is determined in advance depending on the performance and the like of the power feed unit. Note that power that is fed from the power feed unit to an indoor unit is used as auxiliary power.

[0021] The auxiliary power is mainly used to adjust the opening degree of the expansion valve of the indoor unit. In addition, the auxiliary power may be used for various actuator operations in the indoor unit. Examples of the actuator operations include an operation of closing a grill panel included in the indoor unit, and an operation of collecting various pieces of information relating to the indoor unit. The actuator operations that are performed using the auxiliary power are operations set in advance.

[0022] The power feed unit that feeds the auxiliary power to each indoor unit is set in advance. When the feed of power of the main power source to each indoor unit has been interrupted, the set power feed unit feeds auxiliary power.

[0023] For example, in Fig. 1, the first power feed unit 30a feeds auxiliary power to the indoor units 20a, 20b, and 20c. The second power feed unit 30b feeds auxiliary power to the indoor units 20d, 20e, and 20f. Processing of a power feed unit to feed auxiliary power to an indoor unit will be described in detail later.

(2-4) Transmission Line 40

[0024] As illustrated in Fig. 1, the transmission line 40 connects the respective units included in the refrigerant cycle system 1.

[0025] The transmission line 40 is normally used mainly for communication and enables communication among the respective communication units. In addition, the transmission line 40 has a role as a power source line for feeding auxiliary power from a power feed unit to an indoor unit in a case where the main power source of the indoor unit has been interrupted. In other words, the transmission line 40 is used for both transmission and power feed.

[0026] In the present embodiment, as illustrated in Fig. 1, the transmission line 40 includes a first transmission line 41, a second transmission line 42, and a third transmission line 43.

[0027] The first transmission line 41 connects in series the outdoor unit 10 and the first power feed unit 30a.

[0028] The second transmission line 42 connects in series the first power feed unit 30a and the second power feed unit 30b. Specifically, the second transmission line 42 includes transmission lines 42a, 42b, 42c, and 42d that connect the respective units, and connect the first power feed unit 30a, the respective indoor units 20a, 20b, and 20c included in the first indoor unit group 20A, and the second power feed unit 30b. In this case, it is sufficient that the second transmission line 42 connects in series the first power feed unit 30a and the second power feed unit 30b, and the connection form of the respective indoor units 20a, 20b, and 20c included in the first indoor unit group 20A is not limited.

[0029] The third transmission line 43 connects in series the second power feed unit 30b and a third power feed unit (not illustrated). Specifically, the third transmission line 43 includes transmission lines 43a, 43b, 43c, and 43d that connect the respective units, and connects the second power feed unit 30b, the respective indoor units 20d, 20e, and 20f included in the second indoor unit group 20B, and the third power feed unit. In this case, it is sufficient that the third transmission line 43 connects in series the second power feed unit 30b and the third power feed unit, and the connection form of the respective indoor units 20d, 20e, and 20f included in the second indoor unit group 20B is not limited.

(3) Processing of Refrigerant Cycle System 1

[0030] Fig. 3 is a flowchart illustrating an example of processing of the refrigerant cycle system 1 according to the embodiment of the present disclosure. The flowchart presents a case where the main power source to the indoor unit 20a included in the refrigerant cycle system 1 illustrated in Fig. 1 is interrupted and auxiliary power is fed to the indoor unit 20a from the first power feed unit 30a included in the refrigerant cycle system 1 through the transmission line 40.

[0031] First, in step S1, the indoor unit 20a starts various types of processing in a state fed with power from the power source 21a. The indoor unit 20a in this state causes the respective configurations to function and can perform an air conditioning operation such as cooling or heating.

[0032] In step S2, the interruption detection unit 27a of the indoor unit 20a determines whether or not the feed of power from the power source 21a has been interrupted. In step S2, when the interruption detection unit 27a does not detect

an interruption of power from the power source 21a (S2: NO), the indoor unit 20a continues the air conditioning operation and the interruption detection unit 27a continues the determination.

[0033] In contrast, in step S2, when the interruption detection unit 27a detects an interruption of power from the power source 21a (S2: YES), the indoor unit 20a switches the feed source of power for the indoor unit 20a from the power source 21a to the first power feed unit 30a (step S3). In other words, the indoor unit 20a starts feed of auxiliary power from the first power feed unit 30a through the transmission line 40.

[0034] In step S4, the indoor unit 20a outputs the interruption signal to the outdoor unit 10 through the transmission line 40.

[0035] In step S5, the outdoor control unit 15 of the outdoor unit 10 transmits an opening degree adjustment instruction of the expansion valve 24a to the indoor unit 20a. The opening degree adjustment instruction is an instruction for completely opening the expansion valve 24a, for completely closing the expansion valve 24a, for increasing the opening degree, or for decreasing the opening degree. Accordingly, an oil return operation of the indoor unit 20a or the like can be performed. The outdoor control unit 15 of the outdoor unit 10 may transmit operation instructions for instructing various actuator operations to the indoor unit 20a. The indoor control unit 25a of the indoor unit 20a controls the various types of actuators based on the operation instructions.

[0036] In step S6, the indoor control unit 25a of the indoor unit 20a adjusts the opening degree of the expansion valve 24a based on the opening degree adjustment instruction from the outdoor unit 10.

[0037] In step S7, the interruption detection unit 27a of the indoor unit 20a determines whether or not the power from the power source 21a has been interrupted. In other words, it is determined whether or not power feed from the main power source has been recovered. In step S7, when the interruption detection unit 27a detects an interruption of power from the power source 21a (S7: YES), the interruption detection unit 27a repeats the determination and continues the power feed from the first power feed unit 30a.

[0038] In contrast, in step S7, when the interruption detection unit 27a does not detect an interruption of power from the power source 21a (S7: NO), in other words, when the power feed from the main power source has been resumed, the power feed source of the indoor unit 20a is switched from the first power feed unit 30a to the power source 21a (step S8).

[0039] With the above-described processing, the processing of the feed of the auxiliary power to the indoor unit 20a from the first power feed unit 30a through the transmission line 40 in the case where the main power source of the indoor unit 20a has been interrupted is ended.

(4) Features

[0040] The refrigerant cycle system 1 according to the present embodiment includes the refrigerant cycle, the first power feed unit 30a, the second power feed unit 30b, the first transmission line 41, and the second transmission line 42. The refrigerant cycle includes the outdoor unit 10 serving as the heat source unit, the first indoor unit group 20A serving as a first utilization unit group, and the second indoor unit group 20B serving as a second utilization unit group. When the power source of each of the indoor units 20a, 20b, and 20c of the first indoor unit group 20A has been interrupted, the first power feed unit 30a feeds auxiliary power to the utilization unit of which the power source has been interrupted. The first power feed unit 30a is a unit that differs from the outdoor unit 10. When the power source of each of the utilization units 20d, 20e, and 20f of the second indoor unit group 20B has been interrupted, the second power feed unit 30b feeds auxiliary power to the utilization unit of which the power source has been interrupted. The second power feed unit 30b is a unit that differs from the outdoor unit 10. The first transmission line 41 connects the outdoor unit 10 and the first power feed unit 30a to each other. The second transmission line 42 connects the first power feed unit 30a and the second power feed unit 30b to each other. The second power feed unit 30b is connected to the outdoor unit 10 via the first power feed unit 30a.

[0041] Moreover, in the refrigerant cycle system 1 according to the present embodiment, the outdoor unit 10, the first power feed unit 30a, and the second power feed unit 30b are connected in series by the first transmission line 41 and the second transmission line 42.

[0042] When the outdoor unit and the power feed unit can be connected only in parallel, the length of the transmission line that connects the outdoor unit and the power feed unit to each other may be too long. In such a case, the construction of wiring takes time and effort, leading to an increase in the cost for the construction.

[0043] In the refrigerant cycle system 1 according to the present embodiment, the outdoor unit 10, the first power feed unit 30a, and the second power feed unit 30b are connected in series by the first transmission line 41 and the second transmission line 42. Hence, the construction of wiring among the respective units can be efficiently performed.

[0044] Thus, the outdoor unit and the power feed unit can be disposed at locations farther than those of related art. Accordingly, the degree of freedom when the refrigerant cycle system is constructed in a building or the like is increased. (5)

[0045] The embodiment of the present disclosure has been described above, and it is understood that the embodiment and details can be modified in various ways without departing from the gist and scope of the present disclosure described in the claims.

Reference Signs List

[0046]

5	1	refrigerant cycle system
	10	heat source unit
	20A	first utilization unit group
	20B	second utilization unit group
	20a, 20b, 20c, 20d, 20e, 20f	utilization unit
10	21a, 21b, 21c, 21d, 21e, 21f	power source
	30a	first power feed unit
	30b	second power feed unit
	41	first transmission line
	42	second transmission line

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Citation List

Non Patent Literature

- 20 **[0047]** NPL 1: "Mitsubishi Electric Building-air-conditioning Multi-air-conditioner System Design and Construction Manual", Mitsubishi Electric Corporation, issued in July, 2013, p. 146

Claims

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1. A refrigerant cycle system (1) comprising:

- a refrigerant cycle including a heat source unit (10), a first utilization unit group (20A), and a second utilization unit group (20B);
- 30 a first power feed unit (30a) that differs from the heat source unit (10), and when a power source (21a, 21b, 21c) of each utilization unit (20a, 20b, 20c) of the first utilization unit group (20A) has been interrupted, that feeds auxiliary power to the utilization unit of which the power source has been interrupted;
- a second power feed unit (30b) that differs from the heat source unit (10), and when a power source (21d, 21e, 21f) of each utilization unit (20d, 20e, 20f) of the second utilization unit group (20B) has been interrupted, that
- 35 feeds auxiliary power to the utilization unit of which the power source has been interrupted;
- a first transmission line (41) that connects the heat source unit (10) and the first power feed unit (30a) to each other; and
- a second transmission line (42) that connects the first power feed unit (30a) and the second power feed unit (30b) to each other,
- 40 wherein the second power feed unit (30b) is connected to the heat source unit (10) via the first power feed unit (30a).

- 2.** The refrigerant cycle system (1) according to Claim 1, wherein the heat source unit (10), the first power feed unit (30a), and the second power feed unit (30b) are connected in series by the first transmission line (41) and the second
- 45 transmission line (42).

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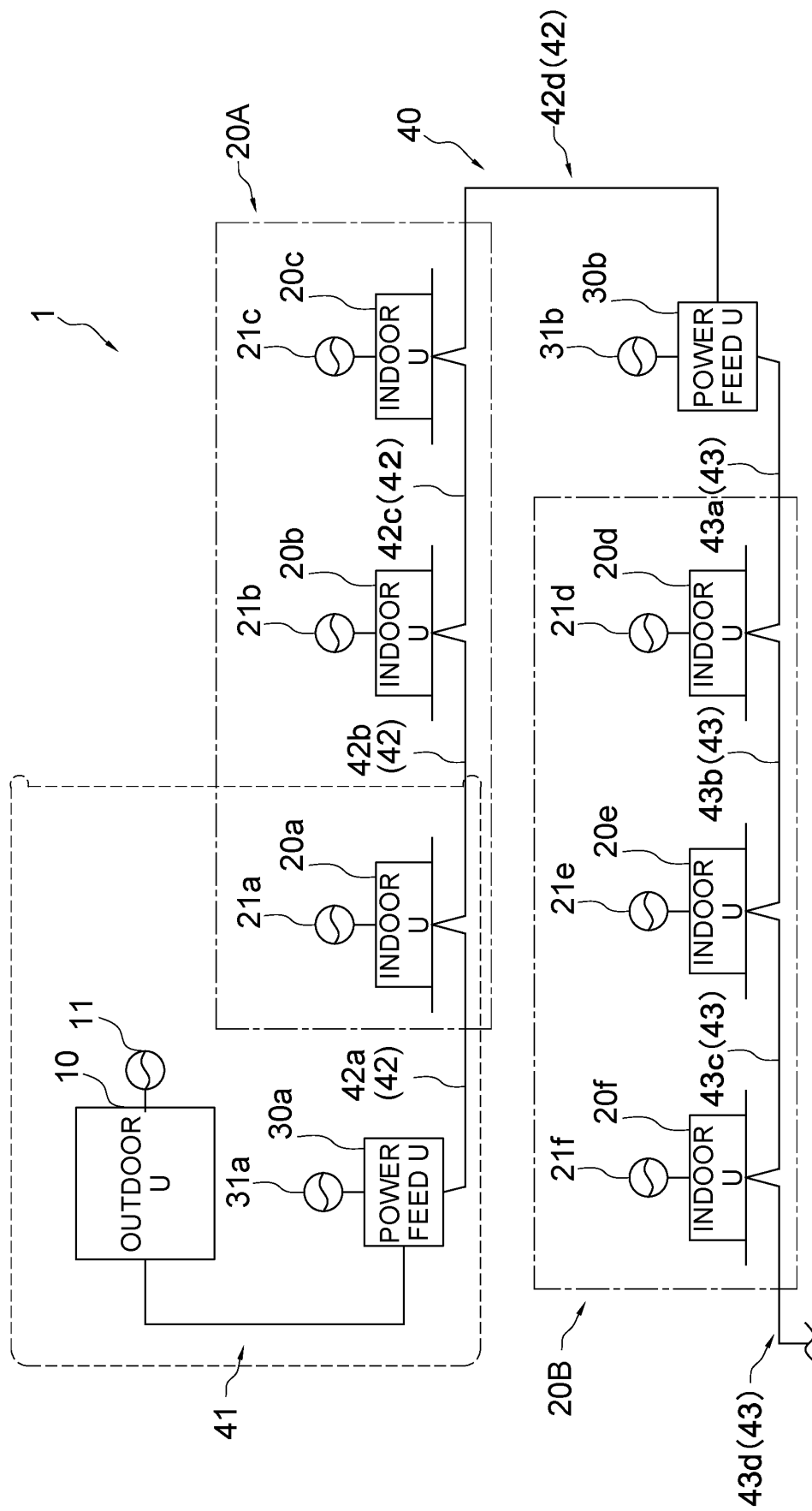


FIG. 1

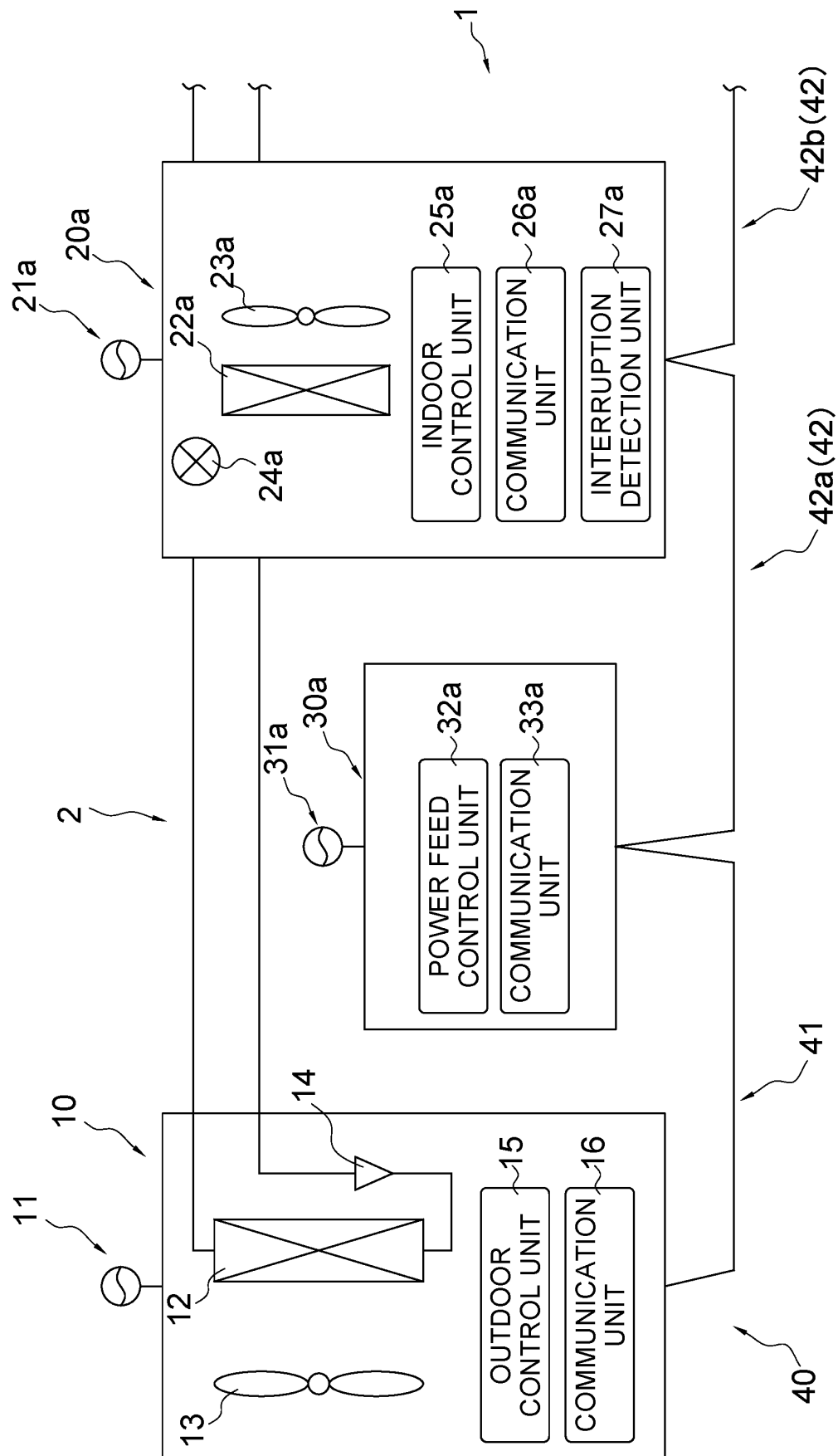


FIG. 2

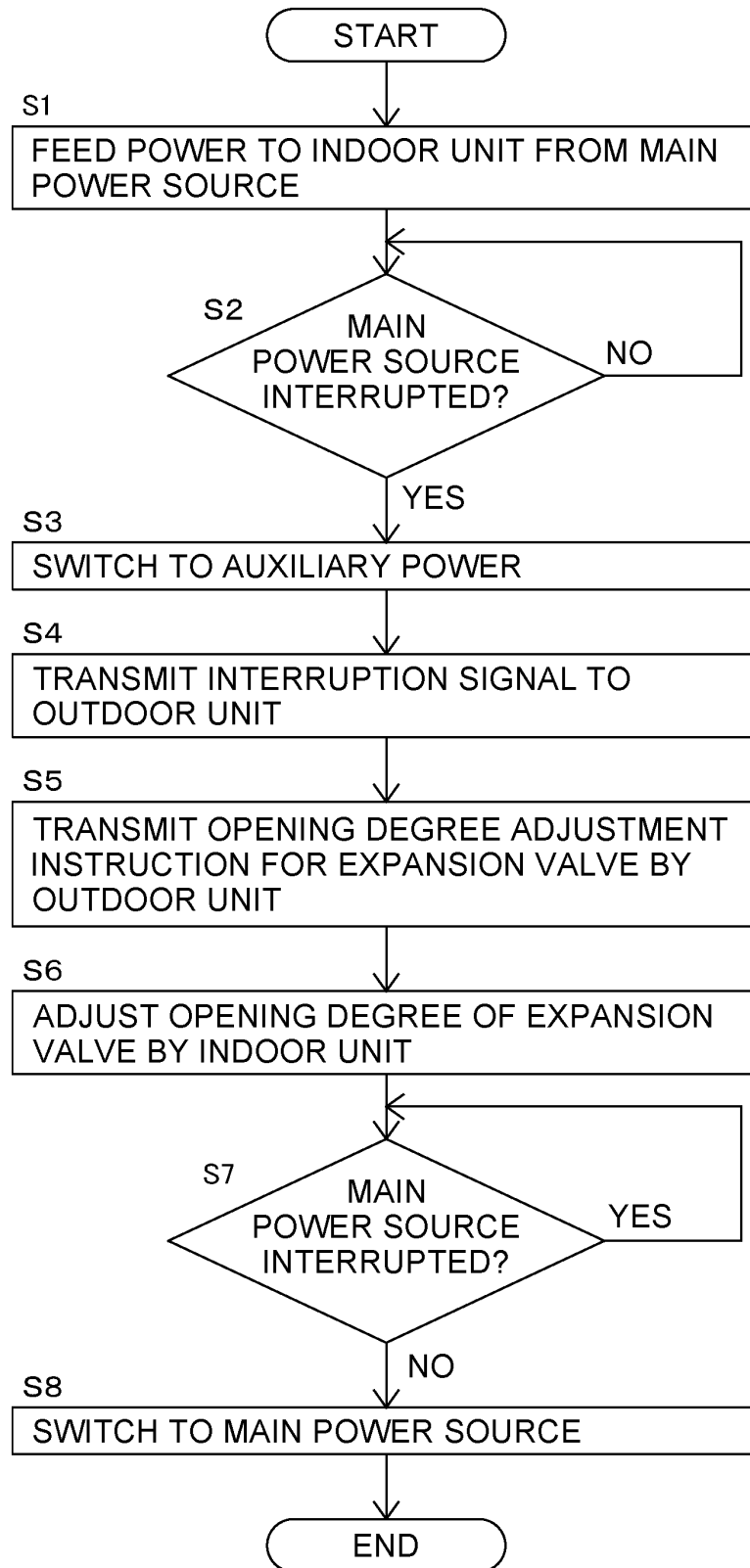


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/010923

A. CLASSIFICATION OF SUBJECT MATTER

F25B 49/02 (2006.01) i; F24F 11/88 (2018.01) i
 FI: F24F11/88; F25B49/02 D

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)

F25B49/02; F24F11/88

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	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

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 2016-109363 A (MITSUBISHI ELECTRIC CORP.) 20.06.2016 (2016-06-20) paragraphs [0011]-[0031]	1-2
Y	JP 2008-249264 A (OSAKA GAS CO., LTD.) 16.10.2008 (2008-10-16) paragraphs [0019]-[0043]	1-2



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
27 May 2020 (27.05.2020)

Date of mailing of the international search report
09 June 2020 (09.06.2020)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/010923

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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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10

JP 2016-109363 A	20 Jun. 2016	(Family: none)	
JP 2008-249264 A	16 Oct. 2008	(Family: none)	

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Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- Mitsubishi Electric Building-air-conditioning Multi-air-conditioner System Design and Construction Manual. Mitsubishi Electric Corporation, July 2013, 146 [0002] [0047]