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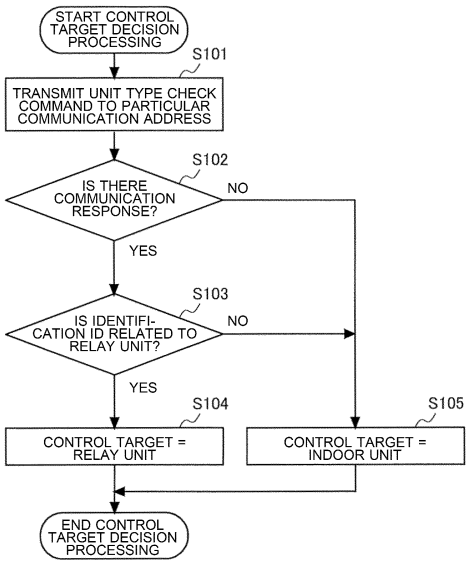
(54) **AIR CONDITIONING SYSTEM AND METHOD FOR SETTING CONTROL SUBJECT OF AIR CONDITIONING SYSTEM**

(57) An air-conditioning system includes an outdoor unit functioning as a heat source device, and an indoor unit configured to condition air in an air-conditioned space, in which the outdoor unit includes an outdoor unit control unit configured to search for a relay unit configured to relay heat transfer between the outdoor unit and the indoor unit by exchanging heat of heat media, and an outdoor unit communication unit configured to communicate with an outside, and the outdoor unit control unit transmits a first communication command from the outdoor unit communication unit to a particular communication address, and when a communication response is returned to the outdoor unit communication unit, determines what exists at the particular communication address based on an identification ID transmitted from the particular communication address to the outdoor unit communication unit, and sets the relay unit as a control target when it is determined that the relay unit exists at the particular communication address, and sets the indoor unit as the control target when it is determined that what exists at the particular communication address is not the relay unit or when the communication response is not returned to the outdoor unit communication unit.

FIG. 6



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Description

Technical Field

[0001] The present disclosure relates to an air-conditioning system in which control according to the presence or absence of a relay unit is performed, and a control target setting method of the air-conditioning system.

Background Art

[0002] For air-conditioning systems, there are a configuration including an outdoor unit functioning as a heat source device, and an indoor unit configured to condition air in an air-conditioned space, in which the outdoor unit performs direct expansion to the indoor unit by using one heat medium, and as in Patent Literature 1, a configuration including, in addition to the outdoor unit and the indoor unit, a relay unit configured to relay heat transfer by exchanging heat of heat media, in which the outdoor unit performs indirect expansion to the indoor unit via the relay unit by using a plurality of heat media. In other words, for air-conditioning systems, there are a configuration in which a relay unit does not exist, and a configuration in which a relay unit exists.

[0003] In recent years, there has been a market demand for restriction on usage of a heat medium having a high global warming potential. In view of the above, to restrict the usage of the heat medium having the high global warming potential, a case is assumed where a system change is desired from an air-conditioning system in which the relay unit does not exist to an air-conditioning system in which the relay unit exists. On the other hand, in future, to reduce costs when a heat medium having a sufficiently low global warming potential is invented, a case is also assumed where a system change is desired from an air-conditioning system in which the relay unit exists to an air-conditioning system in which the relay unit does not exist.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Patent No. 5236008

Summary of Invention

Technical Problem

[0005] However, for air-conditioning systems in related art, different types of software are respectively used for the configuration in which the relay unit does not exist and the configuration in which the relay unit exists. Therefore, a problem occurs that it is necessary to change the software when the configuration of the air-conditioning system is changed, which requires labor and costs.

[0006] The present disclosure has been made to solve the above-described problem, and is aimed at providing an air-conditioning system in which it is possible to reduce labor and costs when the configuration of the air-conditioning system is changed, and a control target setting method of the air-conditioning system.

Solution to Problem

[0007] An air-conditioning system according to one embodiment of the present disclosure includes an outdoor unit functioning as a heat source device, and an indoor unit configured to condition air in an air-conditioned space, in which the outdoor unit includes an outdoor unit control unit configured to search for a relay unit configured to relay heat transfer between the outdoor unit and the indoor unit by exchanging heat of heat media, and an outdoor unit communication unit configured to communicate with an outside, and the outdoor unit control unit transmits a first communication command from the outdoor unit communication unit to a particular communication address, and when a communication response is returned to the outdoor unit communication unit, determines what exists at the particular communication address based on an identification ID transmitted from the particular communication address to the outdoor unit communication unit, and sets the relay unit as a control target when it is determined that the relay unit exists at the particular communication address, and sets the indoor unit as the control target when it is determined that what exists at the particular communication address is not the relay unit or when the communication response is not returned to the outdoor unit communication unit.

[0008] In addition, in a control target setting method of an air-conditioning system according to one embodiment of the present disclosure, the air-conditioning system includes an outdoor unit functioning as a heat source device, and an indoor unit configured to condition air in an air-conditioned space, the outdoor unit having an outdoor unit control unit configured to search for a relay unit configured to relay heat transfer between the outdoor unit and the indoor unit by exchanging heat of heat media, and an outdoor unit communication unit configured to communicate with an outside, and the control target setting method includes transmitting a first communication command from the outdoor unit communication unit to a particular communication address, and when a communication response is returned to the outdoor unit communication unit, determining what exists at the particular communication address based on an identification ID transmitted from the particular communication address to the outdoor unit communication unit, and setting the relay unit as a control target when it is determined that the relay unit exists at the particular communication address, and setting the indoor unit as the control target when it is determined that what exists at the particular communication address is not the relay unit or when the communication response is not returned to the outdoor

unit communication unit.

Advantageous Effects of Invention

[0009] With the air-conditioning system and the control target setting method of the air-conditioning system according to one embodiment of the present disclosure, the setting of the control target is changed between the relay unit and the indoor unit according to the presence or absence of the communication response and information of the identification ID. For this reason, the change of the software is unnecessary, and it is possible to reduce the labor and the costs when the configuration of the air-conditioning system is changed.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1 is a first diagram for describing a configuration of an air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 2] Fig. 2 is a second diagram for describing the configuration of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 3] Fig. 3 is a block diagram illustrating an internal processing configuration of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 4] Fig. 4 is a third diagram for describing the configuration of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 5] Fig. 5 is a fourth diagram for describing the configuration of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 6] Fig. 6 is a flowchart illustrating processing for deciding a control target of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 7] Fig. 7 is a flowchart illustrating processing for deciding a control method of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 8] Fig. 8 is a sequence chart of the air-conditioning system according to Embodiment 1 of the present disclosure.
[Fig. 9] Fig. 9 is a first diagram for describing a configuration of the air-conditioning system according to Embodiment 2 of the present disclosure.
[Fig. 10] Fig. 10 is a second diagram for describing the configuration of the air-conditioning system according to Embodiment 2 of the present disclosure.
[Fig. 11] Fig. 11 is a flowchart illustrating processing for deciding the number of outdoor units to be controlled in the air-conditioning system according to Embodiment 2 of the present disclosure.
[Fig. 12] Fig. 12 is a first sequence chart of the air-conditioning system according to Embodiment 2 of the present disclosure.
[Fig. 13] Fig. 13 is a second sequence chart of the air-conditioning system according to Embodiment 2 of the present disclosure.

Description of Embodiments

[0011] Hereinafter, embodiments of the present disclosure will be described with reference to the drawings. It is noted that the embodiments which will be described below are not intended to limit the present disclosure.

Embodiment 1

[0012] Fig. 1 is a first diagram for describing a configuration of an air-conditioning system 100 according to Embodiment 1 of the present disclosure. Fig. 2 is a second diagram for describing the configuration of the air-conditioning system 100 according to Embodiment 1 of the present disclosure.

[0013] As illustrated in Fig. 1, the air-conditioning system 100 according to the present Embodiment 1 adopts a configuration including an outdoor unit 10 functioning as a heat source device, and an indoor unit 20 configured to condition air in an air-conditioned space, in which the outdoor unit 10 performs direct expansion to the indoor unit 20 by using one heat medium (hereinafter, referred to as a configuration in which a relay unit 30 does not exist). Alternatively, as illustrated in Fig. 2, the air-conditioning system 100 adopts a configuration including, in addition to the outdoor unit 10 and the indoor unit 20, the relay unit 30 configured to exchange heat of heat media and relay heat transfer between the outdoor unit 10 and the indoor unit 20, in which the outdoor unit 10 performs indirect expansion to the indoor unit 20 via the relay unit 30 by using a plurality of heat media (hereinafter, referred to as a configuration in which the relay unit 30 exists). It is noted that in the configuration in which the relay unit 30 exists, the outdoor unit 10 and the relay unit 30 have a one to one correspondence. In addition, communication addresses which will be described below are assigned to the outdoor unit 10, the indoor unit 20, and the relay unit 30. It is noted that the relay unit 30 is, for example, a hydro unit (heat exchanger configured to perform heat exchange between refrigerant and water).

[0014] Fig. 3 is a block diagram illustrating an internal processing configuration of the air-conditioning system 100 according to Embodiment 1 of the present disclosure.

[0015] As illustrated in Fig. 3, the outdoor unit 10 includes an outdoor unit control unit 11, an outdoor unit communication unit 12, and an outdoor unit storage unit 13. In addition, the indoor unit 20 includes an indoor unit control unit 21, an indoor unit communication unit 22, and an indoor unit storage unit 23. In addition, the relay unit 30 includes a relay unit control unit 31, a relay unit communication unit 32, and a relay unit storage unit 33.

[0016] The outdoor unit control unit 11 is configured to

control the outdoor unit 10 to execute an air-conditioning operation in a cooperative manner with the outdoor unit 10, the indoor unit 20, and the relay unit 30 in a same refrigerant system. In addition, the indoor unit control unit 21 is configured to control the indoor unit 20, and the relay unit control unit 31 is configured to control the relay unit 30.

[0017] The outdoor unit communication unit 12 is configured to perform a communication with the outdoor unit 10, the indoor unit 20, and the relay unit 30 in the same refrigerant system. It is noted that, for example, the communication includes a wireless communication such as Wi-Fi (registered trademark), or a wired communication such as a wired LAN. In addition, the indoor unit communication unit 22 is configured to perform a communication with the outdoor unit 10 in the same refrigerant system directly or via the relay unit 30, and the relay unit communication unit 32 is configured to perform a communication with the outdoor unit 10 in the same refrigerant system.

[0018] Each of the outdoor unit storage unit 13, the indoor unit storage unit 23, and the relay unit storage unit 33 is configured to store various information, and is, for example, a ROM, a RAM, a flash memory, or other memories, or a combination of those.

[0019] As illustrated in Fig. 1 and Fig. 2, different communication addresses are respectively assigned to the outdoor unit 10, the indoor unit 20, and the relay unit 30. These communication addresses are manually set by an operator for the respective units of the outdoor unit 10, the indoor unit 20, and the relay unit 30 before power is supplied (on) (before unit type check commands which will be described below are transmitted) after the air-conditioning system 100 is built. In addition, the communication addresses are assigned to the outdoor unit 10 and the relay unit 30 based on a predetermined rule. In further detail, X, X + 1, ... are assigned by priority to units linked to the outdoor unit 10 as a refrigerant circuit, and are subsequently assigned to units of other refrigerant circuits. For example, in a case of a configuration including two relay units 30a and 30b and two outdoor units 10a and 10b, in which the outdoor unit 10a and the relay unit 30a are connected on a one to one basis, and the outdoor unit 10b and the relay unit 30b are connected on a one to one basis, X is assigned to the outdoor unit 10a, X + 1 is assigned to the relay unit 30a, X + 2 is assigned to the outdoor unit 10b, and X + 3 is assigned to the relay unit 30b.

[0020] Herein, the communication addresses and the unit type check commands have mutual relationships, and when the communication addresses are randomly assigned to the respective units, the unit type check commands are indiscriminately transmitted to the units, which is inefficient. In view of the above, when the communication addresses are assigned based on the predetermined rule as described above, it is facilitated to transmit the unit type check commands to the respective units.

[0021] In addition, identification IDs are respectively assigned to the outdoor unit 10, the indoor unit 20, and the relay unit 30. Each of these identification IDs is used to identify whether this unit is one of the outdoor unit 10, the indoor unit 20, and the relay unit 30, whether this unit is in the same refrigerant system, which unit this unit is, and other settings. When the relay unit communication unit 32 receives a unit type check command (hereinafter, also referred to as a first communication command), the relay unit control unit 31 transmits the identification ID to a transmission source at the same time as a communication response or after the communication response.

[0022] For this reason, the outdoor unit control unit 11 transmits the unit type check command to a particular communication address by the outdoor unit communication unit 12, and when a communication response is returned, and the received identification ID is related to the relay unit 30, it is found out that the relay unit 30 exists in the air-conditioning system 100. On the other hand, after the outdoor unit control unit 11 transmits the unit type check command to the particular communication address by the outdoor unit communication unit 12, when the communication response is not returned or when the received identification ID is not related to the relay unit 30 even when the communication response is returned, it is found out that the relay unit 30 does not exist in the air-conditioning system 100. It is noted that unit specification information in which a type of a unit is associated with an identification ID is stored in the outdoor unit storage unit 13.

[0023] Fig. 4 is a third diagram for describing the configuration of the air-conditioning system 100 according to Embodiment 1 of the present disclosure. Fig. 5 is a fourth diagram for describing the configuration of the air-conditioning system 100 according to Embodiment 1 of the present disclosure.

[0024] As illustrated in Fig. 4 and Fig. 5, there are some types of relay units 30, and these types are categorized based on refrigerant to be dealt with. In addition, each of the relay units 30 has an identification ID for identifying a type, and the identification ID is stored in the relay unit storage unit 33.

[0025] Then, the outdoor unit control unit 11 of the outdoor unit 10 changes a control method such as a rotation speed of a compressor, a rotation speed of a fan, an opening degree of an expansion device, and other settings in the same refrigerant system according to the type of the relay unit 30. It is noted that according to the present Embodiment 1, it is set that types of control methods include a type B and a type C according to the types of the relay units 30.

[0026] Fig. 6 is a flowchart illustrating processing for deciding a control target of the air-conditioning system 100 according to Embodiment 1 of the present disclosure. Fig. 7 is a flowchart illustrating processing for deciding a control method of the air-conditioning system 100 according to Embodiment 1 of the present disclosure. Fig. 8 is a sequence chart of the air-conditioning system 100 according to Embodiment 1 of the present

disclosure.

[0027] Hereinafter, the processing for deciding the control target of the air-conditioning system 100 according to the present Embodiment 1 will be described with reference to Fig. 6 and Fig. 8.

[0028] When the power is supplied (that is, when the power is turned on), first, the outdoor unit control unit 11 of the outdoor unit 10 performs the processing for deciding the control target.

(Step S101)

[0029] The outdoor unit control unit 11 transmits the unit type check command from the outdoor unit communication unit 12 to a particular communication address. It is noted that the particular communication address refers to a communication address that may be assigned to the relay unit 30 and the outdoor unit 10. As described above, for example, the particular communication address is X + α when the communication address of the outdoor unit 10 is X.

(Step S102)

[0030] The outdoor unit control unit 11 determines whether or not a communication response is returned to the outdoor unit communication unit 12 from the particular communication address to which the unit type check command is transmitted. When the outdoor unit control unit 11 determines that the communication response is returned to the outdoor unit communication unit 12 (YES), the process proceeds to the processing in step S103. On the other hand, when the outdoor unit control unit 11 determines that the communication response is not returned to the outdoor unit communication unit 12 within a predetermined period of time (NO), the process proceeds to the processing in step S105.

(Step S103)

[0031] The outdoor unit control unit 11 determines whether or not an identification ID transmitted at the same time as the communication response or transmitted after the communication response to the outdoor unit communication unit 12 is related to the relay unit 30. When the outdoor unit control unit 11 determines that the identification ID is related to the relay unit 30 (YES), the process proceeds to the processing in step S104. On the other hand, when the outdoor unit control unit 11 determines that the identification ID is not related to the relay unit 30 (NO), the process proceeds to the processing in step S105.

(Step S104)

[0032] The outdoor unit control unit 11 determines that the relay unit 30 exists, and sets the relay unit 30 as the control target. Then, the outdoor unit control unit 11 transmits a control command to the relay unit 30 to control the indoor unit 20 indirectly via the relay unit 30. It is noted that setting information of the control target is stored in the outdoor unit storage unit 13.

(Step S105)

[0033] The outdoor unit control unit 11 determines that the relay unit 30 does not exist, and sets the indoor unit 20 as the control target. Then, the outdoor unit control unit 11 transmits a control command to the indoor unit 20 to control the indoor unit 20 directly. It is noted that the setting information of the control target is stored in the outdoor unit storage unit 13.

[0034] In this manner, in the air-conditioning system 100 according to the present Embodiment 1, the setting of the control target is changed between the relay unit 30 and the indoor unit 20 according to the presence or absence of the communication response and information of the identification ID.

[0035] Next, the processing for deciding the control method of the air-conditioning system 100 according to the present Embodiment 1 will be described with reference to Fig. 7 and Fig. 8. It is noted that according to the present Embodiment 1, the types of the relay units 30 may include the type B and the type C.

[0036] When the relay unit 30 is set as the control target in step S104 of Fig. 6, the outdoor unit control unit 11 performs the processing for deciding the control method which is illustrated in Fig. 7.

(Step S111)

[0037] The outdoor unit control unit 11 identifies the type of the relay unit 30 from the identification ID transmitted at the same time as the communication response or transmitted after the communication response to the outdoor unit communication unit 12 in step S102 of Fig. 6. When the outdoor unit control unit 11 identifies the type of the relay unit 30 as the type B, the process proceeds to the processing in step S112. On the other hand, when the outdoor unit control unit 11 identifies the type of the relay unit 30 as the type C, the process proceeds to the processing in step S113.

(Step S112)

[0038] The outdoor unit control unit 11 sets the type B as the control method. Then, the outdoor unit control unit 11 controls the rotation speed of the compressor, the rotation speed of the fan, the opening degree of the expansion device, and other settings in the same refrigerant system based on the control method of the type B. It is noted that the setting information of the control method is stored in the outdoor unit storage unit 13.

(Step S113)

[0039] The outdoor unit control unit 11 sets the type C as the control method. Then, the outdoor unit control unit 11 controls the rotation speed of the compressor, the rotation speed of the fan, the opening degree of the expansion device, and other settings in the same refrigerant system based on the control method of the type C. It is noted that the setting information of the control method is stored in the outdoor unit storage unit 13.

[0040] In this manner, in the air-conditioning system 100 according to the present Embodiment 1, when the relay unit 30 is set as the control target, the type of the relay unit 30 is identified based on the identification ID, and the control method according to the type of the relay unit 30 is set.

[0041] As described above, the air-conditioning system 100 according to the present Embodiment 1 includes the outdoor unit 10 functioning as the heat source device, and the indoor unit 20 configured to condition air in the air-conditioned space, in which the outdoor unit 10 includes the outdoor unit control unit 11 configured to search for the relay unit 30 configured to relay heat transfer between the outdoor unit 10 and the indoor unit 20 by exchanging heat of heat media, and the outdoor unit communication unit 12 configured to communicate with an outside. The outdoor unit control unit 11 transmits the first communication command from the outdoor unit communication unit 12 to the particular communication address, and when the communication response is returned to the outdoor unit communication unit 12, the unit existing at the particular communication address is determined based on the identification ID transmitted to the outdoor unit communication unit 12 from the particular communication address. When it is determined that the unit existing at the particular communication address is the relay unit 30, the relay unit 30 is set as the control target. When it is determined that the unit existing at the particular communication address is not the relay unit 30 or when the communication response is not returned to the outdoor unit communication unit 12, the indoor unit 20 is set as the control target.

[0042] In addition, in a control target setting method of the air-conditioning system 100 according to the present Embodiment 1, the air-conditioning system 100 includes the outdoor unit 10 functioning as the heat source device, and the indoor unit 20 configured to condition air in the air-conditioned space, in which the outdoor unit 10 has the outdoor unit control unit 11 configured to search for the relay unit 30 configured to relay heat transfer between the outdoor unit 10 and the indoor unit 20 by exchanging heat of heat media, and the outdoor unit communication unit 12 configured to communicate with the outside, and the control target setting method includes transmitting the first communication command from the outdoor unit communication unit 12 to the particular communication address, and determining the unit existing at the particular communication address based on the identification ID transmitted to the outdoor unit communication unit 12 from the particular communication address when the communication response is returned to the outdoor unit communication unit 12, and setting the relay unit 30 as the control target when it is determined that the unit existing at the particular communication address is the relay unit 30, and setting the indoor unit 20 as the control target when it is determined that the unit existing at the particular communication address is not the relay unit 30 or when the communication response is not returned to the outdoor unit communication unit 12.

[0043] With the air-conditioning system 100 and the control target setting method of the air-conditioning system 100 according to the present Embodiment 1, the setting of the control target is changed between the relay unit 30 and the indoor unit 20 according to the presence or absence of the communication response and the information of the identification ID. Specifically, software that may be used as a platform is prepared in the air-conditioning system 100 according to the present Embodiment 1. Then, a unit specified from the identification ID obtained by the unit type check command and a condition of a system (for example, a system including the relay unit 30 with a heat medium A in which the control method is of the type B are applied to the software that may be used as the platform, and control is performed by the relevant software. It is noted that software corresponding to the unit and the system that are frequently used is prepared as the software that may be used as the platform. With the above-described software, it is possible to flexibly deal with addition or deletion of the unit without update after the system is constructed. For this reason, in the air-conditioning system 100 and the control target setting method of the air-conditioning system 100 according to the present Embodiment 1, the change of the software according to the presence or absence of the relay unit 30 is unnecessary, and it is possible to reduce the labor and the costs when the configuration of the air-conditioning system 100 is changed. It is noted however that when the unit is changed to a new unit after the system is set up, it is necessary to update the unit specification information and part of the software that may be used as the platform according to the change.

[0044] In addition, in the air-conditioning system 100 and the control target setting method of the air-conditioning system 100 according to the present Embodiment 1, the outdoor unit control unit 11 is configured to identify the type of the relay unit 30 based on the identification ID when the relay unit 30 is set as the control target, and set the control method according to the type of the relay unit 30.

[0045] With the air-conditioning system 100 and the control target setting method of the air-conditioning system 100 according to the present Embodiment 1, the control method is changed according to the type of the relay unit 30. For this reason, the change of the software according to the type of the relay unit 30 is unnecessary, and it is possible to reduce the labor and the costs when

the configuration of the air-conditioning system 100 is changed.

Embodiment 2

[0046] Hereinafter, Embodiment 2 of the present disclosure will be described, but a description of a component redundant to that of Embodiment 1 will be omitted, and a same part as or an equivalent part to that of Embodiment 1 is assigned with a same reference sign.

[0047] Fig. 9 is a first diagram for describing a configuration of the air-conditioning system 100 according to Embodiment 2 of the present disclosure. Fig. 10 is a second diagram for describing the configuration of the air-conditioning system 100 according to Embodiment 2 of the present disclosure.

[0048] In the air-conditioning system 100 according to the present Embodiment 2, the outdoor unit 10 includes a plurality of outdoor units in the same refrigerant system. The configuration in which the relay unit 30 does not exist is, as illustrated in Fig. 9, for example, a configuration including the two outdoor units 10a and 10b and the single indoor unit 20. On the other hand, the configuration in which the relay unit 30 exists is, as illustrated in Fig. 10, for example, a configuration including the two outdoor units 10a and 10b, the two relay units 30a and 30b, and the single indoor unit 20. It is noted that in the configuration in which the relay units 30 exist, the outdoor units 10 and the relay units 30 have a one-to-one correspondence.

[0049] As illustrated in Fig. 9 and Fig. 10, different communication addresses are respectively assigned to the outdoor units 10, the indoor unit 20, and the relay units 30. Communication addresses are assigned to the outdoor units 10a and 10b and the relay units 30a and 30b based on a predetermined rule. For example, when the communication address of the outdoor unit 10a is X, in the configuration in which the relay units 30 exist, a communication address $X + \alpha$ is assigned to the relay unit 30, and in the configuration in which the relay units 30 do not exist, the communication address $X + \alpha$ is assigned to the outdoor unit 10b.

[0050] In addition, as illustrated in Fig. 10, when the relay unit 30 and the outdoor unit 10 respectively include the plurality of relay units and the plurality of outdoor units, the outdoor unit 10a and the relay unit 30a are connected on a one to one basis, and the outdoor unit 10b and the relay unit 30b are connected on a one to one basis. Then, the communication address $X + \alpha$ is assigned to the relay unit 30a connected to the outdoor unit 10a where the communication address is X. In addition, a communication address $X + \beta$ is assigned to the outdoor unit 10b different from the outdoor unit 10a, and a communication address $(X + \beta) + \alpha$ is assigned to the relay unit 30b connected to the outdoor unit 10b. In other words, a difference β is set for the communication addresses of the outdoor units 10, and a difference α is set for the communication addresses of the outdoor unit 10 and the relay unit 30 that are connected to each other.

[0051] In addition, an identification ID is assigned to each of the outdoor units 10a and 10b, the indoor unit 20, and the relay units 30a and 30b. This identification ID is used to identify whether this unit is one of the outdoor units 10a and 10b, the indoor unit 20, and the relay units 30a and 30b, whether this unit is in the same refrigerant system, which unit this unit is, and other settings. When the relay unit communication unit 32 receives the unit type check command, the relay unit control unit 31 transmits the identification ID to the transmission source at the same time as the communication response or after the communication response.

[0052] For this reason, the outdoor unit control unit 11 of the outdoor unit 10a transmits the unit type check command to the particular communication address by the outdoor unit communication unit 12, and when the communication response is returned, and the received identification ID is related to the relay unit 30, it is found out that the relay unit 30 exists in the air-conditioning system 100. On the other hand, after the outdoor unit control unit 11 of the outdoor unit 10a transmits the unit type check command to the particular communication address by the outdoor unit communication unit 12, when the communication response is returned, and the received identification ID is related to the outdoor unit 10, it is found out that the plurality of outdoor units 10 exist in the air-conditioning system 100.

[0053] Fig. 11 is a flowchart illustrating processing for deciding the number of the outdoor units 10 to be controlled in the air-conditioning system 100 according to Embodiment 2 of the present disclosure. Fig. 12 is a first sequence chart of the air-conditioning system 100 according to Embodiment 2 of the present disclosure. Fig. 13 is a second sequence chart of the air-conditioning system 100 according to Embodiment 2 of the present invention.

[0054] Hereinafter, the processing for deciding the number of the outdoor units 10 to be controlled in the air-conditioning system 100 according to the present Embodiment 2 will be described with reference to Fig. 11 to Fig. 13. It is noted that according to the present Embodiment 2, a case where two outdoor units 10 exist will be described, but the same also applies to a case where three or more outdoor units 10 exist.

[0055] After the relay unit 30 or the indoor unit 20 is set as the control target by the processing for deciding the control target described according to Embodiment 1, the outdoor unit control unit 11 of the outdoor unit 10a performs the processing for deciding the number of the outdoor units 10 to be controlled as illustrated in Fig. 11.

(Step S201)

[0056] The outdoor unit control unit 11 of the outdoor unit 10a transmits the unit type check command from the outdoor unit communication unit 12 to a particular communication address.

(Step S202)

[0057] The outdoor unit control unit 11 of the outdoor unit 10a determines whether or not a communication response is returned to the outdoor unit communication unit 12 from the particular communication address to which the unit type check command is transmitted. When the outdoor unit control unit 11 of the outdoor unit 10a determines that the communication response is returned to the outdoor unit communication unit 12 (YES), the process proceeds to the processing in step S203. On the other hand, when the outdoor unit control unit 11 of the outdoor unit 10a determines that the communication response is not returned to the outdoor unit communication unit 12 within a predetermined period of time (NO), the processing for deciding the number of the outdoor units 10 to be controlled is ended.

(Step S203)

[0058] The outdoor unit control unit 11 of the outdoor unit 10a determines whether or not an identification ID transmitted simultaneously or after the communication response to the outdoor unit communication unit 12 is related to the outdoor unit 10b different from the outdoor unit 10a including the outdoor unit control unit 11 itself. When the outdoor unit control unit 11 of the outdoor unit 10a determines that the identification ID is related to the outdoor unit 10b (YES), the process proceeds to the processing in step S204. On the other hand, when the outdoor unit control unit 11 of the outdoor unit 10a determines that the identification ID is not related to the outdoor unit 10b (NO), the process returns to the processing in step S201, and the unit type check command is transmitted to a particular communication address that is different from the previous particular communication address from the outdoor unit communication unit 12. For example, when the unit type check command is transmitted to the communication address X + α in the previous time, the unit type check command is transmitted to the communication address X + β.

(Step S204)

[0059] The outdoor unit control unit 11 of the outdoor unit 10a determines that the outdoor unit 10b different from the outdoor unit 10a including the outdoor unit control unit 11 itself exists, and transmits a configuration check command (hereinafter, also referred to as a second communication command) to the communication address of the outdoor unit 10b. At this time, when the outdoor unit communication unit 12 receives the configuration check command, the outdoor unit control unit 11 of the different outdoor unit 10b transmits the identification ID to the transmission source at the same time as the communication response or after the communication response.

(Step S205)

[0060] The outdoor unit control unit 11 of the outdoor unit 10a checks the outdoor unit storage unit 13 on which one of the relay unit 30 and the indoor unit 20 is set as the control target. When the outdoor unit control unit 11 of the outdoor unit 10a confirms that the relay unit 30 is set as the control target (YES), the process proceeds to the processing in step S206. On the other hand, the outdoor unit control unit 11 of the outdoor unit 10a confirms that the indoor unit 20 is set as the control target (NO), the process proceeds to the processing in step S207. It is noted that an execution order of the processing in step S204 and the processing in step S205 may also be reversed.

(Step S206)

[0061] The outdoor unit control unit 11 of the outdoor unit 10a determines, from the identification ID transmitted at the same time as the communication response or transmitted after the communication response to the outdoor unit communication unit 12, whether or not the relay unit 30 connected to the different outdoor unit 10b is of the same type as the relay unit 30 connected to itself. When the outdoor unit control unit 11 of the outdoor unit 10a determines that the relay unit 30 connected to the different outdoor unit 10b is of the same type as the relay unit 30 connected to itself (YES), the process proceeds to the processing in step S208. On the other hand, the outdoor unit control unit 11 of the outdoor unit 10a determines that the relay unit 30 connected to the different outdoor unit 10b is not of the same type as the relay unit 30 connected to itself (NO), the process proceeds to the processing in step S209.

(Step S207)

[0062] The outdoor unit control unit 11 of the outdoor unit 10a determines, from the identification ID transmitted at the same time as the communication response or transmitted after the communication response to the outdoor unit communication unit 12, whether or not the different outdoor unit 10b is connected to the relay unit 30. The outdoor unit control unit 11 of the outdoor unit 10a determines that the different outdoor unit 10b is connected to the relay unit 30 (YES), the process proceeds to the processing in step S210. On the other hand, the outdoor unit control unit 11 of the outdoor unit 10a determines that the different outdoor unit 10b is not connected to the relay unit 30 (NO), the process proceeds to the processing in step S211.

(Step S208)

[0063] Herein, the outdoor unit control unit 11 of the outdoor unit 10a sets a combination of two outdoor units as the number of the outdoor units 10 to be controlled.

Then, the two outdoor units 10a and 10b operate in cooperation with each other. It is noted that setting information of the number of the outdoor units 10 to be controlled is stored in the outdoor unit storage unit 13. Herein, when the plurality of outdoor units 10 operate in cooperation with each other, one of the outdoor units 10 is set as a leader based on a cooling and heating capacity or other information. Then, the outdoor unit 10 set as the leader is configured to perform main control of the air-conditioning system 100. In addition, a communication command for setting the relay unit 30 connected to the outdoor unit 10 of the leader as an operation request destination is transmitted to the indoor unit 20. Then, the indoor unit 20 that has received the communication command sets the relay unit 30 connected to the outdoor unit 10 of the leader as the operation request destination. It is noted that setting information of the operation request destination is stored in the indoor unit storage unit 23.

(Step S209)

[0064] Herein, the outdoor unit control unit 11 of the outdoor unit 10a sets a single outdoor unit as the number of the outdoor units 10 to be controlled. Then, each of the two outdoor units 10a and 10b independently operates. It is noted that the setting information of the number of the outdoor units 10 to be controlled is stored in the outdoor unit storage unit 13. In addition, the communication command for setting the relay unit 30 connected to the outdoor unit 10 of the transmission source as the operation request destination is transmitted to the indoor unit 20. Then, the indoor unit 20 that has received the communication command sets the relay unit 30 connected to the outdoor unit 10 of the transmission source as the operation request destination. It is noted that the setting information of the operation request destination is stored in the indoor unit storage unit 23.

(Step S210)

[0065] Herein, the outdoor unit control unit 11 of the outdoor unit 10a sets a single outdoor unit as the number of the outdoor units 10 to be controlled. Then, each of the two outdoor units 10a and 10b independently operates. It is noted that the setting information of the number of the outdoor units 10 to be controlled is stored in the outdoor unit storage unit 13. In addition, the communication command for setting the outdoor unit 10 of the transmission source as the operation request destination is transmitted to the indoor unit 20. Then, the indoor unit 20 that has received the communication command sets the outdoor unit 10 of the transmission source as the operation request destination. It is noted that the setting information of the operation request destination is stored in the indoor unit storage unit 23.

(Step S211)

[0066] Herein, the outdoor unit control unit 11 of the outdoor unit 10a sets a combination of two outdoor units as the number of the outdoor units 10 to be controlled. Then, the two outdoor units 10a and 10b operate in cooperation with each other. It is noted that the setting information of the number of the outdoor units 10 to be controlled is stored in the outdoor unit storage unit 13. Herein, when the plurality of outdoor units 10 operate in cooperation with each other, one of the outdoor units 10 is set as the leader based on cooling and heating capacity or other information. Then, the outdoor unit 10 set as the leader is configured to perform the main control of the air-conditioning system 100. In addition, the communication command for setting the outdoor unit 10 of the leader as the operation request destination is transmitted to the indoor unit 20. Then, the indoor unit 20 that has received the communication command sets the outdoor unit 10 of the leader as the operation request destination. It is noted that the setting information of the operation request destination is stored in the indoor unit storage unit 23.

[0067] As described above, in the air-conditioning system 100 according to the present Embodiment 2, when the relay unit 30 is set as the control target, the outdoor unit control unit 11 determines whether or not a relay unit 30 connected to the different outdoor unit 10 is of the same type as the relay unit 30 connected to itself based on the identification ID transmitted to the outdoor unit communication unit 12 from the particular communication address after the second communication command is transmitted. When the outdoor unit control unit 11 determines that the relay unit 30 connected to the different outdoor unit 10 is of the same type as the relay unit 30 connected to itself, a combination of outdoor units is set as the number of the outdoor units 10 to be controlled. When the outdoor unit control unit 11 determines that the relay unit 30 connected to the different outdoor unit 10 is not of the same type as the relay unit 30 connected to itself, a single outdoor unit is set as the number of the outdoor units 10 to be controlled.

[0068] On the other hand, when the indoor unit 20 is set as the control target, the outdoor unit control unit 11 determines whether or not the different outdoor unit 10 is connected to a relay unit 30 based on the identification ID transmitted to the outdoor unit communication unit 12 from the particular communication address after the second communication command is transmitted. When the outdoor unit control unit 11 determines that the different outdoor unit 10 is connected to the relay unit 30, a single outdoor unit is set as the number of the outdoor units 10 to be controlled. When the outdoor unit control unit 11 determines that the different outdoor unit 10 is not connected to the relay unit 30, a combination of outdoor units is set as the number of the outdoor units 10 to be controlled.

[0069] As described above, the air-conditioning sys-

tem 100 according to the present Embodiment 2, even when the outdoor unit 10 includes a plurality of outdoor units, it is unnecessary to change the software. For this reason, the number of the outdoor units 10 can be increased without changing the software, and an operation capability can be enhanced. In addition, the control method is changed according to the presence or absence of the relay unit 30 or the type of the relay unit 30. For this reason, the change of the software according to the presence or absence of the relay unit 30 or the type of the relay unit 30 is unnecessary, and it is possible to reduce the labor and the costs when the configuration of the air-conditioning system 100 is changed.

Reference Signs List

[0070] 10 outdoor unit 10a outdoor unit 10b outdoor unit 11 outdoor unit control unit 12 outdoor unit communication unit 13 outdoor unit storage unit 20 indoor unit 21 indoor unit control unit 22 indoor unit communication unit 23 indoor unit storage unit 30 relay unit 30a relay unit 30b relay unit 31 relay unit control unit 32 relay unit communication unit 33 relay unit storage unit 100 air-conditioning system

Claims

1. An air-conditioning system comprising:

an outdoor unit functioning as a heat source device; and
an indoor unit configured to condition air in an air-conditioned space, wherein:

the outdoor unit includes
an outdoor unit control unit configured to search for a relay unit configured to relay heat transfer between the outdoor unit and the indoor unit by exchanging heat of heat media, and
an outdoor unit communication unit configured to communicate with an outside; and
the outdoor unit control unit
transmits a first communication command from the outdoor unit communication unit to a particular communication address, and when a communication response is returned to the outdoor unit communication unit, determines what exists at the particular communication address based on an identification ID transmitted from the particular communication address to the outdoor unit communication unit, and
sets the relay unit as a control target when it is determined that the relay unit exists at the particular communication address, and sets the indoor unit as the control target when it is determined that what exists at the particular communication address is not the relay unit or when the communication response is not returned to the outdoor unit communication unit.

2. The air-conditioning system of claim 1, wherein

when the relay unit is set as the control target, the outdoor unit control unit identifies a type of the relay unit based on the identification ID, and sets a control method according to the type of the relay unit.

3. The air-conditioning system of claim 1 or 2, wherein

after the relay unit or the indoor unit is set as the control target,
the outdoor unit control unit
transmits the first communication command from the outdoor unit communication unit to the particular communication address, and when the communication response is returned to the outdoor unit communication unit, determines what exists at the particular communication address based on the identification ID transmitted from the particular communication address to the outdoor unit communication unit, and
transmits a second communication command to the particular communication address when it is determined that what exists at the particular communication address is a different outdoor unit.

4. The air-conditioning system of claim 3, wherein

when the relay unit is set as the control target, the outdoor unit control unit determines whether or not a relay unit connected to the different outdoor unit is of a same type of the relay unit connected to itself based on the identification ID transmitted from the particular communication address to the outdoor unit communication unit after the second communication command is transmitted, and when it is determined that the relay unit connected to the different outdoor unit is of the same type of the relay unit connected to itself, sets a combination of outdoor units as the number of the outdoor units to be controlled, and sets a single outdoor unit as the number of the outdoor units to be controlled when it is determined that the relay unit connected to the different outdoor unit is not of the same type of the relay unit connected to itself.

5. The air-conditioning system of claim 3 or 4, wherein

when the indoor unit is set as the control target,

the outdoor unit control unit determines whether or not the different outdoor unit is connected to a relay unit based on the identification ID transmitted from the particular communication address to the outdoor unit communication unit after the second communication command is transmitted, and sets a single outdoor unit as the number of the outdoor units to be controlled when it is determined that the different outdoor unit is connected to the relay unit, and sets a combination of outdoor units as the number of the outdoor units to be controlled when it is determined that the different outdoor unit is not connected to the relay unit.

6. The air-conditioning system of claim 4 or 5, wherein when the combination is set as the number of the outdoor units to be controlled, one of the outdoor units is set as a leader based on a cooling and heating capacity.

7. The air-conditioning system of any one of claims 1 to 6, wherein communication addresses are assigned to the outdoor unit and the relay unit based on a predetermined rule.

8. The air-conditioning system of any one of claims 1 to 7, wherein

the outdoor unit includes
an outdoor unit storage unit configured to store unit specification information in which a type of a unit is associated with an identification ID.

9. A control target setting method of an air-conditioning system, the air-conditioning system including

an outdoor unit functioning as a heat source device, and
an indoor unit configured to condition air in an air-conditioned space,
the outdoor unit having
an outdoor unit control unit configured to search for a relay unit configured to relay heat transfer between the outdoor unit and the indoor unit by exchanging heat of heat media, and
an outdoor unit communication unit configured to communicate with an outside, the control target setting method comprising:

transmitting a first communication command from the outdoor unit communication unit to a particular communication address, and when a communication response is returned to the outdoor unit communication unit, determining what exists at the particular communication address based on an identification ID transmitted from the particular communication address to the outdoor unit communication unit; and
setting the relay unit as a control target when it is determined that the relay unit exists at the particular communication address, and setting the indoor unit as the control target when it is determined that what exists at the particular communication address is not the relay unit or when the communication response is not returned to the outdoor unit communication unit.

10. The control target setting method of the air-conditioning system of claim 9, wherein

when the relay unit is set as the control target, a type of the relay unit is identified based on the identification ID, and a control method according to the type of the relay unit is set.

FIG. 1

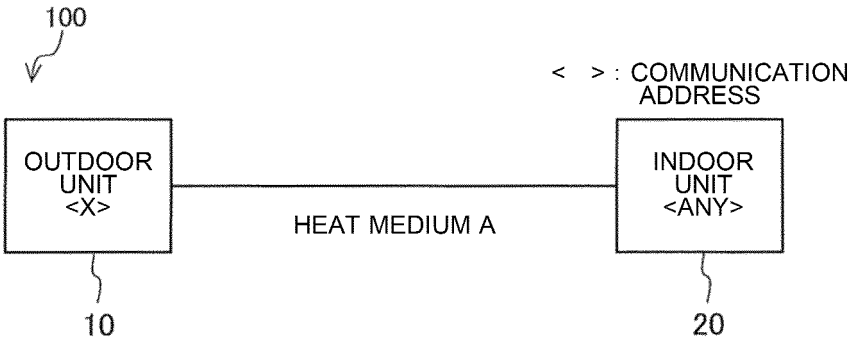

100
< > : COMMUNICATION ADDRESS
OUTDOOR UNIT <X>
HEAT MEDIUM A
INDOOR UNIT <ANY>
10
20

FIG. 2

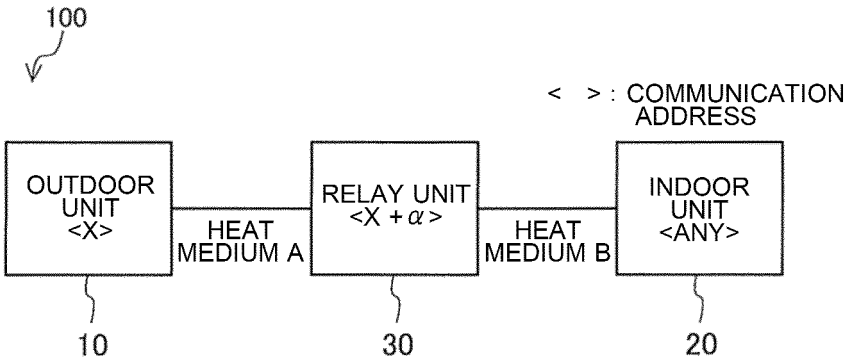

100
< > : COMMUNICATION ADDRESS
OUTDOOR UNIT <X>
HEAT MEDIUM A
RELAY UNIT <X + α>
HEAT MEDIUM B
INDOOR UNIT <ANY>
10
30
20

FIG. 3

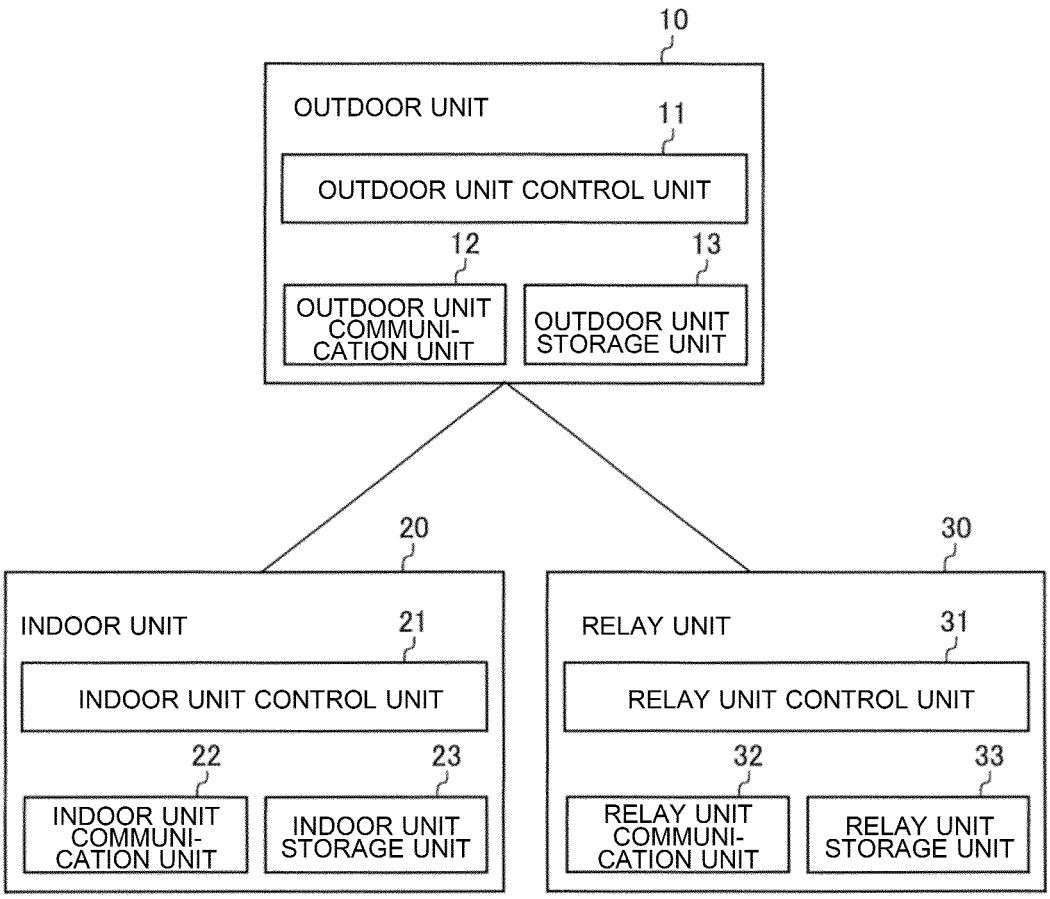

10
OUTDOOR UNIT
11
OUTDOOR UNIT CONTROL UNIT
12
13
OUTDOOR UNIT COMMUNI-CATION UNIT
OUTDOOR UNIT STORAGE UNIT
20
30
INDOOR UNIT
21
INDOOR UNIT CONTROL UNIT
22
23
INDOOR UNIT COMMUNI-CATION UNIT
INDOOR UNIT STORAGE UNIT
RELAY UNIT
31
RELAY UNIT CONTROL UNIT
32
33
RELAY UNIT COMMUNI-CATION UNIT
RELAY UNIT STORAGE UNIT

FIG. 4

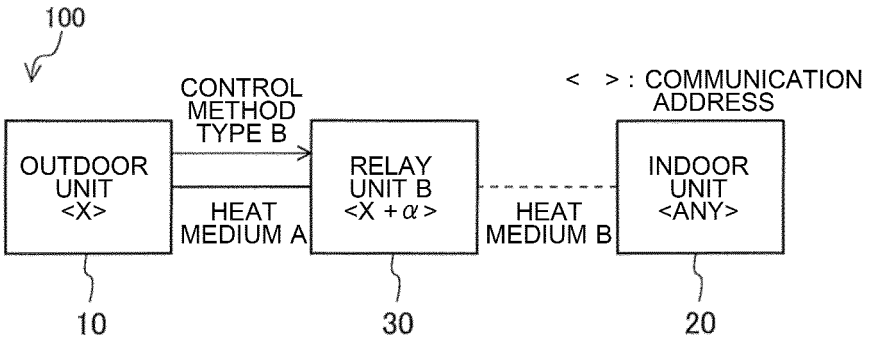

100
CONTROL METHOD TYPE B
< > : COMMUNICATION ADDRESS
OUTDOOR UNIT <X>
HEAT MEDIUM A
RELAY UNIT B <X + α>
HEAT MEDIUM B
INDOOR UNIT <ANY>
10
30
20

FIG. 5

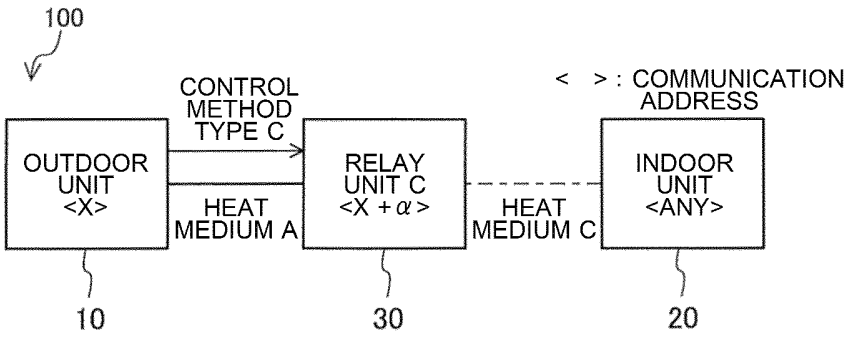

100
CONTROL METHOD TYPE C
< > : COMMUNICATION ADDRESS
OUTDOOR UNIT <X>
HEAT MEDIUM A
RELAY UNIT C <X + α>
HEAT MEDIUM C
INDOOR UNIT <ANY>
10
30
20

FIG. 6

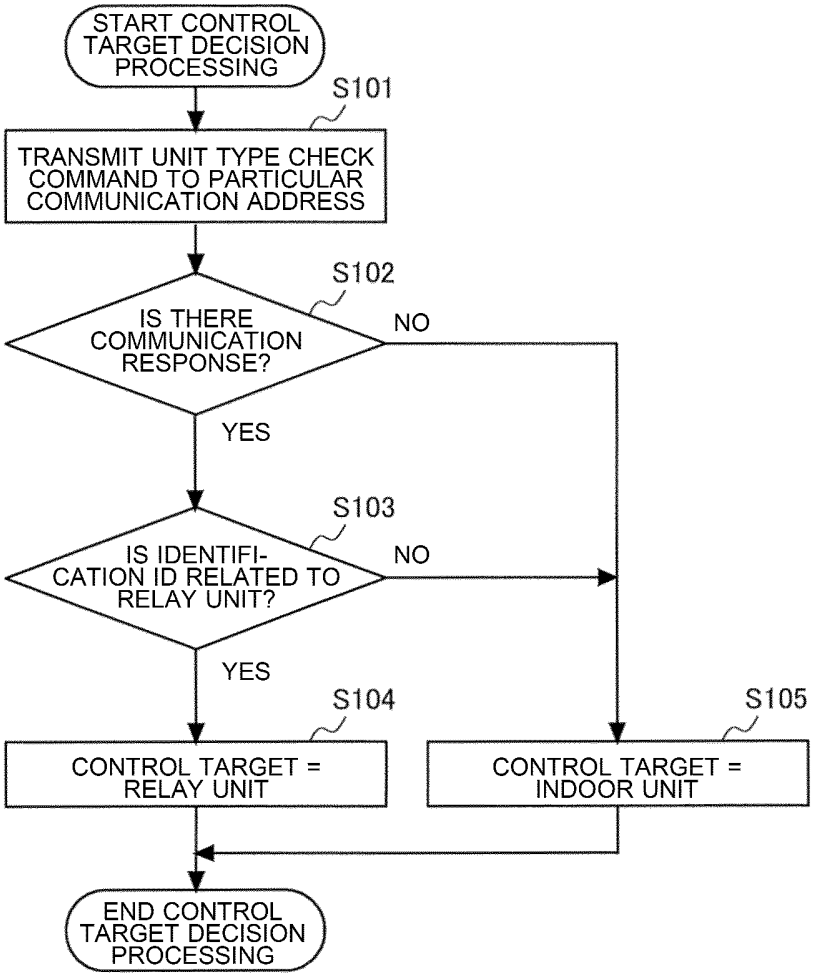

START CONTROL TARGET DECISION PROCESSING
S101
TRANSMIT UNIT TYPE CHECK COMMAND TO PARTICULAR COMMUNICATION ADDRESS
S102
IS THERE COMMUNICATION RESPONSE?
NO
YES
S103
IS IDENTIFI-CATION ID RELATED TO RELAY UNIT?
NO
YES
S104
CONTROL TARGET = RELAY UNIT
S105
CONTROL TARGET = INDOOR UNIT
END CONTROL TARGET DECISION PROCESSING

FIG. 7

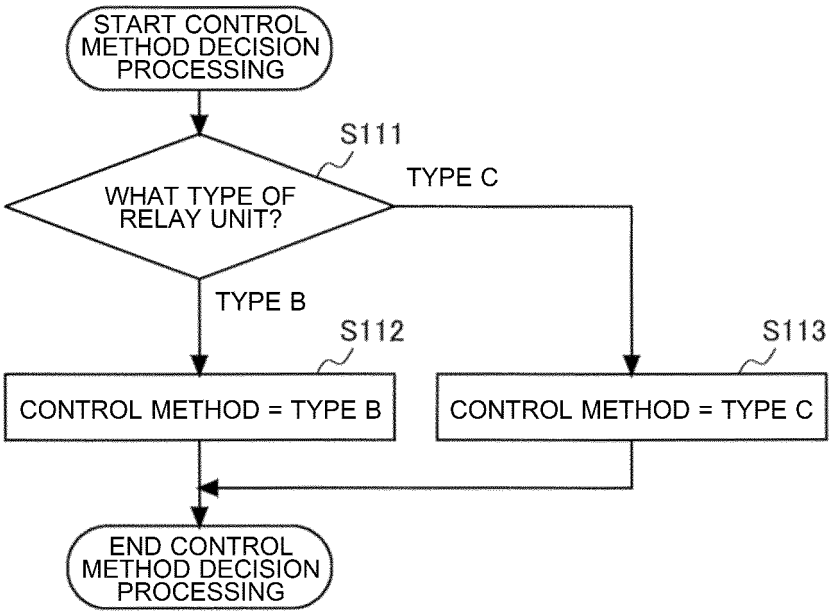

START CONTROL METHOD DECISION PROCESSING
S111
WHAT TYPE OF RELAY UNIT?
TYPE C
TYPE B
S112
S113
CONTROL METHOD = TYPE B
CONTROL METHOD = TYPE C
END CONTROL METHOD DECISION PROCESSING

FIG. 8

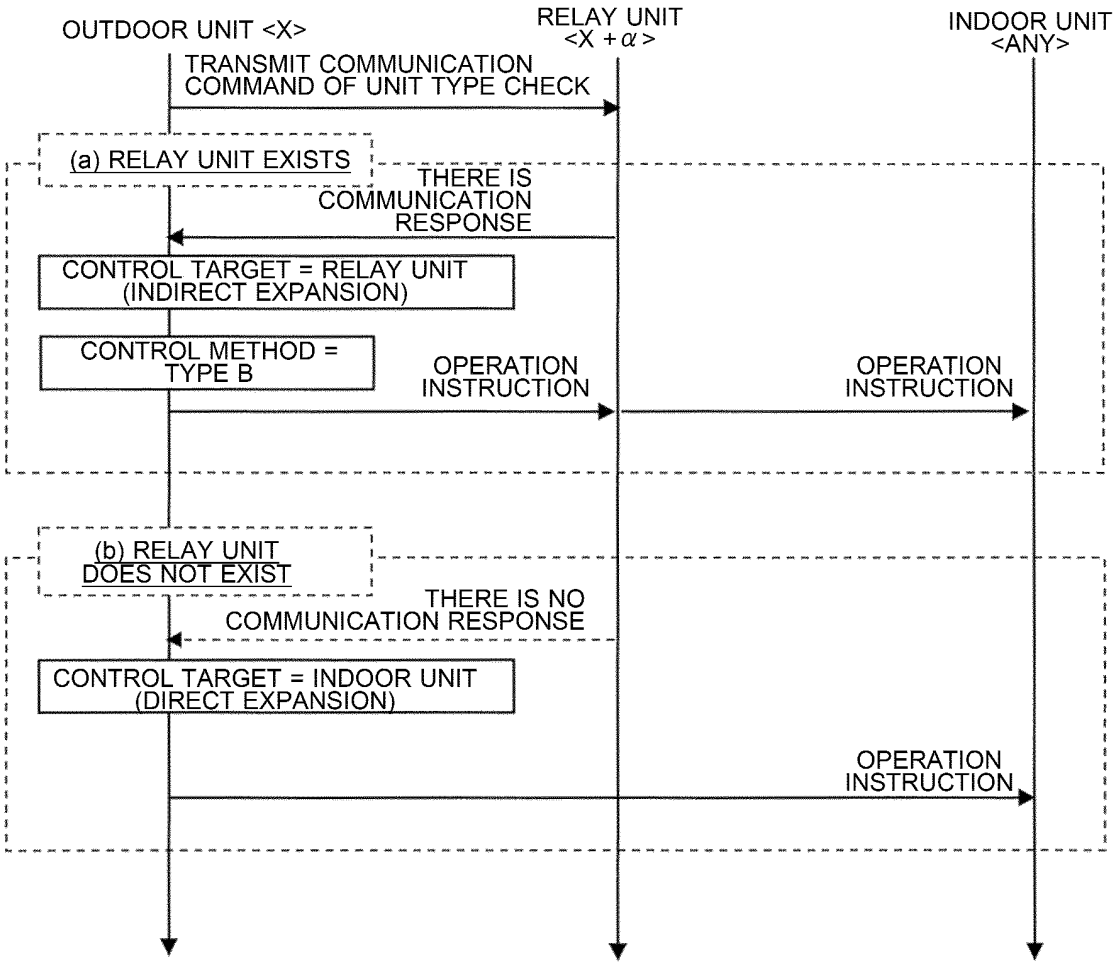

OUTDOOR UNIT <X>
RELAY UNIT <X + α>
INDOOR UNIT <ANY>
TRANSMIT COMMUNICATION COMMAND OF UNIT TYPE CHECK
(a) RELAY UNIT EXISTS
THERE IS COMMUNICATION RESPONSE
CONTROL TARGET = RELAY UNIT (INDIRECT EXPANSION)
CONTROL METHOD = TYPE B
OPERATION INSTRUCTION
OPERATION INSTRUCTION
(b) RELAY UNIT DOES NOT EXIST
THERE IS NO COMMUNICATION RESPONSE
CONTROL TARGET = INDOOR UNIT (DIRECT EXPANSION)
OPERATION INSTRUCTION

FIG. 9

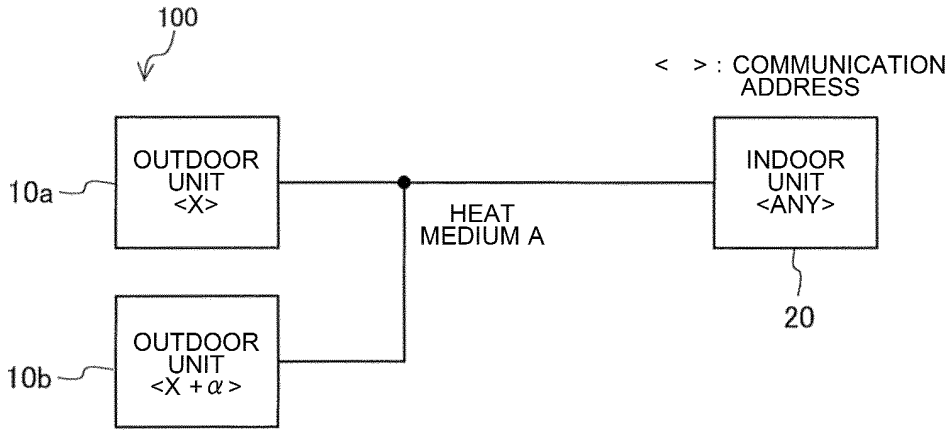

100
< > : COMMUNICATION ADDRESS
10a
OUTDOOR UNIT <X>
10b
OUTDOOR UNIT <X + α>
HEAT MEDIUM A
INDOOR UNIT <ANY>
20

FIG. 10

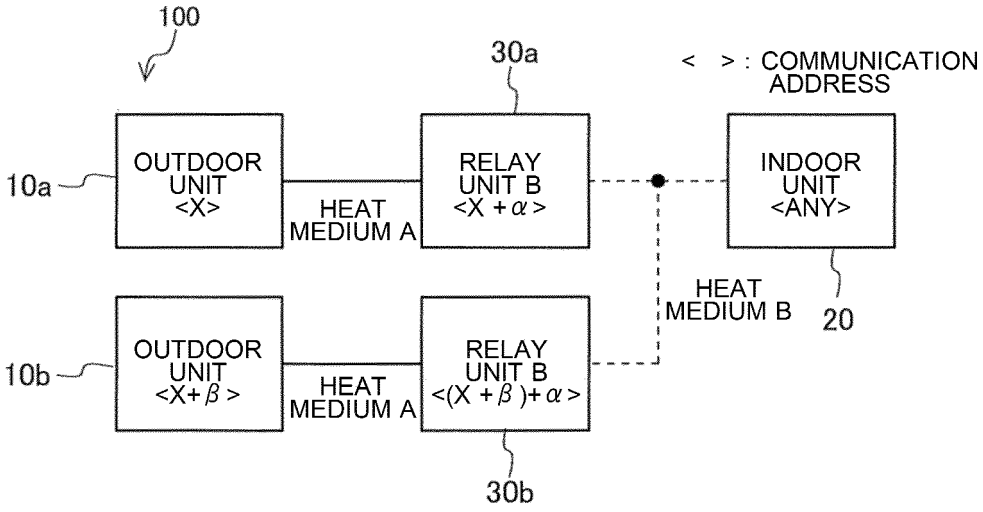

100
30a
< > : COMMUNICATION ADDRESS
10a
OUTDOOR UNIT <X>
HEAT MEDIUM A
RELAY UNIT B <X + α >
INDOOR UNIT <ANY>
HEAT MEDIUM B
20
10b
OUTDOOR UNIT <X+ β >
HEAT MEDIUM A
RELAY UNIT B <(X + β)+ α >
30b

FIG. 11

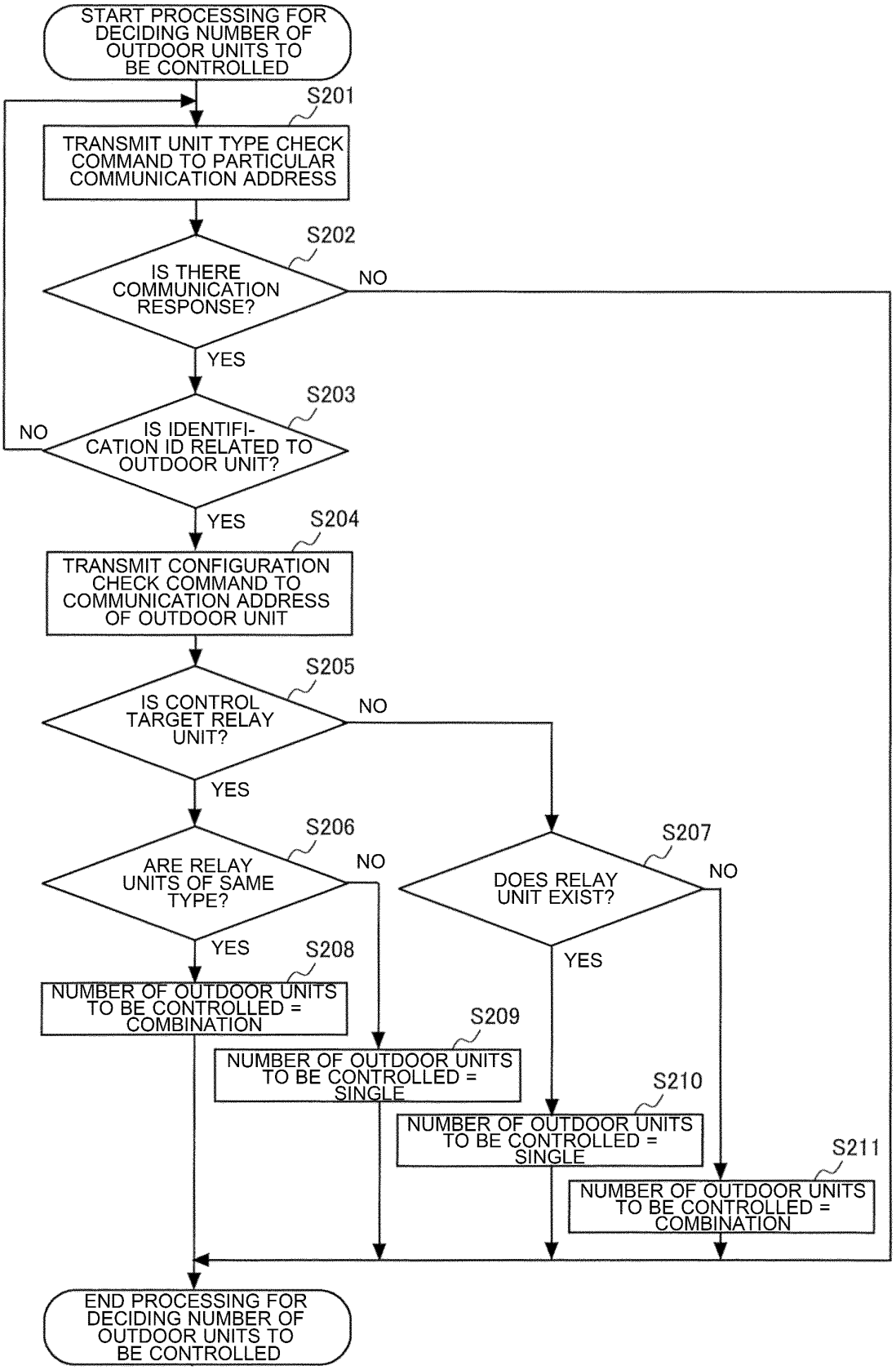

START PROCESSING FOR DECIDING NUMBER OF OUTDOOR UNITS TO BE CONTROLLED
S201
TRANSMIT UNIT TYPE CHECK COMMAND TO PARTICULAR COMMUNICATION ADDRESS
S202
IS THERE COMMUNICATION RESPONSE?
NO
YES
S203
IS IDENTIFI-CATION ID RELATED TO OUTDOOR UNIT?
NO
YES
S204
TRANSMIT CONFIGURATION CHECK COMMAND TO COMMUNICATION ADDRESS OF OUTDOOR UNIT
S205
IS CONTROL TARGET RELAY UNIT?
NO
YES
S206
ARE RELAY UNITS OF SAME TYPE?
NO
YES
S207
DOES RELAY UNIT EXIST?
NO
YES
S208
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = COMBINATION
S209
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = SINGLE
S210
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = SINGLE
S211
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = COMBINATION
END PROCESSING FOR DECIDING NUMBER OF OUTDOOR UNITS TO BE CONTROLLED

FIG. 12

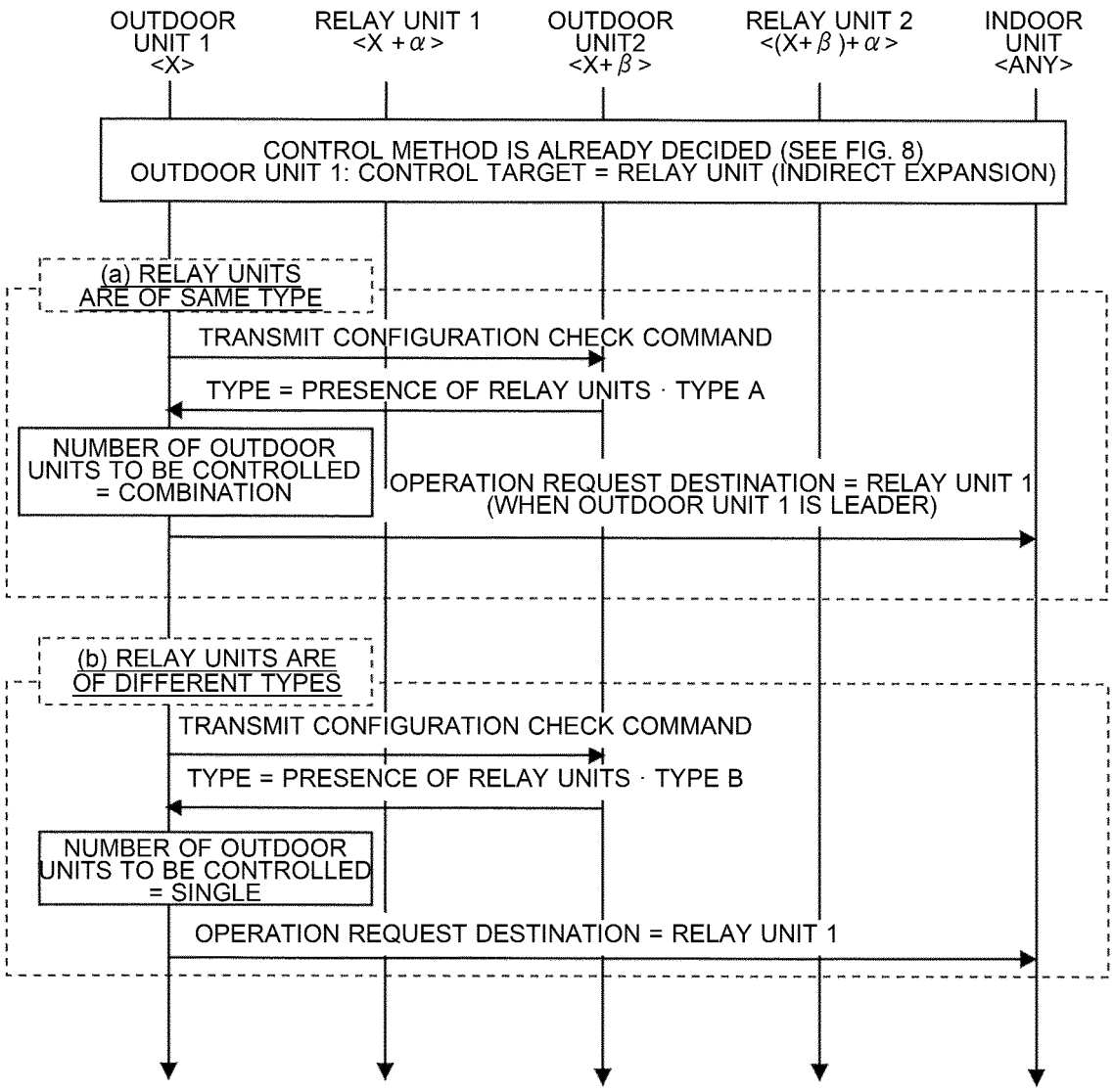
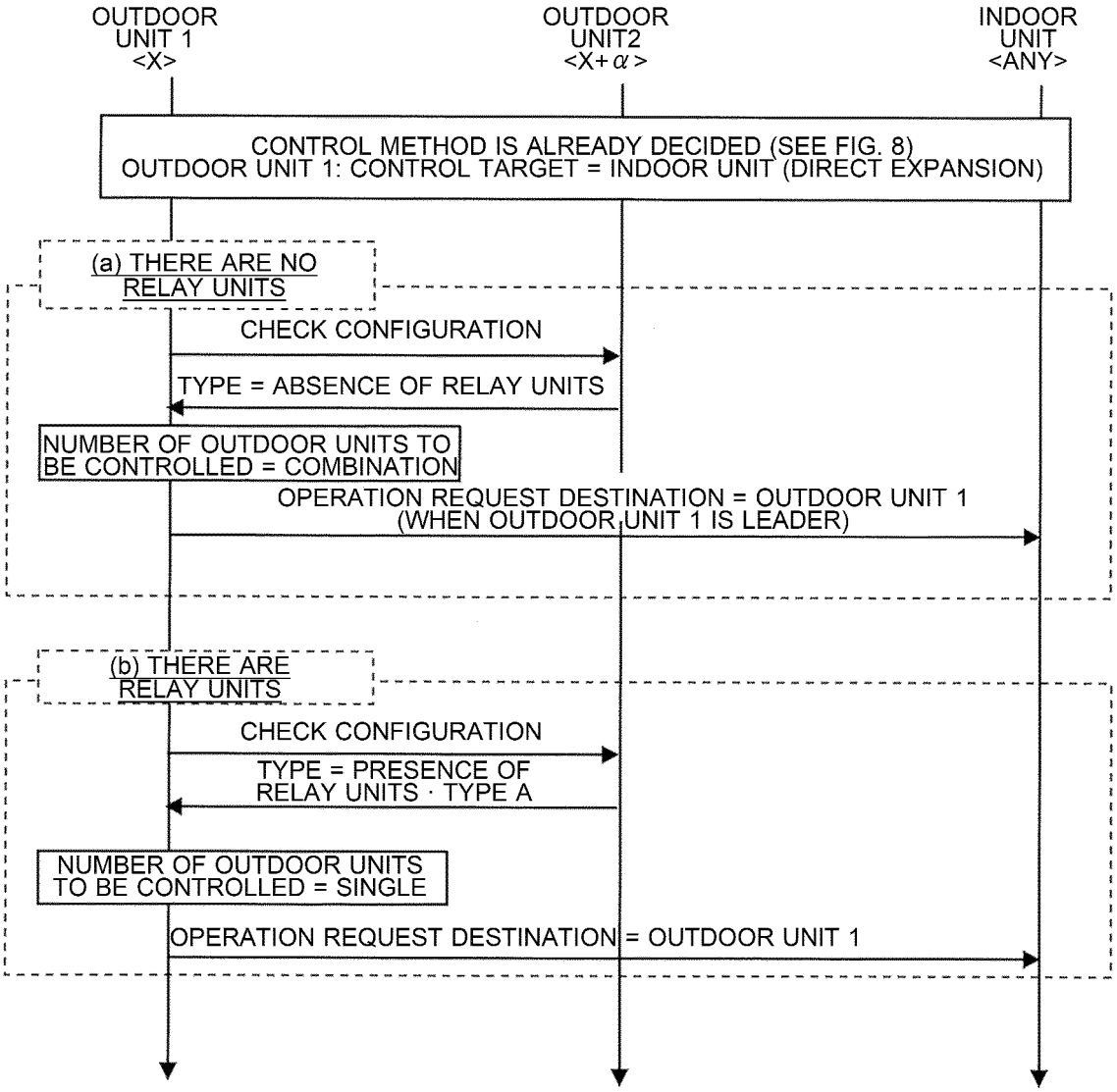

OUTDOOR UNIT 1 <X>
RELAY UNIT 1 <X + α >
OUTDOOR UNIT2 <X+ β >
RELAY UNIT 2 <(X+ β)+ α >
INDOOR UNIT <ANY>
CONTROL METHOD IS ALREADY DECIDED (SEE FIG. 8)
OUTDOOR UNIT 1: CONTROL TARGET = RELAY UNIT (INDIRECT EXPANSION)
(a) RELAY UNITS ARE OF SAME TYPE
TRANSMIT CONFIGURATION CHECK COMMAND
TYPE = PRESENCE OF RELAY UNITS · TYPE A
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = COMBINATION
OPERATION REQUEST DESTINATION = RELAY UNIT 1 (WHEN OUTDOOR UNIT 1 IS LEADER)
(b) RELAY UNITS ARE OF DIFFERENT TYPES
TRANSMIT CONFIGURATION CHECK COMMAND
TYPE = PRESENCE OF RELAY UNITS · TYPE B
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = SINGLE
OPERATION REQUEST DESTINATION = RELAY UNIT 1

FIG. 13


OUTDOOR UNIT 1 <X>
OUTDOOR UNIT2 <X+α>
INDOOR UNIT <ANY>
CONTROL METHOD IS ALREADY DECIDED (SEE FIG. 8)
OUTDOOR UNIT 1: CONTROL TARGET = INDOOR UNIT (DIRECT EXPANSION)
(a) THERE ARE NO RELAY UNITS
CHECK CONFIGURATION
TYPE = ABSENCE OF RELAY UNITS
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = COMBINATION
OPERATION REQUEST DESTINATION = OUTDOOR UNIT 1
(WHEN OUTDOOR UNIT 1 IS LEADER)
(b) THERE ARE RELAY UNITS
CHECK CONFIGURATION
TYPE = PRESENCE OF RELAY UNITS · TYPE A
NUMBER OF OUTDOOR UNITS TO BE CONTROLLED = SINGLE
OPERATION REQUEST DESTINATION = OUTDOOR UNIT 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/040517

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F24F11/50(2018.01)i, F24F5/00(2006.01)i, F24F11/58(2018.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F24F11/50, F24F5/00, F24F11/58

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	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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.
A	WO 2011/114368 A1 (MITSUBISHI ELECTRIC CORPORATION) 22 September 2011, paragraphs [0015]-[0097], fig. 1-11 & US 2012/0297812 A1, paragraphs [0032]-[0117], fig. 1-11 & EP 2549201 A1 & CN 102812309 A	1-10
A	JP 8-14634 A (TOSHIBA CORPORATION) 19 January 1996, paragraphs [0024]-[0079], fig. 1-6 (Family: none)	1-10

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

* Special categories of cited documents:
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"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
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"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
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18.01.2019	29.01.2019

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

International application No.
PCT/JP2018/040517

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 7-113543 A (TOSHIBA CORPORATION) 02 May 1995, entire text, all drawings (Family: none)	1-10
A	JP 2014-150386 A (FUJITSU GENERAL LIMITED) 21 August 2014, entire text, all drawings (Family: none)	1-10

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5236008 B **[0004]**