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

(11) **EP 2 746 687 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.06.2014 Bulletin 2014/26

(51) Int Cl.:
F24F 11/00 *(2006.01)*

(21) Application number: **13191572.0**

(22) Date of filing: **05.11.2013**

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

(30) Priority: **20.12.2012 JP 2012278259**

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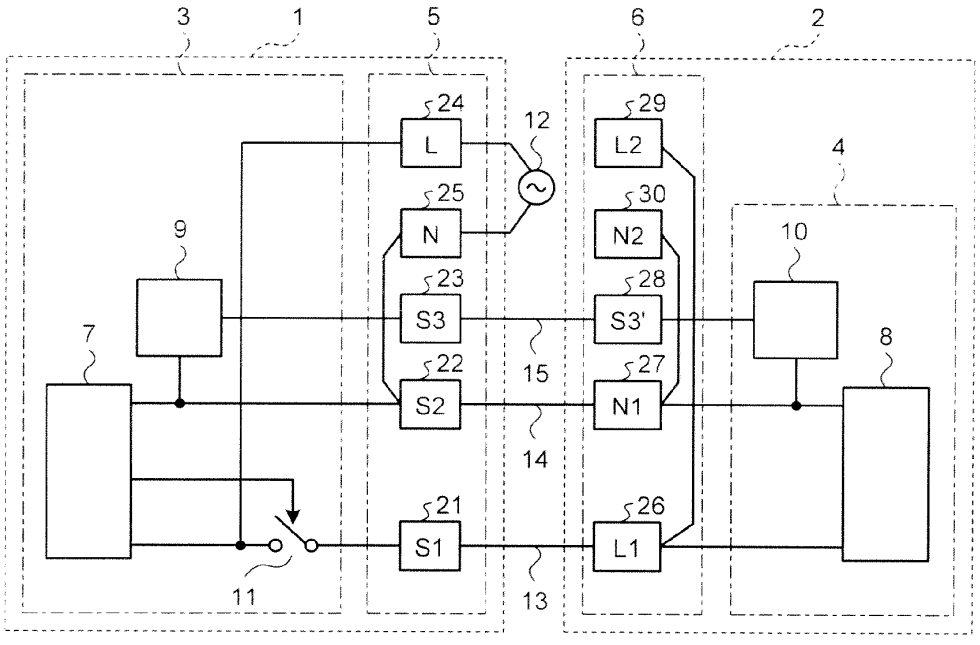
(54) **Air conditioner**

(57) When the indoor-unit-side control board (3) starts to receive power, it is determined whether communication from the outdoor-unit-side communication circuit (10) to the indoor-unit-side communication circuit (9) is performed normally. If the communication from the outdoor-unit-side communication circuit to the indoor-unit-side communication circuit is performed normally, it is determined that the air conditioner is operated under the outdoor-unit power receiving system and power-supply control is performed. If the communication from the outdoor-unit-side communication circuit to the indoor-unit-side communication circuit is not performed normally, it is determined that the air conditioner is operated under the indoor-unit power receiving system and power-supply control is performed.

FIG.1



EP 2 746 687 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an air conditioner.

2. Description of the Related Art

[0002] In conventional air conditioners, as a power receiving system for receiving commercial power supply, there are a system (hereinafter, referred to as an "indoor-unit power receiving system") in which commercial power supply supplied to an indoor unit is supplied to an outdoor unit via a power line and a system (hereinafter, referred to as an "outdoor-unit power receiving system") in which commercial power supply is received on an outdoor unit side and then supplied to an indoor unit. Typically, in the indoor-unit power receiving system, in order to reduce power consumption when the air conditioner is on operational standby (hereinafter, referred to as "standby power"), a power relay is provided on the power supply path from the indoor unit to the outdoor unit and, when the air conditioner is on operational standby, the feeding of power to the outdoor unit is stopped. However, in the outdoor-unit power receiving system, a power relay is not necessary.

[0003] An example of a method of switching between the indoor-unit power receiving system and the outdoor-unit power receiving system is a method in which a power-receiving-system data unit, which includes a memory device or a switching unit, such as a jumper wire and a switch, is included and switching is performed between the indoor-unit power receiving system and the outdoor-unit power receiving system on the basis of the information, which is stored in the memory device, for distinguishing between the indoor-unit power receiving system and the outdoor-unit power receiving system, the presence or absence or the position of the jumper wire, or the switching of the switching unit (for example, see Japanese Patent Application Laid-open 2012-117704).

[0004] In conventional air conditioners, representative of which is the air conditioner disclosed in Japanese Patent Application Laid-open 2012-117704, it is necessary to set whether the air conditioner is the indoor power receiving type or the outdoor power receiving type by setting the information, which is stored in the memory device, or setting the jumper wire and the switching unit when the product is shipped, or by the installation technician when the air conditioner is installed.

[0005] In a case where the setting described above is performed when the product is shipped, it is necessary to prepare an indoor unit and an indoor control board for each of the indoor power receiving type or the outdoor power receiving type. Moreover, it is necessary to handle an indoor unit and an indoor control board for each of the indoor power receiving type or the outdoor power receiving type. Therefore, there is a problem in that the handling cost increases when the product is manufactured or after the product is shipped.

[0006] In a case where the setting described above is performed when the air conditioner is installed, a failure, such as an abnormal operation due to an incorrect setting, may occur. Moreover, when the air conditioner is installed, it is necessary to mount components, such as a jumper wire and a switching unit, in order to perform the setting described above; therefore, there is a problem in that the component cost and the component mounting cost increase.

[0007] The present invention is achieved in view of the above and has an object to provide an air conditioner capable of automatically switching between the indoor-unit power receiving system and the outdoor-unit power receiving system in accordance with the situation when the air conditioner is installed without requiring components for setting whether the air conditioner is the indoor power receiving type or the outdoor power receiving type and without requiring a setting operation when the product is shipped or when the product is installed.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0009] According to an aspect of the present invention, an air conditioner that includes an indoor unit and an outdoor unit, and is capable of using both an indoor-unit power receiving system, in which a commercial power supply supplied to the indoor unit is supplied to the outdoor unit via a power line, and an outdoor-unit power receiving system, in which the commercial power supply supplied to the outdoor unit is supplied to the indoor unit via the power line, wherein the indoor unit includes a communication circuit that performs a predetermined communication with the outdoor unit via a communication line, and a power-supply control circuit that performs power-supply control in accordance with whether communication with the outdoor unit by the communication circuit is possible, and when power starts to be received, if communication with the outdoor unit by the communication circuit is possible, the power-supply control circuit determines that the outdoor-unit power receiving system is used and performs power-supply control, and, if communication with the outdoor unit by the communication circuit is not possible, the power-supply control circuit determines that the indoor-unit power receiving system is used and performs power-supply control.

[0010] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a diagram illustrating an example of wiring of an indoor-unit power receiving system in one example configuration of an air conditioner according to an embodiment;

FIG. 2 is a diagram illustrating an example of wiring of an outdoor-unit power receiving system in one example configuration of the air conditioner according to the embodiment; and

FIG. 3 is a diagram illustrating an example of a power-receiving-system determination flow in an indoor unit of the air conditioner according to the embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Exemplary embodiments of an air conditioner according to the present invention will be explained below in detail with reference to the accompanying drawings. The present invention is not limited to the embodiments.

Embodiment

<Configuration>

[0013] FIG. 1 is a diagram illustrating an example of wiring of an indoor-unit power receiving system in one example configuration of an air conditioner according to the embodiment. FIG. 2 is a diagram illustrating an example of wiring of an outdoor-unit power receiving system in one example configuration of the air conditioner according to the embodiment. As illustrated in FIG. 1 and FIG. 2, the air conditioner according to the present embodiment includes an indoor unit 1 and an outdoor unit 2.

[0014] The indoor unit 1 includes an indoor-unit-side control board 3 and an indoor-unit-side terminal block 5. The indoor-unit-side control board 3 includes an indoor-unit-side power-supply control circuit 7, an indoor-unit-side communication circuit 9, and a relay for supplying commercial power supply (hereinafter, simply referred to as a "relay") 11. In a case where the air conditioner is operated under the indoor-unit power receiving system, the relay 11 has a function of stopping the supply of a commercial power supply 12 to the outdoor unit 2 when the air conditioner is on operational standby.

[0015] The indoor-unit-side terminal block 5 includes an S1 terminal (first terminal) 21 that is connected to the ungrounded-side power-supply input terminal of the indoor-unit-side power-supply control circuit 7 via the relay 11; an S2 terminal (second terminal) 22 that is connected to the grounded-side power-supply input terminal of the indoor-unit-side power-supply control circuit 7; an S3 terminal (third terminal) 23 that is connected to the grounded-side power-supply input terminal of the indoor-unit-side power-supply control circuit 7 via the indoor-unit-side communication circuit 9; an L terminal (fourth terminal) 24 that is connected to the ungrounded-side power-supply input terminal of the indoor-unit-side power-supply control circuit 7; and an N terminal (fifth terminal) 25 that is connected to the S2 terminal 22.

[0016] When the air conditioner according to the embodiment is operated under the indoor-unit power receiving system, the L terminal (fourth terminal) 24 and the N terminal (fifth terminal) 25 are connected to the commercial power supply 12. When the air conditioner according to the embodiment is operated under the outdoor-unit power receiving system, the L terminal (fourth terminal) 24 and the N terminal (fifth terminal) 25 form a pair of commercial-power-supply input paths to which the commercial power supply 12 is input via the outdoor unit 2. When the air conditioner according to the embodiment is operated under the indoor-unit power receiving system, the S1 terminal (first terminal) 21 and the S2 terminal (second terminal) 22 form a pair of commercial-power-supply output paths that supplies the commercial power supply 12 input to the L terminal (fourth terminal) 24 and the N terminal (fifth terminal) 25 to the outdoor unit 2 via the relay 11.

[0017] The outdoor unit 2 includes an outdoor-unit-side control board 4 and an outdoor-unit-side terminal block 6. The outdoor-unit-side control board 4 includes an outdoor-unit-side power-supply control circuit 8 and an outdoor-unit-side communication circuit 10.

[0018] The outdoor-unit-side terminal block 6 includes an L1 terminal (sixth terminal) 26 that is connected to the ungrounded-side power-supply input terminal of the outdoor-unit-side power-supply control circuit 8; an N1 terminal (seventh terminal) 27 that is connected to the grounded-side power-supply input terminal of the outdoor-unit-side power-supply control circuit 8; an S3' terminal (eighth terminal) 28 that is connected to the grounded-side power-supply input terminal of the outdoor-unit-side power-supply control circuit 8 via the outdoor-unit-side communication circuit 10; an L2 terminal (ninth terminal) 29 that is connected to the L1 terminal 26; and an N2 terminal (tenth terminal) 30 that is connected to the N1 terminal 27.

[0019] When the air conditioner according to the embodiment is operated under the indoor-unit power receiving system, the commercial power supply 12 is input to the L1 terminal (sixth terminal) 26 and the N1 terminal (seventh terminal) 27 via the indoor unit 1. When the air conditioner according to the embodiment is operated under the outdoor-unit power receiving system, the L1 terminal (sixth terminal) 26 and the N1 terminal (seventh terminal) 27 form a pair of commercial-power-supply input paths to which the commercial power supply 12 is connected. When the air conditioner according to the embodiment is operated under the outdoor-unit power receiving system, the L2 terminal (ninth terminal) 29 and the N2 terminal (tenth terminal) 30 form a pair of commercial-power-supply output paths that supplies the

commercial power supply 12 input to the L1 terminal (sixth terminal) 26 and the N1 terminal (seventh terminal) 27 to the indoor unit 1.

[0020] The example illustrated in FIG. 1 illustrates an example of wiring of the indoor-unit power receiving system as described above. The commercial power supply 12 is connected between the L terminal 24 and the N terminal 25 on the indoor unit 1 side; the S1 terminal 21 on the indoor unit 1 side and the L1 terminal 26 on the outdoor unit 2 side are connected by a power line 13; the S2 terminal 22 on the indoor unit 1 side and the N1 terminal 27 on the outdoor unit 2 side are connected by a power-supply and communication common line 14; and the S3 terminal 23 on the indoor unit 1 side and the S3' terminal 28 on the outdoor unit 2 side are connected by a communication line 15. With such connections, the power supplied between the L terminal 24 and the N terminal 25 of the indoor-unit-side terminal block 5 from the commercial power supply 12 is supplied to the indoor-unit-side power-supply control circuit 7 and the power is also supplied to the outdoor-unit-side power-supply control circuit 8 via the power line 13 and the power-supply and communication common line 14 by the indoor-unit-side power-supply control circuit 7 closing the relay 11.

[0021] The example illustrated in FIG. 2 illustrates an example of wiring of the outdoor-unit power receiving system as described above. The commercial power supply 12 is connected between the L1 terminal 26 and the N1 terminal 27 on the outdoor unit 2 side; the L terminal 24 on the indoor unit 1 side and the L2 terminal 29 on the outdoor unit 2 side are connected by the power line 13; the N terminal 25 on the indoor unit 1 side and the N2 terminal 30 on the outdoor unit 2 side are connected by the power-supply and communication common line 14; and the S3 terminal 23 on the indoor unit 1 side and the S3' terminal 28 on the outdoor unit 2 side are connected by the communication line 15. With such connections, the power supplied between the L1 terminal 26 and the N1 terminal 27 of the outdoor-unit-side terminal block 6 from the commercial power supply 12 is supplied to the outdoor-unit-side power-supply control circuit 8 and the power is also supplied to the indoor-unit-side power-supply control circuit 7 via the power line 13 and the power-supply and communication common line 14.

[0022] The indoor-unit-side communication circuit 9 performs a predetermined communication with the outdoor-unit-side communication circuit 10 of the outdoor-unit-side control board 4 via the communication line 15 and the power-supply and communication common line 14.

[0023] In the example of the wiring of the indoor-unit power receiving system illustrated in FIG. 1, when the commercial power supply 12 is supplied between the L terminal 24 and the N terminal 25 of the indoor unit 1, the power is supplied to the indoor-unit-side power-supply control circuit 7 from the commercial power supply 12. However, in the present embodiment, the relay 11 is open at this point; therefore, the power is not supplied to the outdoor-unit-side control board 4. Thus, at this point, the power is not supplied to the outdoor-unit-side communication circuit 10 and communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is not established.

[0024] When the air conditioner according to the present embodiment is on operational standby, if the air conditioner receives an operation start signal to operate the air conditioner from a wireless remote controller (not illustrated) or the like, the indoor-unit-side power-supply control circuit 7 shorts the relay 11 to supply power to the outdoor-unit-side control board 4. When power is supplied to the outdoor-unit-side control board 4, a predetermined communication is performed between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10.

[0025] In contrast, when the air conditioner according to the present embodiment is in operation, if the air conditioner receives an operation stop signal to stop the air conditioner from a wireless remote controller (not illustrated) or the like, the indoor-unit-side power-supply control circuit 7 opens the relay 11 to stop supplying power to the outdoor-unit-side control board 4. As described above, in the example of the wiring of the indoor-unit power receiving system, the standby power can be reduced by stopping the supply of power to the outdoor-unit-side control board 4 when the air conditioner is on operational standby.

[0026] Although not illustrated, the indoor unit 1 is provided with an indoor heat exchanger, an indoor fan, a sensor, a display, and the like, which are a mechanical system. In a similar manner, the outdoor unit 2 is provided with an outdoor heat exchanger, an outdoor fan, a refrigerant switching valve, a compressor, and the like, which are a mechanical system.

[0027] In the example of the wiring of the outdoor-unit power receiving system illustrated in FIG. 2, when the commercial power supply 12 is supplied between the L1 terminal 26 and the N1 terminal 27 of the outdoor unit 2, the power is supplied to the indoor-unit-side control board 3 and the outdoor-unit-side control board 4 but not via the relay 11. Moreover, while the commercial power supply 12 continues to be supplied, the power is supplied to the indoor-unit-side control board 3 and the outdoor-unit-side control board 4; therefore, communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is established. In this example of the wiring of the outdoor-unit power receiving system, communication is always performed while the commercial power supply 12 continues to be supplied. Thus, the latest information can always be shared between the indoor unit 1 and the outdoor unit 2; therefore, the startup when the operation is started can be made faster.

[0028] The above is an explanation of the configuration of the air conditioner according to the present embodiment. Next, the operation of the air conditioner according to the present embodiment will be explained.

<Operation>

[0029] In the examples illustrated in FIG. 1 and FIG. 2, an explanation is made of example configurations that can use both the indoor-unit power receiving system and the outdoor-unit power receiving system with the same indoor-unit-side control board 3. An explanation will be made of the power-receiving-system determination procedure in the indoor unit of the air conditioner according to the present embodiment with reference to FIG. 1 to FIG. 3. FIG. 3 is a diagram illustrating an example of a power-receiving-system determination flow in the indoor unit of the air conditioner according to the embodiment.

[0030] When the indoor-unit-side control board 3 of the indoor unit 1 starts to receive power (Step ST101), the indoor-unit-side power-supply control circuit 7 determines whether communication from the outdoor-unit-side communication circuit 10 to the indoor-unit-side communication circuit 9 is performed normally (Step ST102). As described above, at this point, the relay 11 is open (OFF).

[0031] As a method of determining whether communication from the outdoor-unit-side communication circuit 10 to the indoor-unit-side communication circuit 9 is performed normally, for example, it is satisfactory to determine whether the indoor-unit-side communication circuit 9 receives a signal in a preset format from the outdoor-unit-side communication circuit 10. The method of determining whether communication from the outdoor-unit-side communication circuit 10 to the indoor-unit-side communication circuit 9 is performed normally does not limit the present invention.

[0032] If the communication from the outdoor-unit-side communication circuit 10 to the indoor-unit-side communication circuit 9 is performed normally (Yes in Step ST102), it is determined that the air conditioner is operated under the outdoor-unit power receiving system (Step ST103) and the power-receiving-system determination flow ends. Thereafter, the control is performed on the assumption that power continues to be supplied to the indoor-unit-side control board 3 and the air conditioner is operated under the outdoor-unit power receiving system until the indoor unit 1 is reset. When the control is performed on the assumption that the air conditioner is operated under the outdoor-unit power receiving system, the control of shorting and opening of the relay 11 is not performed.

[0033] If the communication from the outdoor-unit-side communication circuit 10 to the indoor-unit-side communication circuit 9 is not performed normally (No in Step ST102), a count is made of the number of times the communication from the outdoor-unit-side communication circuit 10 to the indoor-unit-side communication circuit 9 is not performed normally from when the power starts to be supplied to the indoor-unit-side control board 3 (the number of times the communication fails), and it is determined whether the number of times the communication fails exceeds a predetermined number of times (n times in this example) (Step ST104). If the number of times the communication fails does not exceed the predetermined number of times (n times in this example) (No in Step ST104), the process returns to Step ST102. If the number of times the communication fails exceeds the predetermined number of times (n times in this example) (Yes in Step ST104), it is determined that the air conditioner is operated under the indoor-unit power receiving system (Step ST105) and the air conditioner transitions to an operational standby state (Step ST106).

[0034] In Step ST104, for example, it is possible to count the elapsed time (communication failure elapsed time) from when the power starts to be supplied to the indoor-unit-side control board 3 instead of using the method of counting the number of times the communication fails from when the power starts to be supplied to the indoor-unit-side control board 3 and then to determine whether the communication failure elapsed time exceeds a predetermined time (x seconds in this example). In this case, it is satisfactory that if the communication failure elapsed time does not exceed the predetermined time (x seconds in this example) (No in Step ST104), the process returns to Step ST102, and, if the communication failure elapsed time exceeds the predetermined time (x seconds in this example) (Yes in Step ST104), it is determined that the air conditioner is operated under the indoor-unit power receiving system (Step ST105) and the air conditioner transitions to an operational standby state (Step ST106). Alternatively, the following method may also be used. Specifically, both the number of times the communication fails and the communication failure elapsed time are counted and it is determined whether any one of them exceeds a predetermined value. If the number of times the communication fails or the communication failure elapsed time does not exceed the predetermined value (n times or x seconds) (No in Step ST104), the process returns to Step ST102. If the number of times the communication fails or the communication failure elapsed time exceeds the predetermined value (n times or x seconds) (Yes in Step ST104), it is determined that the air conditioner is operated under the indoor-unit power receiving system (Step ST105) and the air conditioner transitions to an operational standby state (Step ST106).

[0035] Thereafter, when an operation start signal is received from a wireless remote controller (not illustrated) or the like, the indoor-unit-side power-supply control circuit 7 shorts (ON) the relay 11 (Step ST107). Consequently, power is supplied to the outdoor unit 2.

[0036] Next, the indoor-unit-side power-supply control circuit 7 determines whether communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is performed normally (Step ST108). As a method of determining whether communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is performed normally, for example, it is satisfactory to determine whether the indoor-unit-side communication circuit 9 receives a response signal from the outdoor-

unit-side communication circuit 10 in response to the signal transmitted from the indoor-unit-side communication circuit 9. The method of determining whether communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is performed normally does not limit the present invention.

[0037] If the communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is performed normally (Yes in Step ST108), a normal control in the case of the indoor-unit power receiving system is performed, for example, the operation of the air conditioner is started (Step ST109) and the power-receiving-system determination flow ends.

[0038] If the communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is not performed normally (No in Step ST108), a count is made of the number of times the communication between the indoor-unit-side communication circuit 9 and the outdoor-unit-side communication circuit 10 is not performed normally from when the power starts to be supplied to the outdoor-unit-side control board 4 (number of times the communication fails), and it is determined whether the number of times the communication fails exceeds a predetermined number of times (m times in this example) (Step ST110). If the number of times the communication fails does not exceed the predetermined number of times (m times in this example) (No in Step ST110), the process returns to Step ST108. If the number of times the communication fails exceeds the predetermined number of times (m times in this example) (Yes in Step ST110), the indoor-unit-side power-supply control circuit 7 determines that a communication error has occurred, opens (OFF) the relay 11 to stop the supply of power to the outdoor unit 2, and performs an abnormal-time control of announcing the occurrence of a communication error by performing a process of, for example, indicating an abnormality on a display (not illustrated) or making a warning sound (Step ST111), and the power-receiving-system determination flow ends.

[0039] In Step ST110, for example, it is possible to count the elapsed time (communication failure elapsed time) from when the power starts to be supplied to the outdoor-unit-side control board 4 instead of using the method of counting the number of times the communication fails from when the power starts to be supplied to the outdoor-unit-side control board 4 and then to determine whether the communication failure elapsed time exceeds a predetermined time (y seconds in this example). In this case, it is satisfactory that if the communication failure elapsed time does not exceed the predetermined time (y seconds in this example) (No in Step ST110), the process returns to Step ST108, and, if the communication failure elapsed time exceeds the predetermined time (y seconds in this example) (Yes in Step ST110), it is determined that a communication error has occurred, and the supply of power to the outdoor unit 2 is stopped by opening (OFF) the relay 11 and an abnormal-time control as described above is performed (Step ST111). Alternatively, the following method may also be used. Specifically, both the number of times the communication fails and the communication failure elapsed time are counted and it is determined whether any one of them exceeds a predetermined value. If the number of times the communication fails or the communication failure elapsed time does not exceed the predetermined value (m times or y seconds) (No in Step ST110), the process returns to Step ST108. If the number of times the communication fails or the communication failure elapsed time exceeds the predetermined value (m times or y seconds) (Yes in Step ST110), it is determined that a communication error has occurred, and the supply of power to the outdoor unit 2 is stopped by opening (OFF) the relay 11 and an abnormal-time control as described above is performed (Step ST111).

<Effect>

[0040] As described above, according to the air conditioner in the present embodiment, when the indoor-unit-side control board starts to receive power, it is determined whether communication from the outdoor-unit-side communication circuit to the indoor-unit-side communication circuit is performed normally. If the communication from the outdoor-unit-side communication circuit to the indoor-unit-side communication circuit is performed normally, power-supply control is performed on the assumption that the air conditioner is operated under the outdoor-unit power receiving system. If the communication from the outdoor-unit-side communication circuit to the indoor-unit-side communication circuit is not performed normally, power-supply control is performed on the assumption that the air conditioner is operated under the indoor-unit power receiving system. Therefore, it is possible to automatically switch between the indoor-unit power receiving system and the outdoor-unit power receiving system in accordance with the situation when the product is installed without requiring components for setting whether the air conditioner is the indoor power receiving type or the outdoor power receiving type and without requiring a setting operation when the product is shipped or when the product is installed. Therefore, the handling cost when the product is manufactured or after the product is shipped, and the component cost and component mounting cost can be reduced.

[0041] Moreover, the air conditioner can use both the indoor-unit power receiving system and the outdoor-unit power receiving system with the same indoor-unit-side control board; therefore, it is not necessary to develop an indoor-unit-side control board or software for controlling the indoor-unit-side control board for each of the indoor power receiving type and the outdoor power receiving type. Thus, the development cost can be reduced and the development period can be shortened.

[0042] In the above embodiment, an explanation is made of a case of a single connection configuration in which one indoor unit is connected to one outdoor unit; however, it is obvious that the same effect can be obtained even with a multiple connection configuration in which a plurality of indoor units are connected to one outdoor unit.

[0043] Moreover, the configurations illustrated in the above embodiment are examples of the configuration of the present invention and it is obvious that the configurations can be combined with other publicly known technologies and the configurations can be changed, for example, by omitting a part thereof without departing from the scope of the present invention.

[0044] According to the present invention, an effect is obtained where it is possible to automatically switch between the indoor-unit power receiving system and the outdoor-unit power receiving system in accordance with the situation when the product is installed without requiring components for setting whether the air conditioner is the indoor power receiving type or the outdoor power receiving type and without requiring a setting operation when the product is shipped or when the product is installed and thus the handling cost when the product is manufactured or after the product is shipped, and the component cost and component mounting cost can be reduced.

[0045] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. An air conditioner that includes an indoor unit (1) and an outdoor unit (2), and is capable of using both an indoor-unit power receiving system, in which a commercial power supply (12) supplied to the indoor unit is supplied to the outdoor unit via a power line (13), and an outdoor-unit power receiving system, in which the commercial power supply supplied to the outdoor unit is supplied to the indoor unit via the power line, wherein
   the indoor unit includes
   a communication circuit (9) that performs a predetermined communication with the outdoor unit via a communication line (15), and
   a power-supply control circuit (7) that performs power-supply control in accordance with whether communication with the outdoor unit by the communication circuit is possible, and
   when power starts to be received, if communication with the outdoor unit by the communication circuit is possible, the power-supply control circuit determines that the outdoor-unit power receiving system is used and performs power-supply control, and, if communication with the outdoor unit by the communication circuit is not possible, the power-supply control circuit determines that the indoor-unit power receiving system is used and performs power-supply control.

2. The air conditioner according to claim 1, wherein the power-supply control circuit (7) counts number of times communication by the communication circuit (9) fails from when power starts to be received, and, if the number of times communication fails exceeds a predetermined number of times, determines that communication with the outdoor unit (2) is not possible.

3. The air conditioner according to claim 1 or 2, wherein the power-supply control circuit (7) counts communication failure elapsed time, during which communication by the communication circuit (9) fails, from when power starts to be received, and, if the communication failure elapsed time exceeds a predetermined time, determines that communication with the outdoor unit (2) is not possible.

4. The air conditioner according to any one of claims 1 to 3, wherein
   the indoor unit (1) includes
   a pair of commercial-power-supply input paths (24, 25), to which the commercial power supply (12) is connected when operating under the indoor-unit power receiving system and to which the commercial power supply is supplied via the outdoor unit (2) when operating under the outdoor-unit power receiving system, and
   a pair of commercial-power-supply output paths (21, 22) that supplies the commercial power supply connected to the commercial-power-supply input paths to the outdoor unit (2) via a relay (11) when operating under the indoor-unit power receiving system, and
   in a case of operating under the indoor-unit power receiving system, when the air conditioner is on operational standby, the power-supply control circuit (7) stops feeding power to the outdoor unit by opening the relay.

5. The air conditioner according to claim 4, wherein after the power-supply control circuit (7) determines, when power starts to be received, that the indoor-unit power receiving system is used and after the power-supply control circuit starts feeding power to the outdoor unit (2) by shorting the relay (11) when an operation is started, if communication with the outdoor unit (2) by the communication circuit (9) is possible, the power-supply control circuit performs a normal control in a case of the indoor-unit power receiving system and, if communication with the outdoor unit by the communication circuit is not possi-

ble, the power-supply control circuit stops feeding of power to the outdoor unit by opening the relay and performs an abnormal-time control of announcing occurrence of a communication error.

6. The air conditioner according to claim 5, wherein the power-supply control circuit (7) counts number of times communication by the communication circuit (9) fails from when feeding of power to the outdoor unit (2) is started, and, if the number of times communication fails exceeds a predetermined number of times, determines that communication with the outdoor unit is not possible.

7. The air conditioner according to claim 5 or 6, wherein the power-supply control circuit (7) counts communication failure elapsed time, during which communication by the communication circuit (9) fails, from when feeding of power to the outdoor unit (2) is started, and, if the communication failure elapsed time exceeds a predetermined time, determines that communication with the outdoor unit is not possible.

FIG.1

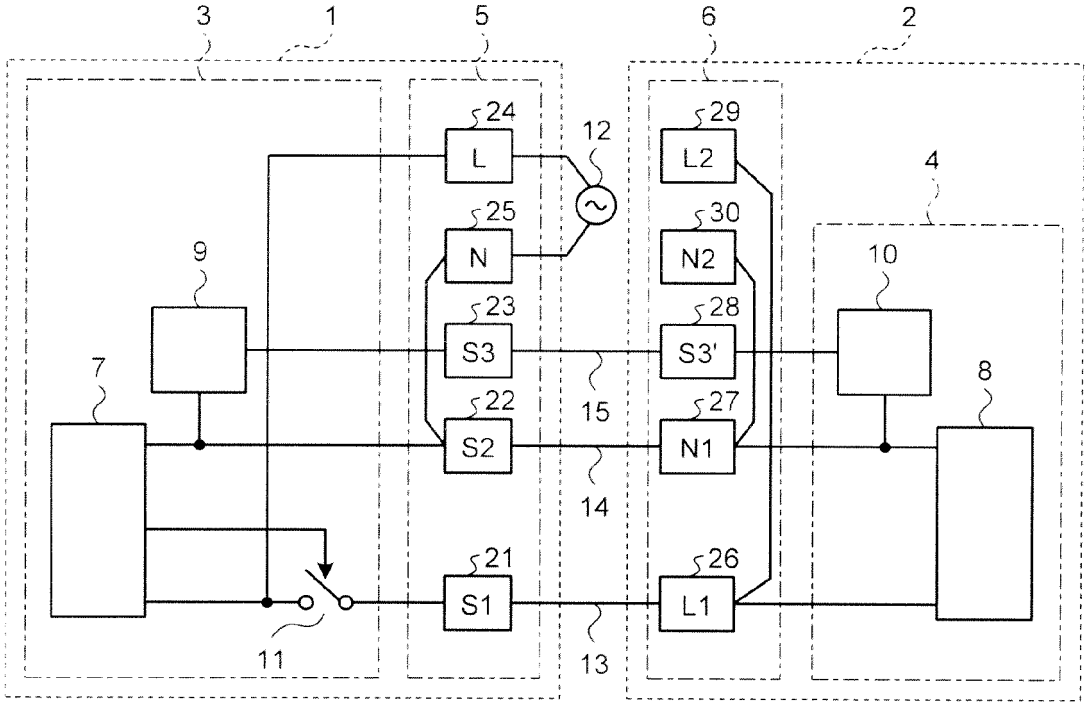

3
1
5
6
2
24
L
12
29
L2
4
25
N
30
N2
9
10
23
S3
28
S3'
7
8
22
S2
15
27
N1
14
21
S1
26
L1
11
13

FIG.2

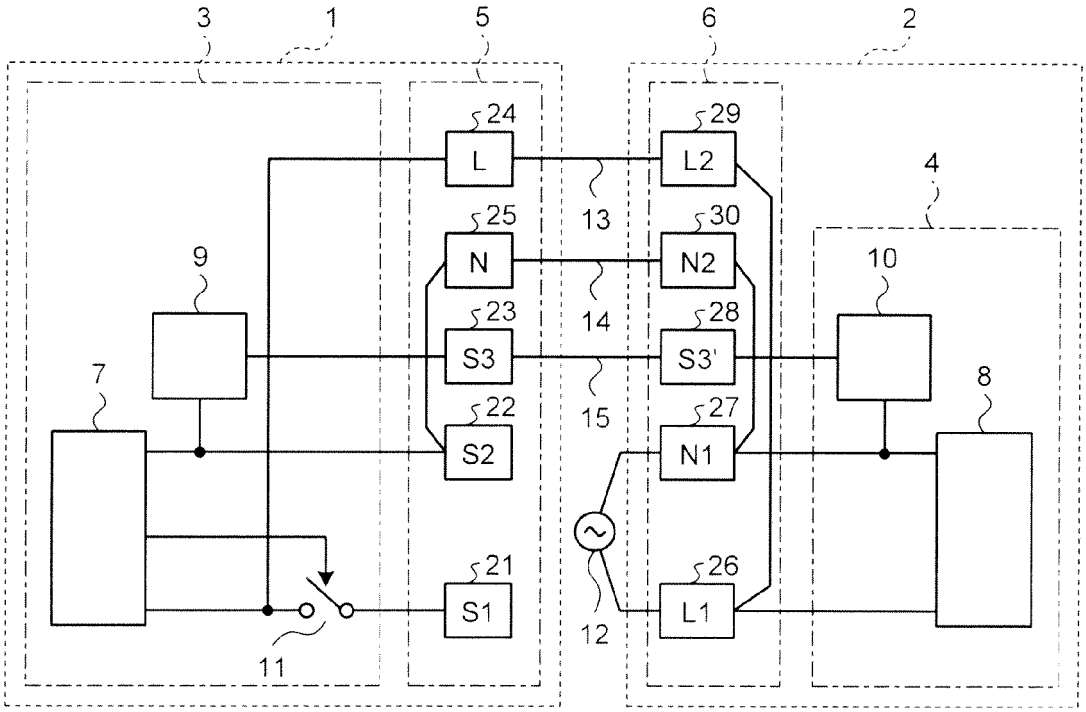
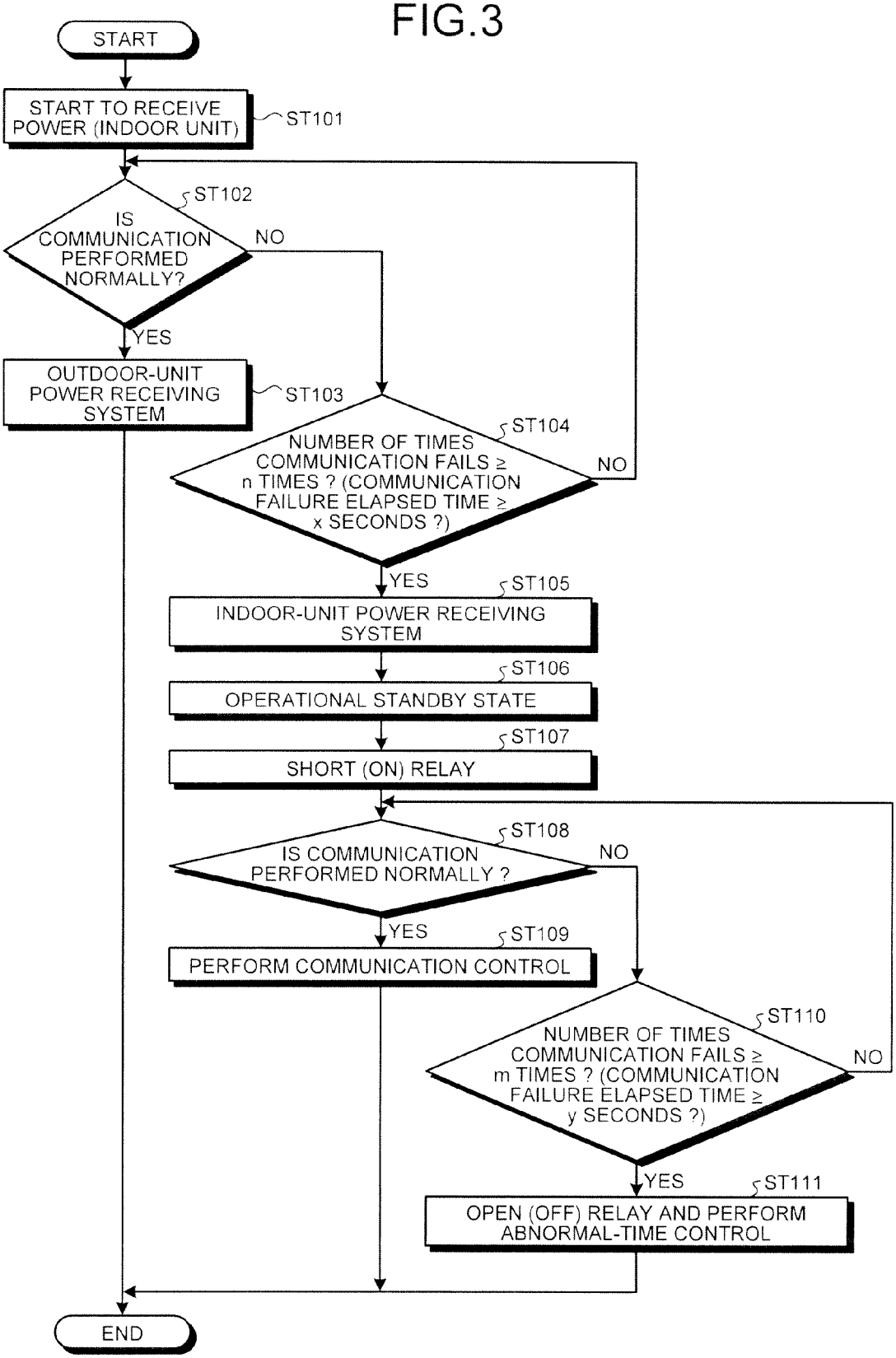

3
1
5
6
2
24
L
29
L2
4
13
25
N
30
N2
9
10
14
23
S3
28
S3'
7
8
15
22
S2
27
N1
21
S1
26
L1
12
11

FIG.3


START
START TO RECEIVE POWER (INDOOR UNIT)
ST101
ST102
IS COMMUNICATION PERFORMED NORMALLY?
NO
YES
OUTDOOR-UNIT POWER RECEIVING SYSTEM
ST103
ST104
NUMBER OF TIMES COMMUNICATION FAILS ≥ n TIMES ? (COMMUNICATION FAILURE ELAPSED TIME ≥ x SECONDS ?)
NO
YES
ST105
INDOOR-UNIT POWER RECEIVING SYSTEM
ST106
OPERATIONAL STANDBY STATE
ST107
SHORT (ON) RELAY
ST108
IS COMMUNICATION PERFORMED NORMALLY ?
NO
YES
ST109
PERFORM COMMUNICATION CONTROL
ST110
NUMBER OF TIMES COMMUNICATION FAILS ≥ m TIMES ? (COMMUNICATION FAILURE ELAPSED TIME ≥ y SECONDS ?)
NO
YES
ST111
OPEN (OFF) RELAY AND PERFORM ABNORMAL-TIME CONTROL
END

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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 1572

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F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 January 2014	Decking, Oliver

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