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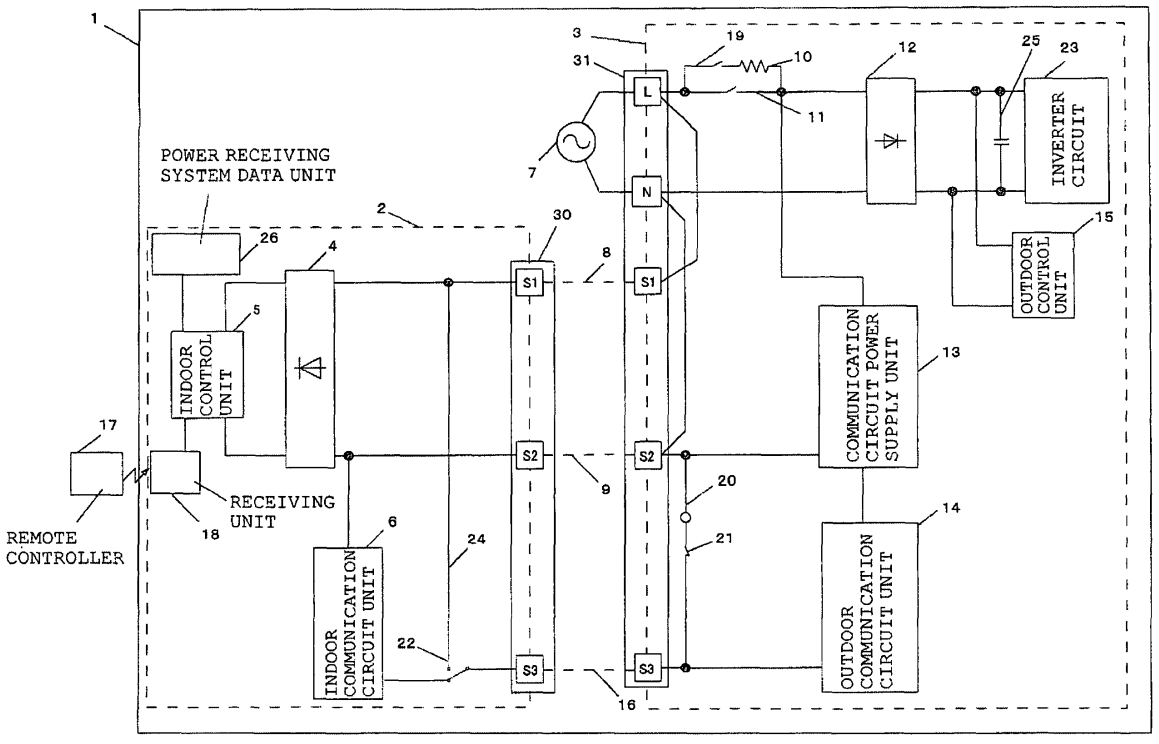
(54) Air conditioner with reduced standby power consuption of the outdoor unit on the basis of a three wire cable connection between indoor and outdoor unit

(57) To obtain an air conditioner which is capable of reducing standby condition power consumption.
An indoor unit (2) includes an outdoor activation relay (22) configured to open and close a connection between a power line (8) and a signal line (16), and an indoor control unit (5) configured to operate the outdoor activation relay (22) and supply the utility power (7) between the signal line (16) and a power signal common line (9), and the indoor control unit (5) opens a connection between the power line (8) and the power signal common line (9) in a standby condition.

FIG. 1



EP 2 241 831 A1

Description

Technical Field

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

Background Art

[0002] As one of the air conditioners in the related art, "an air conditioner in which power supplied to an indoor unit is supplied to an outdoor unit via power supply electric wiring, and a reference frequency extraction circuit, an indoor unit rectifier circuit, and an indoor unit control unit are provided in the indoor unit, **characterized in that** utility power is connected to the indoor unit rectifier circuit and the indoor unit control unit, a power relay and the reference frequency extraction circuit are connected to the power supply electric wiring for supplying power to the outdoor unit, and the reference frequency extraction circuit is brought into a non-energized state by opening the power relay in a standby condition." is proposed (For example, see Patent Literature 1).

Citation List

Patent Literature

[0003] Patent Literature 1: JP-A-2007-225128, (Claim 1)

Summary of Invention

Technical Problem

[0004] In the air conditioner in the related art, communications are carried out between the indoor unit and the outdoor unit, and the outdoor unit is activated by a transmission of an operation start signal or the like to the outdoor unit. However, since the communications are constantly carried out in the standby condition, there is a problem that power is constantly consumed by the indoor unit and the outdoor unit, so that standby condition power consumption is consumed in the standby condition.

[0005] According to the technology described in Patent Literature 1, in a case of an outdoor power receiving system in which the utility power is supplied from the outdoor unit to the indoor unit, there is a problem that control cannot be achieved as-is without increasing the number of cores of the connecting cable between the indoor unit and the outdoor unit from three.

Solution to Problem

[0006] In order to solve the problems as described above, it is an object of the invention to provide an air conditioner in which the standby condition power consumption is reduced.

[0007] An air conditioner according to the invention includes: an indoor unit and an outdoor unit, the indoor unit and the outdoor unit being connected by a three core cable including a power line, a common line, and a signal line to distribute utility power supplied to either one of the outdoor unit or the indoor unit via the power line and the common line,

the indoor unit includes: an outdoor activation relay configured to open and close a connection between the power line and the signal line; and an indoor control unit is configured to operate the outdoor activation relay to supply the utility power between the signal line and the common line, and

the indoor control unit opens the connection between the power line and the signal line in a standby condition. Advantageous Effects of Invention

[0008] The invention is configured to open the connection between the power line and the signal line by the outdoor activation relay in the standby condition, and no utility power is supplied between the signal line and the common line, so that reduction of the standby condition power consumption is achieved.

Brief Description of Drawings

[0009]

Fig. 1 is an electric component system block diagram of an air conditioner according to Embodiment 1;
Fig. 2 is an electric component system block diagram of the air conditioner according to Embodiment 1 in a standby condition;
Fig. 3 is an electric component system block diagram of the air conditioner according to Embodiment 1 in a state in which an outdoor unit is activated;
Fig. 4 is an electric component system diagram of the air conditioner according to Embodiment 1 during operation;
Fig. 5 is a flowchart showing an operation of an indoor unit according to Embodiment 1;
Fig. 6 is a flowchart showing an operation of the outdoor unit according to Embodiment 1;
Fig. 7 is an electric component system block diagram of an air conditioner according to Embodiment 2;
Fig. 8 is a flowchart showing an operation of an outdoor unit according to Embodiment 2;
Fig. 9 is an electric component system block diagram of an air conditioner according to Embodiment 3;
Fig. 10 is a flowchart showing an operation of an indoor unit according to Embodiment 3;
Fig. 11 is an electric component system block diagram of an air conditioner in the standby condition according to Embodiment 4;
Fig. 12 is an electric component system block diagram of the air conditioner according to Embodiment 4 in which one of indoor units is activated;
Fig. 13 is an electric component system block diagram of the air conditioner according to Embodiment 4 in which one of the indoor units is in operation; and
Fig. 14 is a flowchart showing an operation of an

outdoor unit according to Embodiment 4.

Description of Embodiments

Embodiment 1

<Configuration>

[0010] Fig. 1 is an electric component system block diagram of an air conditioner according to Embodiment 1. As shown in Fig. 1, an air conditioner 1 includes an indoor unit 2 and an outdoor unit 3 in Embodiment 1.
The indoor unit 2 includes an indoor terminal base 30. The indoor terminal base 30 includes terminals S1, S2, and S3. The outdoor unit 3 includes an outdoor terminal base 31. The outdoor terminal base 31 includes terminal.s L, N, S1, S2, and S3.

[0011] The indoor unit 2 and the outdoor unit 3 are connected by a three core cable including a power line 8, a power signal common line 9, and a signal line 16.
The power line 8 is connected to the terminal S1 on the indoor terminal base 30 and the terminal S1 on the outdoor terminal base 31.
The power signal common line 9 is connected to the terminal S2 on the indoor terminal base 30 and the terminal S2 on the outdoor terminal base 31.
The signal line 16 is connected to the terminal S3 on the indoor terminal base 30 and the terminal S3 on the outdoor terminal base 31.

[0012] Utility power 7 is connected to the terminals L and N on the outdoor terminal base 31 of the outdoor unit 3.
The terminal L on the outdoor terminal base 31 is connected to the terminal S1 on the outdoor terminal base 31.
The terminal N on the outdoor terminal base 31 is connected to the terminal S2 on the outdoor terminal base 31.
Accordingly, the utility power 7 supplied to the terminals L and N on the outdoor terminal base 31 is supplied from the terminals S1 and S2 on the outdoor terminal base 31 to the terminals S1 and S2 on the indoor terminal base 30 of the indoor unit 2 via the power line 8 and the power signal common line 9.

[0013] The indoor unit 2 includes an indoor rectifier 4, an indoor control unit 5, an indoor communication circuit unit 6, a receiving unit 18, an outdoor activation relay 22, an outdoor power supply line 24, and a power receiving system data unit 26.

[0014] The indoor rectifier 4 is connected to the terminals S1 and S2 of the indoor terminal base 30. The indoor rectifier 4 converts an AC voltage to a given DC voltage, and supplies the same to the indoor control unit 5.

[0015] The indoor communication circuit unit 6 is connected to the terminals S2 and S3 of the indoor terminal base 30. The indoor communication circuit unit 6 carries out communication with an outdoor communication circuit unit 14 (described later) of the outdoor unit 3 via the signal line 16 and the power signal common line 9.

[0016] The power receiving system data unit 26 is connected to the indoor control unit 5. The power receiving system data unit 26 is, for example, a storage device, and is configured to be connected and disconnected by a switching operation of a jumper cable or a switch.
The power receiving system data unit 26 stores information used for discriminating between an indoor power receiving system and an outdoor power receiving system. The power receiving system data unit 26 also stores information used for discriminating whether or not the outdoor unit 3 connected to the indoor unit 2 includes an outdoor relay 11 (described later) and an inrush current preventing relay 19 (described later) and allows reduction of power consumption in a standby condition (hereinafter, referred to as "standby condition power consumption reduction capability information").

Detailed description will be given below.

[0017] The receiving unit 18 is connected to the indoor control unit 5. The receiving unit 18 receives signals from a remote controller 17 and transmits the signals to the indoor control unit 5.

[0018] The indoor control unit 5 operates the outdoor activation relay 22. The indoor control unit 5 also operates the indoor communication circuit unit 6 to perform transmission and reception of a variety of operation signals with respect to the outdoor unit 3.

[0019] The outdoor power supply line 24 is connected at one end thereof to the terminal S1 on the indoor terminal base 30 and at the other end thereof to the outdoor activation relay 22.

[0020] The outdoor activation relay 22 is configured to switch the connection from a connection between the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6 to a connection between the terminal S3 on the indoor terminal base 30 and the outdoor power supply line 24, or vice versa.
In other words, the outdoor activation relay 22 opens and closes the connection between the power line 8 and the signal line 16. When the outdoor activation relay 22 is operated, the utility power 7 is supplied between the signal line 16 and the power signal common line 9.
The outdoor activation relay 22 connects the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6 in a stationary state and, when the operation is effected by the indoor control unit 5, opens the connection between the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6, and connects the terminal S3 on the indoor terminal base 30 to the outdoor power supply line 24.

[0021] Although not shown, the indoor unit 2 is provided with an indoor heat exchanger, an indoor fan, a sensor, a display as mechanical systems.

[0022] The outdoor unit 3 includes an inrush current preventing resistance 10, the outdoor relay 11, an outdoor rectifier 12, a communication circuit power supply unit 13, the outdoor communication circuit unit 14, an outdoor control unit 15, the inrush current preventing re-

lay 19, an inrush current preventing relay coil 20, a power supply cutoff relay 21, an inverter circuit 23, and a capacitor 25.

[0023] The outdoor relay 11 is connected to at one end thereof to the terminal L on the outdoor terminal base 31 and at the other end thereof to the outdoor rectifier 12.
In the stationary state, the outdoor relay 11 opens a contact point (normally open) and, when the operation is effected by the outdoor control unit 15, closes the contact point (hereinafter, also referred to as "short circuit").

[0024] The inrush current preventing resistance 10 is provided in parallel with the outdoor relay 11. The inrush current preventing resistance 10 is connected at one end thereof to the terminal L of the outdoor terminal base 31 via the inrush current preventing relay 19 and at the other end thereof to the outdoor rectifier 12.
The inrush current preventing resistance 10 is configured to restrain an inrush current to the capacitor 25.

[0025] The inrush current preventing relay 19 is provided in parallel with the outdoor relay 11. The inrush current preventing relay 19 is connected at one end thereof to the terminal L of the outdoor terminal base 31 and at the other end thereof to the inrush current preventing resistance 10.
In a stationary state, the inrush current preventing relay 19 opens the contact point (normally open) and, when the inrush current preventing relay coil 20 is energized, closes the contact point to make a short circuit between the inrush current preventing resistance 10 and the terminal L of the outdoor terminal base 31.
In other words, the inrush current preventing relay coil 20 closes the inrush current preventing relay 19 when the utility power 7 is supplied between the signal line 16 and the power signal common line 9.

[0026] The outdoor rectifier 12 is connected to the terminal L on the outdoor terminal base 31 via the outdoor relay 11 and the inrush current preventing resistance 10. The outdoor rectifier 12 is also connected to the terminal N on the outdoor terminal base 31.
The outdoor rectifier 12 converts an AC voltage supplied from the utility power 7 to a given DC voltage, and supplies the same to the outdoor control unit 15 and the inverter circuit 23.

[0027] The capacitor 25 is provided between outputs of the outdoor rectifier 12 for smoothing an output from the outdoor rectifier 12 and supplying a DC voltage to the inverter circuit 23.

[0028] The inverter circuit 23 converts the input DC voltage to an AC voltage of a given frequency and a given voltage. The inverter circuit 23 is provided with a motor or the like connected thereto, and drives a compressor or the like provided in the outdoor unit 3.

[0029] The outdoor control unit 15 operates the outdoor relay 11 and the power supply cutoff relay 21. The outdoor control unit 15 also operates the outdoor communication circuit unit 14 to perform transmission and reception of a variety of operation signals with respect to the indoor unit 2.
The outdoor control unit 15 controls the inverter circuit 23.

[0030] The communication circuit power supply unit 13 is connected at one end thereof to a point between the outdoor relay 11 and the outdoor rectifier 12, thereby being connected to the terminal L on the outdoor terminal base 31 via the outdoor relay 11 and the inrush current preventing relay 19, and at the other end thereof to the terminal S2 on the outdoor terminal base 31.
The communication circuit power supply unit 13 converts an AC voltage supplied from the utility power 7 to a given DC voltage and supplies the same to the outdoor communication circuit unit 14. The communication circuit power supply unit 13 is made up of, for example, a half-wave rectifier circuit.

[0031] The outdoor communication circuit unit 14 is connected at one end thereof to the terminal S3 on the outdoor terminal base 31 and at the other end thereof to the communication circuit power supply unit 13. The outdoor communication circuit unit 14 carries out communications with the indoor communication circuit unit 6 of the indoor unit 2 via the signal line 16 and the power signal common line 9.

[0032] The inrush current preventing relay coil 20 is connected at one end thereof to the terminal S2 on the outdoor terminal base 31, and at the other end thereof to the terminal S3 on the outdoor terminal base 31 via the power supply cutoff relay 21.
The inrush current preventing relay coil 20 closes the contact point of the inrush current preventing relay when being energized.

[0033] The power supply cutoff relay 21 is connected at one end thereof to the inrush current preventing relay coil 20, and at the other end thereof to the terminal S3 on the outdoor terminal base 31.
In the stationary state, the power supply cutoff relay 21 closes the contact point (normally close) and, when operated by the outdoor control unit 15, opens the contact point so that energization of the inrush current preventing relay coil 20 is cut off.

[0034] Although not shown, the outdoor unit 3 is provided with an outdoor heat exchange, an outdoor fan, a sensor, an electromagnetic expansion valve, a refrigerant switching valve, and a compressor as mechanical systems.

[0035] The power signal common line 9 corresponds to a "common line" in the invention.
The outdoor relay 11 and the inrush current preventing relay 19 each correspond to a "power supply relay" in the invention.
The inrush current preventing relay coil 20 corresponds to a "power supply relay coil" in the invention.

[0036] The configuration of the air conditioner in Embodiment 1 has been described.

[0037] Subsequently, an operation of the air conditioner in Embodiment 1 will be described.

<Operation>

[0038] First of all, supply of power in the air conditioner 1 in the standby condition will be described.

[0039] Fig. 2 is an electric component system block diagram of the air conditioner in the standby condition according to Embodiment 1.

[0040] As shown in Fig. 2, the utility power 7 supplied to the terminals L and N of the outdoor terminal base 31 is supplied from the terminals S1 and S2 on the outdoor terminal base 31 to the terminals S1 and S2 on the indoor terminal base 30 of the indoor unit 2 via the power line 8 and the power signal common line 9.

[0041] Then, the indoor rectifier 4 receives the utility power 7 supplied to the terminals S1 and S2 of the indoor terminal base 30 of the indoor unit 2.

[0042] The indoor rectifier 4 converts the input AC voltage to a given DC voltage. The indoor rectifier 4 supplies the converted DC voltage to respective components of the indoor control unit 5 and the indoor unit 2.

[0043] The indoor control unit 5 determines whether the air conditioner 1 employs the indoor power receiving system or the outdoor power receiving system on the basis of data stored in the power receiving system data unit 26 and, when it is determined to be the outdoor power receiving system, enables the control of the outdoor activation relay 22.

[0044] The indoor control unit 5 determines whether or not the outdoor unit 3 connected to the indoor unit 2 is of the type which allows reduction of power consumption in the standby condition on the basis of the standby condition power consumption reduction capability information stored in the power receiving system data unit 26.
In Embodiment 1, a case where the outdoor unit 3 is of the type which allows reduction of the power consumption in the standby condition will be described.
An operation when the outdoor unit 3 is not of the type which allows reduction of the power consumption in the standby condition will be described in conjunction with Embodiment 2.

[0045] The outdoor activation relay 22 connects the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6 in the stationary state.
Accordingly, the indoor communication circuit unit 6 is connected to the outdoor unit 3 via the signal line 16, and is brought into a state of being capable of establishing communications with the outdoor unit 3.
At the same time, the indoor control unit 5 is brought into a state of waiting for the reception of an operation start request signal transmitted from the remote controller 17 and received via the receiving unit 18.

[0046] The contact points of the outdoor relay 11 and the inrush current preventing relay 19 of the outdoor unit 3 are opened in the stationary state.
At the same time, the outdoor activation relay 22 of the indoor unit 2 opens the connection between the terminal S3 on the indoor terminal base 30 and the outdoor power supply line 24.
Therefore, no utility power 7 is supplied between the terminals S2 and S3 on the outdoor terminal base 31, so that the inrush current preventing relay coil 20 is in a non-energized state.
Therefore, even when the utility power 7 is supplied to the terminals L and N on the outdoor terminal base 31 of the outdoor unit 3, the inrush current preventing relay 19 and the outdoor relay 11 are each brought into an opened state.
Therefore, in the standby condition, a power source supply to the respective components connected to downstream of the inrush current preventing relay 19 and the outdoor relay 11 is cut off, so that reduction of the power consumption of the outdoor unit 3 in the standby condition is achieved.

[0047] Subsequently, the operation of the outdoor unit of the air conditioner at the time of activation and during operation will be described.

[0048] Fig. 3 is an electric component system block diagram of the air conditioner according to Embodiment 1, showing a state where the outdoor unit of the air conditioner is activated.
Fig. 4 is an electric component system block diagram of the air conditioner according to Embodiment 1 during operation.
Fig. 5 is a flowchart showing an operation of the indoor unit according to Embodiment 1.
Fig. 6 is a flowchart showing an operation of the outdoor unit according to Embodiment 1.
Referring now to Fig. 3 and Fig. 4, description will be given on the basis of respective steps in Fig. 5 and Fig. 6.

[0049] First of all, an operation of the indoor unit 2 will be described.

(Step 1)

[0050] The indoor control unit 5 receives an operation start request from the remote controller 17 via the receiving unit 18.

(Step 2)

[0051] The indoor control unit 5 makes a reference to the information in the power receiving system data unit 26 and, when data from the power receiving system data unit 26 indicates the outdoor power receiving system, operates the indoor communication circuit unit 6 to start communications with the outdoor unit 3.

(Step 3)

[0052] The indoor control unit 5 determines whether or not communications between the indoor communication circuit unit 6 and the outdoor communication circuit unit 14 of the outdoor unit 3 are established.

[0053] If the communications between the indoor communication circuit unit 6 and the outdoor unit 3 are established, the procedure goes to Step 9.

(Step 4)

[0054] In contrast, if the communication between the indoor communication circuit unit 6 and the outdoor unit 3 is not established in Step 3, the indoor control unit 5 operates (turns ON) the outdoor activation relay 22 to open the connection between the terminal S3 of the indoor terminal base 30 and the indoor communication circuit unit 6, and connects the terminal S3 of the indoor terminal base 30 with the outdoor power supply line 24. Accordingly, the utility power 7 is supplied between the signal line 16 and the power signal common line 9.

(Step 5)

[0055] The indoor control unit 5 operates the outdoor activation relay 22 for a predetermined time.
The predetermined time may be set to a time (n seconds) required for charging the capacitor 25 of the outdoor unit 3. The predetermined time is not limited thereto.

(Step 6)

[0056] The indoor control unit 5 operates the outdoor activation relay 22 for the predetermined time, then stops (turns OFF) the operation thereof, connects the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6, and opens the connection between the terminal S3 on the indoor terminal base 30 and the outdoor power supply line 24 (see Fig. 3).

(Step 7)

[0057] The indoor control unit 5 operates the indoor communication circuit unit 6 to start the communications with the outdoor unit 3.
[0058] Then, the indoor control unit 5 determines whether or not the communications between the indoor communication circuit unit 6 and the outdoor communication circuit unit 14 of the outdoor unit 3 are established again.

(Step 8)

[0059] When the communications between the indoor communication circuit unit 6 and the outdoor unit 3 are established, the indoor communication circuit unit 6 starts communications with the outdoor communication circuit unit 14 of the outdoor unit 3.

(Step 9)

[0060] The indoor control unit 5 carries out communications with the outdoor unit 3 via the indoor communication circuit unit 6, and causes the air conditioner 1 to perform a cooling operation or a heating operation.

(Step 10)

[0061] In contrast, if the communications between the indoor communication circuit unit 6 and the outdoor unit 3 cannot be established in Step 7, the indoor control unit 5 operates the indoor communication circuit unit 6 again to start communications with the outdoor unit 3.
Then, the indoor control unit 5 determines whether or not the communications between the indoor communication circuit unit 6 and the outdoor unit 3 are established within the predetermined time (n seconds) .

(Step 11)

[0062] If the communications between the indoor communication circuit unit 6 and the outdoor unit 3 cannot be established within n seconds in Step 10, the indoor control unit 5 determines that the communications are abnormal.
[0063] Subsequently, an operation of the outdoor unit 3 will be described.

(Step 12)

[0064] When the outdoor activation relay 22 of the indoor unit 2 is turned ON and the utility power 7 is supplied between the signal line 16 and the power signal common line 9 in Step 4, the utility power 7 is supplied between the terminals S2 and S3 on the outdoor terminal base 31 of the outdoor unit 3.

(Step 13)

[0065] When the electric power from the utility power 7 is supplied between the terminals S2 and S3 of the outdoor terminal base 31, the inrush current preventing relay coil 20 is energized via the power supply cutoff relay 21, and makes the inrush current preventing relay 19 short-circuited (see Fig. 3).
When the inrush current preventing relay 19 is made short-circuited, the utility power 7 supplied to the terminals L and N of the outdoor terminal base 31 is supplied to the outdoor rectifier 12 and the communication circuit power supply unit 13 via the inrush current preventing resistor 10.
[0066] The outdoor rectifier 12 converts an AC voltage, supplied from the utility power 7 to a given DC voltage, and supplies the same to the outdoor control unit 15, the capacitor 25, and the inverter circuit 23.
[0067] The communication circuit power supply unit 13 converts an AC voltage supplied from the utility power 7 to a given DC voltage and supplies the same to the outdoor communication circuit unit 14.

(Step 14)

[0068] When the DC power is supplied from the outdoor rectifier 12, the outdoor control unit 15 makes the

outdoor relay 11 short-circuited.

(Step 15)

[0069] Subsequently, the outdoor control unit 15 operates the power supply cutoff relay 21 to open the contact point.

(Step 16)

[0070] When the power supply cutoff relay 21 is opened, the inrush current preventing relay coil 20 is brought into a non-energized state, and the inrush current preventing relay 19 is opened (see Fig. 4).
Accordingly, a short circuit between the terminals S2 and S3 on the outdoor terminal base 31 is prevented during operation of the outdoor unit 3, so that communications between the indoor communication circuit unit 6 and the outdoor communication circuit unit 14 are enabled.

(Step 17)

[0071] Subsequently, the outdoor control unit 15 operates the outdoor communication circuit unit 14 to start communications with the indoor unit 2.
The outdoor communication circuit unit 14 starts communications with the indoor communication circuit unit 6 via the power signal common line 9 and the signal line 16.

(Step 18)

[0072] The outdoor control unit 15 determines whether or not communications between the outdoor communication, circuit unit 14 and the indoor communication circuit unit 6 of the indoor unit 2 are established.

(Step 19)

[0073] When the communications between the outdoor communication circuit unit 14 and the indoor unit 2 are established, the communications with the indoor unit 2 are started.

(Step 20)

[0074] The outdoor control unit 15 carries out communications with the indoor unit 2 via the outdoor communication circuit unit 14, and causes the air conditioner 1 to perform the cooling operation or the heating operation.

(Step 21)

[0075] In contrast, if the communications between the outdoor communication circuit unit 14 and the indoor unit 2 cannot be established in Step 18, the outdoor control unit 15 operates the outdoor communication circuit unit 14 again to start communications with the indoor unit 2. Then, the outdoor control unit 15 determines whether or not the communications between the outdoor communication circuit unit 14 and the indoor unit 2 are established within the predetermined time (n seconds).

(Step 22)

[0076] If the communications between the outdoor communication circuit unit 14 and the indoor unit 2 are not established within n seconds in Step 21, the outdoor control unit 15 determines that the communications are abnormal.

[0077] Subsequently, an operation to bring the air conditioner 1 to the standby condition will be described.

[0078] The indoor control unit 5 receives an operation standby signal from the remote controller 17 via the receiving unit 18.
The indoor control unit 5 transmits the operation standby signal to the outdoor unit 3 via the indoor communication circuit unit 6.
The indoor communication circuit unit 6 transmits the operation standby signal to the outdoor communication circuit unit 14 via the signal line 16 and the power signal common line 9.
The outdoor control unit 15 receives the operation standby signal via the outdoor communication circuit unit 14.
The outdoor control unit 15 operates the outdoor relay 11 to open the contact point upon receipt of the operation standby signal.

[0079] Accordingly, a supply of the utility power 7 to the outdoor rectifier 12 and the communication circuit power supply unit 13 via the terminals L and N on the outdoor terminal base 31 is stopped, and a supply of the DC power to the respective components of the outdoor unit 3 is also stopped.
With the operation as described above, transition to the standby condition described above (Fig. 2) is achieved again.

<Advantages>

[0080] As described above, according to Embodiment 1., the inrush current preventing relay 19 and the outdoor relay 11 are brought into an opened state to cut off the power supply from the utility power 7 to the outdoor unit 3 in the standby condition. Therefore, the standby condition power consumption consumed by the outdoor unit 3 in the standby condition is reduced.

[0081] In order to activate the outdoor unit 3, the utility power 7 is supplied between the signal line 16 and the power signal common line 9, and the operation of the inrush current preventing relay 19 is effected thereby, so that the power supply to the outdoor unit 3 is achieved. Therefore, the control is achieved as-is without increasing the number of cores of the connecting cable between the indoor unit 2 and the outdoor unit 3 from three.

[0082] During operation after having activated the outdoor unit 3, the utility power 7 supplied between the signal line 16 and the power signal common line 9 is stopped.

The power supply cutoff relay 21 is provided in the outdoor unit 3 to prevent a short circuit between the terminals S2 and S3 on the outdoor terminal base 31. Therefore, during operation of the air conditioner 1, communications via the signal line 16 are enabled between the indoor unit 2 and the outdoor unit 3.

[0083] In Embodiment 1, the case where the utility power 7 is connected to the outdoor terminal base 31 of the outdoor unit 3 has been described. The invention is not limited thereto, and the utility power 7 may be connected to the indoor terminal base 30 of the indoor unit 2. For example, the terminals L and N are provided on the indoor terminal base 30 of the indoor unit 2, and the utility power 7 is connected thereto. Then, the terminal L on the indoor terminal base 30 is connected to the terminal S1 on the indoor terminal base 30. The terminal N on the indoor terminal base 30 is connected to the terminal S2 on the indoor terminal base 30.

Accordingly, the utility power 7 supplied to the terminals L and N on the indoor terminal base 30 is supplied from the terminals S1 and S2 on the indoor terminal base 30 to the terminals S1 and S2 on the outdoor terminal base 31 of the outdoor unit 3 via the power line 8 and the power signal common line 9.

In this configuration as well, the same advantages are achieved with the same operation.

Embodiment 2

[0084] In Embodiment 2, a pattern in which the outdoor unit 3 is not of the type which allows reduction of the power consumption in the standby condition will be described.

<Configuration>

[0085] Fig. 7 is an electric component system block diagram of an air conditioner according to Embodiment 2. Subsequently, a configuration of the outdoor unit 3 in Embodiment 2 will be described with a particular emphasis on different points from Embodiment 1.

The indoor unit 2 in Embodiment 2 has the similar configuration as Embodiment 1, and the same numbers reference the same parts.

[0086] As shown in Fig. 7, the outdoor unit 3 in Embodiment 2 does not include the inrush current preventing relay 19, the inrush current preventing relay coil 20, and the power supply cutoff relay 21 which have been described in conjunction with Embodiment 1 (Fig. 1). Other parts of the configuration are the same as those in Embodiment1, and the same numbers reference the same parts.

[0087] The outdoor unit 3 in Embodiment 2 is not of the type which allows reduction of the power consumption in the standby condition. For example, it is the outdoor unit 3 having an electric component system in the related art.

The configuration of the outdoor unit 3 is not limited thereto, and may be varied as long as it is connected to the indoor unit 2 by the three core cable including the power line 8, the power signal common line 9, and the signal line 16.

[0088] The outdoor relay 11 is connected at one end thereof to the terminal L on the outdoor terminal base 31 and at the other end thereof to the outdoor rectifier 12 in the same manner as Embodiment 1.

The inrush current preventing resistance 10 is provided in parallel with the outdoor relay 11. The inrush current preventing resistance 10 is connected at one end thereof to the terminal L on the outdoor terminal base 31 and at the other end thereof to the outdoor rectifier 12.

[0089] The power receiving system data unit 26 in Embodiment 2 stores information indicating that the outdoor unit 3 connected to the indoor unit 2 is not of the type which allows reduction of the power consumption in the standby condition as standby condition power consumption reduction capability information.

<Operation>

[0090] In this configuration, the utility power 7 supplied to the terminals L and N on the outdoor terminal base 31 is supplied to the outdoor rectifier 12 and the communication circuit power supply unit 13 via the inrush current preventing resistance 10 in the standby condition of the air conditioner 1.

[0091] The electric power from the utility power 7 supplied to the terminals L and N of the outdoor terminal base 31 is supplied from the terminals S1 and S2 of the outdoor terminal base 31 to the terminals S1 and S2 of the indoor terminal base 30 of the indoor unit 2 via the power line 8 and the power signal common line 9.

Then, to the indoor rectifier 4 the electric power of the utility power 7 supplied to the terminals S1 and S2 of the indoor terminal base 30 of the indoor unit 2 is input.

The indoor rectifier 4 converts the input AC voltage to a given DC voltage. The indoor rectifier 4 supplies the converted DC voltage to respective components of the indoor control unit 5 and the indoor unit 2.

[0092] The indoor control unit 5 determines whether or not the outdoor unit 3 connected to the indoor unit 2 is of the type which, allows reduction of the power consumption in the standby condition on the basis of the standby condition power consumption capability information stored in the power receiving system data unit 26.

In Embodiment 2, since the outdoor unit 3 is not of the type which allows reduction of the power consumption in the standby condition, the indoor control unit 5 does not effect the operation of the outdoor activation relay 22.

[0093] Upon receipt of the operation start request or the operation standby signal from the remote controller 17 via the receiving unit 18, the indoor control unit 5 effects the operation of the indoor communication circuit unit 6 to start communications with the outdoor unit 3, and transmits the signal to the outdoor unit 3.

[0094] Subsequently, an operation of the outdoor unit

3 at the time of activation in Embodiment 2 will be described.

[0095] Fig. 8 is a flowchart showing an operation of the outdoor unit according to Embodiment 2.
Subsequently, respective steps shown in Fig. 8 will be described.

(Step 23)

[0096] The utility power 7 being supplied to the terminals L and N on the outdoor terminal base 31 is supplied to the outdoor rectifier 12 via the communication circuit power supply unit 13 and the inrush current preventing resistance 10.
Then, the outdoor rectifier 12 converts an AC voltage supplied from the utility power 7 to a given DC voltage, and supplies the same to the outdoor control unit 15, the capacitor 25, and the inverter circuit, 23.
The communication circuit power supply unit 13 converts an AC voltage supplied from the utility power 7 to a given DC voltage and supplies the same to the outdoor communication circuit unit 14.

(Step 24)

[0097] The outdoor control unit 15 effects the operation of the outdoor communication circuit unit 14 to start communications with the indoor unit 2.
The outdoor communication circuit unit 14 starts communications with the indoor communication circuit unit 6 via the power signal common line 9 and the signal line 16.

(Step 25)

[0098] The outdoor control unit 15 determines whether or not communications between the outdoor communication circuit unit 14 and the indoor communication circuit unit 6 of the indoor unit 2 are established.

(Step 26)

[0099] When the communications between the outdoor communication circuit unit 14 and the indoor unit 2 are established, the communications with the indoor unit 2 are started.
The outdoor control unit 15 determines a request signal from the indoor unit 2. When the request signal from the indoor unit 2 is an operation standby signal, the outdoor control unit 15 is brought into a state of waiting an operation start request signal.

(Step 28)

[0100] When the request signal from the indoor unit 2 is the operation standby signal, the outdoor control unit 15 turns the outdoor relay ON (short circuit).

(Step 30)

[0101] The outdoor control unit 15 carries out communications with the indoor unit 2 via the outdoor communication circuit unit 14, and causes the air conditioner 1 to perform the cooling operation or the heating operation.

(Step 31)

[0102] In contrast, if the communications between the outdoor communication circuit unit 14 and the indoor unit 2 cannot be established in Step 25, the outdoor control unit 15 effects the operation of the outdoor communication circuit unit 14 again to start communications with the indoor unit 2.
Then, the outdoor control unit 15 determines whether or not the communications between the outdoor communication circuit unit 14 and the indoor unit 2 are established within the predetermined time (n seconds).

(Step 32)

[0103] If the communications between the outdoor communication circuit unit 14 and the indoor unit 2 are not established within n seconds in Step 31, the outdoor control unit 15 determines that the communications are abnormal.

<Advantages>

[0104] As described the above, in the present embodiment, even when the outdoor unit 3 is not of the type which allows reduction of the power consumption in the standby condition, the indoor unit 2 and the outdoor unit 3 are connected by the three core cable including the power line 8, the power signal common line 9, and the signal line 16. Therefore, the control is achieved without increasing the number of the connecting cable between the indoor unit 2 and the outdoor unit 3 from three cores.

[0105] In addition, even when the outdoor unit 3 always requires the supply of the electric power of the utility power 7, the indoor unit 2 which allows the reduction of the standby condition power consumption can be connected thereto.

[0106] Since the indoor unit 2 and the outdoor unit 3 are connected by the three core cable including the power line 8, the power signal common line 9, and the signal line 16, the outdoor unit 3 of the model in the related art can be connected to the indoor unit 2 without developing the substrate and software.

[0107] The connection of the indoor unit 2 and the outdoor unit 3 is also possible even when the levels of development of the standby condition power consumption reduction capability thereof are different.

Embodiment 3

[0108] In Embodiment 3, a pattern in which the utility

power 7 is connected to the indoor unit 2 will be described.

<Configuration>

[0109] Fig. 9 is an electric component system block diagram of an air conditioner according to Embodiment 3. Subsequently, a configuration of the air conditioner 1 in Embodiment 3 will be described with a particular emphasis on different points from Embodiments 1 and 2.

[0110] As shown in Fig. 9, the indoor unit 2 according to Embodiment 3 includes a 52C relay 27 in addition to the configuration in Embodiment 1. (Fig. 1) .

The indoor terminal base 30 in Embodiment 3 includes terminals N, L in addition to the configuration in Embodiment 1 (Fig. 1).

[0111] The 52C relay 27 is connected at one end thereof to the terminal S1 on the indoor terminal base 30 and at the other end to the indoor rectifier 4. The 52C relay 27 opens a contact point in the stationary state (normally open), and closes the contact point when the operation is effected by the indoor control unit 5.

[0112] The utility power 7 is connected to the terminals L and N on the indoor terminal base 30 of the indoor unit 2. The terminal L on the indoor terminal base 30 is connected to a point between the 52C relay 27 and the indoor rectifier 4.

The terminal N on the indoor terminal base 30 is connected to a point between the terminal S2 on the indoor terminal base 30 and the indoor rectifier 4.

Accordingly, the utility power 7 supplied to the terminals L and N on the indoor terminal base 30 is input to the indoor rectifier 4. The indoor rectifier 4 converts the input AC voltage to a given DC voltage. The indoor rectifier 4 supplies the converted DC voltage to respective components of the indoor control unit 5 and the indoor unit 2.

[0113] The power receiving system data unit 26 in Embodiment 3 stores information indicating that the outdoor unit 3 connected to the indoor unit 2 is not of the type which allows reduction of the power consumption in the standby condition as the standby condition power consumption reduction capability information.

The power receiving system data unit 26 also stores information indicating that the indoor unit 2 employs the indoor power receiving system.

[0114] Other parts of the configuration of the indoor unit 2 are the same as those in Embodiment 1, and the same numbers reference the same parts.

The 52C relay 27 corresponds to an "indoor power distribution relay" in the invention.

[0115] The outdoor unit 3 in Embodiment 3 has a configuration in which the terminals L and N on the outdoor terminal base 31 are not provided and the utility power 7 is not connected thereto in contrast to the configuration of Embodiment 2 (Fig. 7).

As shown in Fig. 9, the terminal S1 on the outdoor terminal base 31 and the outdoor relay 11 are connected directly without the intermediary of the terminal L. The terminal S2 on the outdoor terminal base 31 and the outdoor rectifier 12 are connected directly without the intermediary of the terminal N.

[0116] Other parts of the configuration of the indoor unit 3 are the same as those in Embodiment 2, and the same numbers reference the same parts.

[0117] Although the configuration in which the terminals L and N are not provided on the outdoor terminal base 31 is shown in Fig. 9, the invention is not limited thereto, and a configuration similar to the outdoor unit 3 in Embodiment 2 (Fig. 7) in which the utility power 7 is not connected to the outdoor unit 3 is also applicable.

[0118] The configuration of the outdoor unit 3 is not limited thereto, and may be varied as long as it is connected to the indoor unit 2 by the three core cable including the power line 8, the power signal common line 9, and the signal line 16, and the utility power 7 is not connected thereto.

<Operation>

[0119] Subsequently, supply of power when the air conditioner 1 is in the standby condition will be described.

[0120] As shown in Fig. 9, the utility power 7 is supplied to the terminals L and N on the indoor terminal base 30 of the indoor unit 2. Then, the utility power 7 is input to the indoor rectifier 4.

The indoor rectifier 4 converts the input AC voltage to a given DC voltage. The indoor rectifier 4 supplies the converted DC voltage to respective components of the indoor control unit 5 and the indoor unit 2.

[0121] The indoor control unit 5 determines whether the air conditioner 1 employs the indoor power receiving system or the outdoor power receiving system on the basis of data stored in the power receiving system data unit 26 and, when it is determined to be the indoor power receiving system, enables the control of the 52C relay 27.

[0122] The indoor control unit 5 determines whether or not the outdoor unit 3 connected to the indoor unit 2 is of the type which allows reduction of the power consumption in the standby condition on the basis of the standby condition power consumption reduction capability information stored in the power receiving system data unit 26.

In Embodiment 3, since the outdoor unit 3 is not of the type which allows reduction of the power consumption in the standby condition, the indoor control unit 5 does not operate the outdoor activation relay 22.

[0123] The outdoor activation relay 22 connects the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6 in the stationary state.

Accordingly, the indoor communication circuit unit 6 is connected to the outdoor unit 3 via the signal line 16, and is brought into a state of being capable of establishing communications with the outdoor unit 3.

At the same time, the indoor control unit 5 is brought into a state of waiting for the reception of an operation start request signal transmitted from the remote controller 17 and received via the receiving unit 18.

[0124] In contrast, the 52C relay 27 opens the contact point in the stationary state.
Therefore, no utility power 7 is supplied between the terminals S1 and S2 on the indoor terminal base 30, so that the utility power 7 is not supplied to the outdoor unit 3.
Therefore, in the standby condition, the power source supply to the respective components of the outdoor unit 3 is cut off, so that reduction of the power consumption of the outdoor unit 3 in the standby condition is achieved.
[0125] Subsequently, an operation of the indoor unit 2 at the time of activation in Embodiment 3 will be described.
[0126] Fig. 10 is a flowchart showing an operation of the indoor unit according to Embodiment 3.
Subsequently, respective steps shown in Fig. 10 will be described.

(Step 33)

[0127] The indoor control unit 5 receives an operation start request from the remote controller 17 via the receiving unit 18.

(Step 34)

[0128] The indoor control unit 5 effects the operation (ON) of the 52C relay 27, and connects the terminal L on the indoor terminal base 30 and the terminal S1 on the indoor terminal base 30.
Accordingly, the utility power 7 is supplied between the power line 8 and the power signal common line 9.

(Step 35)

[0129] The indoor control unit 5 effects the operation of the indoor communication circuit unit 6 to start the communications with the outdoor unit 3.

(Step 36)

[0130] The indoor control unit 5 determines whether or not the communication between the indoor communication circuit unit 6 and the outdoor communication circuit unit 14 of the outdoor unit 3 is established.

(Step 37)

[0131] When the communication between the indoor communication circuit unit 6 and the outdoor unit 3 is established, the indoor communication circuit unit 6 starts communications with the outdoor communication circuit unit 14 of the outdoor unit 3.

(Step 38)

[0132] The indoor control unit 5 carries out communications with the outdoor unit 3 via the indoor communication circuit unit 6, and causes the air conditioner 1 to perform the cooling operation or the heating operation.

(Step 39)

[0133] In contrast, if the communications between the indoor communication circuit unit 6 and the outdoor unit 3 cannot be established in Step 36, the indoor control unit 5 effects the operation of the indoor communication circuit unit 6 again to start communications with the outdoor unit 3.
Then, the indoor control unit 5 determines whether or not the communications between the indoor communication circuit unit 6 and the outdoor unit 3 are established within the predetermined time (n seconds).

(Step 40)

[0134] If the communications between the indoor communication circuit unit 6 and the outdoor unit 3 cannot be established within n seconds in Step 39, the indoor control unit 5 determines that the communication is abnormal.
[0135] Subsequently, an operation of the outdoor unit 3 at the time of activation will be described.
[0136] When the electric power from the utility power 7 is supplied between the power line 8 and the power signal common line 9 in Step 34 described above, the electric power from the utility power 7 is supplied to the terminals S1 and S2 on the outdoor terminal base 31 of the outdoor unit 3.
When the electric power from the utility power 7 is supplied to the terminals S1 and S2 on the outdoor terminal base 31, the power is supplied to the outdoor rectifier 12 and the communication circuit power supply unit 13 via the inrush current preventing resistor 10.
The outdoor rectifier 12 converts an AC voltage supplied from the utility power 7 to a given DC voltage, and supplies the same to the outdoor control unit 15, the capacitor 25, and the inverter circuit 23.
The communication circuit power supply unit 13 converts an AC voltage supplied from the utility power 7 to a given DC voltage and supplies the same to the outdoor communication circuit unit 14.
[0137] Operations from then onward are the same as those in Step 24 to Step 32 in Embodiment 2.

<Advantages>

[0138] As described above, in Embodiment 3, even when the outdoor unit 3 is not of the type which allows reduction of the power consumption in the standby condition, the 52C relay is brought into an opened state to cut off the power supply from the utility power 7 to the outdoor unit 3 in the standby condition. Therefore, the standby condition power consumption consumed by the outdoor unit 3 in the standby condition is reduced.
Even in the indoor power receiving system in which the utility power 7 is connected to the indoor unit 2, the indoor

unit 2 and the outdoor unit 3 are connected by the three core cable including the power line 8, the power signal common line 9, and the signal line 16. Therefore, the control is achieved as-is without increasing the number of cores of the connecting cable between the indoor unit 2 and the outdoor unit 3 from three.

For example, in the outdoor unit 3 of a model in the related art, the outdoor unit 3 of the model in the related art can be connected to the indoor unlit 2 without developing the substrate and the software.

The connection of the indoor unit 2 and the outdoor unit 3 is also possible even when the levels of development of the standby condition power consumption reduction capability thereof are different.

The indoor control substrate and the control may be commonly used irrespective of the power receiving mode of the utility power 7 and the connection to the outdoor unit of the prior year model.

[0139] In Embodiment 3, the case of the outdoor unit 3 having no inrush current preventing relay 19 provided therein and not allowing the reduction of the power consumption in the standby condition has been described. The invention is not limited thereto, and the outdoor unit 3 which allows the reduction of the power consumption in the standby condition described in Embodiment 1 may be connected as the outdoor unit 3.

In this case, in addition to the operations described above, the indoor control unit 5 makes a reference to data in the power receiving system data unit 26, and effects the operation of the outdoor activation relay 22 when the outdoor unit 3 is of the type which allows the reduction of the power consumption in the standby condition and the utility power 7 is supplied to the indoor unit 2.

With such the configuration and the operation, the same advantages are achieved.

Embodiment 4

[0140] In Embodiment 4, the mode of the air conditioner 1 in a multiple connection having a plurality of the indoor units will be described.

[0141] Fig. 11 is an electric component system block diagram of an air conditioner in the standby condition according to Embodiment 4.

As shown in Fig. 11, in Embodiment 4, a plurality of the indoor units are provided.

In Embodiment 4, a case where two indoor units, that is, an indoor unit A 28 and an indoor unit B 29 are provided will be described.

The configurations of the indoor unit A 28 and the indoor unit B 29 are the same as the indoor unit 2 in Embodiment 1 (Fig. 1), and the same numbers reference the same parts.

The number of the indoor units is not limited thereto, and three or more of those may be provided.

[0142] The indoor unit A 28 and the indoor unit B 29 each are connected to the outdoor unit 3 respectively by the three core cable including the power line 8, the power signal common line 9, and the signal line 16.

The outdoor terminal base 31 of the outdoor unit 3 is provided with two sets of the terminals S1, S2 and S3 corresponding to the indoor unit A 28 and the indoor unit B 29.

The terminal S1 on the outdoor terminal base 31 is connected to the respective terminals S1 on the outdoor terminal base 31.

The terminal S2 on the outdoor terminal base 31 is connected to the respective terminals S2 on the outdoor terminal base 31.

The terminal S3 on the outdoor terminal base 31 is connected to the respective terminals S3 on the outdoor terminal base 31.

[0143] The outdoor unit 3 in Embodiment 4 includes the outdoor communication circuit units 14 according to the number of the indoor units to be connected in addition to the configuration in Embodiment 1 (Fig. 1).

The outdoor communication circuit units 14 each are connected at one end thereof to the communication circuit power supply unit 13, and at the other end thereof to the terminal S3 to which the signal line 16 of the indoor unit corresponding thereto is connected.

[0144] The outdoor unit 3 is provided with the power supply cutoff relays 21 according to the number of the indoor units to be connected.

The power supply cutoff relays 21 each are connected at one end to the inrush current preventing relay coil 20 and at the other end to the terminal S3 to which the signal line 16 of the indoor unit corresponding to the outdoor communication circuit unit 14 is connected.

[0145] Other parts of the configuration of the outdoor unit 3 are the same as those in Embodiment 1, and the same number reference the same parts.

<Operation>

[0146] First of all, the supply of power in the air conditioner 1 in the standby condition will be described.

[0147] The utility power 7 supplied to the terminals L and N on the outdoor terminal base 31 is supplied from the terminals S1 and S2 on the outdoor terminal base 31 to the terminals S1 and S2 on the indoor terminal bases 30 of the indoor unit A 28 and the indoor unit B 29 via the power line 8 and the power signal common line 9.

Then, the indoor rectifiers 4 each receive an input of the power of the utility power 7 supplied to the terminals S1 and S2 on the indoor terminal bases 30.

The indoor rectifier 4 converts the input AC voltage to a given DC voltage. The indoor rectifier 4 supplies the converted DC voltage to respective components of the indoor control unit 5 and the indoor unit 2.

[0148] The indoor control unit 5 determines whether the air conditioner 1 employs the indoor power receiving system or the outdoor power receiving system on the basis of data stored in the power receiving system data unit 26 and, when it is determined to be the outdoor power receiving system, enables the control of the outdoor ac-

tivation relay 22.
The indoor control unit 5 determines whether or not the outdoor unit 3 connected to the indoor unit 2 is of the type which allows reduction of the power consumption in the standby condition on the basis of the standby condition power consumption reduction capability information stored in the power receiving system data unit 26.

[0149] The outdoor activation relay 22 connects the terminal S3 on the indoor terminal base 30 and the indoor communication circuit unit 6 in the stationary state.
Accordingly, the each indoor communication circuit unit 6 is connected to the outdoor unit 3 via the signal line 16, and is brought into a state of being capable of establishing communications with the outdoor unit 3.
At the same time, the indoor control unit 5 is brought into a state of waiting for the reception of an operation start request signal transmitted from the remote controller 17 and received via the receiving unit 18.

[0150] The contact points of the outdoor relay 11 and the inrush current preventing relay 19 of the outdoor unit 3 are opened in the stationary state.
At the same time, each of the respective outdoor activation relays 22 of the indoor unit A 28 and the indoor unit B 29 opens the connection between the terminal S3 on the indoor terminal base 30 and the outdoor power supply line 24.
Therefore, no utility power 7 is supplied between the terminals S2 and S3 on the outdoor terminal base 31, so that the inrush current preventing relay coil 20 is in the non-energized state.
Therefore, even when the utility power 7 is supplied to the terminals L and N on the outdoor terminal base 31 of the outdoor unit 3, the inrush current preventing relay 19 and the outdoor relay 11 are each brought into an opened state.
Therefore, in the standby condition, the power source supply to the respective components connected to downstream of the inrush current preventing relay 19 and the outdoor relay 11 is cut off, so that reduction of the standby condition power consumption of the outdoor unit 3 in the standby condition is achieved.

[0151] Subsequently, the operation of the outdoor unit of the air conditioner at the time of activation and during operation will be described.

[0152] Fig. 12 is an electric component system block diagram of the air conditioner according to Embodiment 4 in which one of the indoor units is activated.
Fig. 13 is an electric component system block diagram of the air conditioner according to Embodiment 4 in which one of the indoor units is in operation.
The operation to activate the outdoor unit 3 when an operation start request is transmitted from the remote controller 17 only to the indoor unit A 28 will be described.

[0153] When the operation start request is transmitted from the remote controller 17 to the indoor unit A 28, the indoor control unit 5 of the indoor unit A 28 receives the operation start request via the receiving unit 18.
Operations from then onward of the indoor unit A 28 are the same as those in Step 1 to Step 11 in Embodiment 1.

[0154] Subsequently, an operation of the outdoor unit 3 will be described.

[0155] Fig. 14 is a flowchart showing an operation of the outdoor unit according to Embodiment 4.
Referring now to Fig. 12 and Fig. 13, description will be given on the basis of respective steps in Fig. 14.

(Step 41)

[0156] When the outdoor activation relay 22 of the indoor unit A 28 is turned ON and the utility power 7 is supplied between the signal line 16 and the power signal common line 9, the utility power 7 is supplied between the terminals S2 and S3 on the outdoor terminal base 31 of the outdoor unit 3.

(Step 42)

[0157] When the utility power 7 is supplied between the terminals S2 and S3 on the outdoor terminal base 31, the inrush current preventing relay coil 20 is energized via the power supply cutoff relays 21, and makes the inrush current preventing relay 19 short-circuited (see Fig. 12).
When the inrush current preventing relay 19 is made short-circuited, the utility power 7 supplied to the terminals L and N on the outdoor terminal base 31 is supplied to the outdoor rectifier 12 and the communication circuit power supply unit 13 via the inrush current preventing resistance 10.
The outdoor rectifier 12 converts an AC voltage supplied from the utility power 7 to a given DC voltage, and supplies the same to the outdoor control unit 15, the capacitor 25, and the inverter circuit 23.
The communication circuit power supply unit 13 converts an AC voltage supplied from the utility power 7 to a given DC voltage and supplies the same to the outdoor communication circuit units 14.

(Step 43)

[0158] When the DC power is supplied from the outdoor rectifier 12, the outdoor control unit 15 makes the outdoor relay 11 short-circuited.

(Step 44)

[0159] Subsequently, the outdoor control unit 15 effects the operations of all the power supply cutoff relays 21 to open the contact points.

(Step 45)

[0160] When the power supply cutoff relays 21 are opened, the inrush current preventing relay coil 20 is brought into a non-energized state, and the inrush current preventing relay 19 is opened (see Fig. 13).

Accordingly, the short circuit between the terminals S2 and S3 on the outdoor terminal base 31 is prevented during operation of the outdoor unit 3, so that communications between the indoor communication circuit unit 6 and the outdoor communication circuit unit 14 are enabled.

(Step 46)

[0161] Subsequently, the outdoor control unit 15 effects the operations of all the outdoor communication circuit units 14 to start communications with the indoor unit A 28 or the indoor unit B 29.
The outdoor communication circuit units 14 each start communications with the indoor communication circuit unit 6 of the corresponding indoor unit via the power signal common line 9 and the signal line 16.

(Step 47)

[0162] The outdoor control unit 15 determines whether or not communications between the respective outdoor communication circuit units 14 and the indoor communication circuit unit 6 of the corresponding indoor unit are established.
[0163] The outdoor control unit 15 repeats Step 47 until the communications with the indoor communication circuit unit 6 of either one of the indoor unit A 28 or the indoor unit B 29 are established.

(Step 48)

[0164] Since the indoor communication circuit unit 6 of the indoor unit A 28 is in operation here, it is determined that communications between the outdoor communication circuit unit 14 and the indoor communication circuit unit 6 of the indoor unit A 28 are established.
In this case, the outdoor unit 3 starts communication with the indoor unit A 28.

(Step 49)

[0165] The outdoor control unit 15 carries out communications with the indoor unit A 28 via the outdoor communication circuit unit 14, and causes the air conditioner 1 to perform the cooling operation or the heating operation.
[0166] Subsequently, an operation in a case where the operation start request is transmitted from the remote controller 17 to the indoor unit B 29 when the indoor unit A 28 and the outdoor unit 3 are in operation will be described.
[0167] When the operation start request is transmitted from the remote controller 17 to the indoor unit B 29, the indoor control unit 5 of the indoor unit B 29 receives the operation start request via the receiving unit 18.
From then onward, establishment of the communications between the indoor communication circuit unit 6 of the indoor unit B 29 and the outdoor unit 3 with the same operations as in Step 1 to Step 3 in Embodiment 1 is achieved.
[0168] Here the outdoor unit 3 is already in operation by the operations described above, and the outdoor communication circuit unit 14 to be connected to the indoor unit B 29 is repeating the establishment of communications, so that the establishment of communications between the indoor unit B 29 and the outdoor unit 3 is achieved.
Therefore, the outdoor control unit 15 of the indoor unit B 29 carries out the communications with the outdoor unit 3 via the indoor communication circuit unit 6 by the operations in Step 3 and Step 9 in Embodiment 1, and causes the air conditioner 1 to perform the cooling operation or the heating operation.
[0169] Subsequently, an operation to bring the air conditioner 1 to the standby condition will be described.
[0170] In the same manner as in Embodiment 1, the indoor control units 5 each receive an operation standby signal from the remote controller 17 via the corresponding receiving unit 18.
The outdoor control unit 15 of the outdoor unit 3 receives the operation standby signal via the respective outdoor communication circuit units 14.
The outdoor control unit 15 effects the operation of the outdoor relay 11 to open the contact point upon receipt of the operation standby signal from all the indoor units.
[0171] Accordingly, the power supply from the utility power 7 to the outdoor rectifier 12 and the communication circuit power supply unit 13 via the terminals L and N on the outdoor terminal base 31 is stopped, and the supply of the DC power to the respective components of the outdoor unit 3 is also stopped.
With the operation as described above, transition to the standby condition described above (Fig. 11) is achieved again.

<Advantages>

[0172] As described thus far, in Embodiment 4, even when there are a plurality of the indoor units, connection between the respective indoor units and the outdoor unit 3 is achieved as-is without increasing the number of cores of the connecting cable between the respective indoor units and the outdoor unit 3 from three, and the reduction of the standby made power consumption in the standby condition is achieved.

Citation List

[0173] 1:air conditioner, 2:indoor unit, 3: outdoor unit, 4: indoor rectifier, 5: indoor control unit, 6: indoor communication circuit unit, 7: utility power, 8: power line, 9: power signal common line, 10: inrush current preventing resistance, 11: outdoor relay, 12: outdoor rectifier, 13: communication circuit power supply unit, 14: outdoor communication circuit unit, 15: outdoor control unit, 16:

signal line, 17: remote controller, 18: receiving unit, 19: inrush current preventing relay, 20: inrush current preventing relay coil, 21: power supply cutoff relay, 22: outdoor activation relay, 23: inverter circuit, 24: outdoor power supply line, 25: capacitor, 26: power receiving system data unit, 27: 52C relay, 28: indoor unit A, 29: indoor unit B, 30: indoor terminal base, 31: outdoor terminal base

Claims

1. An air conditioner, in which an indoor unit (2) and an outdoor unit (3) are provided, the indoor unit (2) and the outdoor unit (3) being connected by a three-core cable of a power line (8), a common line (9), and a signal line (16), and utility power (7) supplied to either the outdoor unit (3) or the indoor unit (2) is distributed via the power line (8) and the common line (9), wherein
the indoor unit (2) includes:

an outdoor activation relay (22) configured to open and close a connection between the power line (8) and the signal line (16); and
an indoor control unit (5) configured to effect the operation of the outdoor activation relay (22) to supply the utility power (7) between the signal line (16) and the common line (9), and
the indoor control unit (5) opens the connection between the power line (8) and the signal line (16) in a standby condition.

2. The air conditioner of claim 1, wherein the outdoor unit (3) includes:

a power supply relay configured to open and close a connection of the utility power (7) supplied to the outdoor unit (3) and the outdoor unit (3); and
a power supply relay coil configured to close the power supply relay when the utility power (7) is supplied between the signal line (16) and the common line (9).

3. The air conditioner of claim 2, wherein a plurality of the indoor units (28,29) are provided,
the outdoor unit (3) is connected to the plurality of indoor units (28,29) by three core cables each including the power line (8), the common line (9), and the signal line (16), and
the power supply relay coil closes the power supply relay when the utility power (7) is supplied between the signal line (16) and the common line (9) which are connected to any one of the plurality of indoor units (28,29).

4. The air conditioner of any one of claims 1 to 3, wherein the indoor unit (2,28,29) includes an indoor communication circuit unit (6) configured to carry out communications with the outdoor unit (2,28,29) via the signal line (16) and the common line (9), and
the indoor control unit (5) operates the outdoor activation relay (22) for a predetermined time when the communication between the indoor communication circuit unit (6) and the outdoor unit (3) is not established when starting operation.

5. The air conditioner of claim 4, wherein the outdoor unit (3) includes:

an outdoor communication circuit unit (14) configured to carry out communications with the indoor unit (2,28,29) via the signal line (16) and the common line (9);
a power supply cutoff relay (21) configured to cut off energization of the power supply relay coil; and
an outdoor control unit (15) configured to operates the power supply cutoff relay (21),
the power supply relay includes:

an outdoor relay (11) operated by the outdoor control unit (15); and
an inrush current preventing relay (19) connected in parallel with the outdoor relay (11) and configured to be operated by energization of the power supply relay coil, and
the outdoor control unit (15) operates the outdoor relay (11) after a contact point of the inrush current preventing relay (19) is closed by a supply of the utility power (7) between the signal line (16) and the common line (9), opens the contact point by operating the power supply cutoff relay (21) after having closed the contact point of the outdoor relay (11), and operates the outdoor communication circuit unit (14) to start communication with the indoor unit (2, 28, 29) .

6. The air conditioner of claim 1, wherein
a power receiving system data part (26) is provided, in which information to identify whether or not the outdoor unit (3) includes a power supply relay is stored,
and the indoor control unit (5) does not operates the outdoor activation relay (22) when the outdoor unit (3) does not have the power supply relay.

7. The air conditioner of claim 1, wherein the indoor unit (2) includes:

an indoor power distribution relay (27) configured to open and close a connection between the utility power (7) supplied to the indoor unit (2) and the power line (8); and

a power receiving system data unit (26), in which information for discriminating to which the utility power (7) is supplied, the outdoor unit (3) or the indoor unit (2), is stored, and
the indoor control unit (5) is configured to operate the indoor power distribution relay (27) on the basis of the information stored at least in the power receiving system data unit (26), and to supply the utility power (7) from the indoor unit (2) to the outdoor unit (3) via the power line (8) and the common line (9).

8. The air conditioner of claim 7, wherein the power receiving system data unit (26) stores information for discriminating whether or not the outdoor unit (3) includes a power supply relay, and
the indoor control unit (5) does not operate the outdoor activation relay (22) when the outdoor unit (3) does not have the power supply relay.

9. The air conditioner of claim 7, wherein the outdoor unit (3) includes:

a power supply relay configured to open and close a connection between the power line (8) and the outdoor unit (3); and
a power supply relay coil configured to close the power supply relay when the utility power (7) is supplied between the signal line (16) and the common line (9),
the power receiving system data unit (26) stores information for discriminating whether or not the outdoor unit (3) includes the power supply relay, and
the indoor control unit (5) operates the outdoor activation relay (22) when the outdoor unit (3) includes the power supply relay and the utility power (7) is supplied to the indoor unit.

FIG. 1

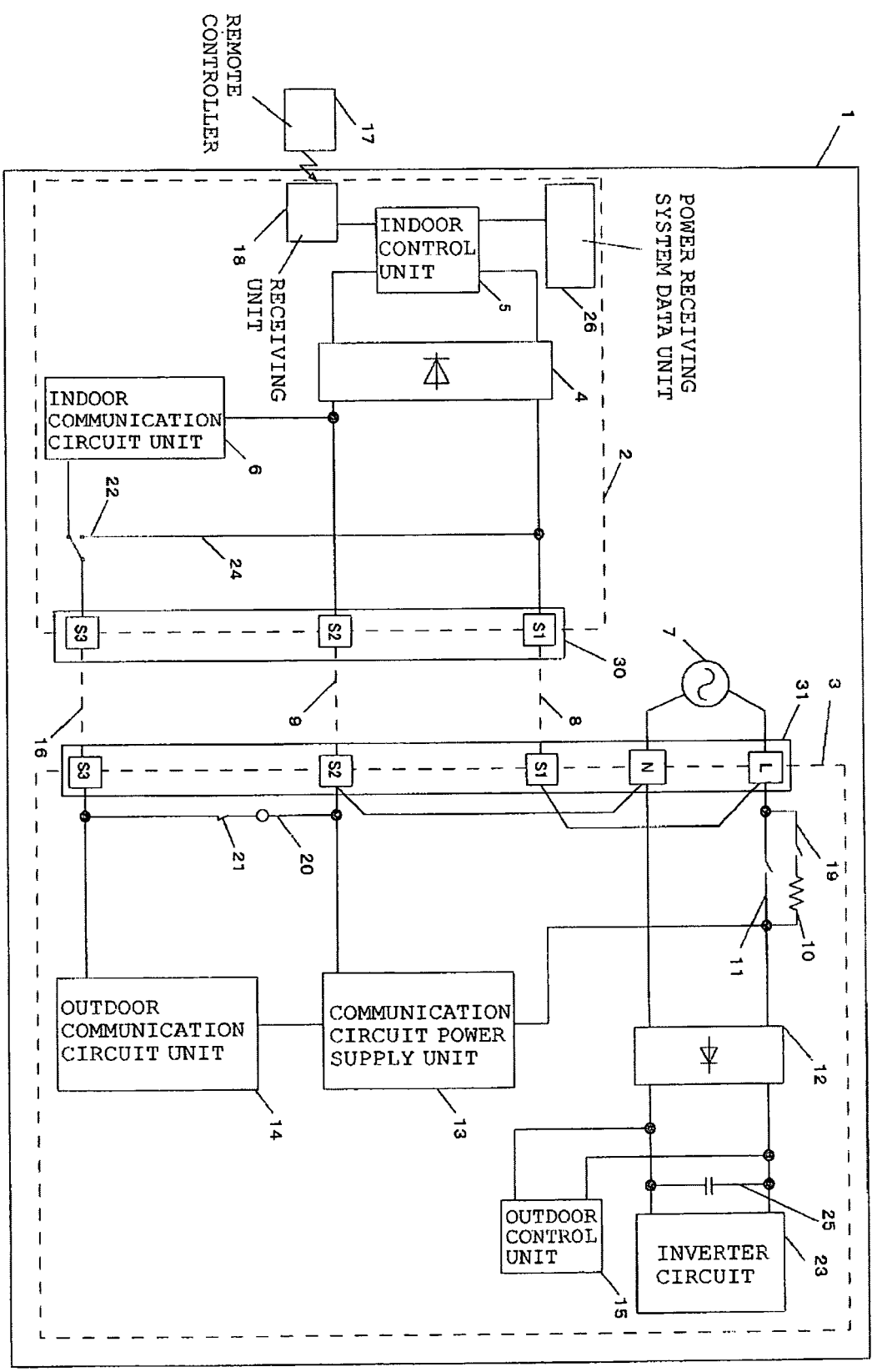

REMOTE CONTROLLER
17
1
18
RECEIVING UNIT
INDOOR CONTROL UNIT
5
26
POWER RECEIVING SYSTEM DATA UNIT
4
INDOOR COMMUNICATION CIRCUIT UNIT
6
2
22
24
S3
S2
S1
30
7
31
3
9
8
16
N
L
21
20
19
10
11
OUTDOOR COMMUNICATION CIRCUIT UNIT
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
12
14
13
OUTDOOR CONTROL UNIT
INVERTER CIRCUIT
25
23
15

FIG. 2

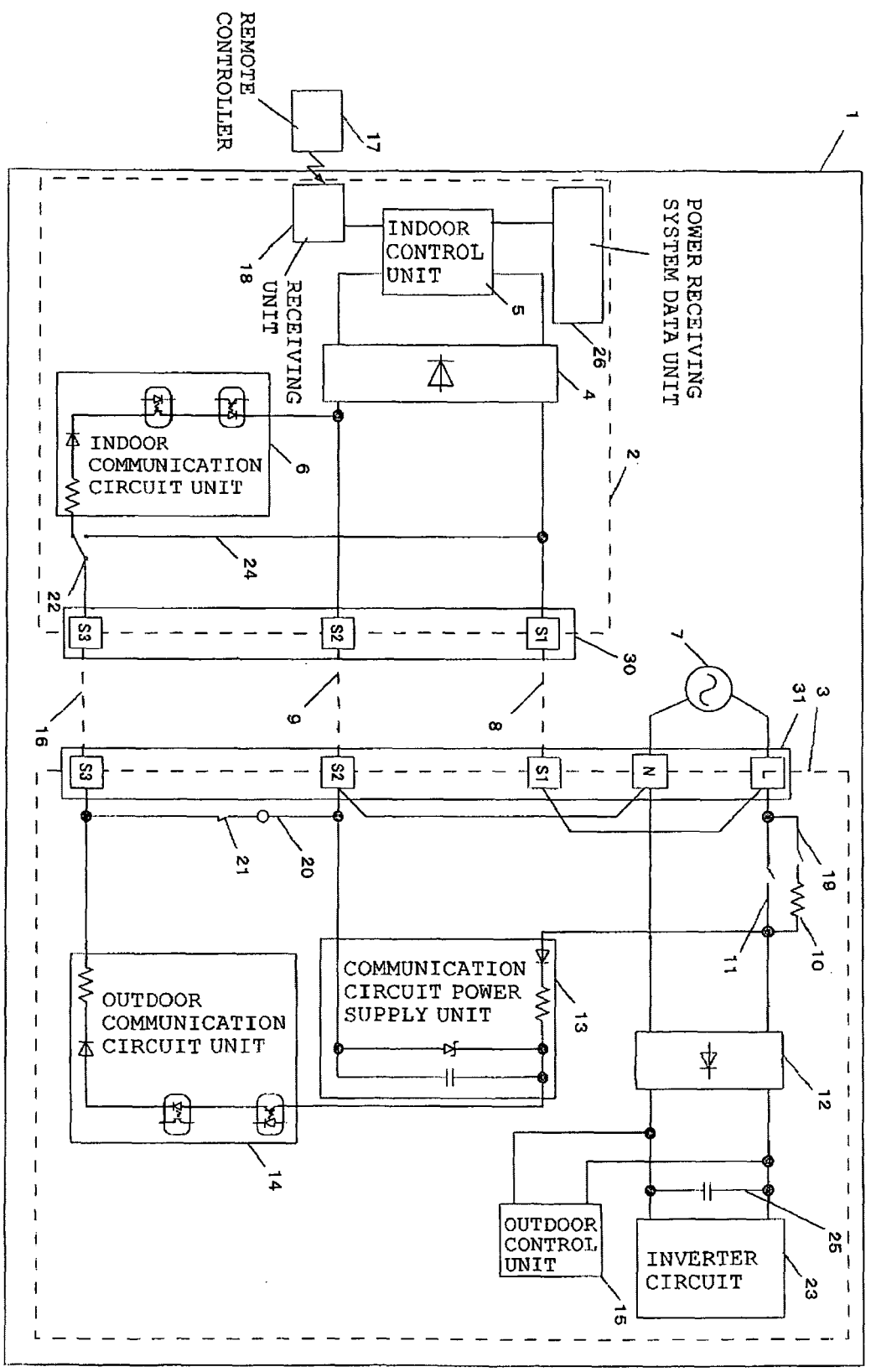

REMOTE CONTROLLER
17
1
RECEIVING UNIT
18
INDOOR CONTROL UNIT
5
POWER RECEIVING SYSTEM DATA UNIT
26
4
INDOOR COMMUNICATION CIRCUIT UNIT
6
2
24
22
S3
S2
S1
30
7
3
31
16
9
8
N
L
21
20
19
10
11
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
OUTDOOR COMMUNICATION CIRCUIT UNIT
12
14
OUTDOOR CONTROL UNIT
15
INVERTER CIRCUIT
25
23

FIG. 3

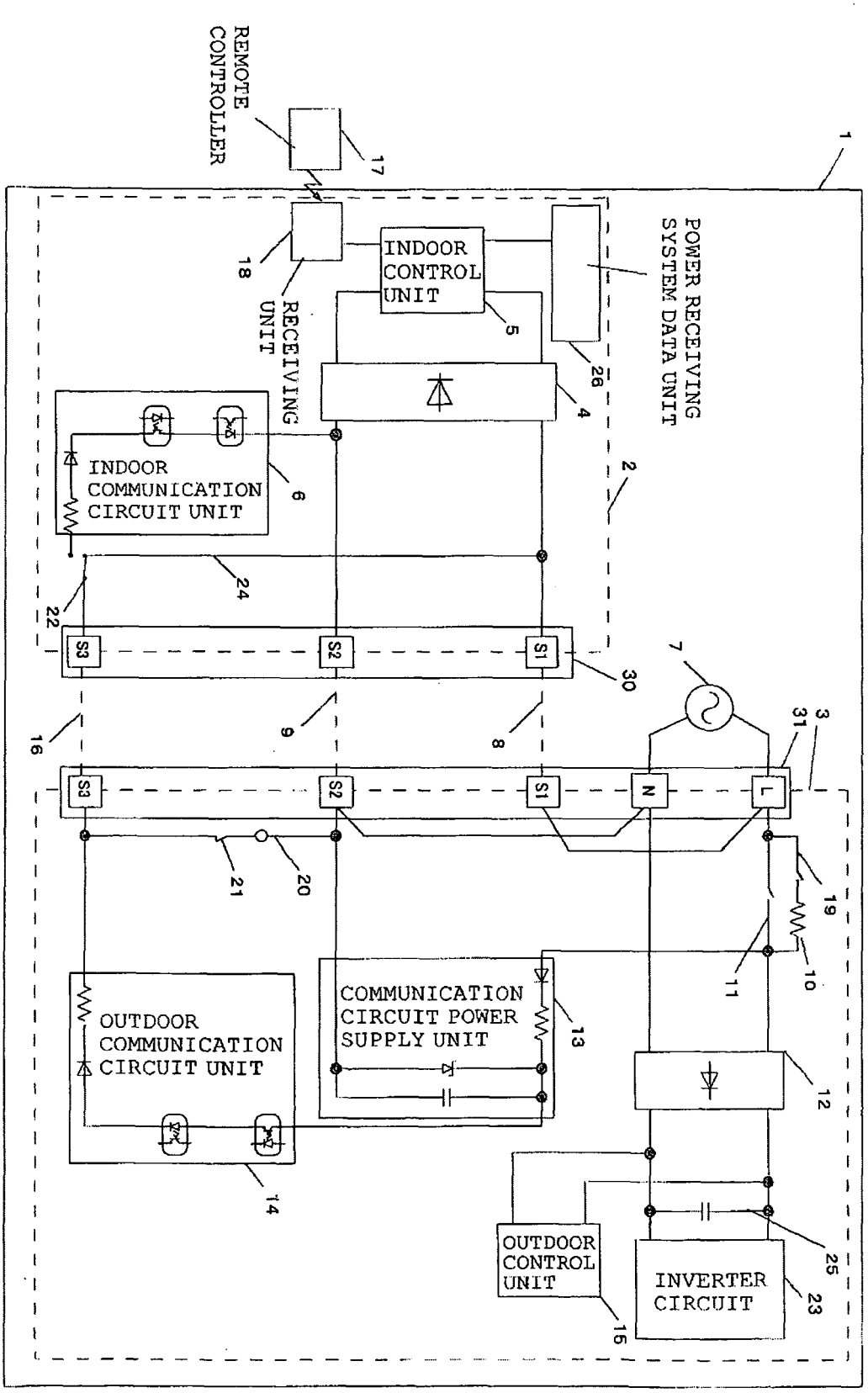

REMOTE CONTROLLER
17
1
18
RECEIVING UNIT
INDOOR CONTROL UNIT
5
POWER RECEIVING SYSTEM DATA UNIT
26
4
2
INDOOR COMMUNICATION CIRCUIT UNIT
6
24
22
S3
S2
S1
30
7
16
9
8
3
31
N
L
21
20
19
10
11
OUTDOOR COMMUNICATION CIRCUIT UNIT
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
12
14
OUTDOOR CONTROL UNIT
INVERTER CIRCUIT
25
23
15

FIG. 4

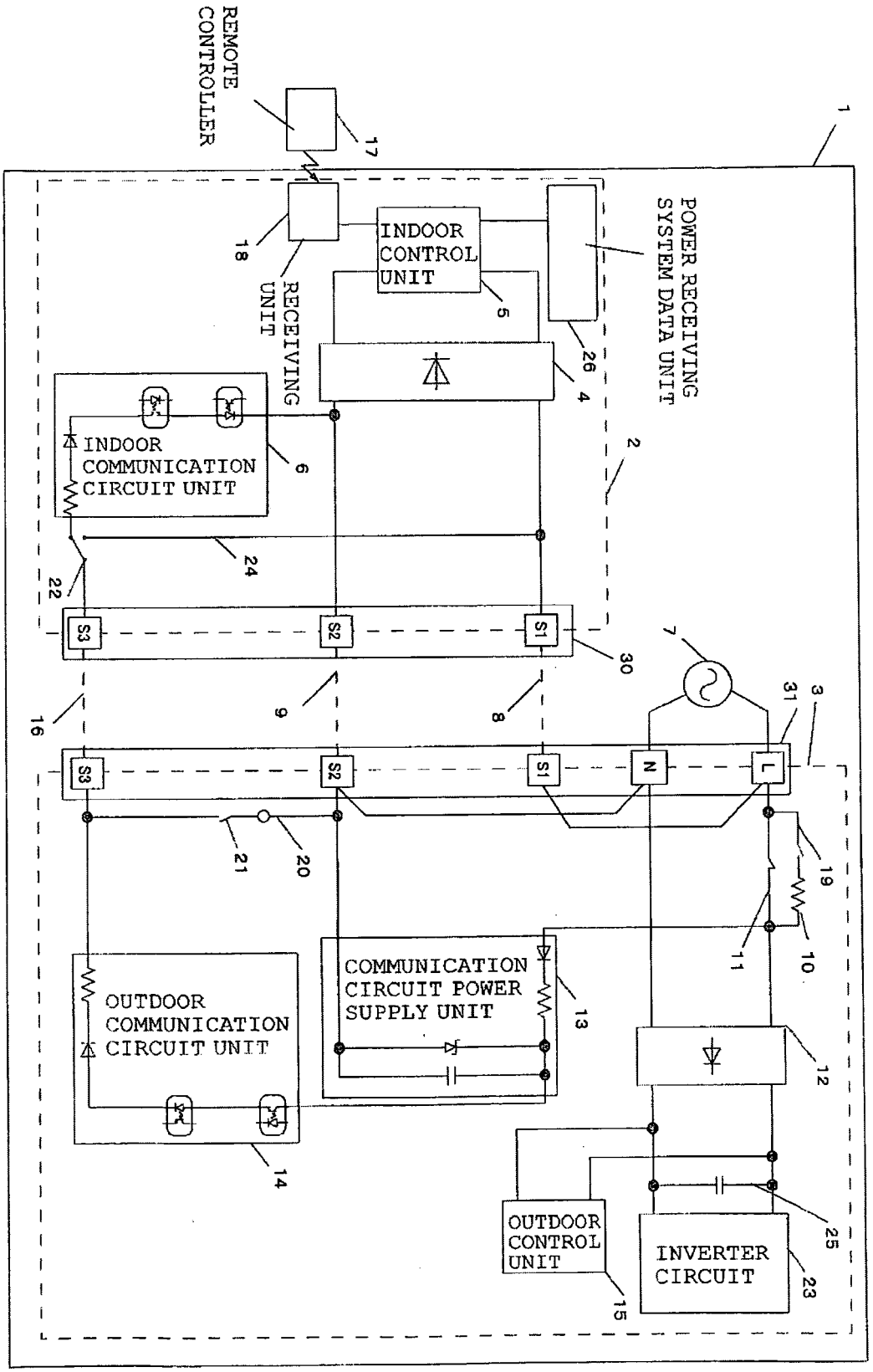

REMOTE CONTROLLER
17
1
18
RECEIVING UNIT
INDOOR CONTROL UNIT
5
POWER RECEIVING SYSTEM DATA UNIT
26
4
2
INDOOR COMMUNICATION CIRCUIT UNIT
6
24
22
S3
S2
S1
30
7
31
3
16
9
8
N
L
21
20
19
11
10
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
12
OUTDOOR COMMUNICATION CIRCUIT UNIT
14
OUTDOOR CONTROL UNIT
15
INVERTER CIRCUIT
25
23

FIG. 5

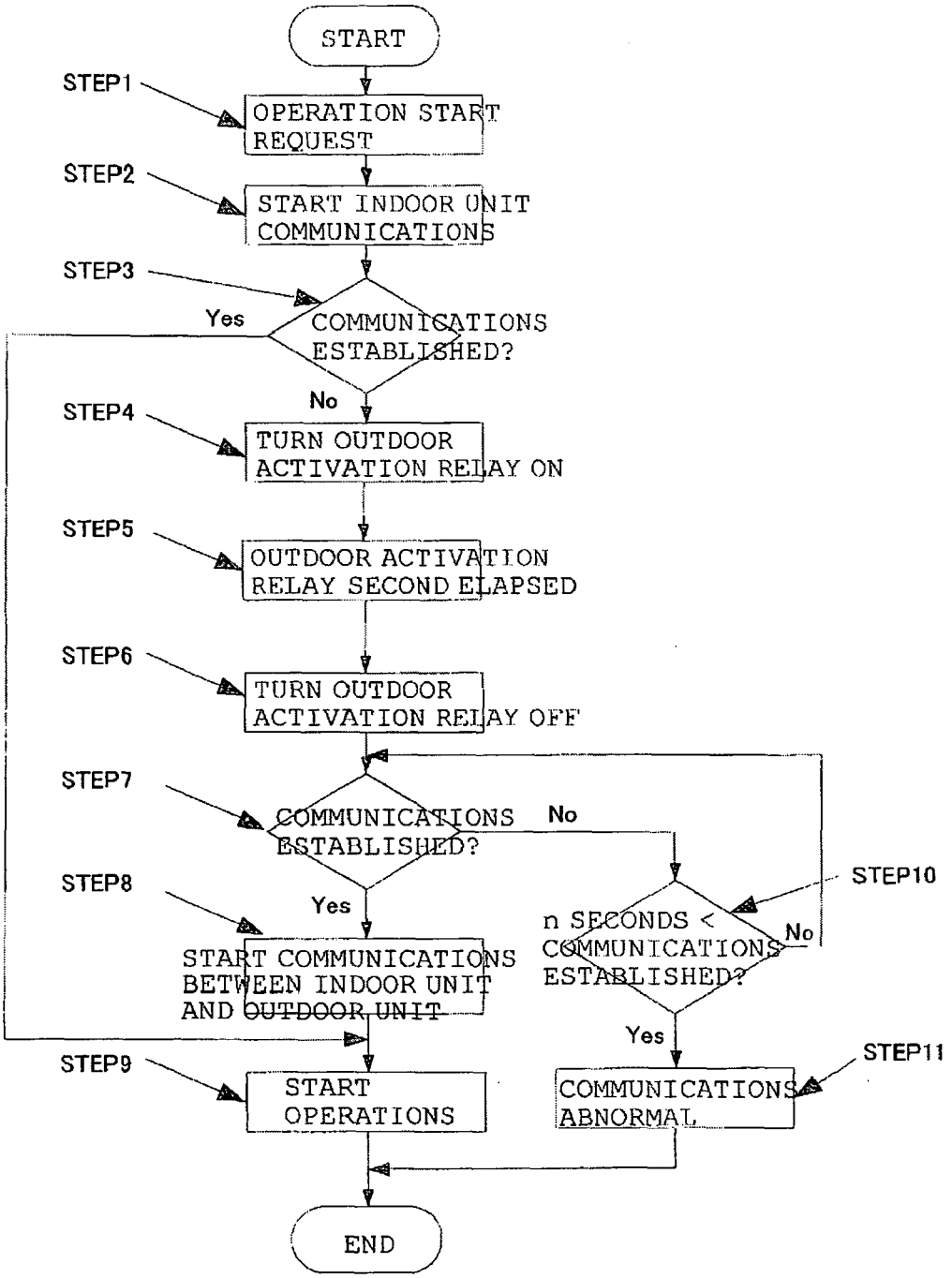

START
STEP1
OPERATION START REQUEST
STEP2
START INDOOR UNIT COMMUNICATIONS
STEP3
COMMUNICATIONS ESTABLISHED?
Yes
No
STEP4
TURN OUTDOOR ACTIVATION RELAY ON
STEP5
OUTDOOR ACTIVATION RELAY SECOND ELAPSED
STEP6
TURN OUTDOOR ACTIVATION RELAY OFF
STEP7
COMMUNICATIONS ESTABLISHED?
No
Yes
STEP8
START COMMUNICATIONS BETWEEN INDOOR UNIT AND OUTDOOR UNIT
STEP10
n SECONDS < COMMUNICATIONS ESTABLISHED?
No
Yes
STEP9
START OPERATIONS
STEP11
COMMUNICATIONS ABNORMAL
END

FIG. 6

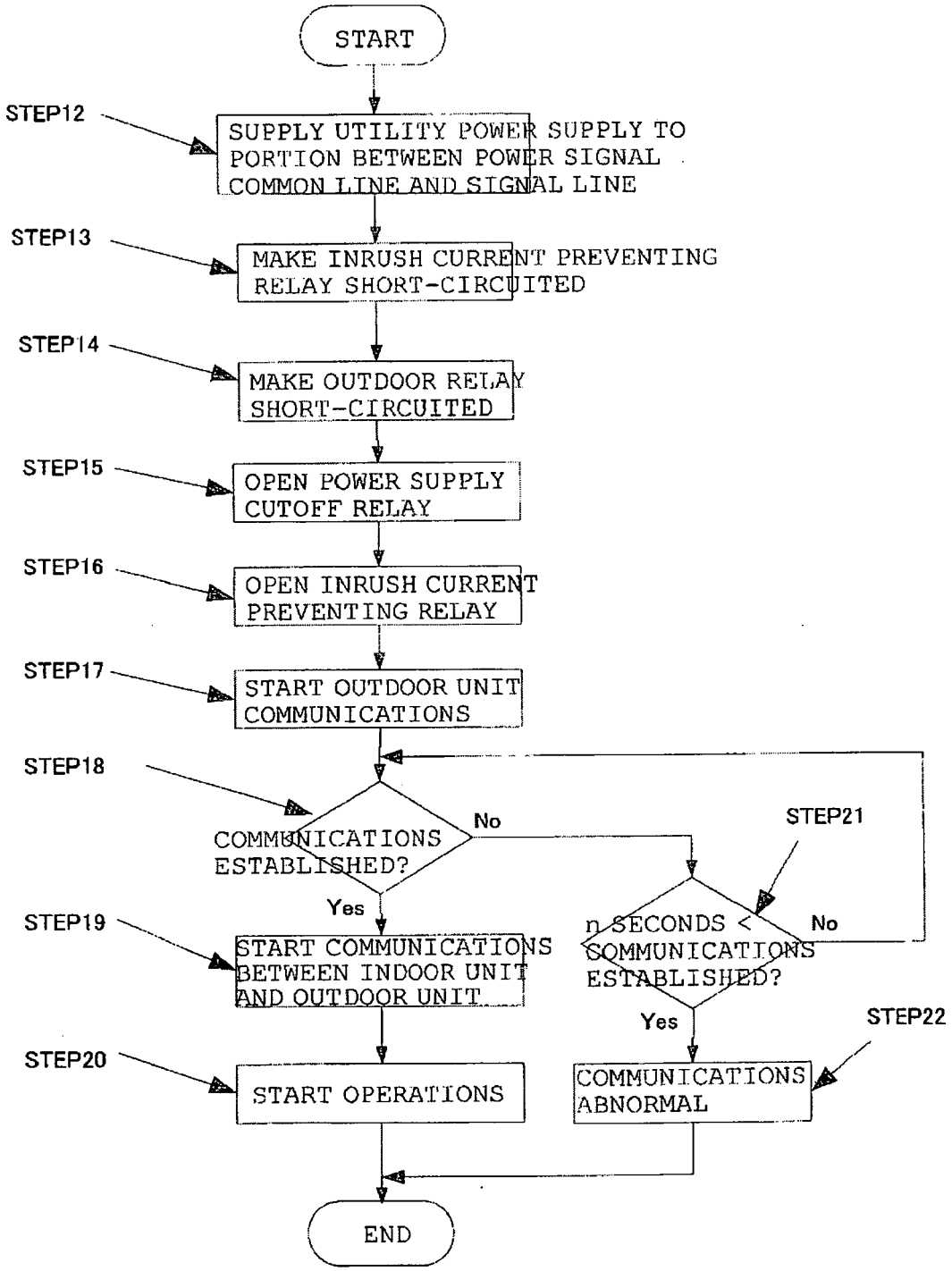

START
STEP12
SUPPLY UTILITY POWER SUPPLY TO PORTION BETWEEN POWER SIGNAL COMMON LINE AND SIGNAL LINE
STEP13
MAKE INRUSH CURRENT PREVENTING RELAY SHORT-CIRCUITED
STEP14
MAKE OUTDOOR RELAY SHORT-CIRCUITED
STEP15
OPEN POWER SUPPLY CUTOFF RELAY
STEP16
OPEN INRUSH CURRENT PREVENTING RELAY
STEP17
START OUTDOOR UNIT COMMUNICATIONS
STEP18
COMMUNICATIONS ESTABLISHED?
No
Yes
STEP21
n SECONDS < COMMUNICATIONS ESTABLISHED?
No
Yes
STEP19
START COMMUNICATIONS BETWEEN INDOOR UNIT AND OUTDOOR UNIT
STEP20
START OPERATIONS
STEP22
COMMUNICATIONS ABNORMAL
END

FIG. 7

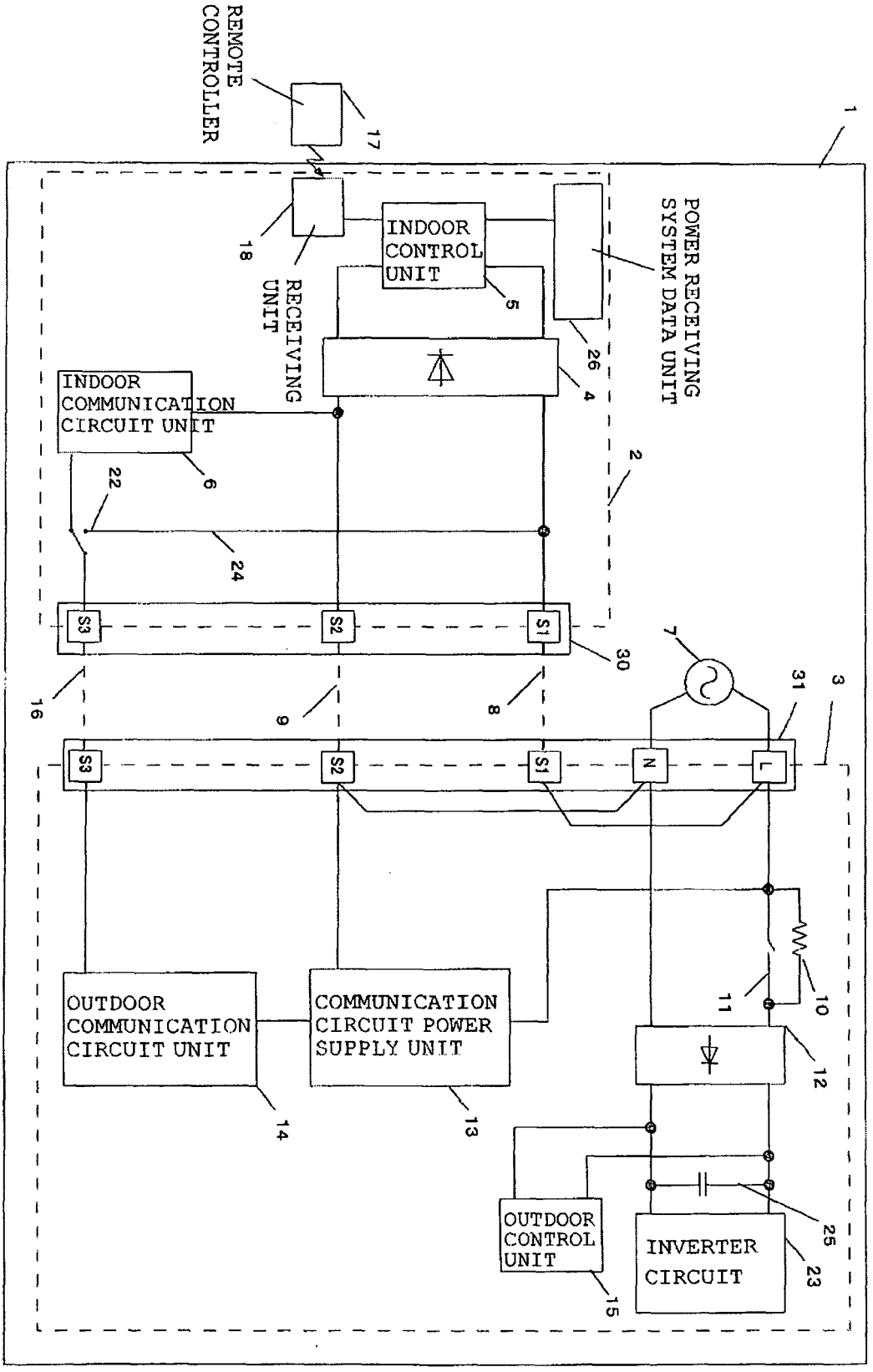

REMOTE CONTROLLER
17
1
18
RECEIVING UNIT
INDOOR CONTROL UNIT
5
POWER RECEIVING SYSTEM DATA UNIT
26
4
INDOOR COMMUNICATION CIRCUIT UNIT
6
22
24
2
S3
S2
S1
30
7
31
3
16
9
8
N
L
OUTDOOR COMMUNICATION CIRCUIT UNIT
14
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
11
10
12
OUTDOOR CONTROL UNIT
15
INVERTER CIRCUIT
25
23

FIG. 8

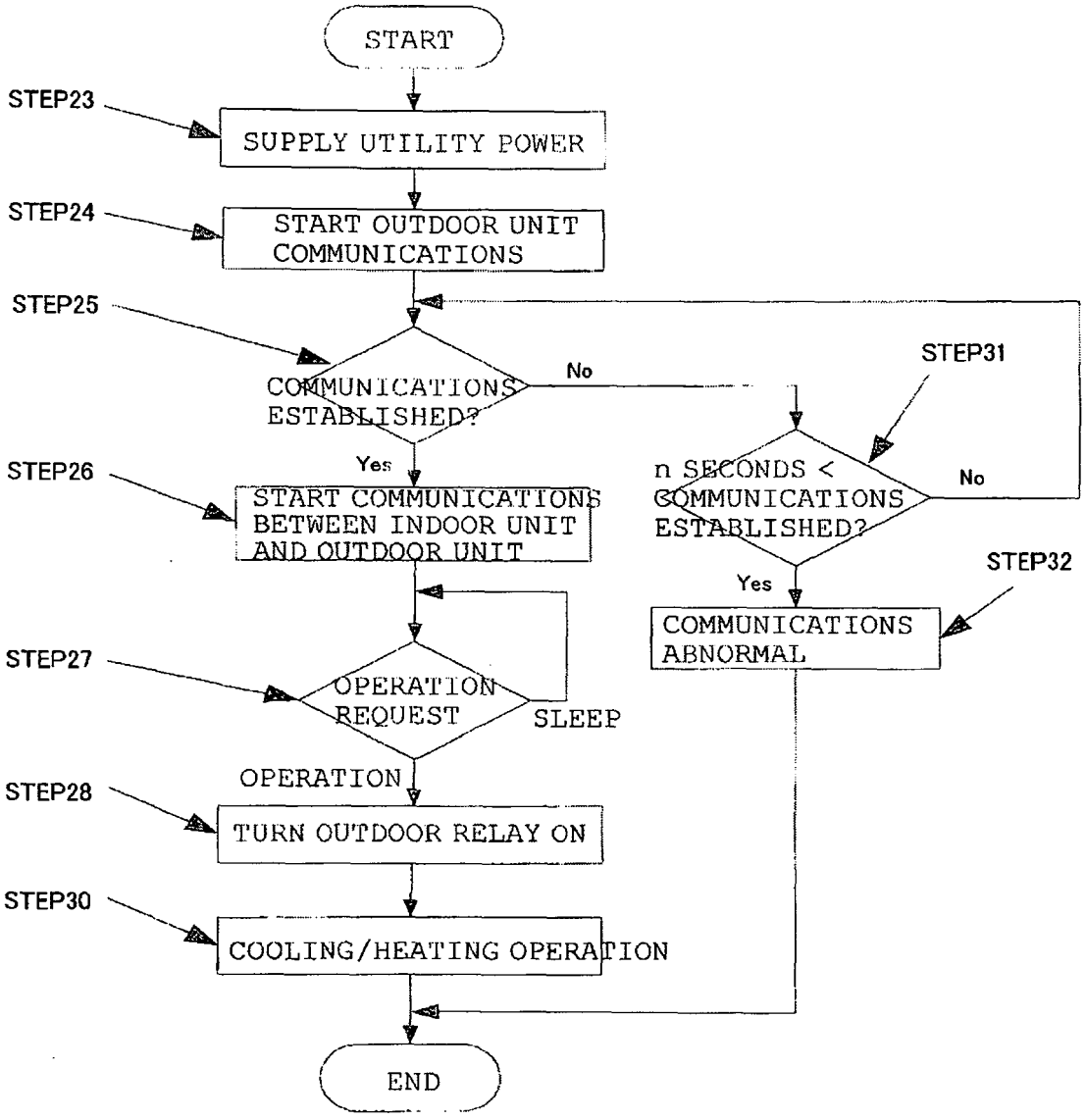

START
STEP23
SUPPLY UTILITY POWER
STEP24
START OUTDOOR UNIT COMMUNICATIONS
STEP25
COMMUNICATIONS ESTABLISHED?
No
STEP31
n SECONDS < COMMUNICATIONS ESTABLISHED?
No
Yes
STEP32
COMMUNICATIONS ABNORMAL
Yes
STEP26
START COMMUNICATIONS BETWEEN INDOOR UNIT AND OUTDOOR UNIT
STEP27
OPERATION REQUEST
SLEEP
OPERATION
STEP28
TURN OUTDOOR RELAY ON
STEP30
COOLING/HEATING OPERATION
END

FIG. 9

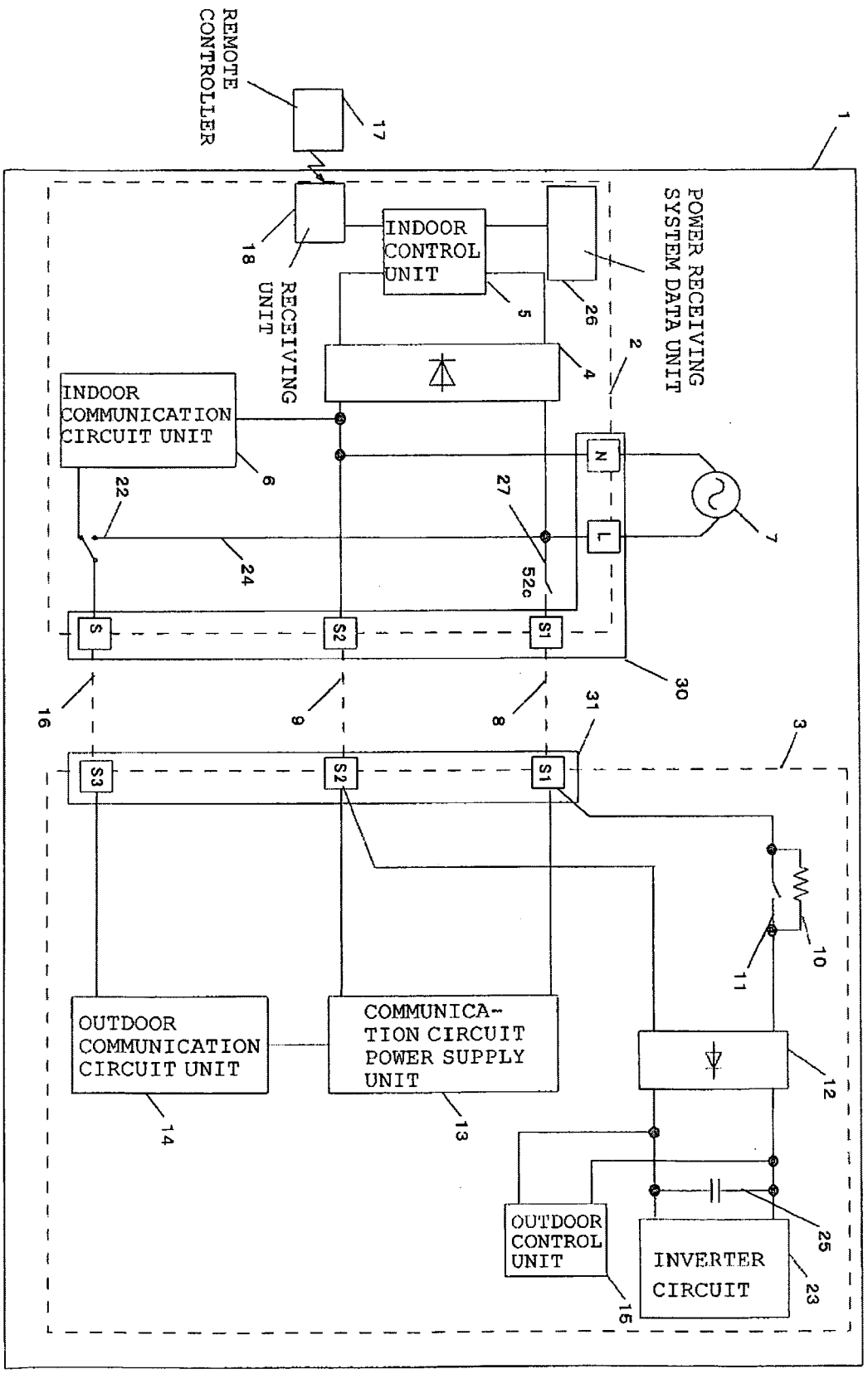

REMOTE CONTROLLER
17
1
18
RECEIVING UNIT
INDOOR CONTROL UNIT
5
26
POWER RECEIVING SYSTEM DATA UNIT
2
4
INDOOR COMMUNICATION CIRCUIT UNIT
6
22
24
27
52c
N
L
7
S
S2
S1
30
16
9
8
31
3
S3
S2
S1
10
11
OUTDOOR COMMUNICATION CIRCUIT UNIT
14
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
12
OUTDOOR CONTROL UNIT
15
INVERTER CIRCUIT
23
25

FIG. 10

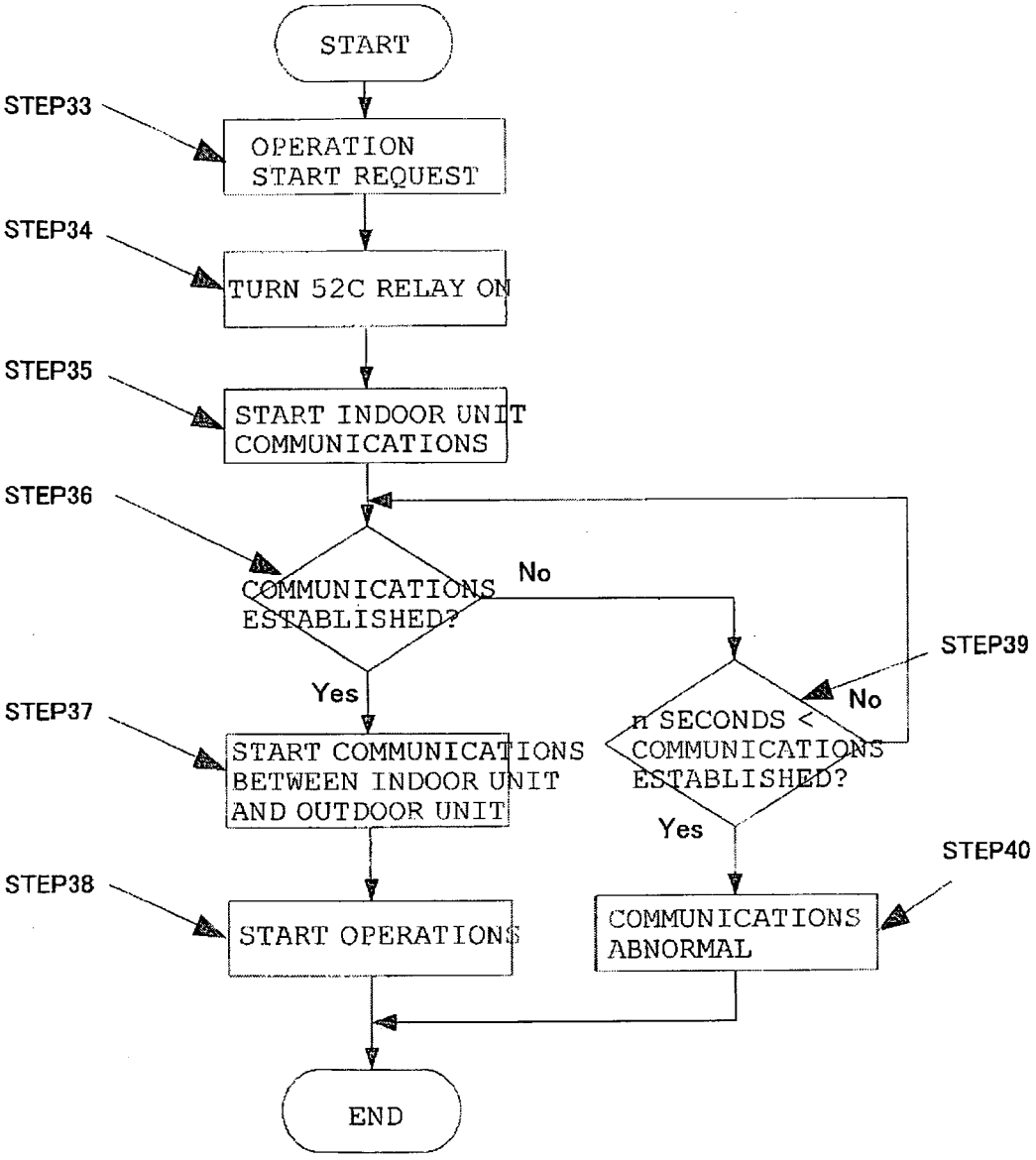

START
STEP33
OPERATION START REQUEST
STEP34
TURN 52C RELAY ON
STEP35
START INDOOR UNIT COMMUNICATIONS
STEP36
COMMUNICATIONS ESTABLISHED?
No
Yes
STEP37
START COMMUNICATIONS BETWEEN INDOOR UNIT AND OUTDOOR UNIT
STEP38
START OPERATIONS
STEP39
n SECONDS < COMMUNICATIONS ESTABLISHED?
No
Yes
STEP40
COMMUNICATIONS ABNORMAL
END

FIG. 11

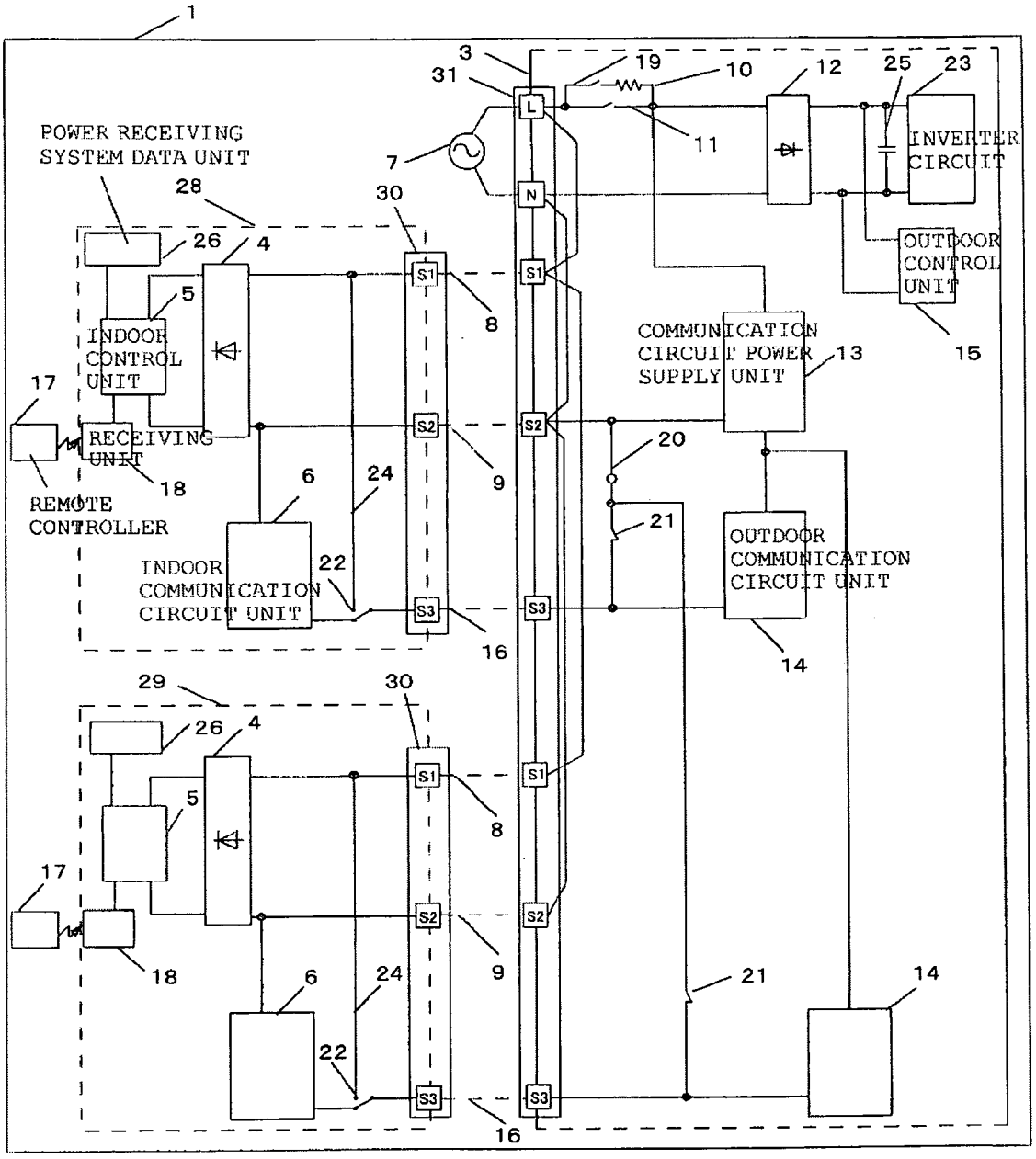
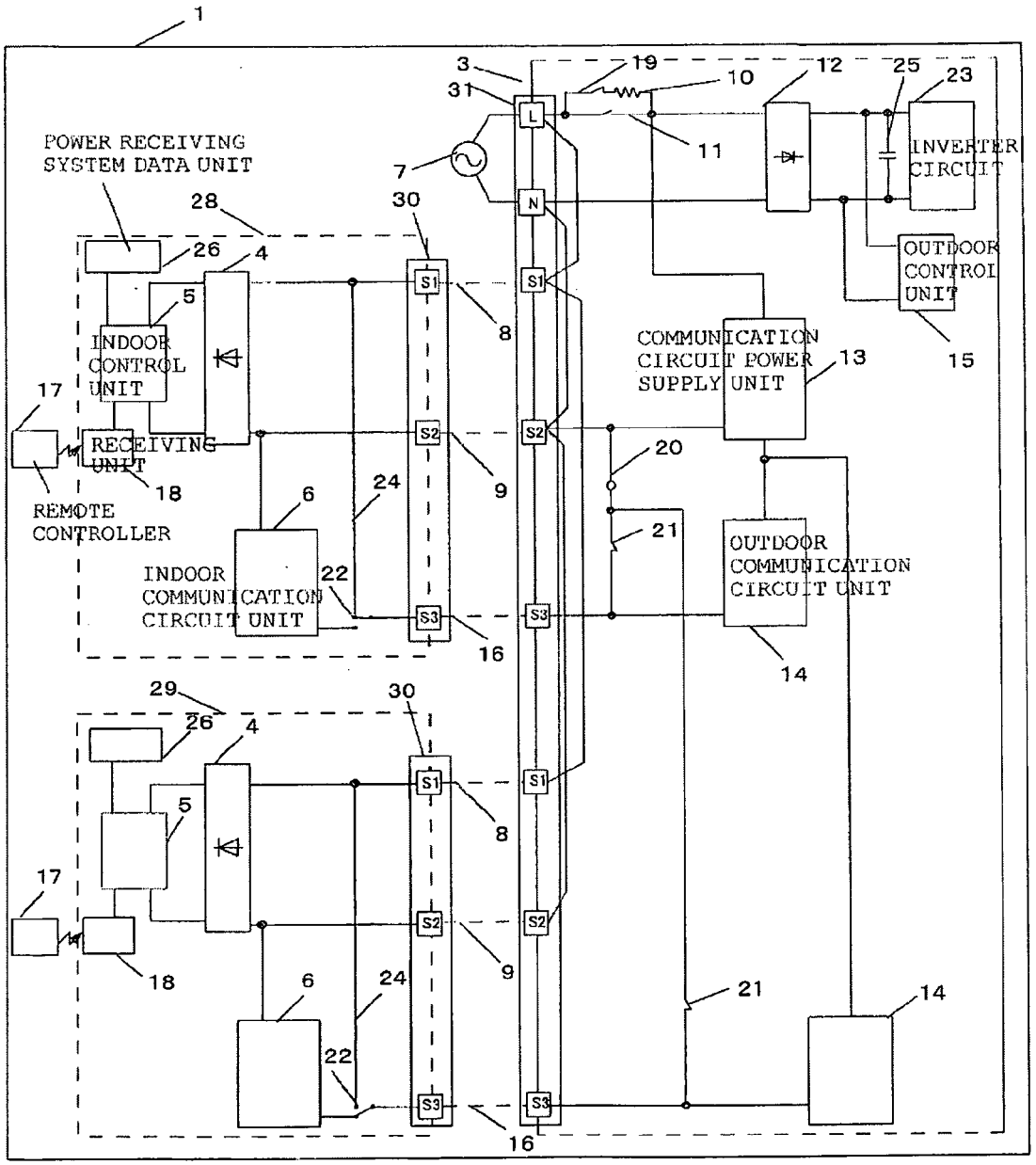

1
3
31
19
10
12
25
23
L
N
S1
S2
S3
7
11
INVERTER CIRCUIT
OUTDOOR CONTROL UNIT
15
POWER RECEIVING SYSTEM DATA UNIT
28
30
26
4
5
INDOOR CONTROL UNIT
8
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
17
RECEIVING UNIT
18
9
20
REMOTE CONTROLLER
6
24
21
OUTDOOR COMMUNICATION CIRCUIT UNIT
INDOOR COMMUNICATION CIRCUIT UNIT
22
16
14
29
30
26
4
5
8
17
18
9
21
14
6
24
22
16

FIG. 12


1
3
19
10
12
25
23
31
L
11
INVERTER CIRCUIT
POWER RECEIVING SYSTEM DATA UNIT
7
N
28
30
26
4
S1
S1
OUTDOOR CONTROL UNIT
5
8
INDOOR CONTROL UNIT
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
15
17
S2
S2
20
RECEIVING UNIT
18
9
6
24
REMOTE CONTROLLER
21
OUTDOOR COMMUNICATION CIRCUIT UNIT
INDOOR COMMUNICATION CIRCUIT UNIT
22
S3
S3
16
14
29
26
4
30
S1
S1
5
8
17
S2
S2
18
9
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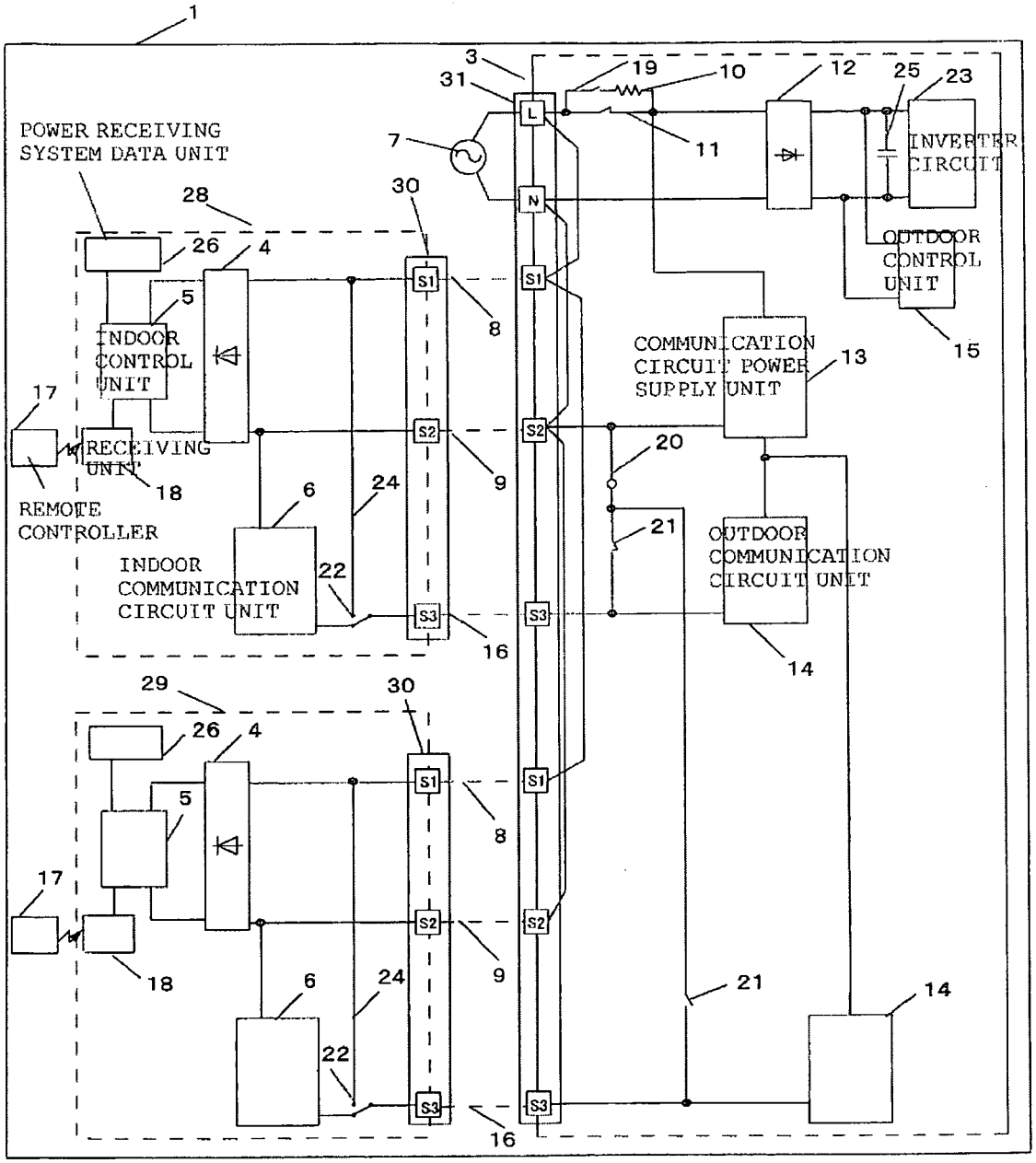
24
21
14
22
S3
S3
16

FIG. 13


1
3
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19
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12
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23
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N
7
11
INVERTER CIRCUIT
OUTDOOR CONTROL UNIT
15
POWER RECEIVING SYSTEM DATA UNIT
28
30
26
4
S1
8
5
INDOOR CONTROL UNIT
COMMUNICATION CIRCUIT POWER SUPPLY UNIT
13
17
RECEIVING UNIT
18
S2
9
20
REMOTE CONTROLLER
6
24
21
OUTDOOR COMMUNICATION CIRCUIT UNIT
INDOOR COMMUNICATION CIRCUIT UNIT
22
S3
16
14
29
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26
4
S1
8
5
17
S2
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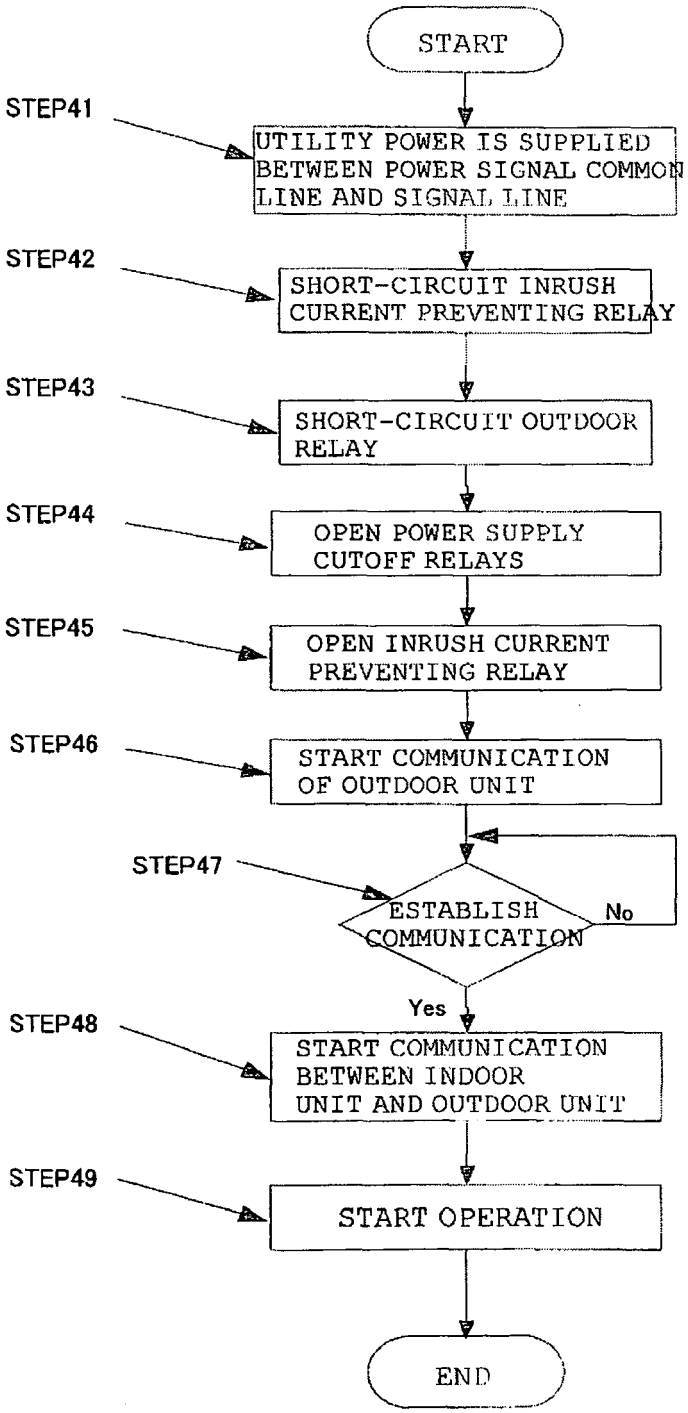
18
6
24
21
14
22
S3
16

FIG. 14


START
STEP41
UTILITY POWER IS SUPPLIED BETWEEN POWER SIGNAL COMMON LINE AND SIGNAL LINE
STEP42
SHORT-CIRCUIT INRUSH CURRENT PREVENTING RELAY
STEP43
SHORT-CIRCUIT OUTDOOR RELAY
STEP44
OPEN POWER SUPPLY CUTOFF RELAYS
STEP45
OPEN INRUSH CURRENT PREVENTING RELAY
STEP46
START COMMUNICATION OF OUTDOOR UNIT
STEP47
ESTABLISH COMMUNICATION
No
Yes
STEP48
START COMMUNICATION BETWEEN INDOOR UNIT AND OUTDOOR UNIT
STEP49
START OPERATION
END

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EUROPEAN SEARCH REPORT

Application Number
EP 10 00 2461

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 830 138 A1 (DAIKIN IND LTD [JP]) 5 September 2007 (2007-09-05) * paragraphs [0004], [0005], [0065], [0067] * -----	1-9	INV. F24F1/00 F24F11/00
X	JP 2009 041857 A (SHARP KK) 26 February 2009 (2009-02-26) * abstract; figure 1 * -----	1	
X	JP 2000 111123 A (DAIKIN IND LTD) 18 April 2000 (2000-04-18) * abstract; figure 1 * -----	1	
A	JP 2007 225128 A (FUJITSU GENERAL LTD) 6 September 2007 (2007-09-06) * abstract; figure 1 * -----	1-9	
A	EP 1 795 823 A1 (DAIKIN IND LTD [JP]) 13 June 2007 (2007-06-13) * paragraph [0022] - paragraph [0029]; figure 2 * -----	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 June 2010	Decking, Oliver

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1830138 A1	05-09-2007	AU 2005308268 A1	01-06-2006
		CN 101065617 A	31-10-2007
		JP 3806882 B2	09-08-2006
		JP 2006153346 A	15-06-2006
		WO 2006057221 A1	01-06-2006
		KR 20070063041 A	18-06-2007
		US 2008161973 A1	03-07-2008
JP 2009041857 A	26-02-2009	NONE	
JP 2000111123 A	18-04-2000	JP 3019844 B2	13-03-2000
JP 2007225128 A	06-09-2007	NONE	
EP 1795823 A1	13-06-2007	AU 2005283581 A1	23-03-2006
		CN 101018987 A	15-08-2007
		JP 2006084060 A	30-03-2006
		WO 2006030704 A1	23-03-2006
		KR 20070046973 A	03-05-2007
		US 2007251250 A1	01-11-2007

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Patent documents cited in the description

- JP 2007225128 A **[0003]**