



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
15.02.2012 Bulletin 2012/07

(51) Int Cl.:
F24F 11/02 (2006.01)

(21) Application number: **10761327.5**

(86) International application number:
PCT/JP2010/001853

(22) Date of filing: **16.03.2010**

(87) International publication number:
WO 2010/116619 (14.10.2010 Gazette 2010/41)

(84) Designated Contracting States:
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 SE SI SK SM TR

- **SARUHASHI, Koichi**
Moriguchi-shi
Osaka 570-8677 (JP)
- **TAKADA, Hajime**
Moriguchi-shi
Osaka 570-8677 (JP)

(30) Priority: **06.04.2009 JP 2009092031**

(71) Applicant: **Sanyo Electric Co., Ltd.**
Osaka 570-8677 (JP)

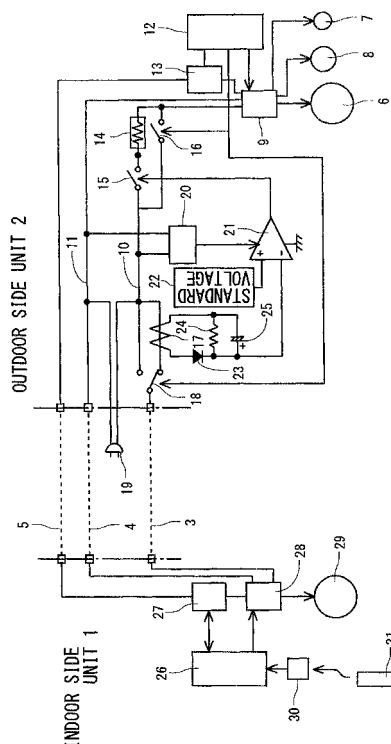
(74) Representative: **Glawe, Delfs, Moll**
Patent- und Rechtsanwälte
Postfach 26 01 62
80058 München (DE)

(72) Inventors:
• **MIYAUCHI, Taku**
Moriguchi-shi
Osaka 570-8677 (JP)

(54) **AIR CONDITIONER**

(57) The present invention particularly relates to a decrease in a standby power in an outdoor side unit, in an air conditioner comprising an indoor side unit and the outdoor side unit. The air conditioner includes a current detector which detects an alternating current flowing through a power line connecting the indoor side unit to the outdoor side unit, and a switch which performs a circuit communicating operation in a case where a current value detected by this current detector exceeds a predetermined standard value, and the air conditioner has a constitution in which via this switch, an operation of an outdoor side control circuit is started, and with the driving of a motor of the indoor side unit, the outdoor side control circuit is operated.

FIG. 1



Description

Technical Field

[0001] The present invention relates to an air conditioner which comprises an indoor side unit and an outdoor side unit and which is configured to supply a driving power of the indoor side unit from the outdoor side unit via a crossover line between the units.

Background Art

[0002] As a conventional air conditioner, a separate type air conditioner is constituted of an indoor side unit and an outdoor side unit, and a commercial alternating-current power is supplied from the indoor side unit to the outdoor side unit via an alternating-current power line between the units, restored to a direct-current power in the outdoor side unit and then supplied to the indoor side unit again.

[0003] This direct-current power is a direct-current power with a high voltage (an output of a main power circuit) in a state where the air conditioner has an air conditioning operation state, and is a direct-current power with a low voltage (an output of an auxiliary power circuit) in a state where the air conditioner does not perform the air conditioning operation (a stop state or a standby state).

[0004] The direct-current power with the high voltage is required for driving a motor for an air blowing fan disposed in the indoor side unit, and the direct-current power with the low voltage is required for driving a control circuit such as a microcomputer, because the motor does not have to be driven in the state where the air conditioning operation is not performed. When the auxiliary power circuit is operated, the main power circuit (an INV drive circuit, to supply a power source for an outdoor fan motor) is stopped, and a standby power in the outdoor side unit is decreased to a degree of a power of the auxiliary power circuit.

[0005] The driving of the main power circuit is started when the control circuit (the microcomputer or the like) of the outdoor side unit receives an air conditioning operation start signal superimposed on a direct-current power line via which the direct-current power is supplied from the outdoor side unit to the indoor side unit (e.g., see Patent Document 1). Moreover, as another conventional air conditioner, a separate type air conditioner is constituted of an indoor side unit and an outdoor side unit, and the indoor side unit is connected to the outdoor side unit via three lines in total including two power lines through which a commercial alternating current flows and a signal line shared by one of these power lines, whereby the commercial alternating current is directly supplied to the power line in the outdoor side unit, and supplied to the indoor side unit successively via the outdoor side unit and the power line.

[0006] When an air conditioning operation is stopped,

the supplying of an alternating-current power to a power circuit of the outdoor side unit is blocked by opening a relay contact piece. The alternating-current power remains to be supplied to the indoor side unit.

[0007] When the air conditioning operation is started, a higher voltage is applied from the indoor side unit to a signal line than a voltage for use in usual signal transmission or reception. The outdoor side unit excites a relay of the outdoor side unit by use of this high voltage as a start power, and closes the relay contact piece, to operate the power circuit, thereby changing the outdoor side unit to an operating state (e.g., see Patent Document 2).

Prior Art Documents

Patent Documents

[0008]

Patent Document 1: Japanese Patent No. 3730808
Patent Document 2: Japanese Patent No. 3019844

Summary of the Invention

Problems to be solved by the Invention

[0009] However, in a technology disclosed in Patent Document 1, it is necessary to keep a microcomputer of an indoor side unit and a microcomputer of an outdoor side unit in a state where a signal for operation/stop or the like is constantly transmitted or received. That is, it is necessary to constantly keep at least the microcomputer of the outdoor side unit in an operating state, and a standby power for this purpose is constantly required. Moreover, the transmission and reception of the signal requires a signal line and a direct-current power line, and hence at least four lines including an alternating-current power line are required, which causes faulty wiring and trouble of an installation work.

[0010] Moreover, in an air conditioner disclosed in Patent Document 2, a special power circuit is required for applying a higher voltage to a signal line than a voltage for use in usual signal transmission and reception, and at the same time, it is necessary to change specifications of a communication circuit of an indoor side unit and an outdoor side unit to those for this high voltage. Furthermore, even if this high voltage is not excessively high, it is necessary to supply a sufficient current for exciting a relay, and owing to a difference between a low impedance of an excitation coil of the relay and a high impedance of the communication circuit, such a constitution as to cut this relay after the start of the operation of the power circuit is also required.

[0011] The present invention focuses attention on the point that the start of an indoor side unit (the start of an air conditioning operation) is associated with the operation start of a motor for an air blowing fan disposed in the indoor side unit, and the consumption of a current by the

operation of this motor is judged so that the start of the air conditioning operation of the indoor side unit can be judged by an outdoor side unit. More specifically, the indoor side unit is connected to the outdoor side unit via two alternating-current power lines and one signal line (shared by one of the alternating-current power lines), and an alternating-current power is supplied to the indoor side unit via the outdoor side unit, whereby even in a case where a control circuit of the outdoor side unit is stopped, when the motor is operated in the indoor side unit, a current increases as much as at least a current for the operation on the alternating-current power line. That is, the current flowing through the alternating-current power line from the outdoor side unit to the indoor side unit increases. This current increase is detected by using a CT, and when a current value detected by this CT exceeds a predetermined value, a relay is energized to start the control circuit of the outdoor side unit. Therefore, the outdoor side unit may include at least a switching circuit to excite this relay and the CT to detect the current.

Means for Solving the Problems

[0012] To solve the above problem, there is provided an air conditioner having a refrigerating cycle in which at least a refrigerant compressor driven by an electromotive element, a heat source side heat exchanger, a pressure reducing unit and a utilization side heat exchanger are circularly connected via a refrigerant piping line, these constituent elements of the refrigerant cycle being divided and disposed in an indoor side unit and an outdoor side unit, the indoor side unit being provided with a motor which drives an air blowing fan of the utilization side heat exchanger, a power to drive the motor being supplied via the outdoor side unit, wherein the indoor side unit is connected to the outdoor side unit via three lines including a first power line and a second power line through which an alternating current flows and a signal line through which a signal is transmitted by using one of the power lines as a common use line, a commercial alternating-current power is applied to the first power line and the second power line in the outdoor side unit, the outdoor side unit includes a current detector which detects, from this commercial alternating-current power, the alternating current flowing through one of the first power line and the second power line, a switch which performs a circuit communicating operation in a case where a current value detected by this current detector exceeds a predetermined standard value, and an outdoor side control circuit to which the commercial alternating-current power is supplied via this switch to control the driving of the electromotive element, the indoor side unit includes an indoor side control circuit which controls the supplying, to the motor, of the commercial alternating-current power obtained via the first power line and the second power line, and this indoor side control circuit starts the driving of the motor in response to the start of an air conditioning operation, and transmits or receives the signal to or from

the outdoor side control circuit of the outdoor side unit via the signal line after driving the motor.

[0013] According to such a constitution, a change of the current consumed by the indoor side unit is detected by the outdoor side unit so that the operation of the outdoor side control circuit of the outdoor side unit can be started.

[0014] In a second aspect of the invention, in addition to the air conditioner according to the first aspect, the predetermined standard value in a case where the switch performs the communicating operation includes at least a current to be consumed by the motor.

[0015] According to such a constitution, when at least the motor is driven, the outdoor side control circuit of the outdoor side unit can be driven.

[0016] In a third aspect of the invention, the air conditioner according to the second aspect additionally includes a normally opened contact piece of a relay constituting a bypass circuit which passes by a circuit after the switch performs the communicating operation of the circuit, and the outdoor side control circuit excites the relay to close the normally opened contact piece.

[0017] According to such a constitution, when the outdoor side control circuit starts the operation, a self holding circuit of power supply is formed.

[0018] In a fourth aspect of the invention, in addition to the air conditioner according to the first to third aspects, at the start of the operation, the operation of the motor disposed in the indoor side unit is started.

[0019] According to such a constitution, in association with the operation start of the indoor side unit, the operation of the motor is also started.

[0020] In a fifth aspect of the invention, in addition to the air conditioner according to the fourth aspect, the outdoor side control circuit includes a microcomputer to which the commercial alternating-current power is supplied to start the operation, and the microcomputer starts a predetermined operation, acquires a signal to judge the start of the air conditioning operation via the signal line to the indoor side control circuit of the indoor side unit, and opens a circuit of the switch in a case where the start of the air conditioning operation cannot be judged.

[0021] According to such a constitution, the outdoor side control circuit of the outdoor side unit starts the operation, and then transmits and receives the signal from and to the indoor side control circuit of the indoor side unit to judge the start of the air conditioning operation, whereby a faulty operation can be suppressed.

[0022] In a sixth aspect of the invention, the air conditioner according to the fourth aspect additionally includes a changeover circuit which disturbs a flow of the alternating current to the current detector after the normally opened contact piece of the relay closes.

[0023] According to such a constitution, after the start of the air conditioning operation of the air conditioner, the current is prevented from flowing through the current detector.

Advantageous Effect of the Invention

[0024] In an air conditioner of the present invention in which an indoor side unit is connected to an indoor side unit via three lines (two power lines and one signal line), a current flowing through a power line is detected to start the operation of an outdoor side control circuit of the outdoor side unit, and hence special signal exchange is not performed, but the operation of the outdoor side control circuit can be associated with the start of an air conditioning operation of the indoor side unit by use of the existing three lines, whereby a standby power in the outdoor side unit can be decreased in a case where the indoor side unit does not perform the air conditioning operation.

Brief Description of the Drawings

[0025]

FIG. 1 is a schematic electric circuit diagram of an air conditioner according to an embodiment of the present invention.

Mode for Carrying out the Invention

[0026] Hereinafter, an air conditioner as an embodiment of the present invention will be described in detail with reference to the drawing. FIG. 1 is a schematic electric circuit diagram of an air conditioner constituted of an indoor side unit 1 and an outdoor side unit 2. The indoor side unit 1 is connected to the outdoor side unit 2 via three lines including power lines 3 and 4 through which an alternating-current power flows and a signal line 5. Moreover, this air conditioner has a refrigerating cycle in which constituent elements such as a refrigerant compressor driven by an electromotive element 6, a heat source side heat exchanger (not shown), a pressure reducing unit (not shown) and a utilization side heat exchanger (not shown) are circularly connected via a refrigerant piping line, the utilization side heat exchanger is disposed in the indoor side unit 1, and the refrigerant compressor, the heat source side heat exchanger and the pressure reducing unit are disposed in the outdoor side unit. It is to be noted that the constituent elements of the refrigerating cycle divided and disposed in the indoor side unit 1 and the outdoor side unit 2 are connected via the refrigerant piping line between both the units. The outdoor side unit 2 is provided with a four-way changeover valve 7, and the refrigerant piping line is disposed so that the flow of a refrigerant discharged from the refrigerant compressor can selectively be switched in order of the heat source side heat exchanger, the pressure reducing unit and the utilization side heat exchanger or in order of the utilization side heat exchanger, the pressure reducing unit and the heat source side heat exchanger.

[0027] Reference numeral 8 is a motor which drives

an air blowing fan to blow air to the heat source side heat exchanger of the outdoor side unit 2, and the motor is connected to a power circuit 9 of the outdoor side unit 2, together with the electromotive element 6 which drives the refrigerant compressor, and the four-way changeover valve 7, whereby the energization of the motor is controlled.

[0028] The power circuit 9 is connected to power bus lines 10 and 11 in the outdoor side unit 2 connected to the power lines 3 and 4, and supplies an operating power to a microcomputer 12 (corresponding to an outdoor side control circuit) which controls the operation of the indoor side unit 2, an outdoor side communication circuit 13 which transmits and receives a signal to and from the indoor side unit 1 via the signal line 5 and the like.

[0029] The four-way changeover valve 7 switches the flow of the refrigerant, when a predetermined direct current is supplied thereto from the power circuit 9, and the supplying of this direct current is controlled by the power circuit 9 in accordance with the signal from the microcomputer 12. The motor 8 is an induction motor having two speed adjustment taps for a low speed and a high speed, the power circuit 9 switches the speed adjustment tap to which this alternating current is to be supplied, in accordance with the signal from the microcomputer 12, and the motor 8 is switched to three speeds including stop, low speed and high speed. When the electromotive element 6 is an induction motor in the same manner as in the motor 8, the power circuit 9 switches the supply/block of the alternating current in accordance with the signal from the microcomputer 12, whereby the operation of the refrigerant compressor can be controlled to be ON/OFF. When a frequency and voltage of the alternating-current power to be supplied to the electromotive element 6 are changed by using an inverter technology, the ability of the refrigerant compressor can be varied. Moreover, when a direct-current brushless motor is used in the electromotive element 6, an energization timing and applied voltage of each stator coil are changed in accordance with a rotary position of a rotor of the motor, whereby the ability of the refrigerant compressor can similarly be varied. The operating ability of the refrigerant compressor can be varied on the basis of an air conditioning load.

[0030] The power bus line 10 extending from the power circuit 9 to the power line 3 is connected to a current limiting PCT element 14, a normally opened contact piece 15 (a relay contact piece corresponding to a switch), a CT (a current detector) 17, and a changeover contact piece (a relay contact piece corresponding to a changeover switch) 18 in order from the power circuit 9. 16 is a normally opened contact piece (a relay contact piece corresponding to a switch) connected in parallel with a series circuit of the PCT element 14 and the normally opened contact piece 15. The changeover contact piece 18 switches two contacts between a normally opened A-contact side and a normally closed B-contact side, and the CT 17 detects the alternating current flowing

through the power bus line 10, when the changeover contact piece 18 is on the normally closed B-contact side. The opening/closing of the normally opened contact piece 16 and the changeover of the changeover contact piece 18 are controlled from the microcomputer 12. Therefore, when the microcomputer 12 does not operate, the normally opened contact piece 16 and the changeover contact piece 18 have a shown state.

[0031] Reference numeral 19 is a power plug connected to a commercial alternating-current power source, the alternating current obtained via this power plug is supplied to the power bus lines 10 and 11 in the outdoor side unit 2, and the power plug is connected to the power bus line 10 between the normally opened contact piece 15 and the changeover contact piece 18.

[0032] Reference numeral 20 is an auxiliary power circuit connected to positions along the power bus lines 10 and 11 where the alternating current from the power plug 19 is directly obtained. The auxiliary power circuit 20 supplies a driving power to a comparator 21 and a standard current setting unit 22 which supplies a standard voltage to one input of this comparator. The normally opened contact piece 15 is switched by an output of the comparator 21. To the other input of the comparator 21, the output of the CT 17 is applied after the output is converted to a voltage corresponding to a current value detected by the CT 17 by a rectifying/smoothing circuit constituted of a rectifying diode 23, a resistor 24 and a capacitor 25. It is to be noted that during rectification, the output may be enlarged by using full wave rectification. Therefore, when the voltage corresponding to the current detected by the CT 17 exceeds a voltage corresponding to a set current set by the standard current setting unit, the output of the comparator 21 inverts. When this output inverts, the normally opened contact piece 15 is closed to enable the supplying of the alternating current to the power circuit 9 through the power bus line 10. It is to be noted that the shown comparator 21 has a constitution in which when an output voltage of the comparator becomes 0-voltage, a relay coil is excited to close the normally opened contact piece 15, but the comparator 21 may have a constitution in which the output voltage of the comparator becomes a high voltage (from about 5 V to 15 V) to excite the relay coil.

[0033] When the outdoor side unit 2 having such a constitution has a shown stop state, any alternating current is not supplied to the power circuit 9, the microcomputer 12 is stopped, and the electromotive element 6, the motor 8 and the four-way changeover valve 7 are not energized. The auxiliary power circuit 20 has the alternating current supplied thereto to operate, so that the comparator 21 operates. When the current detected by the CT 17 exceeds the value set by the standard current setting unit 22, the output of the comparator 21 inverts to close the normally opened contact piece 15.

[0034] When the normally opened contact piece 15 closes, the alternating current from the power plug 19 is supplied to the power circuit 9, and the power circuit 9

supplies the operating power to the microcomputer 12. The microcomputer 12 ends initialization to start a predetermined operation. The microcomputer 12 closes the normally opened contact piece 16, and acquires the supply of the alternating current to the power circuit 9 regardless of the opening/closing of the normally opened contact piece 15, whereby the operation of the microcomputer 12 is continued.

[0035] It is to be noted that the normally opened contact piece 16 is a contact piece closed by exciting a coil of a relay (not shown), and is energized via a drive circuit of the relay in response to the signal of the microcomputer 12. The changeover contact piece 18 similarly switches the A-contact side and the B-contact side of the contact piece in response to the signal of the microcomputer 12. The changeover contact piece 18 switches from the B-contact side to the A-contact side at the same time when the normally opened contact piece 16 closes, and regardless of the current value detected by the CT 17, the output of the comparator 21 does not invert, and the normally opened contact piece 15 remains to be opened.

[0036] Therefore, the operation of the microcomputer 12 is continued until the microcomputer 12 opens the normally opened contact piece 16. After closing the normally opened contact piece 16 and switching the changeover contact piece 18, there is output, to the indoor side unit 1 via the communication circuit 13 and the signal line 5, a signal to request information indicating whether or not the air conditioner has an air conditioning operation state, i.e., whether or not the air conditioning operation is started by a user who directly operates the indoor side unit 1 or automatically by a timer operation. When the signal transmitted to the microcomputer 12 from the indoor side unit 1 via the signal line 5 includes a signal indicating the air conditioning operation state, the microcomputer keeps the normally opened contact piece 16 in a closed state, and keeps the changeover contact piece 18 switched to the A-contact side to maintain the operation thereof. When the signal transmitted from the outdoor side unit 1 does not include the signal indicating the air conditioning operation state, the microcomputer judges that the above output of the comparator 21 inverts owing to a faulty operation, opens the normally opened contact piece 16, and returns the changeover contact piece 18 to the B-contact side, whereby the indoor side unit 2 returns to the stop state.

[0037] The indoor side unit 1 includes a microcomputer 26 (corresponding to an indoor side control circuit) which controls the operation of the indoor side unit 1, an indoor side communication circuit 27 connected to the signal line 5 to transmit and receive a signal to and from the outdoor side unit 2, an indoor side power circuit 28, a motor 29 having the controlled supply of a power from the power circuit 28, to drive an air blowing fan which blows air to the utilization side heat exchanger, a reception circuit 30 which receives a signal (e.g., an infrared signal) transmitted in response to a key operation from a remote controller 31, demodulates the signal and then

outputs the signal to the microcomputer 26 and the like.

[0038] When the remote controller 31 is operated, a switch provided in the indoor side unit 1 is directly operated or operation start time is reached by a timer operation, the microcomputer 26 starts the operation of the motor 29 via the power circuit 8. In the motor 29, an induction motor, a brushless motor or the like can be used in the same manner as in the electromotive element or the motor disposed in the outdoor side unit 2, whereby a rotation number can be controlled. The rotation number of the motor 29 is automatically controlled on the basis of room temperature (a temperature to be controlled) and set temperature (target temperature). Alternatively, the rotation number is controlled to user's desirable rotation number. The minimum rotation number of the motor 29 is set in each of the induction motor and the brushless motor owing to a structure or characteristics thereof, and the operation of the motor 29 is performed with the minimum rotation number or more. Therefore, as long as the motor 29 operates, a power more than a current required for the minimum rotation number is consumed. The current to be consumed by the motor 29 is supplied via the power circuit 28, the power lines 3 and 4, the outdoor side unit 2, the CT 27 and the power plug 19.

[0039] When the air conditioning operation of the indoor side unit 1 is started and the operation of the motor 29 is started, the driving current of the motor 29 is detected by the CT 17 of the outdoor side unit 2, the output of the comparator 21 of the outdoor side unit 2 inverts, and the normally opened contact piece 15 closes to start the operation of the microcomputer 12. It is to be noted that when the air conditioning operation stops, a stop signal is transmitted from the indoor side unit 1 to the microcomputer 12 of the outdoor side unit 2, and the microcomputer 12 opens the normally opened contact piece 16 to stop the operation.

Description of Reference Numerals

[0040]

1	indoor side unit
2	outdoor side unit
3, 4	power line
5	signal line
6	electromotive element
9	power circuit
12	microcomputer
15	normally opened contact piece
17	CT
18	changeover contact piece
26	microcomputer
29	motor

Claims

1. An air conditioner having a refrigerating cycle in

which at least a refrigerant compressor driven by an electromotive element, a heat source side heat exchanger, a pressure reducing unit and a utilization side heat exchanger are circularly connected via a refrigerant piping line, these constituent elements of the refrigerant cycle being divided and disposed in an indoor side unit and an outdoor side unit, the indoor side unit being provided with a motor which drives an air blowing fan of the utilization side heat exchanger, a power to drive the motor being supplied via the outdoor side unit,

wherein the indoor side unit is connected to the outdoor side unit via three lines comprising a first power line and a second power line through which an alternating current flows and a signal line through which a signal is transmitted by using one of the power lines as a common use line, a commercial alternating-current power is applied to the first power line and the second power line in the outdoor side unit, the outdoor side unit includes a current detector which detects, from this commercial alternating-current power, the alternating current flowing through one of the first power line and the second power line, a switch which performs a circuit communicating operation in a case where a current value detected by this current detector exceeds a predetermined standard value, and an outdoor side control circuit to which the commercial alternating-current power is supplied via this switch to control the driving of the electromotive element, the indoor side unit includes an indoor side control circuit which controls the supplying, to the motor, of the commercial alternating-current power obtained via the first power line and the second power line, and this indoor side control circuit starts the driving of the motor in response to the start of an air conditioning operation, and transmits and receives the signal to and from the outdoor side control circuit of the outdoor side unit via the signal line after driving the motor.

2. The air conditioner according to claim 1, wherein when the predetermined standard value in a case where the switch performs the communicating operation includes at least a current to be consumed by the motor.

3. The air conditioner according to claim 2, further comprising a normally opened contact piece of a relay constituting a bypass circuit which passes by a circuit after the switch performs the communicating operation of the circuit, wherein the outdoor side control circuit excites the relay to close the normally opened contact piece.

4. The air conditioner according to any one of claims 1 to 3, wherein at the start of the operation, the operation of the motor disposed in the indoor side unit is started.

5. The air conditioner according to claim 4,
wherein the outdoor side control circuit includes a
microcomputer to which the commercial alternating-
current power is supplied to start the operation, and
the microcomputer starts a predetermined operation,
acquires a signal to judge the start of the air
conditioning operation via the signal line to the indoor
side control circuit of the indoor side unit, and opens
a circuit of the switch in a case where the start of the
air conditioning operation is not judged.
6. The air conditioner according to claim 4,
further comprising a changeover circuit which dis-
turbs a flow of the alternating current to the current
detector after the normally opened contact piece of
the relay is closed.

5

10

15

20

25

30

35

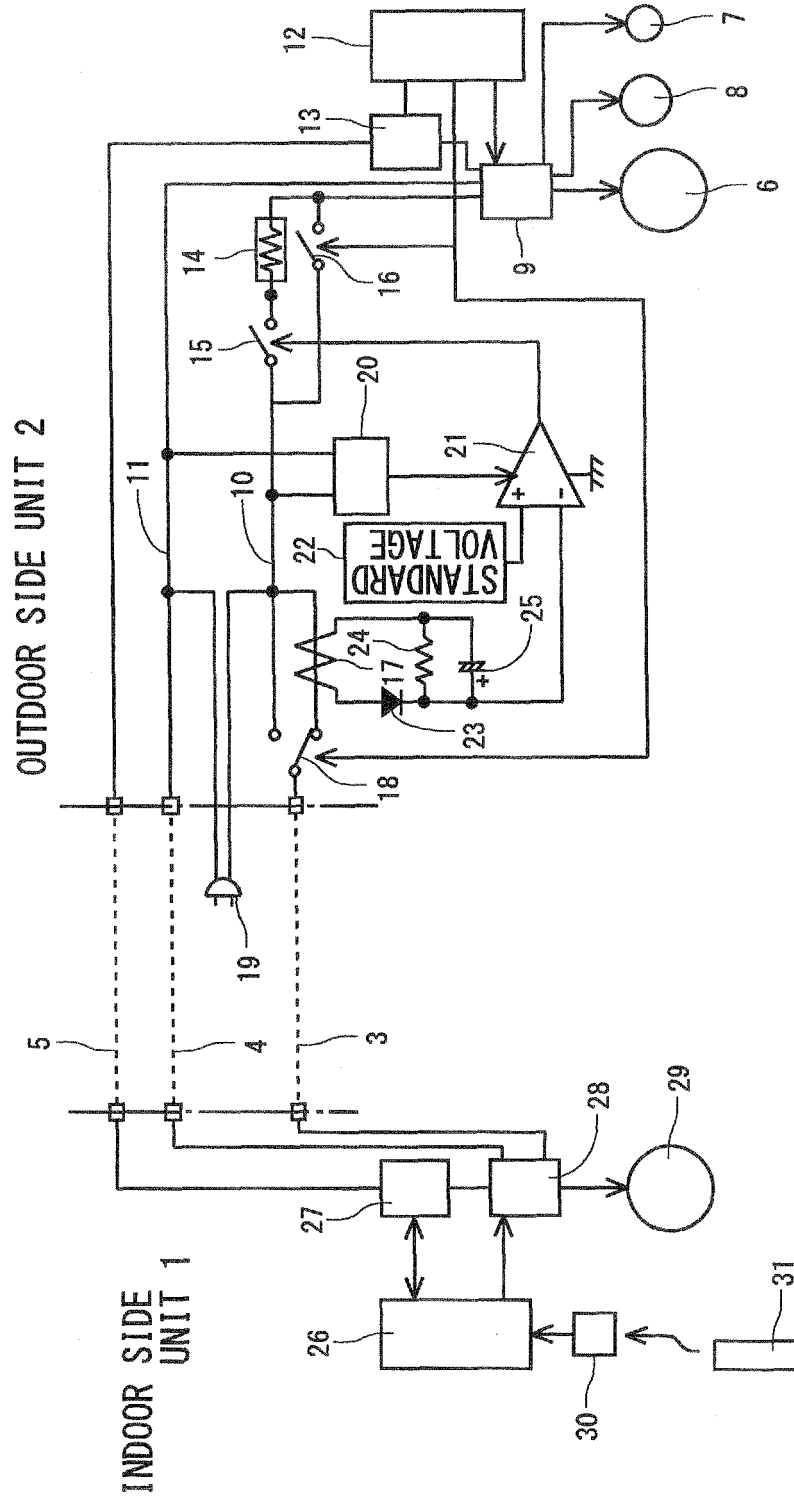
40

45

50

55

FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/001853

A. CLASSIFICATION OF SUBJECT MATTER

F24F11/02 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3730808 B2 (Hitachi, Ltd.), 14 October 2005 (14.10.2005), paragraphs [0024] to [0031]; fig. 1 to 4 (Family: none)	1-6
A	JP 3019844 B1 (Daikin Industries, Ltd.), 07 January 2000 (07.01.2000), claim 1; fig. 1 (Family: none)	1-6
A	JP 2001-41530 A (Daikin Industries, Ltd.), 16 February 2001 (16.02.2001), claim 1; paragraphs [0014], [0015]; fig. 1 (Family: none)	1-6

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

08 June, 2010 (08.06.10)

Date of mailing of the international search report

22 June, 2010 (22.06.10)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/001853

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 8-182182 A (Matsushita Electric Industrial Co., Ltd.), 12 July 1996 (12.07.1996), paragraph [0010]; fig. 1 (Family: none)	1-6
A	JP 2007-225128 A (Fujitsu General Ltd.), 06 September 2007 (06.09.2007), paragraph [0018]; fig. 1 to 3 (Family: none)	1-6
E, A	JP 2010-38484 A (Fujitsu General Ltd.), 18 February 2010 (18.02.2010), claim 1; paragraphs [0039] to [0056]; fig. 2, 3 (Family: none)	1-6

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 3730808 B [0008]
- JP 3019844 B [0008]