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(54) AIR CONDITIONER

(57) [Problem]

The invention provides an air conditioner that can prevent a malfunction due to noise when an optional component is not attached to its air-conditioner main-body.

[Means for solving Problem]

An air conditioner (1) includes a controller (8) connectable to an option component (10) equipped with a switch (12) used for operation of an air-conditioner main-body (2) and a receiver (11) configured to receive a wireless signal (R) transmitted from a remote control device (6) used to operate the air-conditioner main-body (2), wherein the controller (8) includes: a first terminal (21) to which a signal from the receiver (11) is inputted; a second terminal (22) to which a signal from the switch (12) is inputted; and a processer (13) configured to disable input to the second terminal (22) until the signal from the receiver (11) is inputted to the first terminal (21), and configured to enable input to the second terminal (22) after the signal from the receiver (11) is inputted to the first terminal (21).

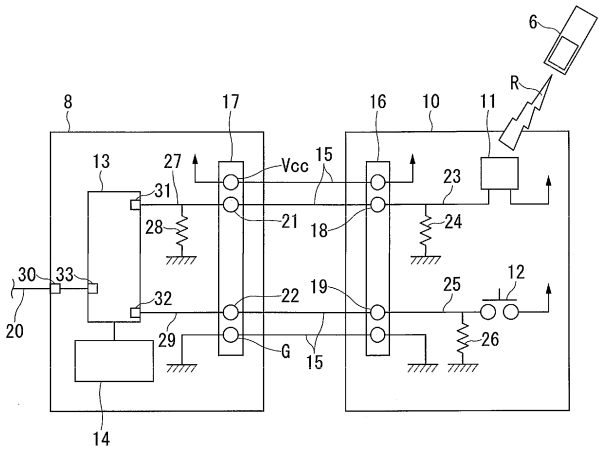

FIG. 3

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Description

Technical Field

[0001] Embodiments of the present invention relate to an air conditioner.

Background Art

[0002] In the conventional air conditioner, an air-conditioner main-body (i.e., indoor unit) attached to a high place such as a ceiling is usually operated by a wired remote controller provided on a wall surface or the like. In addition, when the user does not desire operation using the wired remote controller but desires operation using a wireless remote controller, a signal receiving unit equipped with a signal receiver for receiving an infrared signal from the wireless remote controller is attached as an optional component to the air-conditioner main-body.

Prior Art Document

Patent Document

[0003] Patent Document 1: Japanese Unexamined Patent Application Publication No. 2005-265264

Description of Invention

Problems to be solved by Invention

[0004] The signal receiving unit as an optional component is equipped with a push button switch for instructing operation/stop so that at least operation/stop can be executed in case the wireless remote controller is lost. The push button switch is configured to instruct stop by being pressed (pushed) in a period during which the air conditioner is in operation, and is configured to instruct operation by being pressed (pushed) in a period during which the air conditioner is stopped. That is, the push button switch can reverse the state of the air conditioner at that time (stop from the operational state, operate from the stopped state).

[0005] However, when the optional component cannot be attached to the air-conditioner main-body, there are cases where noise enters the controller of the air-conditioner main-body from the input terminal provided for connection with the optional component. There is a problem that the air-conditioner main-body malfunctions due to this noise. Since the push button switch is a normal contact switch, the push button switch only generates a pulse signal of one shot. Accordingly, in particular, when noise enters from the input terminal of the push button switch, the controller of the air-conditioner main-body may cause an erroneous operation of switching between operation and stop, which the user does not intend.

[0006] In view of the above-described problem, an object of the present invention is to provide an air conditioner that can prevent occurrence of a malfunction due to noise even when an optional component is not attached to its air-conditioner main-body.

Means for solving Problem

[0007] In one embodiment of the present invention, an air conditioner comprising:

an air-conditioner main-body; and
a controller that is provided in the air-conditioner main-body, controls operation of the air-conditioner main-body, and is connectable to an option component equipped with a receiver and a switch used for operation of the air-conditioner main-body, the receiver being configured to receive a wireless signal transmitted from a remote control device used to operate the air-conditioner main-body,
wherein the controller includes:

a first terminal to which a signal from the receiver is inputted;
a second terminal to which a signal from the switch is inputted; and
a processer configured to disable input to the second terminal until the signal from the receiver is inputted to the first terminal, and configured to enable input to the second terminal after the signal from the receiver is inputted to the first terminal.

[0008] In one embodiment of the present invention, the air conditioner, further comprising a nonvolatile memory provided in the controller and configured to store data indicating an enabled state or a disabled state of the second terminal,
wherein the processer is configured to bring a state of the second terminal into a same state as a state before stop of power supply based on data stored in the nonvolatile memory, when power supply to the controller is resumed.

[0009] In one embodiment of the present invention, the air conditioner,
wherein the nonvolatile memory is configured to store data indicating that the second terminal is in a disabled state as default.

[0010] In one embodiment of the present invention, the air conditioner,
wherein the controller further includes a third terminal to which a wired remote controller can be connected.

[0011] In one embodiment of the present invention, the air conditioner,
wherein the processer is configured of a microprocessor, and includes a first port connected to the first terminal and a second port, which is connected to the second terminal and is switchable between an output port and an input port; and
the processer is configured to enable input to the second

terminal after the signal from the receiver is inputted to the first terminal, by switching the second port from the output port to the input port when the processer determines that a signal being inputted to the first port is a signal based on reception of the wireless signal.

Brief Description of Drawings

[0012]

Fig. 1 is a configuration diagram illustrating an air conditioner.
Fig. 2 is a circuit diagram illustrating a control board and an option board before connection.
Fig. 3 is a circuit diagram illustrating the control board and the option board after connection.
Fig. 4 is a flowchart illustrating operation processing.
Fig. 5 is a flowchart illustrating operation processing.

Modes for embodying Invention

[0013] Hereinafter, the present embodiment will be described by referring to the accompanying drawings. First, an air conditioner according to the present embodiment will be described by referring to Fig. 1 to Fig. 5. The reference sign 1 in Fig. 1 denotes an air conditioner that adjusts temperature of indoor air. The air conditioner 1 includes an air-conditioner main-body 2 provided as an indoor unit on the indoor ceiling T and a decorative panel 3 detachably attached to the lower surface of the housing of the air-conditioner main-body 2. In the present embodiment, the air-conditioner main-body 2 of ceiling-embedded type is illustrated. In addition, the air-conditioner main-body 2 may have any form such as a ceiling-suspended type, a wall-mounted type to be mounted at an indoor high place, and a floor-mounted type to be mounted on the floor.

[0014] As shown in Fig. 1, the air-conditioner main-body 2 includes a heat exchanger 4 and a blower 5 that are disposed inside the housing. The air-conditioner main-body 2 as an indoor unit and an outdoor unit provided outdoors are connected via a connection pipe for circulating a refrigerant. A refrigeration cycle is configured by circulating the refrigerant between the air-conditioner main-body 2 and the outdoor unit.

[0015] The air-conditioner main-body 2 is remotely operated by using at least one of a wired remote controller 7 provided on the indoor wall and a wireless remote controller 6 that transmits an infrared signal R as a remote control device for transmitting a wireless signal. The wired remote controller 7 is connected by wire to the air-conditioner main-body 2 and is attached to a wall or the like near the air-conditioner main-body 2.

[0016] Although the wired remote controller is used as a standard product of the air conditioner 1, the air-conditioner main-body 2 can also be connected to the wireless remote controller 6 according to the customer's request. Although coexistence of the wireless remote controller 6 and the wired remote controller 7 is possible, it is general to use only one of them. This is because the operation content of the wired remote controller 7 cannot be displayed on the display of the wireless remote controller 6, which is inconvenient.

[0017] Further, the air-conditioner main-body 2 is provided with a control board (i.e., control unit) 8 for controlling the operation of the heat exchanger 4 and the blower 5. The control board 8 is configured as a common substrate so as to be compatible with either the operation based on the wireless remote controller 6 or the operation based on the wired remote controller 7.

[0018] When the customer desires to operate on the basis of the wireless remote controller 6, the option component 9 is attached to the air-conditioner main-body 2. The option component 9 is provided with an option board 10 for receiving the infrared signal R transmitted from the wireless remote controller 6. The option component 9 of the present embodiment is provided integrally with the decorative panel 3. The option component 9 is detachably attached to the air-conditioner main-body 2 via the decorative panel 3.

[0019] The decorative panel 3 is provided with two types of panels, which are a panel equipped with the option component 9 and another panel as a standard product unequipped with the option component 9. When the customer does not desire to operate on the basis of the wireless remote controller 6, the decorative panel 3 of the standard product unequipped with the option component 9 is attached to air-conditioner main-body 2. That is, air-conditioner main-body 2 is easy to manufacture by making it into one type without changing it. The decorative panel 3 in accordance with the customer's request is selectively attached to the air-conditioner main-body 2.

[0020] When the customer desires to operate by using the wired remote controller 7, the wired remote controller 7 is mounted at the time of installing the air-conditioner main-body 2. In order to facilitate understanding, the embodiment shown in Fig. 1 illustrates the air conditioner 1 in which both the option component 9 (first component) and the wired remote controller 7 (second component) are provided. That is, in the present embodiment, both the operation by the wireless remote controller 6 and the operation by the wired remote controller 7 can be performed.

[0021] As shown in Fig. 2, the option board 10 includes a push button switch 12 and a receiver (i.e., signal receiving unit) 11 composed of circuit components such as a photodiode for receiving the infrared signal R (infrared ray) that is a wireless signal transmitted from the wired remote controller 7. The push button switch 12 is provided for manually operating the air-conditioner main-body 2 when the wireless remote controller 6 is lost or the like. The push button switch 12 is disposed in the vicinity of the receiver 11 in the option component 9. When receiving the infrared signal R, the receiver 11 converts this signal into an electrical signal and outputs it.

[0022] When the push button switch 12 is operated

while the air-conditioner main-body 2 is in operation, the operation is stopped. In addition, operation is started by operating the push button switch 12 while the air-conditioner main-body 2 is stopped. In other words, the push-button switch 12 can be used for turning on/off the air-conditioner main-body 2 (the heat exchanger 4 and the blower 5).

[0023] In addition, the control board 8 included inside the air-conditioner main-body 2 includes a microprocessor 13 (processing unit) configured to execute control processing related to the operation of the air-conditioner main-body 2 and a non-volatile memory 14 configured to store various programs, data, and flags, and these are connected by a wiring pattern provided on the board. The non-volatile memory 14 is electrically connected to the microprocessor 13 by such a wiring pattern.

[0024] The non-volatile memory 14 is a memory capable of writing and reading out data, and is configured of an EEPROM, a flash ROM, or the like which is capable of holding stored contents even when power supply is interrupted. Further, the microprocessor 13 writes information in the non-volatile memory 14 as needed, reads out the stored information, and executes various types of processing on the basis of the data having been read out. Further, the microprocessor 13 is a microcontroller in which a computer system is integrated into one integrated circuit, and operates by programs (software) written in its internal ROM. The microprocessor 13 also includes many ports connected to respective devices for signal input/output.

[0025] As shown in Fig. 3, the control board 8 and the option board 10 are connected via the lead wires 15. A flat cable in which plural lead wires 15 are bundled into one is used for this connection. The control board 8 and the option board 10 are equipped with connectors provided on both ends of the flat cable and sockets 16 and 17 that are connected to the respective connectors.

[0026] It may be configured such that the connector and socket on the side of the option board 10 are omitted, the lead wires 15 are soldered directly to the option board 10, and the connector provided at the end is connected by being plugged in the socket of the control board 8.

[0027] The socket 16 of the option board 10 includes a reception output terminal 18 connected to the receiver 11 and a switch output terminal 19 connected to the push button switch 12. Further, the socket 17 of the control board 8 includes a first terminal 21 connected to the reception output terminal 18 via one lead wire 15 and a second terminal 22 connected to the switch output terminal 19 via the other lead wire 15.

[0028] Moreover, the socket 17 of the control board 8 further includes two terminals other than the first terminal 21 and the second terminal 22, and these two terminals are also connected to the socket 16 of the option board 10. One of both is a DC power supply terminal Vcc, which supplies a predetermined voltage (e.g., a DC voltage of 5 V) generated on the side of the control board 8 to the side of the option board 10. Another of both is a ground terminal G for connecting the ground of the control board 8 to the ground of the option board 10.

[0029] In the present embodiment, when the receiver 11 receives the infrared signal R, the signal outputted from the receiver 11 is inputted to the first terminal 21 through the reception output terminal 18. Additionally, when the push button switch 12 is operated, a short pulse signal outputted from the push button switch 12 is inputted to the second terminal 22 through the switch output terminal 19.

[0030] On the control board 8, the first terminal 21 is connected to the first port 31 of the microprocessor 13 by the wiring pattern and the second terminal 22 is similarly connected to the second port 32 of the microprocessor 13. Furthermore, a line 20 for transmitting the signal outputted from the wired remote controller 7 is connected to a third port 33 of the microprocessor 13 through a third terminal 30. That is, the control board 8 includes the third terminal 30 to which the line 20 extending from the wired remote controller 7 can be connected. Although the microprocessor 13 includes many ports for outputting signals for driving various electrical components in the air-conditioner main-body 2, inputting detection data from sensors, and communicating with the outdoor unit, detailed descriptions of the other ports are omitted.

[0031] A line 23 between the reception output terminal 18 and the receiver 11 on the option board 10 is grounded via a pull-down resistor 24. In addition, a line 25 between the push button switch 12 and the switch output terminal 19 is grounded via a pull-down resistor 26 on the option board 10. A line 27 composed of a wiring pattern between the microprocessor 13 and the first terminal 21 on the control board 8 is grounded via a pull-down resistor 28. A line 29 composed of a wiring pattern between the microprocessor 13 and the second terminal 22 on the control board 8 is not grounded.

[0032] As shown in Fig. 2, when the option board 10 is not connected to the control board 8, i.e., when the option component 9 is not attached to the air-conditioner main-body 2, the first terminal 21 and the second terminal 22 are in the state in which both are not connected anywhere. In some cases, noise from the outside enters the first port 31 or the second port 32 of the microprocessor 13 via the first terminal 21 or the second terminal 22.

[0033] However, the microprocessor 13 checks the reception code format (communication format) indicating whether the signal inputted from the first port 31 is outputted from the receiver 11 or not, and thus a malfunction (erroneous determination) does not occur even when noise enters the first port 31.

[0034] The signal inputted to the second port 32 is a single pulse signal by the push button switch 12, and is a simple signal that indicates only input or non-input. Thus, even under the case where the signal inputted to the second port 32 is noise, when the voltage exceeds a certain voltage value, the microprocessor 13 determines that the signal is inputted, i.e., the switch is pressed. In this case, a malfunction may occur.

[0035] For this reason, the present embodiment is configured such that the second terminal 22 is brought into a disabled state when the option board 10 is not connected to the control board 8. Further, when the option board 10 is connected to the control board 8, this is detected on the basis of a predetermined condition and the second terminal 22 is switched to the enabled state. The disabled state indicates a state in which processing based on an inputted signal is not performed at all even when this signal is inputted. Further, the enabled state indicates a state in which microprocessor 13 on the control board 8 reads in an inputted signal and executes processing based on this signal when this signal is inputted.

[0036] In the microprocessor 13 of the present embodiment, the first port 31 is configured as an input port, and the second port 32 is configured to be switchable between an output port and an input port. The microprocessor 13 uses the second port 32 as an output port, and sets an output of a voltage of 0 V, i.e., a low output. When setting is performed in this manner, the second terminal 22 is brought into the disabled state, i.e., the state in which an input signal is not accepted. When the microprocessor 13 set the second port 32 as an input port, the second terminal 22 is brought into the enabled state.

[0037] When the microprocessor 13 determines that a signal is inputted to the first port 31 through the first terminal 21 and this signal is a signal based on the reception of the infrared signal R, the microprocessor 13 executes the processing of switching the second port 32 to the input port. When the second port 32 switches to an input port, the second terminal 22 switches to the enabled state. When a signal with a voltage of 5V (Hi) or higher or a voltage signal of 0V (Low) is inputted to the second port 32 in the enabled state, this signal is read out and the processing based on this input is executed.

[0038] Furthermore, the non-volatile memory 14 stores data (flag) indicative of indicative of the state of the second terminal 22, i.e., the enabled state or the disabled state of the second port 32. The non-volatile memory 14 stores the information that the second port 32 is in the disabled state as default at the time of installing the decorative panel 3 equipped with the option component 9, which is the first connection of the decorative panel 3 equipped with the option component 9 in the initial state. Thereafter, when the infrared signal R is inputted to the first port 31, the second port 32 is switched to the enabled state and the data indicating this state is stored in the non-volatile memory 14.

[0039] When power is turned on, the microprocessor 13 reads out the data stored in the non-volatile memory 14 and sets the state of the second port 32 to either the disabled state or the enabled state on the basis of the result. In other words, when the data stored in the non-volatile memory 14 indicates the disabled state, the microprocessor 13 sets the second port 32 to the output port that is in the disabled state. When the data stored in the non-volatile memory 14 indicates the enabled state, the microprocessor 13 sets the second port 32 to the input port that is in the enabled state.

[0040] Even when the power supply to the control board 8 (air-conditioner main-body 2) is stopped, the non-volatile memory 14 stores the state of the second port 32 before the power supply is stopped. Thus, when the power supply to the control board 8 is resumed, the state of the second terminal 22 can be brought into the same state as the state before stopping the power supply.

[0041] According to the above-described configuration, when the air-conditioner main-body 2 is shipped from the manufacturing plant (i.e., at the time of the initial state), the non-volatile memory 14 stores data indicating that the second port 32 is an output port, i.e., data indicating that the second terminal 22 is in the disabled state. Thus, when the air-conditioner main-body 2 is installed, the second terminal 22 is in the disabled state. When only the wired remote controller 7 is provided and the decorative panel 3 unequipped with the option component 9 is attached, the disabled state of the second terminal 22 is maintained, and thus occurrence of a malfunction due to noise can be prevented.

[0042] Conversely, when the decorative panel 3 equipped with option component 9 is attached to the air-conditioner main-body 2, the receiver 11 receives the infrared signal R transmitted from the wireless remote controller 6 by operating the wireless remote controller 6, and the second terminal 22 is switched from the disabled state to the enabled state on the basis of this signal having been inputted to the first terminal 21. In other words, when the air-conditioner main-body 2 is installed, the second terminal 22 is automatically switched from the disabled state to the enabled state by performing an operation with the use of the wireless remote controller 6 at the beginning. Thus, there is no need for the trouble of switching the state of the second terminal 22, and it is possible to reduce the labor of the operator who installs the air-conditioner main-body 2.

[0043] In addition, data indicative of the state of the second terminal 22 is stored in the non-volatile memory 14. Thus, once the second terminal 22 is set to the enabled state, the second terminal 22 becomes the enabled state at the time of resumption of power supply even when the power supply is stopped, which eliminates the need for resetting.

[0044] When the operation by wireless remote controller 6 is not performed after installation of the air-conditioner main-body 2, for instance, when the option component 9 is detached from the air-conditioner main-body 2, the second terminal 22 can be returned from the enabled state to the disabled state.

[0045] In the case of returning the second terminal 22 to the disabled state, the operation is performed by using the wired remote controller 7 (switching device). In the present embodiment, the operation is performed by setting the mode of the wired remote controller 7 to the service mode. The second terminal 22 is returned to the disabled state by using the wired remote controller 7 for rewriting the data indicating the state of the second ter-

minal 22 stored in the non-volatile memory 14 to the initial value.

[0046] The control board 8 of the air conditioner 1 of the present embodiment includes hardware resources such as the microprocessor 13, the non-volatile memory, and a non-illustrated volatile memory, and information processing by software is realized with the use of the hardware resources by causing the microprocessor 13 to execute various programs.

[0047] Next, the operation processing of the air conditioner 1 controlled by the microprocessor 13 will be described by referring to Fig. 4 and Fig. 5.

[0048] In the step S11 as shown in Fig. 4, at the time of activation of the control board 8, first, the microprocessor 13 reads out data indicating the state of the second terminal 22 stored in the non-volatile memory 14 and then determines whether the second terminal 22 is set to the enabled state or not.

[0049] When the second terminal 22 is in the enabled state (YES in the step S11), the second port 32 is set as an input port in the step S12 and the processing proceeds to the step S14.

[0050] When the second terminal 22 is not in the enabled state but in the disabled state (NO in the step S11), the second port 32 is set as an output port in the step S13 and the processing proceeds to the step S14.

[0051] In the step S14, the microprocessor 13 checks the receiver 11 as to whether it has received the infrared ray or not. That is, the microprocessor 13 checks signal input at the first port 31 (first terminal 21).

[0052] In the next step S15, the microprocessor 13 determines whether the receiver 11 has received the infrared ray or not, i.e., the signal has been inputted to the first port 31 or not.

[0053] When the receiver 11 has not received the infrared ray (NO in the step S15), the processing proceeds to the step S21 described below.

[0054] When the receiver 11 has received the infrared ray (YES in the step S15), the processing proceeds to the step S16.

[0055] In the step S16, the microprocessor 13 determines whether the signal based on the reception of the infrared signal R transmitted from the wireless remote controller 6 to the receiver 11 is correct or not, i.e., whether the reception code format of the signal inputted to the first port 31 is correct or not.

[0056] When the reception code format is not correct (NO in the step S16), e.g., when noise is mixed into the signal, the inputted signal is ignored and the processing proceeds to the step S21 described below.

[0057] When the reception code format is correct (YES in the step S16), the processing proceeds to the step S17.

[0058] In the step S17, the microprocessor 13 reads out data indicating the state of the second terminal 22 stored in the non-volatile memory 14 and then determines whether the second terminal 22 is in the disabled state or not. When the second terminal 22 is in the enabled state (NO in the step S17), the processing proceeds to the step S20.

[0059] When the second terminal 22 is in the disabled state (YES in the step S17), the processing proceeds to the step S18 in which the data stored in the non-volatile memory 14 is rewritten to data indicating that the second terminal 22 is in the enabled state.

[0060] In the next step S19, the microprocessor 13 sets the second port 32 as an input port, and the processing proceeds to the step S20.

[0061] In the step S20, the microprocessor 13 executes operation switching processing based on the reception code of the signal inputted to the first port 31. The ON/OFF control of the air-conditioner main-body 2, change in air volume of the blower 5, change of the air-conditioning preset temperature, and the like are executed by this operation switching processing. In the present embodiment, the power supply to the control board 8 is maintained even when the air-conditioner main-body 2 is turned off (shutdown). Afterward, the processing proceeds to the step S21.

[0062] In the step S21 as shown in Fig. 5, the microprocessor 13 reads out the data, which indicates the state of the second terminal 22 and is stored in the non-volatile memory 14, and then determines whether the second terminal 22 is in the enabled state or not. When the second terminal 22 is in the disabled state (NO in the step S21), the processing returns to the above-described step S14 and the subsequent processing is looped. When the second terminal 22 is in the enabled state (YES in the step S21), the processing proceeds to the step S22.

[0063] In the step S22, the microprocessor 13 determines whether there is an input based on the operation of the push button switch 12 or not, i.e., whether a signal is inputted to the second port 32 (second terminal 22) or not. When the signal is not inputted to the second port 32 (NO in the step S22), the processing returns to the above-described step S14 and the subsequent processing is looped. When the signal is inputted to the second port 32 (YES in the step S22), the operation ON/OFF switching processing is executed as an emergency procedure operation in the case of losing the wireless remote controller 6. The ON/OFF control of the air-conditioner main-body 2 is executed by this operation ON/OFF switching processing. Afterward, the processing returns to the above-described step S14 and the subsequent processing is looped.

[0064] The operation ON/OFF switching processing is processing including both of (i) stopping (OFF) the operation when the air-conditioner main-body 2 is in operation as described above and (ii) starting (ON) the operation when the air-conditioner main-body 2 is stopped. Various settings such as the preset temperature, air volume of the blower 5, and the operation mode including heating/cooling at the time of starting the operation may be set to the same settings as the previous operation. Additionally or alternatively, it may be set as an automatic operation mode in which all the settings are automatically set by the air-conditioner main-body 2. When various set-

tings at the time of emergency operation by the operation of the push button switch 12 are set to the same settings as the previous operation, it is necessary to store the various settings in the previous operation in the non-volatile memory 14.

[0065] Although a mode in which each step is executed in series is illustrated in the flowcharts of the present embodiment, the execution order of the respective steps is not necessarily fixed and the execution order of part of the steps may be changed. Additionally, some steps may be executed in parallel with another step.

[0066] According to the embodiment described above, the second terminal is in the enabled state when the option component is not attached, and the air conditioner includes the microprocessor (processing unit) configured to execute processing of switching the second terminal to the enabled state when the option component is attached and a signal from the receiver is inputted to the first terminal. In this manner, the second terminal is in the disabled state when the option component is not attached to the air-conditioner main-body, and thus an air conditioner capable of preventing occurrence of a malfunction due to noise is provided. In addition, since the second terminal can be set to the enabled state by the operation of the wireless remote controller after the option component is attached to the air-conditioner main-body, labor of the operator for installing the air conditioner can be reduced.

[0067] Further, when the power supply to the control board is resumed, the microprocessor executes processing of bringing the state of the second terminal into the same state as the state before stop of the power supply, on the basis of the data in the non-volatile memory. Consequently, when the option component is attached to the air-conditioner main-body and the second terminal is brought into the enabled state by the wireless remote controller, the enabled state of the second terminal can be maintained even when the power supply to the air-conditioner main-body is stopped after this.

[0068] Further, the non-volatile memory stores data indicating that the second terminal is in the disabled state as its initial state, whereby the initial state of the second terminal becomes the disabled state. Thus, in the case where the option component cannot be attached to the air-conditioner main-body, a malfunction never occurs even when noise enters the second terminal.

[0069] When the option component is detached from the air-conditioner main-body, the second terminal can be returned from the enabled state to the disabled state by switching the second terminal from the enabled state to the disabled state by an operation other than the wireless remote controller.

[0070] The device for switching the second terminal from the enabled state to the disabled state is a wired remote controller used to operate the air-conditioner main-body. In this manner, the wired remote controller used for the operation of the air-conditioner main-body can also be used as a device for switching the state of the second terminal.

[0071] The microprocessor further includes the first port connected as an input port to the first terminal and the second port that is connected to the second terminal and is switchable between the output port and the input port, and executes processing of switching the second port as the output port to an input port in the case of determining that the signal inputted to the first port is a signal based on the reception of the infrared signal. In this manner, the second terminal is brought into the disabled state by setting the second port to the output port, and a malfunction never occurs even when noise enters the second terminal. Additionally, the second terminal can be switched from the disabled state to the enabled state by switching the second port from the output port to the input port. Further, even when noise enters the first port, it is determined whether the signal is based on the reception of an infrared signal or not, and thus a malfunction can be prevented.

[0072] Although the wireless remote controller 6 transmitting an infrared signal is illustrated as a remote control device in the present embodiment, the wireless remote controller 6 can be replaced by a controller configured to use other wireless communication. For instance, a controller using short-distance wireless-communication technology or wireless LAN network technology may be used as the remote control device.

[0073] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel methods and systems described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the methods and systems described herein may be made without departing from the framework of the inventions. The above-cited invention and their equivalents are intended to cover such forms or modifications as would fall within the scope of the inventions.

Reference Signs List

[0074]

1	air conditioner
2	air-conditioner main-body
3	decorative panel
4	heat exchanger
5	blower
6	wireless remote controller (remote control device)
7	wired remote controller
8	control board (control unit)
9	option component
10	option board
11	receiver
12	push button switch
13	microprocessor (processing unit)
14	non-volatile memory

15 lead wire
16 socket
18 reception output terminal
19 switch output terminal
20 line
21 first terminal
22 second terminal
23 line
24 pull-down resistor
25 line
26 pull-down resistor
27 line
28 pull-down resistor
29 line
30 third terminal
31 first port
32 second port
33 third port
R infrared signal
T ceiling

Claims

1. An air conditioner comprising:

an air-conditioner main-body; and
a controller that is provided in the air-conditioner main-body, controls operation of the air-conditioner main-body, and is connectable to an option component equipped with a receiver and a switch used for operation of the air-conditioner main-body, the receiver being configured to receive a wireless signal transmitted from a remote control device used to operate the air-conditioner main-body,
wherein the controller includes:

a first terminal to which a signal from the receiver is inputted;
a second terminal to which a signal from the switch is inputted; and
a processer configured to disable input to the second terminal until the signal from the receiver is inputted to the first terminal, and configured to enable input to the second terminal after the signal from the receiver is inputted to the first terminal.

2. The air conditioner according to claim 1, further comprising a nonvolatile memory provided in the controller and configured to store data indicating an enabled state or a disabled state of the second terminal,
wherein the processer is configured to bring a state of the second terminal into a same state as a state before stop of power supply based on data stored in the non-volatile memory, when power supply to the controller is resumed.

3. The air conditioner according to claim 1,
wherein the nonvolatile memory is configured to store data indicating that the second terminal is in a disabled state as default.

4. The air conditioner according to claim 1,
wherein the controller further includes a third terminal to which a wired remote controller can be connected.

5. The air conditioner according to claim 1,
wherein the processer is configured of a microprocessor, and includes a first port connected to the first terminal and a second port, which is connected to the second terminal and is switchable between an output port and an input port; and
the processer is configured to enable input to the second terminal after the signal from the receiver is inputted to the first terminal, by switching the second port from the output port to the input port when the processer determines that a signal being inputted to the first port is a signal based on reception of the wireless signal.

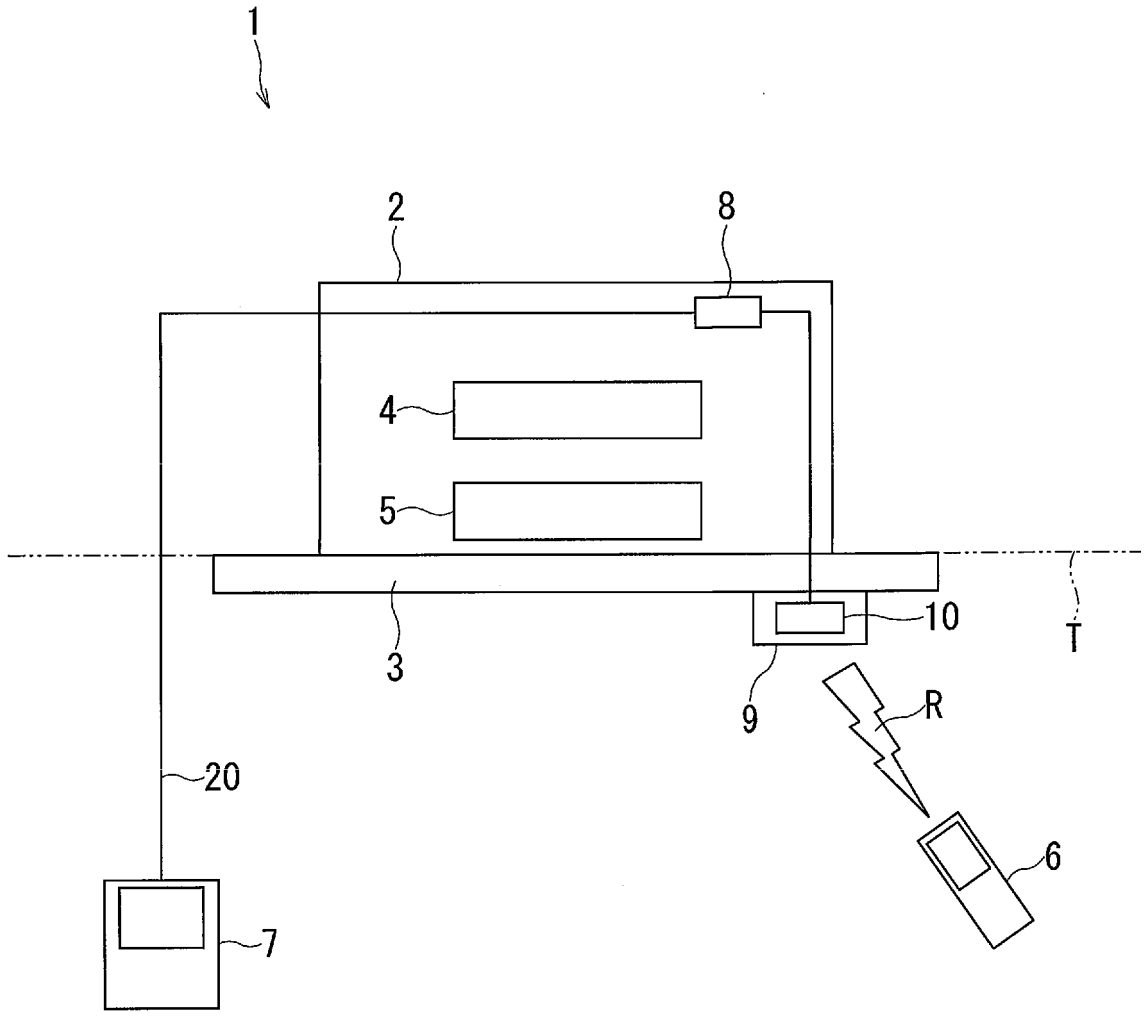


FIG. 1

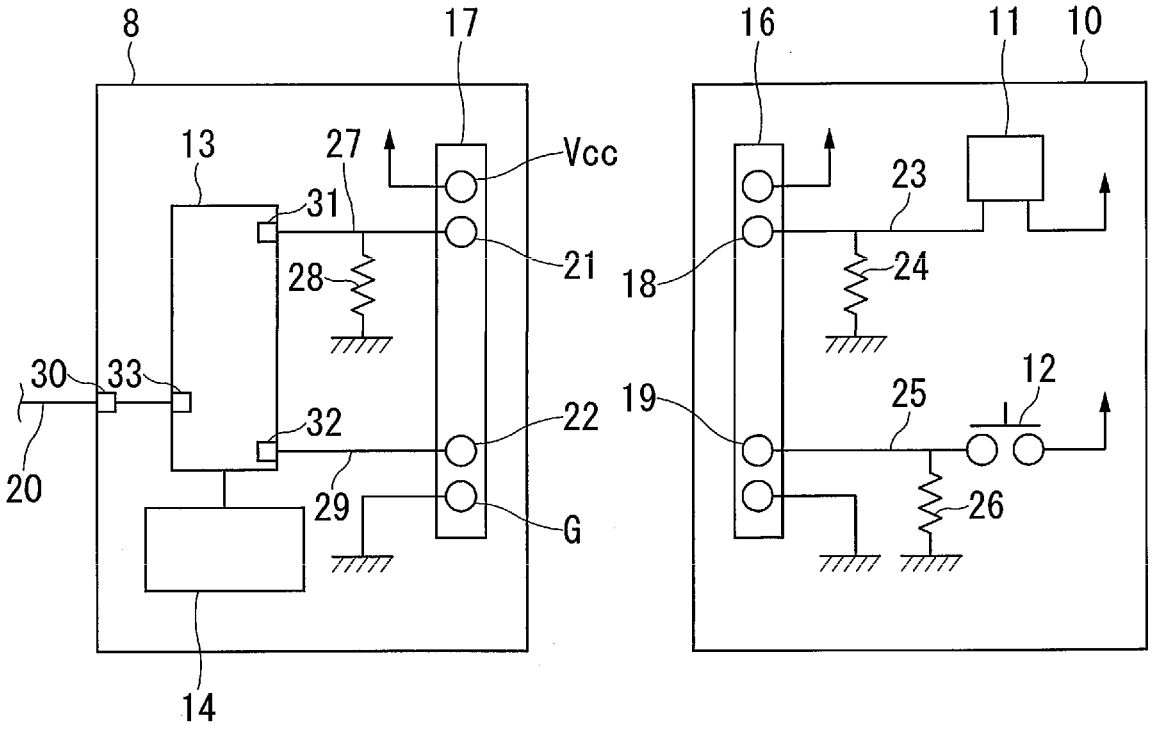
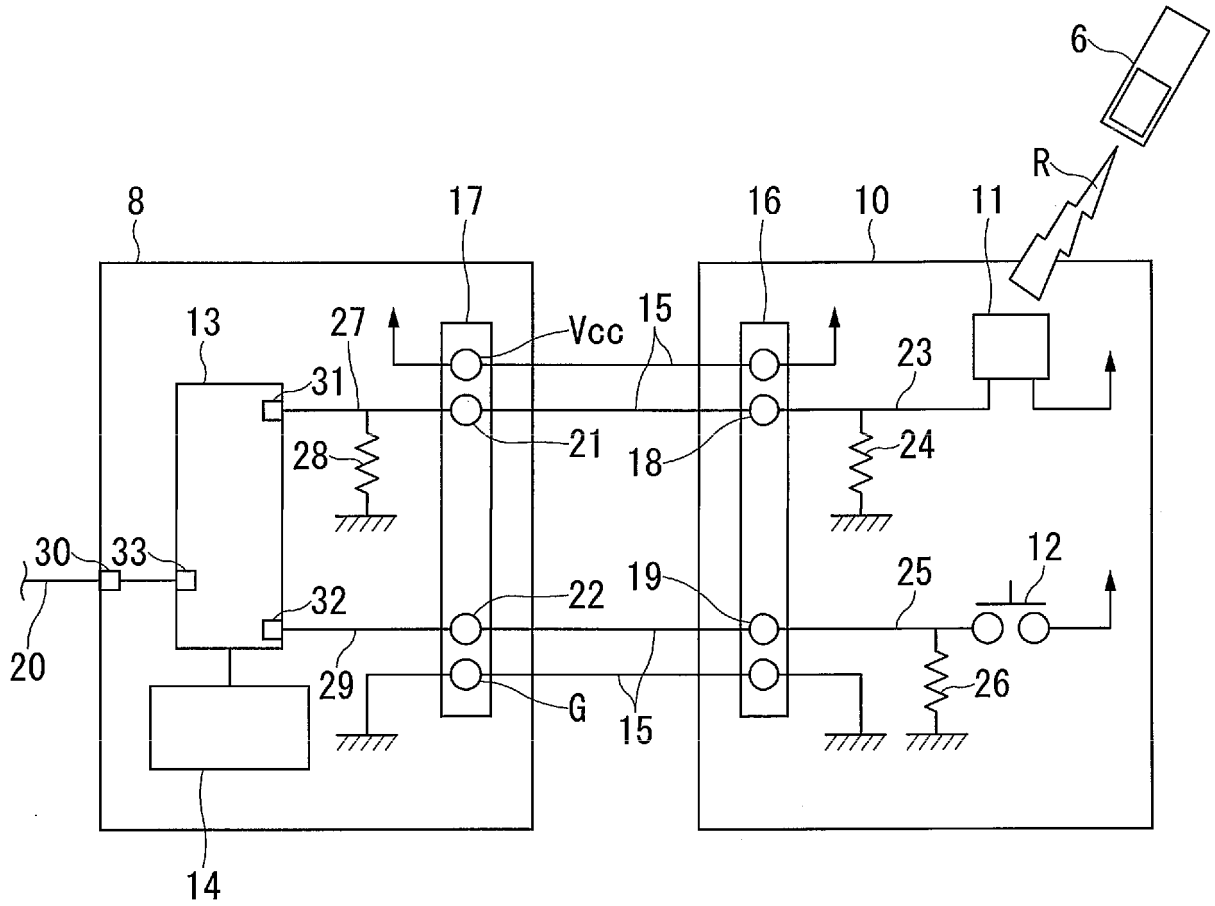

8
17
16
11
10
13
27
Vcc
31
23
21
28
18
24
30
33
12
19
25
32
22
20
29
G
26
14

FIG. 2


6
R
8
17
16
10
11
13
27
Vcc
15
23
31
21
18
28
24
30
33
12
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19
22
32
20
29
G
15
26
14

FIG. 3

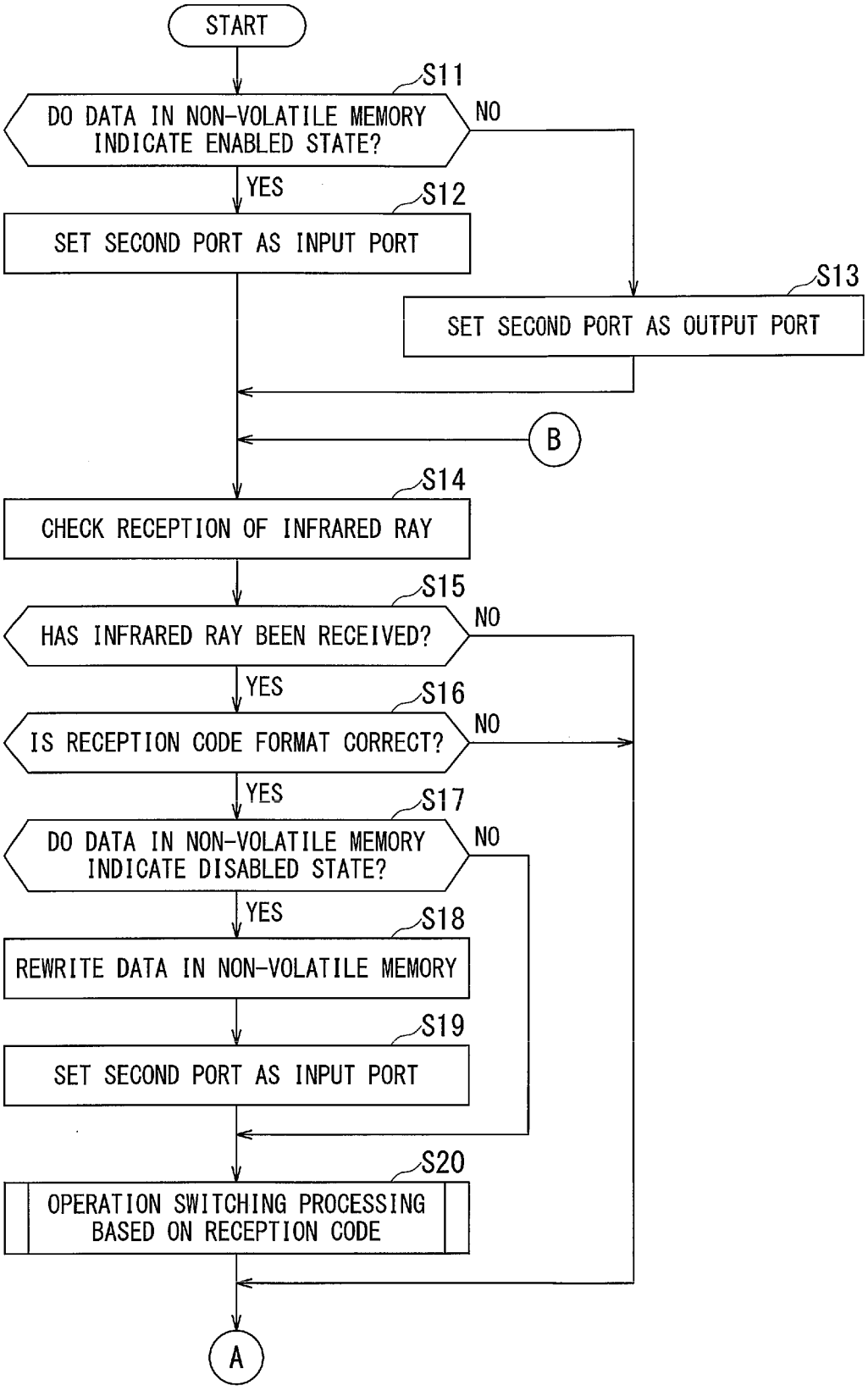
START
S11
DO DATA IN NON-VOLATILE MEMORY INDICATE ENABLED STATE?
NO
YES
S12
SET SECOND PORT AS INPUT PORT
S13
SET SECOND PORT AS OUTPUT PORT
B
S14
CHECK RECEPTION OF INFRARED RAY
S15
HAS INFRARED RAY BEEN RECEIVED?
NO
YES
S16
IS RECEPTION CODE FORMAT CORRECT?
NO
YES
S17
DO DATA IN NON-VOLATILE MEMORY INDICATE DISABLED STATE?
NO
YES
S18
REWRITE DATA IN NON-VOLATILE MEMORY
S19
SET SECOND PORT AS INPUT PORT
S20
OPERATION SWITCHING PROCESSING BASED ON RECEPTION CODE
A

FIG. 4

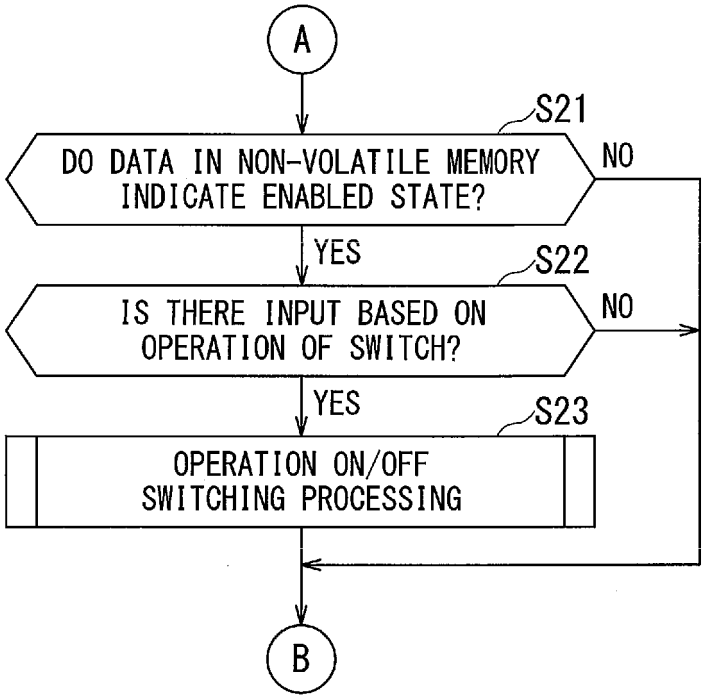
A
S21
DO DATA IN NON-VOLATILE MEMORY INDICATE ENABLED STATE?
NO
YES
S22
IS THERE INPUT BASED ON OPERATION OF SWITCH?
NO
YES
S23
OPERATION ON/OFF SWITCHING PROCESSING
B

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/001376

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, F24F1/00, H05K1/18

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	1996-2017
Kokai Jitsuyo Shinan Koho	1971-2017	Toroku Jitsuyo Shinan Koho	1994-2017

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 2005-265264 A (Matsushita Electric Industrial Co., Ltd.), 29 September 2005 (29.09.2005), paragraphs [0008] to [0010], [0015]; fig. 1 (Family: none)	1-5
A	JP 2010-169275 A (Sanyo Electric Co., Ltd.), 05 August 2010 (05.08.2010), paragraphs [0013] to [0014] (Family: none)	1-5
A	WO 2016/103503 A1 (Mitsubishi Electric Corp.), 30 June 2016 (30.06.2016), paragraphs [0035] to [0037]; fig. 6 (Family: none)	1-5

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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	Date of mailing of the international search report
09 March 2017 (09.03.17)	21 March 2017 (21.03.17)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/001376

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 2011-52836 A (Sanyo Electric Co., Ltd.), 17 March 2011 (17.03.2011), paragraph [0024] (Family: none)	1-5

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005265264 A **[0003]**