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(54) **Household electrical appliance system and radio setting method**

(57) A household electrical appliance system includes a household electrical appliance (1) and a household electrical appliance (2). The household electrical appliance (2) includes: an input unit (24) that receives an input for instructing start of radio setting processing with a pairing button; and a radio setting unit (22) that transmits, when the input unit (24) receives the input for instructing the start of the radio setting processing, a radio setting request and carries out the radio setting processing for radio communication with the household electrical appliance (1). The household electrical appliance (1) in-

cludes a radio setting unit (12) that shifts, after power-on, to a radio setting mode for receiving the radio setting request, in the radio setting mode, carries out, when the radio setting unit (12) receives the radio setting request from the household electrical appliance (2), the radio setting processing for radio communication with the household electrical appliance (2), and ends the radio setting mode after the household electrical appliance (2) is registered as a communication partner.

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a household electrical appliance system including household electrical appliances having a communication function.

2. Description of the Related Art

[0002] In recent years, household electrical appliances having a communication function are increasing. For example, Japanese Patent Application Laid-open No. 2008-004975 discloses a technique in which, when a new air conditioner is added to a home network, a remote controller acquires radio setting information from an information terminal and transmits the air conditioner radio setting information. Japanese Patent Application Laid-open No. 2008-004975 also discloses that, to suppress power consumption and prevent malfunction, an air conditioner enters a radio setting mode for a fixed time after buttons of appliances of the air conditioner are pressed.

[0003] However, according to the related art, a radio setting is complicated. In a remote controller or the like having a simple operation unit, it is difficult to directly operate the remote controller to perform the radio setting.

[0004] In the technology described in Japanese Patent Application Laid-open No. 2008-004975, the information terminal is necessary and the radio setting cannot be performed when the information terminal is not present. Further, when buttons are pressed in both the appliances to perform the radio setting, the radio setting cannot be easily performed between appliances present in unreachable places, remote places, or the like. The radio setting indicates mutual settings for appliances to perform a radio communication.

[0005] The present invention has been devised in view of the above and it is an object of the present invention to obtain a household electrical appliance system and a radio setting method in which household electrical appliances can easily perform radio setting for radio connection irrespective of the configuration and the setting place of an operation unit.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0007] In order to solve above-mentioned problem and achieve the object, a household electrical appliance system according to the present invention includes a first household electrical appliance; and a second household electrical appliance that performs a radio communication with the first household electrical appliance, wherein the second household electrical appliance includes, an input

unit that receives an input for instructing a start of a radio setting processing for registering a communication partner to perform the radio communication; and a transmission-side radio setting unit that transmits, when the input unit receives the input for instructing the start of the radio setting processing, a radio setting request for requesting the start of the radio setting processing and carries out the radio setting processing concerning the first household electrical appliance, and the first household electrical appliance includes a reception-side radio setting unit that shifts, after power-on, to a radio setting mode for receiving the radio setting request, in the radio setting mode, carries out, when the reception-side radio setting unit receives the radio setting request from the second household electrical appliance, the radio setting processing concerning the second household electrical appliance, and ends the radio setting mode after the second household electrical appliance is registered as the communication partner.

[0008] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a diagram of a configuration example of a household electrical appliance system according to a first embodiment;

FIG. 2 is a diagram of an example of a pairing procedure according to the first embodiment;

FIG. 3 is a flowchart for explaining an example of a pairing processing procedure in an indoor machine; FIG. 4 is a flowchart for explaining an example of a pairing processing procedure in a remote controller; FIG. 5 is a flowchart for explaining an example of a pairing processing procedure of a household electrical appliance according to a third embodiment;

FIG. 6 is a flowchart for explaining an example of a pairing processing procedure in a remote controller according to a third embodiment;

FIG. 7 is a diagram of a configuration example of a household electrical appliance system according to a fourth embodiment;

FIG. 8 is a diagram of a configuration example of the household electrical appliance system according to the embodiment in which a master apparatus and a slave apparatus are set; and

FIG. 9 is a diagram of a configuration example of a household electrical appliance system according to a fifth embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] A household electrical appliance system and a radio setting method according to embodiments of the present invention are explained in detail below with reference to the accompanying drawings. The present invention is not limited by the embodiments.

First Embodiment

[0011] FIG. 1 is a diagram of a configuration example of a first embodiment of the household electrical appliance system according to the present invention. As shown in FIG. 1, the household electrical appliance system according to this embodiment includes a household electrical appliance 1 (a first household electrical appliance) and a household electrical appliance 2 (a second household electrical appliance).

[0012] The household electrical appliance 1 is, for example, a main body (an indoor machine or an outdoor machine) of an air conditioner. The household electrical appliance 1 does not include an input unit that receives an input from a user. Even if the household electrical appliance includes the input unit, because the input unit is set in a high place, an input from the input unit is not easy. The household electrical appliance 1 includes a radio transmission and reception unit 11 that performs a predetermined transmission and reception processing for a radio communication, a radio setting unit (a reception-side radio setting unit) 12 that performs a radio setting for a radio connection, and a display unit 13.

[0013] The household electrical appliance 2 is, for example, a remote controller of the air conditioner and has a function of receiving an input from the user. The household electrical appliance 2 includes a radio transmission and reception unit 21 that performs a predetermined transmission and reception processing for a radio communication, a radio setting unit (a transmission-side radio setting unit) 22 that performs a radio setting for a radio connection, a display unit 23, and an input unit (an operation unit) 24. The radio setting indicates mutual settings for the appliances to perform radio communications and is hereinafter represented as a pairing.

[0014] For example, in the case of an indoor machine (of an air conditioner) of a ceiling-embedded type or a wall-mounted type, in some case, an operation unit is not exposed to the surface because of a design, the operation unit is not provided for a reduction in cost, or the user cannot reach the operation unit. For example, a pairing button is provided in a remote controller and the remote controller transmits a pairing request when the pairing button is depressed. The indoor machine is initially set in a mode for always receiving a pairing request from any remote controller. After registration of one remote controller is performed, the radio setting can be performed by changing the mode to a mode for not receiving a pairing request.

[0015] However, in the method for radio setting explained above, when a plurality of indoor machines are installed, for example, the indoor machines react to a pairing request signal all at once and cause a pairing mistake or the indoor machine is paired with, based on a pairing request signal transmitted from another place, a remote controller with which the indoor machine should not be paired.

[0016] There is also a method in which a PIN (Personal Identification Number) code is set in an indoor machine, the PIN code is displayed in a position seen from the inside of a room, and a user inputs a PIN code of an indoor machine that is paired with a remote controller. However, when an operation unit of the remote controller is simple, the method cannot be applied. Because the PIN code is displayed on the indoor machine, when the indoor machine is set on the ceiling, characters on the surface of the indoor machine cannot be read or the indoor machine is unattractive in terms of a design.

[0017] Therefore, in this embodiment, the indoor machine automatically shifts to a pairing mode (a radio setting mode) for receiving a pairing request for a fixed time from power-on. Consequently, the user can easily start the pairing mode without performing operation for the indoor machine. When a switchboard is present in a place far from a setting place of the indoor machine, a long time is required from the power-on until transmission of a pairing request through the operation of the remote controller. In such a case, the indoor machine enters the pairing mode for a fixed time after staying on standby for a predetermined time from the power-on. For example, the predetermined time for the standby can be determined by a switch of the outdoor machine or the indoor machine or determined based on, for example, the number of times a power supply is turned on again.

[0018] FIG. 2 is a diagram of an example of a pairing procedure performed when the household electrical appliance 1 is the indoor machine of the air conditioner and the household electrical appliance 2 is the remote controller of the air conditioner. First, when a power supply for the household electrical appliance (the indoor machine) 1 is turned on (main power supply on) as shown in (1) of FIG. 2, as explained above, the household electrical appliance 1 enters the pairing mode immediately or after the predetermined time elapses.

[0019] When a pairing button (a button indicated by P in FIG. 2) is pressed by the operation of the input unit 24 of the household electrical appliance (the remote controller) 2 as shown in (2) of FIG. 2, as shown in (3) of FIG. 2, the radio setting unit 22 of the household electrical appliance 2 transmits a pairing request through the radio transmission and reception unit 21 using a radio signal. When the radio setting unit 12 of the household electrical appliance 1 receives the pairing request through the radio transmission and reception unit 11, as shown in (4) of FIG. 2, the radio setting unit 12 transmits ACK, which is a response indicating that the pairing request is received.

[0020] When the radio setting unit 22 of the household

electrical appliance 2 receives the ACK through the radio transmission and reception unit 21 as shown in (5) of FIG. 2, the radio setting unit 22 registers an ID (Identifier) of the household electrical appliance 1 stored in the received ACK (a pairing registration for the household electrical appliance 1). As shown in (6) of FIG. 2, the radio setting unit 22 transmits, through the radio transmission and reception unit 21, pairing registration completion notification for notifying that the pairing registration is completed. When the radio setting unit 12 of the household electrical appliance 1 receives the pairing registration completion notification through the radio transmission and reception unit 11, as shown in (7) of FIG. 2, the radio setting unit 12 registers an ID of the household electrical appliance 2 stored in the received pairing registration completion notification (a pairing registration for the household electrical appliance 2). The household electrical appliances 1 and 2 in which the IDs thereof are registered each other can thereafter perform the radio communication.

[0021] The remote controller includes the pairing button as the input unit 24. When the pairing button is pressed, the remote controller transmits a pairing request. However, a form of the input unit 24 is not limited to this. The input unit 24 only has to be capable of receiving a transmission instruction for a pairing request.

[0022] As explained above, in this embodiment, the remote controller (the household electrical appliance 2) receives the ACK from the indoor machine (the household electrical appliance 1) and registers the ID of the indoor machine. Some inexpensive remote controller in the past ends the pairing mode when registration is performed once. In that case, when the indoor machine cannot receive a pairing request because of a communication error or the like, even if the remote controller recognizes that the remote controller and the indoor machine are paired and executes a following processing, the indoor machine does not receive the processing. As explained above, because the indoor machine transmits the ACK and the remote controller receives the ACK and then registers the ID of the indoor machine, such a problem can be prevented.

[0023] FIGS. 3 and 4 are flowcharts for explaining examples of pairing processing procedures performed when the household electrical appliance 1 is the indoor machine of the air conditioner and the household electrical appliance 2 is the remote controller of the air conditioner. An example of a pairing processing procedure in the indoor machine is shown in FIG. 3. An example of a pairing processing procedure in the remote controller is shown in FIG. 4.

[0024] When the power supply for the indoor machine is turned on (step S1), the radio setting unit 12 of the indoor machine (the household electrical appliance 1) carries out mode switching and shifts to the pairing mode for receiving a pairing request (step S2). As timing for carrying out step S2, step S2 can be carried out after a predetermined time elapses from the power-on.

[0025] The radio setting unit 12 of the indoor machine determines whether a pairing request signal is received (step S3). When a pairing request signal is received, the radio setting unit 12 transmits ACK in which pairing information necessary for pairing such as the ID of the own apparatus is stored (step S4). The radio setting unit 12 records the ID of the remote controller (the household electrical appliance 2) at the transmission source stored in the pairing request signal. The radio setting unit 12 determines whether a pairing registration completion notification signal is received from the remote controller, the ID of which is recorded (step S5). When the pairing registration completion notification signal is received (Yes at step S5), the radio setting unit 12 registers the ID of the remote controller (step S6) and ends the pairing mode (step S7). Thereafter, the indoor machine does not receive a pairing request (e.g., even if the indoor machine receives a pairing request, the indoor machine discards the pairing request).

[0026] When the radio setting unit 12 determines at step S3 that a pairing request signal is not received (No at step S3), the radio setting unit 12 determines whether a fixed time elapses after the mode switching is carried out (step S2) (step S8). When the fixed time does not elapse (No at step S8), the radio setting unit 12 repeats step S3. When the fixed time elapses after the mode switching is carried out (step S2) (Yes at step S8), the radio setting unit 12 instructs the display unit 13 to perform error display indicating that a pairing is not carried out. The display unit 13 performs display based on the instruction (step S9). The radio setting unit 12 ends the pairing mode (step S7). A display method of the display unit 13 is not limited. In the case of the indoor machine, an error can be displayed by, for example, turning on or blinking on and off of an LED (Light Emitting Diode) or can be notified by sound such as a buzzer instead of the display.

[0027] When the radio setting unit 12 does not receive a pairing registration completion notification signal at step S5 (No at step S5), the radio setting unit 12 determines whether a fixed time elapses from the mode switching (step S2) (step S10). When the fixed time does not elapse (No at step S10), the processing returns to step S5. When the fixed time elapses (Yes at step S10), the processing proceeds to step S9.

[0028] When the fixed time does not elapse at step S10 (No at step S10), the radio setting unit 12 can perform retransmission of the ACK at every predetermined retransmission period.

[0029] On the other hand, after the power supply for the remote controller (the household electrical appliance 2) is turned on (step S11), when the pairing button of the input unit 24 is pressed, a transmission instruction for a pairing request is input (step S12). The radio setting unit 22 shifts to the pairing mode (a mode for performing a setting of pairing) and transmits a pairing request signal (step S13).

[0030] The radio setting unit 22 determines whether

the radio setting unit 22 receives ACK corresponding to the transmitted pairing request signal (step S14). When the radio setting unit 22 receives the ACK (Yes at step S14), the radio setting unit 22 registers the ID of the indoor machine stored in the received ACK (step S15). The radio setting unit 22 transmits a registration completion notification signal (step S16) and ends the pairing mode (step S17).

[0031] When the radio setting unit 22 does not receive the ACK at step S14 (No at step S14), the radio setting unit 22 determines whether a fixed time elapses after the radio setting unit 22 shifts to the pairing mode (step S18). When the fixed time does not elapse (No at step S18), the processing returns to step S14. When the fixed time elapses (Yes at step S18), the radio setting unit 22 instructs the display unit 23 to perform error display indicating that pairing is not carried out. The display unit 23 performs display based on the instruction (step S19). The radio setting unit 22 ends the pairing mode (step S17). A display method of the display unit 23 is not limited. For example, in the case of the remote controller, the display unit 23 displays details of an error on a liquid crystal screen or the like.

[0032] When the fixed time does not elapse at step S18 (No at step S18), the radio setting unit 22 can perform retransmission of a pairing request signal at every predetermined retransmission period.

[0033] In this embodiment, to surely perform radio setting, the household electrical appliance 2 transmits the registration completion notification signal and the household electrical appliance 1 pairing-registers the household electrical appliance 2 after receiving the registration completion notification signal from the household electrical appliance 2. However, it is also possible that the household electrical appliance 2 does not transmit the registration completion notification signal and the household electrical appliance 1 proceeds to step S6 after step S4. Similarly, in this embodiment, to surely perform radio setting, the household electrical appliance 1 transmits the response to the pairing request and the household electrical appliance 2 pairing-registers the household electrical appliance 1 after receiving the response. However, it is also possible that the household electrical appliance 1 does not transmit the pairing request and the household electrical appliance 2 pairing-registers the household electrical appliance 1 after the transmission of the pairing request.

[0034] As explained above, in this embodiment, after the power supply is turned on, the household electrical appliance 1 shifts to the pairing mode after the elapse of the predetermined time (0 hour is also included as the predetermined time). When the household electrical appliance 2 is instructed from the input unit 24 to transmit the pairing request (a radio setting request), the household electrical appliance 2 shifts to the pairing mode. The household electrical appliance 1 and the household electrical appliance 2 continue the pairing mode for a fixed period. When a pairing processing is not completed in

the fixed period, the household electrical appliance 1 and the household electrical appliance 2 perform error display and end the pairing mode. When the pairing processing is completed before the fixed period elapses, the household electrical appliance 1 and the household electrical appliance 2 end the pairing mode after the completion. Therefore, even if a special interface is not provided for radio setting processing (the pairing processing), radio setting can be carried out by simple operation of only power-on (breaker) operation. Therefore, the household electrical appliances can easily perform a radio setting for a radio connection irrespective of the configuration and the setting place of the operation unit. When a pairing is performed during manufacturing, the same effects are obtained and there is an effect such as yield improvement. It is unnecessary to display a PIN code or the like on the surface of the household electrical appliance and it is possible to eliminate the limitation in terms of a design.

Second Embodiment

[0035] A household electrical appliance system according to a second embodiment of the present invention is explained. The configuration of the household electrical appliance system according to this embodiment and the configurations of the household electrical appliances 1 and 2 are similar to those in the first embodiment. Differences from the first embodiment are explained below.

[0036] In this embodiment, a pairing processing is performed according to a procedure explained in the first embodiment. However, the operation of this embodiment can be applied when the pairing processing is carried out according to other procedures.

[0037] In a household electrical appliance such as an air conditioner of a ceiling-embedded type, even if a pairing button, a pairing reset button, and a release button are provided, the buttons cannot be easily pressed. In some case, an interface (an operation unit) for a pairing is not provided in an indoor machine to reduce cost.

[0038] In the first embodiment, the method in which the pairing processing can be easily carried out for the household electrical appliance that cannot be easily operated is explained. However, for example, when a remote controller is purchased anew or replaced with a service component or when the household electrical appliance is paired with another remote controller because of a pairing mistake, it is necessary to perform the pairing again because a communication between the remote controller and the indoor machine cannot be performed in that state.

[0039] However, for example, in the case of a model for one-to-one communication, in some case, the pairing cannot be performed again unless the pairing is reset (pairing registration is released). Among a plurality of appliances that can be registered, the pairing reset is also necessary when the appliances are paired by mistake and the operation unit designate one appliance and can-

not release the pairing.

[0040] Therefore, in this embodiment, the household electrical appliances 1 and 2 have a function of receiving a pairing reset. As a method of receiving the pairing reset, for example, within a fixed time after power-on of the indoor machine (the household electrical appliance 1), the pairing button of the remote controller (the household electrical appliance 2) is pressed long to carry out the pairing reset. Specifically, for example, the pairing reset is carried out according to a procedure explained below.

[0041] As in the first embodiment, after the predetermined time elapses (including the elapse of 0 hour) after the power-on, the indoor machine shifts to the pairing mode. However, in the pairing mode, the indoor machine receives the pairing reset as well. In the remote controller, when the pairing button is pressed long, the radio setting unit 22 releases the pairing registration for the indoor machine and transmits a release notification for notifying the release of the pairing registration. An example in which the remote controller registers one indoor machine is explained. However, when the remote controller can register a plurality of indoor machines, the registration of all the indoor machines can be released or an indoor machine, the registration of which is released, can be designated by combining long-pressing of a button or the like for designating an indoor machine and long-pressing of the pairing button.

[0042] In the indoor machine that receives the release notification, the radio setting unit 12 releases the pairing registration for the remote controller. When pairing registrations for a plurality of remote controllers are possible, only a remote controller at a transmission source of the release notification can be released or the registrations of all the remote controllers can be released.

[0043] When the power supply is restarted within a fixed time after the power supply for the indoor machine is turned on, the pairing reset can be performed without using the pairing button of the remote controller. For example, the indoor machine includes a counter for incrementing a flag by 1 during the start after the power-on of the indoor machine. The indoor machine sets the flag to 0 after the fixed time from the power-on. In this case, when the power supply is restarted until the fixed time elapses from the power-on, the flag changes to 1 or more. When the fixed time elapses, the flag changes to 0. Therefore, if the pairing reset is performed when the flag is 1, the pairing reset is performed when the power supply is restarted within the fixed time. In this case, the indoor machine transmits a release notification for notifying the remote controller of a release of the pairing registration. The remote controller that receives the release notification releases the pairing registration for the indoor machine at the transmission source. The indoor machine can transmit the pairing release notification when the remote controller accesses the indoor machine next time.

[0044] Even when the main body of the indoor machine is set on the ceiling, a power supply such as a breaker is often set in a place where the power supply can be

operated. Therefore, even when it is difficult to operate the indoor machine itself, it is possible to easily carry out the pairing reset by turning on the power supply.

[0045] The pairing reset can be carried out every time the power supply is restarted. In that case, after the pairing reset, the pairing processing is carried out again. In the case of a model that allows registrations of a plurality of household electrical appliances, the indoor machine can enter the pairing mode without performing the pairing reset and receive a pairing request from a new remote controller.

[0046] As explained above, in this embodiment, the household electrical appliances 1 and 2 have the function of carrying out the pairing reset with a simple operation. Therefore, for example, when a remote controller is purchased anew or replaced with a service component, it is possible to carry out the pairing reset. Therefore, the household electrical appliances can easily perform a radio setting (resetting) for a radio connection irrespective of the configuration and the setting place of the operation unit.

Third Embodiment

[0047] FIG. 5 is a flowchart for explaining an example of a pairing processing procedure of the household electrical appliance 1 according to a third embodiment 3 of the present invention. The configuration of the household electrical appliance system according to this embodiment and the configurations of the household electrical appliances 1 and 2 are similar to those in the first embodiment. Differences from the first embodiment are explained below.

[0048] In an apartment house such as a condominium, air conditioners are often initially installed. The same holds true in a store such as an office. The air conditioners are set at the same period and a pairing is performed in a plurality of rooms at the same time. In this case, it is anticipated that a radio signal from a remote controller reaches the next room and an indoor machine is paired with the remote controller in the next room by mistake. In this case, a control of the indoor machine is changed by an unexpected operation. In this case, it is necessary to perform a pairing reset to reset the pairing. The operation is extremely complicated.

[0049] Therefore, in this embodiment, when the radio setting unit 12 of the indoor machine (the household electrical appliance 1) receives pairing requests from a plurality of household electrical appliances in a fixed time after the radio setting unit 12 shifts to a pairing mode, the radio setting unit 12 performs error display, suspends a processing of a pairing registration halfway, and discards pairing information being subjected to the processing of the radio setting. Consequently, the radio setting unit 12 prevents a plurality of household electrical appliances from being simultaneously registered in the fixed time and prevents a registration mistake.

[0050] The pairing processing according to this em-

bodiment is explained with reference to FIG. 5. The radio setting unit 12 of the indoor machine carries out steps S1 to S3 as in the first embodiment. When the radio setting unit 12 receives a pairing request signal (Yes at step S3), the radio setting unit 12 determines whether a fixed time elapses from the mode switching (step S2) (step S21). When a pairing request signal is received, the pairing request signal is stored. When the fixed time does not elapse from the mode switching (No at step S21), the processing returns to step S3.

[0051] When the fixed time elapses from the mode switching (Yes at step S21), the radio setting unit 12 determines whether the radio setting unit 12 receives pairing request signals from a plurality of household electrical appliances (step S22). When the radio setting unit 12 does not receive pairing request signals from the plurality of household electrical appliances (No at step S22), the radio setting unit 12 carries out steps S4 to S7 as in the first embodiment. When the radio setting unit 12 receives pairing request signals from a plurality of household electrical appliances (Yes at step S22), the radio setting unit 12 suspends the pairing processing and transmits an error notification to the transmission sources of the pairing request signals (step S23) and the processing proceeds to step S9. Steps S8 and S9 are the same as those in the first embodiment.

[0052] When the indoor machine receives a pairing request signal, the radio setting unit 12 stores the pairing request signal until the fixed time elapses. When the indoor machine receives the pairing request signal only from one household electrical appliance, the radio setting unit 12 performs pairing registration. However, the pairing registration is not limited to this. The radio setting unit 12 can carry out the pairing registration based on a pairing request signal received first and, when a pairing request signal is not received from another appliance before the fixed time elapses from the mode switching, continue the registration. In that case, when a pairing request signal is received from another appliance before the fixed time elapses from the mode switching, the radio setting unit 12 suspends a pairing registration work based on the pairing request signal received first and carries out steps S23, S8, and S7.

[0053] FIG. 6 is a flowchart for explaining an example of a pairing processing procedure in a remote controller according to this embodiment. Steps S11 to S15 are the same as those in the first embodiment. After step S15, the radio setting unit 22 determines whether an error notification is received (step S31). When the radio setting unit 22 receives the error notification (Yes at step S31), the processing proceeds to step S19.

[0054] When the radio setting unit 22 does not receive the error notification (No at step S31), the radio setting unit 22 determines whether a fixed time elapses from the mode switching (step S32). When the fixed time elapses (Yes at step S32), the processing proceeds to step S16. When the fixed time does not elapse (No at step S32), the processing returns to step S31. Steps S18 and S19

are the same as those in the first embodiment.

[0055] The pairing processing of the indoor machine (the household electrical appliance 1) is explained above. However, concerning the remote controller (the household electrical appliance 2), similarly, the pairing registration processing can be suspended when responses to a pairing request signal are received from a plurality of household electrical appliances.

[0056] As explained above, in this embodiment, when pairing requests are received from a plurality of household electrical appliances in the fixed time after shifting to the pairing mode, the error display is performed and the processing of the pairing registration is suspended halfway. Therefore, all appliances likely to be registered by mistake are not registered, whereby it is possible to prevent a registration mistake.

Fourth Embodiment

[0057] FIG. 7 is a diagram of a configuration example of the household electrical appliance system according to a fourth embodiment of the present invention. The household electrical appliance system according to this embodiment configures an air conditioner. The household electrical appliance system according to this embodiment includes indoor machines 1-1 to 1-3 having a configuration same as that of the household electrical appliance 1 according to the first embodiment and an outdoor machine 3 (a third household electrical appliance). The outdoor machine 3 is connected to a power supply 4. An example in which three indoor machines are provided is explained. However, the number of indoor machines is not limited to this. Although not shown in FIG. 7, the indoor machines 1-1 to 1-3 are operated by a remote controller having a configuration similar to that of the household electrical appliance 2 explained in the first embodiment. Differences from the first embodiment are explained below.

[0058] In an air conditioner, as indicated by the example shown in FIG. 7, in some case, a plurality of indoor machines are connected to one outdoor machine. Conversely, in some configuration, a plurality of outdoor machines are connected to one indoor machine. In such a case, different power supplies are not provided for the respective units (the indoor machines or the outdoor machines). A power supply is often shared by the units. In the example shown in FIG. 7, the outdoor machine 3 is connected to the power supply 4. Electric power is supplied to the indoor machines 1-1 to 1-3 through the outdoor machine 3.

[0059] When the power supply for a plurality of units is shared, as explained in the first embodiment, when the air conditioner enters the pairing mode when a predetermined time elapses after power-on, all the units enter the pairing mode all at once. Therefore, it is likely that a registration mistake occurs because the units enter the pairing mode all at once. As a result, setting takes a long time.

[0060] Therefore, in this embodiment, based on order

of connection of connection lines 31, 32, and 33, which connect the outdoor machine 3 and the indoor machines 1-1 to 1-3, to the outdoor machine 3 (positions of connected terminals or the like), time for shift to the pairing mode is set different for each of the connection lines 31, 32, and 33. For example, when numbers of order of terminals or the like of outdoor machines to which the connection lines 31, 32, and 33 are connected (e.g., numbers or the like of the terminals or numbers for identifying connection destinations) are respectively first, second, and third, predetermined times (standby times before entering the pairing mode) of the indoor machines 1-1 to 1-3 are set such that the indoor machines enter the pairing mode in the order of the numbers.

[0061] For example, the indoor machine 1-1 is set to enter the pairing mode for two minutes after a fixed time after power-on, the indoor machine 1-2 enters the pairing mode for two minutes after the fixed time + 2 minutes after the power-on, and the indoor machine 1-3 is set to enter the pairing mode for two minutes after the fixed time + 4 (=2+2) minutes after the power-on. In this way, the indoor machines 1-1 to 1-3 enter the pairing mode for two minutes each not to overlap one another. Therefore, a setting mistake can be prevented. Further, because the order of entering the pairing mode is determined in positions where the indoor machines 1-1 to 1-3 are connected to the outdoor machine 3, an installation company can easily and visually recognize a setting and does not misunderstand the setting. A continuation time of the pairing mode is not limited to two minutes.

[0062] Rather than setting the times when the indoor machines 1-1 to 1-3 enter the pairing mode as explained above, the power supply can be turned on with time shifted in the order of the connection to the outdoor machine 3 to prevent the times of the pairing mode from overlapping as explained above.

[0063] After a random time after the turn-on of the indoor machines 1-1 to 1-3, the indoor machines 1-1 to 1-3 shift to the pairing mode and declare the shift to the pairing mode (transmit a mode notification for notifying the shift to the pairing mode). A mechanism such as Carrier Sense for not shifting to the pairing mode during a fixed period when a declaration of the pairing mode is received from another appliance can be provided in the indoor machines 1-1 to 1-3 to prevent the times of the pairing modes from overlapping.

[0064] When the outdoor machine 3 and the indoor machines 1-1 to 1-3 perform a communication through a preferential connection, the indoor machines 1-1 to 1-3 can respectively perform communications with the outdoor machine 3 to set time when the indoor machines 1-1 to 1-3 enter the pairing mode. When the indoor machines 1-1 to 1-3 are respectively connected to communication ports of the outdoor machine 3, a time when the indoor machines 1-1 to 1-3 enter the pairing mode can be determined according to numbers of the communication ports.

[0065] While the indoor machines 1-1 to 1-3 are in the

pairing mode, the indoor machines 1-1 to 1-3 inform an installer or an operator on the outside using an LED or a buzzer, whereby the installer or the operator can grasp which of the indoor machines 1-1 to 1-3 are in the pairing mode. Operations of this embodiment other than the operation for preventing the pairing mode from overlapping in the appliances are the same as those in the first, second, or third embodiment.

[0066] When the indoor machines 1-1 to 1-3 are connected to an apparatus with abundant interfaces such as a centralized controller by radio, it is possible to simultaneously perform pairing from the centralized controller by broadcast and designate numbers of the appliances later.

[0067] When an inexpensive model in which time until shift to the pairing mode cannot be set is included in the indoor machines 1-1 to 1-3, the inexpensive model can be set to suspend the pairing processing of the inexpensive model for a fixed time when the other appliances are in the pairing mode or not to respond even if a pairing request signal is received.

[0068] When a plurality of indoor machines are connected to one outdoor machine, among the indoor machines, a master apparatus functioning as a representative apparatus that communicates with the outside or an access point of radio and a slave apparatus that operates based on an instruction from the master apparatus could be set. In such a case, the master apparatus can be determined by a method same as the method of determining the order of entering the pairing mode. For example, the master apparatus is determined based on the order of connection lines connected to an outdoor machine 3-1 or numbers of communication ports. Alternatively, the indoor machines 1-1 to 1-3 determine the master apparatus according to communications with the outdoor machine 3-1.

[0069] FIG. 8 is a diagram of a configuration example of the household electrical appliance system according to this embodiment in which a master apparatus and a slave apparatus are set. The household electrical appliance system according to this embodiment configures an air conditioner. The household electrical appliance system includes indoor machines 1-1 to 1-4 having a configuration same as that of the household electrical appliance 1 and outdoor machines 3-1 and 3-2. The outdoor machines 3-1 and 3-2 are respectively connected to power supplies 4-1 and 4-2. The number of indoor machines connected to the outdoor machines 3-1 and 3-2 is not limited to this. The indoor machines 1-1 to 1-3 are operated by a remote controller having a configuration same as that of the household electrical appliance 2 explained in the first embodiment 1, although not shown in FIG. 7.

[0070] In the configuration example shown in FIG. 8, because one indoor machine 1-4 is connected to the outdoor machine 3-2, the indoor machine 1-4 is a master apparatus (MASTER). However, because three indoor machines 1-1 to 1-3 are connected to the outdoor ma-

chine 3-1, it is necessary to set a master apparatus. All the indoor machines 1-1 to 1-3 have the same configuration and can operate as both a master apparatus and a slave apparatus.

[0071] In such a case, a master apparatus is determined by a method same as the method of determining the order of entering the pairing mode. An indoor machine determined as the master apparatus carries out the pairing processing and the like between an external household electrical appliance (a remote controller, etc.) as in the first, second, or third embodiment. Specifically, the indoor machine 1-1 functioning as the master apparatus receives various setting requests from the household electrical appliance 2 (the remote controller) ((1) of FIG. 8) and notifies the household electrical appliance 2 of setting ((2) of FIG. 8). Similarly, the indoor machine 1-4 functioning as the master apparatus receives various setting requests from the household electrical appliance 2 (the remote controller) ((3) of FIG. 2) and notifies the household electrical appliance 2 of setting ((4) of FIG. 8).

[0072] As explained above, in this embodiment, when a plurality of indoor machines 1-1 to 1-3 that share the power supply are present, times in which the indoor machines 1-1 to 1-3 are in the pairing mode are prevented from overlapping. Therefore, it is possible to prevent a setting mistake caused by simultaneous shift of the indoor machines 1-1 to 1-3 to the pairing mode.

Fifth Embodiment

[0073] FIG. 9 is a diagram of a configuration example of the household electrical appliance according to a fifth embodiment of the present invention. The household electrical appliance system according to this embodiment includes the indoor machines 1-1 to 1-2 of an air conditioner having a configuration similar to that of the household electrical appliance 1 according to the first embodiment, an indoor machine 5 of an air conditioner of a high-class model having a configuration similar to that of the household electrical appliance 1 according to the first embodiment, a remote controller, which is the household electrical appliance 2 according to the first embodiment, and a centralized controller 6. An example in which three indoor machines are provided is explained. However, the number of indoor machines is not limited to this. Differences from the first embodiment are explained below.

[0074] In radio of an air conditioner, an centralized controller (a multi-function apparatus), which is a remote controller, capable of performing centralized management is attached to a high-class model. A remote controller (a limited-function apparatus) capable of performing only 1-to-1 control is attached to an inexpensive model. For example, when an air conditioner of the high-class model and the air conditioner of an inexpensive model are set close to each other, unless there is a mechanism for allowing the remote controller of the inexpensive model to operate only an air conditioner corresponding thereto, an

unintended air conditioner is arbitrarily operated.

[0075] Therefore, in this embodiment, in the household electronic appliance 2, which is the remote controller of the inexpensive model, an ID of a counterpart of a pairing is registered during the pairing processing to set the household electrical appliance 2 to be unable to communicate with appliances other than the counterpart (set to be able to be connected only ad hoc).

[0076] For example, as shown in FIG. 9, when the household electrical appliance 2 pairing-registers the indoor machine 1-2, the radio setting unit 22 of the household electrical appliance 2 does not receive communication of other appliances (e.g., even if the radio setting unit 22 receives a signal, the radio setting unit 22 discards the signal when the signal is not a transmission signal from a pairing-registered appliance).

[0077] It is also possible that, when a registration mistake occurs or when it is desired to set a pairing counterpart of an indoor machine to a remote controller of another air conditioner of the inexpensive model, pairing cannot be performed again unless a pairing-registered remote controller mutually communicates with the air conditioner and releases the pairing registration.

[0078] It is also possible that the indoor machines 1-1 and 1-2 check whether an ID with which the indoor machines 1-1 and 1-2 are pairing-registered (an ID of the household electrical appliance 2) is the same as an ID held by the other indoor machines 1-1 and 1-2 with which the other indoor machines 1-1 and 1-2 are pairing-registered (an ID of the household electrical appliance 2) and, when the IDs are the same, measures for, for example, releasing registrations other than a registration of one of the indoor machines 1-1 to 1-2 and 5 can be taken (e.g., the indoor machines 1-1 and 1-2 record time when the pairing registration is performed first, only a registration of the indoor machines 1-1 and 1-2 pairing-registered first is validated, and a registration of the other indoor machines 1-1 to 1-2 is released). When the indoor machine 5 and the household electrical appliance 2, which is the remote controller of the inexpensive model, are paired, the household electrical appliance 2 cannot be paired with the indoor machines 1-1 and 1-2. Therefore, it is desirable to pair the indoor machine 5 with only the centralized controller 6.

[0079] When the household electrical appliance 2, which is the remote controller of the inexpensive model, is paired again, the household electrical appliance 2 is overwritten with IDs of the indoor machines 1-1 and 1-2, which are counterparts of re-pairing, to disable the household electrical appliance 2 to communicate with the other indoor machines 1-1 and 1-2 paired with the household electrical appliance 2 so far. In this case, the other indoor machines 1-1 and 1-2 paired with the household electrical appliance 2 so far keep the ID of the household electrical appliance 2 pairing-registered. Therefore, for example, when the indoor machines 1-1 and 1-2 detect a transmission signal other than a signal transmitted to the indoor machines 1-1 and 1-2, the indoor machines

1-1 and 1-2 release the pairing registration for the household electrical appliance 2.

[0080] To realize the above, the indoor machines 1-1, 1-2, and 5 store, in performing the pairing registration, besides an ID of a registration counterpart, information for distinguishing a type (e.g., whether the household electrical appliance is the inexpensive model that performs only 1-to-1 communication or the centralized controller) together with the ID. The appliances can notify the indoor machines 1-1, 1-2, and 5 of the type. Alternatively, the type can be allowed to be distinguished based on the ID and the indoor machines 1-1, 1-2, and 5 can distinguish the type based on the ID. A limitation corresponding to the type for, for example, disabling an inexpensive remote controller to be registered for the high-class model (the indoor machine 5) is provided based on the type. Consequently, a registration mistake of the system can be prevented. Operations of this embodiment other than those explained above are the same as those in the first to fourth embodiments.

[0081] As explained above, in this embodiment, the household electrical appliance 2, which is the remote controller of the inexpensive model that performs only 1-to-1 control, is set to register an ID of a pairing counterpart during the pairing processing and to be unable to communicate with appliances other than the appliance. Therefore, even when a high-class model and an inexpensive model are mixed, it is possible to prevent a registration mistake.

[0082] According to the present invention, there is an effect that it is possible to easily perform a radio setting for a radio connection with a simple operation.

[0083] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. A household electrical appliance system comprising:

a first household electrical appliance (1); and
a second household electrical appliance (2) that performs a radio communication with the first household electrical appliance (1), wherein the second household electrical appliance (2) includes:

an input unit (24) that receives an input for instructing a start of a radio setting processing for registering a communication partner to perform the radio communication; and
a transmission-side radio setting unit (22) that transmits, when the input unit (24) re-

ceives the input for instructing the start of the radio setting processing, a radio setting request for requesting the start of the radio setting processing and carries out the radio setting processing concerning the first household electrical appliance, and

the first household electrical appliance (1) includes a reception-side radio setting unit (12) that shifts, after power-on, to a radio setting mode for receiving the radio setting request, in the radio setting mode, carries out, when the reception-side radio setting unit (12) receives the radio setting request from the second household electrical appliance (2), the radio setting processing concerning the second household electrical appliance (2), and ends the radio setting mode after the second household electrical appliance (2) is registered as the communication partner.

2. The household electrical appliance system according to claim 1, wherein, when the reception-side radio setting unit (12) does not receive the radio setting request even when a fixed time elapses after shifting to the radio setting mode, the reception-side radio setting unit (12) ends the radio setting mode.

3. The household electrical appliance system according to claim 1 or 2, wherein
when the reception-side radio setting unit (12) receives the radio setting request from the second household electrical appliance (2), the reception-side radio setting unit (12) transmits a response to the radio setting request to the second household electrical appliance (2), and
the transmission-side radio setting unit (22) carries out the radio setting processing concerning the first household electrical appliance (1) after receiving the response to the radio setting request transmitted to the first household electrical appliance (1).

4. The household electrical appliance system according to claim 3, wherein, when the transmission-side radio setting unit (22) does not receive the response to the radio setting request even when a fixed time elapses after the input unit receives the input for instructing the start of the radio setting processing, the transmission-side radio setting unit (22) suspends the radio setting processing.

5. The household electrical appliance system according to claim 3 or 4, wherein, when the transmission-side radio setting unit (22) does not receive the response to the radio setting request even when a predetermined retransmission period time elapses after transmitting the radio setting request, the transmission-side radio setting unit (22) retransmits the radio

setting request.

6. The household electrical appliance system according to any one of claims 3 to 5, wherein when the transmission-side radio setting unit (22) carries out the radio setting processing concerning the first household electrical appliance (1), the transmission-side radio setting unit (22) transmits radio setting completion notification for notifying a completion of radio setting to the first household electrical appliance (1), and the reception-side radio setting unit (12) carries out the radio setting processing concerning the second household electrical appliance (2) after receiving the radio setting completion notification from the second household electrical appliance (2). 5
7. The household electrical appliance system according to claim 6, wherein, when the reception-side radio setting unit (12) does not receive the radio setting completion notification even when the predetermined retransmission period time elapses after transmitting the response to the radio setting request, the reception-side radio setting unit (12) retransmits the response. 10
8. The household electrical appliance system according to any one of claims 1 to 7, wherein, when the reception-side radio setting unit (12) receives radio setting requests from a plurality of the second household electrical appliances (2), the reception-side radio setting unit (12) suspends the radio setting processing with the second household electrical appliance (2). 15
9. The household electrical appliance system according to any one of claims 1 to 8, wherein, when the transmission-side radio setting unit (22) receives radio setting requests from a plurality of the first household electrical appliances (1), the transmission-side radio setting unit (22) suspends the radio setting processing with the first household electrical appliance (1). 20
10. The household electrical appliance system according to any one of claims 1 to 9, wherein the household electrical appliance system includes a plurality of the first household electrical appliances (1) that share a power supply, and time frames in which the first household electrical appliances (1) shift to the radio setting mode are different from one another among the first household electrical appliances (1). 25
11. The household electrical appliance system according to claim 10, further comprising third household electrical appliances (3) respectively connected to the first household electrical appliances (1) that

share the power supply, wherein

the first household electrical appliances (1) are set based on connection positions connected to the third household electrical appliances (3) such that time frames in which the first household electrical appliances (1) shift to the radio setting mode are different from one another.

12. The household electrical appliance system according to claim 10, further comprising third household electrical appliances (3) that respectively perform a wired communication with the first household electrical appliances (1) that share the power supply, wherein the first household electrical appliances (1) are set based on positions of communication ports connected to the third household electrical appliances such that time frames in which the first household electrical appliances (1) shift to the radio setting mode are different from one another. 30
13. The household electrical appliance system according to claim 10, further comprising third household electrical appliances (3) that respectively perform a wired communication with the first household electrical appliances (1) that share the power supply, wherein the first household electrical appliances (1) determine times when the first household electrical appliances (1) shift to the radio setting mode according to the communication with the third household electrical appliance (3). 35
14. The household electrical appliance system according to claim 10, wherein the household electrical appliance system determines, for each of the first household electrical appliances (1), time when the power supply is turned on such that time frames in which the first household electrical appliances (1) shift to the radio setting mode are different from one another among the first household electrical appliances (1). 40
15. The household electrical appliance system according to claim 10, wherein the first household electrical appliance (1) shifts to the radio setting mode after a random time elapses after the power-on, transmits mode notification for notifying that the first household electrical appliance (1) is in the radio setting mode to the other first household electrical appliances (1), and, when the first household electrical appliance (1) receives mode notifications from the other first household electrical appliances (1), does not shift to the radio setting mode for a fixed period. 45
16. The household electrical appliance system according to any one of claims 1 to 15, wherein, when the household electrical appliance system includes, as

the second household electrical appliance (2), a multi-function appliance that can register a plurality of the first household electrical appliances (1) as communication partners, the transmission-side radio setting unit of the multi-function appliance transmits the radio setting request by broadcast.

17. The household electrical appliance system according to any one of claims 1 to 16, wherein, when the household electrical appliance system includes, as the second household electrical appliance (2), a limited-function appliance that performs 1-to-1 communication, the transmission-side radio setting unit (22) of the limited-function appliance permits a communication only with the first household electrical appliance (1) registered as a communication partner and, when the limited-function appliance performs the radio setting processing anew with another first household electrical appliance (1), overwrites information concerning the radio setting processing.
18. The household electrical appliance system according to claim 17, wherein, when the reception-side radio setting unit (12) receives a radio signal to an other first household electrical appliance (1) transmitted from the second household electrical appliance (2) registered as a communication partner by the reception-side radio setting unit (12), the reception-side radio setting unit (12) releases the registration of the second household electrical appliance (2).
19. The household electrical appliance system according to claim 18, wherein
the household electrical appliance system includes, as the second household electrical appliance (2), a limited-function appliance and a multi-function appliance and specifies types for identifying the limited-function appliance and the multi-function appliance, and
the reception-side radio setting unit (12) acquires and stores a type corresponding to the second household electrical appliance (2) in registering the second household electrical appliance (2) and, when the type of the second household electrical appliance (2) is the limited-function appliance, releases the registration of the second household electrical appliance (2) when the reception-side radio setting unit (12) receives a radio signal to an other first household electrical appliance (1) transmitted from the second household electrical appliance registered as a communication partner by the reception-side radio setting unit (12).
20. The household electrical appliance system according to claim 19, when the household electrical appliance system includes, as the first household electrical appliance (1), an appliance that performs a radio communication with the limited-function appliance

and an appliance that performs a radio communication with the multi-function appliance, the reception-side radio setting unit (12) of the appliance that performs the radio communication with the multi-function appliance does not carry out the radio setting processing of the second household electrical appliance (2) when a type of the second household electrical appliance is the limited-function appliance.

21. The household electrical appliance system according to any one of claims 1 to 20, wherein
the input unit (24) receives an input for instructing release of radio setting,
when the input unit receives the input for instructing the release of the radio setting, the transmission-side radio setting unit (22) release a registration of the first household electrical appliance (1) registered as a communication partner and transmits a release notification for notifying the release of the radio setting to the first household electrical appliance (1), and
when the reception-side radio setting unit (12) receives the release notification, the reception-side radio setting unit (12) releases a registration of the second household electrical appliance (2) at a transmission source as a communication partner.
22. The household electrical appliance system according to any one of claims 1 to 20, wherein
when a power supply is turned on again within a predetermined time after the power supply is turned on, the reception-side radio setting unit (12) releases a registration of the second household electrical appliance (2) registered as a communication partner and transmits a release notification for notifying a release of radio setting to the second household electrical appliance (2), and
when the transmission-side radio setting unit (22) receives the release notification, the transmission-side radio setting unit (22) releases a registration of the first household electrical appliance (1) at a transmission source as a communication partner.
23. The household electrical appliance system according to claim 22, wherein the reception-side radio setting unit (12) transmits the release notification when there is a radio access from the second household electrical appliance (2) after the power supply is turned on again.
24. The household electrical appliance system according to any one of claims 1 to 23, wherein the first household electrical appliance (1) notifies an outside by an LED or a buzzer that the first household electrical appliance (1) is in the radio setting mode.
25. A radio setting method in a household electrical appliance system including a first household electrical appliance (1) and a second electrical appliance (2)

that performs a radio communication with the first household electrical appliance, the radio setting method comprising:

the second household electrical appliance (2) 5
receiving an input for instructing a start of a radio
setting processing for registering a communica-
tion partner to perform the radio communication;
the second household electrical appliance (2) 10
transmitting, when the input for instructing the
start of the radio setting processing is received,
a radio setting request for requesting the start
of the radio setting processing and carrying out
the radio setting processing concerning the first 15
household electrical appliance; and
the first household electrical appliance (1) shift-
ing, after power-on, to a radio setting mode for
receiving the radio setting request, in the radio
setting mode, carrying out, when the first house- 20
hold electrical appliance (1) receives the radio
setting request from the second household elec-
trical appliance (2), the radio setting processing
concerning the second household electrical ap-
pliance (2), and ending the radio setting mode 25
after the second household electrical appliance
(2) is registered as the communication partner.

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FIG.1

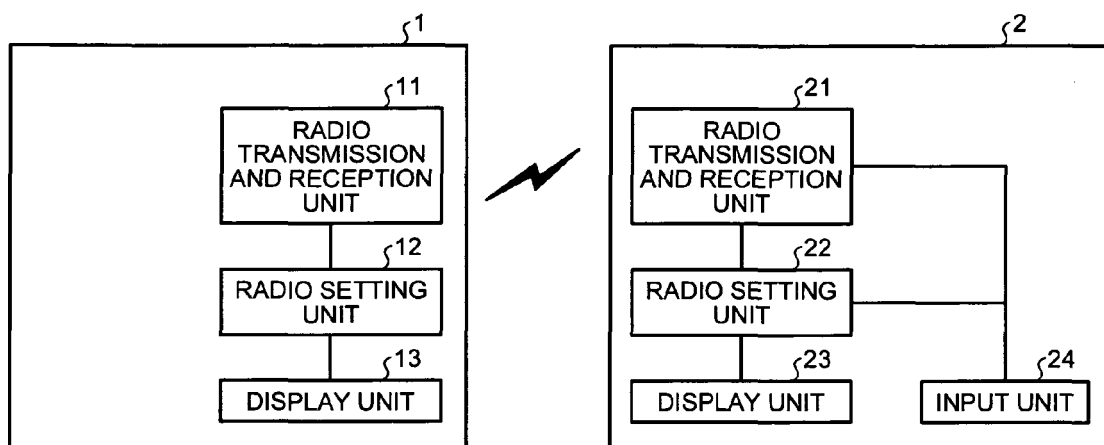


FIG.2

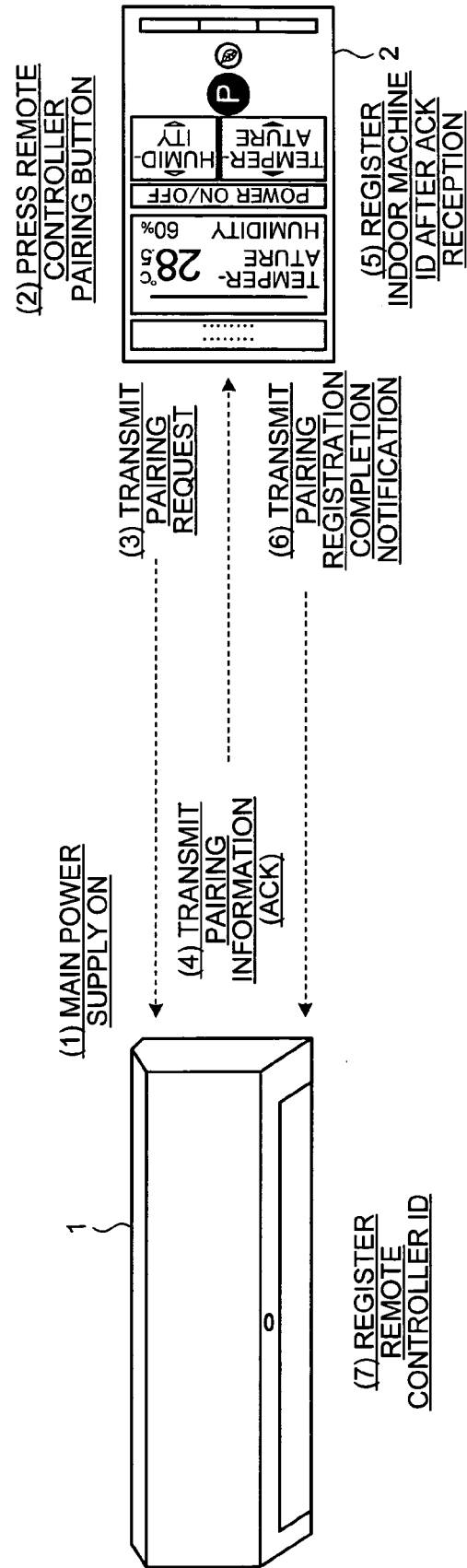


FIG.3

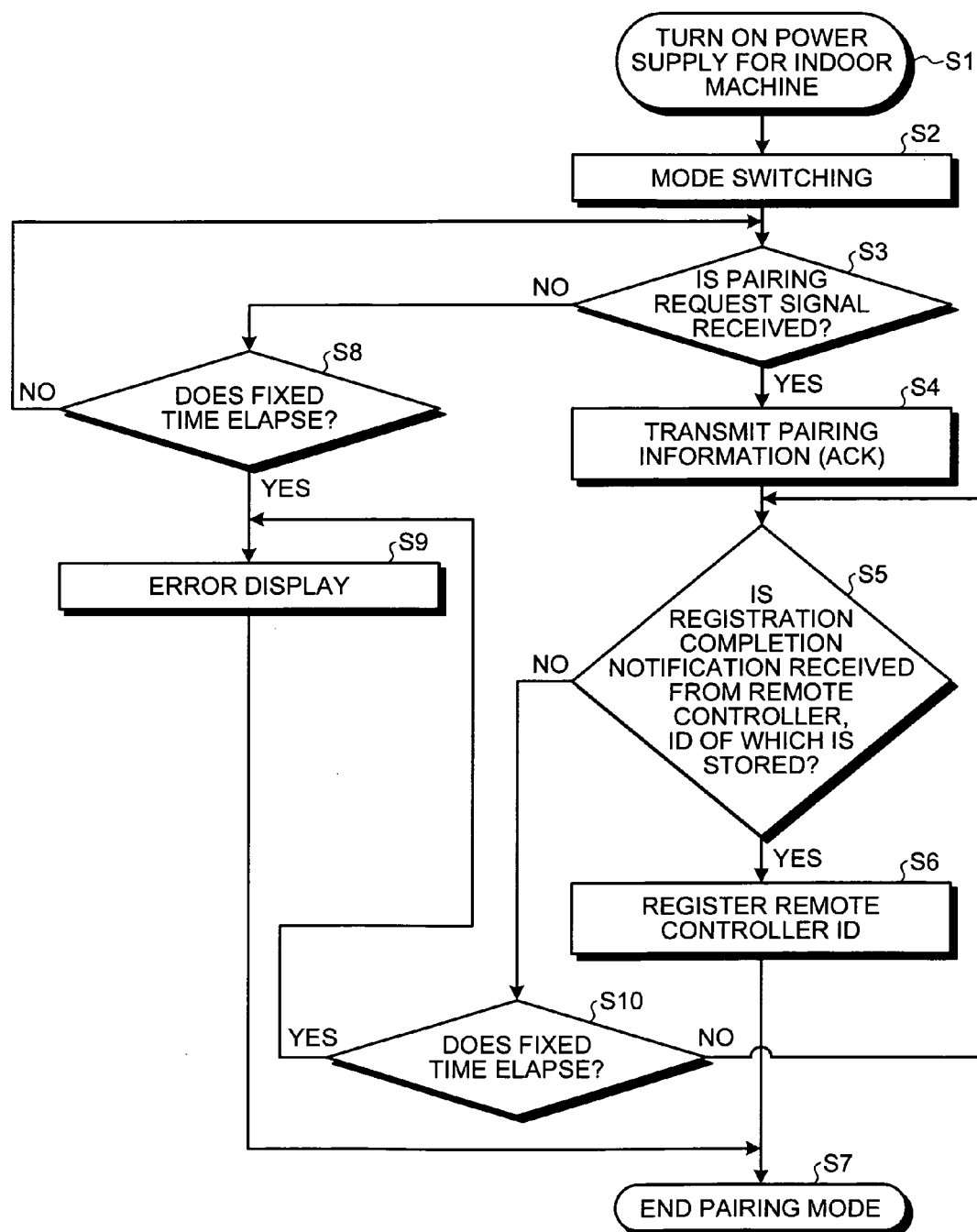


FIG.4

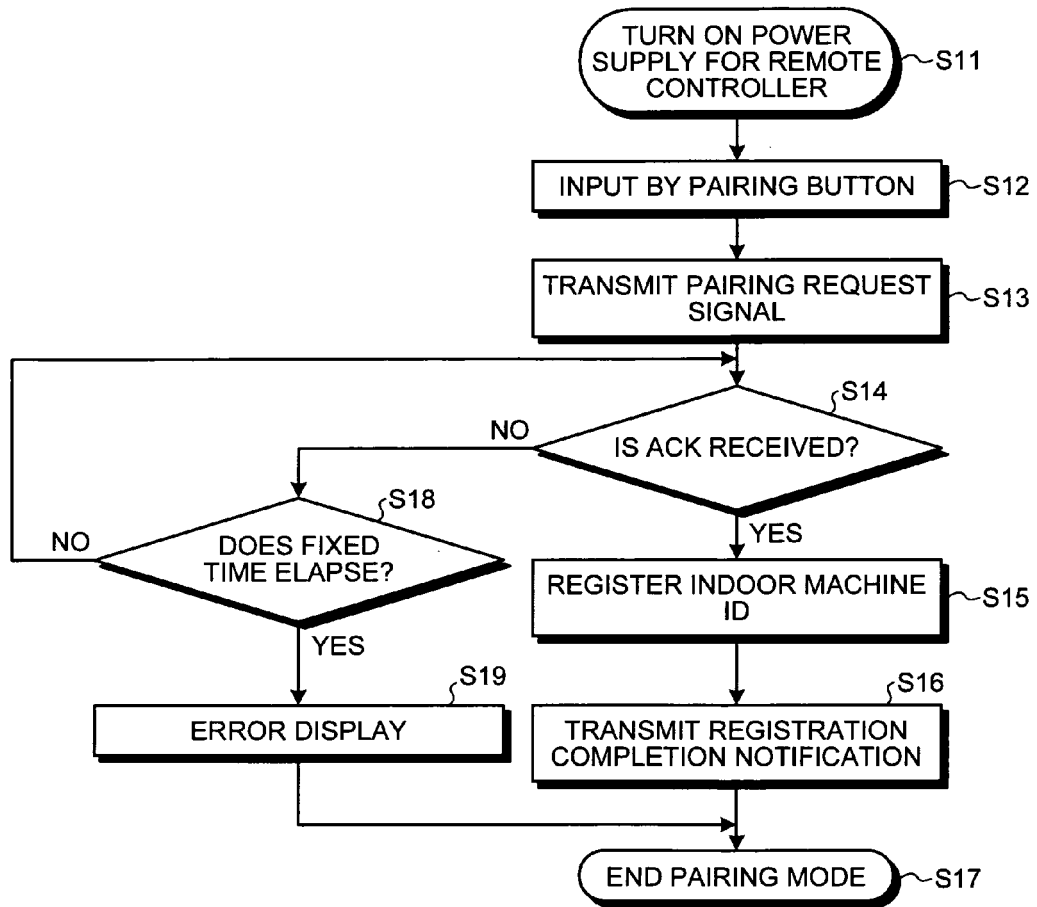


FIG.5

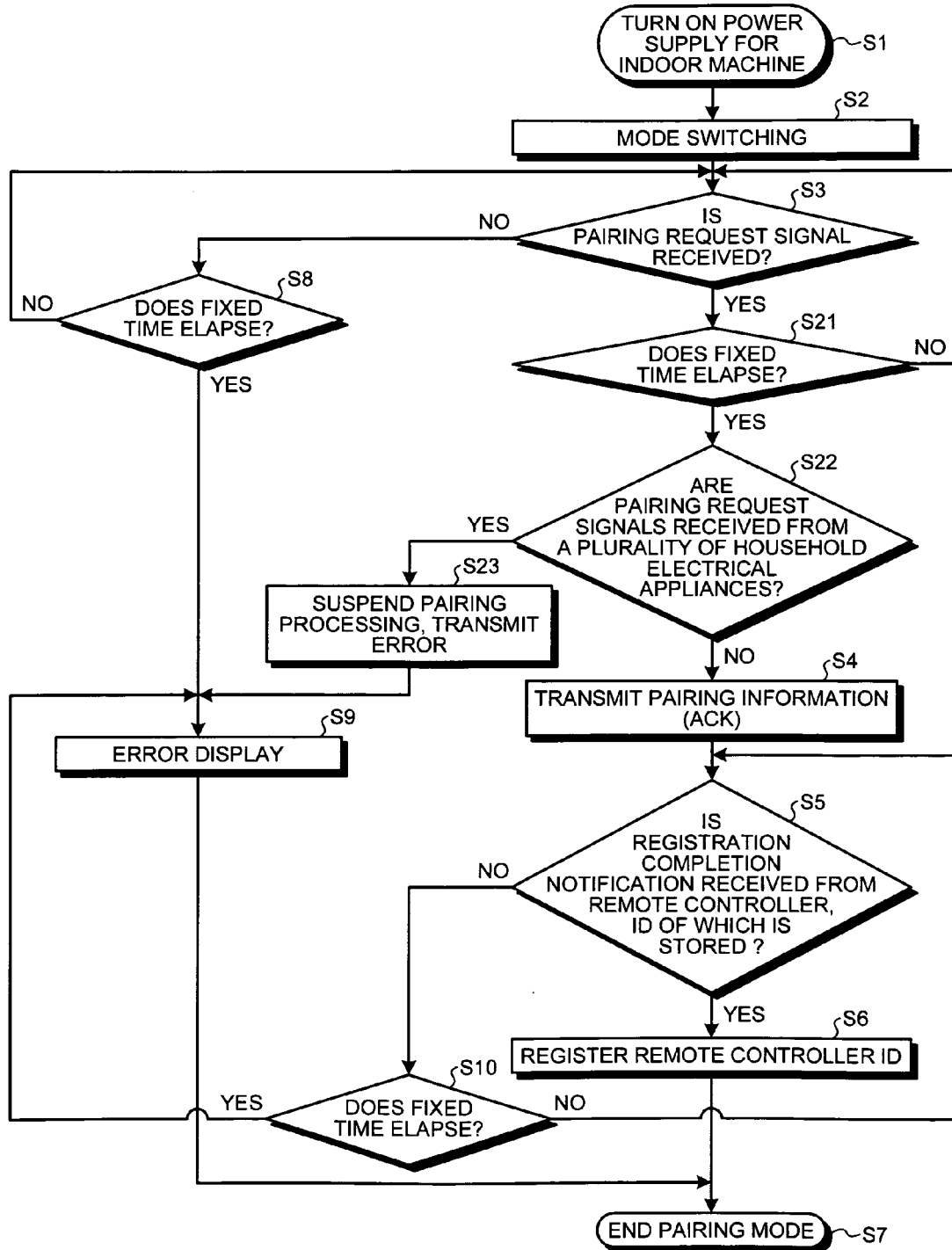


FIG.6

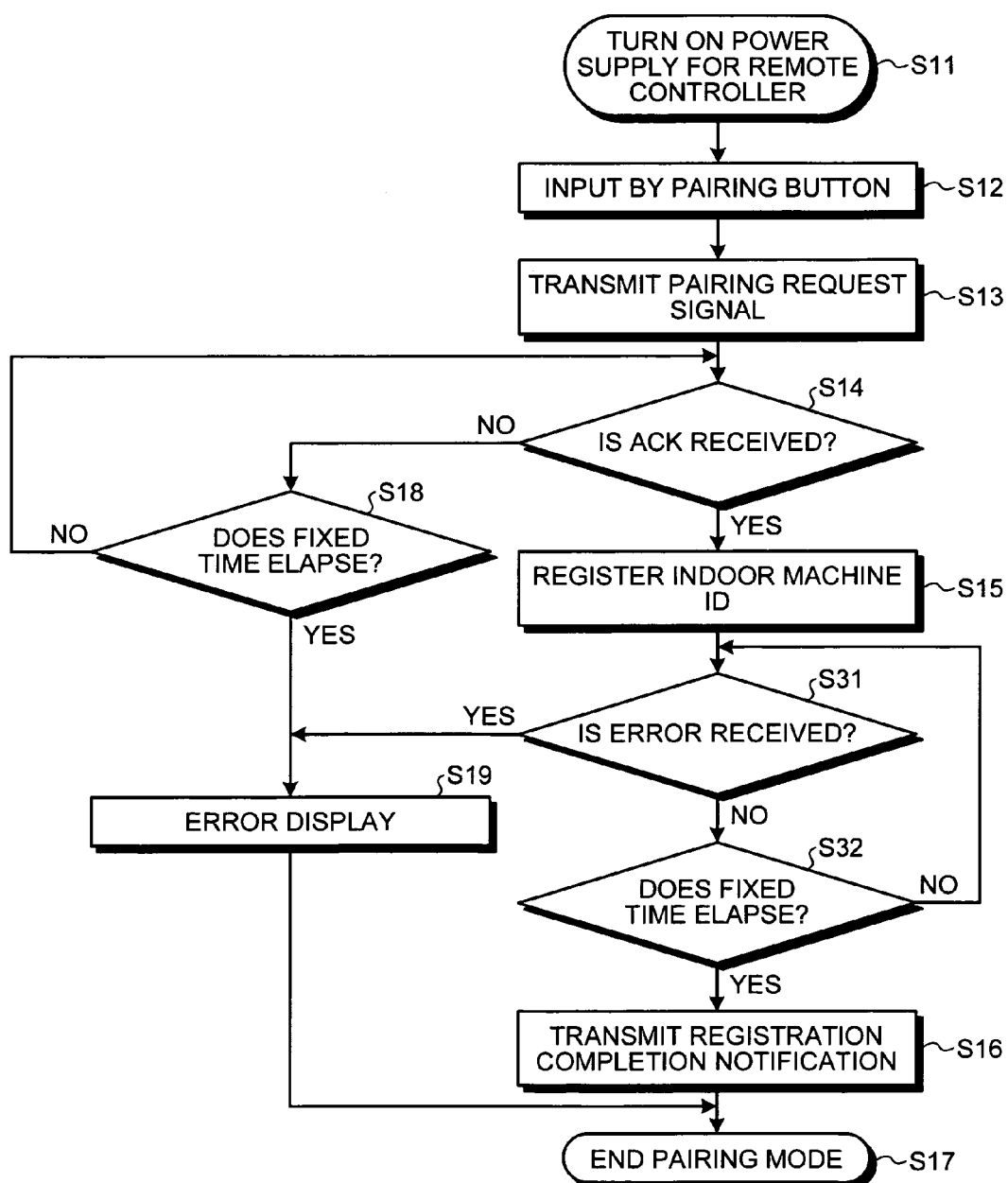


FIG.7

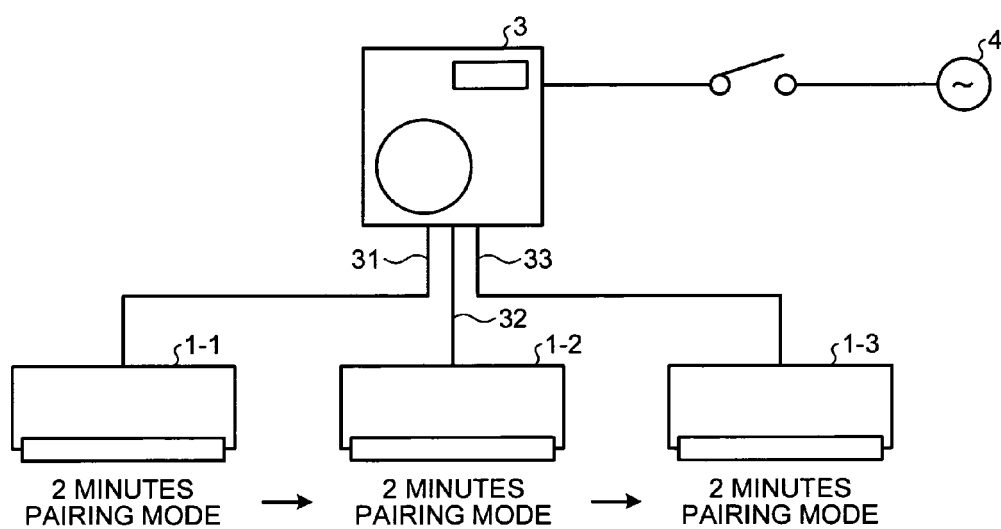


FIG.8

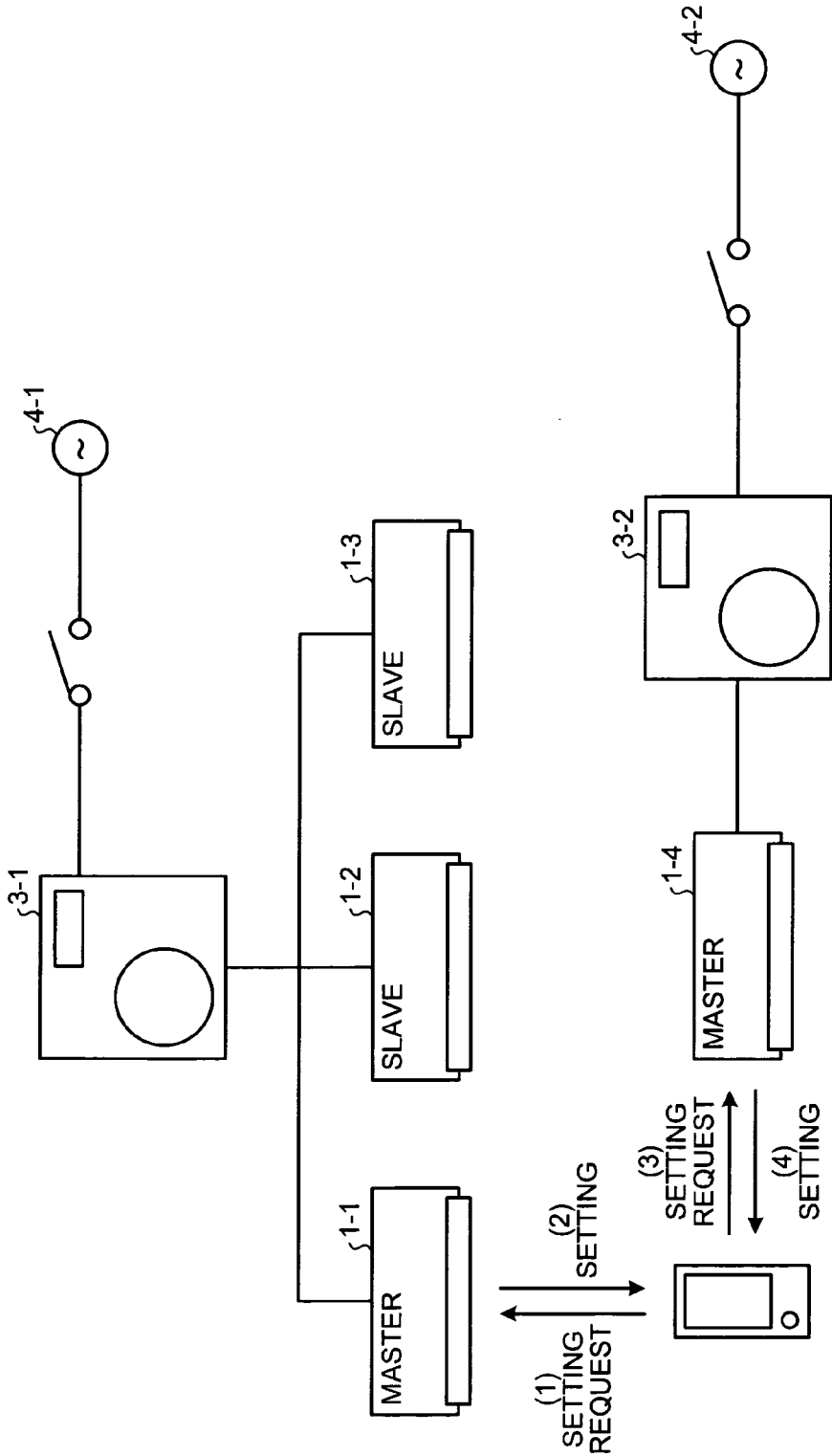
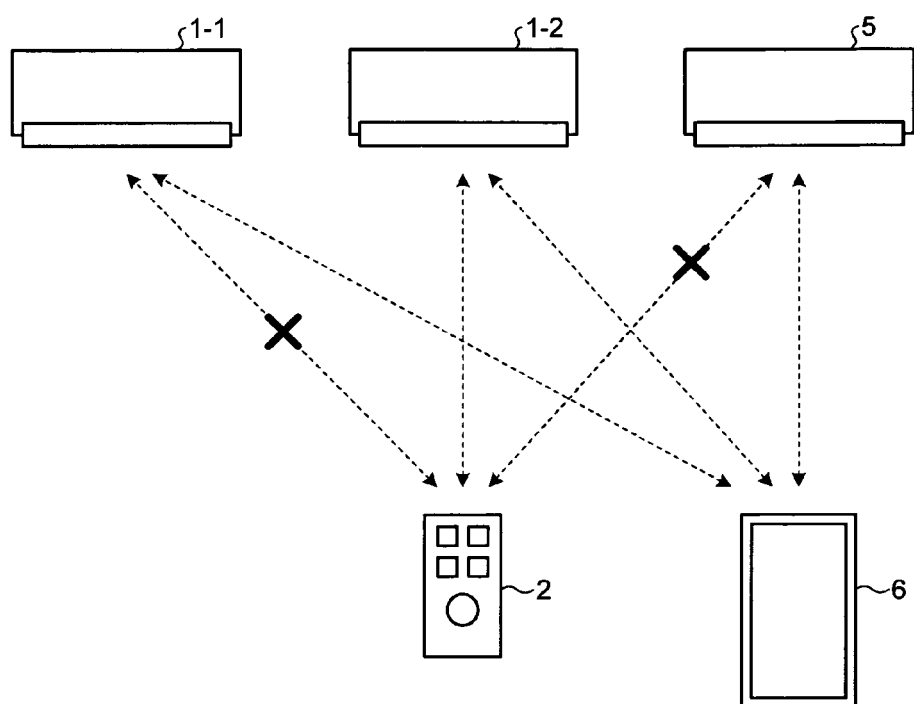


FIG.9



REFERENCES CITED IN THE DESCRIPTION

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