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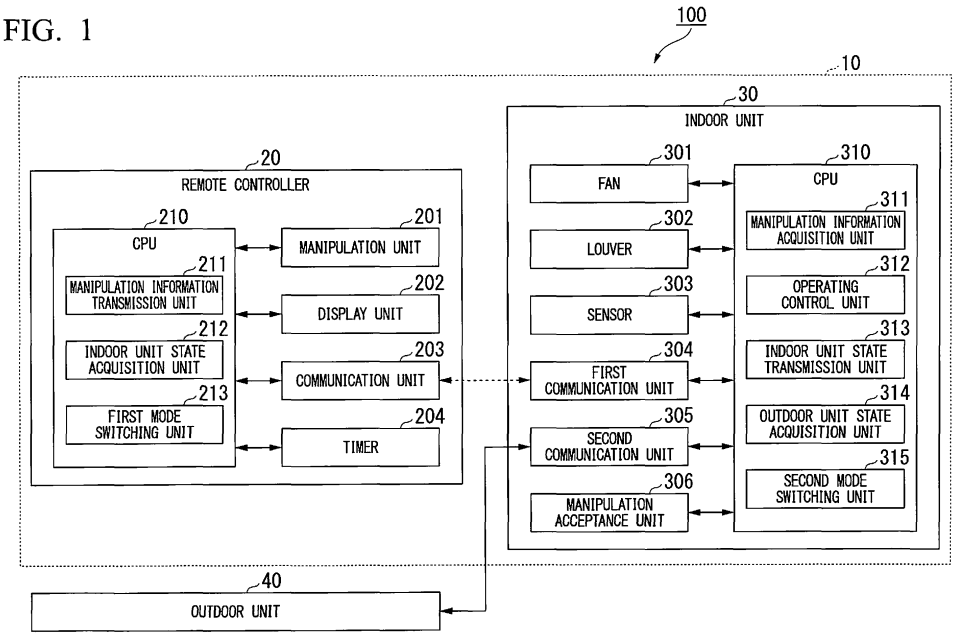
(54) AIR CONDITIONING SYSTEM AND CONTROL METHOD

(57) An air conditioning system is equipped with an indoor unit (30), and a remote controller (20) communicably connected to the indoor unit (30). The remote controller (20) has a manipulation information transmission unit (211) which is configured to transmit manipulation information including a starting instruction and a stopping instruction of the indoor unit (30) to the indoor unit (30) on the basis of a manipulation of a user; an indoor unit state acquisition unit (211) which is configured to periodically acquire an indoor unit state indicating a state of the indoor unit (30); and a first mode switching unit (213) which is configured to switch an operation state of a first module (10) including the indoor unit (30) and the remote controller (20) on the basis of the manipulation information and the indoor unit state.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an air conditioning system and a control method.

Description of Related Art

[0002] In a conventional air conditioning system, in order to send and receive a signal for controlling the operation of an indoor unit and an outdoor unit by accepting the manipulation of a user, and in order to monitor the states of the indoor unit and the outdoor unit, the devices are maintained in a state in which they can always communicate with each other even during stop of the system, which is a cause of increasing standby power.

[0003] In order to reduce such standby power, for example, Patent Document 1 discloses an air conditioning system that reduces power required for communication, by prohibiting communication between the indoor unit and the outdoor unit when the air conditioning system is stopped.

[Patent Documents]

[0004] [Patent Document 1] Japanese Unexamined Patent Application, First Publication No. 2000-97484

[0005] However, in the conventional air conditioning system, the user generally performs manipulation such as start and stop of the air conditioning system via a remote controller. Even when the air conditioning system is stopped, the indoor unit and the remote controller are maintained in a normally communicable state in order to accept control information and display the status to the remote controller. Therefore, further reduction in standby power is required.

[0006] The present invention has been made in view of such problems, and provides an air conditioning system and a control method capable of reducing the standby power.

SUMMARY OF THE INVENTION

[0007] In order to solve the above problem, the present invention adopts the following means.

[0008] According to a first aspect of the present invention, an air conditioning system includes an indoor unit, and a remote controller communicably connected to the indoor unit.

[0009] The remote controller has a manipulation information transmission unit which is configured to transmit manipulation information including an starting instruction and a stopping instruction of the indoor unit to the indoor unit on the basis of a manipulation of a user; an indoor unit state acquisition unit which is configured to periodically acquire an indoor unit state indicating a state of the indoor unit; and a first mode switching unit which is configured to switch an operation state of a first module including the indoor unit and the remote controller, on the basis of the manipulation information and the indoor unit state.

[0010] The first mode switching unit is configured to switch the operation state of the first module into a stop preparation mode in which a stopping process of the indoor unit is executed when the manipulation information transmission unit transmits manipulation information including the stopping instruction to the indoor unit, and to switch the operation state of the first module to a standby mode, in which communication between the indoor unit and the remote controller is stopped, when the operation state of the first module is in the stop preparation mode and the indoor unit is determined to be in the stopped state on the basis of the indoor unit state.

[0011] In the conventional air conditioning system, even while the air conditioning system is in the stopped state by accepting the stop operation, electric power (standby power) for maintaining the remote controller and the indoor unit in a communicable state has been consumed in order to monitor the indoor unit state and in order to always be able to transmit and receive manipulation information.

[0012] However, in the air conditioning system according to the aforementioned embodiment, when the indoor unit is in a stopped state by accepting the stop operation of the user, the first mode switching unit of the remote controller stops the communication between the remote controller and the indoor unit. In this way, it is possible to reduce the electric power for maintaining the remote controller and the indoor unit in a communicable state during the 'standby mode.' This makes it possible to reduce the standby power of an entire air conditioning system 100.

[0013] According to a second aspect of the present invention, in the air conditioning system according to the aforementioned first aspect, the indoor unit state acquisition unit is configured to stop acquisition of the indoor unit state when the operation state of the first module is in the standby mode.

[0014] In this way, the indoor unit state acquisition unit stops the process of periodically performing transmission request of the indoor unit state, until accepting a new instruction from the first mode switching unit. As a result, while the operation state of the first module is in the 'standby mode,' the remote controller can reduce the electric power required for communication for acquiring the indoor unit state.

[0015] According to a third aspect of the present invention, the air conditioning system according to the first or second aspect may further include an outdoor unit communicably connected to the indoor unit.

[0016] The indoor unit has a manipulation information acquisition unit which is configured to acquire the manipulation information, an outdoor unit state acquisition unit

which is configured to periodically acquire an outdoor unit state indicating a state of the outdoor unit, and a second mode switching unit which is configured to switch an operation state of a second module including the indoor unit and the outdoor unit, on the basis of the manipulation information and the outdoor unit state.

[0017] The second mode switching unit is configured to switch the operation state of the second module to a stop preparation mode, in which a stopping process of the outdoor unit is executed, when the manipulation information acquisition unit acquires manipulation information including a stopping instruction, and to switch the operation state of the second module to a standby mode, in which communication between the indoor unit and the outdoor unit is stopped, when the operation state of the second module is in the stop preparation mode and the outdoor unit is determined to be in the stopped state on the basis of the outdoor unit state.

[0018] In this way, when the operation state of the second module is in the 'standby mode,' the air conditioning system can further reduce the electric power for maintaining the indoor unit and the outdoor unit in a communicable state.

[0019] Further, since the air conditioning system according to the aforementioned aspect separately performs switching of the operation state of the first module and the operation state of the second module in parallel, even if a state in which, after one of the indoor unit and the outdoor unit completes the stopping process, the other continues the stopping process is continued for a long time, when the indoor unit first stops the stopping process, only the operation state of the first module can be switched to the 'standby mode,' and when the outdoor unit first completes the stopping process, only the operation state of the second module can be switched to the 'standby mode.'

[0020] Therefore, it is possible to reduce the electric power of the module switched to the 'standby mode' in advance, without waiting for completion of the stopping process of both the indoor unit and the outdoor unit. As a result, it is possible to reduce the standby power of the entire air conditioning system.

[0021] According to a fourth aspect of the present invention, in the air conditioning system according to the third aspect, the outdoor unit state acquisition unit may stop acquisition of the outdoor unit state when the operation state of the second module is in a standby mode.

[0022] As a result, while the operation state of the second module is in the 'standby mode,' the indoor unit can reduce the electric power required for communication for obtaining the outdoor unit state.

[0023] According to a fifth aspect of the present invention, an air conditioning system includes an indoor unit, and an outdoor unit communicably connected to the indoor unit via a communication line.

[0024] An indoor unit side switch and an outdoor unit side switch are connected in series to the communication line.

[0025] The indoor unit has a manipulation information acquisition unit which is configured to acquire manipulation information including a starting instruction and a stopping instruction of the indoor unit, which are input on the basis of manipulation of a user; an outdoor unit state acquisition unit which is configured to periodically acquire an outdoor unit state indicating a state of the outdoor unit; and a second mode switching unit which is configured to switch a conduction state of the indoor unit side switch and the outdoor unit side switch, on the basis of the manipulation information and the outdoor unit state.

[0026] The second mode switching unit is configured to maintain a conduction state of the outdoor unit side switch, and to switch the indoor unit side switch to a non-conduction state, when the manipulation information acquisition unit acquires manipulation information including a stopping instruction, and when the outdoor unit is determined to be in a stopped state on the basis of the outdoor unit state.

[0027] In this way, when the operation state of the second module is in the 'standby mode,' the communication line for connecting the indoor unit and the outdoor unit is in a non-conduction state. As a result, in the air conditioning system, the standby power can be reduced by the amount of the electric power not flowing through the communication line.

[0028] Further, it is possible to easily switch the permission and stop of communication between the indoor unit and the outdoor unit, only by switching the indoor unit side switch to the conduction state or the non-conduction state in the second mode switching unit.

[0029] According to a sixth aspect of the present invention, a method for controlling an air conditioning system equipped with an indoor unit, and a remote controller communicably connected to the indoor unit having: a manipulation information transmitting step of transmitting manipulation information including an starting instruction and a stopping instruction of the indoor unit to the indoor unit on the basis of manipulation of a user; an indoor unit state acquiring step of periodically acquiring an indoor unit state indicating the state of the indoor unit; and a first mode switching step of switching an operation state of a first module including the indoor unit and the remote controller, on the basis of the manipulation information and the indoor unit state.

[0030] In the first mode switching step, when the manipulation information including a stopping instruction is transmitted to the indoor unit in the manipulation information transmission step, the operation state of the first module is switched to a stop preparation mode in which a stopping process of the indoor unit is executed, and when the operation state of the first module is in the stop preparation mode and the indoor unit is determined to be in the stopped state on the basis of the indoor unit state, the operation state of the first module is switched to a standby mode in which communication between the indoor unit and the remote controller is stopped.

[0031] According to a seventh aspect of the present

invention, in the control method according to the aforementioned sixth aspect, the air conditioning system further includes an outdoor unit communicably connected to the indoor unit.

[0032] The control method further has a manipulation information acquisition step of acquiring the manipulation information; an outdoor unit state acquiring step of periodically acquiring an outdoor unit state indicating a state of the outdoor unit; and a second mode switching step of switching an operation state of the second module including the indoor unit and the outdoor unit, on the basis of the manipulation information and the outdoor unit state.

[0033] In the second mode switching step, when the manipulation information including the stopping instruction is acquired in the manipulation information acquisition step, the operation state of the second module is switched to a stop preparation mode in which a stopping process of the outdoor unit is executed, and when the operation state of the second module is in a stop preparation mode and the outdoor unit is determined to be in a stopped state on the basis of the outdoor unit state, the operation state of the second module is switched to a standby mode in which communication between the indoor unit and the outdoor unit is stopped.

[0034] According to the air conditioning system and the control method of the present invention, the standby power can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035]

FIG. 1 is a first diagram showing a functional configuration of an air conditioning system according to an embodiment of the present invention.

FIG. 2 is a second diagram showing the functional configuration of the air conditioning system according to an embodiment of the present invention.

FIG. 3 is a diagram showing an operation state of a first module according to an embodiment of the present invention.

FIG. 4 is a diagram showing an operation state of a second module according to an embodiment of the present invention.

FIG. 5 is a diagram showing a communication circuit which connects the indoor unit and the outdoor unit according to an embodiment of the present invention.

FIG. 6 is a diagram showing a processing flow of the air conditioning system according to an embodiment of the present invention.

FIG. 7 is a diagram showing the hardware configuration of a remote controller, an indoor unit, and an outdoor unit according to an embodiment of the present invention.

FIG. 8 is a diagram showing a processing flow of an air conditioning system according to a modified example of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0036] Hereinafter, an air conditioning system 100 according to a first embodiment of the present invention will be described with reference to FIGS. 1 to 7.

(Overall configuration of air conditioning system)

[0037] FIG. 1 is a first diagram showing a functional configuration of an air conditioning system according to an embodiment of the present invention. FIG. 2 is a second diagram showing a functional configuration of an air conditioning system according to an embodiment of the invention. As shown in FIGS. 1 and 2, an air conditioning system 100 includes a remote controller 20, an indoor unit 30, and an outdoor unit 40.

[0038] The remote controller 20 accepts the manipulation of the user and transmits the manipulation information according to the manipulation to the indoor unit 30.

[0039] The indoor unit 30 is communicably connected to the remote controller 20 using a wireless communication technology such as infrared communication, executes various operations in accordance with the manipulation information transmitted from the remote controller 20, and outputs control information for controlling the operation of the outdoor unit 40. In another embodiment, the remote controller 20 and the indoor unit 30 may be communicably connected via a wired communication.

[0040] The outdoor unit 40 is communicably connected to the indoor unit 30 by radio and executes various operations according to the control information transmitted from the indoor unit 30.

(Functional configuration of remote controller)

[0041] As shown in FIG. 1, the remote controller 20 includes a manipulation unit 201, a display unit 202, a communication unit 203, a timer 204, and a CPU 210.

[0042] The manipulation unit 201 is an input device such as a button and a touch panel which accepts the manipulation from the user.

[0043] The display unit 202 is a display device such as a liquid crystal display that displays various kinds of information, such as the operation state of the air conditioning system 1, and the temperature and humidity of the room in which the indoor unit 30 is provided. The display unit 202 sequentially updates the display contents in accordance with the manipulation performed by the user via the manipulation unit 201, and the states of the indoor unit 30 and the outdoor unit 40.

[0044] The communication unit 203 transmits and receives various kinds of information to and from the indoor unit 30.

[0045] The timer 204 measures the elapsed time after various processes and communications are performed

in the remote controller 20.

[0046] The CPU 210 has a manipulation information transmission unit 211, an indoor unit state acquisition unit 212, and a first mode switching unit 213.

[0047] The manipulation information transmission unit 211 creates manipulation information on the basis of the manipulation performed by the user via the manipulation unit 201, and transmits the manipulation information to the indoor unit 30 via the communication unit 203. The manipulation information may include, for example, a starting instruction and a stopping instruction of the air conditioning system 100. Further, the manipulation information may include instructions such as temperature, air volume, and wind direction.

[0048] The indoor unit state acquisition unit 212 periodically acquires the state of the indoor unit 30 (indoor unit state). Specifically, the indoor unit state acquisition unit 212 performs the transmission request of the indoor unit state to the indoor unit 30 via the communication unit 203 at each predetermined acquisition interval (for example, one minute), and acquires the indoor unit state included in the response from the indoor unit 30.

[0049] On the basis of the manipulation information created by the manipulation information transmission unit 211 and the indoor unit state acquired by the indoor unit state acquisition unit 212, the first mode switching unit 213 switches the operation state of the first module 10 including the remote controller 20 and the indoor unit 30.

[0050] FIG. 3 is a view showing the operation state of the first module according to the embodiment of the present invention.

[0051] As shown in FIG. 3, the operation state of the first module 10 is set to one of an 'operating mode,' a 'stop preparation mode,' and a 'standby mode.'

[0052] The 'operating mode' represents a state in which both the remote controller 20 and the indoor unit 30 are started (state during operation). When the manipulation for starting the air conditioning system 100 (start manipulation) is accepted from the user at the time of the 'stop preparation mode' or the 'standby mode,' the first mode switching unit 213 sets the operation state of the first module 10 to the 'operating mode.'

[0053] The 'stop preparation mode' represents a state in which a process for stopping the operation of the indoor unit 30(stopping process) is being executed. The first mode switching unit 213 switches the operation state of the first module 10 to the 'stop preparation mode' when accepting a manipulation of stopping the air conditioning system 100 (stop manipulation) from the user at the time of the 'operating mode.'

[0054] The 'standby mode' represents a state in which the stopping process of the indoor unit 30 is completed, the operations of the remote controller 20 and the indoor unit 30 are stopped, and only the minimum necessary power (standby power) is supplied. When the indoor unit state acquisition unit 212 acquires the indoor unit state indicating that the operation of the indoor unit 30 is stopped at the time of the 'stop preparation mode,' the first mode switching unit 213 switches the operation state of the first module 10 to the 'standby mode.'

[0055] Further, in this embodiment, when the operation state of the first module 10 is in the 'operating mode' or the 'stop preparation mode,' the remote controller 20 and the indoor unit 30 are maintained in the normally communicable state. On the other hand, when the operation state of the first module 10 is in the 'standby mode,' the communication between the remote controller 20 and the indoor unit 30 is cut off.

(Functional configuration of indoor unit)

[0056] As shown in FIGS. 1 and 2, the indoor unit 30 includes a fan 301, a louver 302, a sensor 303, a first communication unit 304, a second communication unit 305, a manipulation acceptance unit 306, and a CPU 310.

[0057] The fan 301 takes in air in a room in which the indoor unit 30 is provided into the indoor unit 30 by rotating, and sends the air cooled or heated by a heat exchanger (not shown) to the room.

[0058] The louver 302 changes the sending direction of the air sent to the room by the fan 301.

[0059] The start and stop of the operation, and the operation amount of the fan 301 and the louver 302 are controlled via the actuators connected thereto.

[0060] The sensor 303 is a device for measuring a state of a room in which the indoor unit 30 and the indoor unit 30 are provided, and includes at least one sensor for measuring the temperature of each part of the indoor unit 30, and the temperature and humidity of the room.

[0061] The first communication unit 304 is a device for transmitting and accepting various kinds of information to and from the remote controller 20.

[0062] The second communication unit 305 is a device for transmitting and accepting various kinds of information to and from the outdoor unit 40.

[0063] A manipulation acceptance unit 306 is an input device such as a button and a touch panel which is provided in the main body of the indoor unit 30 to receive the manipulation from the user.

[0064] The manipulation acceptance unit 306 creates manipulation information on the basis of the operation performed by the user via the manipulation acceptance unit 306, and outputs the manipulation information to the CPU 310. The manipulation information includes, for example, a starting instruction and a stopping instruction of the air conditioning system 100.

[0065] The CPU 310 has a manipulation information acquisition unit 311, an operating control unit 312, an indoor unit state transmission unit 313, an outdoor unit state acquisition unit 314, and a second mode switching unit 315.

[0066] The manipulation information acquisition unit 311 acquires the manipulation information accepted from the remote controller 20 via the first communication unit 304. When the user performs the manipulation via the

manipulation acceptance unit 306, the manipulation information acquisition unit 311 acquires the manipulation information from the manipulation acceptance unit 306.

[0067] The operating control unit 312 controls the operations of the indoor unit 30 and the outdoor unit 40 on the basis of the manipulation information acquired by the manipulation information acquisition unit 311.

[0068] For example, when the operating control unit 312 acquires the manipulation information including the stopping instruction, the operating control unit 312 starts the stopping process of the indoor unit 30, and transmits control information for requesting the stop of the operation to the outdoor unit 40. Further, when the operating control unit 312 acquires the manipulation information including the starting instruction, the operating control unit 312 operates each part of the indoor unit 30 to satisfy the setting (setting of cooling or heating, temperature setting, etc.) designated by the user, and transmits the control information for requesting the start of operation according to the setting to the outdoor unit 40.

[0069] When accepting the transmission request of the indoor unit state from the remote controller 20, the indoor unit state transmission unit 313 creates the indoor unit state according to the request and transmits the indoor unit state to the remote controller 20 via the first communication unit 304.

[0070] Further, the indoor unit state transmission unit 313 creates the indoor unit state on the basis of at least one of the operation states of the fan 301 and the louver 302 (the state indicating operation or stop, the operation amount of the actuator, etc.), and the states of the indoor unit 30 and the room (temperature, humidity, etc.) measured by the sensor 303.

[0071] The outdoor unit state acquisition unit 314 periodically acquires the state of the outdoor unit 40 (outdoor unit state). Specifically, the outdoor unit state acquisition unit 314 performs the transmission request of the outdoor unit state to the outdoor unit 40 via the second communication unit 305 at each predetermined acquisition interval (for example, one minute), and acquires the outdoor unit state included in the response from the outdoor unit 40.

[0072] The second mode switching unit 315 switches the operation state of the second module 11 including the indoor unit 30 and the outdoor unit 40 on the basis of the manipulation information acquired by the manipulation information acquisition unit 311 and the outdoor unit state acquired by the outdoor unit state acquisition unit 314.

[0073] FIG. 4 is a diagram showing the operation state of the second module according to the embodiment of the present invention.

[0074] As shown in FIG. 4, the operation state of the second module 11 is set to one of 'operating mode,' 'stop preparation mode,' and 'standby mode.'

[0075] The 'operating mode' represents a state in which both the indoor unit 30 and the outdoor unit 40 are started (a state in operation). When the manipulation information acquisition unit 311 acquires the manipulation information including the starting instruction at the time of the 'stop preparation mode' or the 'standby mode,' the second mode switching unit 315 switches the operation state of the second module 11 to the 'operating mode.'

[0076] The 'stop preparation mode' represents a state in which a process for stopping the operation (stopping process) of the outdoor unit 40 is being executed. When the manipulation information acquisition unit 311 acquires the manipulation information including the stopping instruction at the time of the 'operating mode,' the second mode switching unit 315 switches the operation state of the second module 11 to the 'stop preparation mode.'

[0077] The 'standby mode' represents a state in which the stopping process of the outdoor unit 40 is completed, the operation of the outdoor unit 40 is stopped, and only the minimum necessary power (standby power) is supplied. When the outdoor unit state acquisition unit 314 acquires the outdoor unit state indicating that the operation of the outdoor unit 40 has stopped at the time of the 'stop preparation mode,' the second mode switching unit 315 switches the operation state of the second module 11 to the 'standby mode.'

[0078] Further, in this embodiment, when the operation state of the second module 11 is in the 'operating mode' or the 'stop preparation mode,' the indoor unit 30 and the outdoor unit 40 are maintained in a normally communicable state. On the other hand, when the operation state of the second module 11 is in the 'standby mode,' the communication between the indoor unit 30 and the outdoor unit 40 is cut off.

(Functional configuration of outdoor unit)

[0079] As shown in FIG. 2, the outdoor unit 40 has a fan 401, a compressor 402, a sensor 403, a communication unit 404, and a CPU 410.

[0080] The fan 401 takes in the outdoor air into the outdoor unit 40 by rotating, and sends the air after the heat exchange by heat exchangers (not shown) of the indoor unit 30 and the outdoor unit 40 to the outside.

[0081] The compressor 402 compresses the gas serving as a refrigerant to generate a high-temperature and high-pressure gas. The high-temperature and high-pressure gas generated by the compressor 402 is sent to the heat exchanger of the outdoor unit 40 or the heat exchanger of the indoor unit 30 on the basis of the control information from the indoor unit 30.

[0082] The start and stop of the operation, and the operation amount of the fan 401 and the compressor 402 are controlled via the actuators and the engines connected thereto.

[0083] The sensor 403 is a device for measuring the state of the outdoor unit 40 and outside thereof, and includes at least one sensor for measuring the temperature of each part of the outdoor unit 40, the gas pressure of the compressor 402, the temperature and humidity of the

outside, and the like.

[0084] The communication unit 404 is a device for transmitting and accepting various kinds of information to and from the indoor unit 30.

[0085] The CPU 410 has a control information acquisition unit 411, an outdoor unit control unit 412, and an outdoor unit state transmission unit 413.

[0086] The control information acquisition unit 411 acquires the control information accepted from the indoor unit 30 via the communication unit 404.

[0087] The outdoor unit control unit 412 controls the operations (start and stop of operation, and operation amount) of each part of the outdoor unit 40 to satisfy the setting (setting of cooling operation or heating operation, temperature setting, and the like) designated by the user, on the basis of the control information acquired by the control information acquisition unit 411.

[0088] When accepting the transmission request of the outdoor unit state from the indoor unit 30, the outdoor unit state transmission unit 413 creates the outdoor unit state response to the outdoor unit state, and transmits the outdoor unit state to the indoor unit 30 via the communication unit 404.

[0089] Further, the outdoor unit state transmission unit 413 creates the outdoor unit state, on the basis of at least one of the operation state of the fan 401 and the compressor 402 (a state indicating the operation or stop, the operation amount of the actuator and the engine, etc.) and the states (temperature, humidity, pressure, etc.) of the outdoor unit 40 and the outside measured by the sensor 403.

[0090] FIG. 5 is a diagram showing a communication circuit which connects an indoor unit and an outdoor unit according to an embodiment of the present invention.

[0091] Hereinafter, a communication circuit between the second communication unit 305 of the indoor unit 30 and the communication unit 404 of the outdoor unit 40 will be described with reference to FIG. 5.

[0092] As shown in FIG. 5, the indoor unit 30, the second communication unit 305 and the communication unit 404 of the outdoor unit 40 are communicably connected via a communication line 50. Indoor unit side switches 51a and 51b and outdoor unit side switches 53a and 53b are connected in series to the communication line 50, and electric power is supplied from a constant voltage power supply 55. The indoor unit side switches 51a and 51b and the outdoor unit side switches 53a and 53b are photo couplers.

[0093] Further, an indoor unit side transistor 52 which is configured to switch the indoor unit side switch 51b to a conducting state or a non-conducting state is connected to the indoor unit side switch 51b. An outdoor unit side transistor 54 which is configured to switch the outdoor unit side switch 53b to the conducting state or the non-conducting state is connected to the outdoor unit side switch 53b.

[0094] The indoor unit side switches 51a and 51b and the indoor unit side transistor 52 constitute the second communication unit 305 of the indoor unit 30. The outdoor unit side switches 53a and 53b and the outdoor unit side transistor 54 constitute a communication unit 404 in the outdoor unit 40.

[0095] When the control information is transmitted from the indoor unit 30 to the outdoor unit 40, the second communication unit 305 of the indoor unit 30 controls ON (conduction) and OFF (non-conduction) of the indoor unit side transistor 52 to switch ON (conduction) and OFF (non-conduction) of the indoor unit side switch 51b. At this time, the outdoor unit side transistor 54 is maintained in the ON (conduction) state. In this manner, a digital signal is generated by switching ON and OFF of the indoor unit side switch 51b, and the digital signal is transmitted to the outdoor unit side switch 53a via the communication line 50, and is input to a signal acceptance terminal Rx0 of the CPU 410. As a result, the control information is transmitted from the indoor unit 30 to the outdoor unit 40 as a digital signal.

[0096] Further, when the outdoor unit state is transmitted from the outdoor unit 40 to the indoor unit 30, the communication unit 404 of the indoor unit 30 controls ON (conduction) and OFF (non-conduction) of the outdoor unit side transistor 54, and switches ON (conduction) and OFF (non-conduction) of the outdoor unit side switch 53b. At this time, the indoor unit side transistor 52 is maintained in the ON (conduction) state. In this manner, a digital signal is generated by switching ON and OFF of the outdoor unit side switch 53b, and the digital signal is transmitted to the indoor unit side switch 51a via the communication line 50, and is input to a signal acceptance terminal Rx00 of the CPU 310. As a result, the control information is transmitted from the outdoor unit 40 to the indoor unit 30 as a digital signal.

[0097] When the operation state of the second module 11 is in the 'operating mode' or 'stop preparation mode, ' the second mode switching unit 315 performs the instruction for permitting the communication with the outdoor unit 40 to the second communication unit 305. Then, when the control information is not transmitted from the indoor unit 30 side, the second communication unit 305 maintains the indoor unit side transistor 52 in the ON state in order to wait for the outdoor unit information transmitted from the outdoor unit 40. At this time, when the communication line 50 is closed by the indoor unit side transistor 52, electric power from the constant voltage power supply 55 is continuously supplied to the communication line 50.

[0098] On the other hand, when the operation state of the second module 11 is in the 'standby mode,' the second mode switching unit 315 of the indoor unit 30 performs instruction for stopping communication with the outdoor unit 40 to the second communication unit 305. Then, the second communication unit 305 switches the indoor unit side transistor 52 to OFF to cut off communication with the outdoor unit 40, while maintaining the outdoor unit side transistor 54 in the ON state. At this time, since the communication line 50 is opened by the indoor

unit side transistor 52, electric power from the constant voltage power supply 55 does not flow through the communication line 50. Since the outdoor unit side transistor 54 is maintained in the ON state, the outdoor unit 40 can always receive the control information from the indoor unit 30.

(Processing flow of air conditioning system)

[0099] FIG. 6 is a diagram showing a processing flow of the air conditioning system according to the embodiment of the present invention. As shown in FIG. 6, the air conditioning system 100 according to the present embodiment simultaneously performs a process in the first module 10 including the remote controller 20 and the indoor unit 30, and a process in the second module 11 including the indoor unit 30 and the outdoor unit 40 in parallel.

[0100] First, the process in the first module 10 will be described with reference to FIG. 6.

[0101] When the operation state of the first module 10 is in the 'operating mode,' the indoor unit state acquisition unit 212 of the remote controller 20 transmits the transmission request of the indoor unit state to the indoor unit 30 at each predetermined acquisition interval (for example, one minute) (step S100).

[0102] When accepting the transmission request of the indoor unit state from the remote controller 20, the indoor unit state transmission unit 313 of the indoor unit 30 creates the indoor unit state according to the request, and transmits the indoor unit state to the remote controller 20 (step S101).

[0103] When the operation state of the first module 10 is in the 'operating mode,' the remote controller 20 and the indoor unit 30 repeatedly execute the processes of the above-described steps S100 and S101.

[0104] When the user performs the manipulation for stopping the air conditioning system 100 (stop manipulation) via the manipulation unit 201 of the remote controller 20, the first mode switching unit 213 of the remote controller 20 switches the operation state of the first module 10 from 'operating mode' to 'stop preparation mode' (step S102).

[0105] Further, the manipulation information transmission unit 211 of the remote controller 20 creates manipulation information including a stopping instruction on the basis of the manipulation of the user, and transmits the manipulation information to the indoor unit 30 (step S103).

[0106] When the manipulation information acquisition unit 311 acquires the manipulation information including the stopping instruction, the operating control unit 312 of the indoor unit 30 starts the stopping process of the indoor unit 30 (step S104).

[0107] While the stopping process of the indoor unit 30 is being executed, the indoor unit state acquisition unit 212 of the remote controller 20 repeatedly executes a process (step S105) for performing the transmission request of the indoor unit state to the indoor unit 30 at each predetermined acquisition interval, similarly to the aforementioned process of step S100. As a result, the remote controller 20 monitors whether or not the stopping process of the indoor unit 30 is completed in the 'stop preparation mode.'

[0108] When the stopping process of the indoor unit 30 is being executed, the indoor unit state transmission unit 313 of the indoor unit 30 transmits the indoor unit state indicating that the indoor unit 30 is in operation (step S106). When the stopping process of the indoor unit 30 is completed, the indoor unit state transmission unit 313 of the indoor unit 30 transmits the indoor unit state indicating that the indoor unit 30 is stopped (step S107).

[0109] When the stopping process of the indoor unit 30 is completed, the indoor unit state transmission unit 313 of the indoor unit 30 may transmit the indoor unit state indicating that the indoor unit 30 is stopped, irrespective of whether or not a transmission request from the remote controller 20 is accepted.

[0110] When determining that the indoor unit 30 is stopped on the basis of the indoor unit state acquired by the indoor unit state acquisition unit 212, the first mode switching unit 213 changes the operation state of the first module 10 from the 'stop preparation mode' to the 'standby mode' (step S108).

[0111] Further, when the operation state of the first module 10 is switched to the 'standby mode,' the first mode switching unit 213 performs a process of stopping the communication between the remote controller 20 and the indoor unit 30 (step S109).

[0112] Specifically, the first mode switching unit 213 instructs the indoor unit state acquisition unit 212 to stop the process of acquiring the indoor unit state (the process of making a transmission request). As a result, the indoor unit state acquisition unit 212 stops the process of regularly performing the transmission request of the indoor unit state until accepting a new instruction from the first mode switching unit 213. At this time, the indoor unit 30 maintains a state in which the manipulation information from the remote controller 20 and the transmission request for indoor unit state can always be accepted.

[0113] Further, the first mode switching unit 213 instructs the display unit 202 of the remote controller 20 to turn off the display. As a result, while the operation state of the first module 10 is in the 'standby mode,' the remote controller 20 can reduce the electric power required for communication for acquiring the indoor unit state and the electric power required for displaying the display unit 202 .

[0114] Next, the process in the second module 11 will be described with reference to FIG. 6.

[0115] When the operation state of the second module 11 is in the 'operating mode,' the outdoor unit state acquisition unit 314 of the indoor unit 30 performs the transmission request of the outdoor unit state to the outdoor unit 40 at each predetermined acquisition interval (for example, one minute) (step S200).

[0116] When accepting the transmission request of the outdoor unit state from the indoor unit 30, the outdoor unit state transmission unit 413 of the outdoor unit 40 creates an outdoor unit state according to the request and transmits the outdoor unit state to the indoor unit 30 (step S201).

[0117] The indoor unit 30 and the outdoor unit 40 repeatedly execute the above-described processes of steps S200 to S201 when the operation state of the second module 11 is in the 'operating mode.'

[0118] When the manipulation information acquisition unit 311 of the indoor unit 30 acquires the manipulation information including the stopping instruction from the remote controller 20, the second mode switching unit 315 of the indoor unit 30 switches the operation state of the second module 11 from the 'operating mode' to the 'stop preparation mode' (step S202). Further, the operating control unit 312 of the indoor unit 30 transmits the control information for requesting the stop of the operation to the outdoor unit 40 (step S203).

[0119] The outdoor unit control unit 412 of the outdoor unit 40 starts the stopping process of the outdoor unit 40 (step S204) when the control information acquisition unit 411 accepts the control information requesting the stop of the operation.

[0120] During execution of the stopping process of the outdoor unit 40, the outdoor unit state acquisition unit 314 of the indoor unit 30 repeatedly executes a process (step S205) of performing a transmission request of the outdoor unit state to the outdoor unit 40 at each predetermined acquisition interval, similarly to the process of the above-described step S100. As a result, the indoor unit 30 monitors whether or not the stopping process of the outdoor unit 40 is completed in the 'stop preparation mode.'

[0121] The outdoor unit state transmission unit 413 of the outdoor unit 40 transmits an outdoor unit state indicating that the outdoor unit 40 is in operation when the stopping process of the outdoor unit 40 is being executed (step S206). When the stopping process of the outdoor unit 40 is completed, the outdoor unit state transmission unit 413 transmits the outdoor unit state indicating that the outdoor unit 40 is stopped (step S207).

[0122] When the stopping process of the outdoor unit 40 is completed, the outdoor unit state transmission unit 413 of the outdoor unit 40 may transmit the outdoor unit state indicating that the outdoor unit 40 is stopped, regardless of whether or not the transmission request from the indoor unit 30 is accepted.

[0123] When determining that the outdoor unit 40 is stopped on the basis of the outdoor unit state acquired by the outdoor unit state acquisition unit 314, the second mode switching unit 315 switches the operation state of the second module 11 from the 'stop preparation mode' to the 'standby mode' (step S208).

[0124] Further, when the operation state of the second module 11 is switched to the 'standby mode,' the second mode switching unit 315 performs the process of stopping the communication between the indoor unit 30 and the outdoor unit 40 (step S209).

[0125] Specifically, the second mode switching unit 315 instructs the outdoor unit state acquisition unit 314 to stop the process of acquiring the outdoor unit state (the process of making a transmission request). As a result, the outdoor unit state acquisition unit 314 stops the process of regularly performing the transmission request of the outdoor unit state until a new instruction from the second mode switching unit 315 is received.

[0126] Furthermore, the second mode switching unit 315 instructs the second communication unit 305 to stop the communication with the outdoor unit 40. Upon receiving the instruction, the second communication unit 305 switches the indoor unit side transistor 52 to the OFF state to cut off the communication with the outdoor unit 40, while maintaining the outdoor unit side transistor 54 in the ON state. As a result, since the communication line 50 is opened by the indoor unit side transistor 52, the electric power from the constant voltage power supply 55 does not flow through the communication line 50.

(Hardware configuration of remote controller, indoor unit, and outdoor unit)

[0127] FIG. 7 is a diagram showing hardware configuration of a remote controller, an indoor unit, and an outdoor unit according to an embodiment of the present invention.

[0128] Hereinafter, the hardware configuration of the remote controller 20, the indoor unit 30, and the outdoor unit 40 according to the present embodiment will be described with reference to FIG. 7.

[0129] The computer 900 includes a CPU 901, a main storage device 902, an auxiliary storage device 903, an input and output interface 904, and a communication interface 905.

[0130] The remote controller 20, the indoor unit 30, and the outdoor unit 40 are mounted on different computers 900, respectively. The operations of the respective parts of the remote controller 20, the indoor unit 30, and the outdoor unit 40 are stored in the auxiliary storage device 903 of each computer 900 in the form of a program. The CPU 901 (the CPU 210, the CPU 310, and the CPU 410) reads the program from the auxiliary storage device 903, develops the program in the main storage device 902, and executes the aforementioned processes in accordance with the program. In accordance with the program, the CPU 901 secures a storage area for storing various kinds of information acquired and generated through the processes in the main storage device 902. Further, the CPU 901 secures a storage area for storing data under process in the auxiliary storage device 903 in accordance with the program.

[0131] Further, the computer 900 is connected to the external storage device 910 via the input and output interface 904, and the storage area may be reserved in the external storage device 910. Further, the computer 900

is connected to the external storage device 920 via the communication interface 905, and the storage area may be secured in the external storage device 920.

[0132] In at least one embodiment, the auxiliary storage device 903 is an example of a non-transitory tangible medium. Other examples of non-transitory tangible media include magnetic disks, magneto-optical disks, CD-ROMs, DVD-ROMs, semiconductor memories, and the like connected via the input and output interface 904. Further, when the program is distributed to the computer 900 via a communication line, the distributed computer 900 may develop the program in the main storage device 902 and execute the aforementioned processes.

[0133] In addition, the program may achieve a part of the above-described functions. Furthermore, the program may be a so-called differential file (differential program) that achieves the above-described function by a combination with another program already stored in the auxiliary storage device 903.

(Function and effect)

[0134] In this way, the air conditioning system 100 according to the present embodiment includes the indoor unit 30, and the remote controller 20 communicably connected to the indoor unit 30.

[0135] The remote controller 20 has a manipulation information transmission unit 211 that transmits manipulation information including a starting instruction and a stopping instruction of the indoor unit 30 to the indoor unit 30 on the basis of the manipulation of the user, an indoor unit state acquisition unit 212 which is configured to periodically acquire the indoor unit state, and a first mode switching unit 213 which is configured to switch the operation state of the first module 10 including the indoor unit 30 and the remote controller 20 on the basis of the manipulation information and the indoor unit state.

[0136] When the manipulation information transmission unit 211 transmits the manipulation information including the stopping instruction to the indoor unit 30, the first mode switching unit 213 switches the operation state of the first module 10 to the 'stop preparation mode' for executing the stopping process of the indoor unit. Further, when the operation state of the first module 10 is in the 'stop preparation mode' and the indoor unit 30 is determined to be in the stopped state on the basis of the indoor unit state, the first mode switching unit 213 switches the operation state of the first module 10 to the 'standby mode' for stopping the communication between the indoor unit 30 and the remote controller 20.

[0137] In the conventional air conditioning system, even while the air conditioning system is in the stopped state by accepting the stop operation, in order to monitor the indoor unit state and in order to always be able to transmit and receive manipulation information, electric power (standby power) for maintaining the remote controller and the indoor unit in a communicable state has been consumed.

[0138] However, in the air conditioning system 100 according to the present embodiment, when the indoor unit 30 is in a stopped state by accepting the stop operation of the user, the first mode switching unit 213 of the remote controller 20 stops the communication between the remote controller 20 and the indoor unit 30. In this way, it is possible to reduce the electric power for maintaining the remote controller 20 and the indoor unit 30 in a communicable state during the 'standby mode.'

[0139] Furthermore, when the operation state of the first module 10 is in the 'standby mode,' the first mode switching unit 213 instructs the display unit 202 of the remote controller 20 to turn off the display. As a result, the remote controller 20 can reduce electric power required for displaying the display unit 202.

[0140] This makes it possible to reduce the standby power of the entire air conditioning system 100.

[0141] Furthermore, when the operation state of the first module 10 is in the 'standby mode,' the indoor unit state acquisition unit 212 stops acquisition of the indoor unit state.

[0142] In this way, the indoor unit state acquisition unit 212 stops the process of periodically performing transmission request of the indoor unit state until accepting a new instruction from the first mode switching unit 213.

[0143] As a result, while the operation state of the first module 10 is in the 'standby mode,' the remote controller 20 can reduce the electric power required for communication for acquiring the indoor unit state.

[0144] Further, the air conditioning system 100 further includes an outdoor unit 40 that is communicably connected to the indoor unit 30.

[0145] The indoor unit 30 has a manipulation information acquisition unit 311 that acquires the manipulation information, an outdoor unit state acquisition unit 314 that periodically acquires the outdoor unit state, and a second mode switching unit 315 which is configured to switch the operation state of the second module 11 including the indoor unit 30 and the outdoor unit 40 on the basis of the manipulation information and the outdoor unit state.

[0146] When the manipulation information acquisition unit 311 acquires the manipulation information including the stopping instruction, the second mode switching unit 315 switches the operation state of the second module 11 to the 'stop preparation mode' for executing the stopping process of the outdoor unit 40. When the operation state of the second module 11 is in the 'stop preparation mode' and the outdoor unit 40 is determined to be in the stopped state on the basis of the outdoor unit state, the second mode switching unit 315 switches the operation state of the second module 11 to the 'standby mode' in which the communication between the indoor unit 30 and the outdoor unit 40 is stopped.

[0147] In this way, when the operation state of the second module 11 is in the 'standby mode,' the air conditioning system 100 can further reduce the electric power for maintaining the indoor unit 30 and the outdoor unit 40

in the communicable state.

[0148] As a result, it is possible to reduce the standby power of the entire air conditioning system 100.

[0149] Further, the air conditioning system 100 according to the present embodiment separately performs a process of switching the operation state of the first module 10 including the remote controller 20 and the indoor unit 30, and a process of switching the operation state of the second module 11 including the indoor unit 30 and the outdoor unit 40 in parallel.

[0150] In this way, even if a state in which, after one of the indoor unit 30 and the outdoor unit 40 completes the stopping process, the other continues the stopping process is continued for a long time, when the indoor unit 30 first stops the stopping process, only the operation state of the first module 10 can be switched to the 'standby mode,' and when the outdoor unit 40 first completes the stopping process, only the operation state of the second module 11 can be switched to the 'standby mode.'

[0151] Therefore, it is possible to reduce the electric power of the module switched to the 'standby mode' in advance, without waiting for completion of the stopping process of both the indoor unit 30 and the outdoor unit 40.

[0152] Further, when the operation state of the second module 11 is in the 'standby mode,' the outdoor unit state acquisition unit 314 stops acquisition of the outdoor unit state.

[0153] In this way, the outdoor unit state acquisition unit 314 stops the process of regularly performing the transmission request of the outdoor unit state until accepting a new instruction from the second mode switching unit 315.

[0154] As a result, while the operation state of the second module 11 is in the 'standby mode,' the indoor unit 30 can reduce the electric power required for communication for acquiring the outdoor unit state.

[0155] The air conditioning system 100 according to the present embodiment includes an indoor unit 30, and an outdoor unit 40 that is communicably connected to the indoor unit 30 via the communication line 50.

[0156] An indoor unit side switch 51b and an outdoor unit side switch 53b are connected in series to the communication line 50.

[0157] The indoor unit 30 has a manipulation information acquisition unit 311 that acquires manipulation information including an starting instruction and a stopping instruction of the indoor unit 30 which are input on the basis of the user's manipulation, an outdoor unit state acquisition unit 314 that periodically acquires the outdoor unit state, and a second mode switching unit 315 which is configured to switch the conduction state of the indoor unit side switch 51b and the outdoor unit side switch 53b on the basis of the manipulation information and the outdoor unit state.

[0158] When the manipulation information acquisition unit 311 acquires the manipulation information including the stopping instruction and the outdoor unit 40 is determined to be in the stopped state on the basis of the outdoor unit state, the second mode switching unit 315 maintains the conduction state of the outdoor unit side switch 53b and switches the indoor unit side switch 51b to the non-conduction state.

[0159] In the conventional air conditioning system, while the air conditioning system is in the stopped state by accepting the stopping operation, in order to monitor the outdoor unit state even and in order to always be able to transmit and receive the control information, the communication line for connecting the indoor unit and the outdoor unit has been always maintained in the conduction state. That is, even when the air conditioning system is stopped, electric power is always supplied to the communication line, which is one cause of increasing the standby power.

[0160] However, in the air conditioning system 100 according to the present embodiment, when the outdoor unit 40 is in the stopped state by accepting the stopping operation of the user, the second mode switching unit 315 of the indoor unit 30 switches the indoor unit side switch 51b to the non-conduction state, while maintaining the conduction state of the outdoor unit side switch 53b. In this way, since the communication line 50 is opened during the 'standby mode,' the electric power does not flow through the communication line 50, and the standby power can be reduced.

[0161] In addition, it is possible to easily switch the permission and stop of communication between the indoor unit 30 and the outdoor unit 40, only by switching the indoor unit side switch 51b to the conduction state or the non-conduction state using the second mode switching unit 315.

(Modified example)

[0162] Although the embodiments of the present invention have been described above in detail, the embodiments not limited thereto, as long as they do not deviate from the technical idea of the present invention, and some design changes and the like can also be made.

[0163] FIG. 8 is a diagram showing a process flow of an air conditioning system according to a modified example of the present invention.

[0164] For example, in the aforementioned embodiment, the aspect in which, when the operation state of the first module 10 is in the 'standby mode,' the indoor unit state acquisition unit 212 of the remote controller 20 stops the process of acquiring the indoor unit state at each predetermined acquisition interval (for example, one minute) has been described. However, when the user does not manipulate the remote controller 20 and performs a starting operation from the manipulation acceptance unit 306 of the indoor unit 30, the indoor unit 30 and the outdoor unit 40 are started by accepting the starting operation, but the remote controller 20 cannot know that the indoor unit 30 is started.

[0165] Therefore, in the present modified example, by performing the following process, the remote controller

20 can recognize the state of the indoor unit 30.

[0166] As shown in FIG. 8, in a case in which the operation state of the first module 10 is in the 'standby mode,' when a predetermined checking interval t has elapsed, the indoor unit state acquisition unit 212 of the remote controller 20 according to this modified example performs the transmission request of the indoor unit state to the indoor unit 30 (step S110). Further, the predetermined checking interval t is set to the time (for example, 1 hour) longer than the acquisition interval (one minute) in the 'operating mode' and the 'stop preparation mode.'

[0167] At this time, the indoor unit 30 maintains a state in which the manipulation information from the remote controller 20 and the transmission request of the indoor unit state can always be accepted. Therefore, the indoor unit state transmission unit 313 of the indoor unit 30 accepts the transmission request of the remote controller 20 and transmits the indoor unit state (step S111). In the example of FIG. 8, the starting operation of the user is not accepted at this point, and the indoor unit 30 also maintains the stopped state. Therefore, in step S111, the indoor unit state transmission unit 313 transmits the indoor unit state indicating that the indoor unit 30 is in the stopped state.

[0168] Further, it is assumed that the user performs the starting operation via the manipulation acceptance unit 306 of the indoor unit 30. In this case, the second mode switching unit 315 of the indoor unit 30 switches the operation state of the second module 11 to the 'operating mode' (step S210).

[0169] Further, the operating control unit 312 of the indoor unit 30 performs a process of operating each part of the indoor unit 30 (step S211), and transmits control information which requests the start of operation to the outdoor unit 40 (step S212).

[0170] When the control information acquisition unit 411 of the outdoor unit 40 acquires the control information which requests the start of operation, the outdoor unit control unit 412 controls (starts) the operation of each part of the outdoor unit 40 on the basis of the control information (step S213).

[0171] Further, when the operation state of the second module 11 is switched to the 'operating mode,' the indoor unit 30 and the outdoor unit 40 repeatedly execute a transmission request of the outdoor unit state (step S214) and a transmission of the outdoor unit state (step S215) at each predetermined acquisition interval (for example, one minute). This operation is the same as in the aforementioned embodiment.

[0172] Even after the indoor unit 30 and the outdoor unit 40 are started, the operation state of the first module 10 is maintained in the 'standby mode,' and the remote controller 20 does not recognize that the indoor unit 30 is in operation.

[0173] However, when the predetermined checking interval t further elapses, the indoor unit state acquisition unit 212 of the remote controller 20 according to this modified example performs the transmission request of the indoor unit state to the indoor unit 30 again (step S112).

[0174] The indoor unit state transmission unit 313 of the indoor unit 30 accepts the transmission request of the remote controller 20 and transmits the indoor unit state (step S113). In the example of FIG. 8, the indoor unit 30 is already in operation at this point. Therefore, in step S113, the indoor unit state transmission unit 313 transmits the indoor unit state indicating that the indoor unit 30 is in operation.

[0175] When the indoor unit state acquisition unit 212 acquires the indoor unit state indicating that the indoor unit 30 is in operation, the first mode switching unit 213 of the remote controller 20 switches the operation state of the first module 10 from the 'standby mode' to the 'operating mode' (step S114).

[0176] As a result, even when the user performs the manipulation via the manipulation acceptance unit 306 of the indoor unit 30, the first mode switching unit 213 of the remote controller 20 can make the operation state of the first module 10 and the operation state of the second module 11 match each other.

[Industrial Applicability]

[0177] According to the air conditioning system and the control method of the present invention, the standby power can be reduced.

EXPLANATION OF REFERENCES

[0178]

1 Air conditioning system
10 First module
11 Second module
20 Remote controller
30 Indoor unit
40 Outdoor unit
50 Communication line
51a Indoor unit side switch
51b Indoor unit side switch
52 Indoor unit side transistor
53a Outdoor unit side switch
53b Outdoor unit side switch
54 Outdoor unit side transistor
55 Constant voltage power supply
100 Air conditioning system
201 Manipulation unit
202 Display unit
203 Communication unit
204 Timer
211 Manipulation information transmission unit
212 Indoor unit state acquisition unit
213 First mode switching unit
301 Fan
302 Louver
303 Sensor
304 First communication unit

305 Second communication unit
306 Manipulation acceptance unit
311 Manipulation information acquisition unit
312 Operating control unit
313 Indoor unit state transmission unit
314 Outdoor unit state acquisition unit
315 Second mode switching unit
401 Fan
402 Compressor
403 Sensor
404 Communication unit
411 Control information acquisition unit
412 Outdoor unit control unit
413 Outdoor unit state transmission unit

Claims

1. An air conditioning system (1) comprising:

an indoor unit (30); and
a remote controller (20) communicably connected to the indoor unit (30);
wherein the remote controller (20) has

a manipulation information transmission unit (211) which is configured to transmit manipulation information including an starting instruction and a stopping instruction for the indoor unit (211) to the indoor unit (30) on the basis of a manipulation of a user;
an indoor unit state acquisition unit (212) which is configured to periodically acquire an indoor unit state indicating a state of the indoor unit (30); and
a first mode switching unit (213) which is configured to switch an operation state of a first module (10) including the indoor unit (30) and the remote controller (20), on the basis of the manipulation information and the indoor unit state,

wherein, the first mode switching unit (213) is configured to switch the operation state of the first module to a stop preparation mode, in which a stopping process of the indoor unit (30) is executed, when the manipulation information transmission unit (211) transmits manipulation information including the stopping instruction to the indoor unit (30), and the first mode switching unit (213) is configured to switch the operation state of the first module (10) to a standby mode, in which communication between the indoor unit (30) and the remote controller (20) is stopped, when the operation state of the first module (10) is in the stop preparation mode and the indoor unit (30) is determined to be in the stopped state on the basis of the indoor unit state.

2. The air conditioning system (1) according to claim 1, wherein the indoor unit state acquisition unit (212, 313) is configured to stop acquisition of the indoor unit state, when the operation state of the first module (10) is in the standby mode.

3. The air conditioning system (1) according to claim 1 or 2, further comprising:

an outdoor unit (40) communicably connected to the indoor unit,
wherein the indoor unit (30) has

a manipulation information acquisition unit (311) which is configured to acquire the manipulation information;
an outdoor unit state acquisition unit (314) which is configured to periodically acquire an outdoor unit state indicating a state of the outdoor unit (40); and
a second mode switching unit (315) which is configured to switch an operation state of a second module (11) including the indoor unit (30) and the outdoor unit (40), on the basis of the manipulation information and the outdoor unit state,

wherein, the second mode switching unit is configured to switch the operation state of the second module (11) to a stop preparation mode, in which a stopping process of the outdoor unit (40) is executed, when the manipulation information acquisition unit (311) acquires manipulation information including a stopping instruction, and
the second mode switching unit is configured to switch the operation state of the second module (11) to a standby mode, in which communication between the indoor unit (30) and the outdoor unit (40) is stopped, when the operation state of the second module (11) is in the stop preparation mode and the outdoor unit (40) is determined to be in the stopped state on the basis of the outdoor unit state.

4. The air conditioning system (1) according to claim 3, wherein the outdoor unit state acquisition unit (314) is configured to stop acquisition of the outdoor unit state when the operation state of the second module (11) is in a standby mode.

5. An air conditioning system (1) comprising:

an indoor unit (30); and
an outdoor unit (40) communicably connected to the indoor unit via a communication line (50);
an indoor unit side switch (51a, 51b) and an outdoor unit side switch (53a, 53b) connected in series to the communication line (50),

wherein the indoor unit (30) has

a manipulation information acquisition unit (311) which is configured to acquire manipulation information including a starting instruction and a stopping instruction of the indoor unit (30), which is input on the basis of manipulation of a user;
an outdoor unit state acquisition unit (314) which is configured to periodically acquire an outdoor unit state indicating a state of the outdoor unit (40); and
a second mode switching unit (315) which is configured to switch a conduction state of the indoor unit side switch (51a, 51b) and the outdoor unit side switch (53a, 53b), on the basis of the manipulation information and the outdoor unit state, and

wherein, the second mode switching unit is configured to maintain a conduction state of the outdoor unit side switch (53a, 53b), and to switch the indoor unit side switch (51a, 51b) to a non-conduction state, when the manipulation information acquisition unit (311) acquires manipulation information including a stopping instruction, and when the outdoor unit is determined to be in a stopped state on the basis of the outdoor unit state.

6. A method for controlling an air conditioning system (1) equipped with an indoor unit (30), and a remote controller (20) communicably connected to the indoor unit (30), the method comprising:

a manipulation information transmitting step of transmitting manipulation information including an starting instruction and a stopping instruction of the indoor unit to the indoor unit on the basis of manipulation of a user;
an indoor unit state acquiring step of periodically acquiring an indoor unit state indicating the state of the indoor unit (30); and
a first mode switching step of switching an operation state of a first module (10) including the indoor unit (30) and the remote controller (20), on the basis of the manipulation information and the indoor unit state,
wherein, in the first mode switching step,
when the manipulation information including a stopping instruction is transmitted to the indoor unit (30) in the manipulation information transmission step, the operation state of the first module (10) is switched to a stop preparation mode in which a stopping process of the indoor unit (30) is executed, and
when the operation state of the first module (10) is in the stop preparation mode and the indoor unit (30) is determined to be in the stopped state on the basis of the indoor unit state, the operation state of the first module (10) is switched to a standby mode in which communication between the indoor unit (30) and the remote controller (20) is stopped.

7. The method according to claim 6, wherein the air conditioning system (1) further comprises an outdoor unit (40) communicably connected to the indoor unit (30),

the method further comprising:

a manipulation information acquisition step of acquiring the manipulation information;
an outdoor unit state acquiring step of periodically acquiring an outdoor unit state indicating a state of the outdoor unit (40); and
a second mode switching step of switching an operation state of a second module (11) including the indoor unit (30) and the outdoor unit (40), on the basis of the manipulation information and the outdoor unit state,

wherein, in the second mode switching step,
when the manipulation information including the stopping instruction is acquired in the manipulation information acquisition step, the operation state of the second module (11) is switched to a stop preparation mode in which a stopping process of the outdoor unit (40) is executed, and when the operation state of the second module (11) is in a stop preparation mode and the outdoor unit (40) is determined to be in a stopped state on the basis of the outdoor unit state, the operation state of the second module (11) is switched to a standby mode in which communication between the indoor unit (30) and the outdoor unit (40) is stopped.

FIG. 1

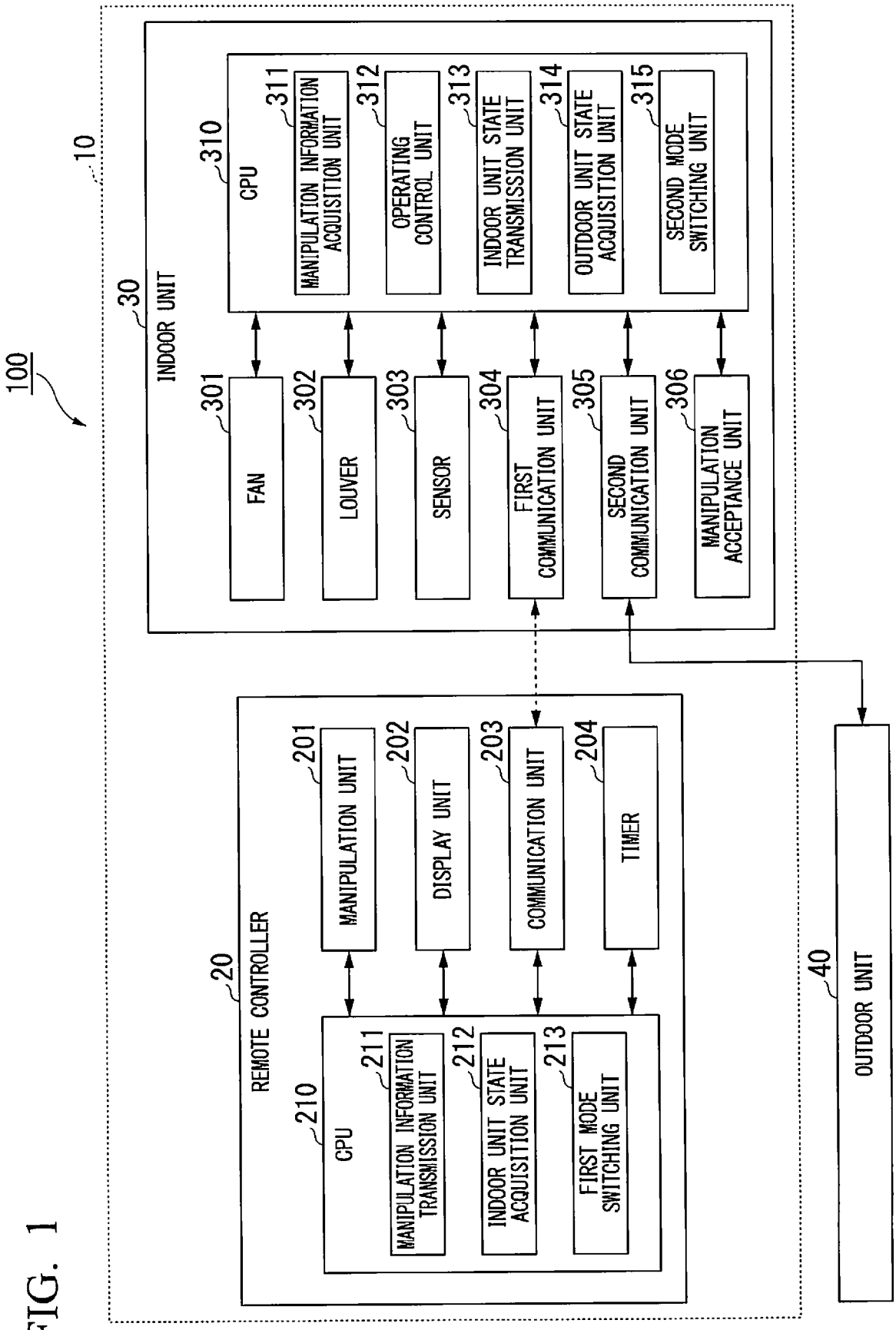

100
10
30
INDOOR UNIT
310
CPU
311
MANIPULATION INFORMATION ACQUISITION UNIT
312
OPERATING CONTROL UNIT
313
INDOOR UNIT STATE TRANSMISSION UNIT
314
OUTDOOR UNIT STATE ACQUISITION UNIT
315
SECOND MODE SWITCHING UNIT
301
FAN
302
LOUVER
303
SENSOR
304
FIRST COMMUNICATION UNIT
305
SECOND COMMUNICATION UNIT
306
MANIPULATION ACCEPTANCE UNIT
20
REMOTE CONTROLLER
201
MANIPULATION UNIT
202
DISPLAY UNIT
203
COMMUNICATION UNIT
204
TIMER
210
CPU
211
MANIPULATION INFORMATION TRANSMISSION UNIT
212
INDOOR UNIT STATE ACQUISITION UNIT
213
FIRST MODE SWITCHING UNIT
40
OUTDOOR UNIT

FIG. 2

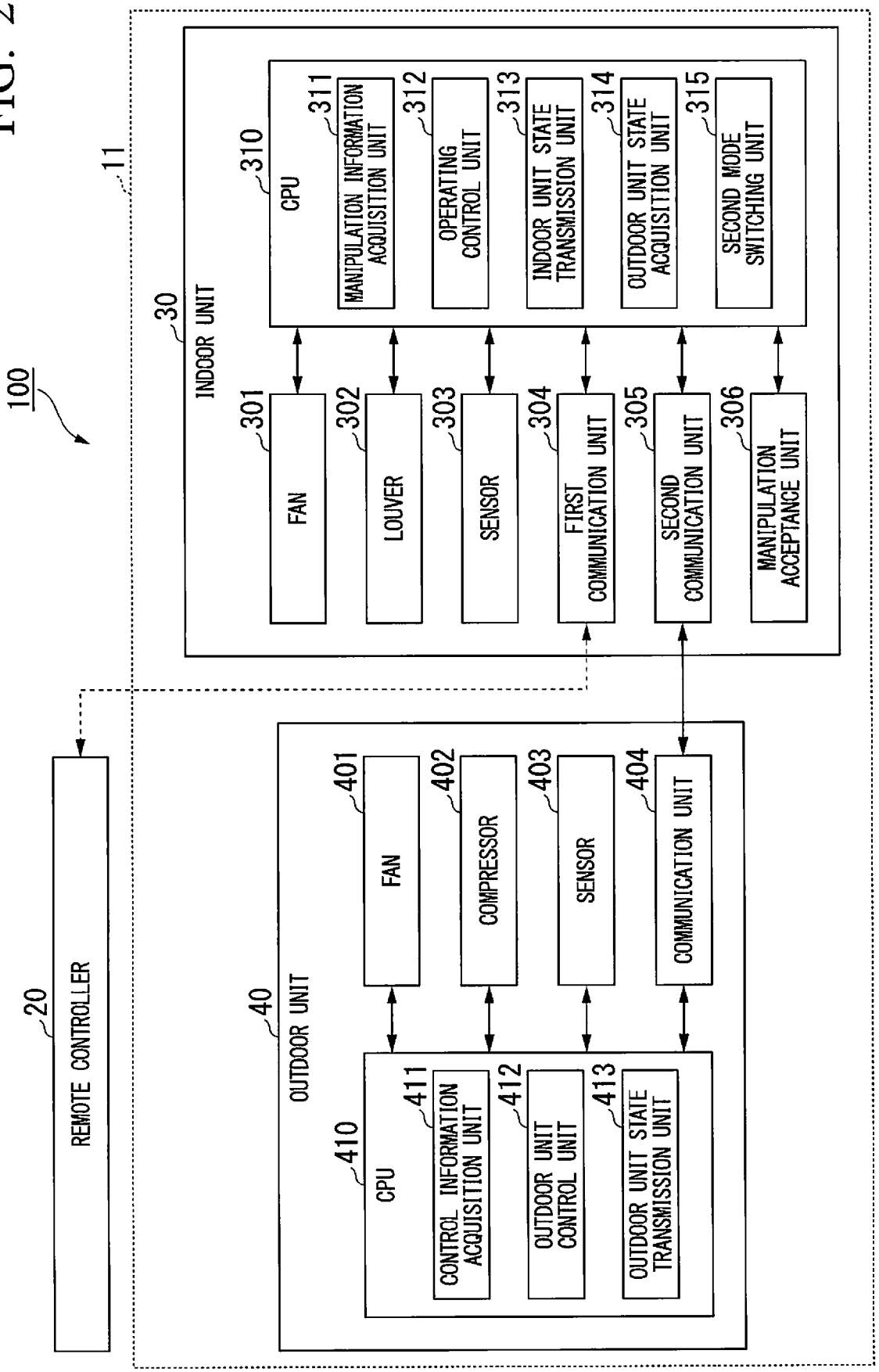

100
11
20
REMOTE CONTROLLER
30
INDOOR UNIT
310
CPU
311
MANIPULATION INFORMATION ACQUISITION UNIT
312
OPERATING CONTROL UNIT
313
INDOOR UNIT STATE TRANSMISSION UNIT
314
OUTDOOR UNIT STATE ACQUISITION UNIT
315
SECOND MODE SWITCHING UNIT
301
FAN
302
LOUVER
303
SENSOR
304
FIRST COMMUNICATION UNIT
305
SECOND COMMUNICATION UNIT
306
MANIPULATION ACCEPTANCE UNIT
40
OUTDOOR UNIT
401
FAN
402
COMPRESSOR
403
SENSOR
404
COMMUNICATION UNIT
410
CPU
411
CONTROL INFORMATION ACQUISITION UNIT
412
OUTDOOR UNIT CONTROL UNIT
413
OUTDOOR UNIT STATE TRANSMISSION UNIT

FIG. 3

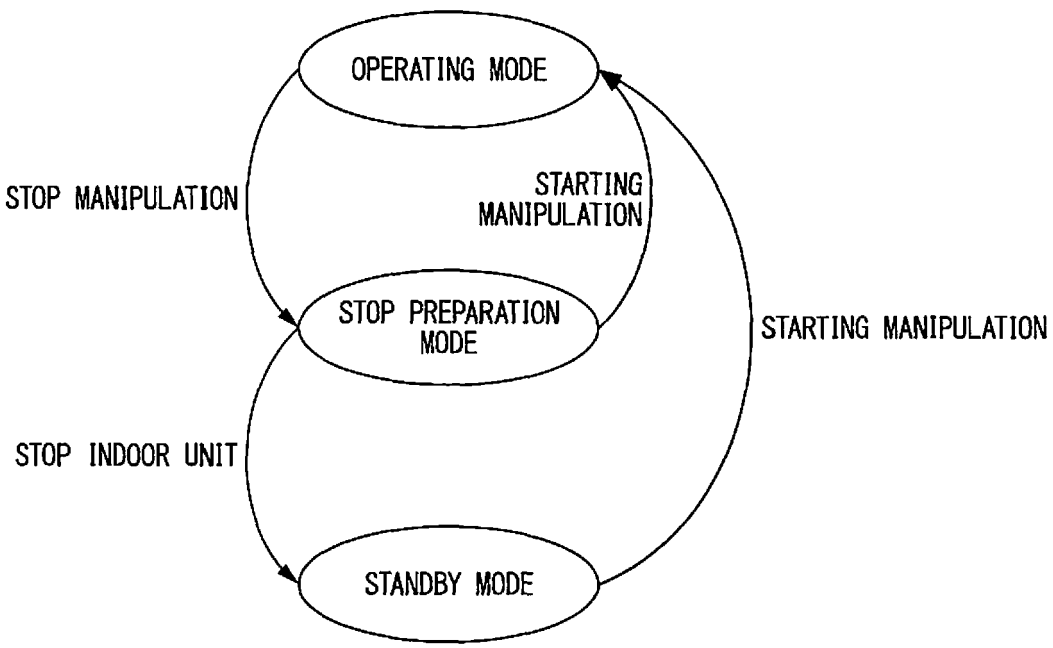

OPERATION STATE OF FIRST MODULE
OPERATING MODE
STOP MANIPULATION
STARTING MANIPULATION
STOP PREPARATION MODE
STARTING MANIPULATION
STOP INDOOR UNIT
STANDBY MODE

FIG. 4

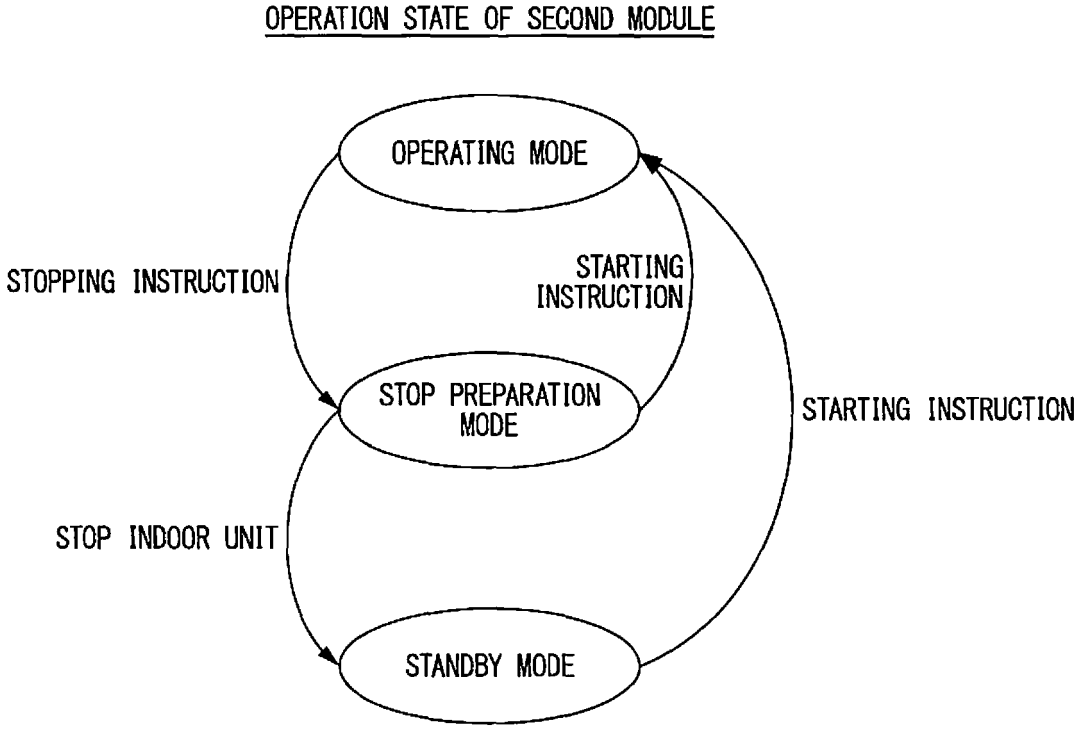

OPERATION STATE OF SECOND MODULE
OPERATING MODE
STOPPING INSTRUCTION
STARTING INSTRUCTION
STOP PREPARATION MODE
STARTING INSTRUCTION
STOP INDOOR UNIT
STANDBY MODE

FIG. 5

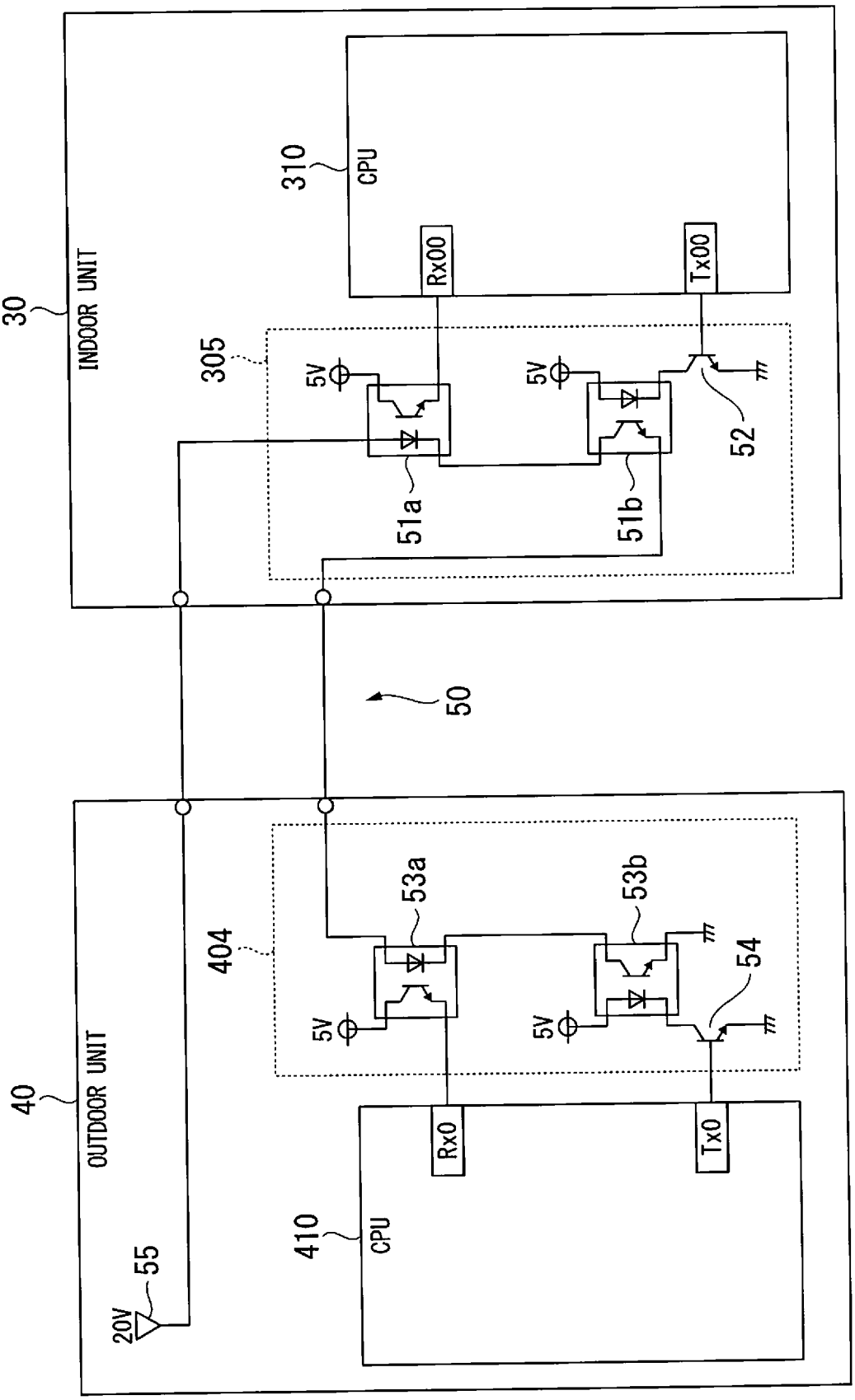

30
INDOOR UNIT
310
CPU
Rx00
Tx00
305
5V
5V
51a
51b
52
50
40
OUTDOOR UNIT
404
53a
53b
54
5V
5V
Rx0
Tx0
410
CPU
20V
55

FIG. 6

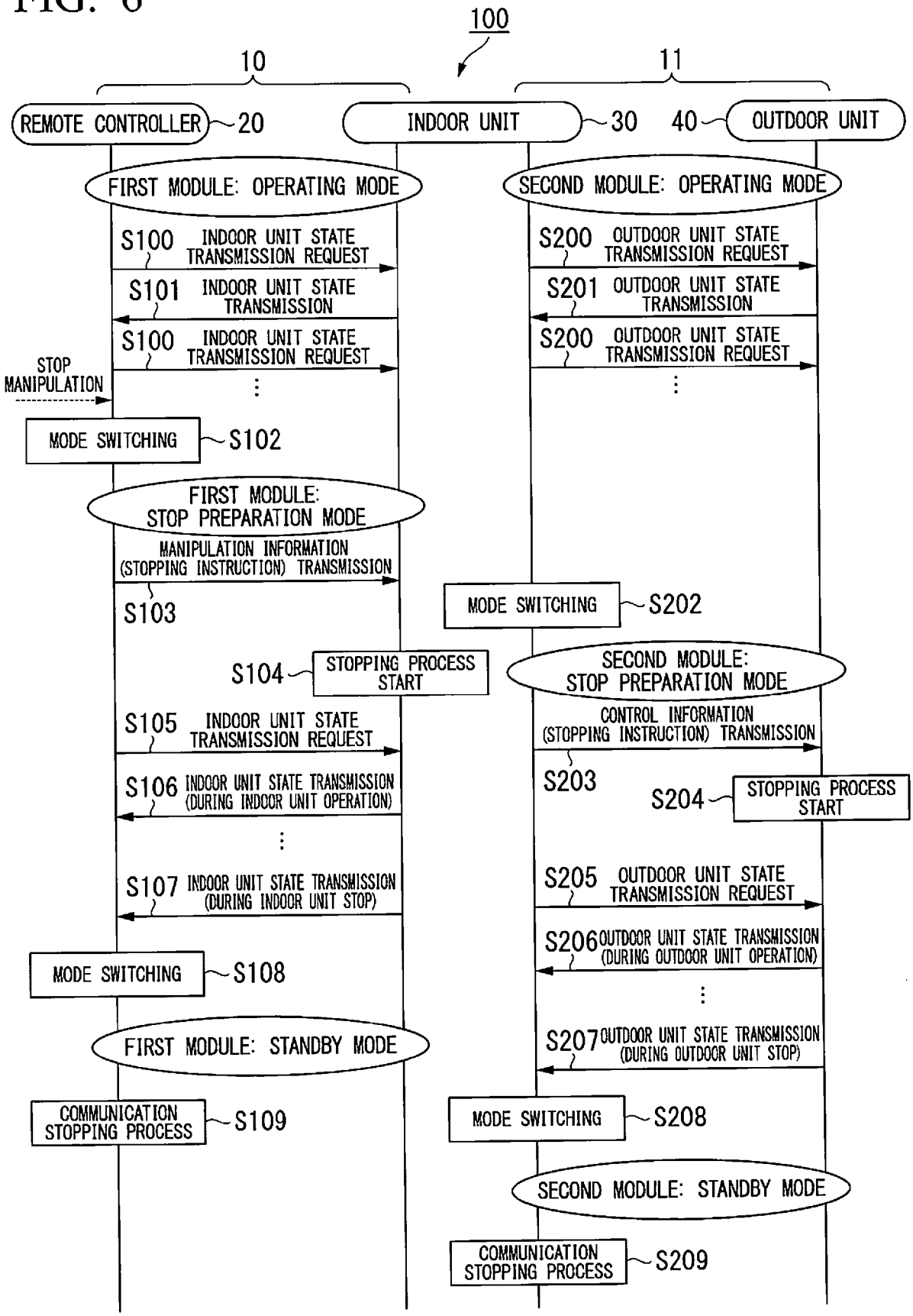

100
10
11
REMOTE CONTROLLER
20
INDOOR UNIT
30
40
OUTDOOR UNIT
FIRST MODULE: OPERATING MODE
SECOND MODULE: OPERATING MODE
S100 INDOOR UNIT STATE TRANSMISSION REQUEST
S101 INDOOR UNIT STATE TRANSMISSION
S100 INDOOR UNIT STATE TRANSMISSION REQUEST
S200 OUTDOOR UNIT STATE TRANSMISSION REQUEST
S201 OUTDOOR UNIT STATE TRANSMISSION
S200 OUTDOOR UNIT STATE TRANSMISSION REQUEST
STOP MANIPULATION
MODE SWITCHING
S102
FIRST MODULE: STOP PREPARATION MODE
MANIPULATION INFORMATION (STOPPING INSTRUCTION) TRANSMISSION
S103
MODE SWITCHING
S202
S104
STOPPING PROCESS START
SECOND MODULE: STOP PREPARATION MODE
S105 INDOOR UNIT STATE TRANSMISSION REQUEST
CONTROL INFORMATION (STOPPING INSTRUCTION) TRANSMISSION
S106 INDOOR UNIT STATE TRANSMISSION (DURING INDOOR UNIT OPERATION)
S203
S204
STOPPING PROCESS START
S107 INDOOR UNIT STATE TRANSMISSION (DURING INDOOR UNIT STOP)
S205 OUTDOOR UNIT STATE TRANSMISSION REQUEST
S206 OUTDOOR UNIT STATE TRANSMISSION (DURING OUTDOOR UNIT OPERATION)
MODE SWITCHING
S108
FIRST MODULE: STANDBY MODE
S207 OUTDOOR UNIT STATE TRANSMISSION (DURING OUTDOOR UNIT STOP)
COMMUNICATION STOPPING PROCESS
S109
MODE SWITCHING
S208
SECOND MODULE: STANDBY MODE
COMMUNICATION STOPPING PROCESS
S209

FIG. 7

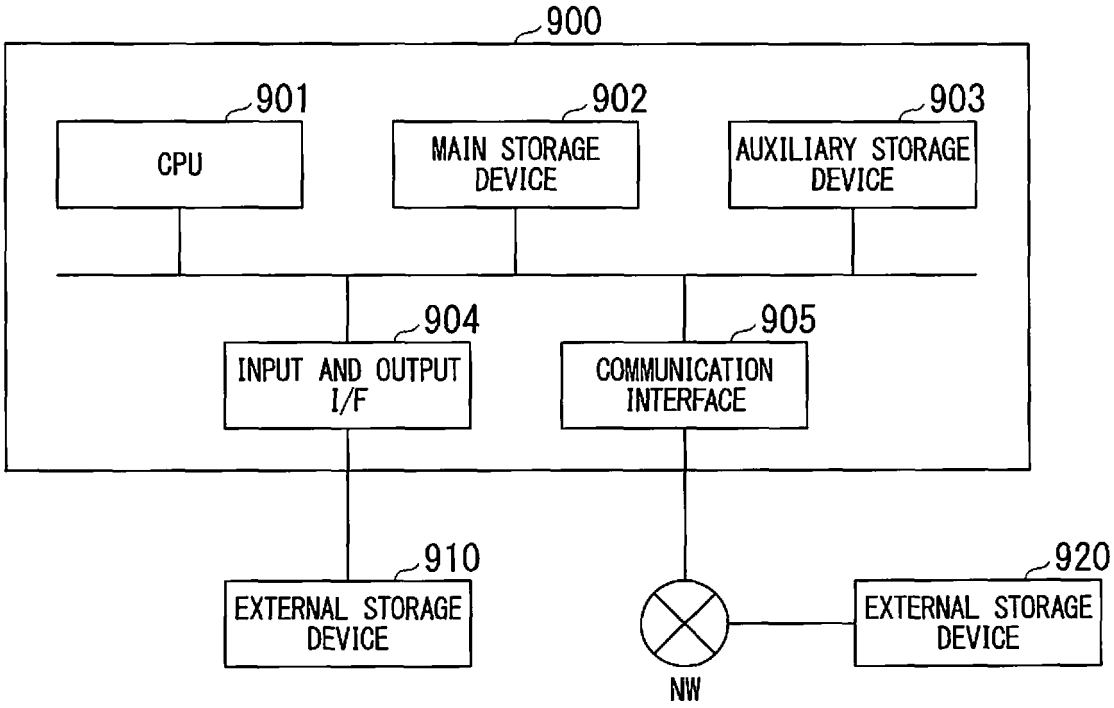
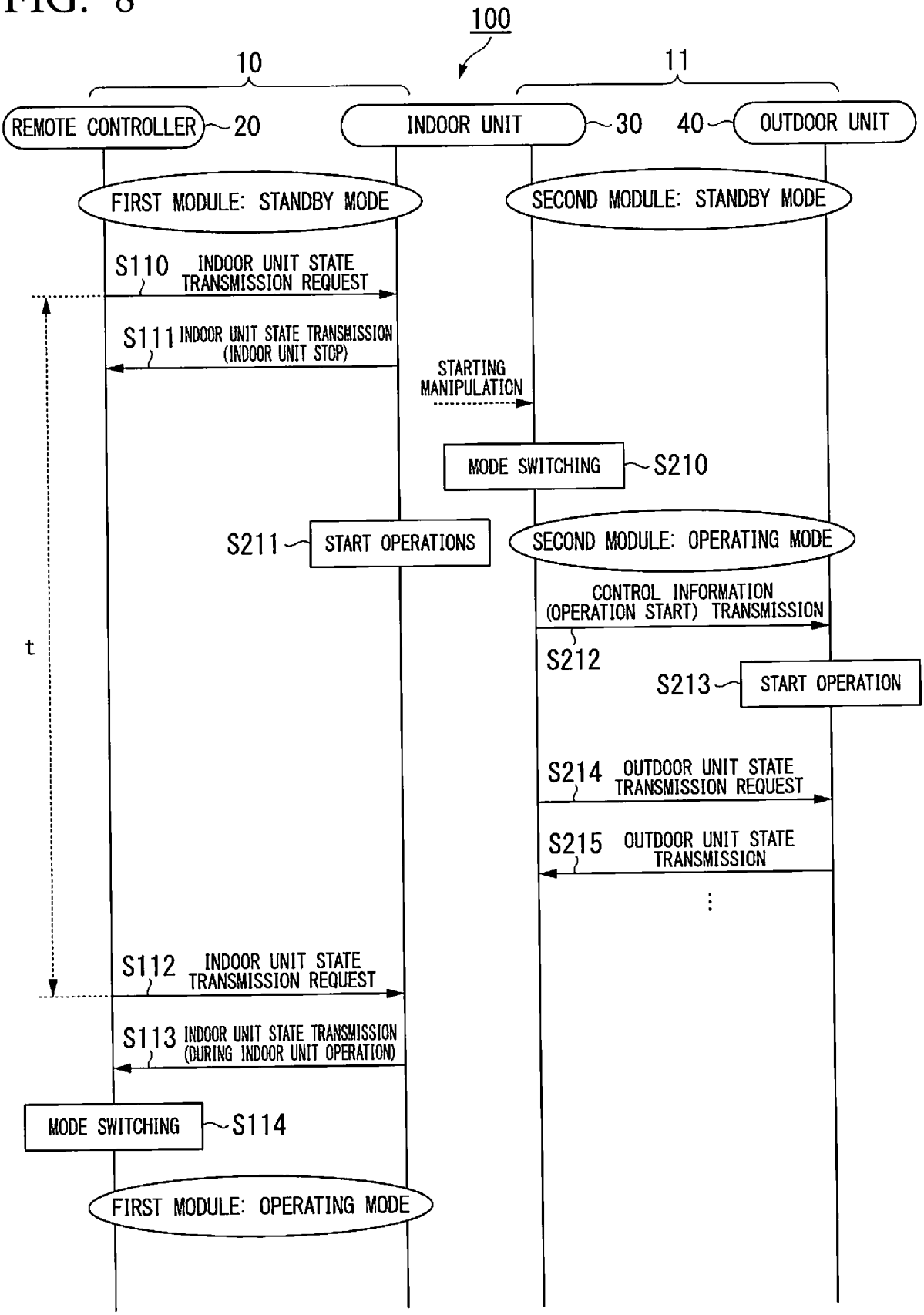

900
901
CPU
902
MAIN STORAGE DEVICE
903
AUXILIARY STORAGE DEVICE
904
INPUT AND OUTPUT I/F
905
COMMUNICATION INTERFACE
910
EXTERNAL STORAGE DEVICE
NW
920
EXTERNAL STORAGE DEVICE

FIG. 8


100
10
11
REMOTE CONTROLLER
20
INDOOR UNIT
30
40
OUTDOOR UNIT
FIRST MODULE: STANDBY MODE
SECOND MODULE: STANDBY MODE
S110
INDOOR UNIT STATE TRANSMISSION REQUEST
S111
INDOOR UNIT STATE TRANSMISSION (INDOOR UNIT STOP)
STARTING MANIPULATION
MODE SWITCHING
S210
S211
START OPERATIONS
SECOND MODULE: OPERATING MODE
CONTROL INFORMATION (OPERATION START) TRANSMISSION
S212
S213
START OPERATION
S214
OUTDOOR UNIT STATE TRANSMISSION REQUEST
S215
OUTDOOR UNIT STATE TRANSMISSION
t
S112
INDOOR UNIT STATE TRANSMISSION REQUEST
S113
INDOOR UNIT STATE TRANSMISSION (DURING INDOOR UNIT OPERATION)
MODE SWITCHING
S114
FIRST MODULE: OPERATING MODE

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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