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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an air conditioner that displays contents of a maintenance operation and its operation time.

2. Description of the Related Art

[0002] Recently, there has been an air conditioner for performing bidirectional communication between an air conditioner (hereinafter, "AC") body and a remote controller (hereinafter, "RC"), which is disclosed in, for example, Japanese Laid-open Patent Publication No. 2007-278696. This type of conventional technology includes one in which when an operation stop command is sent from the RC to the AC body, the AC body stops the operation, and information such as the operation time and power consumption (electricity expenses) is transmitted from the AC body to the RC, so that it is notified to a user.

[0003] In the AC during a cooling operation, dew drops are easily formed on a heat exchanger due to a difference between a room temperature and a temperature of the heat exchanger. Therefore, if the operation is stopped in this state, an internal humidity of an indoor unit becomes high, which causes mold and bad odor. Therefore, some of recent ACs automatically perform a drying operation in order to dry the dew drops formed on the heat exchanger or the like after the cooling operation is stopped.

[0004] A filter is provided in the indoor unit of the ACs so that dirt and dust in the air do not enter an air-intake, and some of the ACs have a function of automatically cleaning the filter when the operation is stopped after the operation time reaches a predetermined integrated operation time.

[0005] In this way, the conventional air conditioner automatically starts a maintenance operation (drying operation and filter cleaning) independently of a stop operation performed by the user when the AC satisfies predetermined conditions. Therefore, in the conventional air conditioner, when an operator controls the stop operation of the air conditioning operation, the operation time and power consumption (electricity expenses) of the air conditioning operation are transmitted from the AC body to the RC through bidirectional communication, however, the information for the maintenance operation is not transmitted.

[0006] When this is viewed from the operator, the operation is not stopped even if the stop operation of the air conditioner is performed. Therefore, because it is not known what type of operation is being operated and how long the operation is continued, the air conditioner may be forcibly stopped or a new air-conditioning operation may be started, that is, the maintenance operation is not

satisfactorily performed.

[0007] Accordingly, it is an object in one aspect of an embodiment of the invention to provide an air conditioner capable of clearly recognizing contents of a maintenance operation and a time for the maintenance operation.

[0008] JP-H08-271039 A shows an air conditioner according to the preamble of claim 1.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0010] According to an aspect of the present invention, an air conditioner is defined in claim 1 and includes an air conditioner body that performs maintenance operation after air conditioning is operated; and a remote controller that controls the operation of the air conditioner body, wherein the air conditioner body includes a body receiver that receives a control signal for controlling the operation from the remote controller, a body transmitter that transmits operation information for the air conditioner body to the remote controller, and a maintenance-operation information generator that generates contents of the maintenance operation and its operation time as the operation information, and the remote controller includes a remote-controller transmitter that transmits a control signal for controlling the operation to the air conditioner body, a remote-controller receiver that receives operation information for the air conditioner body transmitted from the air conditioner body, and a display unit that displays the contents of maintenance operation and the operation time included in the operation information received by the remote-controller receiver, wherein when the remote-controller transmitter transmits a control signal to stop the operation to the air conditioner body, the body receiver receives the control signal, the maintenance-operation information generator generates the contents of the maintenance operation and its operation time as the operation information, while when operation information is transmitted from the body transmitter, the remote-controller receiver receives the operation information and displays the contents of the maintenance operation and its operation time on the display unit.

[0011] The above and other objects, features, advantages and technical and industrial significance of this invention, which is defined in the claims, 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

[0012]

FIG. 1 is a diagram for explaining a relationship among an air conditioner body and a RC according

to one embodiment of the present invention, a humidifier, and an externally connected device;
FIG. 2 is a block diagram of a schematic configuration among the air conditioner body, the RC, the humidifier, and the externally connected device in FIG. 1;

FIG. 3 is a plan view of the RC of the air conditioner according to the present embodiment;

FIG. 4 is a sequence diagram of a pairing setting operation performed between the RC and AC according to the present embodiment;

FIG. 5 is a diagram of one example of AC model information that can be received during the pairing setting in FIG. 4;

FIG. 6 is a diagram of one example of AC model information minimum required for the pairing setting in FIG. 4;

FIG. 7 is a communication sequence diagram when log information is exchanged between the RC and the AC after the pairing setting according to the present embodiment;

FIG. 8 is a diagram of a display example when a start operation is performed from the RC to the air conditioner body while the operation is stopped;

FIG. 9 is a diagram of a display example when a stop operation is performed from the RC to the air conditioner body in operation;

FIG. 10 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then an inner cleaning operation is performed;

FIG. 11 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then an inner cleaning operation and a filter cleaning operation are performed;

FIG. 12 is a flowchart of the operation of the air conditioner according to the present embodiment;

FIG. 13 is a communication sequence diagram when log information is exchanged between the RC according to the present embodiment and PC;

FIG. 14 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 15 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 16 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 17 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 18 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 19 is a diagram of a PC screen example through which the PC manages operation information for the

AC based on the acquired log information;

FIG. 20 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 21 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 22 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 23 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 24 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 25 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 26 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 27 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

FIG. 28 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information; and

FIG. 29 is a diagram of a PC screen example through which the PC manages operation information for the AC based on the acquired log information;

DESCRIPTION OF THE EMBODIMENT(S)

[0013] Exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

First Example

Description of Configuration

[0014] FIG. 1 is a diagram for explaining a relationship among an air conditioner body and a RC according to one embodiment of the present invention, a humidifier, and an externally connected device. FIG. 2 is a block diagram of a schematic configuration among the air conditioner body, the RC, the humidifier, and the externally connected device in FIG. 1. FIG. 3 is a plan view of the RC of the air conditioner according to the present embodiment.

[0015] As illustrated in FIG. 1, the air conditioner according to the present embodiment is formed with an AC indoor unit 2 being an air conditioner body, a RC 1, and an outdoor unit (not illustrated). A remote operation and various settings are performed from the RC 1 to the AC indoor unit 2 using bidirectional communication through radio frequency (RF) modules. When the RC 1 acquires

various operation information from the AC indoor unit 2, the information is displayed on a display unit of the RC 1, to be used for operation control and various settings. The RC 1 according to the present embodiment has a wired connection with a personal computer (PC) 3 through a universal serial bus (USB) connection terminal being an external connection terminal to transmit the acquired various operation information thereto, so that the PC 3 can manage the operation information. The RC 1 according to the present embodiment can remotely operate a humidifier 4 or the like being a unit to be operated other than the AC indoor unit 2 using infrared light-emitting diode (IR LED) being an infrared transmitter.

[0016] Each schematic configuration of the RC 1, the AC indoor unit 2 being the air conditioner body, the PC 3 connected to the RC 1 through the USB connection terminal, and of the humidifier 4, which are configured as illustrated in FIG. 1, will be explained with reference to FIG. 2. The RC 1 includes an RF module 11 being a RC transmitter and an RC receiver including a transceiver and an antenna for performing bidirectional wireless communication with the AC indoor unit 2, a USB socket 12 for USB connection with the PC 3 that manages information, an IR LED 13 that transmits a command to the humidifier 4 through an infrared (IR) diode to control it, an MPU board 14 that mounts thereon a micro processor unit (MPU) including a memory that stores therein data such as the various operation information received from the AC indoor unit 2 for a fixed period (here, 40 days) and controls units of the RC 1, a liquid-crystal display (LCD) unit 15 being a display unit for displaying control information of the RC 1 and the operation information (operation time, power consumption, etc.) of the AC indoor unit 2, a key operating unit 16 through which an operation-targeted device is controlled, a real time clock (RTC) 17 being a timer dedicated for measuring time for time management, and a battery 18 for supplying power to the units of the RC 1.

[0017] As illustrated in FIG. 2, the AC indoor unit 2 includes an RF module 21 being a body receiver and a body transmitter for performing bidirectional wireless communication with the RF module 11 of the RC 1, and an MPU board 22 mounting thereon an MPU that controls the units of the AC indoor unit 2 based on commands from the RC 1 received by the RF module 21, collects the operation information for the AC indoor unit 2, calculates operation time and power consumption (electricity expenses) in an air-conditioner operation mode 22a or in a maintenance operation mode 22b, and also includes memory that stores therein data for a fixed period (here, 10 days). The MPU board 22 forms a maintenance-operation information generator that generates contents of characteristic maintenance operation according to the present invention and its operation time as operation information. The AC indoor unit 2 further includes an RTC 23 being a timer required for displaying a countdown for the operation time of the maintenance operation.

[0018] As illustrated in FIG. 2, the PC 3 includes a USB

socket 31 for connecting a USB cable to the USB socket 12 of the RC 1. The PC 3 installs operation-information management software to thereby enable data transmission/reception upon USB connection, periodical collection of operation information from the AC indoor unit 2 through the RC 1, and continuous control of the operation on the PC screen.

[0019] As illustrated in FIG. 2, the humidifier 4 includes an infrared proximity detector (IR PD) unit 41 for receiving an infrared signal transmitted from the IR LED 13 of the RC 1. The RC 1 can control the humidifier 4 using this infrared signal (command).

[0020] As illustrated in FIG. 3, the RC 1 controlling the air conditioner includes the LCD unit 15 formed from a liquid-crystal display portion for displaying operation information (contents of maintenance information, operation time, power consumption, etc.), and the key operating unit 16 for controlling the operation of the AC indoor unit 2. The key operating unit 16 is provided with Start/Stop key 16a for controlling operation start and operation stop of the AC indoor unit 2, and also with OK key 16b required for start of pairing.

[0021] The air conditioner according to the present embodiment performs bidirectional wireless communication using the RF modules between the RC 1 and the AC indoor unit 2. Therefore, if a different model of AC is provided close to these two, the RC 1 cannot discriminate an operation-target device from the other, and thus the air conditioner requires previous pairing setting.

Pairing Setting

[0022] FIG. 4 is a sequence diagram of a pairing setting operation performed between the RC 1 and the AC indoor unit 2 according to the present embodiment. FIG. 5 is a diagram of one example of AC model information that can be received during the pairing setting in FIG. 4. FIG. 6 is a diagram of one example of AC model information minimum required for the pairing setting in FIG. 4.

[0023] First, when registration setting of the RC 1 is selected or when a pairing partner of the RC 1 is not stored on a nonvolatile memory (not illustrated, hereinafter, "EEPROM") mounted on the MPU board 14 of the RC 1 (when "Not registered" is displayed on the LCD unit 15), a mode is shifted to an RC registration setting mode, and a pairing screen is displayed, where a sequence to perform pairing with the AC indoor unit 2 appears. Likewise, when a pairing partner of the AC indoor unit 2 is not also registered, this is indicated by a lamp (not illustrated) provided in the AC indoor unit 2. As illustrated in FIG. 4, when the operator depresses a pairing button (not illustrated) provided in the AC indoor unit 2, a pairing execution status is indicated with sound of a buzzer and with blinking of the lamp, a pairing request signal of the AC indoor unit 2 is sent to the RF module 21, and the pairing is started (Step S60).

[0024] During displaying the pairing screen on the LCD unit 15 of the RC 1, by concurrently depressing the

Start/Stop key 16a of the key operating unit 16 of the RC 1 illustrated in FIG. 3 and the OK key 16b provided inside an operation cover, the pairing request signal is sent to the RF module 11, and the pairing is started (Step S61). "Pairing is being registered" is displayed on the LCD unit 15 of the RC 1. Here, communication for the pairing is performed between the RF modules 11 and 21 (Step S62), and after it is checked whether these are models whose pairing can be registered (Step S63), a pairing complete signal indicating completion of the pairing of the RF modules is transmitted from the RF module 21 to the MPU board 22 (Step S64), and the pairing complete signal indicating completion of the pairing of the RF modules is transmitted from the RF module 11 to the MPU board 14 (Step S65).

[0025] Then, an AC model information request is transmitted as general data from the RC 1 to the AC indoor unit 2 (Step S66). At this time, a signal indicating the AC model information that can be received from the AC indoor unit 2 includes, as illustrated in FIG. 5, a series name (Z/S), manufacturing year of the indoor unit (A to Z), a character string (model name: within 16 characters), a derivative model (1), and an AC ID (MAC address). When receiving the AC model information request by the AC indoor unit 2, the RF module 21 of the AC indoor unit 2 transmits a general-data transmission complete signal to the RC 1 to notify the RC 1 that the transmission has been successful (Step S67). The MPU board 14 of the RC 1 switches the RF module 11 to the reception mode (Step S68).

[0026] Subsequently, the MPU board 22 of the AC indoor unit 2 transfers the model information of the AC to the RC 1 (Step S69). When the RC 1 receives the model information of the AC indoor unit 2, the RF module 11 transmits an information transfer complete signal to the AC indoor unit 2, to notify the AC indoor unit 2 that the transmission has been successful (Step S70).

[0027] When acquiring the AC model information, the RC 1 notifies the RF module 11 that the reception mode is canceled (Step S71), and receives a reception mode complete signal (Step S72).

[0028] The MPU board 14 of the RC 1 determines whether the AC indoor unit 2 for setting the pairing is the corresponding model, based on the acquired AC model information. When the AC indoor unit 2 is the corresponding model and the received signal includes at least the signal illustrated in FIG. 6, the MPU board 14 of the RC 1 transmits the general data for the successful pairing to the AC indoor unit 2 (Step S73). When receiving the general data for the successful pairing, the RF module 21 of the AC indoor unit 2 notifies the RC 1 that the transmission of the general data is completed (transmission has been successful) (Step S74). The MPU board 14 of the RC 1 displays the success of the pairing on the LCD unit 15 for 5.5 seconds, and the operator selects "Z" or "S" according to the series name, so that the contents of the selected model are written to the EEPROM.

[0029] Meanwhile, when it is determined that the AC

indoor unit 2 for performing the pairing setting is not the corresponding model, or when the received AC model information is any information other than the signal illustrated in FIG. 6, the MPU board 14 of the RC 1 transmits general data for unsuccessful pairing to the AC indoor unit 2 (Step S75). When receiving the general data for unsuccessful pairing, the RF module 21 of the AC indoor unit 2 notifies the RC 1 that transmission of the general data is completed (Step S76). The MPU board 14 of the RC 1 displays the unsuccessful pairing on the LCD unit 15 for 5.5 seconds, performs a pairing clearing process (Step S77), and receives notification that the pairing clearing process is completed (Step S78).

[0030] In the case of the unsuccessful pairing, the MPU board 22 of the AC indoor unit 2 also performs a pairing clearing process (Step S79), and receives notification that the pairing clearing process is completed (Step S80). The pairing setting is ended in this manner.

[0031] Between the RC 1 and the AC indoor unit 2 which end the pairing setting, operation control and various settings are performed from the RC 1 to the AC indoor unit 2 and the RC 1 requests an operation status log (history) stored in the AC indoor unit 2 according to the following communication sequence, thus acquiring the log.

Communication Sequence between AC and RC

[0032] FIG. 7 is a communication sequence diagram when log information is exchanged between the RC and the AC after the pairing setting according to the present embodiment. The RC 1 requests the operation status log from the AC indoor unit 2 every day at fixed time, to perform a collecting operation.

[0033] First, as illustrated in FIG. 7, when the time reaches fixed time (here, AM 0:30) based on the RTC 17, the MPU board 14 of the RC 1 transmits a log request to the MPU board 22 of the AC indoor unit 2 through the RF modules 11 and 21 (Step S81). The RC 1 transmits the log request and then waits for the log data sent from the AC indoor unit 2. When the log is not received after a predetermined time has passed during waiting for the log, the RC 1 determines this as a reception error due to reception time-out, ends the waiting for reception of the log, and ends the log collection on that day. Because the EEPROM of the MPU board 22 of the AC indoor unit 2 has a capacity such that logs for the AC operation status for 10 days at maximum can be stored, even if the reception error occurs, the logs are collectively transferred when the next log can be received.

[0034] As illustrated in FIG. 7, when sequentially receiving the log data from the AC indoor unit 2 (Steps S82, S83, ...), the RC 1 stores the log data in the EEPROM of the MPU board 14 at each time. A method of storing logs is implemented in such a manner that when the EEPROM has any area where data is not stored, the log is written to the area, while when the EEPROM has no area where data is not stored, the log is overwritten to the write area

of the oldest log, and is stored therein. When receiving the end of log indicating the end of log data from the AC indoor unit 2 (Step S84), the RC 1 completes acquisition of the logs.

[0035] Between the RC 1 and the AC indoor unit 2, the RC 1 transmits an operation control command to the AC indoor unit 2 at any time other than the fixed time, and acquires the operation status log from the AC indoor unit 2, so that the acquired operation status log can be displayed on the LCD unit 15 of the RC 1.

Contents of Maintenance Operation and Display of Operation Time

[0036] FIG. 8 is a diagram of a display example when a start operation is performed from the RC to the air conditioner body while the operation is stopped. FIG. 9 is a diagram of a display example when a stop operation is performed from the RC to the air conditioner body in operation. FIG. 10 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then inner cleaning operation is performed. FIG. 11 is a diagram of a display example when the stop operation is performed from the RC to the air conditioner body in operation and then inner cleaning operation and a filter cleaning operation are performed.

[0037] When the AC indoor unit 2 is stopped and the RC 1 also displays the operation-stop screen as illustrated in FIG. 8, the operator depresses the Start/Stop key 16a of the RC 1, and an indicator is changed to "Operating" illustrated by an open arrow in response to the depression, and an indicator of the AC indoor unit 2 is also changed to "Operating". However, when communication cannot be established even if the Start/Stop key 16a of the RC 1 is depressed, "Communication x" illustrated by a black arrow and indicating that the communication is disabled" is displayed on the LCD unit 15. Therefore, the operator can learn, just by looking at the display of the RC 1, whether the communication is successfully established and the command is executed or the communication is disabled and the command is not executed.

[0038] When the AC indoor unit 2 is operating and the RC 1 also displays a screen of "Operating" as illustrated in FIG. 9, the operator depresses the Start/Stop key 16a of the RC 1, and the log is requested from the AC indoor unit 2 before an operation-stop status is displayed. The MPU board 22 of the AC indoor unit 2 calculates electricity expenses and an operation time in the air-conditioner operation mode 22a and transmits the calculated results to the RC 1, so that the electricity expenses and the operation time of Today's operation (air-conditioning operation) can be displayed in "Notice" indicated by an open arrow. After 5.5 seconds have passed since the display of "Notice", the operation-stop status indicated by an open arrow is displayed. A total of today's electricity expenses and a total of yesterday's electricity expenses

are displayed on the operation-stop screen.

[0039] Power consumption of the AC fluctuates caused by a cooling or heating operation mode and a set temperature. Therefore, the power consumption is determined in such a manner that the AC indoor unit 2 measures the power consumption in real time, integrates power consumptions to determine power consumption, and determines the power consumption using the determined power consumption and the electricity expenses per unit time stored in the MPU board 22 of the AC indoor unit 2, although these are not illustrated.

[0040] When the AC indoor unit 2 is in air-conditioning operation and the RC 1 also displays a screen of "in cooling operation" as illustrated in FIG. 10, the operator depresses the Start/Stop key 16a of the RC 1, the log is requested from the AC indoor unit 2 similarly to the case of FIG. 9, and the today's electricity expenses and its operation time calculated by the MPU board 22 of the AC indoor unit 2 are displayed on the RC 1. Here, the MPU board 22 of the AC indoor unit 2 determines that the air-conditioning operation is cooling operation and condensation may be formed on the heat exchanger or the like, and automatically starts inner cleaning operation for drying the inside of the indoor unit after the air-conditioning operation is stopped, to perform the inner cleaning operation of the maintenance operation. The inner cleaning operation time is determined according to the cooling operation time before the operation is stopped using a table stored in the MPU board 22 of the AC indoor unit 2.

[0041] At the time of starting the maintenance operation, the MPU board 22 of the AC indoor unit 2 calculates electricity expenses required for the maintenance operation from the maintenance operation time and from the electricity expenses per unit time of the maintenance operation stored in the MPU board 22 of the AC indoor unit 2, and transmits information for the maintenance operation mode, the operation time, and for the electricity expenses to the RC 1, and the RC 1 displays thereon the received information.

[0042] The RC 1 displays a remaining time of the inner cleaning operation (remaining: about 90 minutes) using the maintenance operation time information after 5.5 seconds have passed since the display, and the remaining time is counted down on the display. The measurement of the countdown is performed by the RTC 17 of the RC 1. Alternatively, the measurement is performed by the RTC 23 of the AC indoor unit 2, and the countdown information may be transmitted to the RC 1 and displayed thereon.

[0043] In this manner, at the time of the maintenance operation, the indicator indicating that "inner cleaning operation" as illustrated in FIG. 10 is performed and the "remaining operation time" are displayed on the LCD unit 15 of the RC 1. This enables the operator to learn the contents of the maintenance operation after the operation is stopped and the remaining time of the maintenance operation. Therefore, these pieces of information help

the operator determine whether a normal operation is waited until the end of the maintenance operation or the maintenance operation is suspended to perform the normal operation, depending on the remaining time. For example, if the operator depresses the Start/Stop key 16a of the RC 1 when some time still remains, the inner cleaning operation is suspended, and the operation-stop screen indicated by the white arrow is displayed. The operation-stop screen displays thereon a total of the today's electricity expenses and a total of the yesterday's electricity expenses, and displays an amount of money including electricity expenses required for the inner cleaning operation up to its suspension in the total of the today's electricity expenses.

[0044] When the inner cleaning operation as illustrated in FIG. 10 is displayed and the maintenance operation is ended without suspension, as illustrated by the black arrow, the operation time only for the maintenance operation (here, inner cleaning operation) and actual electricity expenses are displayed, and the operation-stop status indicated by the white arrow is then displayed. The operation-stop screen displays thereon the total of the today's electricity expenses and the total of the yesterday's electricity expenses.

[0045] When the AC indoor unit 2 is in the air-conditioning operation and the RC 1 also displays thereon a screen of "in cooling operation" as illustrated in FIG. 11, and when the operator depresses the Start/Stop key 16a of the RC 1, similarly to the case of FIG. 10, the RC 1 requests the log from the AC indoor unit 2, and the electricity expenses for today's operation and the operation time calculated by the MPU board 22 of the AC indoor unit 2 are displayed on the RC 1. Similarly to FIG. 10, the MPU board 22 of the AC indoor unit 2 determines that the air-conditioning operation is the cooling operation and condensation may be formed on the heat exchanger or the like, and automatically starts the inner cleaning operation after the air-conditioning operation is stopped. At this time, the AC indoor unit 2 transmits information for the maintenance operation mode, the operation time, and for the electricity expenses to the RC 1, and the RC 1 displays thereon the received information.

[0046] The RC 1 displays a countdown of the remaining operation time during the inner cleaning operation, using the maintenance operation time information, after 5.5 seconds have passed since the display of the information.

[0047] The inner cleaning is finished after 90 minutes, and the RC 1 displays an operation time only for the inner cleaning operation and actual electricity expenses as indicated by the white arrow. When it is determined that the air-conditioning operation time reaches a predetermined air-conditioning operation integrated time, as illustrated in FIG. 11, the MPU board 22 of the AC indoor unit 2 automatically starts the filter cleaning operation for cleaning the filter as indicated by the white arrow. At this time, also, the AC indoor unit 2 transmits information for the maintenance operation mode, the operation time, and

for the electricity expenses to the RC 1, similarly to the inner cleaning operation, and the RC 1 displays the received information. Thereafter, during the filter cleaning operation, the operation status and the countdown of the remaining time are displayed on the RC 1. The countdown display is similar to the case of the inner cleaning operation, and may therefore be performed by using either one of the RTCs in the RC 1 and in the AC indoor unit 2.

[0048] When the maintenance operation is ended without suspension of the filter cleaning operation illustrated in FIG. 11 (after 10 minutes), as illustrated by the white arrow, the operation time only for the filter cleaning operation and the electricity expenses are displayed, and the operation-stop status indicated by the next white arrow is then displayed. The operation-stop screen displays thereon a total of the today's electricity expenses and a total of the yesterday's electricity expenses.

20 Contents of Maintenance Operation and Display of Operation Time

[0049] FIG. 12 is a flowchart of the operation of the air conditioner according to the present embodiment. The operation in the case of automatically performing maintenance operation after the air-conditioning operation will be explained with reference to FIG. 12. First, it is determined whether the stop of the air-conditioning operation is required by the operator during the air-conditioning operation (Step S100). When the stop of the air-conditioning operation is not required, the AC indoor unit 2 waits until the stop of the air-conditioning operation is required (Step S101).

[0050] When the operator stops the air-conditioning operation through the RC 1 (Yes at Step S100), the MPU board 22 of the AC indoor unit 2 calculates an operation time and electricity expenses for the air-conditioning operation, and the information for the air-conditioning operation time and the electricity expenses or the like is transmitted from the AC indoor unit 2 to the RC 1 through the RF module 21, and the RC 1 acquires the information for the air-conditioning operation time and the electricity expenses or the like (Step S102). The AC indoor unit 2 determines whether the maintenance operation is required after the air-conditioning operation is ended. When the maintenance operation is not required (No at Step S103), the MPU board 14 of the RC 1 displays the acquired operation time and electricity expenses for the air-conditioning operation (Step S104).

[0051] At Step S103, when it is determined that the maintenance operation is required (Yes at Step S103), the MPU board 22 of the AC indoor unit 2 extracts a preset maintenance operation time from the table stored in the MPU board 22 of the AC indoor unit 2, calculates the electricity expenses, and generates the information for the maintenance operation (Step S105). The AC indoor unit 2 transmits the maintenance operation information to the RC 1, and the RC 1 displays the maintenance

operation time and the electricity expenses on the LCD unit 15 of the RC 1 (Step S106). The RC 1 displays a countdown of the remaining operation time based on the operation time sent from the AC indoor unit 2 (Step S107). The RC 1 sets the reception wait status from the AC indoor unit 2 to be off for energy saving until completion of the countdown, and notifies the AC indoor unit 2 of the completion after the countdown is completed. The AC indoor unit 2 calculates a maintenance operation time and its actual electricity expenses, and calculates a total operation time of the air-conditioning operation and the maintenance operation and electricity expenses therefor, and transmits the information to the RC. The RC 1 displays the maintenance operation time and the electricity expenses on the LCD unit 15 (Step S108), and, thereafter, displays the total operation time and electricity expenses for the air-conditioning operation and the maintenance operation (Step S109).

[0052] As explained above, when the maintenance operation is automatically started after the air-conditioning operation is stopped, the air conditioner according to the present embodiment causes the RC 1 to display thereon the contents of the maintenance operation and the time required for the maintenance operation. Therefore, the operator can get to know what kind of maintenance operation is being performed after the air-conditioning operation is stopped, and learn even how long the maintenance operation is continued. Therefore, these pieces of information help the operator determine how to perform the following operation using the RC. Particularly, when the operation time of the maintenance operation is displayed as the countdown, the operator can learn the remaining time of the maintenance operation, and this information helps the operator determine whether the normal operation is waited until the end of the maintenance operation or the maintenance operation is suspended to perform the normal operation.

Communication Sequence between RC and PC

[0053] The RC 1 according to the present embodiment includes the USB socket 12 being an external connection terminal connecting to the PC 3 that can manage operation information for the AC indoor unit 2. Therefore, by USB-connecting the RC 1 and the PC 3, the operation information for the AC indoor unit 2 can be collected to the PC 3 through the RC 1, which enables the PC 3 to manage the operation information for the AC indoor unit 2.

[0054] FIG. 13 is a communication sequence diagram when log information is exchanged between the RC and PC according to the present embodiment. The logs of the operation status of the AC stored in the EEPROM of the MPU board 14 of the RC 1 are transmitted to the PC 3 according to the communication sequence between the AC indoor unit 2 and the RC 1. The EEPROM of the MPU board 14 of the RC 1 has a capacity such that the logs received from the AC for 40 days at maximum can

be stored.

[0055] First, when the RC 1 and the PC 3 are USB-connected to each other, a series of processes (enumeration) until communication becomes possible by the USB driver is performed, and completion of the enumeration allows communication between the RC 1 and the PC 3 (Step S85). During the enumeration, an indicator of "connection is detected: USB-connected" is displayed on the LCD unit 15 of the RC 1.

[0056] When the enumeration is completed, the PC 3 requests the AC information from the RC 1 (Step S86). The RC 1 responds to the request and transmits the AC information stored in the EEPROM of the MPU board 14 to the PC 3 (Step S87). The AC information includes a product name of an AC, a series name, a performance range, manufacturing year of the indoor unit, a voltage to be used, an AC MAC address, room information, and a RC type.

[0057] The PC 3 checks the received AC information against the managed AC information, and identifies to which of ACs the received AC information corresponds. When a plurality of ACs are managed by the PC 3, it is necessary to check to which of the ACs the received AC information corresponds.

[0058] The PC 3 requests AC-operation setting information from the RC 1 in order to load the operation setting information (Step S88). The RC 1 responds to this request and transmits the AC-operation setting information stored in the EEPROM of the MPU board 14 to the PC 3 (Step S89). The AC-operation setting information includes a volume level, with or without voice, switching to an energy saving function (human sensor), equipped with an inner cleaning function or not, a time for maintenance, equipped with an energy saving fan or not, equipped with an auto powerful function or not, and current switching.

[0059] The PC 3 requests a log from the RC 1 in order to load the log (Step S90). The RC 1 responds to this log request from the PC 3 and transmits the log data thereto (Step S91). The PC 3 and the RC 1 repeat a request for next data and transmission of log data (Steps S92, S93, S94) respectively. The RC 1 transmits "End of log" to the PC 3 when no log data to be transmitted remains (Step S95), and the log loading process is thereby completed in the PC 3. Thereafter, the USB connection for connecting the PC 3 and the RC 1 is disconnected (Step S96), and the RC 1 is thereby released from the communication mode with the PC 3, so that the display of the LCD unit 15 shifts to the normal display.

[0060] In this manner, the operation log of the AC temporarily stored (logs for 10 days at maximum can be stored) in the AC indoor unit 2 is transmitted to the RC 1 and stored therein (logs for 40 days at maximum can be stored), and the log stored in the RC 1 is transferred to the PC 3 when the RC 1 and the PC 3 are USB-connected to each other. The PC 3 uses the operation-information management software pre-installed therein to enable management of the operation information for the AC indoor unit 2 as illustrated in FIG. 14 to FIG. 29.

Management of Operation Information in PC

[0061] FIG. 14 to FIG. 29 are diagrams of a PC screen example through which the operation information for the AC is managed based on the log information acquired by the PC. First, the screen as illustrated in FIG. 14 is displayed in the PC 3 using the operation-information management software. The operator clicks on a "Select AC" tag 100, and clicks on a button 101 of "Living room 1" provided in the Select AC tag 100. Then clicking on a calendar tag 102 allows to display a calendar screen 103 in which dairy operation time and electricity expenses, monthly and yearly electricity expenses, monthly target electricity expenses for the AC in the "Living room 1" are described. This enables the operator to continuously check the operation status and the electricity expenses for each AC, thus using the information for efficient usage and setting of the AC.

[0062] When the PC 3 and the RC 1 are USB-connected to each other, as illustrated in FIG. 15, the RC 1 is connected to the PC 3, and a window 104 indicating "Receiving data" is displayed. When new operation information is loaded into the PC 3, as illustrated in FIG. 16, a screen in which operation times and electricity expenses up to the previous day stored in the RC 1 are added to the calendar screen 103 is displayed.

[0063] The operator clicks on a graph tag 105 on the screen in the state of FIG. 16, and, as illustrated in FIG. 17, a graph screen 106 in which dairy electricity expenses are illustrated by a bar graph can be displayed. This enables the operator to get to know at a glance an increase and a decrease of the electricity expenses of the AC for one month. In addition, as cumulative electricity expenses of the AC required for "Living room 1", a total of electricity expenses for one month, a total of electricity expenses for the previous month, a total of annual electricity expenses, a total of electricity expenses for the previous year, and monthly target electricity expenses, or the like are also displayed, and therefore the operation status of the AC can be obtained from various angles.

[0064] In the screen of FIG. 18, by clicking on an all-rooms total button 108 in the Select AC tag 100, the graph screen 106 in which electricity expenses for the Living-room 1 button 101 and electricity expenses for a Bedroom 1 button 107 are added up respectively is displayed in different colors (different densities in a monochrome display). This enables the operator to get to know at a glance the total of the electricity expenses for the ACs in all the rooms and its breakdown. In addition, the graph screen 106 is provided with a "Reduce" button 109 and an "Enlarge" button 110. For example, when the Enlarge button 110 is clicked in the state of FIG. 18, a graph rate changes as illustrated in FIG. 19 in the graph screen 106, so that the graph can be enlarged. This enables the operator to clearly learn a fine change of electricity expenses.

[0065] For example, as illustrated in FIG. 20, a large number of ACs such as the Living-room 1 button 101, a Dining-room 1 button 111, a Japanese-room 1 button

112, a Bedroom 1 button 113, a Kids-room 1 button 114, Another room 1 button 115, a Kids-room 2 button 116 are registered in the Select AC tag 100. In this case, by clicking the all-rooms total button 108, the graph indicating the total of electricity expenses for all the rooms for each day is displayed. As for the graph indicating the total of electricity expenses for all the rooms for one day, the electricity expenses for each room are further displayed in different colors (different densities in monochrome display), and this enables the operator to get to know at a glance the breakdown of the electricity expenses even for the large number of ACs.

[0066] In the graph display illustrated in FIG. 18, by clicking on a specific day, as illustrated in FIG. 21, a window 117 indicating details of the operation status on that day can be opened. The electricity expenses and the operation time for all the rooms on that day, and an average temperature of outside air temperatures, or the like can be displayed on the window 117.

[0067] Furthermore, an AC-setting confirmation screen 119 as illustrated in FIG. 22 is a screen obtained when the Living-room 1 button 101 of the Select AC tag 100 is clicked and a "Confirm AC setting" tag 118 is clicked. The AC-setting confirmation screen 119 is used to easily confirm the details of setting contents of the AC registered in the Living-room 1 button 101 on the screen of the PC 3. Moreover, each function of the setting contents is also displayed on the AC-setting confirmation screen 119, so that when a setting content is to be changed, the operator can change the setting content while understanding it right. In addition, by clicking on a Next page button 120, as illustrated in FIG. 23, an AC-setting confirmation screen 119 at the next page is displayed. When the setting content is to be changed, the setting content to be changed is clicked, so that contents to be changed are displayed as a menu and the setting content is changed by clicking on a desired content. If the operator wants to return to the AC-setting confirmation screen 119 at the previous page, a Previous page button 121 is clicked. The setting information changed in this manner is sent from the USB-connected PC 3 to the RC 1. When a command or the like is sent from the RC 1 to the AC indoor unit 2, the changed setting information is sent with the command, so that the setting of the AC indoor unit 2 is changed.

[0068] In the calendar display in FIG. 16, when a One point advice button 123 illustrated in FIG. 24 is clicked, a One-point advice window 122 is opened, and some advice for the operator to efficiently use the AC is displayed. When a plurality of One-point advice windows 122 are provided, by clicking a Next page button 122a or a Previous page button 122b, another One-point advice window 122 can be opened (see FIG. 25).

[0069] As illustrated in FIG. 26, a file management tag 124 adjacent to the Select AC tag 100 is clicked, to display a Load button 125 for loading data from CD-ROM or the like, a Write button 126 for writing data to CD-R or the like, a Delete Model button 127 for deleting a model of

ACs registered in the AC selection tag, a File button 128 for writing a file to a flexible disk (FD) or the like, a "How to use this software" button 129 for displaying Help for the PC software, and a button 130 for "About this software" with which a name, a source, and version information of the PC software are displayed. For example, the Delete Model button 127 among these buttons is clicked, to open a window 131 as illustrated in FIG. 27, and a list of already registered models is displayed. For example, the Living-room 1 button among the window 131 is clicked, to open a confirmation window 132 to confirm the deletion, as illustrated in FIG. 28, and by clicking on "Yes" or "No", it can be deleted or the deletion thereof can be cancelled.

[0070] As illustrated in FIG. 29, the button 130 for "About this software" in the file management tag 124 is clicked, to enable display of a screen 133 in which a name of the PC software, a name of its source, or released date, although it is not illustrated, are displayed.

[0071] As explained above, in the air conditioner according to the present embodiment, the operation information for the AC indoor unit 2 can be managed even by the PC 3 through the RC 1. Therefore, the contents which cannot be displayed within the display screen of the RC 1 can be displayed in detail using a display of an externally connected device such as the PC 3. Particularly, in the setting screen of the AC as illustrated in FIG. 23 and FIG. 24, functions for inner cleaning and filter cleaning intervals for the maintenance operation are described, so that the operator understands the contents, which enables the operator to appropriately set the maintenance operation. Moreover, when the contents of the maintenance operation are displayed on the LCD unit 15 of the RC 1, the operator can appropriately determine whether the maintenance operation is continued or is suspended to perform normal operation.

[0072] According to the present invention, the RC transmitter transmits the control signal for stopping the operation to the air conditioner body, the body receiver receives the control signal, the maintenance-operation information generator generates the contents of the maintenance operation and its operation time as the operation information. When the operation information is transmitted from the body transmitter, the RC receiver receives the operation information and displays the contents of the maintenance operation and its operation time on the display unit. Thus, there is such an effect that because the contents of the maintenance operation and the operation time are transmitted from the air conditioner body to the RC and are displayed on the display unit, the contents of the maintenance operation and the time required for the maintenance operation can be obtained, and these pieces of information thereby help the operator determine how to perform the operation using the RC.

Claims

1. An air conditioner comprising:

- an air conditioner body (2) that performs maintenance operation after air conditioning is operated; and
- a remote controller (1) that controls the operation of the air conditioner body, wherein
- the air conditioner body (2) includes

- a body receiver (21) that receives a control signal for controlling the operation from the remote controller (1),
- a body transmitter (21) that transmits operation information for the air conditioner body (2) to the remote controller (1), and
- a maintenance-operation information generator (22) that generates contents of the maintenance operation and its operation time as the operation information, and

- the remote controller (1) includes

- a remote-controller transmitter (11) that transmits a control signal for controlling the operation to the air conditioner body (2),
- a remote-controller receiver (11) that receives operation information for the air conditioner body (2) transmitted from the air conditioner body (2), and
- a display unit (15) that displays the contents of maintenance operation and the operation time included in the operation information received by the remote-controller receiver (11), wherein when the remote-controller transmitter (11) transmits a control signal to stop the operation to the air conditioner body (2), the body receiver receives the control signal, the maintenance-operation information generator generates the contents of the maintenance operation and its operation time as the operation information, while when operation information is transmitted from the body transmitter (21), the remote-controller receiver (11) receives the operation information and displays the contents of the maintenance operation and its operation time on the display unit (15),

characterized in that

the display unit (15) displays, when the maintenance operation is automatically started after air-conditioning operation by the air conditioner body (2) is stopped, the contents of the maintenance operation and time required for the maintenance operation.

2. The air conditioner according to claim 1, further com-

prising a timer (17, 23) that manages time provided in at least one of the air conditioner body (2) and the remote controller (1), wherein
after the operation time of the maintenance operation is displayed on the display unit (15), the timer (17, 23) is used to display a countdown of a remaining time of the maintenance operation.

3. The air conditioner according to claim 2, wherein when the timer (17, 23) is provided in the air conditioner body (2), countdown information is transmitted from the body transmitter (21) to the remote-controller receiver (11) for each fixed time after the countdown is started, and the contents of the maintenance operation and the remaining time are displayed on the display unit (15).

Patentansprüche

1. Klimaanlage, umfassend:

- einen Klimaanlagekörper (2), der nach dem Klimatisierungsbetrieb einen Wartungsbetrieb durchführt, und
- eine Fernsteuerung (1), die den Betrieb des Klimaanlagekörpers steuert, wobei
- der Klimaanlagekörper (2) umfasst:

- einen Körperempfänger (21), der von der Fernsteuerung (1) ein Steuersignal zum Steuern des Betriebs empfängt, und
- einen Körpersender (21), der Betriebsinformationen für den Klimaanlagekörper (2) an die Fernsteuerung (2) sendet, und
- einen Wartungsbetrieb-Informationsgenerator (22), der Inhalte des Wartungsbetriebs und seine Betriebszeit als Betriebsinformationen generiert, und

- die Fernsteuerung (1) umfasst:

- einen Fernsteuerungssender (11), der ein Steuersignal zum Steuern des Betriebs an den Klimaanlagekörper (2) sendet,
- einen Fernsteuerungsempfänger (11), der von dem Klimaanlagekörper (2) gesendete Betriebsinformationen für den Klimaanlagekörper (2) empfängt, und
- eine Anzeigeeinheit (15), die die Inhalte des Wartungsbetriebs und die Betriebszeit anzeigt, die in den von dem Fernsteuerungsempfänger (11) erhaltenen Betriebsinformationen enthalten sind, wobei, wenn der Fernsteuerungssender (11) ein Steuersignal zum Beenden des Betriebs an den Klimaanlagekörper (2) sendet, der Körperempfänger das Steuersignal empfängt, der

Wartungsbetrieb-Informationsgenerator die Inhalte des Wartungsbetriebs und seine Betriebszeit als Betriebsinformationen generiert, während, wenn Betriebsinformationen von dem Körpersender (21) gesendet werden, der Fernsteuerungsempfänger (11) die Betriebsinformationen empfängt und die Inhalte des Wartungsbetriebs und seine Betriebszeit auf der Anzeigeeinheit (15) anzeigt,

dadurch gekennzeichnet, dass

wenn der Wartungsbetrieb automatisch gestartet wird, nachdem der Klimatisierungsbetrieb durch den Klimaanlagekörper (2) beendet ist, die Anzeigeeinheit (15) die Inhalte des Wartungsbetriebs und die für den Wartungsbetrieb benötigte Zeitdauer anzeigt.

2. Klimaanlage nach Anspruch 1, ferner umfassend eine in wenigstens einem von dem Klimaanlagekörper (2) und der Fernsteuerung (1) vorgesehene Zeitschaltuhr (17, 23), die Zeit verwaltet, wobei nachdem die Betriebszeit des Wartungsbetriebs auf der Anzeigeeinheit (15) angezeigt ist, die Zeitschaltuhr (17, 23) verwendet wird, um einen Countdown der verbleibenden Zeitdauer des Wartungsbetriebs anzuzeigen.

3. Klimaanlage nach Anspruch 2, wobei, wenn die Zeitschaltuhr (17, 23) in dem Klimaanlagekörper (2) vorgesehen ist, für jeden festen Zeitpunkt, nachdem der Countdown gestartet ist, Countdown-Informationen von dem Körpersender (21) an den Fernsteuerungsempfänger (11) gesendet werden, und die Inhalte des Wartungsbetriebs und die verbleibende Zeitdauer auf der Anzeigeeinheit (15) angezeigt werden.

Revendications

1. Climatiseur comprenant :

- un corps de climatiseur (2) qui réalise une opération de maintenance une fois qu'une climatisation est opérée ; et
- une télécommande (1) qui commande l'opération du corps de climatiseur, dans lequel
- le corps de climatiseur (2) inclut

- un récepteur de corps (21) qui reçoit un signal de commande pour commander l'opération à partir de la télécommande (1),
- un émetteur de corps (21) qui transmet des informations d'opération pour le corps de climatiseur (2) à la télécommande (1), et
- un générateur d'informations d'opération

de maintenance (22) qui génère un contenu de l'opération de maintenance et son temps d'opération en tant qu'informations d'opération, et

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- la télécommande (1) inclut

-- un émetteur de télécommande (11) qui transmet un signal de commande pour commander l'opération du corps de climatiseur (2),

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-- un récepteur de télécommande (11) qui reçoit des informations d'opération pour le corps de climatiseur (2) transmises à partir du corps de climatiseur (2), et

15

-- une unité d'affichage (15) qui affiche le contenu de l'opération de maintenance et le temps d'opération inclut dans les informations d'opération reçues par le récepteur de télécommande (11), dans lequel lorsque l'émetteur de télécommande (11) transmet un signal de commande pour arrêter l'opération au corps de climatiseur (2), le récepteur de corps reçoit le signal de commande, le générateur d'informations d'opération de maintenance génère le contenu de l'opération de maintenance et son temps d'opération en tant qu'informations d'opération, alors que lorsque des informations d'opération sont transmises à partir de l'émetteur de corps (21), le récepteur de télécommande (11) reçoit les informations d'opération et affiche le contenu de l'opération de maintenance et son temps d'opération sur l'unité d'affichage (15),

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caractérisé en ce que

l'unité d'affichage (15) affiche, lorsque l'opération de maintenance est démarrée automatiquement une fois que l'opération de climatisation par le corps de climatiseur (2) est arrêtée, le contenu de l'opération de maintenance et le temps requis pour l'opération de maintenance.

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2. Climatiseur selon la revendication 1, comprenant en outre une minuterie (17, 23) qui gère le temps prévu dans au moins un du corps de climatiseur (2) et de la télécommande (1), dans lequel une fois que le temps d'opération de l'opération de maintenance est affiché sur l'unité d'affichage (15), la minuterie (17, 23) est utilisée pour afficher un compte-à-rebours d'un temps restant de l'opération de maintenance.

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3. Climatiseur selon la revendication 2, dans lequel lorsque la minuterie (17, 23) est prévue dans le corps de climatiseur (2), des informations de compte-à-rebours sont transmises de l'émetteur de corps (21)

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au récepteur de télécommande (11) pour chaque temps fixe une fois que le compte-à-rebours a démarré, et le contenu de l'opération de maintenance et le temps restant sont affichés sur l'unité d'affichage (15).

FIG.1

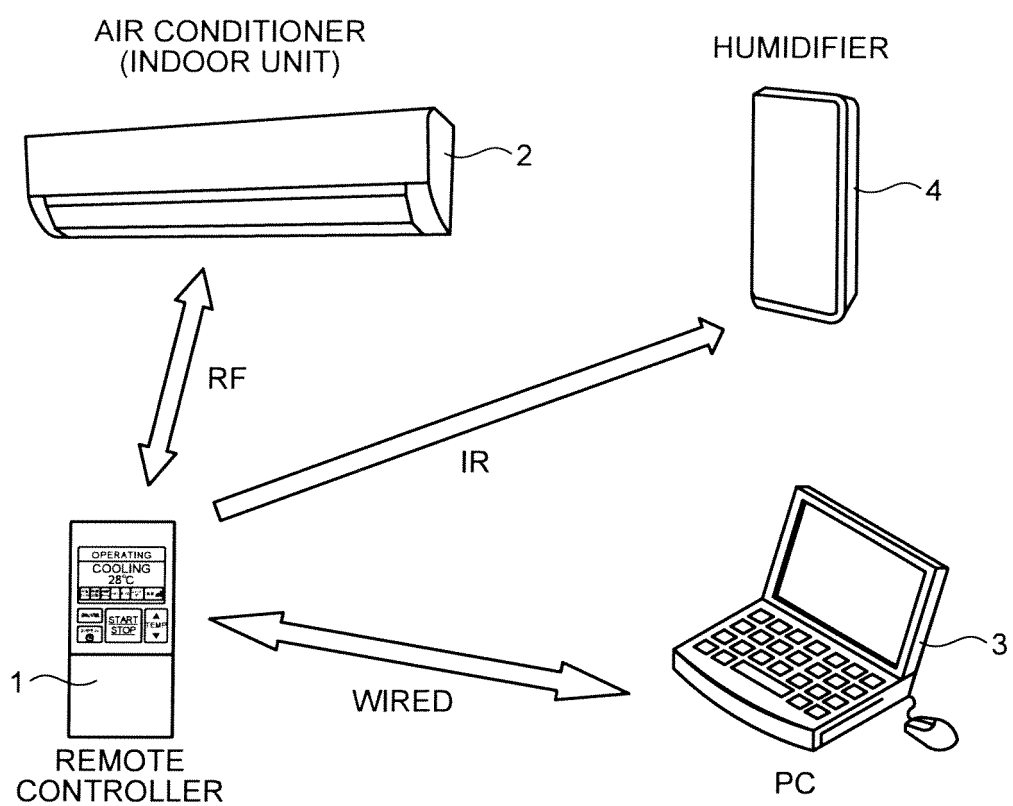


FIG.2

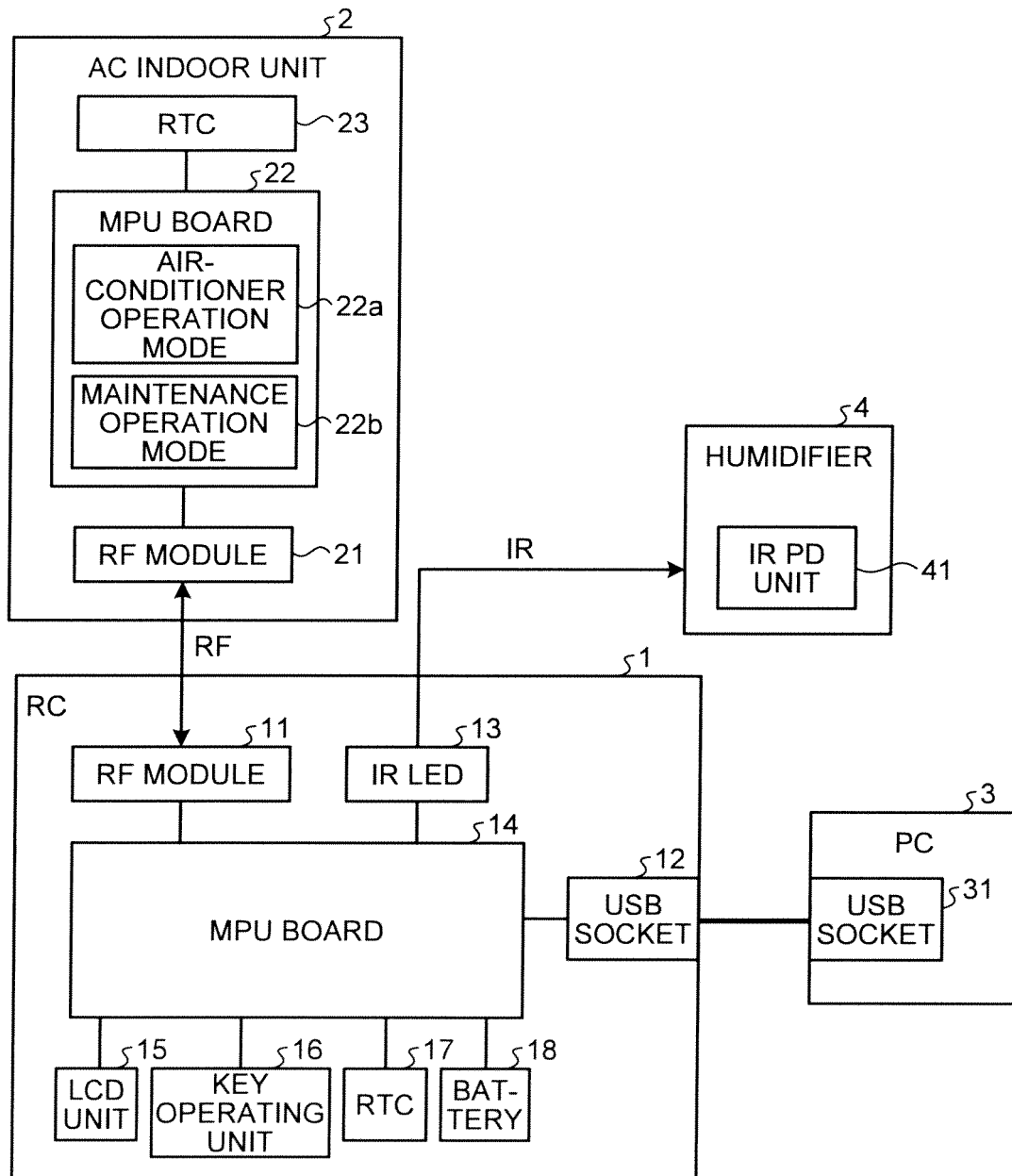


FIG.3

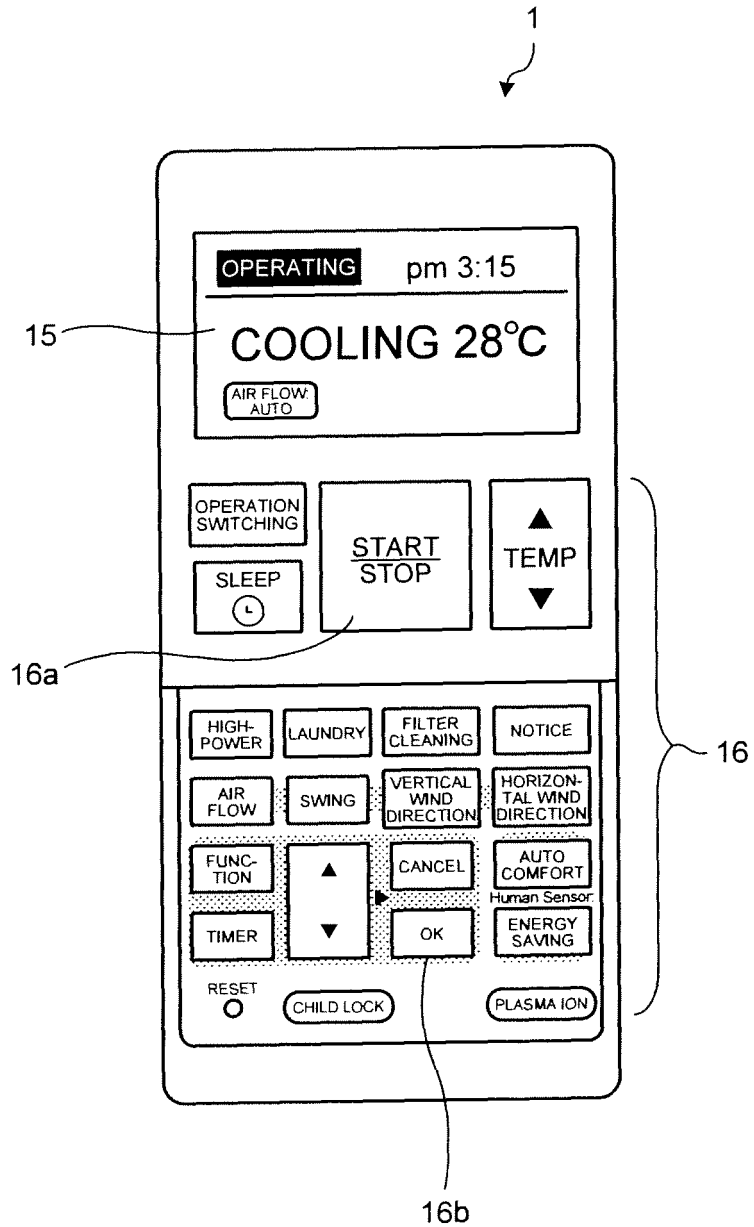


FIG.4

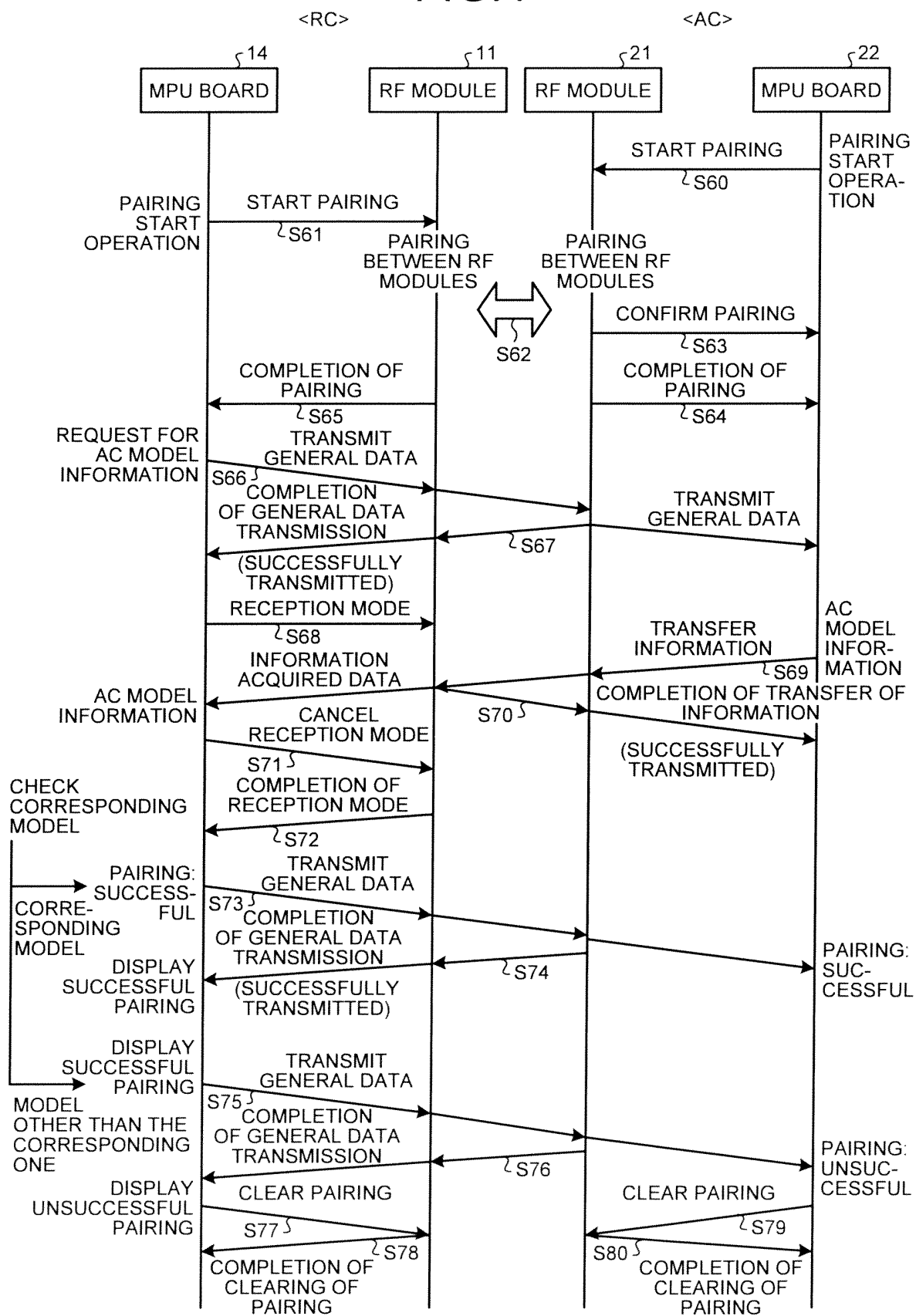


FIG.5

AC MODEL INFORMATION	SERIES NAME: Z/S
	MANUFACTURING YEAR OF INDOOR UNIT: A TO Z
	CHARACTER STRING: (MODEL NAME, WITHIN 16 CHARACTERS)
	DERIVATIVE MODEL: 1
	AC ID (MAC ADDRESS)

FIG.6

AC MODEL INFORMATION	SERIES NAME: Z OR S
	MANUFACTURING YEAR OF INDOOR UNIT: A
	DERIVATIVE MODEL: 1

FIG.7

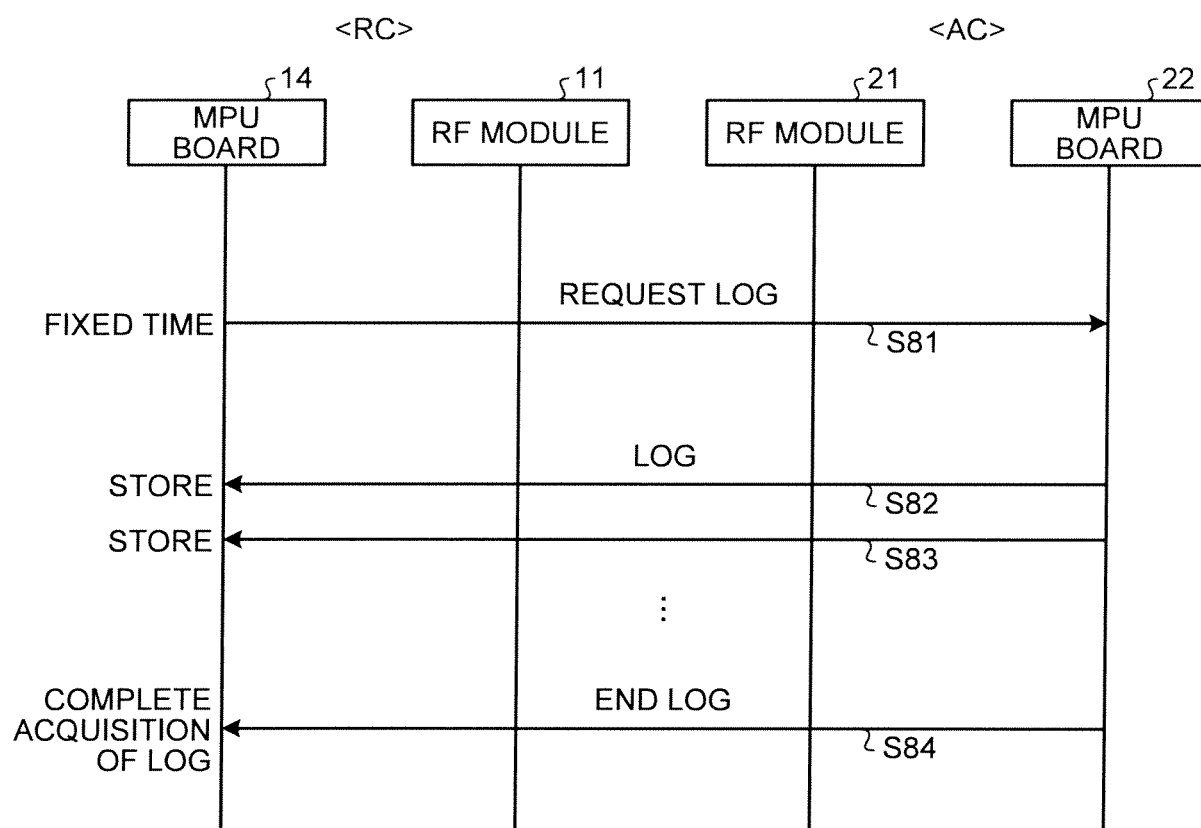


FIG.8

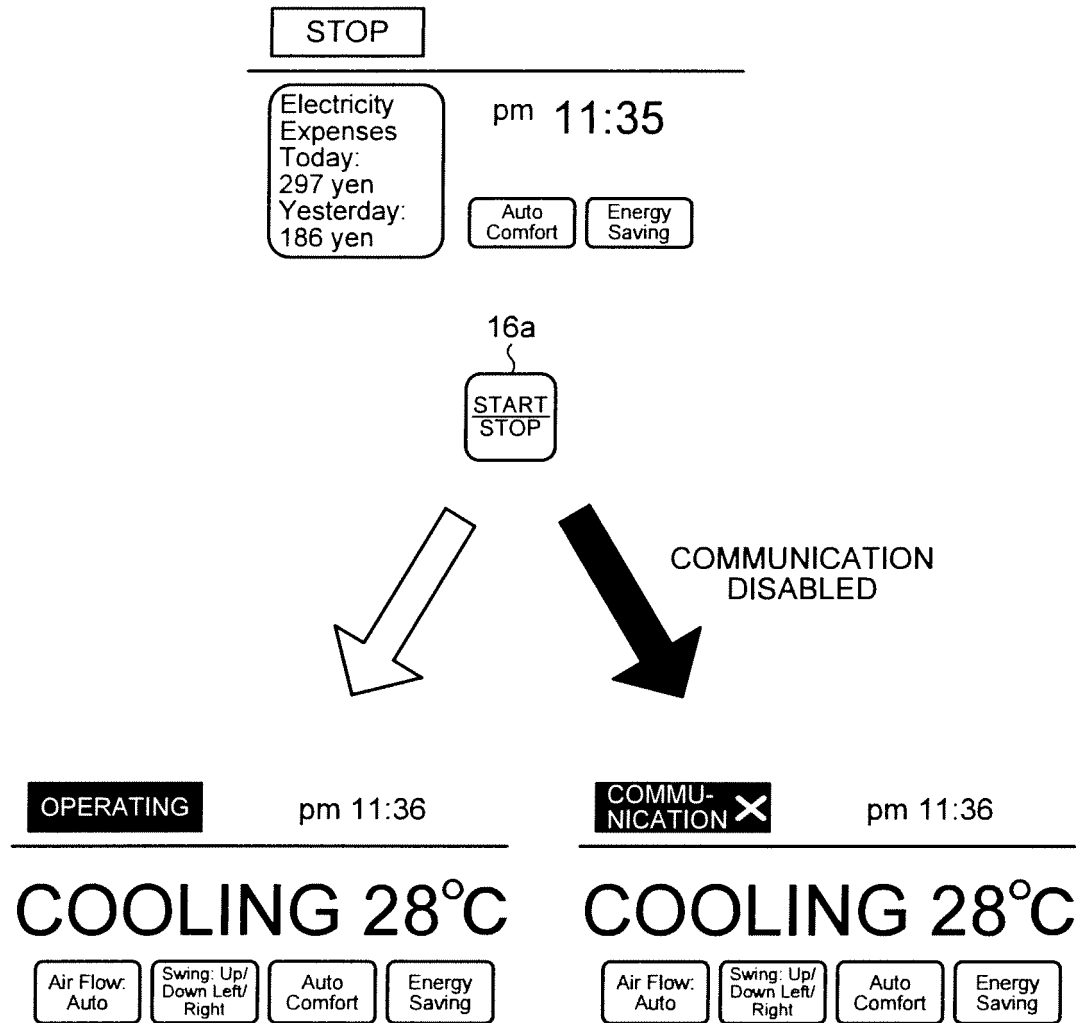


FIG.9

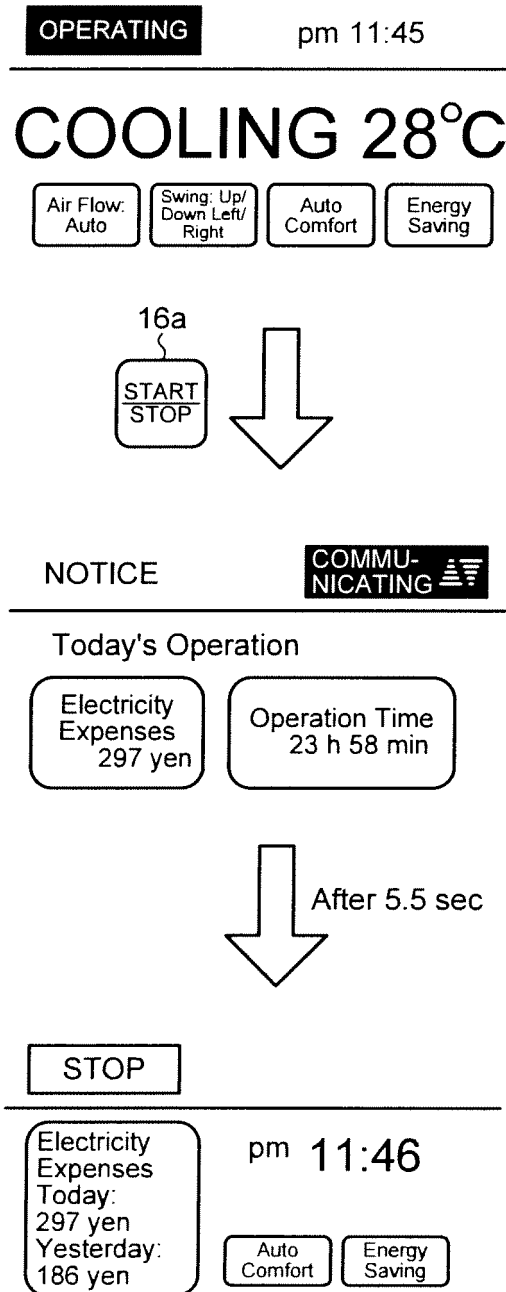


FIG.10

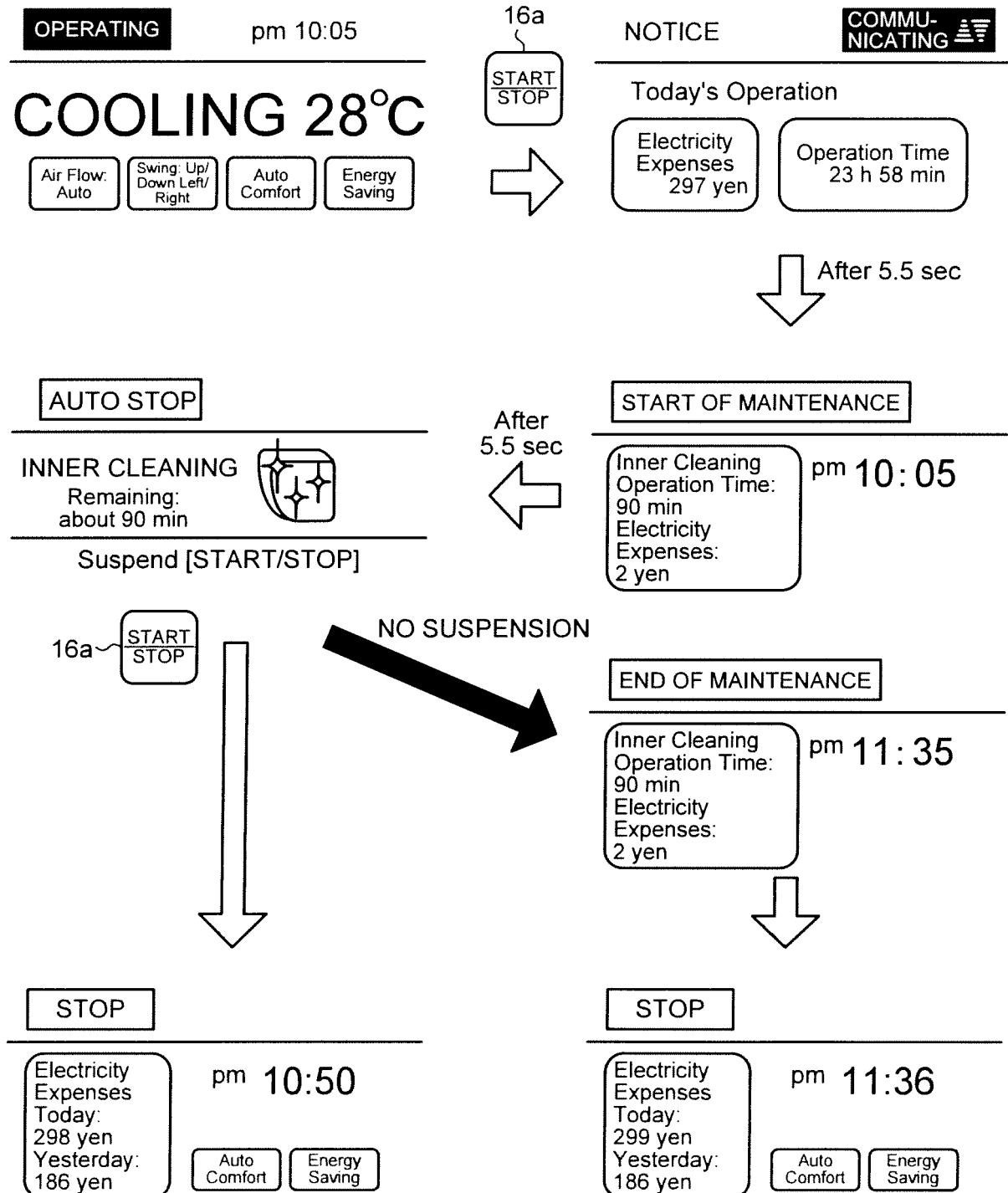


FIG. 11

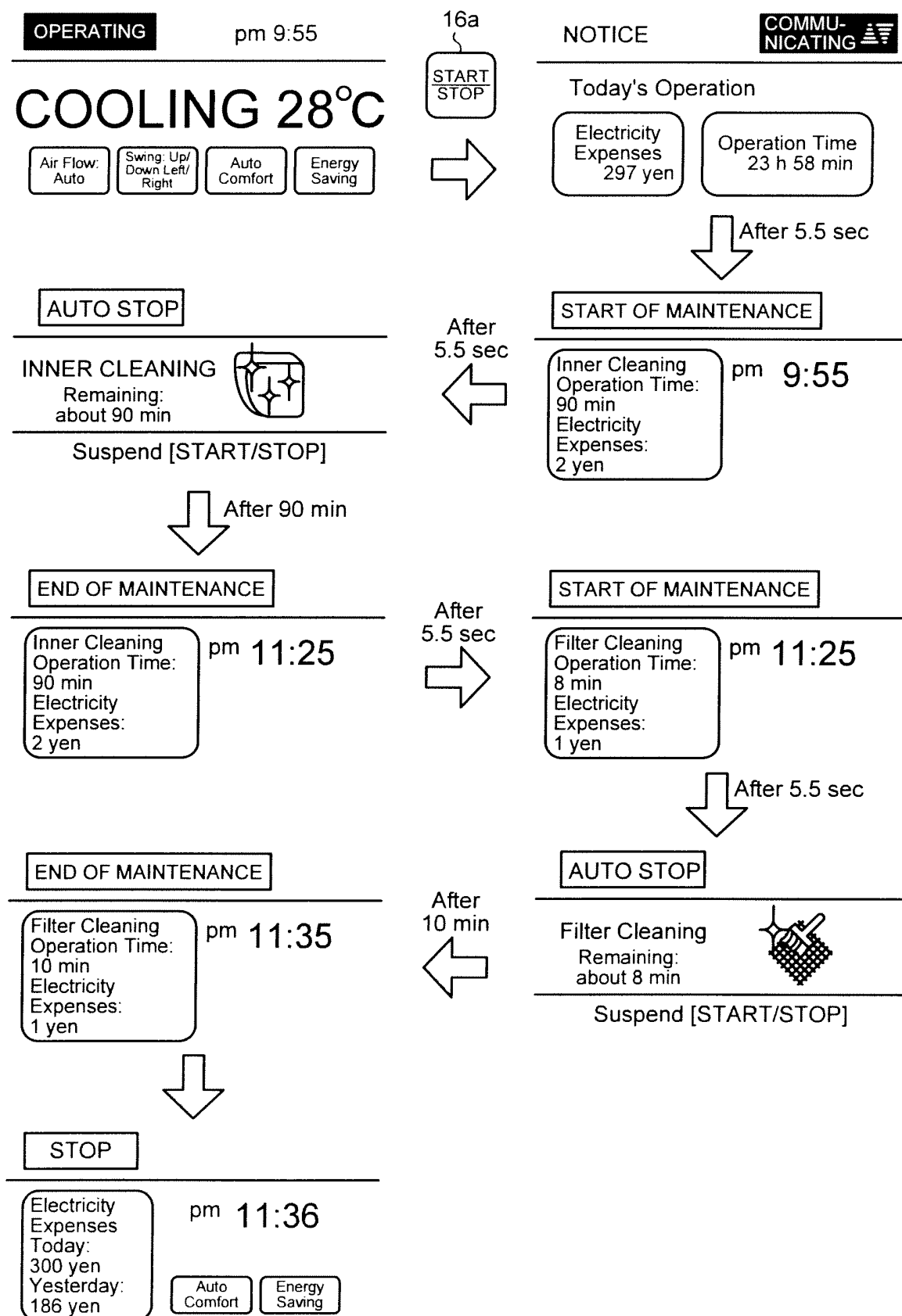


FIG.12

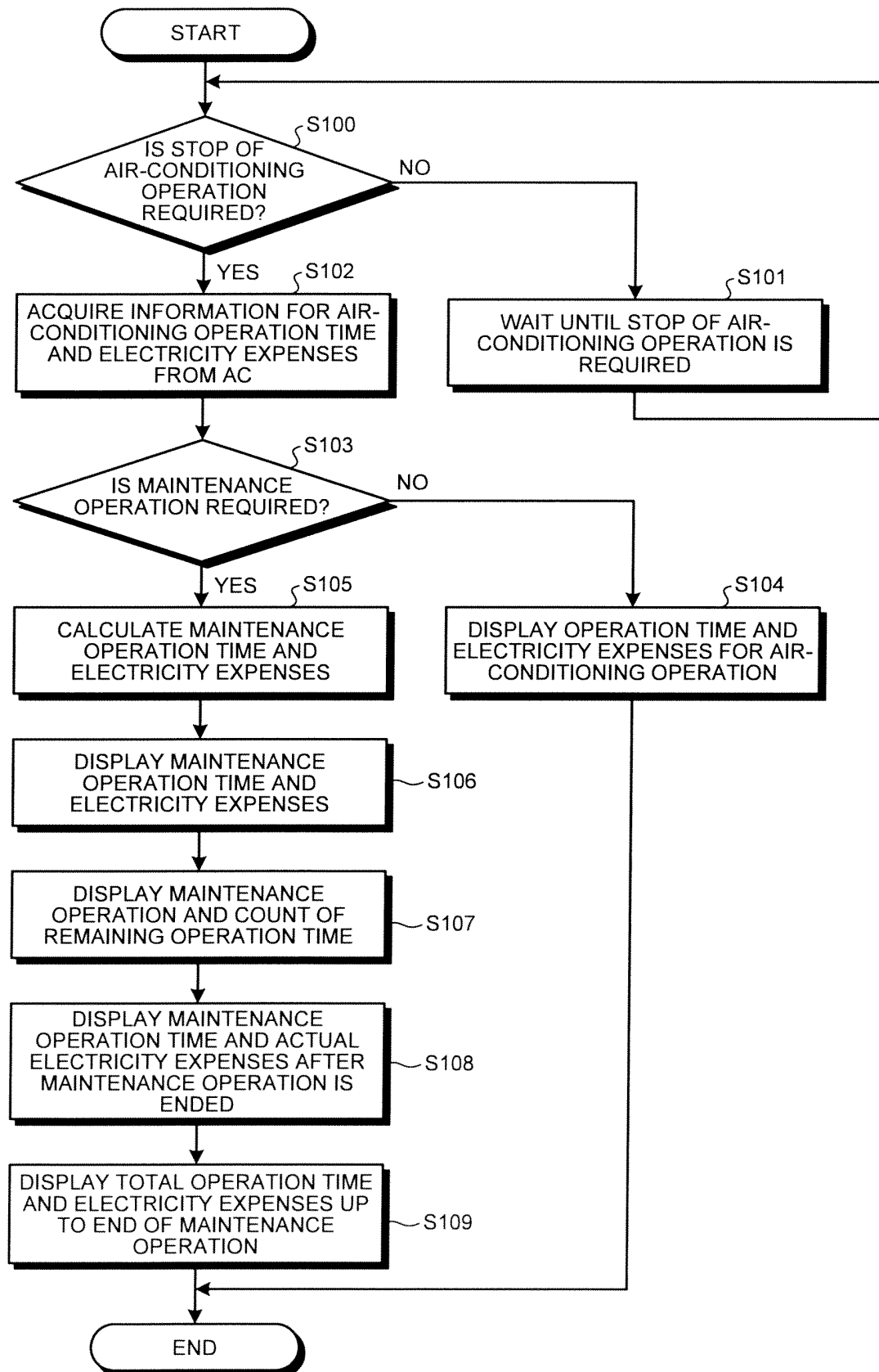


FIG. 13

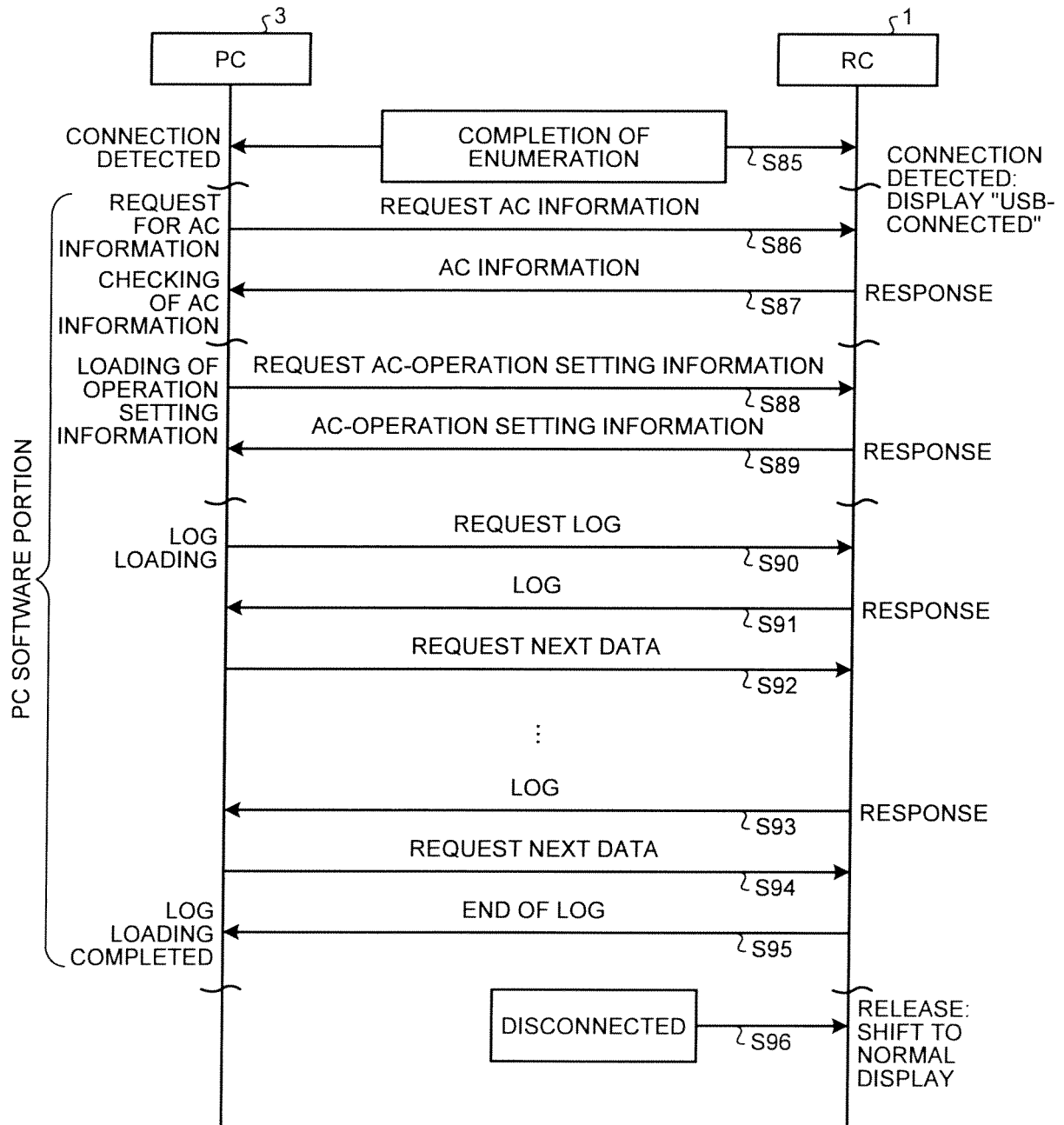


FIG.14

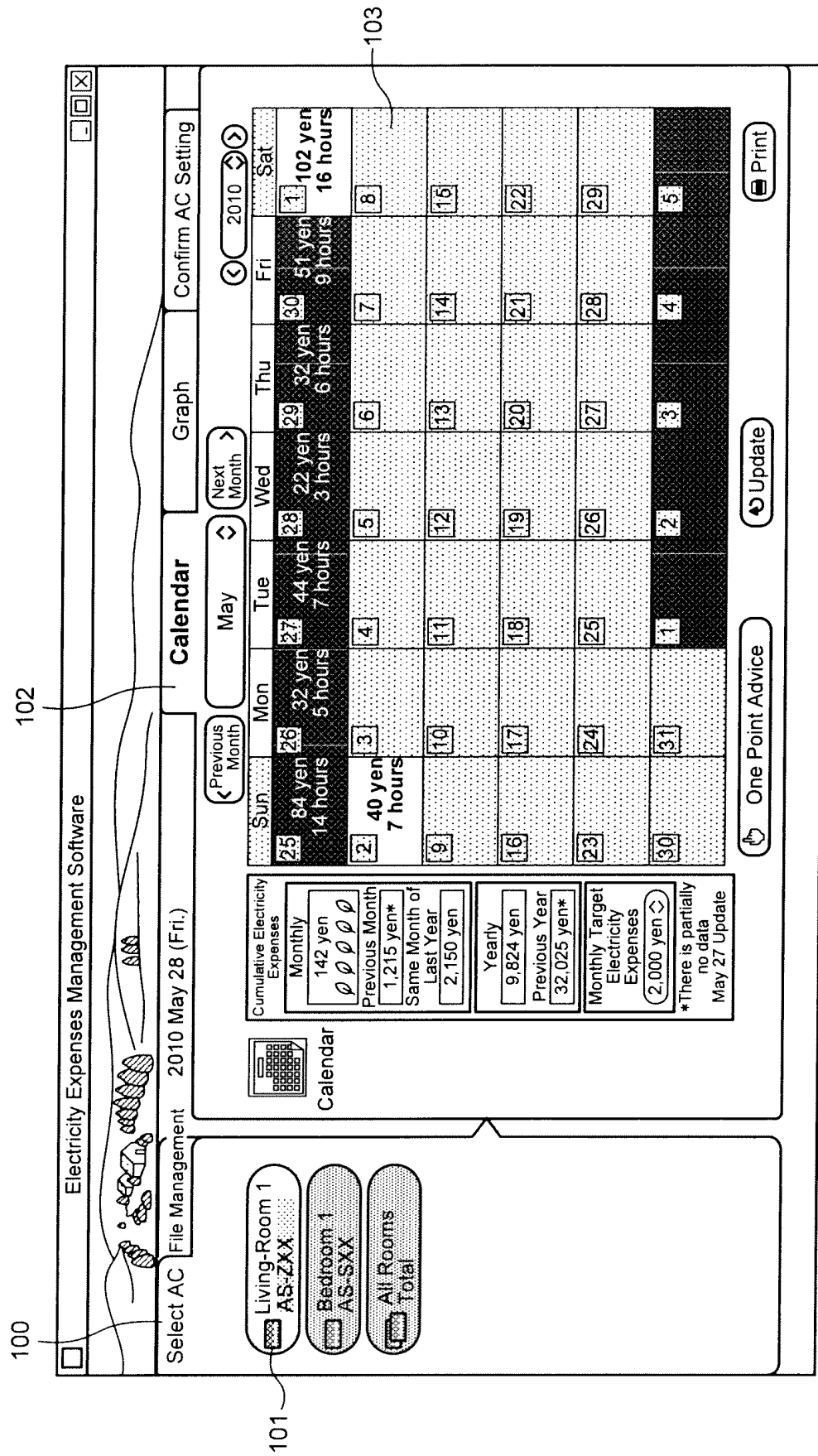


FIG.15

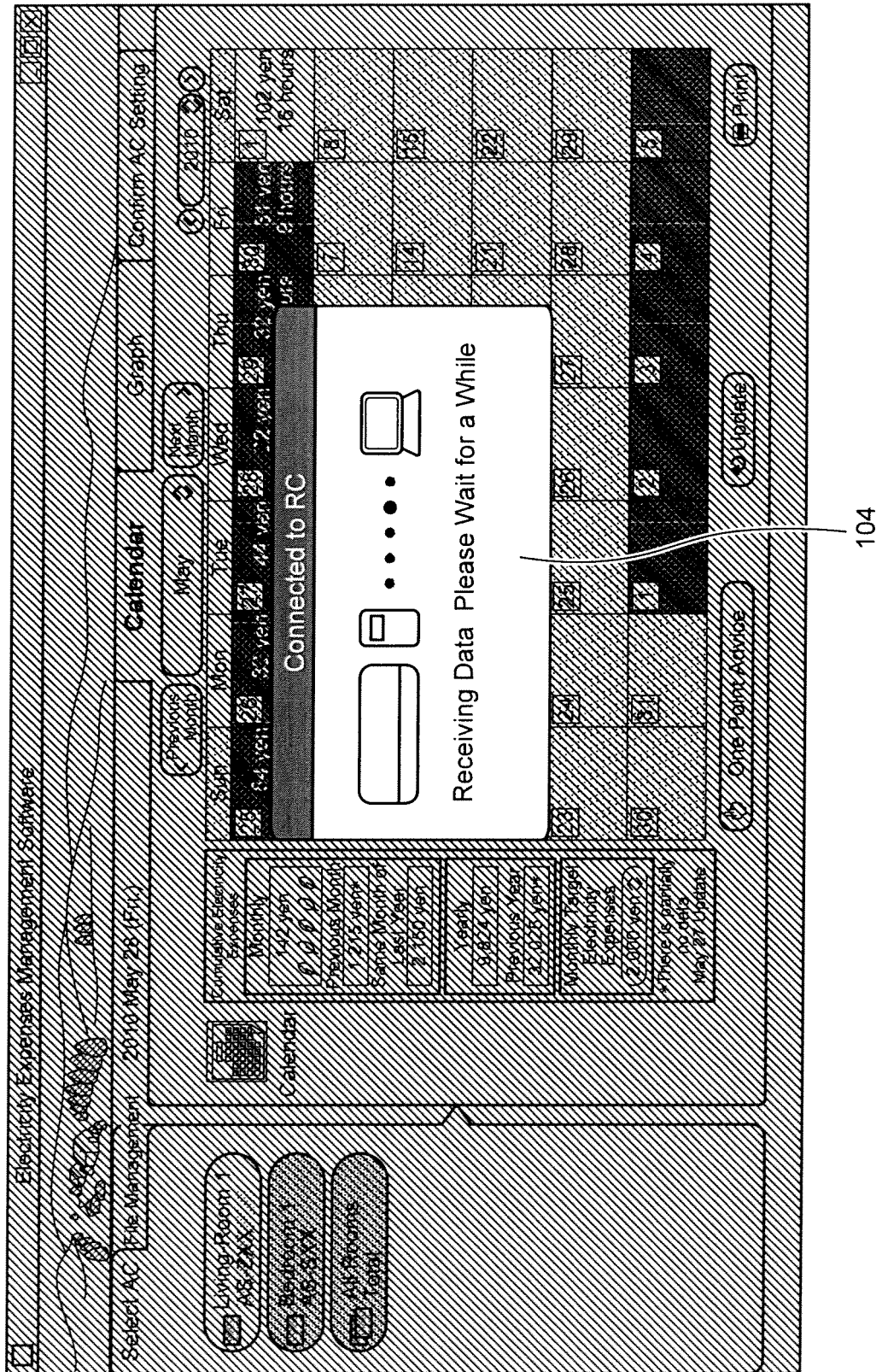


FIG.16

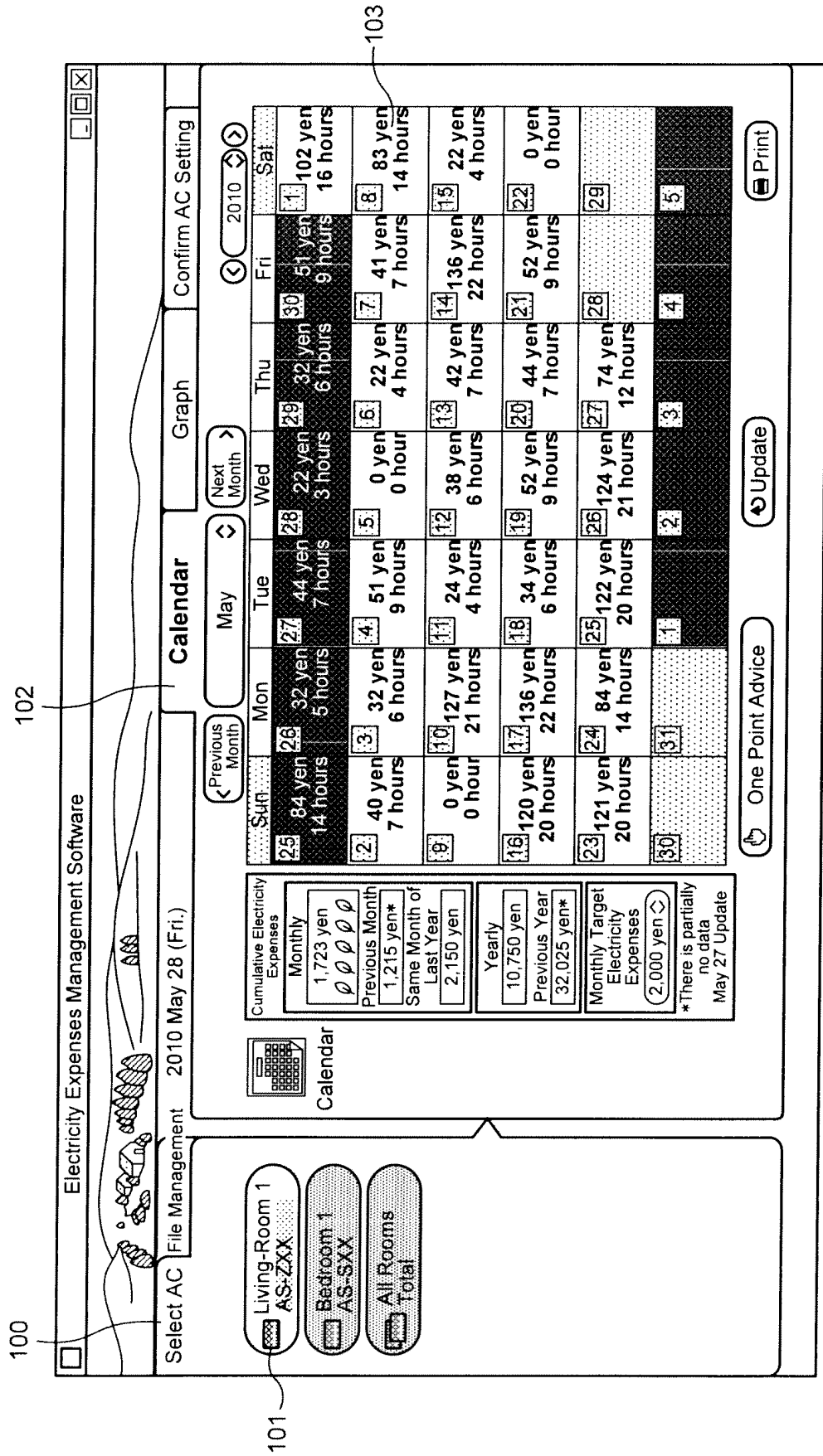


FIG.17

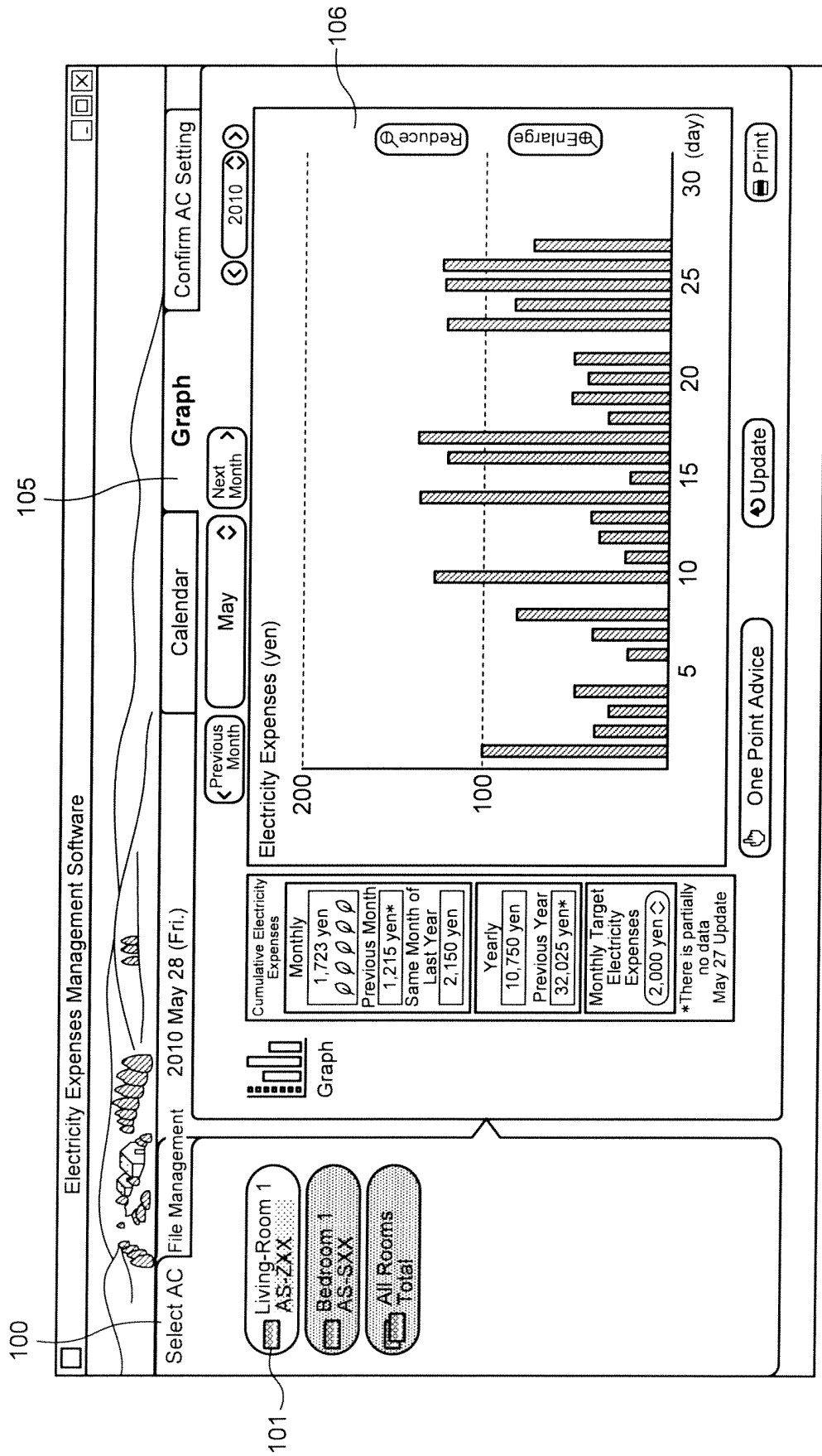


FIG. 18

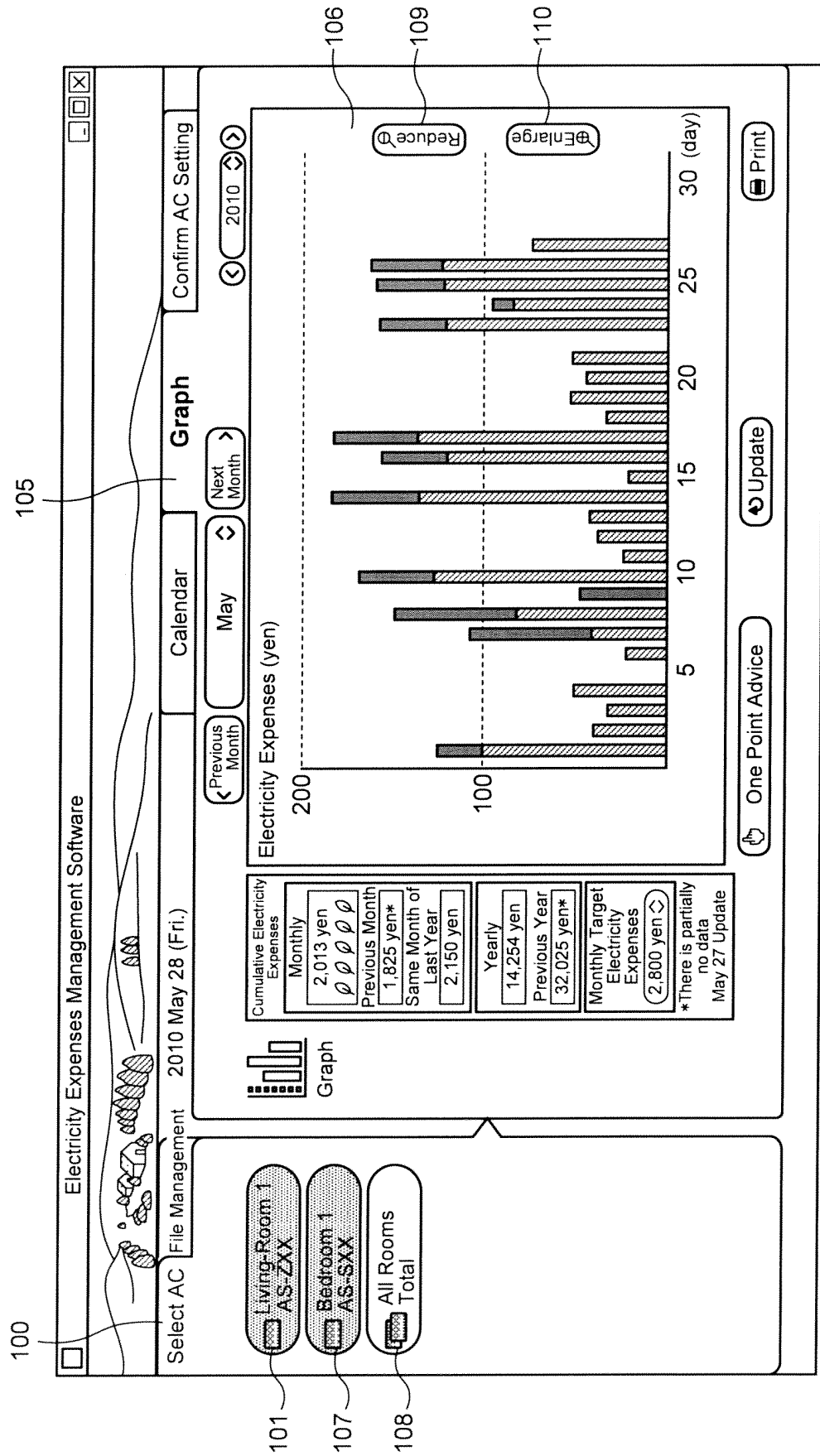


FIG.19

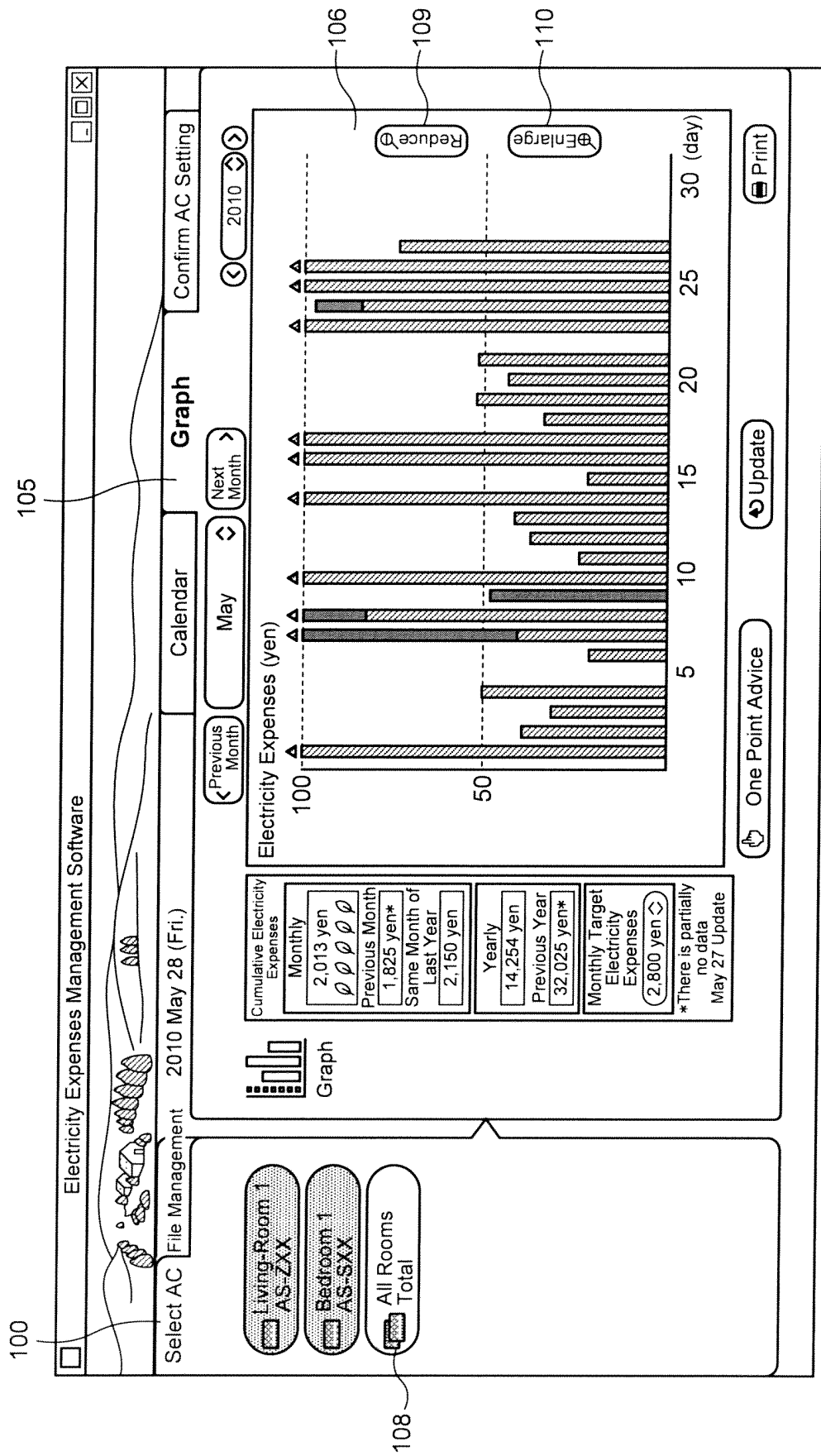


FIG.20

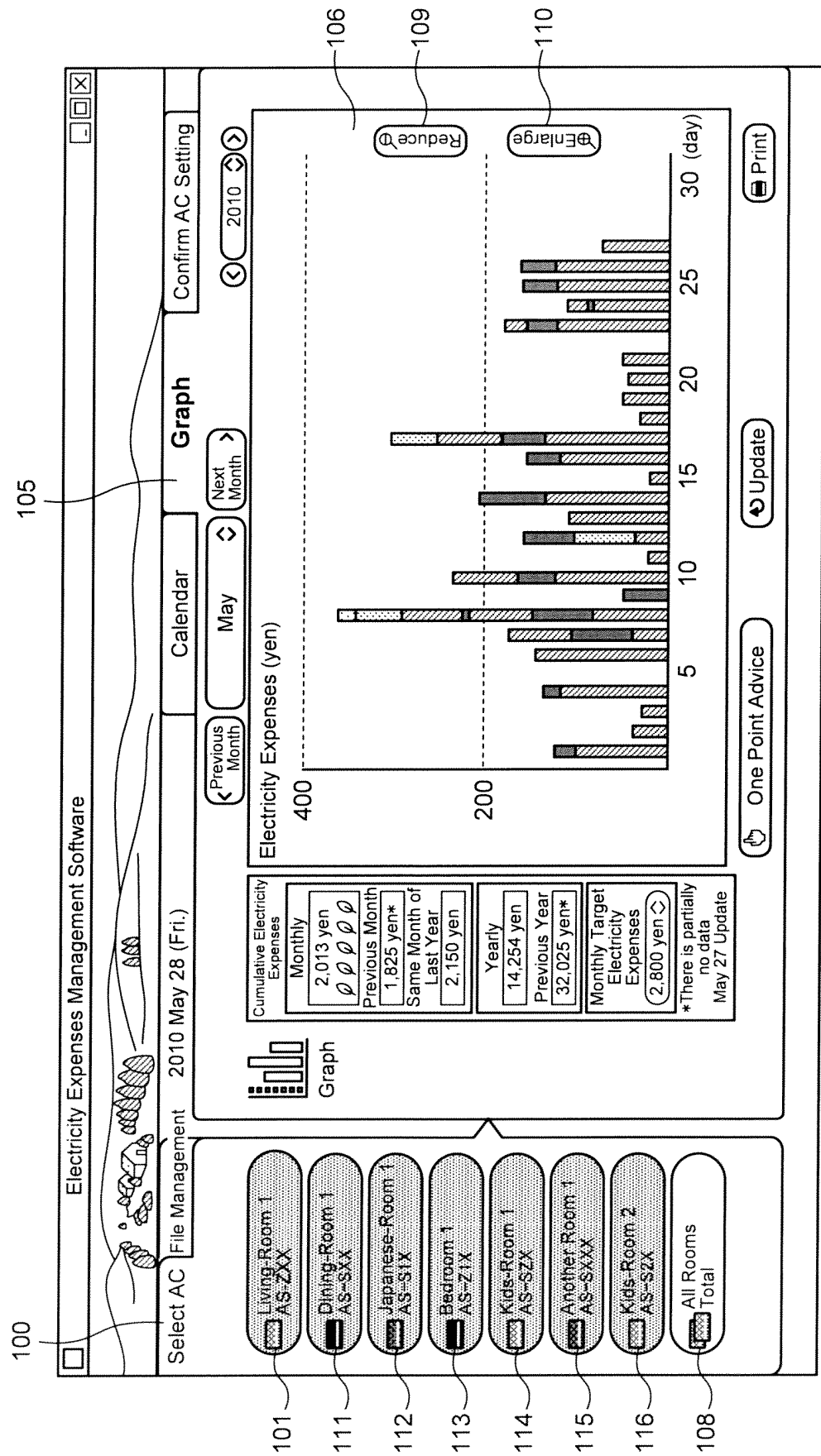


FIG.21

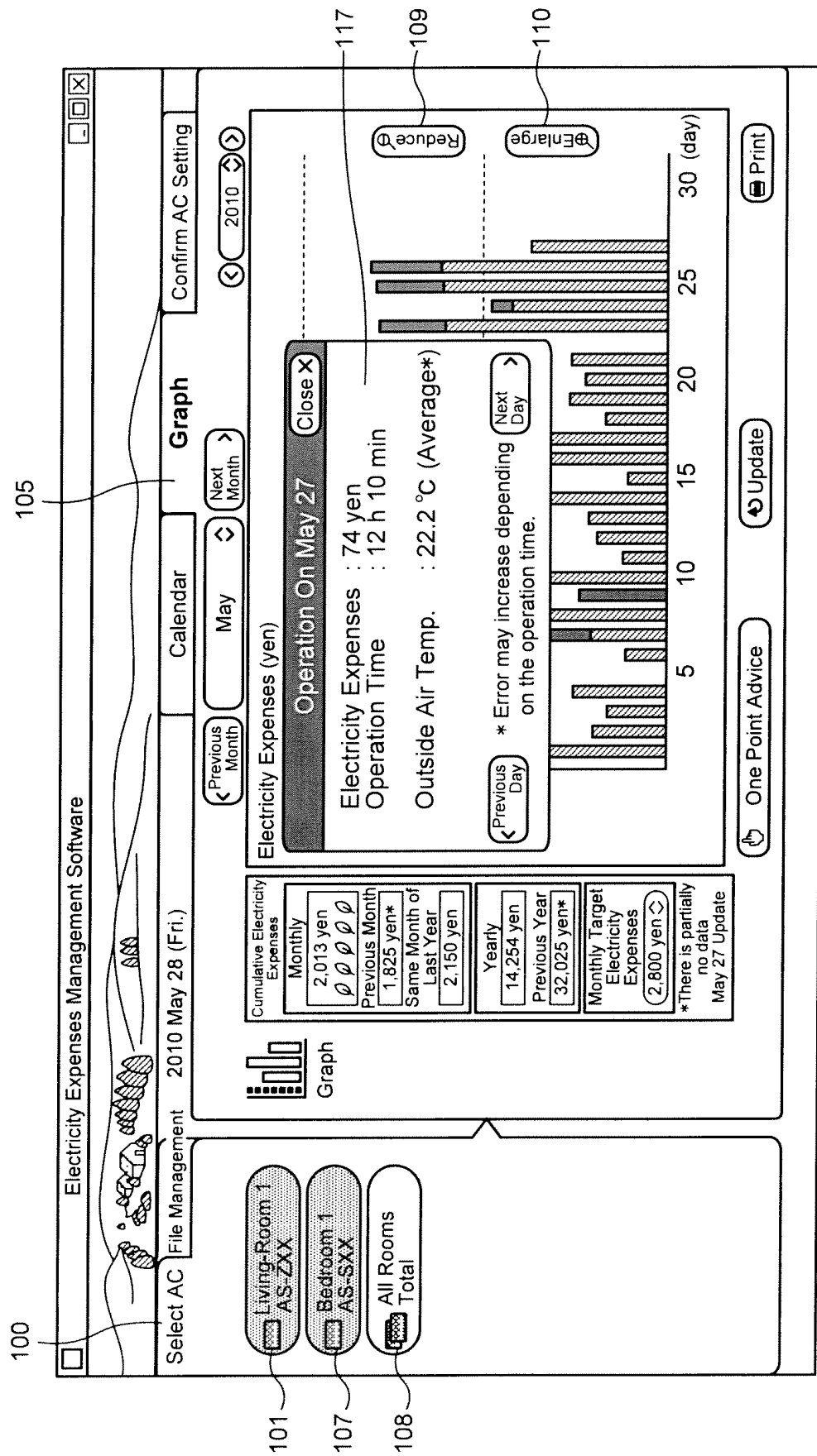


FIG.22

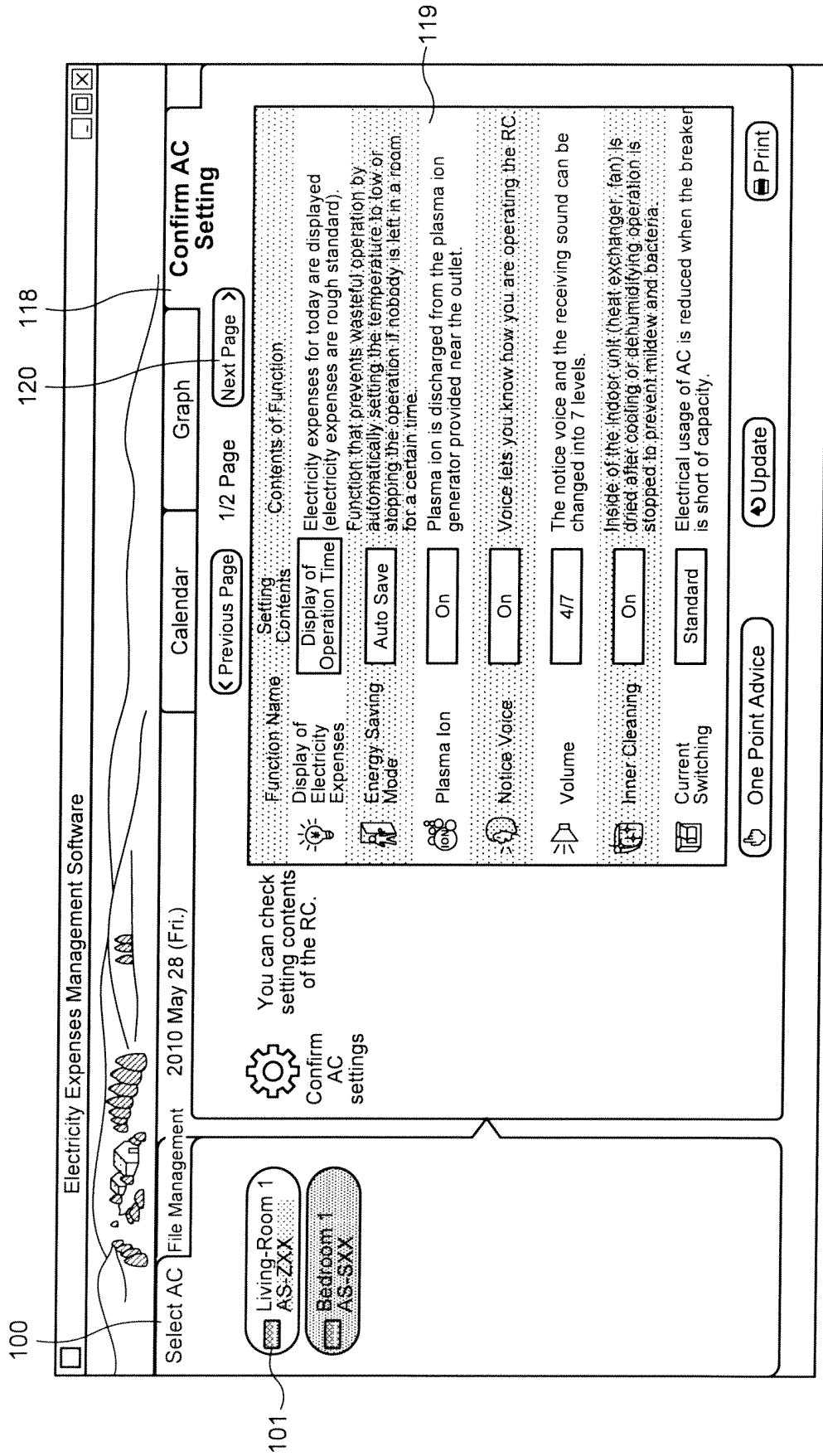


FIG.23

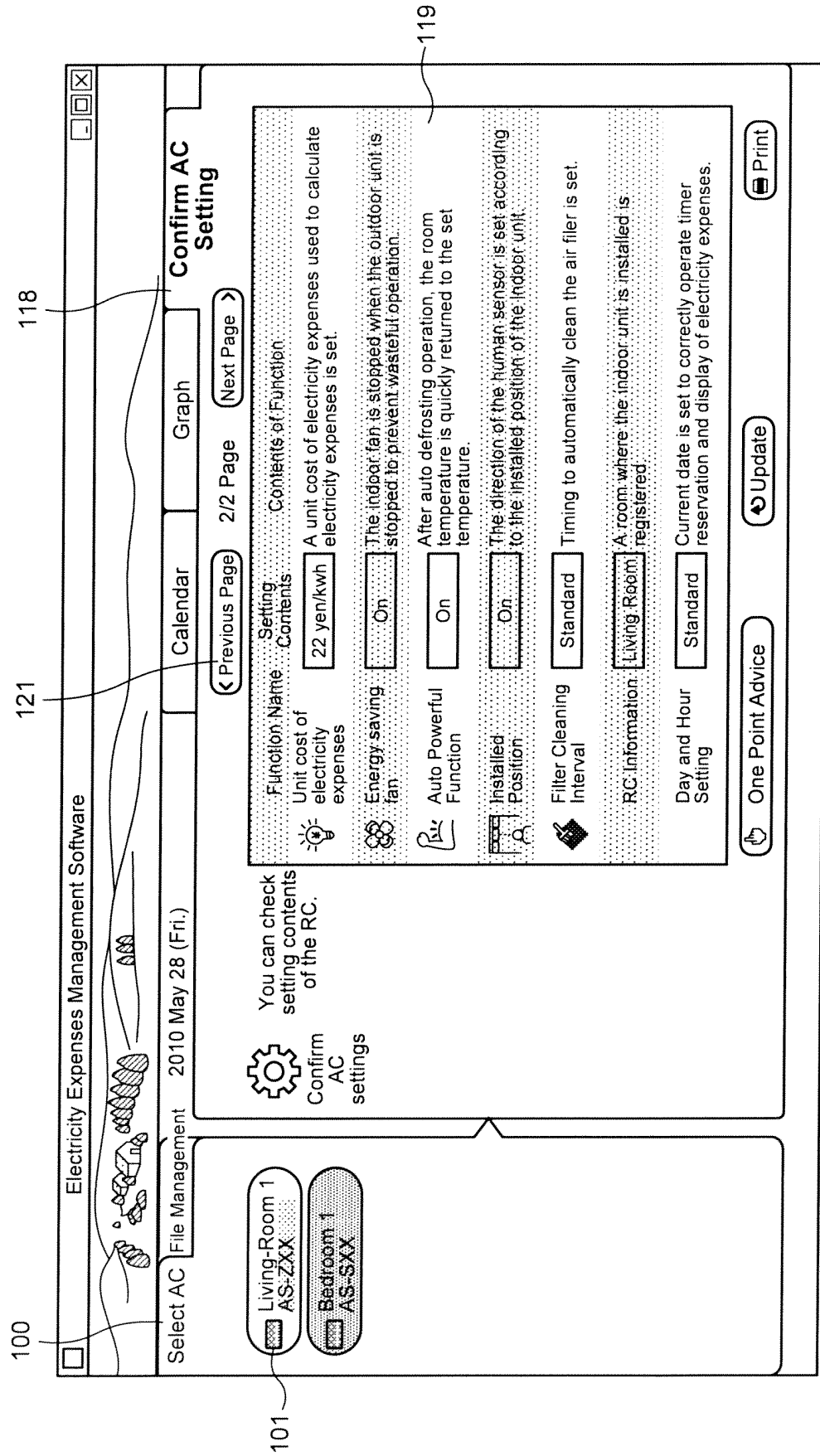


FIG. 24

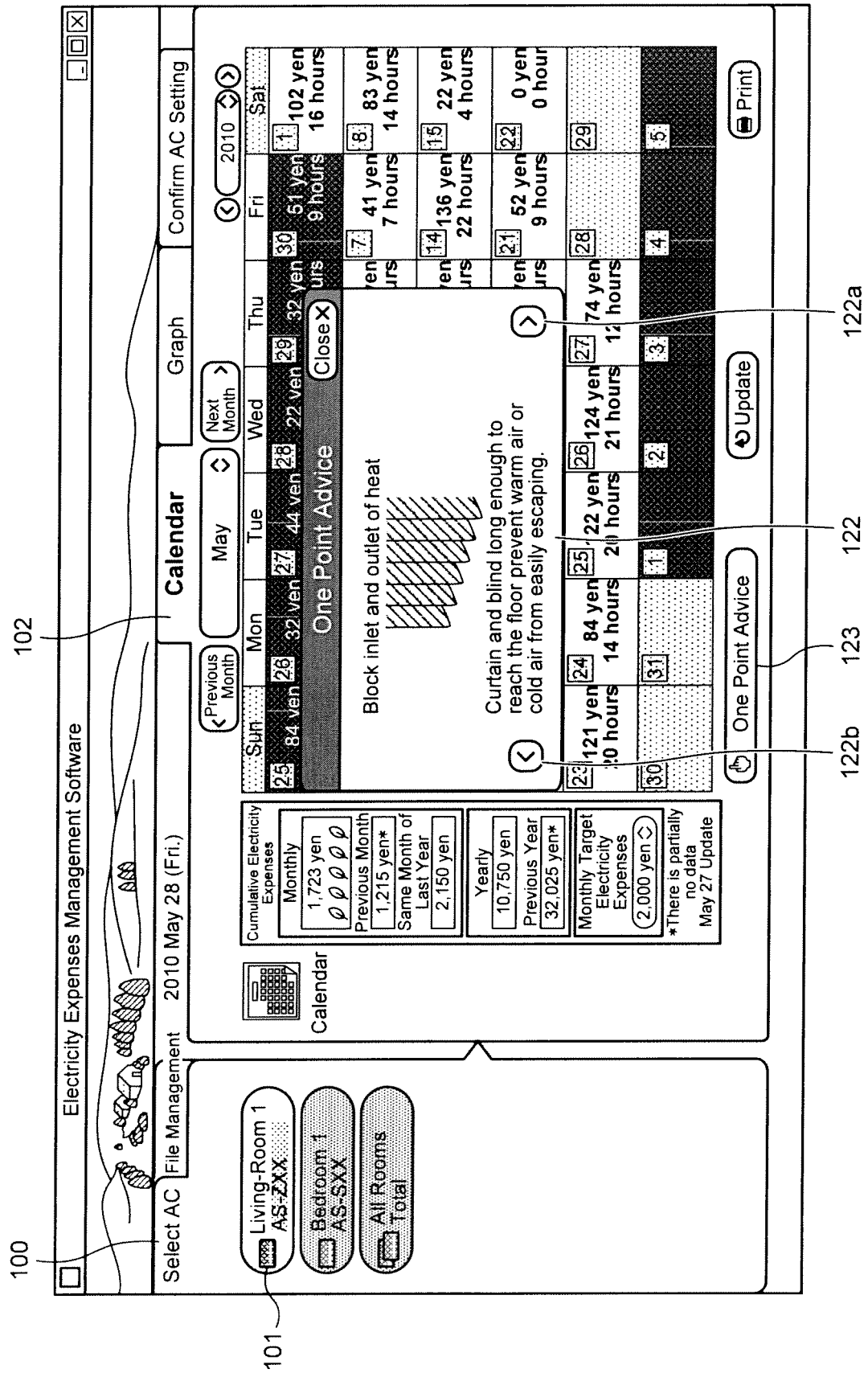


FIG. 25

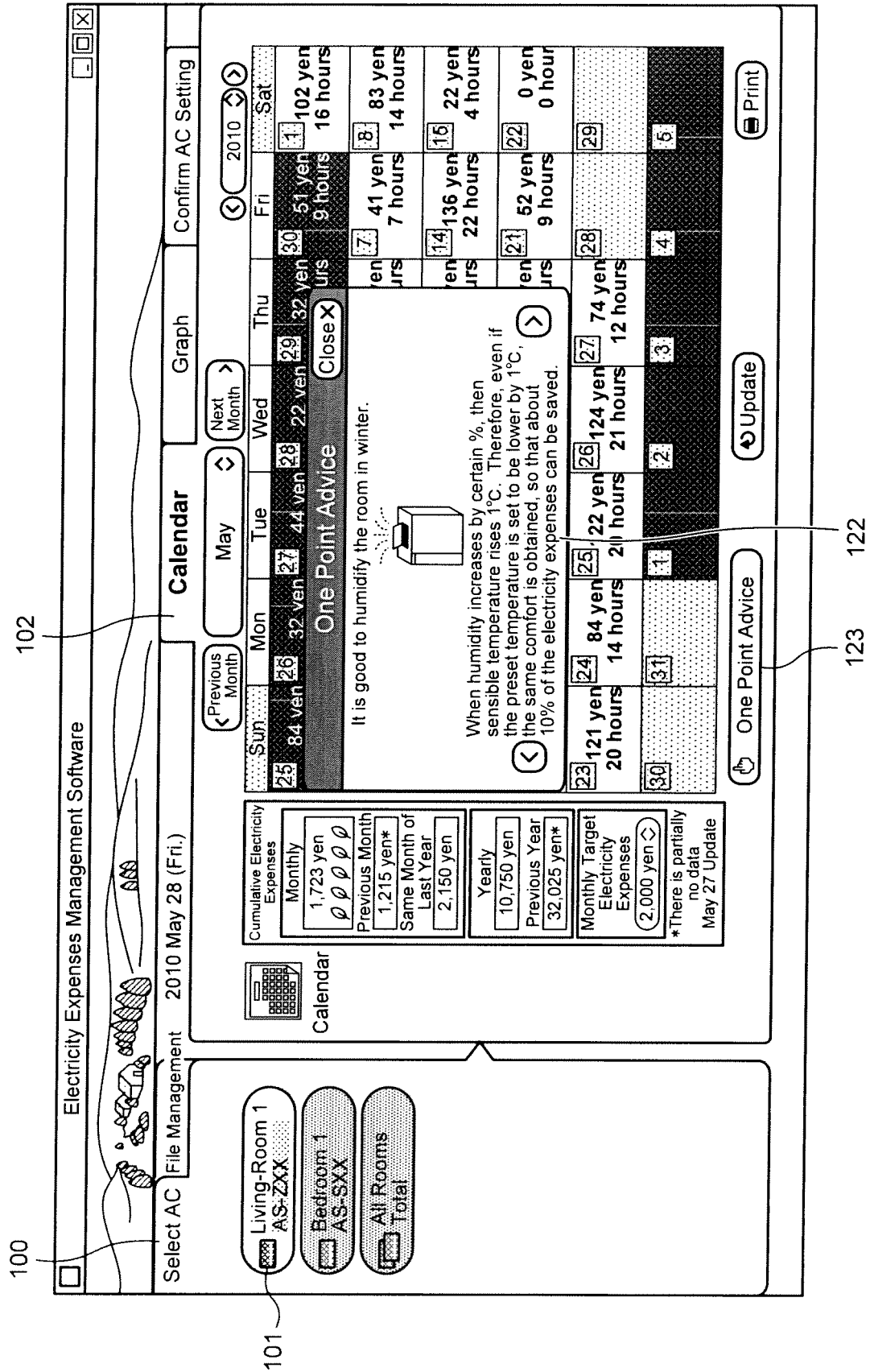


FIG.26

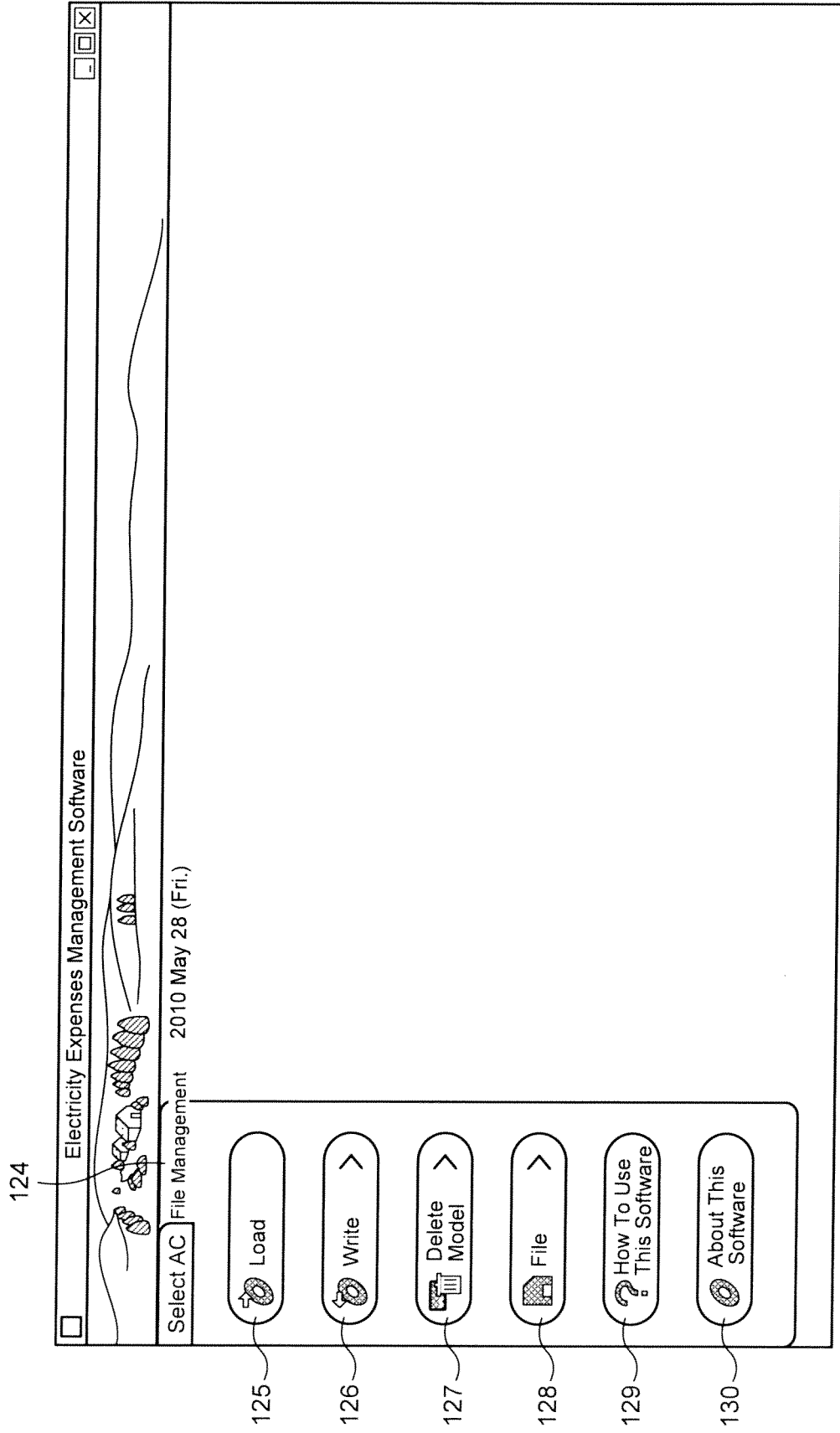


FIG.27

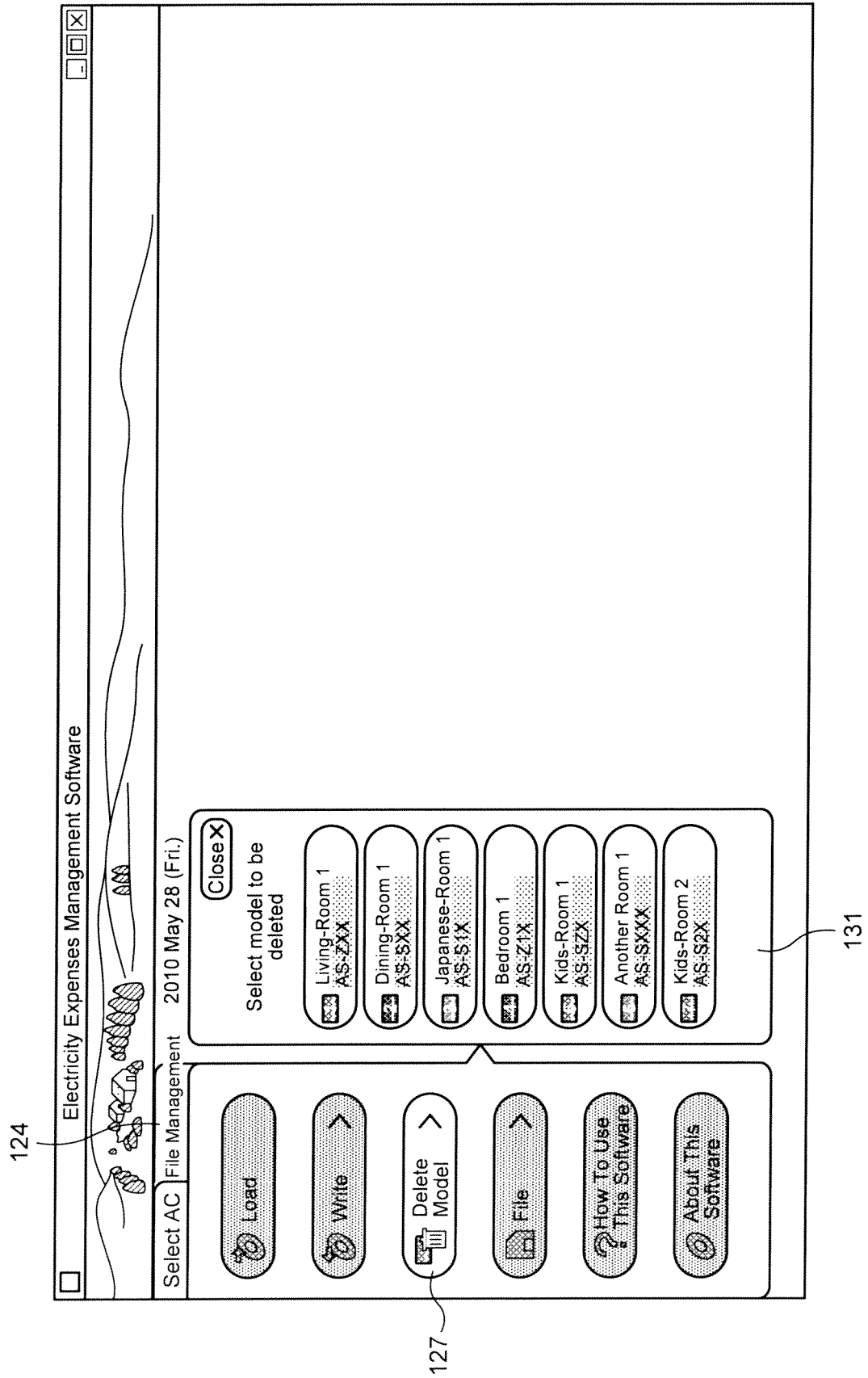


FIG.28

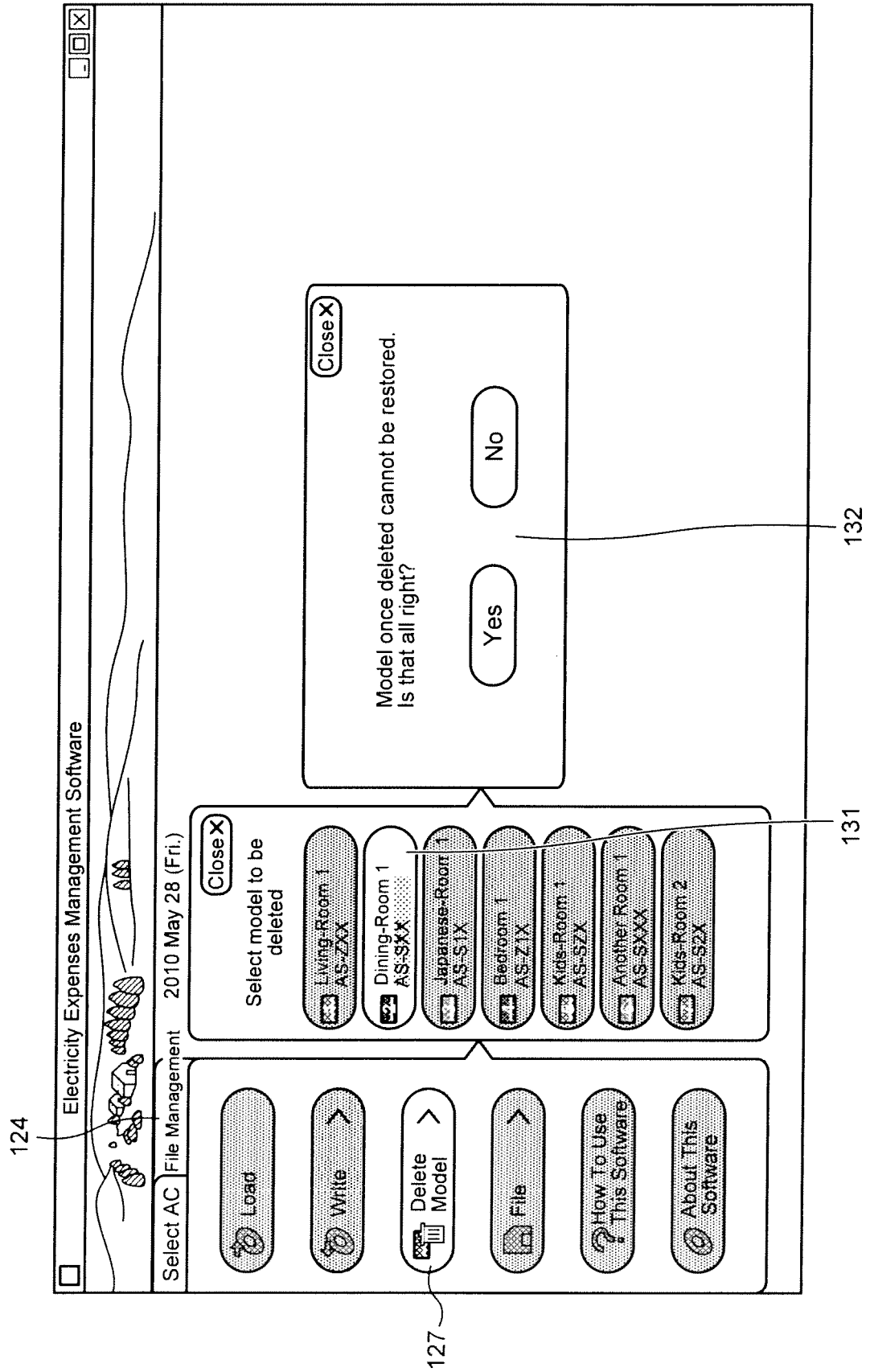
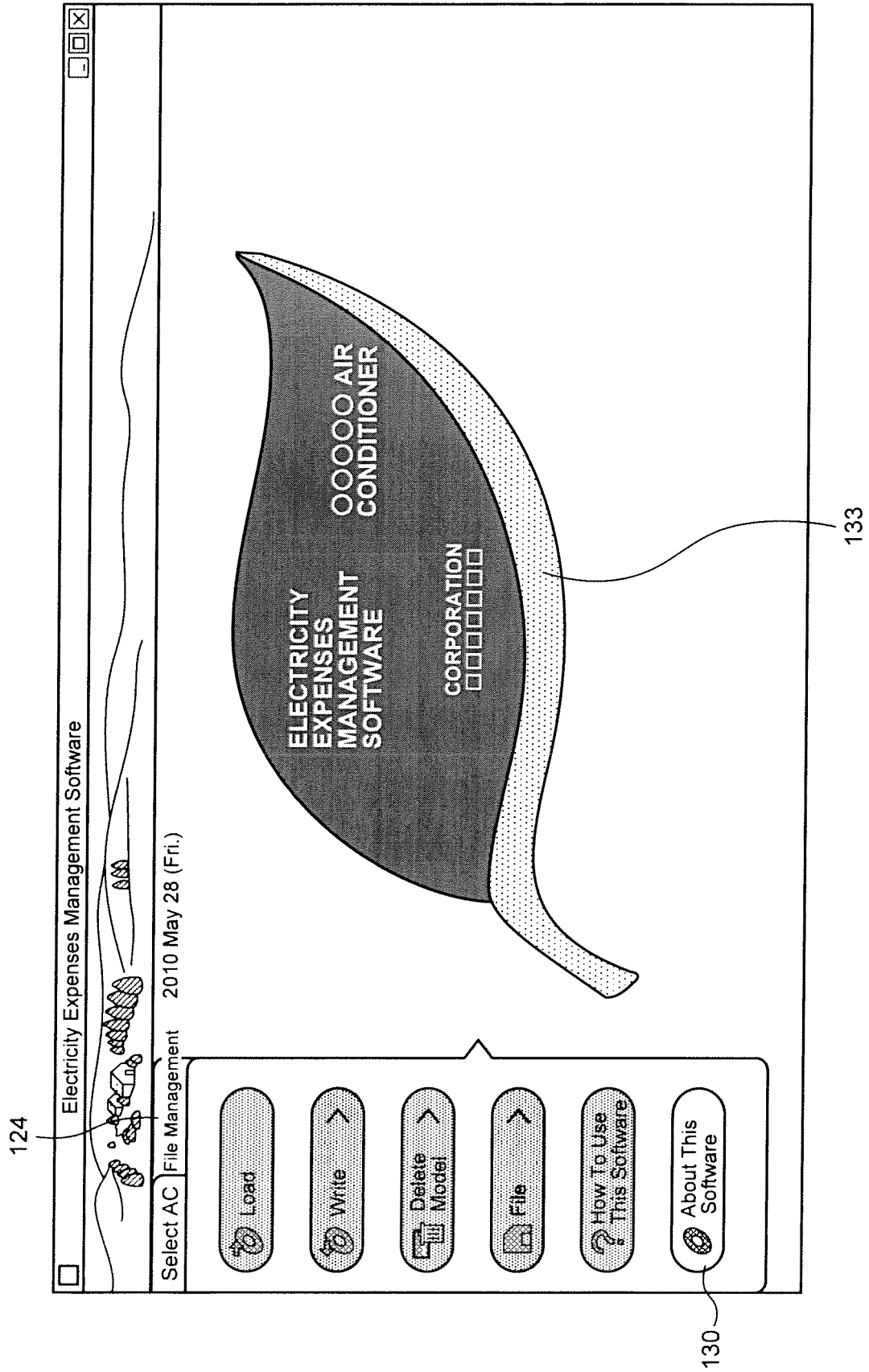


FIG.29



REFERENCES CITED IN THE DESCRIPTION

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