(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 043 330 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.07.2016 Bulletin 2016/28

(51) Int Cl.:
G08C 17/00 *(2006.01)*

(21) Application number: **15201445.2**

(22) Date of filing: **20.12.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **08.01.2015 JP 2015002022**
13.07.2015 JP 2015139438

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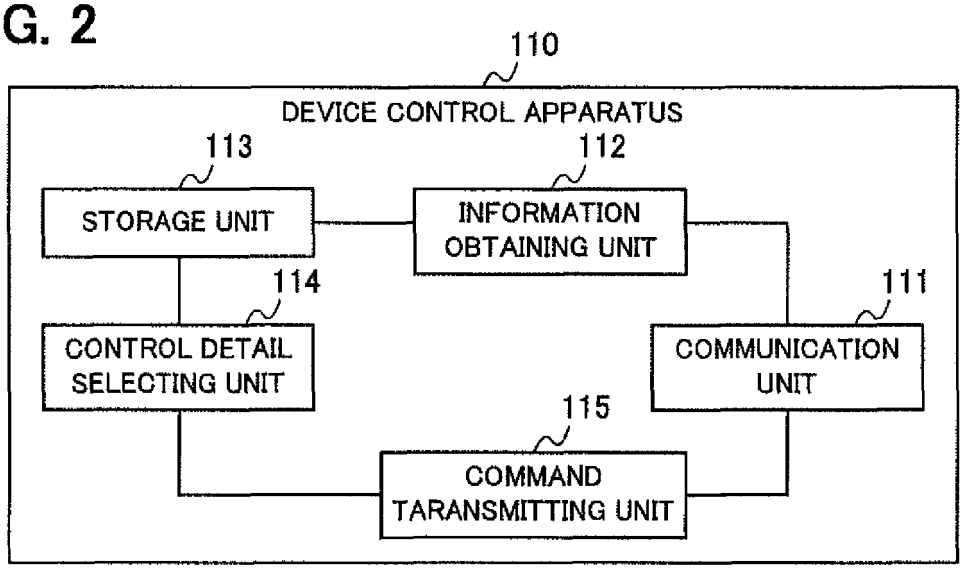
(54) DEVICE CONTROL APPARATUS AND DEVICE CONTROL SYSTEM

(57) In order to control a plurality of control target devices of different types automatically in a cooperative manner, a device control apparatus 110 includes: a storage unit 113 configured to store device control effect information indicating, for each of the control target devices, the control target device, a control detail, and an effect that is caused by the control detail of the control target device and can be sensed by a user who is present in the same space as the control target device; a control detail selecting unit 114 configured to select the control target device and the control detail that cause the effect of achieving a predetermined purpose, from among the plurality of control target devices, on the basis of the device control effect information; and a command transmitting unit 115 configured to transmit a device control command corresponding to the control detail selected by the control detail selecting unit 114, to the control target device selected by the control detail selecting unit 114.

FIG. 2



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Description

TECHNICAL FIELD

[0001] The present invention relates to a device control apparatus and a device control system, and particularly to a device control apparatus and a device control system that control one or more control target devices.

BACKGROUND ART

[0002] There are conventional control systems that control a plurality of devices in a cooperative manner. For example, an air conditioning system described in Japanese Patent Application Publication No. 2008-249233 sets data indicating operation target devices, operation details, operation conditions, and effective periods and performs remote control of air conditioning devices in accordance with the conditions indicated by the data.

SUMMARY OF THE INVENTION

[0003] However, the conventional control systems perform the cooperative control in accordance with the conditions that have been set manually in advance, so unless a large number of conditions are set, it is difficult to perform precise control according to fluctuation of its environment. In particular, in order to control cooperatively a large number of devices of different types, a huge number of combinations of conditions and control details should be considered, therefore manual setting is very difficult.

[0004] The present invention is made to solve the above problem and has a purpose to control a plurality of control target devices of different types automatically in a cooperative manner.

[0005] A device control apparatus according to the present invention includes: a storage unit configured to store device control effect information indicating, for each of a plurality of control target devices, the control target device, a control detail, and an effect that is caused by the control detail of the control target device and can be sensed by a user who is present in the same space as the control target device; a control detail selecting unit configured to select the control target device and the control detail that cause the effect of achieving a predetermined purpose, from among the plurality of control target devices, on the basis of the device control effect information; and a command transmitting unit configured to transmit a device control command corresponding to the control detail selected by the control detail selecting unit, to the control target device selected by the control detail selecting unit.

[0006] A device control system according to the present invention includes a plurality of control target devices and a device control apparatus that controls each of the plurality of control target devices. The device control apparatus includes: a storage unit configured to store device control effect information indicating, for each of the control target devices, the control target device, a control detail, and an effect that is caused by the control detail of the control target device and can be sensed by a user who is present in the same space as the control target device; a control detail selecting unit configured to select the control target device and the control detail that cause the effect of achieving a predetermined purpose, from among the plurality of control target devices, on the basis of the device control effect information; and a command transmitting unit configured to transmit a device control command corresponding to the control detail selected by the control detail selecting unit, to the control target device selected by the control detail selecting unit.

[0007] According to one aspect of the present invention, it is possible to control a plurality of control target devices of different types automatically in a cooperative manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a schematic diagram illustrating a configuration of a device control system according to a first embodiment.

FIG. 2 is a block diagram that schematically illustrates a configuration of a device control apparatus in the first embodiment.

FIG. 3 is a schematic diagram illustrating an example of device management information in the first embodiment.

FIG. 4 is a schematic diagram illustrating an example of device control effect information in the first embodiment.

FIG. 5 is a schematic diagram illustrating an example of a computer in the first embodiment.

FIG. 6 is a block diagram that schematically illustrates a configuration of a control target device in the first embodiment.

FIG. 7 is a flowchart illustrating a sequence of a process performed by the device control apparatus in the first embodiment.

FIG. 8 is a schematic diagram illustrating a configuration of a device control system according to a second embodiment.

FIG. 9 is a block diagram that schematically illustrates a configuration of a device control apparatus in the second embodiment.

FIG. 10 is a schematic diagram illustrating an example of target value information in the second embodiment.

FIG. 11 is a flowchart illustrating a sequence of a process performed by the device control apparatus in the second embodiment.

FIG. 12 is a schematic diagram illustrating a configuration of a device control system according to a third embodiment.

FIG. 13 is a block diagram that schematically illustrates a configuration of a device control apparatus in the third embodiment.

FIG. 14 is a schematic diagram illustrating an example of a first part of device control effect information in the third embodiment.

FIG. 15 is a schematic diagram illustrating an example of a second part of the device control effect information in the third embodiment.

FIG. 16 is a schematic diagram illustrating an example of person position information in the third embodiment.

FIG. 17 is a flowchart illustrating a sequence of a process performed by the device control apparatus in the third embodiment.

MODE FOR CARRYING OUT THE INVENTION

First Embodiment.

[0009] FIG. 1 is a schematic diagram illustrating a configuration of a device control system 100 according to the first embodiment.

[0010] The device control system 100 includes a device control apparatus 110 and one or more control target devices 130. In the first embodiment, the control target devices 130 are described as an air conditioner 130A, a television 130B, and a cooking heater 130C, but these are examples, so the control target devices 130 are not limited to these devices. The control target devices 130 may be any devices that can be operated remotely.

[0011] It is assumed that the device control apparatus 110 and each of the control target devices 130 are capable of communicating with each other. Specifically, means for performing communication is Ethernet (registered trademark), wireless LAN, or infrared communication, for example, but is not limited to these means. The means for performing communication may be any communication medium that is capable of transmitting device control commands as described later.

[0012] The device control apparatus 110 is capable of transmitting device control commands to each of the control target devices 130. The device control command indicates an execution instruction of a control detail such as a change of power supply status, drive mode, or setting information. For example, the air conditioner 130A uses control instructions such as "power supply ON", "power supply OFF", "drive mode cooling", "drive mode heating", "set temperature 28°C", and "set temperature 29°C", and these respective control instructions are assigned different device control commands.

[0013] In general, a device control command is an encoded value by which each of the control instructions can be identified. It is assumed that correspondence between each of the control instructions and each of the encoded values is determined in advance for each type of the control target devices 130.

[0014] The correspondence between each of the control instructions and each of the encoded values may be compliant with a standardized protocol such as ECHONET Lite (registered trademark), for example. Moreover, the correspondence between each of the control instructions and each of the encoded values may be shared only between the device control apparatus 110 and the control target devices 130 that constitute a specific device control system.

[0015] Determination of time points at which the device control apparatus 110 transmits device control commands, selection of the control target devices 130 as transmission targets, and selection of control instructions may be performed automatically in the device control apparatus 110, or may be performed in accordance with explicit instructions by a user.

[0016] When the user explicitly gives instructions, the user may operate a remote control. Besides, the device control apparatus 110 may be equipped with buttons for user's operation as well as the remote control and the device control commands corresponding to the buttons pressed by the user may be transmitted. Further, it is preferable that the device control apparatus 110 may also be equipped with a display device and the user may carry out operation interactively to select the control target device 130 as the target to which the device control command is transmitted and to select the control instruction.

[0017] Moreover, the device control apparatus 110 is capable of obtaining device status information indicating a status of the device, from each of the control target devices 130. The device status information includes a control detail such as a status of power supply, a drive mode, and setting information, information based on a value detected by a sensor equipped in the device, and so on. The device status information is a predetermined value for each type of the control target devices 130, like the device control commands.

[0018] When the device control apparatus 110 obtains the device status information from each of the control target devices 130, it can notify the user of the device status information and use the device status information for determining transmission of device control commands.

[0019] Next, the components of the device control apparatus 110 will be described.

[0020] FIG. 2 is a block diagram that schematically illustrates the configuration of the device control apparatus 110.

[0021] The device control apparatus 110 includes a communication unit 111, an information obtaining unit 112, a storage unit 113, a control detail selecting unit 114, and a command transmitting unit 115.

[0022] The communication unit 111 communicates with each of the control target devices 130. For example, the communication unit 111 transmits device control commands to the control target devices 130, and receives various types of information including the device status information from the control target devices 130. The medium used in the communication is, for example,

Ethernet, a wireless LAN, infrared communication, or the like, as described above.

[0023] The information obtaining unit 112 obtains information from each of the control target devices 130 via the communication unit 111. The information obtained by the information obtaining unit 112 includes device location information, device control command information, individual device control effect information, and device status information. In addition, the information obtaining unit 112 stores the obtained information in the storage unit 113.

[0024] The device location information is information indicating locations at which the respective control target devices 130 are installed. For example, the installed location is defined, as a unit, by a room such as a living room, a main bedroom, or a bathroom, in order to identify the control target devices 130 installed in the same room. For example, a unique number is assigned to each of the rooms, and the number assigned to each of the rooms in which the respective control target devices 130 are installed is used as the device location information.

[0025] Moreover, places narrower than the rooms may be used as units indicating installed locations for some control target devices 130. For example, a living room may be divided into a living room west side and a living room east side, in order to use them as units for the locations in which the control target devices 130 are installed. In this case, the sizes of the units may be different in such a manner that the device location information of one of the control target devices 130 indicates the living room and the device location information of another one of the control target devices 130 indicates the living room west side. In this case, a plurality of control target devices 130 having device location information indicating different unit sizes are present in the device control system 100.

[0026] If a plurality of items of device location information indicating different unit sizes are present, it is desirable that the hierarchical relationship of the device location information can be determined. The hierarchical relationship is a relationship indicating that if an area indicated by one item of the device location information includes an area indicated by another one item of the device location information, the one item of the device location information including the another is at a higher level than the another. For example, the living room west side is a divided part of the living room, therefore the living room includes the living room west side and the living room is at a higher level than the living room west side. In the same way, the living room is also at a higher level than the living room east side. Thus, a control target device 130 in the living room west side and a control target device 130 in the living room east side are identified to be installed in the same living room.

[0027] For example, hierarchical relationship information indicating the hierarchical relationship may be stored in the storage unit 113. In addition, the hierarchical relationship identifying information indicating the hierarchical relationship may be included in the device location information. Specifically, by adding hierarchical relationship identifying information indicating the device location information of a higher level to the device location information of a lower level, the hierarchical relationship is identified.

[0028] For example, by retaining the value that is input on installing each of the control target devices 130, the device control apparatus 110 is capable of obtaining the device location information.

[0029] The device control command information is information indicating a list of device control commands that each of the control target devices 130 process. For example, in the protocol of ECHONET Lite, information named SET property map, which corresponds to the device control command information, is prescribed. The device control apparatus 110 receives the SET property map from each of the control target devices 130, thereby obtaining a list of items of commands which the control target devices 130 can accept, such as power supply status and drive mode. Moreover, the device control command information may include codes that are transmitted as device control commands.

[0030] In addition, the first embodiment is configured to obtain the device control command information from each of the control target devices 130, but is not limited to this example. For instance, the device control apparatus 110 may obtain it by searching an external database on the basis of identification information such as a model number of each of the control target devices 130. Moreover, if the types of the control target devices 130 are fixed, the device control apparatus 110 may retain the information inside in advance.

[0031] As a rule, the device control command information is specific to a device and does not change. Hence, as to the timing of obtaining it, for example, it is sufficient to obtain it once when the device control apparatus 110 starts and thereafter each time the device control apparatus 110 finds a new control target device 130. Alternatively, each of the control target devices 130 may be configured to transmit the device control command information to the device control apparatus 110 on starting in order that the information obtaining unit 112 may receive it.

[0032] The device status information is information indicating the status of each of the control target devices 130, in other words, the control detail in each of the control target devices 130. That is, the device status information indicates the detail of control that each of the control target devices 130 is executing in accordance with a control instruction or a combination of control instructions. The device status information includes information such as a power supply status and a drive mode or information based on a value detected by a sensor equipped in the device, for example.

[0033] As to timing at which the information obtaining unit 112 obtains the device status information, it is acceptable to obtain it on a regular basis, such as at one

minute intervals, for example.

[0034] The individual device control effect information indicates, for each control detail, in the case where the control detail corresponding to a control instruction or a combination of control instructions according to one or more device control commands included in the device control command information is executed in accordance with a predetermined procedure, how much the effect of a control target device 130 changes as compared with before the control detail corresponding to the control instruction or the combination of control instructions is executed.

[0035] It is not necessary that the individual device control effect information includes all effects of the control details corresponding to the control instructions or the combinations of the control instructions, therefore it is acceptable that the effect of the control detail that does not change its effect even if it is executed is not included. Moreover, the individual device control effect information need not include the effect of a control detail that is unlikely to be executed in practice such as a control detail that causes an excessive change in temperature setting of an air conditioner or a sound volume of a television.

[0036] Here, the generated effects are effects that can be perceived by users in spaces where the control target devices 130 are installed; in the case of the air conditioner 130A, for example, the effects indicate a temperature change, noise, or the like, in a specific drive mode or temperature setting.

[0037] Moreover, the individual device control effect information may include information indicating whether the effect generated when the status of the control target device 130 is a specific status is a main effect or a side effect. The main effect is an effect that is intentionally generated when the control target device 130 is in the specific status. Moreover, the side effect is an effect that is generated unintentionally in the specific status.

[0038] For example, in the case of the air conditioner 130A, when the drive mode is cooling, absorbing heat is intended and therefore the effect of heat absorption is the main effect. On the other hand, the effect of sound emission in working the air conditioner 130A is not intended and therefore it is the side effect.

[0039] The storage unit 113 stores information that is necessary for the processes in the device control apparatus 110. For example, the storage unit 113 stores the device location information, the device control command information, and the individual device control effect information which are obtained by the information obtaining unit 112. In the first embodiment, the storage unit 113 stores the device control effect information and device management information including the device location information and the device control command information. The device control effect information is information in which all items of the individual device control effect information are gathered.

[0040] FIG. 3 is a schematic diagram illustrating an example of the device management information.

[0041] As illustrated in the drawing, the device management information 150 is information in the form of a table including a device name field 150a, a device address field 150b, a device location information field 150c, and a device control command information field 150d.

[0042] The device name field 150a stores device names as control target device identification information for identifying the control target devices 130.

[0043] The device address field 150b stores communication addresses, for example, IP addresses, of the control target devices 130.

[0044] The device location information field 150c stores the device location information indicating locations (spaces) in which the control target devices 130 are installed. The device location information field 150c stores the device location information obtained by the information obtaining unit 112.

[0045] The device control command information field 150d stores information indicating details of device control commands that are to be transmitted to the control target devices 130. For example, the device control command information field 150d includes an item field 150e and a control instruction field 150f.

[0046] The item field 150e stores items that are controlled by the device control commands.

[0047] The control instruction field 150f stores information indicating control instructions that are to be transmitted as the device control commands. These control instructions instruct individual controls that are to be executed by the control target devices 130.

[0048] In addition, the device control command information field 150d stores the device control command information obtained by the information obtaining unit 112.

[0049] FIG. 4 is a schematic diagram illustrating an example of the device control effect information.

[0050] As illustrated in the drawing, the device control effect information 151 is information in the form of a table including a device name field 151a, a control detail field 151b, and an effect field 151c.

[0051] The device name field 151a stores the device names of the control target devices 130.

[0052] The control detail field 151b stores control details in the control target devices 130. The control detail indicates one or more control details to be executed in accordance with the control instructions or the combinations of control instructions.

[0053] The effect field 151c stores information relevant to effects according to the control target devices 130 identified in the device name field 151a and the control details identified in the control detail field 151b.

[0054] The effect field 151c includes a heat generation field 151d, a heat absorption field 151e, a sound emission field 151f, a main effect field 151g, and a side effect field 151h.

[0055] The heat generation field 151d stores heat generation amounts as physical quantities of the effects according to the control target devices 130 identified in the device name field 151a and the control details identified

in the control detail field 151b.

[0056] The heat absorption field 151e stores heat absorption amounts as physical quantities of the effects according to the control target devices 130 identified in the device name field 151a and the control details identified in the control detail field 151b.

[0057] The sound emission field 151f stores sound volumes as physical quantities of the effects according to the control target devices 130 identified in the device name field 151a and the control details identified in the control detail field 151b.

[0058] The main effect field 151g stores information indicating main effects according to the control target devices 130 identified in the device name field 151a and the control details identified in the control detail field 151b.

[0059] The side effect field 151h stores information indicating side effects according to the control target devices 130 identified in the device name field 151a and the control details identified in the control detail field 151b.

[0060] In FIG. 4, heat generation, heat absorption, and sound emission are shown as examples for the effects (main effects or side effects), but this examples are not limitations. As other examples of the effects, light emission, ventilation, dehumidification, humidification, and the like are given. In these examples, the physical quantity of the effect is light intensity generated by a light source, the amount of ventilation by a ventilation fan, a change in the amount of water vapor due to dehumidification or humidification and the like.

[0061] In addition, for example, the noise generated by the air conditioner 130A possibly differs depending on the temperature in the room, even in the same drive mode. Moreover, even if the same temperature is set, the effect differs due to the difference in the drive mode. Therefore, it is desirable that the physical quantities included in the device control effect information 151 are values variable depending on the situation.

[0062] It is desirable that a time point at which the information obtaining unit 112 obtains individual device control effect information is a time point that makes it possible to follow the variations in the individual device control effect information according to the situation as properly as possible. For example, it is desirable that the obtaining is performed on a regular basis, such as at one minute intervals or that the obtaining is performed immediately before the control detail selecting unit 114, described later, selects a control detail. Alternatively, each of the control target devices 130 may transmit a notification to the device control apparatus 110 when the individual device control effect information relevant to each of the control target devices 130 changes, and then the information obtaining unit 112 may obtain the individual device control effect information at that time point.

[0063] To return to FIG. 2, the control detail selecting unit 114 selects a control target device 130 to which a device control command is to be transmitted and a control detail that is to be transmitted at a predetermined time point on the basis of the device management information 150 and the device control effect information 151 stored in the storage unit 113. An example of a time point and a selection method of selecting these will be described later.

[0064] The command transmitting unit 115 transmits, via the communication unit 111, the device control command according to the control detail selected by the control detail selecting unit 114 to the control target device 130 selected by the control detail selecting unit 114.

<Selection Method of Control Target Device 130 and Control Detail>

[0065] Here, an example of a method of selecting the control detail performed by the control detail selecting unit 114 will be described. The control detail selecting unit 114 selects a control target device 130 and a control detail, for the purpose of making the environment perceived by a person comfortable.

[0066] As one example, processes of the control detail selecting unit 114 when the device control apparatus 110 controls the air conditioner 130A will be described.

[0067] First, the control detail selecting unit 114 obtains device status information to monitor whether the device status (control detail) changes.

[0068] Here, for example, it is assumed that the user turns on the power supply of the cooking heater 130C manually and that the power supply status included in the device status information changes. At this time, the control detail selecting unit 114 obtains a side effect that is caused when the power supply of the cooking heater 130C is changed to *ON*, with reference to the device management information 150 and the device control effect information 151 stored in the storage unit 113.

[0069] For example, it is assumed that the device control effect information specifies that the side effect corresponding to the control detail of turning on the power supply of the cooking heater 130C is heat generation and the heat generation amount is 150 kcal/h.

[0070] On the assumption that the environment in the space is in a thermal equilibrium state, if it is left as it is, the temperature in the space will rise due to the heat generation of 150kcal/h. Hence, the same amount of heat needs to be absorbed by air conditioning or the like, in order to keep the environment in the space in a comfortable state.

[0071] Thus, the control detail selecting unit 114 identifies one or more control target devices 130 in the same space where the cooking heater 130C which is the effect generation source is installed, with reference to the device management information. Then, the control detail selecting unit 114 searches for a control target device 130 and a control detail having the effect for absorbing the heat quantity, with reference to the device control effect information corresponding to the one or more control target devices 130 that are identified.

[0072] For example, if the device control effect information specifies, as an effect caused when the power

supply status of the air conditioner 130A is changed to *ON,* that the heat quantity of 150kcal/h is absorbed, it is possible to cancel the side effect of the cooking heater 130C and to keep the thermal equilibrium in the space by transmitting the device control command of the control detail changing the power supply status of the air conditioner 130A to *ON.*

[0073] Thus, the control detail selecting unit 114 determines to transmit to the air conditioner 130A the device control command corresponding to the control detail of changing the power supply status to *ON.*

[0074] The above is an example of the selection of the control target device 130 and the control detail by the control detail selecting unit 114.

[0075] Although, in this example, the purpose of control is to cancel the side effect of heat generation in order to keep the thermal equilibrium, it is also conceivable that when the user is watching a television 130B, control is performed to decrease noise that is generated from another control target device 130 or to turn up the sound volume of the television 130B, for example. Moreover, if a hot-water floor heating system is included in the control target devices 130, for example, it is also conceivable that when the power supply status of an air conditioner 130A is changed to *ON,* in order to intensify its main effect, control is performed to make the power supply status of the hot-water floor heating system *ON.*

[0076] Control methods performed by the control detail selecting unit 114 as described above are generalized and summarized in three patterns described below:

(1) To cancel a side effect generated by a certain control target device 130, by generating, from another control target device 130, a main effect that works in the opposite direction to the side effect generated by the certain control target device 130;

(2) To reinforce a main effect generated by a certain control target device 130, by generating, from another control target device 130, a main effect that works in the same direction as the main effect generated by the certain control target device 130; and

(3) In order that a side effect generated by a certain control target device 130 does not hinder a main effect generated by another control target device 130, to weaken the side effect generated by the certain control target device 130 or reinforce the main effect generated by the another control target device 130.

[0077] By performing such control, it is possible to automatically perform control to cancel an influence from the space due to a change in the status of the device and to keep the space comfortable for users.

[0078] In the above example, the control detail selecting unit 114 selects the control detail when the device status information changes, but this time point is exemplary and not limiting. Various other time points are also conceivable; for example, it may be performed on a regular basis such as once in ten minutes, it may be performed in response to a request from the user or the outside, or the like.

[0079] Moreover, when there are a plurality of combinations of a control target device 130 and a control detail that generate the same effect, the control detail selecting unit 114 needs to select from the plurality of combinations. In this case, the combination of the smallest physical quantity may be selected from among the combinations having the main effect of the physical quantity capable of canceling the physical quantity of the side effect in the device control effect information 151, for example. Further, if there are a plurality of combinations of the smallest physical quantity, the one having the smallest side effect or the one having the smallest electric power consumption may be selected. Further, when there are a plurality of combinations even after using the side effect or the electric power consumption, the one closest to the top of the device control effect information 151 may be selected. In addition, if priorities are set to the combinations in advance, the one having the highest priority may be selected. In this case, the information obtaining unit 112 may obtain the electric power consumption when the control detail of a device is changed to a specific control detail according to a device control command, in addition to the individual device control effect information, for example.

[0080] For example, the above-described device control apparatus 110 may be configured by a widely used computer 900 illustrated in FIG. 5, including a central processing unit (CPU) 901, a memory 902, an external storage device 903 such as a hard disk drive (HDD), a reader/writer device 905 that reads information from and writes information into a portable storage medium 904 such as a compact disk (CD) or a digital versatile disk (DVD), an input device 906 such as a keyboard and a mouse, an output device 907 such as a display, and a communication device 908 such as a network interface card (NIC) for connecting to a communication network.

[0081] For example, the storage unit 113 is configured by the memory 902 or the external storage device 903 utilized by the CPU 901; the information obtaining unit 112, the control detail selecting unit 114, and the command transmitting unit 115 are configured by the CPU 901 loading predetermined programs stored in the external storage device 903 into the memory 902 and executing them; and the communication unit 111 is configured by the communication device 908 utilized by the CPU 901.

[0082] These predetermined programs may be downloaded to the external storage device 903 from the storage medium 904 via the reader/writer device 905 or a network via the communication device 908, and then loaded onto the memory 902 to be executed by the CPU 901. Alternatively, they may be loaded directly onto the memory 902 from the storage medium 904 via the reader/writer device 905 or the network via the communication device 908 to be executed by the CPU 901.

[0083] However, the device control apparatus 110 is

not limited to a computer system executing software. For example, the device control apparatus 110 may be configured as hardware with a high density logic IC such as an application specific integrated circuit (ASIC) and a field programmable gate array (FPGA), or may be configured as software as a digital signal processor (DSP) or the like. Alternatively, components specialized for specific uses may be configured by hardware such as extension boards mounted on a computer system, while other general-purpose components may be configured by the computer system executing software.

[0084] FIG. 6 is a block diagram that schematically illustrates the configuration of the control target device 130.

[0085] The control target device 130 includes a communication unit 131, a storage unit 132, a function unit 133, and a control unit 134.

[0086] The communication unit 131 communicates with the device control apparatus 110. For example, the communication unit 131 receives device control commands from the device control apparatus 110 and transmits various types of information including the device status information to the device control apparatus 110. The medium used for the communication is, for example, Ethernet, wireless LAN, infrared communication, or the like, as described above.

[0087] The storage unit 132 stores information that is necessary for the processes of the control target device 130. For example, the storage unit 132 stores the device location information, the device control command information, and the individual device control effect information of the control target device 130.

[0088] The function unit 133 is a part that executes function as the control target device 130. For example, if the control target device 130 is the air conditioner 130A, the function unit 133 executes the function of controlling an air temperature. Moreover, if the control target device 130 is the television 130B, the function unit 133 executes the function of receiving a broadcast signal and outputting images. Further, if the control target device 130 is the cooking heater 130C, the function unit 133 executes the function of heating.

[0089] The control unit 134 controls processes in the control target device 130. For example, the control unit 134 causes the communication unit 131 to transmit various types of information stored in the storage unit 132. Moreover, the control unit 134 generates device status information indicating the status of the function unit 133 and causes the communication unit 131 to transmit it. Further, the control unit 134 obtains device control commands received by the communication unit 131 and sets up the function unit 133 in accordance with its control details.

[0090] The storage unit 132 is configured by a memory or an external memory device utilized by a CPU, and the control unit 134 is configured by the CPU loading into a memory predetermined programs stored in an external memory device and executing them, and the communication unit 131 is configured by a communication device utilized by the CPU, for example. However, the control unit 134 may be configured as hardware with a high density logic IC such as an ASIC and an FPGA, or may be configured as software by a DSP or the like, for example.

[0091] Next, processes from determining a control detail until transmitting a control command by the device control apparatus 110 will be described in detail.

[0092] FIG. 7 is a flowchart illustrating the sequence of the processes performed by the device control apparatus 110.

[0093] First, the information obtaining unit 112 obtains device status information from all the control target devices 130 that constitute the device control system 100 (S10).

[0094] Then, the control detail selecting unit 114 determines whether a change in the control detail of each of the control target device 130 has occurred (S11). For example, the control detail selecting unit 114 performs this determination by storing in the storage unit 113 the device status information transmitted previously by each of the control target device 130. If a change has occurred (Yes in S11), the process proceeds to step S12, and if no change has occurred (No in S11), the processes end.

[0095] In step S12, the control detail selecting unit 114 searches the device control effect information 151 stored in the storage unit 113 for a side effect that is caused by the control detail after the change detected in step S11. Specifically, the control detail selecting unit 114 obtains the side effect corresponding to the control detail after the change from the device control effect information 151.

[0096] Then, the control detail selecting unit 114 determines whether or not the side effect is obtained in step S12 (S13). For example, if the side effect corresponding to the control detail after the change does not exist in the device control effect information 151, no side effect can be obtained. If the side effect is obtained (Yes in S13), the process proceeds to step S14, and if the side effect is not obtained (No in S13), the processes end.

[0097] In step S14, the control detail selecting unit 114 searches the device management information 150 and the device control effect information 151 stored in the storage unit 113 for a combination of a control detail that can generate the main effect for canceling the side effect obtained in step S12 and a control target device 130 that is in the same space where the generation source of this side effect is installed.

[0098] A main effect capable of cancelling a side effect differs depending on the types of the effects. For example, paired-type effects can cancel each other, e.g. heat absorption and heat generation. Moreover, in the case of sound emission, it is possible to make the side effect less noticeable by intensifying another main effect. That is, it is assumed that the main effect capable of cancelling the side effect is determined for each side effect in advance, and information indicating such a main effect is stored in advance in the memory unit 113.

[0099] Next, the control detail selecting unit 114 deter-

mines whether or not there is the combination of the control target device 130 and the control detail that generates the main effect capable of canceling the side effect obtained in step S12 (S15). If there is the combination (Yes in S15), the process proceeds to step S16, and if there is not the combination (No in S15), the processes end.

[0100] In step S16, the control detail selecting unit 114 determines whether or not there are two or more combinations that generate the main effect capable of canceling the side effect obtained in step S12. If there are two or more combinations (Yes in S16), the process proceeds to step S17, and if there is one combination (No in S16), the process proceeds to step S18.

[0101] In step S17, the control detail selecting unit 114 selects one combination from among the combinations that generate the main effect capable of canceling the side effect obtained in step S12. The way to select is as described above. Then, the process proceeds to step S18.

[0102] In step S18, the command transmitter unit 115 transmits, to the control target device 130 as a target via the communication unit 111, a device control command or a combination of device control commands corresponding to the control detail in the one combination specified by the control detail selecting unit 114.

[0103] As described above, when the control detail of a control target device 130 changes, the device control apparatus 110 in the first embodiment can control the control target device 130 automatically to make the environment perceived by the user comfortable, in response to the change of the control detail.

Second Embodiment.

[0104] FIG. 8 is a schematic diagram illustrating the configuration of the device control system 200 according to the second embodiment.

[0105] The device control system 200 includes a device control apparatus 210, one or more control target devices 130, and one or more environment detection sensors 260.

[0106] The device control system 200 according to the second embodiment is configured in the same way as the device control system 100 according to the first embodiment, except the device control apparatus 210 and the environment detection sensors 260. In the following description, the device control apparatus 210 and the environment detection sensors 260, which are different from the first embodiment, will be described.

[0107] The environment detection sensors 260 measure and detect values relevant to the environment of the user, and transmit the measured values to the device control apparatus 210. In the second embodiment, a temperature sensor 260A and a noise sensor 260B are utilized as the environment detection sensors 260, but they are not limited to these.

[0108] The temperature sensor 260A measures room temperature and transmits the measured values to the device control apparatus 210. The temperature sensor 260A includes a communication means for transmitting the measured value to the device control apparatus 210. The temperature sensor 260A transmits the measured values to the device control apparatus 210 at regular intervals such as, for example, one minute intervals. Alternatively, the temperature sensor 260A measures room temperature and returns the measured values when it receives temperature obtaining requests from the device control apparatus 210.

[0109] Moreover, the temperature sensor 260A transmits, to the device control apparatus 210, sensor location information indicating the location in which the temperature sensor 260A is installed, in addition to the measured values. It is desirable that this sensor location information corresponds to the device location information of the control target devices 130.

[0110] The noise sensor 260B measures the intensity of noise, and transmits the measured values to the device control apparatus 210. The noise sensor 260B includes a communication means for transmitting the measured values to the device control apparatus 210, in the same way as the temperature sensor 260A. In addition, the noise sensor 260B also transmits, to the device control apparatus 210, sensor location information indicating the location in which the noise sensor 260B is installed, in addition to the measured values.

[0111] FIG. 9 is a block diagram that schematically illustrates the configuration of the device control apparatus 210.

[0112] The device control apparatus 210 includes a communication unit 111, an information obtaining unit 212, a storage unit 213, a control detail selecting unit 214, a command transmitting unit 115, and a target obtaining unit 216.

[0113] The device control apparatus 210 in the second embodiment is configured in the same way as the device control apparatus 110 in the first embodiment, except the information obtaining unit 212, the storage unit 213, the control detail selecting unit 214, and the target obtaining unit 216. In the following description, the information obtaining unit 212, the storage unit 213, the control detail selecting unit 214, and the target obtaining unit 216, which are different from the first embodiment, will be described.

[0114] The information obtaining unit 212 obtains the device location information, the device control command information, the individual device control effect information, and the device status information, in the same way as the first embodiment, and obtains the measured values and the sensor location information from the environment detection sensors 260 via the communication unit 111.

[0115] The target obtaining unit 216 obtains target values for the state of the environment, which are set by the user. The target value is a measured value such as ideal room temperature for the user, noise intensity acceptable for the user, or the like, for example. The target values

obtained by the target obtaining unit 216 are stored in the storage unit 213.

[0116] The target value is defined as a value range. For example, as for the room temperature, the target value is within a range of 28°C or lower, of 18°C to 28°C, or the like. In other words, the target value is a range of measured values determined to be preferable by the user.

[0117] Moreover, the user may set target values for the states of a plurality of environments simultaneously. For example, the target value of the room temperature may be set to 18°C to 28°C, while the target value of the noise is set to 50dB or less. In this case, the user may set priority to each of the target values additionally. The priority is a criterion for determining which target value is to be prioritized and achieved, when the target values for the states of the plurality of environments cannot be achieved simultaneously.

[0118] The obtaining of the target value by the target obtaining unit 216 will be described.

[0119] For example, if the device control apparatus 210 is equipped with buttons for allowing the user to perform operation, the target obtaining unit 216 accepts setting of the target values by the user operation.

[0120] If there is another device for allowing the user to set the target values in addition to the device control apparatus 210, the target obtaining unit 216 may obtain the target values set by the user via the communication unit 111. The device for setting the target values may be an information terminal such as a smartphone or a tablet, for example. Further, the target obtaining unit 216 may obtain set temperature in the air conditioner 130A and set it as the target value.

[0121] The storage unit 213 stores information that is necessary for the processes in the device control apparatus 210. The storage unit 213 in the second embodiment stores target value information and sensor location information, in addition to the device management information 150 and the device control effect information 151 in the first embodiment.

[0122] FIG. 10 is a schematic diagram illustrating an example of the target value information.

[0123] As illustrated in the drawing, the target value information 252 is information in the form of a table including an item field 252a and a target value field 252b.

[0124] The item field 252a stores items of environment for which target values are set.

[0125] The target value field 252b stores ranges of the target values.

[0126] The target value field 252b includes a lower limit field 252c and an upper limit field 252d.

[0127] The lower limit field 252c stores lower limits of the ranges of the target values. If "none" is stored in this field, it indicates that there is no lower limit.

[0128] The upper limit field 252d stores upper limits of the ranges of the target values. If "none" is stored in this field, it indicates that there is no upper limit.

[0129] To return to FIG. 9, in addition to the processes similar to those in the first embodiment, the control detail selecting unit 214 selects a combination of the control target device 130 and the control detail so that the environment of the user may be within the ranges of the target values indicated in the target value information 252 stored in the storage unit 213. On the basis of the combination selected in the way like that, the command transmitter unit 115 sends the device control command or the combination of the device control commands to the control target device 130 via the communication unit 111.

<Selection Method of Control Target Device 130 and Control Detail>

[0130] An example of a method for selecting a combination of a control target device 130 and a control detail by the control detail selecting unit 214 in the second embodiment will be described.

[0131] In addition, in this example, it is assumed that the target obtaining unit 216 obtains a target value from the user in advance and the storage unit 213 stores the target value information 252 illustrated in FIG. 10, before the control detail selecting unit 214 selects the combination of the control target device 130 and the control detail. Further, it is assumed that the storage unit 213 stores the device management information 150 illustrated in FIG. 3 and the device control effect information 151 illustrated in FIG. 4.

[0132] In the first embodiment, the control detail selecting unit 114 performs control when the control detail of the control target devices 130 changes. In addition to this, in the second embodiment, the control detail selecting unit 214 also controls the control target devices 130 on the basis of the measured values of the environment detection sensors 260, e.g., the temperature sensor 260A.

[0133] When the temperature sensor 260A transmits a measured value of temperature to the device control apparatus 210, the control detail selecting unit 214 determines whether or not the measured value is within the range of the target value of room temperature, which is obtained by the target obtaining unit 216.

[0134] If the measured value is not within the range of the target value, the control detail selecting unit 214 controls so that it may approach the target value. For example, if the measured value of the room temperature is 30°C, since the upper limit of the temperature is 28°C as illustrated in FIG. 10, it exceeds the range of the target value. The control detail selecting unit 214 accordingly performs control so as to lower the room temperature.

[0135] Specifically, the control detail selecting unit 214 identifies the control target device 130 in the same space where the temperature sensor 260A is installed, with reference to the device management information 150 stored in the storage unit 213. Then, the control detail selecting unit 214 searches the device control effect information 151 stored in the storage unit 213 for a combination of a control target device 130 and a control detail having the

effect for absorbing heat quantity. Here, whether or not the control target device 130 is installed in the same space is determined with reference to the device location information and the sensor location information.

[0136] Here, the device control effect information 151 specifies that the absorption amount increases by heat quantity of 1600kcal/h as an effect caused when the power supply status of the air conditioner 130A is changed to *ON*. Hence, the control detail selecting unit 214 determines to transmit the device control command corresponding to the control detail of changing the power supply status of the air conditioner 130A to *ON,* and therefore it is possible to absorb the heat quantity and decrease the room temperature.

[0137] However, a value range relevant to noise is also set as the target value. Hence, it is necessary to prevent the noise from falling outside the range of the target value when the power supply status of the air conditioner 130A is changed to *ON.*

[0138] Therefore, the control detail selecting unit 214 obtains a value measured by the noise sensor 260B, and synthesizes the measured value and the amount of sound specified in the device control effect information 151, and calculates the amount of noise in the room when the power supply status of the air conditioner 130A is changed to *ON.*

[0139] For example, if the measured value of the noise sensor 260B is 37dB, the control detail selecting unit 214 calculates a synthesized sound pressure with 42dB specified in the device control effect information 151 and obtains approximately 44dB.

[0140] This value is within the target value of 50dB, and therefore the control detail selecting unit 214 determines to transmit the device control command for the control detail of changing the power supply status of the air conditioner 130A to *ON*, and the command transmitting unit 115 transmits the device control command.

[0141] On the other hand, if the noise falls outside 50dB as the upper limit of the target value, the control detail selecting unit 214 searches for a combination of a control target device 130 and a control detail capable of heat absorption while achieving the target value of 50dB. If there is the combination, the control detail selecting unit 214 selects to transmit the device control command corresponding to the combination.

[0142] Moreover, when there is no combination of a control target device 130 and a control detail capable of heat absorption while achieving the target value of 50dB, the control detail selecting unit 214 selects a combination that achieves only the target value given the highest priority, with reference to the priority for the target values.

[0143] By performing such control, device control can be automatically performed so that the room environment may get closer to an ideal environment for the user.

[0144] Next, processes from selecting a control detail until transmitting a device control command by the device control apparatus 210 in the second embodiment will be described in detail. FIG. 11 is a flowchart illustrating a sequence of the processes performed by the device control apparatus 210.

[0145] First, the information obtaining unit 212 obtains information indicating an environmental state from the environment detection sensors 260 (S20). Specifically, the information obtaining unit 212 obtains room temperature from the temperature sensor 260A or intensity of noise from the noise sensor 260B.

[0146] Next, the control detail selecting unit 214 determines whether or not the obtained environmental state deviates from the range of the target value, with reference to the target value information 252 stored in the storage unit 213 (S21). If the obtained environmental state deviates from the range of the target value (Yes in S21), the process proceeds to step S22, and if the obtained environmental state does not deviate from the range of the target value (No in S21), the processes end.

[0147] In step S22, the control detail selecting unit 214 searches the device management information 150 and the device control effect information 151 stored in the storage unit 213 for a combination of a control detail that generates the main effect capable of making the obtained environmental states closer to the range of the target value and a control target device 130 that is installed in the same space as the environment detection sensors 260.

[0148] Then, the control detail selecting unit 214 determines whether or not the combination has been found (S23). If the combination has been found (Yes in S23), the process proceeds to step S24, and if the combination has not been found (No in S23), the processes end.

[0149] In step S24, the control detail selecting unit 214 determines whether or not the side effect causes deviation from the target value for each of the found combinations, and excludes the deviating combination.

[0150] Then, the control detail selecting unit 214 determines whether or not any combination still remains, after excluding the combination deviating from the target value (S25). If no combination remains (No in S25), the process proceeds to step S26, and if one or more combinations remain (Yes in S25), the process proceeds to step S27.

[0151] In step S26, the control detail selecting unit 214 excludes the target value having the lowest priority with reference to the priority of the target values and the processes are repeated from the search of the device control command in step S22 again.

[0152] In step S27, the control detail selecting unit 214 determines whether or not two or more combinations remain. If two or more combinations remain (Yes in S27), the process proceeds to step S28, and if one combination remains (No in S27), the process proceeds to step S29.

[0153] In step S28, the control detail selecting unit 214 selects one combination from among the plurality of remaining combinations. The way to select is same as step S17 of FIG. 7 in the first embodiment. Then, the process proceeds to step S29.

[0154] In step S29, the command transmitting unit 115

transmits a device control command to the control target device 130 which is a target, via the communication unit 111, on the basis of the one combination selected by the control detail selecting unit 214.

[0155] As described above, in the second embodiment, the control target device 130 is controlled automatically so that the environment for the user may be the targeted environment.

Third Embodiment.

[0156] FIG. 12 is a schematic diagram illustrating the configuration of the device control system 300 in the third embodiment.

[0157] The device control system 300 includes a device control apparatus 310 and one or more control target devices 130.

[0158] The device control system 300 according to the third embodiment is configured in the same way as the device control system 100 according to the first embodiment except the device control apparatus 310. In the following description, the device control apparatus 310, which is different from the first embodiment, will be described.

[0159] FIG. 13 is a block diagram that schematically illustrates the configuration of the device control apparatus 310.

[0160] The device control apparatus 310 includes a communication unit 111, an information obtaining unit 312, a storage unit 313, a control detail selecting unit 314, a command transmitting unit 115, and a person position identifying unit 317.

[0161] The device control apparatus 310 in the third embodiment is configured in the same way as the device control apparatus 110 in the first embodiment except the information obtaining unit 312, the storage unit 313, the control detail selecting unit 314, and the person position identifying unit 317. In the following description, the information obtaining unit 312, the storage unit 313, the control detail selecting unit 314, and the person position identifying unit 317, which are different from the first embodiment, will be described.

[0162] In the same way as in the first embodiment, the information obtaining unit 312 obtains device location information, device control command information, individual device control effect information, and device status information.

[0163] Here, the individual device control effect information obtained by the information obtaining unit 312 in the third embodiment includes effect position information indicating a position (effect position) where the effect of the control detail reaches.

[0164] Moreover, as described later, when the information obtaining unit 312 obtains the detected position information, it supplies the information to the person position identifying unit 317.

[0165] FIGS. 14 and 15 are schematic diagrams illustrating an example of the device control effect information in the third embodiment. As illustrated in the drawing, the device control effect information 351 is information in the form of a table including a device name field 151a, a control detail field 151b, and an effect field 351c. The device control effect information 351 in the third embodiment is configured in the same way as in the first embodiment except an effect position field 351i included in the effect field 351c.

[0166] The effect position field 351i stores information indicating the effect positions of the control target devices 130 identified in the device name field 151a and the control details identified in the control detail field 151b.

[0167] The effect position indicates the main position at which the effect (the main effect or the side effect) of the control detail is generated. It is desirable that the effect positions should be defined by the same unit as the positions in the device location information.

[0168] Since it is conceivable that the effect of the control detail generally is generated at a location in which the device is installed, the effect position is identical with the device position of the corresponding control target device 130, in many cases.

[0169] However, for example, in the case of an air conditioner, the installation position of the device and the position where the wind blown from the air conditioner reaches are apart from each other, and therefore the effect position and the device position are not always identical with each other. Further, an air conditioner used commonly is capable of adjusting the wind direction and a position where the effect such as heat generation is generated can be changed by changing the wind direction.

[0170] In this case, the effect position included in the individual device control effect information has different values depending on control details even in the same control target device 130.

[0171] To return to FIG. 13, the person position identifying unit 317 identifies a position where the user exists. It is desirable that the positions where the user exists should be defined by the same units as the positions in the device location information or the position in the effect position information.

[0172] The identification of a person position by the person position identifying unit 317 will be described.

[0173] Methods of identifying a person position by the person position identifying unit 317 are roughly divided into two kinds. The one method is identifying a person position by the person position identifying unit 317; and the other method is obtaining, through the information acquiring unit 312, information indicating a person position retained in the control target device 130 and then identifying the person position on the basis of the information.

[0174] The person position identifying unit 317 determines the person position, for example, on the basis of the operating status of the control target device 130. For example, when the power supply status of a control target device 130 changes, it is conceivable that the person

exists near the control target device 130, in general. Hence, the person position identifying unit 317 determines that the person exists at the installation position of the control target device 130 based on the device location information for a predetermined period of time (e.g., 30 minutes) after the person position identifying unit 317 obtains the change of the power supply status of the control target device 130.

[0175] Alternatively, in the case of a cooking heater or the like, it is conceivable that the person very probably continues existing nearby while the power supply is *ON.* Hence, the person position identifying unit 317 obtains the power supply status of the control target device 130 and determines that the person exists at the installation position of the control target device 130 based on the device location information while it is *ON.*

[0176] However, in the case of the target control device 130 whose power supply status may change due to timer control, such as a video recorder, the change in the power supply status is not used for determining a person position.

[0177] It is assumed that the types of the control target devices 130 for which the change in the power supply status is used for determining a person position and the types of the control target devices 130 for which the period during which the power supply is *ON* is used for determining a person position are determined in advance; and it is assumed that the storage unit 313 stores person position detectable device information that identifies these types, device names belonging to the types, and periods during which the power supply is *ON.*

[0178] Next, a case in which the person position identifying unit 317 obtains the information indicating a person position retained in a control target device 130 via the information obtaining unit 312 in order to obtain the person position will be described. For example, some of the control target devices 130, such as an air conditioner, have a function of detecting a person position or person existence by a sensor or the like.

[0179] The person position identifying unit 317 obtains information relevant to the person position or the person existence detected by the control target device 130 as the detected position information.

[0180] It is assumed that the person position is identical with the installation position of the control target device 130 that has detected the existence of the person, for example. Alternatively, if the control target device 130 has position information indicating an area of the person detection in advance, the position information may be used as the detected position information. Further, if the control target device 130 is capable of detecting a person position, this may be used as the detected position information.

[0181] In this case, in the control target device 130 illustrated in FIG. 6, a person position detecting unit (not illustrated in the drawings), such as a sensor, is included in the function unit 133, and the control unit 134 generates the detected position information on the basis of the detection result by the person position detecting unit. Then, the control unit 134 transmits this detected position information to the device control apparatus 310 via the communication unit 131.

[0182] Since the position of a person changes as time passes, it is desirable that the identification of the person position should be executed on a regular basis by the person position identifying unit 317. For example, it is conceivable that the identification is performed on a regular basis, such as at one minute intervals.

[0183] The storage unit 313 stores information that is necessary for the processes in the device control apparatus 310. The storage unit 313 in the third embodiment stores device control effect information 351 and person position information in addition to the device management information 150 in the first embodiment.

[0184] FIG. 16 is a schematic diagram illustrating an example of the person position information.

[0185] As illustrated in the drawing, the person position information 353 is a table including a person number field 353a and a position field 353b.

[0186] The person number field 353a stores the numbers for identifying persons whose positions are obtained. With respect to the numbers, different numbers may be assigned every time each position for the persons is obtained, for example. Moreover, when a control target device 130 can detect a plurality of persons, different numbers are assigned to the respective persons.

[0187] The position field 353b stores person positions indicating the positions at which the persons indicated in the person number field 353a exist.

[0188] To return to FIG. 13, the control detail selecting unit 314 selects a control target device 130 that is a target for transmitting the device control command and a control detail that is to be transmitted at a predetermined time point, on the basis of the device management information 150, the device control effect information 351, and the person position information 353 stored in the storage unit 313.

<Selection Method of Control Target Device 130 and Control Detail>

[0189] An example of a selection method for selecting a combination of a control target device 130 and a control detail, which is performed by the control detail selecting unit 314 in the third embodiment, will be described.

[0190] In the third embodiment, in the same way as the first embodiment, the control detail selecting unit 314 performs control for cancelling the spatial influence caused by the change of the device status when the control detail of a control target device 130 changes. However, the control detail selecting unit 314 prioritizes cancelling the influence at the position where a person exists when it selects the control detail for cancelling the spatial influence caused by the change of the device status.

[0191] As one example, processes by the control detail selecting unit 314 when the device control apparatus 310

controls the air conditioner 130A will be described.

[0192] For example, it is assumed that the user turns on the power supply of the cooking heater 130C manually and that the power supply status included in the device status information accordingly changes.

[0193] In this case, in the same way as in the first embodiment, the control detail selecting unit 314 obtains the side effect that is caused when the power supply of the cooking heater 130C is changed to *ON,* with reference to the device management information 150 and the device control effect information 351 stored in the storage unit 313.

[0194] For example, it is assumed that, in the device control effect information, the side effect corresponding to the control detail of tuning on the cooking heater 130C is heat generation and the heat generation amount is 150kcal/h.

[0195] Here, for the purpose of absorbing the same heat quantity by cooling or the like, the control detail selecting unit 314 first identifies a person who is in the same space as the cooking heater 130C which is the generation source of the effect, with reference to the person position information and the device management information.

[0196] At this time, even though the positions of the cooking heater 130C and the person are not identical with each other, considering the hierarchical relationship of the position information, the control detail selecting unit 314 regards the cooking heater 130C and the person as being in the same space, for example, when the position at a higher level than the position of the cooking heater 130C is identical with the position of the person, when the position of the cooking heater 130C is identical with the position at a higher level than the position of the person, or when the positions at a higher level than the both are identical with each other. That is, when an inclusion relationship between the effect position and the person position exists, the control detail selecting unit 314 determines that the effect position and the person position are identical with each other.

[0197] Next, the control detail selecting unit 314 searches the device control effect information corresponding to the identified control target device 130 for a control target device 130 and a control detail that have the effect of absorbing the heat quantity and have the effect position identical with the person position.

[0198] For example, if the person position information specifies that a person exists in the living room east side and the device control effect information specifies that a heat quantity of 150kcal/h is absorbed at the position of the living room east side as the effect caused when the power supply status of the air conditioner 130A is made to be *ON* and the wind direction is changed to the left, the control detail selecting unit 314 transmits a device control command of the control detail of making the power supply status of the air conditioner 130A *ON* and changing the wind direction to the left. This makes it possible to cancel the side effect of the cooking heater 130C in the living room east side where the person exists and to keep thermal equilibrium in the space.

[0199] By performing control like that, it is possible to perform control of canceling the spatial influence caused by the change in the state of the device preferentially at the position where the user is present and to keep the space comfortable for the user.

[0200] When there are a plurality of combinations of a control target device 130 and a control detail that generate the same effect, the control detail selecting unit 314 needs to select from among the plurality of combinations. In this case, the selection can be made by the same method as the method described in the first embodiment. Moreover, the control detail selecting unit 314 may select a combination having an effect position indicated by a unit of a lower level. Further, the control detail selecting unit 314 may preferentially select a combination having an effect position at which the number of persons whose person positions are identical with the effect position are larger.

[0201] Moreover, if no combination of a control target device 130 and a control detail exists, the control detail selecting unit 314 searches for a combination with an effect position identical with a position at a higher level than the person position. Even after the search, if no combination of a control target device 130 and a control detail exists, in the same way as the first embodiment, the control detail selecting unit 314 searches for a combination with an effect position identical with the position of the device that generates the side effect.

[0202] Further, if no combination of a control target device 130 and a control detail exists, the control detail selecting unit 314 may search the device control effect information for a combination having an effect position identical with the effect position of the side effect.

[0203] Next, processes from deciding the control detail until transmitting the control command by the device control apparatus 310 will be described in detail.

[0204] FIG. 17 is a flowchart illustrating a sequence of the processes performed by the device control apparatus 310.

[0205] First, the information obtaining unit 312 obtains device status information from all control target devices 130 that constitute the device control system 300 (S30).

[0206] Then, the control detail selecting unit 314 determines whether a change in the control detail of each of the control target devices 130 has occurred (S31). For example, the control detail selecting unit 314 performs this determination, by storing in the storage unit 313 the device status information previously transmitted from each of the control target devices 130. If a change has occurred (Yes in S31), the process proceeds to step S32, and if no change has occurred (No in S31), the processes end.

[0207] In step S32, the control detail selecting unit 314 searches the device control effect information 351 stored in the storage unit 313 for a side effect caused by the control detail after the change detected in step S31. Specifically, the control detail selecting unit 314 obtains the

side effect corresponding to the control detail after the change from the device control effect information 351.

[0208] Then, the control detail selecting unit 314 determines whether or not the side effect is obtained in step S32 (S33). For example, if the side effect corresponding to the control detail after the change does not exist in the device control effect information 351, no side effect can be obtained. If the side effect is obtained (Yes in S33), the process proceeds to step S34, and if the side effect is not obtained (No in S33), the processes end.

[0209] In step S34, the control detail selecting unit 314 identifies the position of a person that exists in the same space as the control target device 130 of which the control detail has changed as detected in step S31, with reference to the person position information 353 stored in the storage unit 313. Here, the control detail selecting unit 314 may identify the position of the person that exists at a position of a higher level than the control target device 130.

[0210] Then, the control detail selecting unit 314 determines whether or not the position of the person is obtained in step S34 (S35). If the position of the person is obtained (Yes in S35), the process proceeds to step S38, and if the position of the person is not obtained (No in S35), the process proceeds to step S36.

[0211] If the process proceeds to step S36, the control detail selecting unit 314 searches the device control effect information 351 stored in the storage unit 313 for a combination of a control target device 130 and a control detail that generates the main effect for canceling the side effect obtained in step S32.

[0212] A main effect capable of cancelling a side effect differs depending on the types of the effects. For example, paired-type effects can cancel each other, e.g. heat absorption and heat generation. Moreover, in the case of sound emission, it is possible to make the side effect less noticeable by intensifying another main effect. That is, it is assumed that the main effect capable of cancelling the side effect is determined for each side effect in advance, and information indicating such a main effect is stored in advance in the storage unit 313.

[0213] Next, the control detail selecting unit 314 determines whether or not there is the combination of the control target device 130 and the control detail that generates the main effect capable of canceling the side effect obtained in step S32 (S37). If there is the combination (Yes in S37), the process proceeds to step S40, and if there is not the combination (No in S37), the processes end.

[0214] In step S40, the control detail selecting unit 314 determines whether or not there are two or more combinations that generate the main effect capable of canceling the side effect obtained in step S32. If there are two or more combinations (Yes in S40), the process proceeds to step S41, and there is one combination (No in S40), the process proceeds to step S42.

[0215] In step S41, the control detail selecting unit 314 selects one combination from among the combinations that generate the main effect capable of canceling the side effect obtained in step S32. The way to select is as described above. Then, the process proceeds to step S42.

[0216] In step S42, the command transmitting unit 115 transmits, to the control target device 130 of target via the communication unit 111, a device control command or a combination of device control commands corresponding to the control detail in the one combination specified by the control detail selecting unit 314.

[0217] After step S42, the processes end.

[0218] Here, processes performed when the result of step S35 is 'Yes' and then the process proceeds to step S38 will be described.

[0219] If the process proceeds to step S38, the control detail selecting unit 314 searches the device control effect information 351 stored in the storage unit 313 for a combination of a control target device 130 and a control detail which generates the main effect capable of canceling the side effect obtained in step S32 and whose effect position is identical with the person position identified in step S34 or the person position replaced in step S44.

[0220] Next, the control detail selecting unit 314 determines whether or not there is a combination of a control target device 130 and a control detail which generates the main effect capable of canceling the side effect obtained in step S38 and whose effect position is identical with the person position identified in step S34 or the person position replaced in step S44 (S39). If there is the combination (Yes in S39), the process proceeds to step S40, and thereafter the aforementioned processes are performed. If there is not the combination (No in S39), the process proceeds to step S43.

[0221] In step S43, the control detail selecting unit 314 determines whether or not there is a position of a higher level with respect to the person position identified in step S34 or the person position replaced in step S44. Information about whether a certain position is at a higher level than another certain position is stored in the storage unit 313 in advance. If there is the higher level position (Yes in S43), the process proceeds to step S44, and if there is no higher level position (No in S43), the process proceeds to step S36 and then the same processes as performed when it is determined that no person has been obtained in step S35 are performed.

[0222] If the process proceeds to step S44, the control detail selecting unit 314 replaces the person position which is the determination target with the higher level position, proceeds the process to step S38, and repeats the processes.

[0223] As described above, when the control detail of a control target device 130 changes, the device control apparatus 310 in the third embodiment is capable of automatically controlling the control target devices 130 so as to make the environment perceived by a user comfortable in response to the change of the control detail and the position of the user.

Claims

1. A device control apparatus (110) comprising:

   a storage unit (113) configured to store device control effect information indicating, for each of a plurality of control target devices (130), the control target device (130), a control detail, and an effect that is caused by the control detail of the control target device (130) and can be sensed by a user who is present in the same space as the control target device (130);
   a control detail selecting unit (114) configured to select the control target device (130) and the control detail that cause the effect of achieving a predetermined purpose, from among the plurality of control target devices (130), on the basis of the device control effect information; and
   a command transmitting unit (115) configured to transmit a device control command corresponding to the control detail selected by the control detail selecting unit (114), to the control target device (130) selected by the control detail selecting unit (114).

2. The device control apparatus (110) according to claim 1, further comprising an information obtaining unit (112) configured to obtain device status information indicating the control detail in each of the plurality of control target devices (130), wherein
   the control detail selecting unit (114) monitors a change of the control detail in each of the plurality of control target devices (130) on the basis of the device status information obtained by the information obtaining unit (112),
   when the change of the control detail in one control target device (130) among the plurality of control target devices (130) has occurred, the control detail selecting unit (114) identifies the effect caused by the control detail after the change in the one control target device (130), and
   when the identified effect is an undesirable effect for a user who is present in the same space as the one control target device (130), the control detail selecting unit (114) selects the control target device (130) and the control detail that cause the effect capable of canceling the identified effect.

3. The device control apparatus (310) according to claim 2, further comprising a person position identifying unit (317) configured to identify a person position where a user is present,
   wherein the control detail selecting unit (314) selects the control target device (130) and the control detail that cause the effect capable of canceling the undesirable effect at the person position.

4. The device control apparatus (310) according to claim 3, wherein
   the device control effect information further indicates an effect position where the effect is generated, and
   the control detail selecting unit (314) selects the control target device (130) and the control detail that cause the effect which is capable of canceling the undesirable effect and whose effect position is identical with the person position.

5. The device control apparatus (310) according to claim 4, wherein
   the control detail selecting unit (314) determines that the effect position and the person position are identical with each other, if there is an inclusion relationship between the effect position and the person position.

6. The device control apparatus (310) according to any one of claims 3 to 5, wherein
   the person position identifying unit (317) monitors a change of the control detail in each of the plurality of control target devices (130) and, when the change of the control detail in one control target device (130) among the plurality of control target devices (130) has occurred, determines that a person is present at an installation position of the one control target device (130).

7. The device control apparatus (310) according to any one of claims 3 to 6, wherein
   the person position identifying unit (317) obtains information indicating the person position from the control target device (130) that has a function of detecting presence or a position of a person, among the plurality of control target devices (130).

8. The device control apparatus (110) according to any one of claims 2 to 7, wherein
   the effect includes a main effect that is caused intentionally by the control target device (130) and a side effect that is caused unintentionally by the control target device (130),
   the undesirable effect is the side effect, and
   the control detail selecting unit (114) selects the control target device (130) and the control detail that cause the main effect capable of canceling the side effect.

9. The device control apparatus (110) according to claim 8, wherein
   the device control effect information further indicates a physical quantity of the effect, and
   the control detail selecting unit (114) selects the control target device (130) and the control detail that cause the main effect having the physical quantity capable of canceling the physical quantity of the side effect.

10. The device control apparatus (110) according to claim 9, wherein if there are a plurality of combinations of the control target device (130) and the control detail that cause the main effect capable of canceling the side effect, the control detail selecting unit (114) selects the control target device (130) and the control detail in the combination causing the main effect having the smallest physical quantity.

11. The device control apparatus (110) according to claim 10, wherein if there are a plurality of combinations causing the main effect having the smallest physical quantity, the control detail selecting unit (114) selects the control target device (130) and the control detail in the combination causing the side effect having the smallest physical quantity.

12. The device control apparatus (110) according to claim 10, wherein
the device control effect information further indicates electric power consumption for the control detail of the control target device (130), and
if there are a plurality of combinations causing the main effect having the smallest physical quantity, the control detail selecting unit (114) selects the control target device (130) and the control detail in the combination that minimizes the electric power consumption.

13. The device control apparatus (110) according to claim 1, further comprising an information obtaining unit (112) configured to obtain device status information indicating the control detail in each of the plurality of control target devices (130),
wherein the control detail selecting unit (114) monitors a change of the control detail in each of the plurality of control target devices (130) on the basis of the device status information obtained by the information obtaining unit (112),
when the change of the control detail in one control target device (130) among the plurality of control target devices (130) has occurred, the control detail selecting unit (114) identifies the effect caused by the control detail after the change in the one control target device (130) on the basis of the device control effect information, and
when the identified effect is a desirable effect for a user who is present in the same space as the one control target device (130), the control detail selecting unit (114) selects the control target device (130) and the control detail that cause the effect capable of amplifying the identified effect.

14. The device control apparatus (110) according to claim 13, wherein
the effect includes a main effect that is caused intentionally by the control target device (130) and a side effect that is caused unintentionally by the control target device (130),
the desirable effect is the main effect, and
the control detail selecting unit (114) selects the control target device (130) and the control detail that cause the main effect which is same as the effect caused by the one control target device (130).

15. The device control apparatus (110) according to claim 1, further comprising an information obtaining unit (112) configured to obtain device status information indicating the control detail in each of the plurality of control target devices (130),
wherein the control detail selecting unit (114) monitors a change of the control detail in each of the plurality of control target devices (130) on the basis of the device status information obtained by the information obtaining unit (112),
when the change of the control detail in one control target device (130) among the plurality of control target devices (130) has occurred, the control detail selecting unit (114) identifies the effect caused by the control detail after the change in the one control target device (130), on the basis of the device control effect information, and
when the identified effect is an undesirable effect for a user who is present in the same space as the one control target device (130), the control detail selecting unit (114) selects the one control target device (130) and also selects the control detail capable of weakening the identified effect.

16. The device control apparatus (110) according to claim 15, wherein
the effect includes a main effect that is caused intentionally by the control target device (130) and a side effect that is caused unintentionally by the control target device (130),
the undesirable effect is the side effect, and
the control detail selecting unit (114) selects the control detail of the one control target device (130) which is capable of weakening the side effect.

17. The device control apparatus (110) according to claim 1, further comprising an information obtaining unit (112) configured to obtain device status information indicating the control detail in each of the plurality of control target devices (130),
wherein the control detail selecting unit (114) monitors a change of the control detail in each of the plurality of control target devices (130) on the basis of the device status information obtained by the information obtaining unit (112),
when the change of the control detail in one control target device (130) among the control target devices (130) has occurred, the control detail selecting unit (114) identifies the effect caused by the control detail after the change in the one control target device (130), on the basis of the device control effect infor-

mation, and
when the identified effect is an undesirable effect for a user who is present in the same space as the one control target device (130), the control detail selecting unit (114) selects another control target device (130) that is causing a desirable effect for a user who is present in the same space as the one control target device (130) and also selects the control detail that further intensifies the desirable effect in the selected another control target device (130).

18. The device control apparatus (110) according to claim 17, wherein
the effect includes a main effect that is caused intentionally by the control target device (130) and a side effect that is caused unintentionally by the control target device (130),
the undesirable effect is the side effect,
the desirable effect is the main effect, and
the control detail selecting unit (114) selects the control detail that intensifies the main effect in the another control target device (130).

19. The device control apparatus (210) according to any one of claims 2 to 18, wherein
the device control effect information further indicates a physical quantity of the effect,
the storage unit (213) further stores device location information indicating a position where each of the plurality of control target devices (130) is installed and target value information indicating a range of a measured value relevant to an environment regarded as preferable by a user,
the information obtaining unit (212) further obtains the measured value detected by an environment detection sensor (260), from the environment detection sensor (260) that detects the measured value relevant to an environment of a user, and
when the measured value obtained by the information obtaining unit (212) deviates from the range indicated by the target value information, the control detail selecting unit (214) selects the control target device (130) and the control detail that cause the effect of making the measured value detected by the environment detection sensor (260) within the range.

20. A device control system (100) comprising a plurality of control target devices (130) and a device control apparatus (110) that controls each of the plurality of control target devices (130), wherein
the device control apparatus (110) includes:

a storage unit (113) configured to store device control effect information indicating, for each of the control target devices (130), the control target device (130), a control detail, and an effect that is caused by the control detail of the control target device (130) and can be sensed by a user who is present in the same space as the control target device (130);
a control detail selecting unit (114) configured to select the control target device (130) and the control detail that cause the effect of achieving a predetermined purpose, from among the plurality of control target devices (130), on the basis of the device control effect information; and
a command transmitting unit (115) configured to transmit a device control command corresponding to the control detail selected by the control detail selecting unit (114), to the control target device (130) selected by the control detail selecting unit (114).

FIG. 1

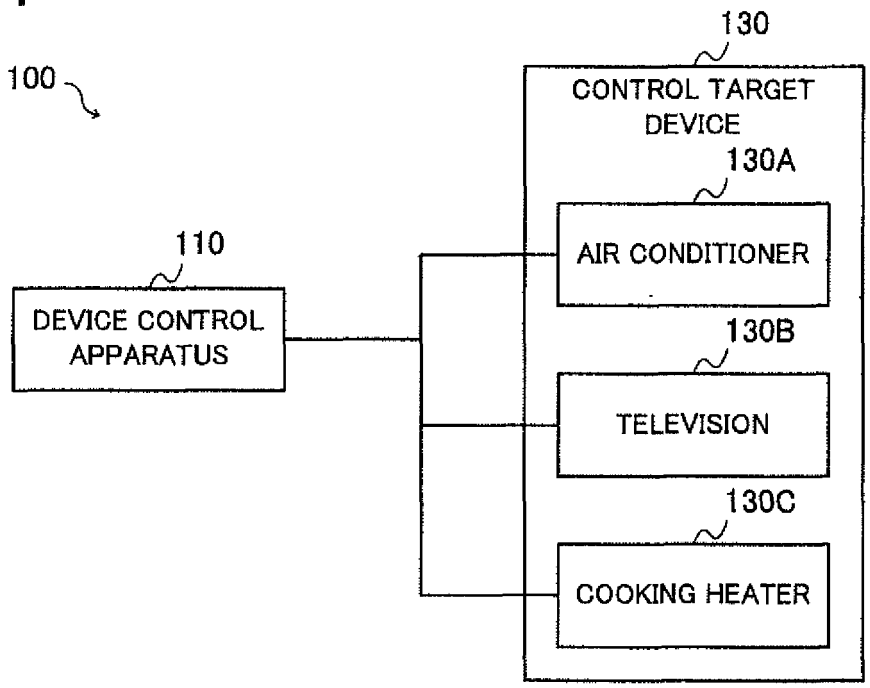

100
110
DEVICE CONTROL APPARATUS
130
CONTROL TARGET DEVICE
130A
AIR CONDITIONER
130B
TELEVISION
130C
COOKING HEATER

FIG. 2

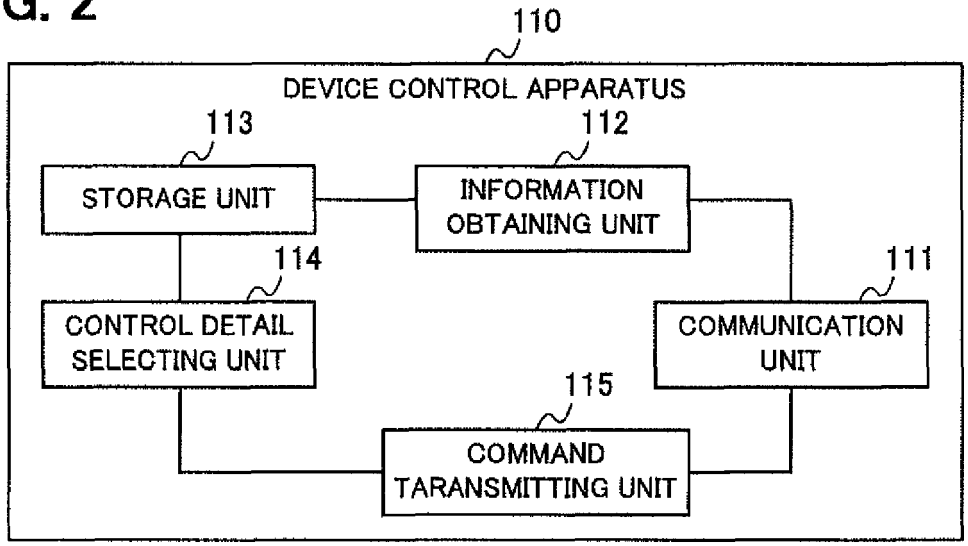

110
DEVICE CONTROL APPARATUS
113
STORAGE UNIT
112
INFORMATION OBTAINING UNIT
114
CONTROL DETAIL SELECTING UNIT
111
COMMUNICATION UNIT
115
COMMAND TARANSMITTING UNIT

FIG. 3

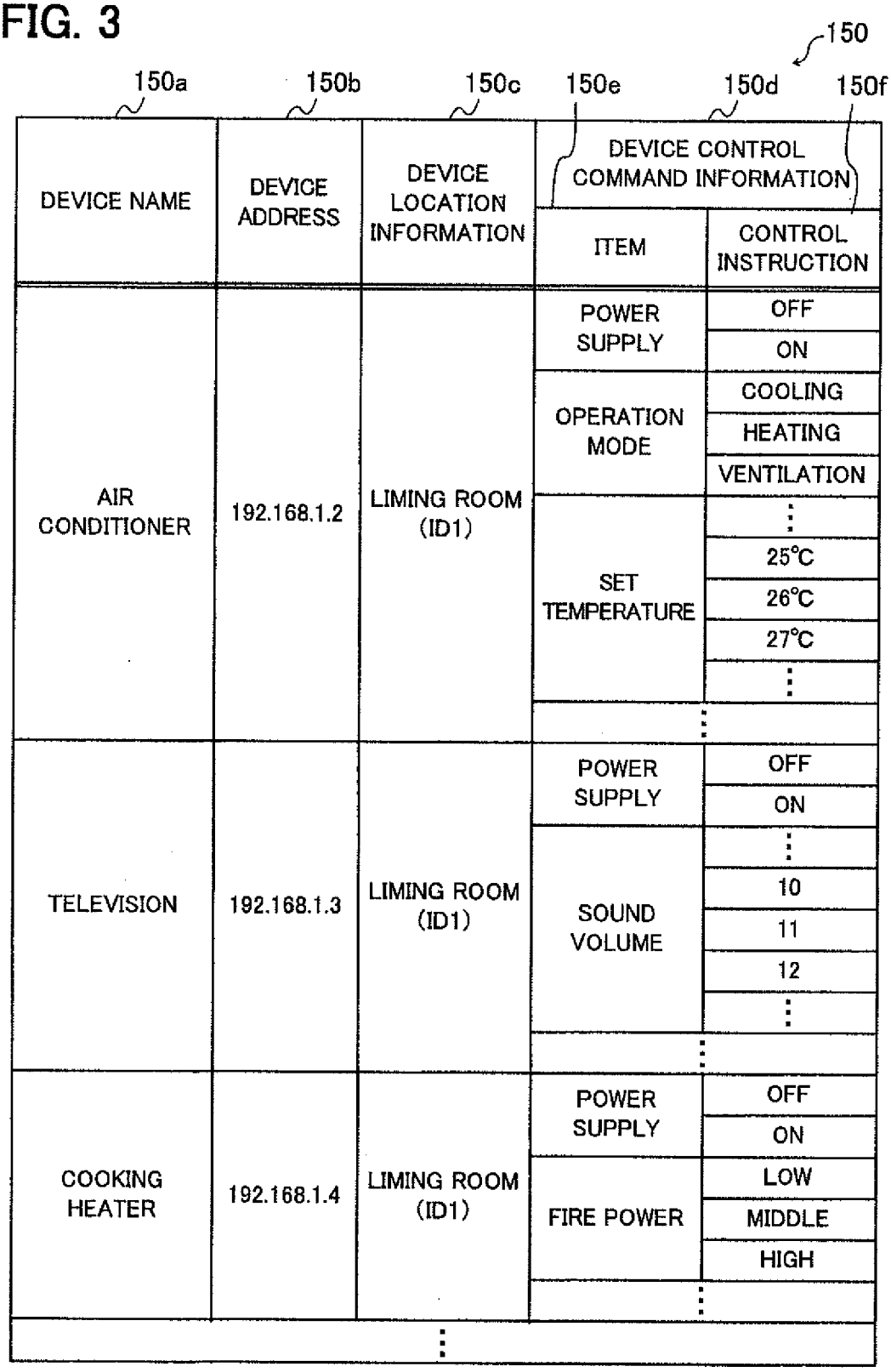
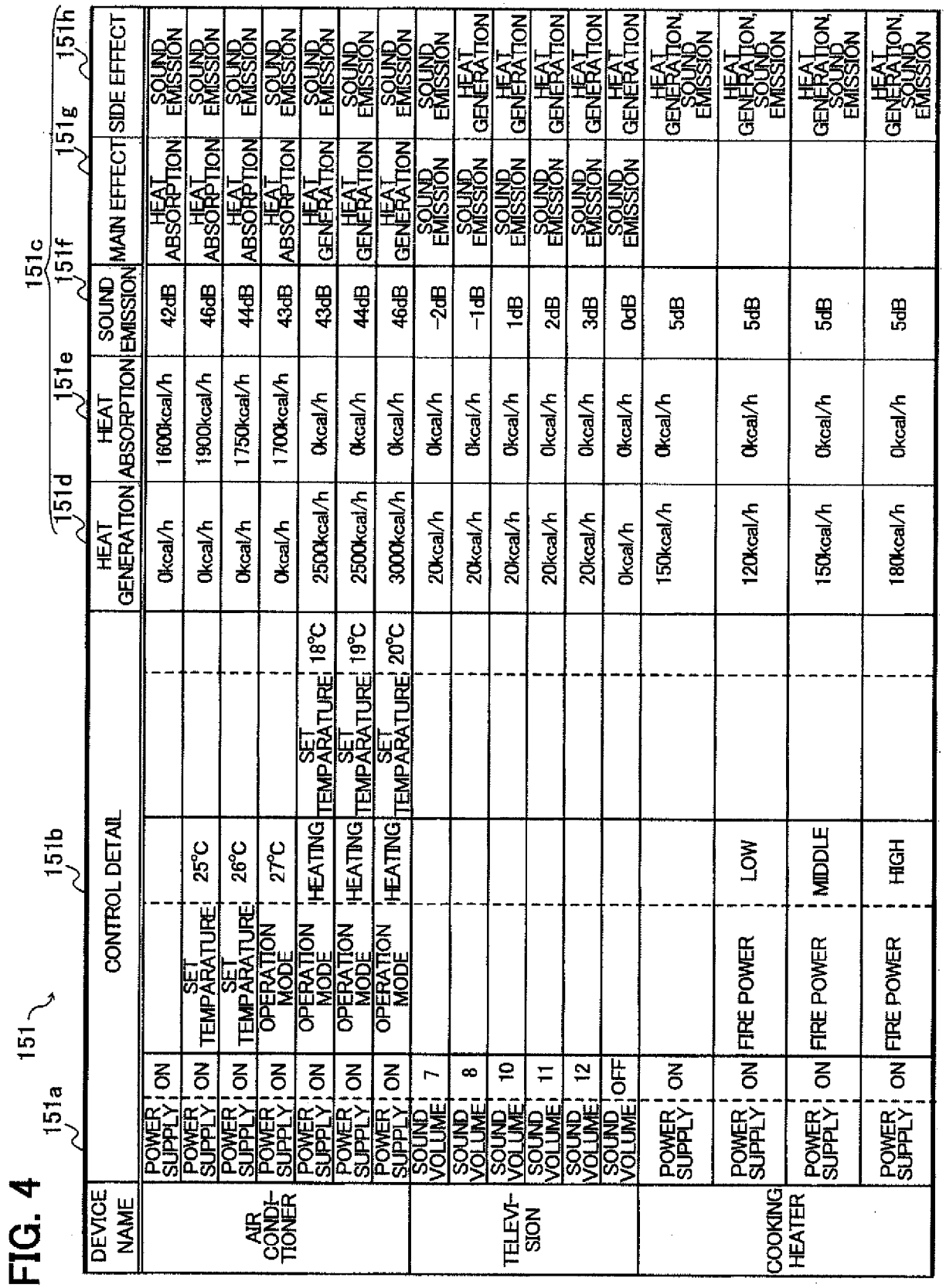

150
150a
150b
150c
150e
150d
150f
DEVICE NAME
DEVICE ADDRESS
DEVICE LOCATION INFORMATION
DEVICE CONTROL COMMAND INFORMATION
ITEM
CONTROL INSTRUCTION
AIR CONDITIONER
192.168.1.2
LIMING ROOM (ID1)
POWER SUPPLY
OFF
ON
OPERATION MODE
COOLING
HEATING
VENTILATION
SET TEMPERATURE
25℃
26℃
27℃
TELEVISION
192.168.1.3
LIMING ROOM (ID1)
POWER SUPPLY
OFF
ON
SOUND VOLUME
10
11
12
COOKING HEATER
192.168.1.4
LIMING ROOM (ID1)
POWER SUPPLY
OFF
ON
FIRE POWER
LOW
MIDDLE
HIGH

FIG. 4



DEVICE NAME	CONTROL DETAIL			HEAT GENERATION	HEAT ABSORPTION	SOUND EMISSION	MAIN EFFECT	SIDE EFFECT
AIR CONDITIONER	POWER SUPPLY	ON		0kcal/h	1600kcal/h	42dB	HEAT ABSORPTION	SOUND EMISSION
	POWER SUPPLY	ON	SET TEMPARATURE 25°C	0kcal/h	1900kcal/h	46dB	HEAT ABSORPTION	SOUND EMISSION
	POWER SUPPLY	ON	SET TEMPARATURE 26°C	0kcal/h	1750kcal/h	44dB	HEAT ABSORPTION	SOUND EMISSION
	POWER SUPPLY	ON	OPERATION MODE 27°C	0kcal/h	1700kcal/h	43dB	HEAT ABSORPTION	SOUND EMISSION
	POWER SUPPLY	ON	OPERATION MODE HEATING SET TEMPARATURE 18°C	2500kcal/h	0kcal/h	43dB	HEAT GENERATION	SOUND EMISSION
	POWER SUPPLY	ON	OPERATION MODE HEATING SET TEMPARATURE 19°C	2500kcal/h	0kcal/h	44dB	HEAT GENERATION	SOUND EMISSION
	POWER SUPPLY	ON	OPERATION MODE HEATING SET TEMPARATURE 20°C	3000kcal/h	0kcal/h	46dB	HEAT GENERATION	SOUND EMISSION
TELEVISION	SOUND VOLUME	7		20kcal/h	0kcal/h	-2dB	SOUND EMISSION	SOUND EMISSION
	SOUND VOLUME	8		20kcal/h	0kcal/h	-1dB	SOUND EMISSION	HEAT GENERATION
	SOUND VOLUME	10		20kcal/h	0kcal/h	1dB	SOUND EMISSION	HEAT GENERATION
	SOUND VOLUME	11		20kcal/h	0kcal/h	2dB	SOUND EMISSION	HEAT GENERATION
	SOUND VOLUME	12		20kcal/h	0kcal/h	3dB	SOUND EMISSION	HEAT GENERATION
	SOUND VOLUME	OFF		0kcal/h	0kcal/h	0dB	SOUND EMISSION	HEAT GENERATION
COOKING HEATER	POWER SUPPLY	ON		150kcal/h	0kcal/h	5dB		HEAT GENERATION, SOUND EMISSION
	POWER SUPPLY	ON	FIRE POWER LOW	120kcal/h	0kcal/h	5dB		HEAT GENERATION, SOUND EMISSION
	POWER SUPPLY	ON	FIRE POWER MIDDLE	150kcal/h	0kcal/h	5dB		HEAT GENERATION, SOUND EMISSION
	POWER SUPPLY	ON	FIRE POWER HIGH	180kcal/h	0kcal/h	5dB		HEAT GENERATION, SOUND EMISSION

FIG. 5

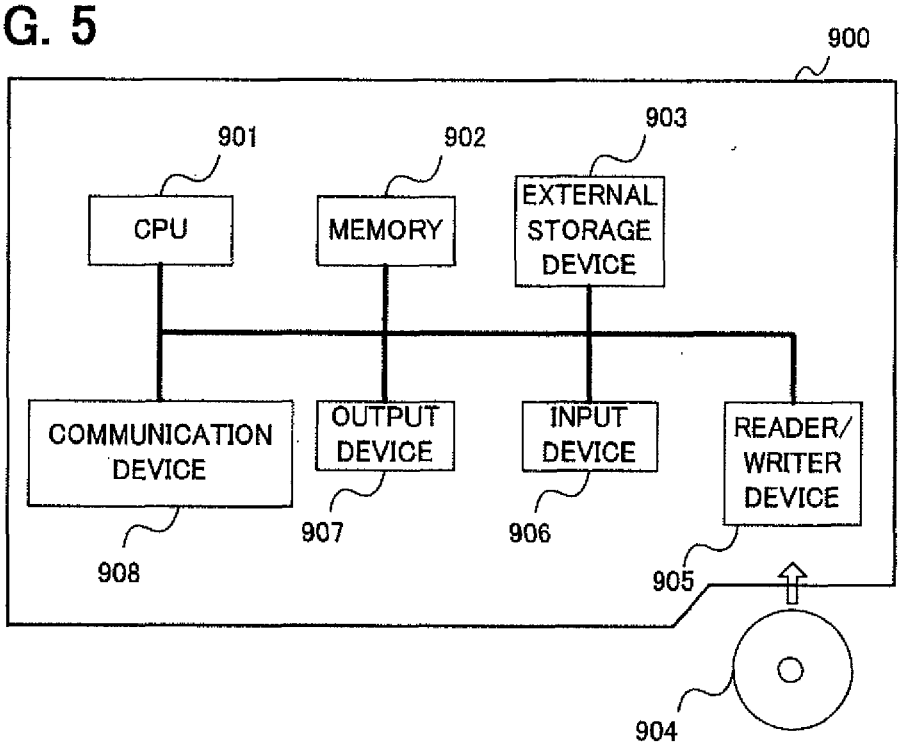

900
901
902
903
CPU
MEMORY
EXTERNAL STORAGE DEVICE
COMMUNICATION DEVICE
OUTPUT DEVICE
INPUT DEVICE
READER/ WRITER DEVICE
908
907
906
905
904

FIG. 6

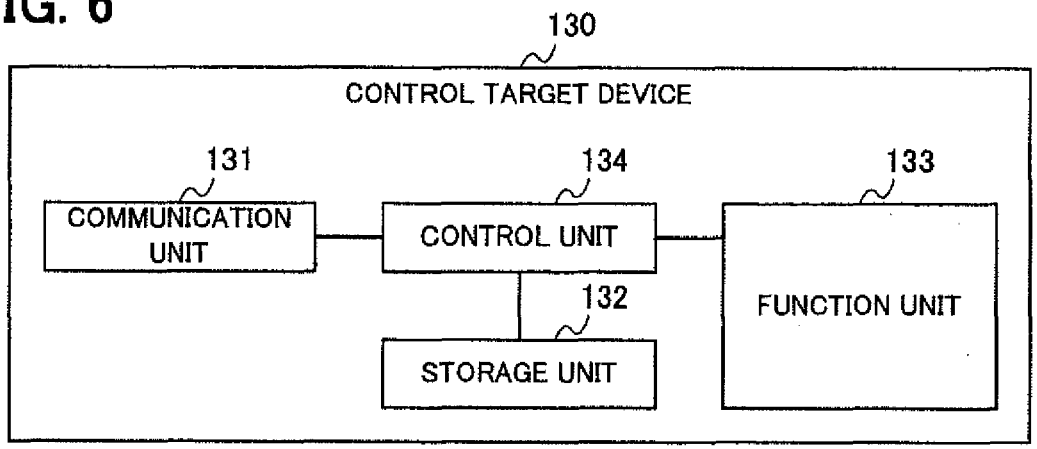

130
CONTROL TARGET DEVICE
131
134
133
COMMUNICATION UNIT
CONTROL UNIT
FUNCTION UNIT
132
STORAGE UNIT

FIG. 7

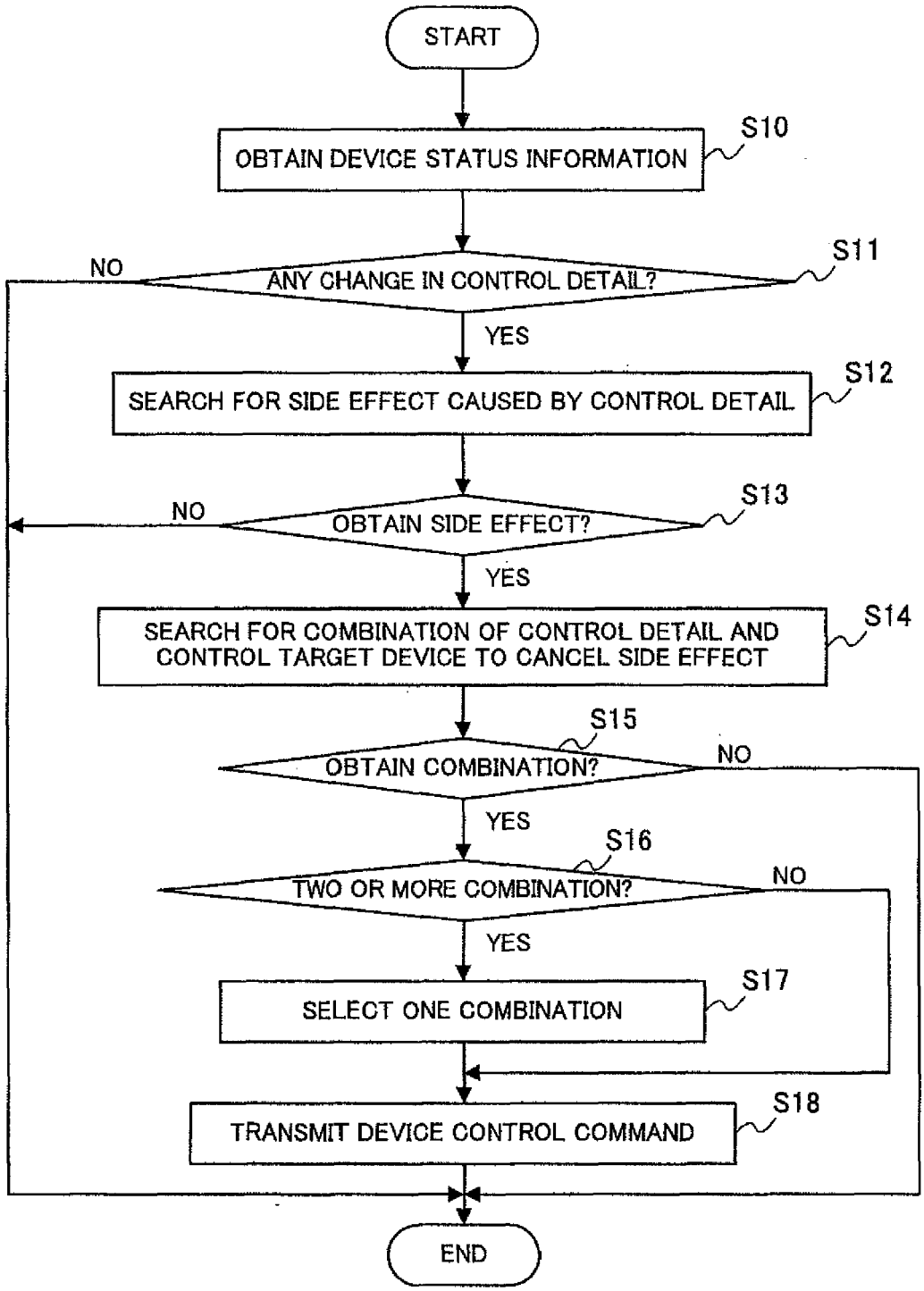

START
OBTAIN DEVICE STATUS INFORMATION
S10
ANY CHANGE IN CONTROL DETAIL?
S11
NO
YES
SEARCH FOR SIDE EFFECT CAUSED BY CONTROL DETAIL
S12
OBTAIN SIDE EFFECT?
S13
NO
YES
SEARCH FOR COMBINATION OF CONTROL DETAIL AND CONTROL TARGET DEVICE TO CANCEL SIDE EFFECT
S14
OBTAIN COMBINATION?
S15
NO
YES
TWO OR MORE COMBINATION?
S16
NO
YES
SELECT ONE COMBINATION
S17
TRANSMIT DEVICE CONTROL COMMAND
S18
END

FIG. 8

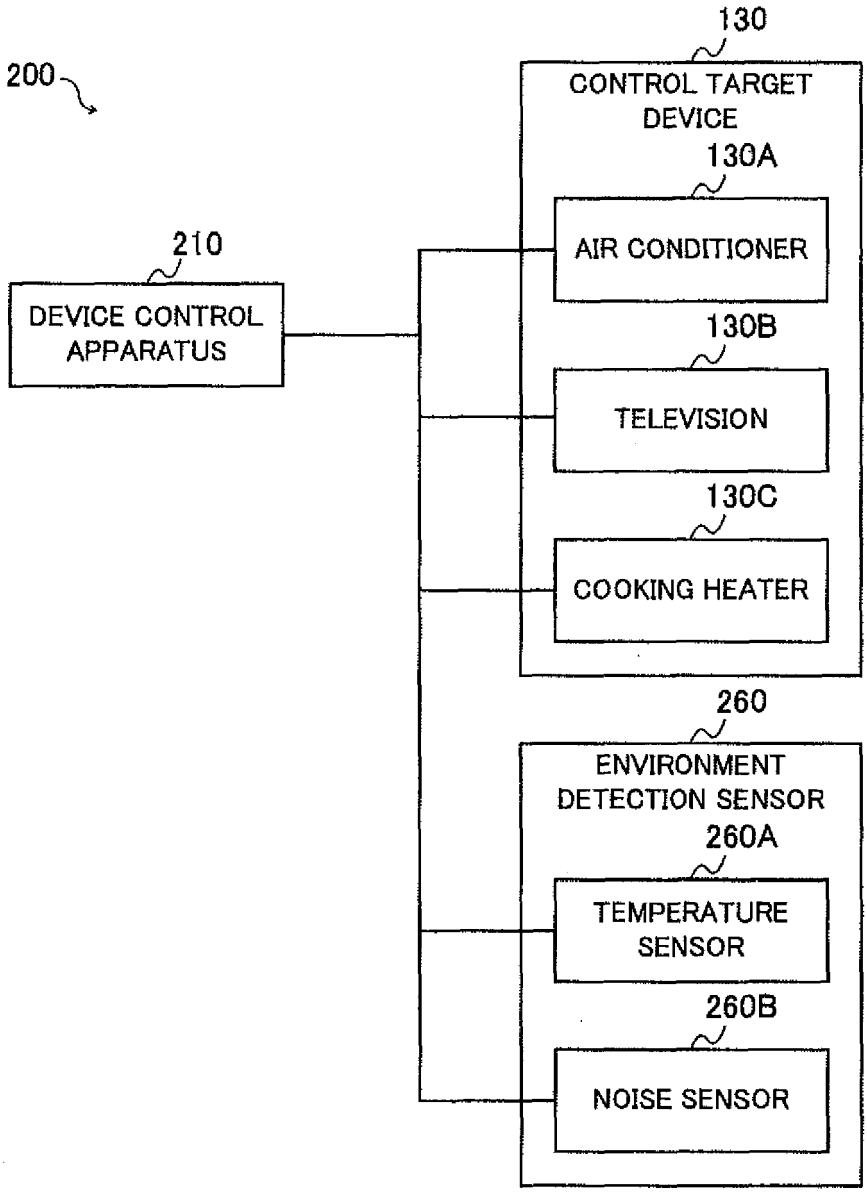

200
210
DEVICE CONTROL APPARATUS
130
CONTROL TARGET DEVICE
130A
AIR CONDITIONER
130B
TELEVISION
130C
COOKING HEATER
260
ENVIRONMENT DETECTION SENSOR
260A
TEMPERATURE SENSOR
260B
NOISE SENSOR

FIG. 9

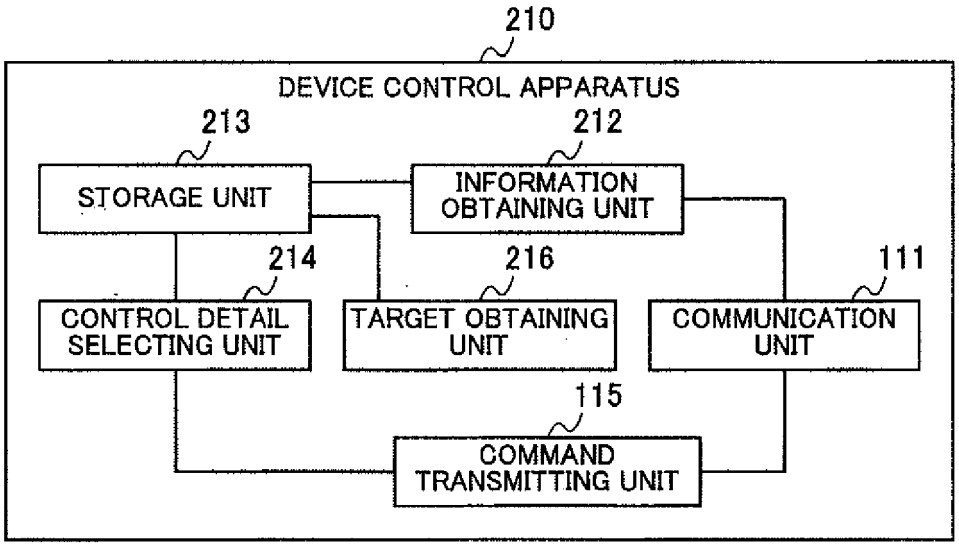


FIG. 10

252

ITEM	TARGET VALUE	
	LOWER LIMIT	UPPER LIMIT
TEMPARATURE	18°C	28°C
NOISE	NONE	50dB

FIG. 11

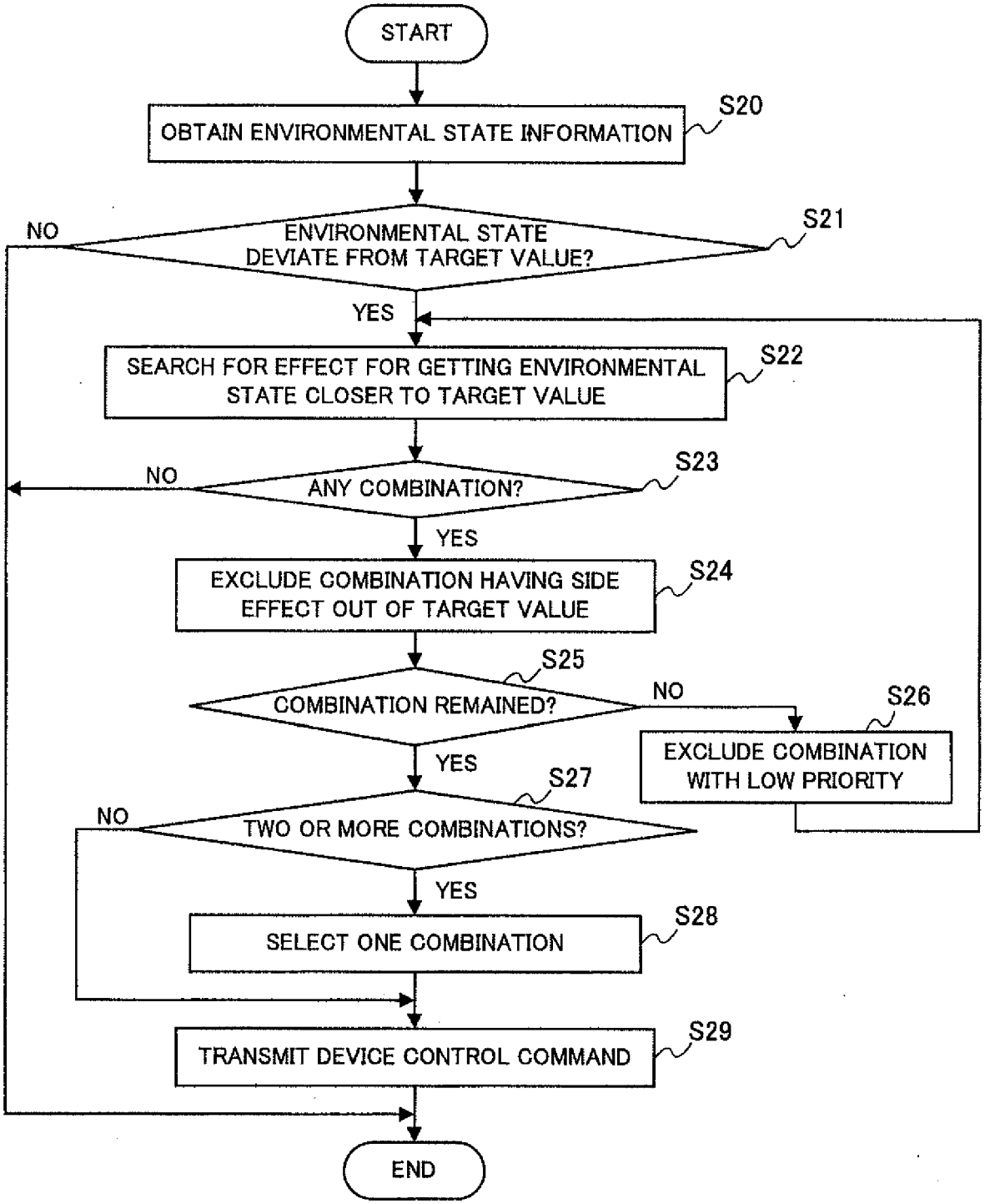

START
OBTAIN ENVIRONMENTAL STATE INFORMATION
S20
ENVIRONMENTAL STATE DEVIATE FROM TARGET VALUE?
S21
NO
YES
SEARCH FOR EFFECT FOR GETTING ENVIRONMENTAL STATE CLOSER TO TARGET VALUE
S22
ANY COMBINATION?
S23
NO
YES
EXCLUDE COMBINATION HAVING SIDE EFFECT OUT OF TARGET VALUE
S24
COMBINATION REMAINED?
S25
NO
EXCLUDE COMBINATION WITH LOW PRIORITY
S26
YES
TWO OR MORE COMBINATIONS?
S27
NO
YES
SELECT ONE COMBINATION
S28
TRANSMIT DEVICE CONTROL COMMAND
S29
END

FIG. 12

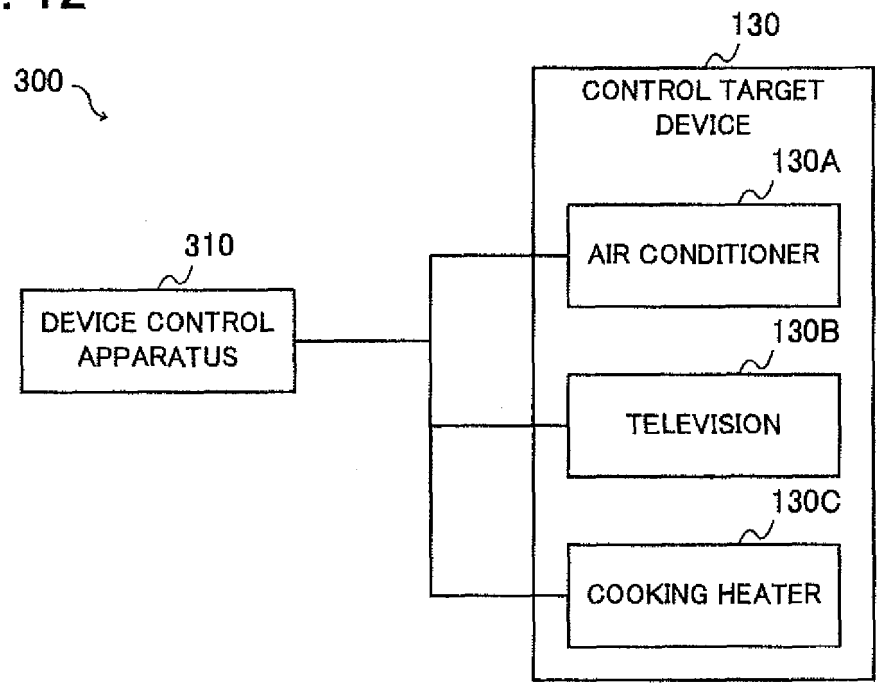

300
130
CONTROL TARGET DEVICE
130A
AIR CONDITIONER
130B
TELEVISION
130C
COOKING HEATER
310
DEVICE CONTROL APPARATUS

FIG. 13

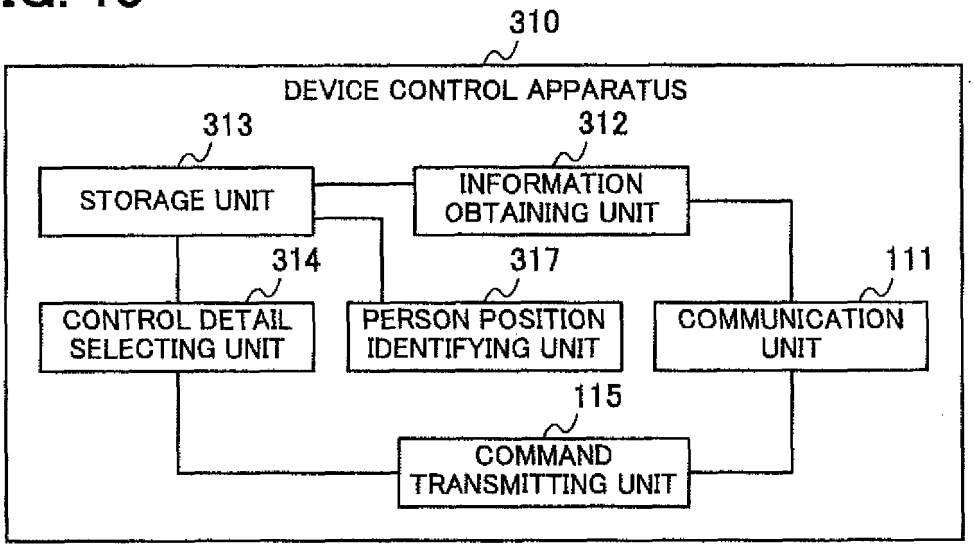

310
DEVICE CONTROL APPARATUS
313
STORAGE UNIT
312
INFORMATION OBTAINING UNIT
314
CONTROL DETAIL SELECTING UNIT
317
PERSON POSITION IDENTIFYING UNIT
111
COMMUNICATION UNIT
115
COMMAND TRANSMITTING UNIT

FIG. 14

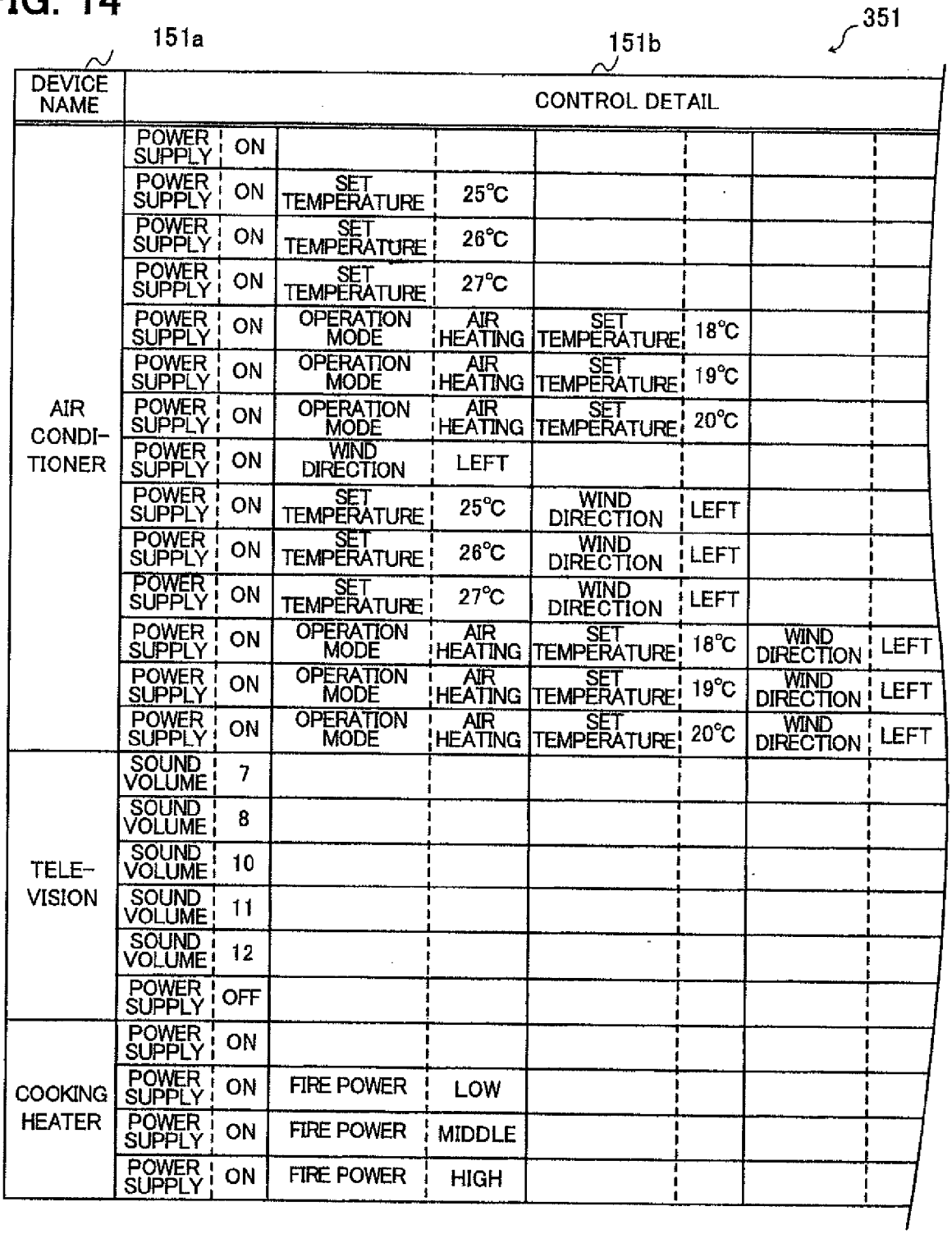

151a
151b
351
DEVICE NAME
CONTROL DETAIL
AIR CONDITIONER
TELEVISION
COOKING HEATER
POWER SUPPLY ON
SET TEMPERATURE 25°C
SET TEMPERATURE 26°C
SET TEMPERATURE 27°C
OPERATION MODE AIR HEATING SET TEMPERATURE 18°C
OPERATION MODE AIR HEATING SET TEMPERATURE 19°C
OPERATION MODE AIR HEATING SET TEMPERATURE 20°C
WIND DIRECTION LEFT
SET TEMPERATURE 25°C WIND DIRECTION LEFT
SET TEMPERATURE 26°C WIND DIRECTION LEFT
SET TEMPERATURE 27°C WIND DIRECTION LEFT
OPERATION MODE AIR HEATING SET TEMPERATURE 18°C WIND DIRECTION LEFT
OPERATION MODE AIR HEATING SET TEMPERATURE 19°C WIND DIRECTION LEFT
OPERATION MODE AIR HEATING SET TEMPERATURE 20°C WIND DIRECTION LEFT
SOUND VOLUME 7
SOUND VOLUME 8
SOUND VOLUME 10
SOUND VOLUME 11
SOUND VOLUME 12
POWER SUPPLY OFF
POWER SUPPLY ON
FIRE POWER LOW
FIRE POWER MIDDLE
FIRE POWER HIGH

FIG. 15

351c

351

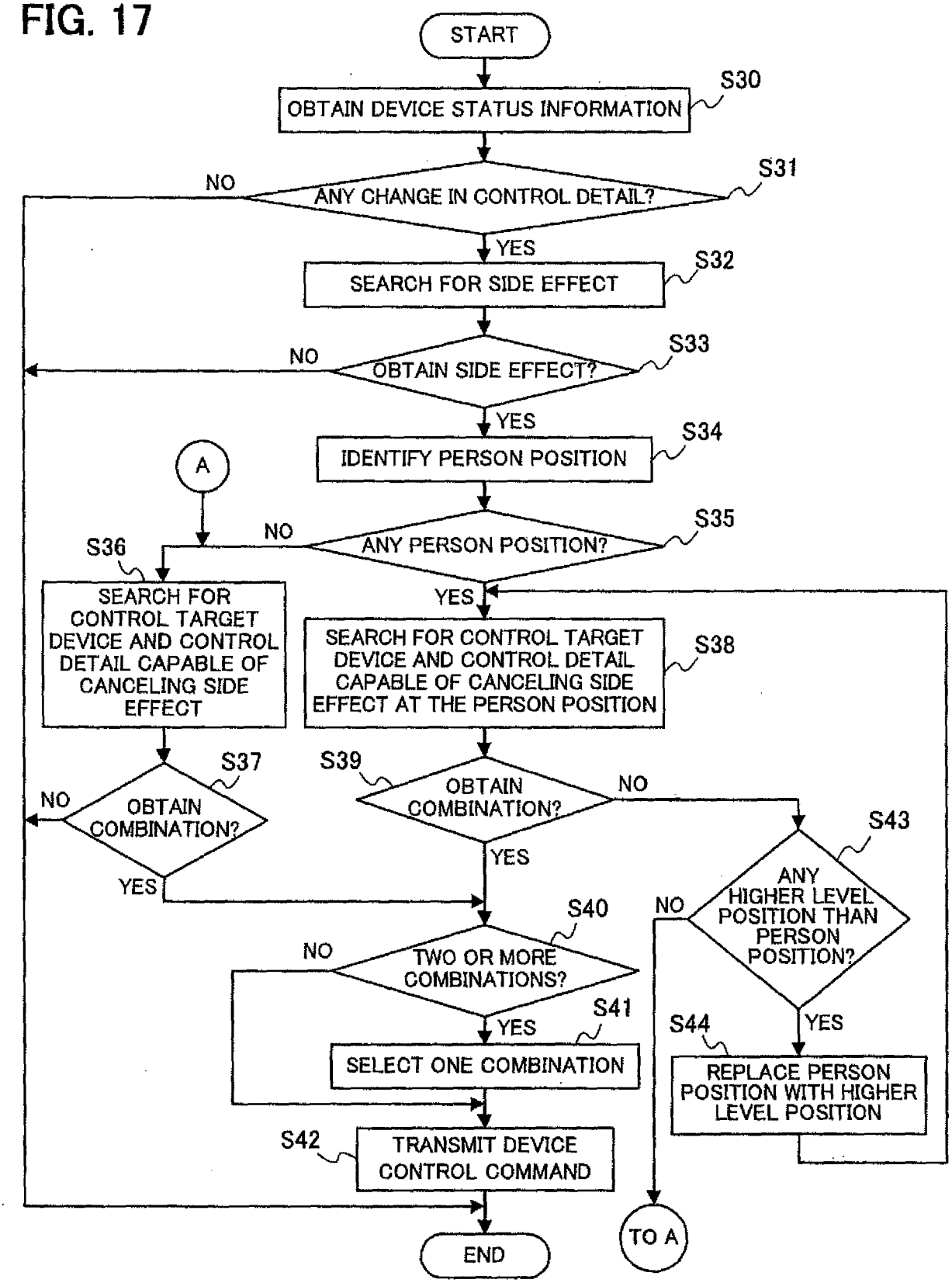
151a DEVICE NAME	151d HEAT GENERATION	151e HEAT ABSORPTION	151f SOUND EMMITION	151g MEIN EFFECT	151h SIDE EFFECT	351i EFFECT POSITION
AIR CONDI-TIONER	0kcal/h	1600kcal/h	42dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM
	0kcal/h	1900kcal/h	46dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM
	0kcal/h	1750kcal/h	44dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM
	0kcal/h	1700kcal/h	43dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM
	2500kcal/h	0kcal/h	43dB	HEAT GENERATION	SOUND EMMITION	LIVING ROOM
	2500kcal/h	0kcal/h	44dB	HEAT GENERATION	SOUND EMMITION	LIVING ROOM
	3000kcal/h	0kcal/h	46dB	HEAT GENERATION	SOUND EMMITION	LIVING ROOM
	0kcal/h	1600kcal/h	42dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM EAST SIDE
	0kcal/h	1900kcal/h	46dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM EAST SIDE
	0kcal/h	1750kcal/h	44dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM EAST SIDE
	0kcal/h	1700kcal/h	43dB	HEAT ABSORPTION	SOUND EMMITION	LIVING ROOM EAST SIDE
	2500kcal/h	0kcal/h	43dB	HEAT GENERATION	SOUND EMMITION	LIVING ROOM EAST SIDE
	2500kcal/h	0kcal/h	44dB	HEAT GENERATION	SOUND EMMITION	LIVING ROOM EAST SIDE
	3000kcal/h	0kcal/h	46dB	HEAT GENERATION	SOUND EMMITION	LIVING ROOM EAST SIDE
TELE-VISION	20kcal/h	0kcal/h	-2dB	SOUND EMMITION	HEAT GENERATION	LIVING ROOM
	20kcal/h	0kcal/h	-1dB	SOUND EMMITION	HEAT GENERATION	LIVING ROOM
	20kcal/h	0kcal/h	1dB	SOUND EMMITION	HEAT GENERATION	LIVING ROOM
	20kcal/h	0kcal/h	2dB	SOUND EMMITION	HEAT GENERATION	LIVING ROOM
	20kcal/h	0kcal/h	3dB	SOUND EMMITION	HEAT GENERATION	LIVING ROOM
	0kcal/h	0kcal/h	0dB	SOUND EMMITION	HEAT GENERATION	LIVING ROOM
COOKING HEATER	150kcal/h	0kcal/h	5dB		HEAT GENERATION SOUND EMMITION	LIVING ROOM EAST SIDE
	120kcal/h	0kcal/h	5dB		HEAT GENERATION SOUND EMMITION	LIVING ROOM EAST SIDE
	150kcal/h	0kcal/h	5dB		HEAT GENERATION SOUND EMMITION	LIVING ROOM EAST SIDE
	180kcal/h	0kcal/h	5dB		HEAT GENERATION SOUND EMMITION	LIVING ROOM EAST SIDE

FIG. 16

353

353a PERSON NUMBER	353b POSITION
1	LIVING ROOM EAST SIDE(ID12)
2	LIVING ROOM EAST SIDE(ID12)

FIG. 17


START
OBTAIN DEVICE STATUS INFORMATION
S30
ANY CHANGE IN CONTROL DETAIL?
S31
NO
YES
SEARCH FOR SIDE EFFECT
S32
OBTAIN SIDE EFFECT?
S33
NO
YES
IDENTIFY PERSON POSITION
S34
A
ANY PERSON POSITION?
S35
NO
YES
S36
SEARCH FOR CONTROL TARGET DEVICE AND CONTROL DETAIL CAPABLE OF CANCELING SIDE EFFECT
SEARCH FOR CONTROL TARGET DEVICE AND CONTROL DETAIL CAPABLE OF CANCELING SIDE EFFECT AT THE PERSON POSITION
S38
S37
OBTAIN COMBINATION?
NO
YES
S39
OBTAIN COMBINATION?
NO
YES
S43
ANY HIGHER LEVEL POSITION THAN PERSON POSITION?
NO
YES
S40
TWO OR MORE COMBINATIONS?
NO
YES
S41
SELECT ONE COMBINATION
S44
REPLACE PERSON POSITION WITH HIGHER LEVEL POSITION
S42
TRANSMIT DEVICE CONTROL COMMAND
END
TO A

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EUROPEAN SEARCH REPORT

Application Number
EP 15 20 1445

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

G08C
H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 May 2016	Baas, Gert-Jan

CATEGORY OF CITED DOCUMENTS

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25-05-2016

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