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(72) Inventors:
• **KAMIJO, Masahiro**
Tokyo 100-8310 (JP)
• **YOSHIMURA, Kiyoshi**
Tokyo 100-8310 (JP)
• **TAKAGI, Masahiko**
Tokyo 100-8310 (JP)

(71) Applicant: **Mitsubishi Electric Corporation**
Chiyoda-ku
Tokyo 100-8310 (JP)

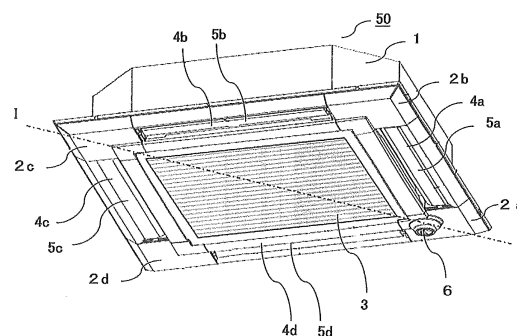
(74) Representative: **Pfenning, Meinig & Partner mbB**
Patent- und Rechtsanwälte
Theresienhöhe 11a
80339 München (DE)

(54) **AIR CONDITIONER**

(57) An air-conditioning apparatus is provided which determines an installation position of an infrared sensor and makes correspondence between an air direction control vane and a temperature detection area. An air-conditioning apparatus (50) includes a cabinet (1), a square decorative panel (2) installed to cover an opening (14) of a lower surface thereof, air outlets (5) at four places around an air inlet (13), air direction vanes (5) independently adjustable in angle for the respective air outlets (4), an infrared sensor (6) capable of detecting a floor surface temperature for each of divided areas (A) quartered in a circumferential direction, and a controller (16). The infrared sensor (6) is installed to one of corners (C) of the decorative panel (6) to face different directions at the respective corners (C). The controller (16) controls one of the air direction vanes (5) so as to blow out an airflow of one of the air outlets (4) and the air-conditioning apparatus to perform an operation, makes a determination (D1) of the installation position of the infrared sensor (6) from one of the divided areas (A) in which a temperature difference in floor surface between before and during an operation of the one of the air direction vanes (5) equals or exceeds a specified value, a disposition position of the one of the air direction vanes (5), and an installation direction of the infrared sensor (6), and makes the one of the divided areas (A) in which the temperature difference equals or exceeds the specified value correspond to the one of the air direction vanes (5) to be con-

trolled.

FIG. 1



Description

Technical Field

5 **[0001]** The present invention relates to an air-conditioning apparatus, and particularly to a setting of an installation position of an infrared sensor of an air-conditioning apparatus.

Background Art

10 **[0002]** In conventional ceiling concealed and ceiling suspended air-conditioning apparatuses, some of them installed with an infrared sensor divide an air-conditioned space into a plurality of areas, detect radiation temperature or presence of a person with the infrared sensor, and perform an air-conditioning operation mainly for an area with a person and eliminate unevenness in temperature.

15 **[0003]** For example, Patent Literature 1 discloses an air-conditioning apparatus that performs an efficient air-conditioning operation by recognizing a mounting position of the air-conditioning apparatus itself in a room based on a temperature distribution output by an infrared sensor.

20 **[0004]** Further, Patent Literature 2 discloses an air-conditioning apparatus in which an infrared sensor installed thereto has a fixed standard installation position. When the installation position of the air-conditioning apparatus is changed, an operation of making correspondence between the installation position and a control of an air-conditioning operation is performed by using a mark or the like.

Citation List

Patent Literature

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[0005]

Patent Literature 1: Japanese Examined Patent Application Publication No. 7-113472

Patent Literature 2: Japanese Unexamined Patent Application Publication No. 2012-83077

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Summary of Invention

Technical Problem

35 **[0006]** The air-conditioning apparatus in Patent Literature 1 has a fixed installation position of the infrared sensor, and thus has a problem that the installation position of the infrared sensor in the air-conditioning apparatus is unchangeable.

[0007] The air-conditioning apparatus in Patent Literature 2 has a problem that a person needs to memorize the installation position and perform an operation of setting and registering the information of the installation position with a remote controller, which is troublesome and creates a possibility of erroneous setting.

40 **[0008]** The present invention has been made to solve the problems as described above, and aims to provide an air-conditioning apparatus capable of automatically determining an installation position of an infrared sensor and facilitating making correspondence between an air direction control vane and a temperature detection area.

Solution to Problem

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[0009] An air-conditioning apparatus related to the present invention includes: a cabinet including therein a heat exchanger and a fan, having a lower surface with an opening, and installed to a ceiling; a square decorative panel larger than the opening of the cabinet, having an air inlet in a central part thereof, and installed to cover the opening of the lower surface of the cabinet; air outlets disposed at four places around the air inlet along four sides of the decorative panel; air direction vanes provided in the air outlets, and independently adjustable in angle for the respective air outlets; an infrared sensor capable of detecting a floor surface temperature for each of divided areas quartered in a circumferential direction; and a controller. The infrared sensor is installed to one of four corners of the decorative panel, and is configured such that a facing direction of an installation reference of the infrared sensor varies depending on each of four corners installed with the infrared sensor. The controller controls one of the air direction vanes so as to blow out an airflow toward a floor surface from one of the air outlets and the air-conditioning apparatus to perform a heating operation or a cooling operation, performs a determination to determine an installation position of the infrared sensor from one of the divided areas in which a temperature difference between the floor surface temperature before an operation of the one of the air direction vanes and the floor surface temperature during the operation of the one of the air direction vanes detected with

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the infrared sensor equals or exceeds a specified value, a disposition position of the one of the air direction vanes set to blow out the airflow toward the floor surface, and the installation reference of the infrared sensor, and makes the one of the divided areas in which the difference between the floor surface temperatures equals or exceeds the specified value correspond to the one of the air direction vanes to be controlled. Advantageous Effects of Invention

[0010] According to the present invention, the operation of making correspondence between the detection range of the infrared sensor and the air direction control vane is automated regardless of the installation position of the infrared sensor, therefore making settings easy, preventing erroneous setting, and obtaining correct operations of the infrared sensor and air direction control. Brief Description of Drawings

[0011]

[Fig. 1] Fig. 1 is a perspective view illustrating an overall configuration of an air-conditioning apparatus in Embodiment 1.

[Fig. 2] Fig. 2 is a diagram illustrating a cross section of an I-I part of the air-conditioning apparatus in Fig. 1.

[Fig. 3] Fig. 3 is a bottom view of the air-conditioning apparatus in Fig. 1.

[Fig. 4] Fig. 4 is a diagram simplifying Fig. 3 and illustrating directions of detection areas in a case in which an infrared sensor is installed to each of corners.

[Fig. 5] Fig. 5 is a bottom view when the infrared sensor is installed to a corner C2.

[Fig. 6] Fig. 6 is a flowchart of a control in Embodiment 1.

[Fig. 7] Fig. 7 is a flowchart of a control in Embodiment 2.

Description of Embodiments

Embodiment 1

[0012] Fig. 1 is a perspective view illustrating an overall structure of an air-conditioning apparatus in Embodiment 1.

[0013] The air-conditioning apparatus according to Embodiment 1 is installed as concealed in a ceiling or suspended from a ceiling. An air-conditioning apparatus 50 is formed of a box-shaped cabinet 1 having a lower surface with an opening and a square decorative panel 2 installed to cover the opening of the lower surface of the cabinet 1 and larger than the opening of the cabinet 1.

[0014] The decorative panel 2 is provided with a substantially square air inlet 3 at a central part thereof. Air outlets 4a to 4d (these will hereinafter occasionally be described collectively as the air outlets 4) are provided around four sides of this air inlet 3 to surround the air inlet 3. Further, the air outlets 4a to 4d are respectively provided with air direction vanes 5a to 5d (these will hereinafter occasionally be described collectively and simply as the air direction vanes 5), which are air guiding means for changing the air direction to the upward or downward direction. The directions of air blown out of the respective air outlets 4 are set to face four directions spaced at intervals of 90 degrees in a plan view of the air-conditioning apparatus 50 as viewed from below. Corner panels 2a to 2d are attachably and detachably installed to corners of the decorative panel 2.

[0015] Further, one of corners (corner portions) of a lower surface of the decorative panel 2 (a corner C1, for example) is installed with an infrared sensor 6 that detects radiation temperatures in a plurality of areas of airflows blown out of the air outlets 4 or detects presence of a person with a human body sensor. The installation position of the infrared sensor 6 is not limited to the illustrated position. The infrared sensor 6 may be installed at a preferable position in any one of corners C1 to C4 of the lower surface of the decorative panel 2 in accordance with the layout of a room and other factors.

[0016] Fig. 2 is a diagram illustrating a cross section of an I-I part of the air-conditioning apparatus 50 in Fig. 1.

[0017] An electric motor 7 is provided at a central part of a top surface inside the cabinet 1, with an output shaft facing down. The output shaft is installed with a centrifugal fan 8, and a heat exchanger 9 is installed to surround this fan 8. Further, an air passage 17 is formed around the outer circumference of the heat exchanger 9 to surround the heat exchanger 9. An internal cover 10 is disposed outside the air passage 17 to separate heat-exchanged air from the air outside the air-conditioning apparatus 50. A drain pan 11 is disposed under the heat exchanger 9 to receive condensed water generated by heat exchange between air and refrigerant in the heat exchanger 9 and form a part of the air passage 17. The decorative panel 2 is disposed under this drain pan 11. The air inlet 3 provided in the decorative panel 2 communicates with an air inlet of the fan 8. The air passage 17 formed by the internal cover 10 and the drain pan 11 communicates with the air outlets 4.

[0018] An air filter 12 for preventing dust and other substances from entering the interior of the air-conditioning apparatus 50 is installed to the air inlet 3 provided in the decorative panel 2, and a grille 13 supporting the air filter and functioning as a blind is provided outside this air filter 12. Further, a bell mouth 14 for smoothly guiding the air suctioned from the air inlet 3 to the fan 8 and a suction temperature sensor 15 for detecting a suction temperature are provided between the air filter 12 and the fan 8.

[0019] Further, the decorative panel 2 is connected to a remote controller 16 (equivalent to a controller of the invention of the present application), and the remote controller 16 controls the operation of the air-conditioning apparatus 50. The remote controller 16 performs an operation control of the electric motor 7, that is, an operation control of the fan 8 and operation controls such as the setting of the opening degrees of the air direction vanes 5 in the air outlets 4. The remote controller 16 is formed of a control unit 19 and other units. The remote controller 16 may further include a display unit 20 and an operation unit 18. This remote controller 16 is not limited to a wired one, and may be configured to wirelessly emit electrical signals. If the installation position of the infrared sensor 6 is changed in the air-conditioning apparatus 50, this remote controller 16 is operated to detect the installation position.

[0020] Fig. 3 is a bottom view of the air-conditioning apparatus 50 in Fig. 1.

[0021] The infrared sensor 6 is installed to the corner C1. This state illustrates a standard installation position of the infrared sensor 6 at the time of shipment of the decorative panel 2 by a manufacturer (an initial state).

[0022] Fig. 4 is a diagram simplifying Fig. 3 and illustrating directions of a detection area A in a case in which the infrared sensor 6 is installed to each of the corners. The detection area A of the infrared sensor 6 is quartered into detection areas A1 to A4 (equivalent to divided areas of the invention of the present application). The infrared sensor 6 has a fixed installation direction according to each corner when installed to one of the corners. For example, assuming the infrared sensor 6 is installed to each of the corners, the detection area A1 faces four directions different from one another every 90 degrees. The infrared sensor 6 in Embodiment 1 is, for example, integrated with the corner panel 2a, and an installation reference is provided at a corner of an inside (on the side of the air inlet 3) of the corner panel 2a. When installed to each of the other three corners, the infrared sensor 6 is also installed to be located at the corner of the inside with the use of the installation reference. The infrared sensor 6 is thereby installed to face the four directions different from one another every 90 degrees at the respective corners.

[0023] It is sufficient that the installation direction is different for each position at which the infrared sensor 6 is installed, and the installation position is detectable if the infrared sensor faces directions different from one another by an angle allowing the infrared sensor to detect that the installation direction is different.

[0024] For example, when the infrared sensor is installed to the corner C1, the infrared sensor 6 is installed such that the center of the detection area A1 of the infrared sensor 6 faces the upward direction in Fig. 4 (the direction of a side of four sides of the square decorative panel 2 disposed with the air direction vane 5a). With the position used as a reference, a detection area A2, a detection area A3, and a detection area A4 are sequentially arranged in the counterclockwise direction at intervals of 90 degrees. In this case, the air direction vane 5 corresponding to the detection area A1 detected by the air-conditioning apparatus 50 is the air direction vane 5a. It is therefore unnecessary to use an installation position detection function of the infrared sensor 6.

[0025] When the infrared sensor 6 is installed to the corner C2, the infrared sensor 6 is installed such that the center of the detection area A1 faces the left direction in Fig. 4 (the direction of a side disposed with the air direction vane 5b). In this case, the air direction vane corresponding to the detection area A1 detected by the air-conditioning apparatus 50 is the air direction vane 5a, which is different from the air direction vane 5b as the air direction vane actually desired to be made to correspond to the facing direction of the detection area A1.

[0026] When the infrared sensor 6 is installed to the corner C3, the infrared sensor 6 is installed such that the center of the detection area A1 faces the downward direction in Fig. 4 (the direction of a side disposed with the air direction vane 5c). In this case, the air direction vane corresponding to the detection area A1 detected by the air-conditioning apparatus 50 is the air direction vane 5a, which is different from the air direction vane 5c as the air direction vane actually desired to be made to correspond to the facing direction of the detection area A1.

[0027] When the infrared sensor 6 is installed to the corner C4, the infrared sensor 6 is installed such that the center of the detection area A1 faces the downward direction in Fig. 4 (the direction of a side disposed with the air direction vane 5d). In this case, the air direction vane corresponding to the detection area A1 detected by the air-conditioning apparatus 50 is the air direction vane 5a, which is different from the air direction vane 5d as the air direction vane actually desired to be made to correspond to the facing direction of the detection area A1.

[0028] The detection areas A2 to A4 are also sequentially arranged in the counterclockwise direction at intervals of 90 degrees when the infrared sensor 6 is installed to the corners C2 to C4. If the air direction vane 5 corresponding to the detection area A is different from the actually desired one, as described above, it is necessary to change the corresponding air direction vane 5 by using the installation position detection function.

[0029] Fig. 5 is a bottom view when the infrared sensor 6 is installed to the corner C2. This drawing illustrates the detection areas when the infrared sensor 6 is installed to the corner C2. The infrared sensor 6 is rotatable about an axis in the vertical direction by 360 degrees (rotatable by 360 degrees in the plane of Fig. 5) by a motor (not illustrated). The sensor with a certain viewing angle rotates about the axis in the vertical direction and is capable of detecting, for example, a temperature distribution around the entire circumference. When the installation position detection function is used, the detection area of the infrared sensor 6 is divided at intervals of 90 degrees in the circumferential direction, and the four detection areas A1 to A4 are set, as illustrated in Fig. 5. In Fig. 5, the division into the detection areas A1 to A4 is performed by quartering with lines parallel to the directions of the diagonals of the square decorative panel 2, but is not

limited thereto. If the division is performed in other directions, however, the relationship between the detection area A and the direction of the air blown out by the air direction vane 5 changes. Thereby, a correspondence table (later-described Table 1) which shows relationship between the detection areas A and the air direction vanes 5 is changed. The correspondence table is used in determining the installation position of the infrared sensor by the installation position detection function of the infrared sensor 6. Further, the division number of the detection areas A is not limited to four. It is sufficient that the detection area A is divided into a plurality of areas so that the temperature distribution on a floor surface or the like around the air-conditioning apparatus 50 is figured out. The correspondence table (later-described Table 1) showing the relationship between the detection areas A and the air direction vanes 5 is appropriately set in accordance with the division of the area.

[0030] In Embodiment 1, with the detection areas A of the infrared sensor 6 obtained by quartering at 90 degrees, the four installation directions of the infrared sensor 6 different from one another every 90 degrees, and the arrangement of the air direction vanes 5 with blowout directions set at intervals of 90 degrees, it is possible to make correspondence between the installation position detection function and the detection areas A and the air direction vanes 5, without increasing the resolution of detection of the infrared sensor 6 or complicating a control.

[0031] Fig. 6 is a flowchart of a control in Embodiment 1. An operation will be described with reference to Fig. 5 and Fig. 6.

[0032] As in Fig. 5, a description will be given of a case in which the installation position of the infrared sensor 6 was not reset when the installation position was changed to the corner C2 from the corner C1. The corner C1 is the standard installation position of the infrared sensor 6. When the temperature of the detection area A1 is high in the state of Fig. 5, the air direction vane 5b should actually be driven and placed in a downward blowing state. However, the installation position of the infrared sensor 6 has not been reset, and the infrared sensor 6 is recognized as installed to the corner C1. Thus, the air direction vane 5a is driven when the remote controller 16 recognizes that the temperature of the detection area A1 is high. The remote controller 16 of the air-conditioning apparatus 50 performs control processes as described below to eliminate such mismatch between the detection area A and the air direction vane 5 to be driven.

(Step S11)

[0033] The installation position detection function is executed and started from the remote controller 16.

(Step S12)

[0034] It is determined whether the suction temperature detected by the suction temperature sensor 15 equals or exceeds a specified value.

(Step S13)

[0035] If the suction temperature detected by the suction temperature sensor 15 equals or exceeds the specified value (equals or exceeds 24 degrees Celsius, for example) (in the case of Y at step S12), a cooling operation is started.

(Step S14)

[0036] If the suction temperature detected by the suction temperature sensor 15 is lower than the specified value (lower than 24 degrees Celsius, for example) (in the case of N at step S12), a heating operation is started.

(Step S15)

[0037] The temperature of the floor surface is measured with the infrared sensor 6 for each of the detection areas A1 to A4, and is recorded and saved as a temperature t0. Herein, the temperature t0 is a matrix of data measured for the floor surface divided into a plurality of parts.

(Step S16)

[0038] Only one of the air direction vanes 5 (the air direction vane 5a, for example) is set to downward blowing to direct a blown-out airflow toward the floor surface.

(Step S17)

[0039] After the operation is performed for a specified time, the temperature of the floor surface is measured again with the infrared sensor 6, and is recorded and saved as a temperature t1. Herein, the temperature t1 is a matrix of data

measured for the floor surface divided into a plurality of parts.

(Step S18)

[0040] The temperature t_0 measured at step S15 and the temperature t_1 measured at step S17 are compared for each of the detection areas A1 to A4. The detection area with the largest absolute value of the temperature change (absolute value of the difference between t_0 and t_1) is identified, regardless of the cooling operation or the heating operation.

[0041] The determination may be made by a method of identifying the detection area A with the lowest temperature of the floor surface when the cooling operation is being performed, or identifying the detection area A with the highest temperature of the floor surface when the heating operation is being performed.

(Step S19)

[0042] It is determined which corner is installed with the infrared sensor 6 based on Table 1 in accordance with the identified detection area A. For example, if the air direction vane 5a is placed in the downward blowing state and the temperature change is the largest in the detection area A2, it is uniquely determined that the infrared sensor 6 is installed to the corner C2.

[Table 1]

		air direction vane			
		5a	5b	5c	5d
infrared sensor installation position	corner C1	area A1	area A2	area A3	area A4
	corner C2	area A4	area A1	area A2	area A3
	corner C3	area A3	area A4	area A1	area A2
	corner C4	area A2	area A3	area A4	area A1

(Step S20)

[0043] The detection area A of the infrared sensor 6 and the air direction vane 5 to be controlled are made to correspond to each other as determined at step S19. For example, in the initial state, settings are made such that the infrared sensor 6 is installed to the corner C1. As described in Table 1 above, the air direction vane 5a operates for the detection area A1, the air direction vane 5b operates for the detection area A2, the air direction vane 5c operates for the detection area A3, and the air direction vane 5d operates for the detection area A4. For example, if it is determined at step S19 that the infrared sensor 6 is installed to the corner C2 as in Fig. 5, settings are made such that the air direction vane 5b operates for the detection area A1, the air direction vane 5c operates for the detection area A2, the air direction vane 5d operates for the detection area A3, and the air direction vane 5a operates for the detection area A4. These settings are written in the remote controller 16 (equivalent to the controller of the invention of the present application).

[0044] As described above, only one predetermined air direction vane 5 is set in the downward blowing state to cause a change in the temperature of the floor surface, and the area where the temperature change is detected is uniquely determined for each of the corners. With the use of these procedures, it is possible to detect the correct installation position of the infrared sensor 6 without erroneous setting, and thus to get correspondence between the detection areas A of the infrared sensor 6 and the respective air direction vanes 5. Consequently, it is possible to enhance the precision of detection by the infrared sensor 6, and accurately perform a control such as a control of eliminating unevenness in temperature in a room in accordance with the temperature detected by the infrared sensor 6, and a control of distributing or not distributing air to a person by detecting a human body. The infrared sensor 6 is provided with a human body detection function to realize such control processes.

Embodiment 2

[0045] In Embodiment 1 described above, the installation position of the infrared sensor 6 is detected under the condition that only one of the air direction vanes 5 is set in the downward blowing state and the comparison of floor surface temperatures detected with the infrared sensor 6 is performed once. A description will be given of a case in which a plurality of the air direction vanes 5 are set in the downward blowing state, and the temperature is detected

multiple times with the infrared sensor 6 and floor surface temperatures are compared.

[0046] Fig. 7 is a flowchart of a control in Embodiment 2. An operation of the air-conditioning apparatus 50 will be described with reference to Fig. 7.

[0047] Steps S21 to S25 are similar to steps S11 to S15 in Embodiment 1.

(Step S26)

[0048] Of the air direction vanes 5, X vane(s) is/are set to downward blowing to direct the blown-out airflow toward the floor surface. Herein, X is one of 1, 2, or 3.

(Step S27)

[0049] After the operation is performed for a specified time, the temperature of the floor surface is measured again with the infrared sensor 6, and is saved as the temperature t1. Herein, the temperature t1 is a matrix of data measured for the floor surface divided into a plurality of parts. In the case of the second or subsequent measurement of t1, the data matrix of t1 is overwritten.

(Step S28)

[0050] The temperature t0 measured at step S25 and the temperature t1 measured at step S27 are compared for each of the detection areas A1 to A4. In this step, if the temperature difference between t0 and t1 of the detection area A where the temperature difference between t0 and t1 is the largest does not reach a specified value (in the case of N), the procedure returns to step S27 to measure again the temperature of the floor surface.

(Step S29)

[0051] The top X detection area(s) A with the largest absolute value(s) of the temperature change is/are identified, regardless of the cooling operation or the heating operation. The top X detection area(s) A with the lowest temperature(s) of the floor surface may be identified when the cooling operation is being performed, and the top X detection area(s) A with the highest temperature(s) of the floor surface may be identified when the heating operation is being performed.

(Step S30)

[0052] It is determined which corner of the corners C1 to C4 is installed with the infrared sensor 6 based on Table 1 above in accordance with the correspondence relationship between the X detection area(s) A identified at step S29 and the X air direction vane(s) 5 set to downward blowing. This result is represented as a determination D1. For example, if the air direction vane 5a and the air direction vane 5b are set to downward blowing and the temperature changes in the detection area A3 and the detection area A4 are increased, it is uniquely determined that the infrared sensor 6 is installed to the corner C3.

(Step S31)

[0053] Of the air direction vanes 5, Y air direction vane(s) 5 other than the air direction vane(s) 5 set in the downward blowing state last time (the X vane(s) set in the downward blowing state at step S26) is/are set in the downward blowing state. Herein, Y is smaller than 4-X.

(Step S32)

[0054] After the operation is performed for a specified time, the temperature of the floor surface is measured again with the infrared sensor 6, and is saved as a temperature t2. Herein, the temperature t2 is a matrix of data measured for the floor surface divided into a plurality of parts. In the case of the second or subsequent measurement of t2, the data matrix of t2 is overwritten.

(Step S33)

[0055] The temperature t1 measured at step S27 and the temperature t2 measured at step S32 are compared for each of the detection areas A1 to A4. In this step, if the temperature difference between t1 and t2 of the detection area A where the temperature difference between t1 and t2 is the largest does not reach a specified value (in the case of N),

the procedure returns to step S32 to measure again the temperature of the floor surface. If the temperature difference reaches the specified value (in the case of Y), the procedure proceeds to step S34.

(Step S34)

[0056] The top Y detection area(s) A with the largest absolute value of the temperature change is/are identified, regardless of the cooling operation or the heating operation. The top Y detection area(s) A with the lowest temperature(s) of the floor surface may be identified when the cooling operation is being performed, and the top Y detection area(s) A with the highest temperature(s) of the floor surface may be identified when the heating operation is being performed.

(Step S35)

[0057] It is determined which corner of the corners C1 to C4 is installed with the infrared sensor 6 based on Table 1 above in accordance with the correspondence relationship between the Y detection area(s) A identified at step S34 and the Y air direction vane(s) 5 set to downward blowing. This result is represented as a determination D2. For example, if the air direction vanes 5c and 5d are set to downward blowing and the temperature changes in the detection area A1 and the detection area A2 are increased, it is uniquely determined that the infrared sensor 6 is installed to the corner C3.

(Step S36)

[0058] The result of the determination D1 obtained at step S30 and the result of the determination D2 obtained at step S36 are compared. If the results match (in the case of Y), the procedure proceeds to step S37. If the results are different (in the case of N), the control processes from step S26 are repeated again.

(Step S37)

[0059] Based on the installation position of the infrared sensor 6 determined as described above, correct correspondence is made between the detection areas A and the air direction vanes 5.

[0060] As described above, a plurality of the air direction vanes 5 are set to downward blowing, and the correspondence relationship thereof with the detection areas A is checked, thereby making it possible to enhance the precision of detecting the correct installation position as compared with Embodiment 1. Further, it is possible to detect the detection area A accurately by repeating the steps of the multiple temperature measurements and comparisons, that is, by repeating the temperature measurements based on alternation of the air direction vane(s) 5 to be set in the downward blowing state. Consequently, the installation position is accurately detected, making it possible to enhance the precision of detection by the infrared sensor 6.

[0061] The control may be performed with steps S31 to S36 omitted. Further, a control may be performed in which the repetition of the temperature measurement at step S28 and step S33 is omitted and a step of changing the air direction vane(s) 5 to be set in the downward blowing is executed, and then a step of measuring the temperature is executed. The omission of these control processes may be appropriately set in accordance with specifications of the air-conditioning apparatus 50.

Reference Signs List

[0062]

1 cabinet 2 decorative panel 2a corner panel 2b corner panel 2c corner panel 2d corner panel 3 air inlet 4 air outlet 4a air outlet 4b air outlet 4c air outlet 4d air outlet 5 air direction vane 5a air direction vane 5b air direction vane 5c air direction vane 5d air direction vane 6 infrared sensor 7 electric motor 8 fan 9 heat exchanger 10 internal cover 11 drain pan 12 air filter 13 grille 14 bell mouth 15 suction temperature sensor 16 remote controller 17 air passage 18 operation unit 19 control unit 20 display unit 50 air-conditioning apparatus A detection area A1 detection area A2 detection area A3 detection area A4 detection area C1 corner C2 corner C3 corner C4 corner D1 determination D2 determination t0 temperature t1 temperature t2 temperature

Claims

1. An air-conditioning apparatus comprising:

a cabinet including therein a heat exchanger and a fan, having a lower surface with an opening, and installed to a ceiling;

a square decorative panel larger than the opening of the cabinet, having an air inlet in a central part thereof, and installed to cover the opening of the lower surface of the cabinet;

air outlets disposed at four places around the air inlet along four sides of the decorative panel;

air direction vanes provided in the air outlets, and independently adjustable in angle for the respective air outlets; an infrared sensor capable of detecting a floor surface temperature for each of divided areas quartered in a circumferential direction; and

a controller,

wherein the infrared sensor is installed to one of four corners of the decorative panel, and configured such that a facing direction of an installation reference of the infrared sensor varies depending on each of four corners installed with the infrared sensor, and

wherein the controller

controls one of the air direction vanes so as to blow out an airflow toward a floor surface from one of the air outlets and the air-conditioning apparatus to perform a heating operation or a cooling operation,

performs a determination to determine an installation position of the infrared sensor from one of the divided areas in which a temperature difference between the floor surface temperature before an operation of the one of the air direction vanes and the floor surface temperature during the operation of the one of the air direction vanes detected with the infrared sensor equals or exceeds a specified value, a disposition position of the one of the air direction vanes set to blow out the airflow toward the floor surface, and the installation reference of the infrared sensor, and

makes the one of the divided areas in which the temperature difference equals or exceeds the specified value correspond to the one of the air direction vanes to be controlled.

2. The air-conditioning apparatus of claim 1, wherein the controller further performs a control another one or two of the air direction vanes in the air outlets to blow out the airflow toward the floor surface.

3. The air-conditioning apparatus of claim 1 or 2, wherein, if the temperature difference is below the specified value, the controller again performs to detect the floor surface temperature with the infrared sensor.

4. The air-conditioning apparatus of any one of claims 1 to 3, wherein, after performing the determination, the controller further performs a control to blow out the airflow toward the floor surface from one or more of the air direction vanes different from the one of the air direction vanes controlled in the determination, performs a redetermination to redetermine the installation position of the infrared sensor from one or more of the divided areas in which a temperature difference between the floor surface temperature during the operation of the one of the air direction vanes used in the determination and the floor surface temperature during a current operation detected with the infrared sensor equals or exceeds a specified value, a disposition position or disposition positions of the one or more of the air direction vanes set to blow out the airflow toward the floor surface, and the installation reference of the infrared sensor, makes each of the divided areas correspond to each of the air direction vanes to be controlled if a result of the determination and a result of the redetermination match, and repeats each process again from detecting the floor surface temperature of the divided areas if the result of the determination and the result of the redetermination do not match.

5. The air-conditioning apparatus of any one of claims 1 to 4, wherein the infrared sensor is provided with a human body detection function.

FIG. 1

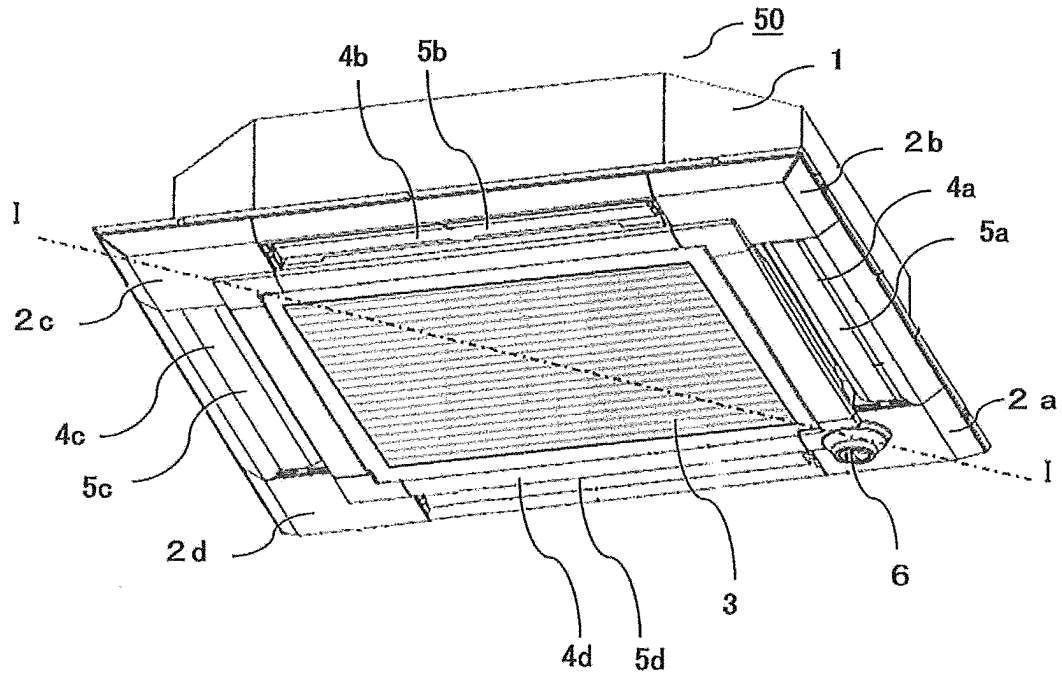


FIG. 2

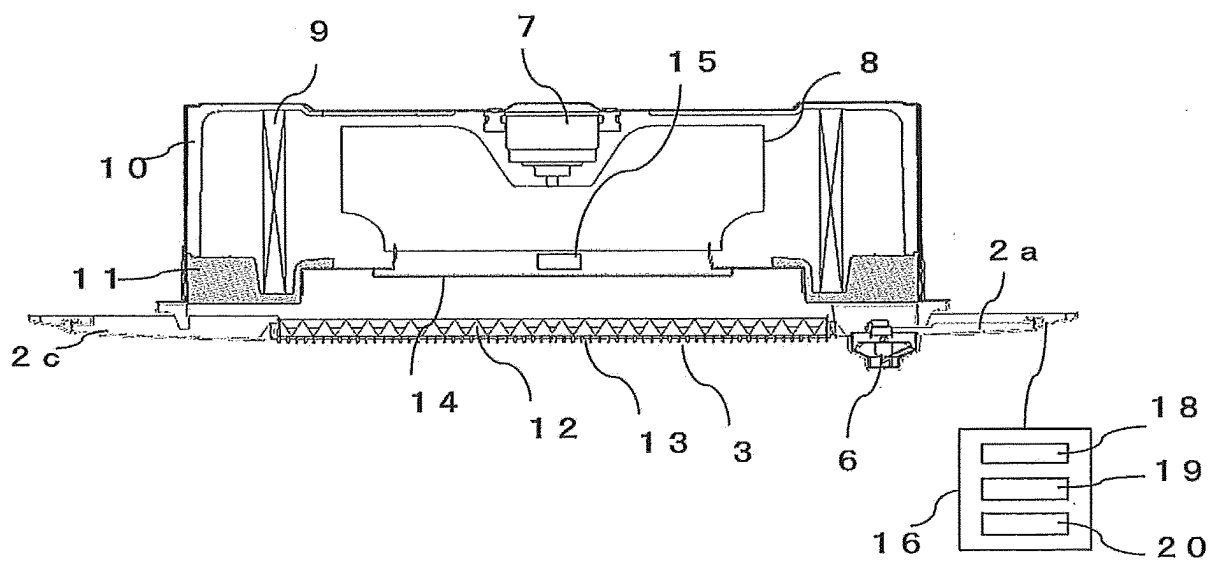


FIG. 3

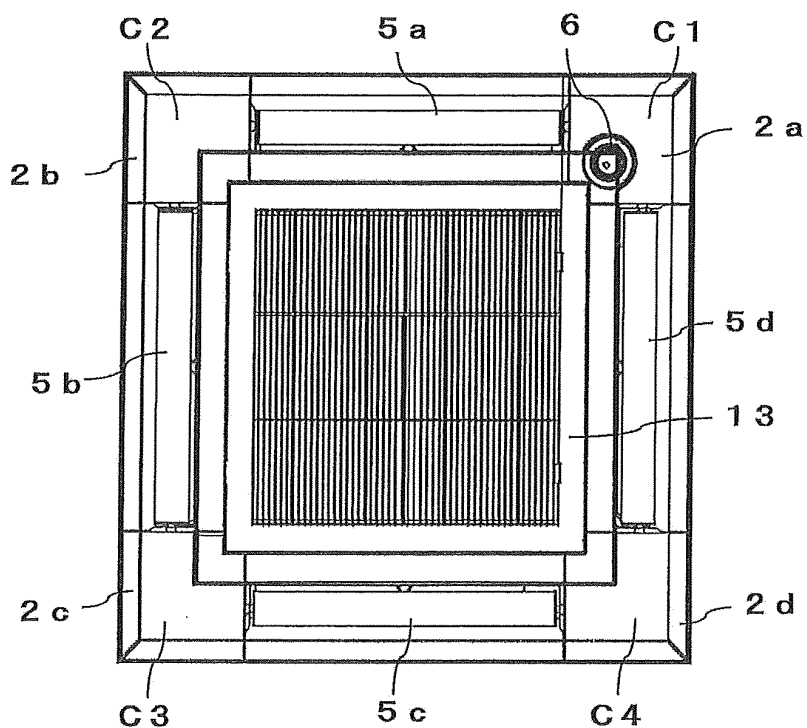


FIG. 4

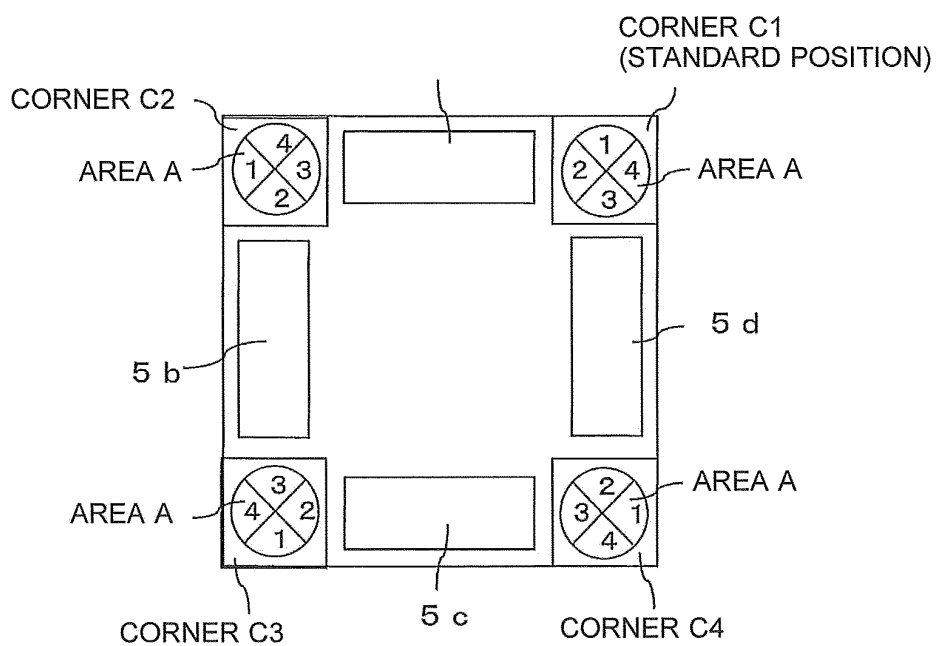


FIG. 5

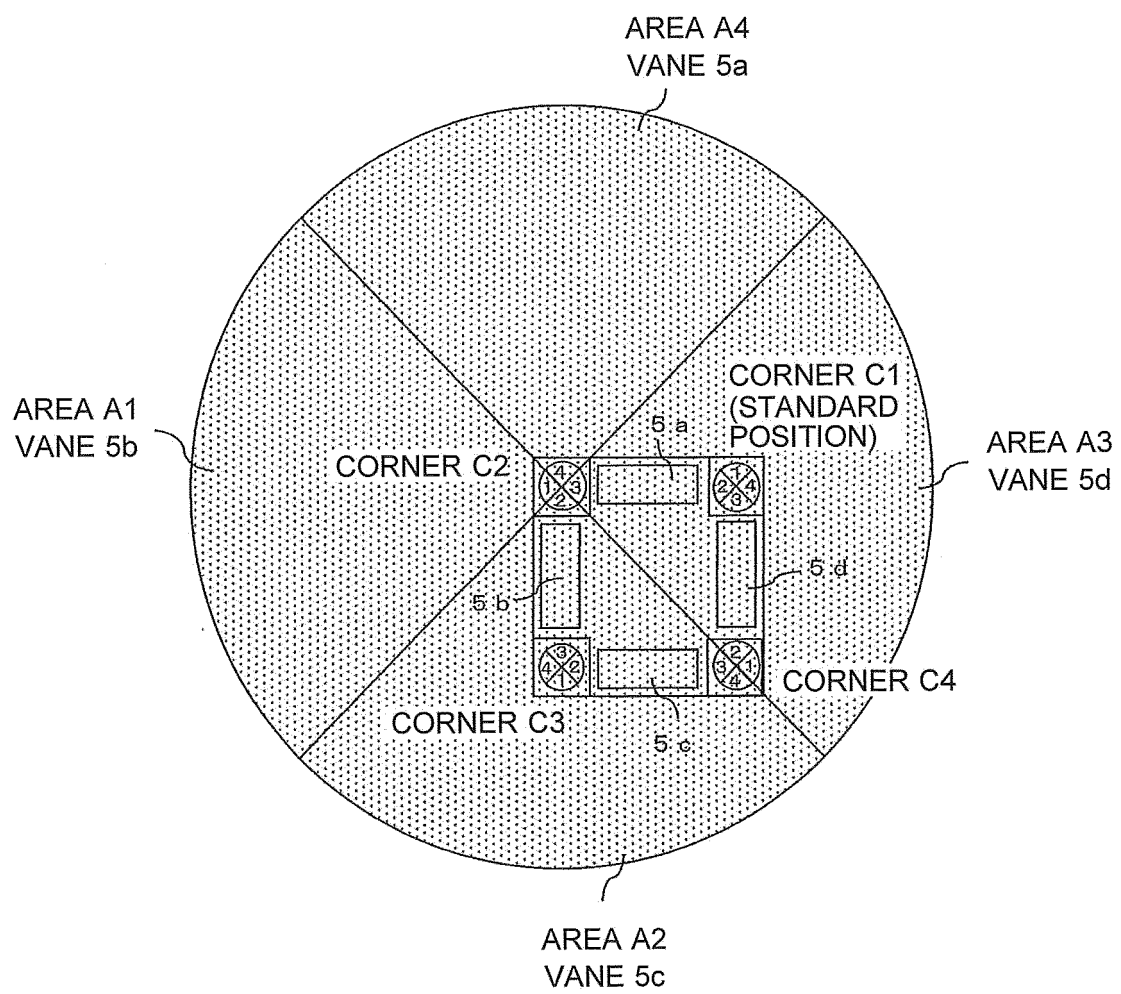


FIG. 6

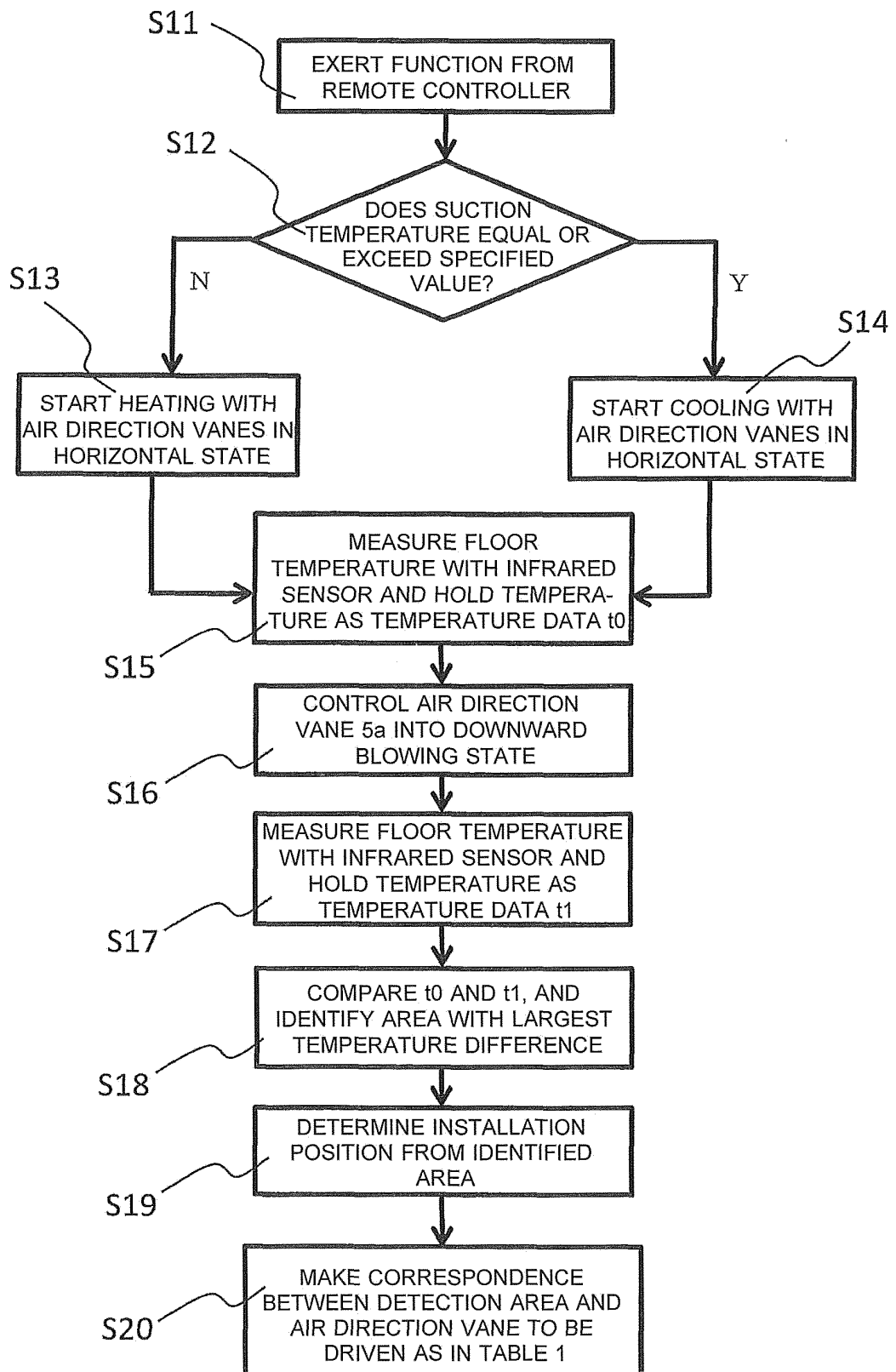
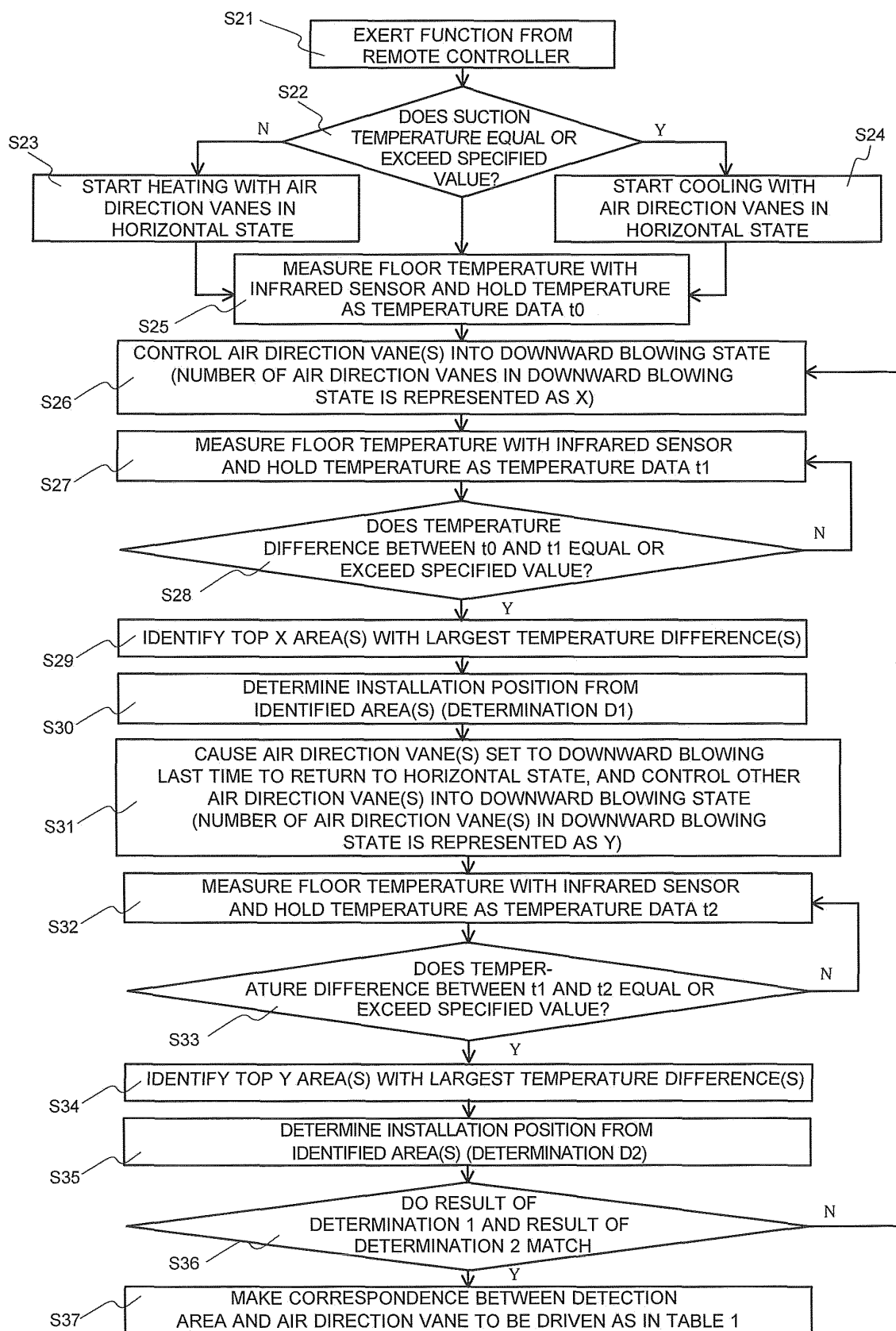


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/057314

A. CLASSIFICATION OF SUBJECT MATTER

F24F11/02(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2012-83077 A (Mitsubishi Electric Corp.), 26 April 2012 (26.04.2012), paragraphs [0014] to [0032]; fig. 1 to 8 (Family: none)	1-5
A	JP 7-113472 B2 (Daikin Industries, Ltd.), 06 December 1995 (06.12.1995), claims (Family: none)	1-5
A	JP 2013-164217 A (Daikin Industries, Ltd.), 22 August 2013 (22.08.2013), paragraphs [0026] to [0057]; fig. 1 to 5 (Family: none)	1-5

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

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Date of the actual completion of the international search
05 June 2015 (05.06.15)Date of mailing of the international search report
16 June 2015 (16.06.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 7113472 A [0005]
- JP 2012083077 A [0005]