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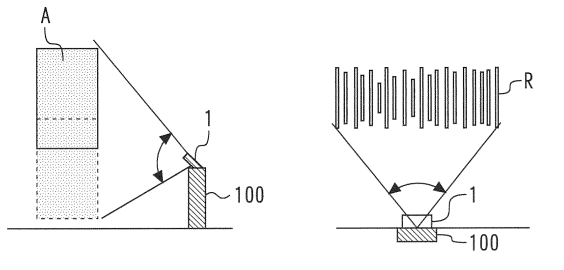
(54) **DEHUMIDIFIER**

(57) In a dehumidifier which performs clothes drying, there are problems such as a problem that evaluation information on a user being satisfied with a degree of dryness of washed clothes is not reflected on the operation control. In order to solve the problem, the dehumidifier includes a casing, a blowing fan that sucks indoor air into the casing and blows out the air, dehumidification means for removing moisture from the indoor air taken into the casing by the blowing fan and control means for controlling the blowing fan and the dehumidification means. The dehumidifier is configured such that the control means performs a clothes drying operation of detecting a state of clothes to be dried and drying the clothes according to the detected state, and an operation time of the clothes drying operation is determined based on evaluation information on a degree of dryness of clothes in a clothes drying operation formerly performed.

Fig. 5



(a) VERTICAL LOUVER DIRECTION (b) HORIZONTAL LOUVER DIRECTION

EP 2 977 504 A1

Description

Technical Field

[0001] The present invention relates to a dehumidifier that removes moisture in a room, and more particularly to a dehumidifier having a function of drying laundry such as clothes, which is an object to be dried R, hung in a room.

Background Art

[0002] Conventionally, there is a dehumidifier including: an inlet provided in a body; an evaporator and a condenser provided in the body; a sirocco fan that blows out dry air from an outlet provided in the body; an air direction plate rotatably provided in the outlet of the body for multidirectionally blowing out dry air; and a motor that rotationally drives the air direction plate, wherein the dry air dehumidified and heated by the evaporator and the condenser is blown out from the outlet into a room by a blower to efficiently dehumidify the room, and uniformly dry clothes when the dehumidifier is used for drying clothes (for example, see Patent Literature 1).

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent Laid-Open No. 7-139759 (Figure 1)

Summary of Invention

Technical Problem

[0004] However, the configuration described in Patent Literature 1 does not perform appropriate operation control of air blowing or dehumidification according to a humidity or a temperature around the dehumidifier, but has a problem in energy saving. Also, evaluation information on a user being satisfied with a degree of dryness of washed clothes is not reflected on the operation control.

[0005] The present invention solves the above described problems, and has an object to provide a dehumidifier that performs appropriate dehumidification control according to a user's usage pattern.

Means for Solving the Problems

[0006] In order to solve the above described problems, the dehumidifier includes a casing, a blowing fan that sucks indoor air into the casing and blows out the air, dehumidification means for removing moisture from the indoor air taken into the casing by the blowing fan and control means for controlling the blowing fan and the dehumidification means. The dehumidifier is configured such that the control means performs a clothes drying operation of detecting a state of clothes to be dried and drying the clothes according to the detected state, and an operation time of the clothes drying operation is determined based on evaluation information on a degree of dryness of clothes in a clothes drying operation formerly performed.

Advantageous Effects of Invention

[0007] According to the present invention, a dehumidifier can be obtained capable of reflecting evaluation on a degree of dryness of clothes for every clothes drying performed according to a state of clothes to be dried, as evaluation information on an operation, and performing a clothes drying operation to suit to a preference of an individual user.

Brief Description of Drawings

[0008]

[Figure 1] Figure 1 is a perspective view of an appearance of a dehumidifier according to Embodiment 1.

[Figure 2] Figure 2 is a schematic configuration diagram of an inner structure of the dehumidifier according to Embodiment 1.

[Figure 3] Figure 3 is a schematic perspective view of air direction variable means.

[Figure 4] Figure 4 is a control block diagram of the dehumidifier according to Embodiment 1.

[Figure 5] Figure 5 includes diagrams illustrating an example of placement of an object to be dried R, according to Embodiment 1.

[Figure 6] Figure 6(a) is a conceptual diagram of data of an object to be dried R detected by an infrared sensor before a drying operation according to Embodiment 1, and Figure 6(b) is a conceptual diagram of data of the an object to be dried R detected by the infrared sensor after a lapse of a predetermined period of time from a start of the drying operation according to Embodiment 1.

[Figure 7] Figure 7 is a flowchart of an operation during a clothes drying operation of the dehumidifier according to Embodiment 1.

[Figure 8] Figure 8 is a table showing target degrees of dryness and coefficients of the dehumidifier according to Embodiment 1.

[Figure 9] Figure 9(a) illustrates an example of a determination count table and Figure 9(b) illustrates an example of an application rank Dx table.

Description of Embodiments

Embodiment 1

[0009] Now, with reference to the drawings, Embodiment 1 of the present invention will be described.

[0010] Figure 1 is a perspective view of an appearance of a dehumidifier according to this embodiment. Figure 2 is a schematic configuration diagram of an inner structure of the dehumidifier according to this embodiment. Figure 3 is a schematic perspective view of air direction variable means. Figure 4 is a control block diagram of the dehumidifier according to this embodiment. Figure 5 is a flowchart of an operation during a clothes drying operation of the dehumidifier according to this embodiment.

[0011] With reference to Figure 1, an outer shell of a dehumidifier J is constituted by a self-supporting dehumidifier casing 100 (hereinafter referred to as a casing 100).

[0012] The casing 100 has an inlet 101 for taking in indoor air P, and an outlet 103 for discharging dry air Q from which moisture is removed from the casing 100 into a room. The casing 100 includes therein a water storage tank 102 that stores moisture removed from air taken into the inlet 101.

[0013] The inlet 101 opens in a back surface of the casing 100, and a filter for preventing dust from entering the casing 100 is provided in the opening.

[0014] Air direction variable means 1 capable of varying an air direction of the dry air Q is provided in the outlet 103. The air direction variable means 1 includes a vertical louver 1a capable of varying a vertical air direction, and a horizontal louver 1b capable of varying a horizontal air direction.

[0015] The water storage tank 102 is mounted removably from the casing 100.

[0016] Further, with reference to Figure 2, the dehumidifier J includes therein a blowing fan 2 that generates an airflow for sucking the indoor air P from the inlet 101 and discharging the dry air Q from the outlet 103, a fan motor 2a for rotating the blowing fan 2, a temperature sensor 3 (temperature detection means) for detecting a temperature of the indoor air P sucked from the inlet 101, a humidity sensor 4 (humidity detection means) for detecting a humidity of the indoor air P, dehumidification means 5 for removing moisture contained in the indoor air P and generating the dry air Q, a vertically variable motor 1c capable of vertically varying the vertical louver 1a, a horizontally variable motor 1d capable of horizontally varying the horizontal louver 1b, an infrared sensor 6 as surface temperature detection means, and a control circuit 7 as control means for controlling each portion.

[0017] The dehumidification means 5 is located in an air trunk from the inlet 101 to the outlet 103, and removes and condenses moisture in air. An example of a system used in the dehumidification means 5 includes a system in which a heat pump circuit is configured to condense moisture in air using an evaporator, or a desiccant system in which moisture in air removed by an absorbent is condensed using a heat exchanger.

[0018] The moisture removed from the indoor air P by the dehumidification means 5 is stored as condensed water C in the water storage tank 102, and the air from which the moisture is removed is the dry air Q.

[0019] Next, with reference to Figure 3, the vertical louver 1a that constitutes the air direction variable means 1 has a rectangular opening extending widthwise of the casing 100, and is vertically variable substantially around a rotary shaft of the vertically variable motor 1c described above.

[0020] Thus, an air direction is variable vertically (upward and downward).

[0021] The horizontal louvers 1b are placed at regular intervals in the vertical louver 1a, and horizontally variably journaled on a back opposite to an opening of the vertical louver 1a so as to be operated by driving the horizontally variable motor 1d described above.

[0022] Thus, an air direction is variable horizontally (leftward and rightward).

[0023] The infrared sensor 6 is mounted to one surface of the horizontal louver 1b substantially at a middle placed in the vertical louver 1a.

[0024] Thus, a range of a surface temperature detected by the infrared sensor 6 is substantially the same as the direction of the dry air Q variable by the air direction variable means 1. Specifically, the infrared sensor 6 can detect a surface temperature of the entire region within a range to which the air direction variable means 1 can blow air.

[0025] The infrared sensor 6 uses, for example, an effect of a thermoelectromotive force, and includes an infrared absorbing film 6a that receives heat (infrared) emitted from a surface of a predetermined region, and a thermistor 6b that detects a temperature of the infrared absorbing film 6a (see Figure 3).

[0026] The infrared sensor 6 converts a difference between a temperature of a thermal portion (hot junction) of the infrared absorbing film 6a that absorbs emitted heat and is thus increased in temperature and a temperature of the infrared absorbing film 6a (cold junction) detected by the thermistor 6b into an electric signal such as a voltage, and inputs the electric signal to a control circuit 7 described below. A surface temperature of a predetermined region can be determined from a magnitude of the electric signal.

[0027] In this embodiment, the infrared sensor 6 is used for recognizing an object to be dried R such as laundry from differences in surface temperature among detected objects.

[0028] With reference to Figures 5 and 6, the control circuit 7 divides a detectable region A that can be detected by the infrared sensor 6 into cells of a predetermined size, and determines a surface temperature of each cell, and thereby determines, e.g., a position and/or a degree of dryness of the object to be dried R.

[0029] For example, it is detected that shaded parts B in the detectable region A each have a temperature lower than that of the other part. Here, the shaded parts B each have a lower temperature as the shaded parts B are more densely shaded in the Figure.

[0030] Then, the control circuit 7 determines that the laundry is positioned over the parts whose surface tem-

peratures are low, and in a dehumidifying operation, controls a direction of the air direction variable means 1 and/or motion of the fan motor so as to efficiently blow dehumidified air to the position.

[0031] When the control circuit 7 detects that a dehumidification mode is selected by a switch operation of an operation portion (not shown), the control circuit 7 drives the air direction variable means 1 to allow air blowing from the outlet 103, drives the fan motor 2a to rotate the blowing fan 2, and drives the dehumidification means 5 so as to provide an optimum humidity in the room.

[0032] Also, the control circuit 7 drives the vertically variable motor 1c and the horizontally variable motor 1d of the air direction variable means 1 so as to blow air toward a desired region in the room.

[0033] Thus, the indoor air P is taken from the inlet 101 into the dehumidifier casing 100, the temperature sensor 3 and the humidity sensor 4 detect a temperature and a humidity in the room, respectively, and then the dehumidification means 5 dehumidifies the indoor air P into the dry air Q, which is blown out from the outlet 103 into the room.

[0034] Next, with reference to Figure 4, the control circuit 7 and various sensors and electronic components connected to the control circuit will be described.

[0035] The control circuit 7 controls an operation of the entire dehumidifier J by inputs from various sensors and switches and predetermined algorithms, and includes an input circuit 7a, an output circuit 7b, a CPU 7c, a storage portion 7d, and a timer portion 7e as operation time measuring means for measuring an operation time from a start of the operation.

[0036] Also, the storage portion 7d stores the algorithms described above for controlling the components of the dehumidifier J. The algorithms include an operation control program for determining operation control based on inputs from various sensors or switches, and an operation time determination program for determining a subsequent operation time based on detection signals from the temperature sensor 9 and the humidity sensor 10 and an output of the timer portion.

[0037] To the control circuit 7 thus configured, various sensors and switches such as the operation switch 8 for turning on/off the operation of the dehumidifier J, the temperature sensor 9, the humidity sensor 10, the infrared sensor 6, and a dryness evaluation switch 11 as evaluation input means for the user to input evaluation on a degree of dryness of laundry are connected through the input circuit 7a.

[0038] The dryness evaluation switch 11 may be replaced by the operation switch 8 as in a later description of an operation (step S 17 and subsequent steps). For example, evaluation on the degree of dryness may be estimated from timing when the user operates the operation switch 8.

[0039] Further, to the control circuit 7, electric components such as a display portion 12 for indicating a state of the dehumidifier, the dehumidification device 5, the fan motor 2a, the vertically variable motor 1c, and the horizontally variable motor 1d are connected through the output circuit 7b.

[0040] Next, with reference to Figure 7, the operation during the clothes drying operation of the dehumidifier J with the components configured as described above will be described.

[0041] In the description below, time measurement, humidity measurement, and temperature measurement are performed by the timer portion 7e, the humidity sensor 10, the temperature sensor 9, and the infrared sensor 6, respectively, described above, and various arithmetic processings that are performed based on these measurement values are performed by the control circuit 7.

[0042] In step S1, when the control circuit 7 of the dehumidifier detects that the clothes drying operation is started, the control circuit 7 starts driving components required for the dehumidifying operation such as the dehumidification device 5 and the fan motor 2a, and the process moves to step S2.

[0043] Next, in steps S2 to S9, an amount of an object to be dried R and a degree of ease of drying the object to be dried R are detected, and an application rank Dx in an application rank Dx table, which is to be applied in the present clothes drying operation, and a value to be updated in a determination count table for determining an application rank Dx, which is to be applied in a future clothes drying operation in which an amount of an object to be dried R and a degree of ease of the drying the object to be dried R are similar to those of the present clothes drying operation, are determined.

[0044] With reference to Figure 8, as application ranks Dx, D1 to D5 are set according to target degrees of dryness, and each application rank has corresponding coefficients a and b, which are provided for each of conditions such as an amount of an object to be dried R and a degree of ease of drying the object to be dried R by means of processes in step S 17 and subsequent steps described later in former operations and applied.

[0045] Then, the coefficients a and b are set for each application rank Dx, and are used for calculating dehumidification time Y in steps S14 and S15, which will be described later.

[0046] In this embodiment, five application ranks Dx are set. However, if the operation time of the clothes drying operation needs to be more finely changed, five or more application ranks may be set, and if there is no need for finely changing the operation time, less than five application ranks may be set.

[0047] Then, with reference to Figure 9(b), in the application rank Dx table, six values are set for respective combinations of "large", "medium" and "small", each being a size of an area occupied by the object to be dried R, and "normal" and "easy-to-dry", each being a degree of ease of drying the object to be dried R, which are detected by the infrared sensor 6.

[0048] In the first operation, an initial value D3 is set. Target degrees of dryness of higher values show higher

degrees of dryness. Specifically, in this example, D5 is a rank with the longest operation time, and D1 is a rank with the shortest operation time.

[0049] The coefficients a and b for each application rank Dx are stored in the storage portion 7d in the control circuit 7, and when the rank is increased or reduced by user's evaluation information described later, the coefficients a and b in an applied rank are read and used for calculation.

[0050] Also, with reference to Figure 9(a), as the values to be updated in the determination count table, count values are set for six patterns of a state of an object to be dried R ("large area, normal", "large area, easy-to-dry", "medium area, normal", "medium area, easy-to-dry", "small area, normal" and "small area, easy-to-dry), which are categorized in terms of "large", "medium" and "small", each being a size of an applicable area in which the object to be dried R is positioned, which is detected by the infrared sensor 6, and "normal" and "easy-to-dry", each being a degree of ease of drying the object to be dried R.

[0051] Then, these count values are changed in steps S41 and S31, which will be described later, and based on the counts, in steps S42 to S43 and steps S32 to S33, whether or not to change the application rank Dx, which is illustrated in Figure 9(b), is determined for each of conditions such as an amount of the object to be dried R and a degree of ease of drying the object to be dried R.

[0052] Referring back to Figure 7, first, in step S2, the infrared sensor 6 and the air direction variable means 1 with the infrared sensor 6 attached thereto are driven to measure a surface temperature of each of cells of an area to which dehumidified air can be blown, and the operation proceeds to step S3.

[0053] Here, an initial behavior of the infrared sensor 6 may be performed before or simultaneously with driving of the dehumidification device 5 and the fan motor 2a.

[0054] In step S3, cells (area) in which the object to be dried R is positioned are estimated from the surface temperatures of the respective cells measured in step S2, and a cell count m1 of the cells (the number of cells in the part B (shaded part) illustrated in Figure 6) is made, and then the operation proceeds to step S4. As a reference for estimation of a cell in which an object to be dried R is positioned, whether or not the cell has a temperature is lower than that of cells in the periphery thereof may be employed or whether or not the cell is a cell having a temperature that is equal or lower than a predetermined temperature may be employed.

[0055] Here, cells in which the object to be dried R is positioned form an intensive blow area to which dehumidified air is actively blown by the air direction variable means 1 in a dehumidifying operation.

[0056] Next, in step S4, based on the cell count m1 made in step S3, an applicable area for an application rank Dx is determined, and the operation proceeds to step S5. Specifically, in this step, the amount of the object to be dried R is considered. As the cell count m1 is larger, the area of the cells occupied by the laundry is larger, and thus, it is possible to determine that the object to be dried R is large.

[0057] In this embodiment, there are three levels, "large ($b \leqq m1$)", "medium ($a \leqq m1 < b$)" and "small ($m1 < a$)" ($a < b$) in applicable area, according to the cell counts.

[0058] Next, in steps S5 and S6, a dehumidifying operation is performed for a predetermined period of time.

[0059] In this embodiment, a dehumidifying operation is performed for 60 minutes (step S6), and the operation proceeds to step S7. Here, during the dehumidifying operation, a degree of dryness of the intensive blow area, which includes the cells in which the object to be dried R is positioned, is measured every ten minutes using the infrared sensor 6, and for a cell determined as being dried, one point is added as a dryness point (step S5).

[0060] The increment of the dryness count to the cell is used for determination of a degree of dryness of the object to be dried R, and it is possible to determine that in a cell for which the dryness count have been incremented more, a part of the object to be dried R at the position of the cell is more advanced in drying.

[0061] In step S7, a cell count m2 of cells to which predetermined points or more have been added as dryness points is made, and the operation proceeds to step S8. In this embodiment, the count of cells for which two or more points have been added is made. Specifically, the number of parts advanced in drying is counted, and the cells in the part B, which are reduced in the process from Figures 6(a) to 6(b), are subject to the counting.

[0062] In step S8, m2/m1 is calculated, and if m2/m1 is a predetermined value or more, the operation proceeds to step S9, and degree of ease of drying the object to be dried R in the application rank Dx is switched to "easy-to-dry ", and the operation proceeds to step 10.

[0063] Also, if the value of m2/m1 is smaller than the predetermined value, the operation proceeds to step S10 with the degree of ease of drying the object to be dried R in the application rank Dx remained "normal". Here, in this embodiment, a criterion value for m2/m1 is set to 0.8 so that the object to be dried R is determined as being "easy-to-dry" if the object to be dried R is dried in 80 or more percent of the cells.

[0064] Specifically, step S8 is a step for determining a degree of ease of drying an object to be dried R, which is hung to dry. Specifically, as the count of the cells m2 in which the object to be dried R has been dried within the predetermined period of time is larger, the object to be dried R can be determined to be easier to dry.

[0065] In step S10, an atmospheric relative humidity detected by the humidity sensor 10 is determined at predetermined time intervals (every 10 minutes in this embodiment), and humidity detection is continued until a preset relative humidity (50% or lower in this example) is detected (step S11). Then, when the preset relative humidity is reached, the process moves to step S6.

[0066] In step S12, an operation time t1 from the start

of the operation when the atmospheric relative humidity (a humidity of the indoor air) becomes less than 50% and a detection temperature T as an atmospheric temperature (a temperature of the indoor air) detected by the temperature sensor 9 are obtained, and the process moves to step S13. Then, in step S13, a product of the detection temperature T and the operation time t1 is calculated, and the process moves to step S 14.

[0067] Then, in step S14, a coefficient D is calculated, and the process moves to step S 15.

[0068] The coefficient D is one of variables that change a drying operation time of the clothes drying operation, and is calculated by an expression below obtained by experiments, and the process moves to step S15. "D = a x (T x t1)^b" ("^" refers to a power).

[0069] Here, for the coefficient a and the coefficient b, values corresponding to the applicable rank Dx (Figure 8) selected in S2 to S9 are used.

[0070] Then, in step S15, the coefficient D obtained in step S14 is used to calculate a remaining dehumidifying operation time Y by an expression obtained by experiment, "Y = t1 x (D - T/100)", the remaining dehumidifying operation time Y is determined, and the process moves to step S16.

[0071] Then, if the user does not stop the operation, the clothes drying operation is performed until the remaining dehumidifying operation time Y passes, but in step S16, it is determined whether the operation time reaches Z or not. The operation time Z is a time during which drying of laundry proceeds to some extent and is set by an experimental value. After the operation time Z, the user's evaluation on the degree of dryness of clothes is effective (evaluation on the degree of dryness of clothes is obtained from a user's usage pattern).

[0072] When the operation time reaches Z in step S16, the process moves to step S 17.

[0073] The processes in step S 17 and subsequent steps are effective after the lapse of the predetermined operation time Z. This is for excluding a stop of the operation due to an incorrect operation of the operation switch 8 or the like during the clothes drying operation from evaluation on the degree of dryness of clothes used for changing the application rank Dx performed in step S17 and subsequent steps. In this embodiment, Y is set to be larger than Z.

[0074] For example, with step S16, if the operation is stopped by an incorrect operation immediately after the start of the clothes drying operation, evaluation on the degree of dryness of clothes that are hardly dried can be excluded, thereby preventing incorrect determination and increasing accuracy of determination.

[0075] Then, step S 17 and subsequent steps are flows of user's evaluation on the degree of dryness of clothes.

[0076] In this embodiment, the user's evaluation on the degree of dryness of clothes is estimated from timing when the user stops the operation, that is, timing when the user operates the operation switch 8.

[0077] In step S17, it is determined whether or not the user operates the operation switch to stop the operation before the lapse of the dehumidifying operation time Y.

[0078] Originally, through step S 18 for determining whether or not the remaining dehumidifying operation time Y calculated in step S 15 is reached, the clothes drying operation is finished in step S 19.

[0079] However, if the user checks the degree of dryness of laundry before the lapse of the dehumidifying operation time Y, determines that there is no need for a further drying operation, and stops the operation before moving to step S18, the process moves to step S31.

[0080] The storage portion 7d has a determination count, which is increased and reduced according to the user's evaluation on the degree of dryness of clothes estimated as described above. An initial value of the determination count is 0.

[0081] In step S21, the determination count, which is a subject value to be updated in the setting count table, the subject value being selected in S2 to S9, is reduced by one point, the result is stored in the storage portion 7d, and the process moves to step S32.

[0082] In step S32, it is determined whether an accumulated count number of the determination count is a predetermined number ("-2" in this embodiment) or smaller.

[0083] In this embodiment, it is determined whether the user stops the operation twice before the lapse of the remaining dehumidification time Y in this and former clothes drying operations. Specifically, it is determined whether the user has an intention to eliminate the need for the operation until the dehumidification time Y, and also incorrect determination due to an incorrect input or a prank by a person other than the user is prevented.

[0084] Then, the process moves to step S33, the application rank Dx corresponding to a state of the object to be dried R in the present clothes drying operation, which has been selected in S2 to S9, is reduced by one to determine a rank applied to a next operation. Simultaneously, the determination count is reset.

[0085] As described above, the user stops the operation before the lapse of the remaining dehumidifying operation time Y, and thus the dehumidifying operation time Y is corrected to be reduced in subsequent operations.

[0086] In this embodiment, the accumulated count number of the determination count is "-2" in step S32, but the accumulated count number maybe "-1" if the rank of the coefficient D is changeably set, or less than "-2" if the rank D is less changeably set.

[0087] When the operation is stopped before the remaining dehumidification time Y, the determination count is reduced by one point. However, the number of points to be reduced may be changed according to timing of the stop. For example, when the operation is earlier stopped, the number of points to be reduced may be larger, and when the operation is stopped closer to the dehumidification time Y, the number of points to be reduced may be smaller.

[0088] Next, in step S 17, when the user does not stop

the operation before the lapse of the remaining dehumidification time Y, it is determined in step S18 whether or not the time Y calculated in step S15 is reached.

[0089] In step S18, when an operation finish condition is satisfied (when the time Y has passed), the process moves to step S 19, and the clothes drying operation is once finished. Then, in step S20, the dehumidifier J internally transitions to a standby state. The standby state refers to a state where dehumidification and air blowing are stopped.

[0090] When the operation finish condition is not satisfied (the time Y has not passed) in step S18, the process moves to step S 17.

[0091] This standby state has a time limit, and it is determined in step S22 whether a predetermined time has passed. When the predetermined time has passed in the standby state, the process moves to step S23, and the operation is finished. This time limit is five hours in this embodiment.

[0092] It is determined in step S21 whether the user again pushes the operation switch 8 to start the clothes drying operation when the dehumidifier is in the standby state. From the user restarting the operation, it is estimated that the user checks the degree of dryness of laundry and determines that the drying operation is again required. When the operation is restarted before moving to step S23, the process moves to step S41.

[0093] In step S41, the determination count, which is a subject value to be updated in the setting count table, the subject value being selected in S2 to S9, is increased by one point, and the process moves to step S42. This result is stored in the storage portion 7d.

[0094] In step S42, it is determined whether the accumulated count number of the determination count is a predetermined value ("+2" in this embodiment) or larger.

[0095] Thus, in this embodiment, it is determined whether or not the user restarts the operation twice after the lapse of the remaining dehumidification time Y in this and former clothes drying operations. Specifically, it is determined whether or not the user has an intention to again dry the clothes in spite of the operation until the dehumidification time Y, and also incorrect determination due to an incorrect input or a prank by a person other than the user is prevented.

[0096] Then, the process moves to S43, the application rank Dx corresponding to a state of the object to be dried R in the present clothes drying operation, which has been selected in S2 to S9, is increased by one to determine a rank applied to a next operation. Simultaneously, the determination count is reset, the process moves to step S44, and an additional clothes drying operation is performed.

[0097] As described above, the user restarts the operation in the standby state, and thus the operation time is corrected to be increased.

[0098] The control flows in step S 17 and subsequent steps described above are summarized below.

(1) When the user turns off the operation before the remaining dehumidifying operation time Y passes:

> It is estimated that the user determines that dehumidification is sufficient before the set remaining dehumidifying operation time Y. In the next and subsequent operations, the remaining dehumidifying operation time Y is set to be reduced as compared to this time (the application rank Dx is reduced).

(2) When dehumidification is performed until the remaining dehumidifying operation time Y (the additional operation is not performed):

> It is estimated that the user determines that dehumidification is sufficient in the set remaining dehumidifying operation time Y. Specifically, it is determined that the remaining dehumidification time as set has no problem. In the next and subsequent operations, the dehumidifying operation time Y is obtained from the coefficient used for obtaining the dehumidifying operation time Y set this time (the application rank Dx is not changed).

(3) When the user adds the operation after dehumidification is performed until the remaining dehumidifying operation time Y:

> It is estimated that the user determines that dehumidification is insufficient. In the next and subsequent operations, the remaining dehumidifying operation time Y is set to be increased as compared to this time (the application rank Dx is increased).

[0099] In this embodiment, the example has been described in which the user's evaluation on the degree of dryness of clothes is estimated from the timing when the user stops the operation, that is, the timing when the user operates the operation switch 8, the estimation is regarded as an input of evaluation information, which leads to correction of the operation time during the normal operation, but not limited to this. The dryness evaluation switch 11 as shown in Figure 4 may be provided so that the user positively inputs evaluation information.

[0100] In the case where the user inputs evaluation on the degree of dryness using the dryness evaluation switch 11, for (1) to (3) above, an evaluation of "excessive drying" corresponds to (1), an evaluation of "moderate" corresponds to (2), and an evaluation of "insufficient drying" corresponds to (3).

[0101] As described above, according to this embodiment, the degree of dryness of laundry, which is an object to be dried R, is corrected for the operation time determined by the control circuit 7 based on the user's evaluation on the degree of dryness of clothes, and the op-

eration is controlled in the corrected operation time.

[0102] Also, the user's evaluation information input from the evaluation information input means may be stored in the storage portion 7d, and an amount of correction of the operation time may be changed by accumulation of user's evaluations. This allows a user's satisfaction level on drying to be reflected as evaluation information on the operation time of the clothes drying operation, and allows a drying operation of laundry to be performed to suit to a preference of an individual user.

[0103] In particular, a coefficient used in an expression used for determining dehumidification time and a determination count value for changing the coefficient are determined according to an amount of an object to be dried R and a degree of ease of drying the object to be dried R (degree of quickness of drying), enabling proper dehumidification time to be set according to conditions such as the amount of object to be dried R and/or the degree of ease of drying (degree of quickness of drying).

[0104] Also, although in this embodiment, a position of an object to be dried R is detected using the infrared sensor 6, such detection may be performed by means of image processing using an optical sensor such as a camera.

[0105] Also, a degree of ease of drying the object to be dried R (degree of quickness of drying) may be obtained from a value detected by the humidity sensor 4.

Industrial Applicability

[0106] The dehumidifier according to the present invention can be used for drying laundry, which is an object to be dried R, hung in a room.

Description of Symbols

[0107] 1 air direction variable means, 1a vertical louver, 1b horizontal louver, 1c vertically variable motor, 1d horizontally variable motor, 2 blowing fan, 2a fan motor, 3 temperature sensor, 4 humidity sensor, 5 dehumidification device, 6 infrared sensor, 6a infrared absorbing film, 6b thermistor, 7 control circuit, 7a input circuit, 7b output circuit, 7c CPU, 7d storage portion, 7e timer portion, 8 operation switch, 9 temperature sensor, 10 humidity sensor, 11 dryness evaluation switch, 12 display portion, 100 dehumidifier casing, 101 inlet, 102 water storage tank, 103 outlet, P indoor air, Q dry air

Claims

1. A dehumidifier comprising:

a casing;
a blowing fan that sucks indoor air into the casing and blows out the air;
dehumidification means for removing moisture from the indoor air taken into the casing by the blowing fan; and
control means for controlling the blowing fan and the dehumidification means,
wherein the control means performs a clothes drying operation of detecting a state of clothes to be dried and drying the clothes according to the detected state, and an operation time of the clothes drying operation is determined based on evaluation information on a degree of dryness of clothes in a clothes drying operation formerly performed.

2. The dehumidifier according to claim 1, wherein the state of the clothes includes an amount of the clothes to be dried.

3. The dehumidifier according to claim 1, wherein the state of the clothes includes a degree of ease of drying the clothes to be dried.

4. The dehumidifier according to any one of claims 1 to 3, wherein the state of the clothes is detected using an infrared sensor.

5. The dehumidifier according to any one of claims 1 to 4, further comprising:

temperature detection means for detecting a temperature of the indoor air;
humidity detection means for detecting a humidity of the indoor air; and
operation time measuring means for measuring an operation time from a start of the clothes drying operation,
wherein the control means determines a subsequent operation time based on outputs of an output signal for the operation time from the operation time measuring means and detection signals from the temperature detection means and the humidity detection means when the detection signal from the humidity detection means is a detection signal corresponding to a predetermined humidity or lower, and further corrects the operation time based on the evaluation information to control the clothes drying operation in the corrected operation time.

6. The dehumidifier according to claim 5, further comprising storage means,
wherein the storage means stores the evaluation information obtained in each clothes drying operation, and
the control means changes an amount of correction of the operation time based on the evaluation information accumulated in the storage means.

7. The dehumidifier according to any one of claims 1 to 6, further comprising an operation switch for start-

ing and stopping the clothes drying operation, wherein the control means obtains the evaluation information based on operation timing of the operation switch in the clothes drying operation.

8. The dehumidifier according to any one of claims 1 to 6, further comprising evaluation input means with which a user can input the evaluation information, wherein the control means changes an amount of correction of the operation time based on the evaluation information input by the evaluation input means.

Fig. 1

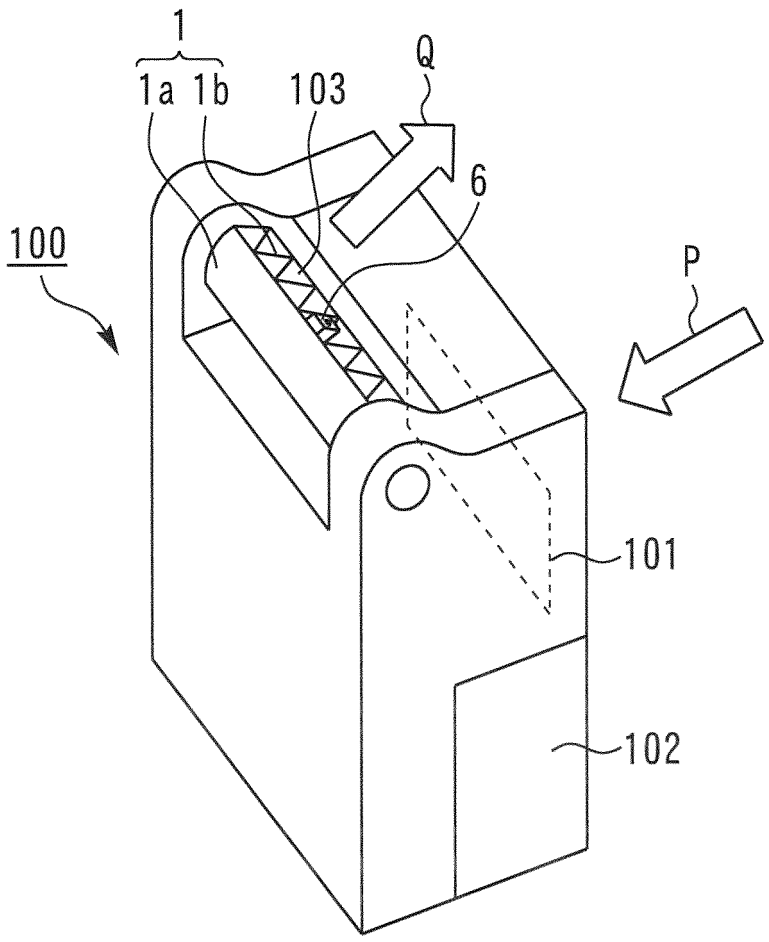


Fig. 2

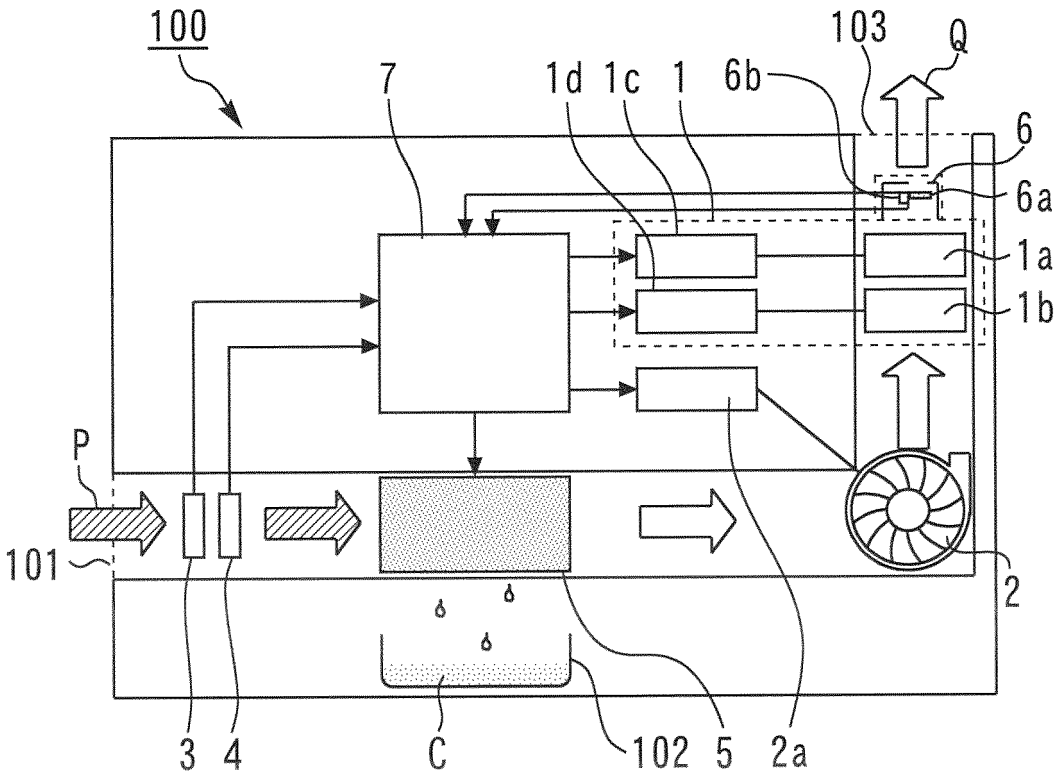


Fig. 3

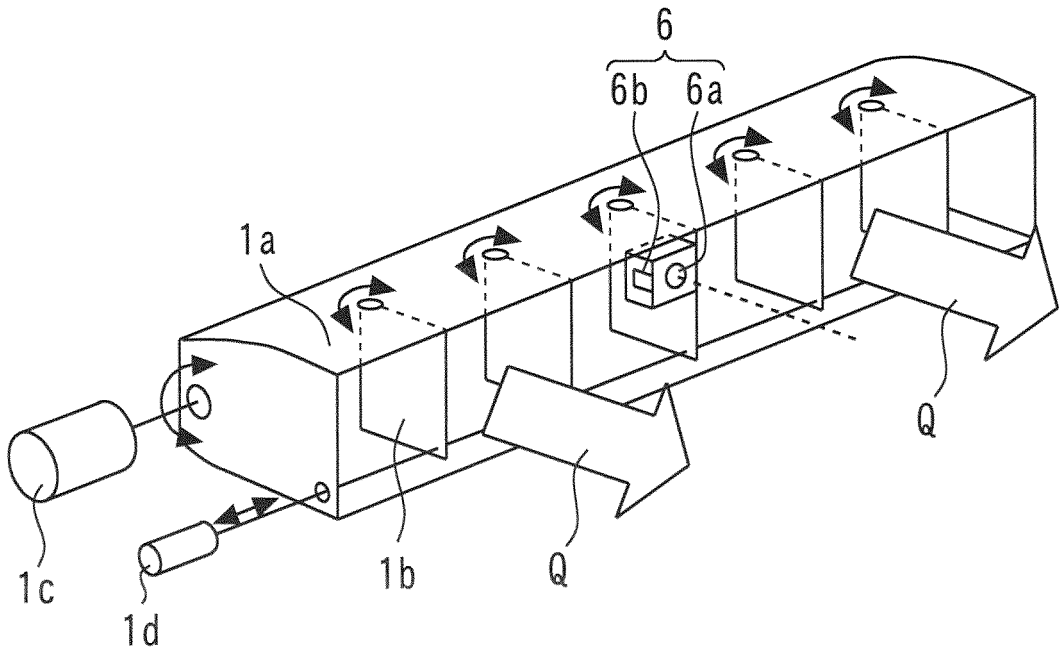


Fig. 4

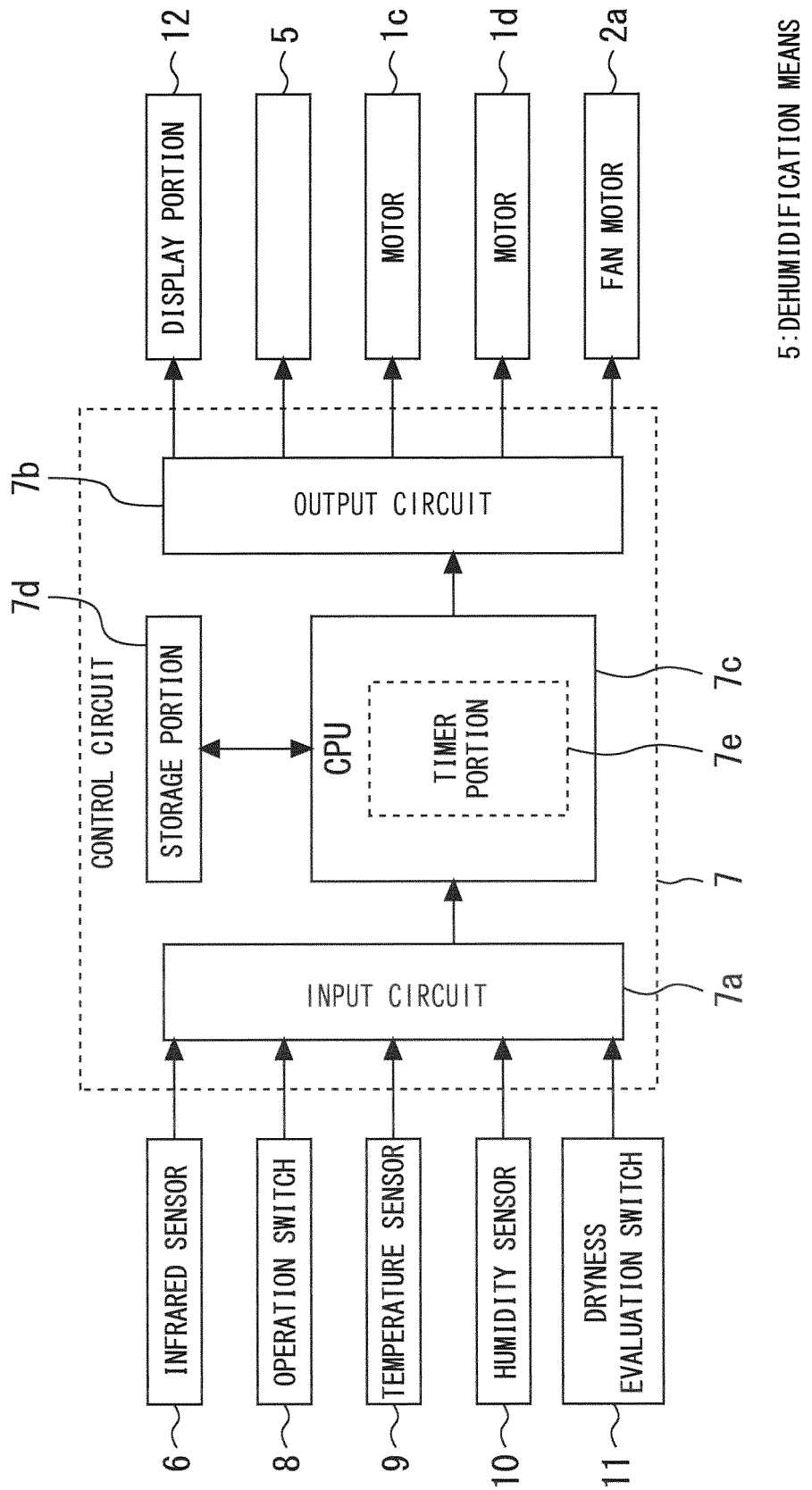
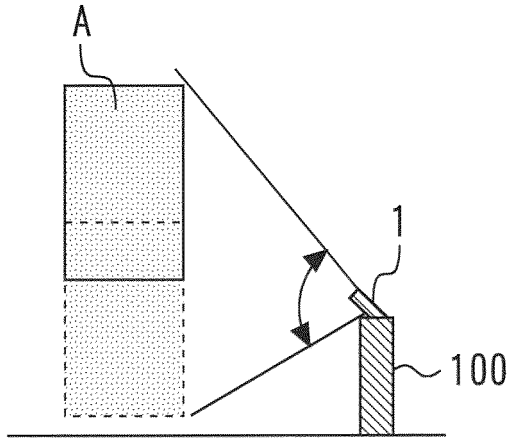
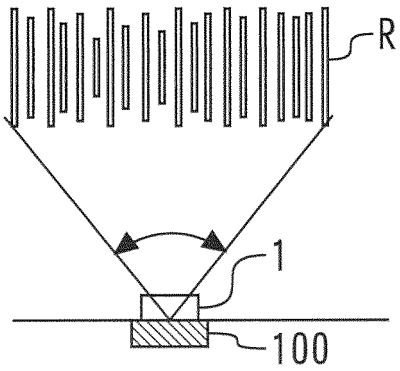

12
5
1c
1d
2a
DISPLAY PORTION
MOTOR
MOTOR
FAN MOTOR
7b
OUTPUT CIRCUIT
7d
CONTROL CIRCUIT
STORAGE PORTION
CPU
TIMER PORTION
7c
7e
7
INPUT CIRCUIT
7a
INFRARED SENSOR
OPERATION SWITCH
TEMPERATURE SENSOR
HUMIDITY SENSOR
DRYNESS EVALUATION SWITCH
6
8
9
10
11
5:DEHUMIDIFICATION MEANS

Fig. 5



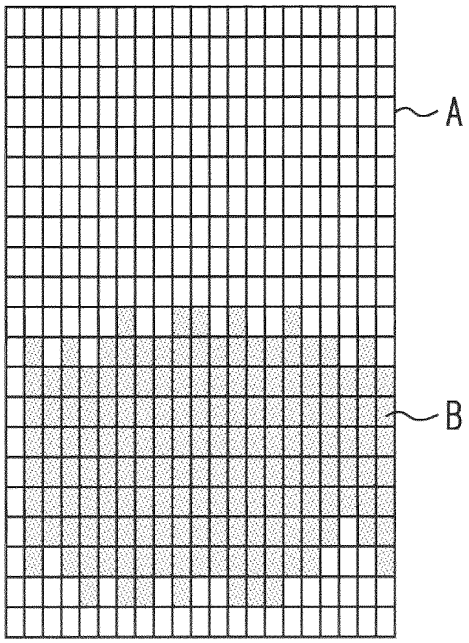
(a) VERTICAL LOUVER DIRECTION



(b) HORIZONTAL LOUVER DIRECTION

Fig. 6

(a) STATE BEFORE DRYING OPERATION



(b) STATE AFTER LAPSE OF PREDETERMINED PERIOD OF TIME FROM START OF DRYING OPERATION

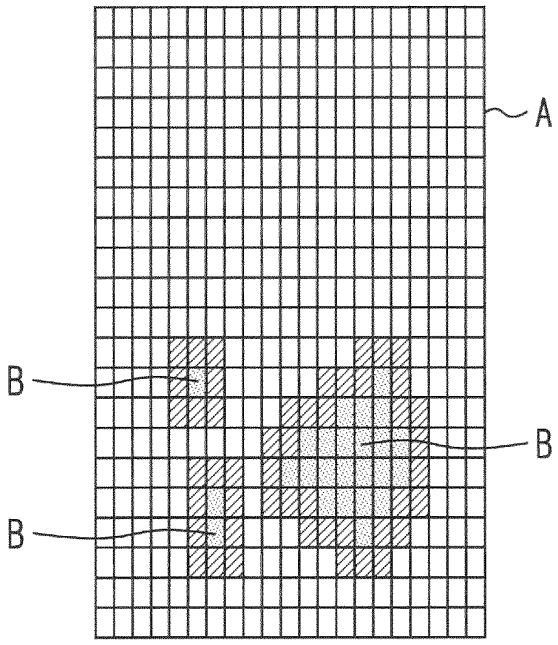
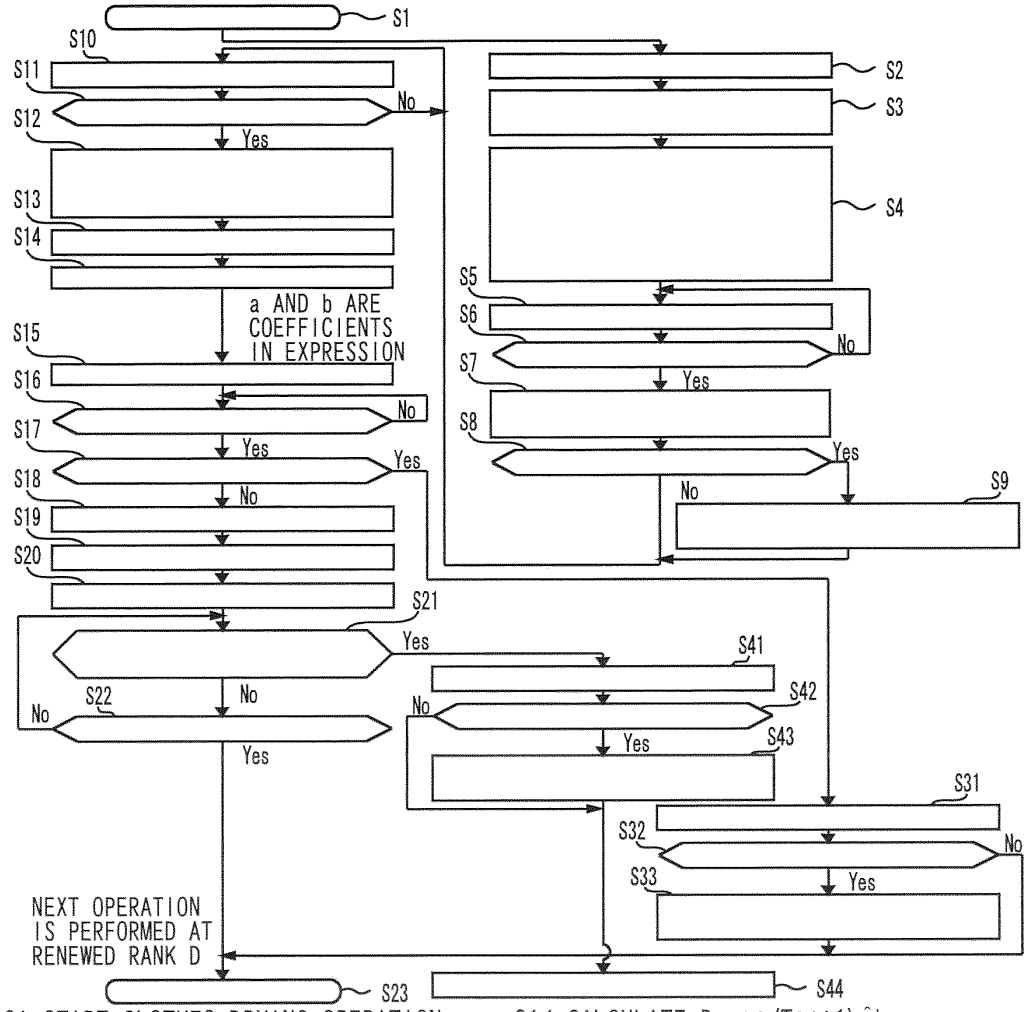


Fig. 7



S1: START CLOTHES DRYING OPERATION
S2: INFRARED SENSOR INITIAL OPERATION
S3: MAKE CELL COUNT m1 IN INTENSIVE BLOW AREA
S4: DETERMINE APPLICABLE AREA IN APPLICATION RANK Dx TABLE IN WHICH
m1 < a: AREA "SMALL"
a ≦ m1 < b: AREA "MEDIUM"
b ≦ m1: AREA "LARGE"
S5: MAKE DRYNESS COUNT EVERY TEN MINUTES
S6: 60-MINUTE OPERATION ENDS?
S7: MAKE CELL COUNT m2 OF CELLS HAVING DRYNESS COUNT OF 2 OR MORE
S8: m2/m1 EQUAL TO OR EXCEEDS 0.8?
S9: SWITCHING TO EASY-TO-DRY IN AREA-BASED RANK D TABLE
S10: DETERMINE HUMIDITY EVERY 10 MINUTES
S11: IS HUMIDITY OF 50% OR LOWER DETECTED?
S12: OBTAIN TIME WHEN HUMIDITY BECOMES LOWER THAN 50%: t1, AND TEMPERATURE AT THE TIME: T
S13: CALCULATE T×t1
S14: CALCULATE D=a×(T×t1)^b BY APPLICATION RANK Dx
S15: CALCULATE SUBSEQUENT DEHUMIDIFICATION TIME Y Y=t1×(D-T/100)
S16: IS OPERATION TIME Z REACHED?
S17: DOES USER STOP OPERATION?
S18: DETERMINATION REGARDING FINISH CONDITION
S19: FINISH CLOTHES DRYING OPERATION
S20: MOVE TO STANDBY STATE
S21: IS OPERATION RESTARTED? (OPERATION BUTTON)
S22: HAS 5 HOURS PASSED AFTER STANDBY?
S23: FINISH OPERATION
S31: REDUCE DETERMINATION COUNT BY ONE
S32: IS DETERMINATION COUNT -2 OR SMALLER?
S33: REDUCE APPLICATION RANK Dx BY ONE AND RESET COUNT
S41: INCREASE DETERMINATION COUNT BY ONE
S42: IS DETERMINATION COUNT 2 OR LARGER?
S43: INCREASE APPLICATION RANK Dx BY ONE AND RESET COUNT
S44: ADD CLOTHES DRYING OPERATION

Fig. 8

<TARGET DEGREES OF DRYNESS AND COEFFICIENTS FOR EACH RANK>

RANK Dx	TARGET DEGREE OF DRYNESS	COEFFICIENT a	COEFFICIENT b
D1	97.5	a1	b1
D2	98	a2	b2
D3 (INITIAL VALUE)	98.5	a3	b3
D4	99	a4	b4
D5	99.5	a5	b5

Fig. 9

(a)
(DETERMINATION COUNT TABLE)

		DEGREE OF EASE OF DRYING	
		NORMAL	EASY-TO-DRY
APPLICABLE AREA	LARGE	0	0
	MEDIUM	0	0
	SMALL	0	0

COUNT INCREASED/REDUCED ACCORDING TO THE EVALUATION IN THE PROCESSES OF STEP S17 AND SUBSEQUENT STEPS

(b)
(APPLICATION RANK Dx TABLE)

		DEGREE OF EASE OF DRYING	
		NORMAL	EASY-TO-DRY
APPLICABLE AREA	LARGE	D3	D2
	MEDIUM	D3	D2
	SMALL	D3	D2

RANK Dx VARIES WITHIN D1 TO D5 ACCORDING TO COUNT IN DETERMINATION COUNT TABLE

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/053314

A. CLASSIFICATION OF SUBJECT MATTER
D06F58/28(2006.01)i, *D06F58/10*(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)
D06F58/28, D06F58/10

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 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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.
Y A	JP 2011-214825 A (Mitsubishi Electric Corp., Mitsubishi Electric Home Appliance Co., Ltd.), 27 October 2011 (27.10.2011), paragraphs [0006], [0012] to [0113]; all drawings (Family: none)	1-6,8 7
Y A	JP 2008-167889 A (Matsushita Electric Industrial Co., Ltd.), 24 July 2008 (24.07.2008), paragraph [0145]; all drawings (Family: none)	1-6,8 7

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 April, 2014 (16.04.14)	28 April, 2014 (28.04.14)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/053314

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 8-117493 A (Electrolux Zanussi Elettrodomestici S.p.A.), 14 May 1996 (14.05.1996), paragraphs [0008], [0018] to [0038]; all drawings & EP 707107 A1	1-6,8 7
Y	JP 6-187012 A (Basch-Siemens Hausgerate GmbH), 08 July 1994 (08.07.1994), entire text & EP 582051 A2 & DE 4225768 A1 & ES 2115694 T3	8
A	JP 2000-342444 A (Zojirushi Corp.), 12 December 2000 (12.12.2000), entire text; all drawings (Family: none)	1-8

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 7139759 A **[0003]**