

DEHUMIDIFIER AND CONTROL METHOD THEREOF

FIELD OF THE INVENTION

[0001]

5 The present invention relates to a dehumidifier, for example, which is able to supply low-humidity air into a dry room, and relates to a control method thereof.

BACKGROUND ART

10 [0002]

For example, a dry room, which is a space under the low-humidity environment, is commonly used in manufacturing processes such as a display device, a semiconductor device and a non-aqueous battery. A dehumidifier using a dry-type
15 dehumidification is well known as a device for supplying low dew point air into the dry room. The dehumidifier is able to have processed air passing through an absorption roter (a dehumidification roter) so as to absorb moisture in the processed air. Further the dehumidifier is able to have
20 recycled air that is heated at predetermined temperature passing through it so as to recover the ability of dehumidification.

[0003]

25 In respect to this kind of dehumidifiers, for example, Patent Document 1 discloses a dehumidifier that controls

recycling ability of the dehumidification material on the basis of relation either between temperature of the recycled air and a dehumidifying ability, between rotational speed of the absorption roter and the dehumidifying ability, or between a quantity of recycled air and the dehumidifying ability, so as to maintain a dew point of supplied air by freely lowering the recycling ability.

[0004]

Patent Document 1: JP H6-63344 A

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED

[0005]

However, in the dehumidifier disclosed in the Patent Documents 1, it is necessary to prepare many data such as relations between temperature of the recycled air and the dehumidifying ability and between rotational speed of the absorption roter and the dehumidifying ability. In this case, this preparation is troublesome and its control is complicated.

[0006]

Embodiments of the present invention seek to provide a dehumidifier such that it may stabilize a dew point of a secondary side without a complex control, even though a quantity of the recycled air is changed.

MEANS FOR SOLVING THE PROBLEM

[0007]

According to a first aspect, there is provided a dehumidifier comprising an absorption roter to absorb moisture in the processed air wherein the absorption roter has a plurality of divided areas of the absorption roter including a processing area, a recycling area and a purging area, a heater to heat recycled air so as to separate the absorbed moisture from the absorption roter, and a rotating means to rotationally drive the absorption roter, wherein the dehumidifier comprises a supplied air quantity detector configured to detect quantity of the supplied air for a secondary side, a humidity detector configured to detect absolute humidity of the processed air at prior to a point through which the absorption roter passes, a rotational speed control means configured to control rotational speed of the absorption roter rotated by the rotating means, a recycled air quantity control means configured to control quantity of the recycled air on the basis of a calculation result of the quantity of the recycled air wherein the quantity of the recycled air is calculated on the basis of the absolute humidity of the processed air detected by the humidity detector, the quantity of the supplied air detected by the supplied air quantity detector, and a predetermined dew point of the processed air.

[0008]

According to an embodiment, a recycled air quantity control means is able to control the quantity of the recycled air on the basis of a calculation result of the quantity of the recycled air wherein the quantity of the recycled air is calculated on the basis of the absolute humidity of the processed air detected by the humidity detector, the quantity of the supplied air detected by the supplied air quantity detector, and a predetermined dew point of the processed air. Thus, it may stabilize the dew point of a secondary side without a complex control even though the quantity of the recycled air is changed.

[0008a]

According to a second aspect, there is provided a dehumidifier comprising: an absorption roter to absorb moisture in processed air wherein the absorption roter has a plurality of divided areas of the absorption roter including a processing area, a recycling area and a purging area; a heater to heat recycled air so as to separate the absorbed moisture from the absorption roter; and a rotating means to rotationally drive the absorption roter, wherein the dehumidifier comprises: a processing area control means arranged at prior to a point where the processed air passes through the absorption roter wherein the processing area control means is configured to be able to change the size of the processing area by shielding a part of the processing area of the absorption roter, and configured to control the processing area so as to increase or decrease the size of the processing area in response to a quantity of supplied air for a secondary side.

[0008b]

According to a third aspect, there is provided a control method of a dehumidifier, the dehumidifier comprising: an absorption roter to absorb moisture in processed air wherein the absorption roter has a plurality of divided areas of the absorption roter including a processing area, a recycling area and a purging area; a heater to heat recycled air to separate the absorbed moisture from the absorption roter; and a rotating means to rotationally drive the absorption roter, wherein the control method has the steps comprising: controlling a quantity of the recycled air on the basis of a calculation result of the quantity of the recycled air wherein the quantity of the recycled air is calculated on the basis of the absolute humidity of processed air at prior to a point through which the absorption roter passes, a quantity of supplied air given by differential pressure between air in primary side of the absorption roter and air in secondary side of it, and a predetermined dew point of the processed air; and controlling rotational speed of the absorption roter on the basis of a calculation result of the rotational speed wherein the rotational speed of the absorption roter is calculated on the basis of the quantity of the supplied air.

[0008c]

According to a fourth aspect, there is provided a control method of a dehumidifier, the dehumidifier comprising: an absorption roter to absorb moisture in processed air wherein the absorption roter has a plurality of divided areas of the absorption

roter including a processing area, a recycling area and a purging area; a heater to heat recycled air so as to separate the absorbed moisture from the absorption roter; and a rotating means to rotationally drive the absorption roter, wherein the control method has the steps comprising: calculating the size of the processing area which will be needed on the basis of a quantity of supplied air for secondary side given by differential pressure between air in primary side before passing through the absorption roter and air in secondary side after passing through it; and shielding a part of the processing area of the absorption roter on the basis of a calculation result of the size of the processing area.

ADVANTAGEOUS EFFECT OF THE INVENTION

[0009]

According to embodiments of the present invention, it is possible to provide a dehumidifier and a control method thereof such that it is able to stabilize the dew point of a secondary side without a complex control even though the quantity of the recycled air is changed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a typical block diagram illustrating a dehumidifier according to the present embodiment;

FIG. 2A is a drawing illustrating a shielding mechanism

with five processing area adjustment plates opened;

FIG. 2B is a drawing illustrating a shielding mechanism with five processing area adjustment plates laminated;

FIG. 2C is a drawing illustrating a shielding mechanism
5 with two of five processing area adjustment plates laminated;

FIG. 3A is an explanatory drawing illustrating a maximum area example in which a processing area of absorption roter is maximized;

FIG. 3B is an explanatory drawing illustrating a minimum
10 area example in which a processing area of absorption roter is minimized;

FIG. 4 is a flow chart illustrating a procedure of controlling a dehumidifier according to the present embodiment;

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DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENT

[0011]

Embodiments of the present invention will be described in detail with reference to the related drawings as needed.

20 FIG. 1 is a typical block diagram illustrating a dehumidifier according to the present embodiment.

[0012]

As shown in Fig.1, a dehumidifier 10 according to the
25 present embodiment comprises an absorption roter 12 to absorb moisture in the processed air passing through the processing

air using by dehumidification material (not illustrated), a processing fan 14a for supplying the processed air, a inverter 14b for controlling drive of the processing fan 14a, a recycling fan 16a for supplying the recycled air so as to separate the absorbed moisture from the absorption roter 12, an inverter 16b for controlling drive of the recycling fan 16a, a heater 18 for heating the recycled air to predetermined temperature so as to separate the absorbed moisture from the absorption roter 12, and a moter (rotating means) 20 for rotationally driving the absorption roter 12 in the direction of an arrow A at the predetermined rotational speed.

[0013]

In addition, the moter 20 comprises a driver (not illustrated), as will be mentioned below, electrically connected to a controller 32 wherein the rotational speed of the moter 20 is controlled on the basis of the a otational speed control signal outputted from the controller 32, and a rotational speed cpntrol means is configured by the controller 32 and the driver.

[0014]

In addition, the dehumidifier 10 has a cooling coil 22a for pre-cooling outside air (open air) taken into the dehumidifier, another cooling coil 22b for cooling the supplied air (dry air) absorbed by the absorption roter 12, a shielding

mechanism (a processing area control means) 24 for controlling the processing area so as to increase or decrease the size of the processing area in response to a quantity of the supplied air for a secondary side, a temperature and humidity sensor
5 (humidity detector) 26 for detecting temperature and humidity of the processed air at prior (upstream side) to a point where the processed air passes through the absorption roter 12, a differential pressure gauge 28 for measuring differential pressure between air in primary side before passing through the
10 absorption roter and in secondary side after passing through it, a dew point sensor 30 for detecting a dew point of the supplied air supplied into an air-conditioned room (a dry room), which is not illustrated, a controller (rotational speed control means, recycled air quantity control means) 32 for
15 controlling and/or calculating a quantity of the recycled air, and for controlling rotational speed of the motor 20.

[0015]

In addition, detection signals such as a temperature
20 detection signal and a humidity detection signal detected by temperature and humidity sensor 26, and a detection signal from the dew point sensor are inputted to the controller 32. And the controller 32 is configured to execute predetermined control on the basis of above detection signals.

25 In addition, the differential pressure gauge 28 and the controller 32 are able to act as the supplied air quantity

detector. Furthermore, the controller 32 is electrically connected to the inverter 14b for driving the processing fan 14a and is able to control the quantity of the processed air by controlling processing fan 14a on the basis of a control
5 signal inputted to the inverter 14b.

[0016]

Furthermore, the controller 32 is electrically connected to the inverter 16b for driving the recycling fan 16a and is
10 able to control the quantity of the processed air by controlling recycling fan 16a on the basis of a control signal inputted to the inverter 16b.

In addition, the controller 32 is able to control by outputting a heat control signal to the heater 18 so as to
15 maintain heating temperature of the recycled air heated by the heater 18 at predetermined temperature.

[0017]

The absorption roter 12 has a disk like shape. For example,
20 the absorption roter 12 has internal dehumidification material (not illustrated) made of honeycome-form nonwoven fabric impregnated with lithium chloride or silica gel. As mentioned below, the absorption roter 12 is able to absorb the moisture in the processed air by its passing along the axis direction.

25 In addition, the absorption roter 12 has partition plates (not illustrated) at fore and aft portions of the absorption

roter 12, thus the absorption roter 12 has three divided areas
sparated by the partition plates. Processing area 36, recycling
area 38 and purging area 40 are arranged in this order in a
clockwise direction when viewed from upstream side of a
5 processing passage 42, as will be mentioned below.

[0018]

In addition, the absorption roter 12 is pivotally
supported to a moter axis of the motor 20. The controller 32
10 has motor 20 rotationally driven by a rotational speed control
signal (not illustrated) from the controller 32 so that the
absorption roter 12 is rotated in the direction of an arrow A.
Thus the internal dehumidification material (not illustrated)
inside the absorption roter 12 is configured to pass and revolve
15 in the order of processing area 36, recycling area 38, purging
area 40, processing area 36, recycling area 38

[0019]

The processing area 36 is connected to a processing
20 passage 42 of which one end at the upstream side is communicated
with outside air so as to take outside air into the processing
passage 42 and the other end at the downstream side is
communicated with an air-conditioned room (a dry room), which
is not illustrated. The cooling coil 22a, the processing fan
25 14a, the humidity sensor 26, the absorption roter 12, the
cooling coil 22b and the dew point sensor 30 is respectively

arranged in the processing passage 42 in this order from the upstream side to the downstream side.

[0020]

5 As mentioned above, the differential pressure gauge 28, which measures differential pressure between air in primary side before passing through the absorption roter and in secondary side after passing through it, is arranged in the processing passage at fore and aft positions when viewed from
10 the absorption roter 12.

[0021]

 A recycling passage 44 diverges from the upstream side of the processing passage 42. The recycling passage 44 is
15 communicated with the purging area 40 and the recycling area 38. The recycled air passes through the processing area 36 by turning around after passing through the purging area 40 so that the recycled air is discharged into the atmosphere. The heater 18, the recycling fan 16a and and the inverter 16b are arranged
20 in the recycling passage 44. The heater heats the recycled air passing through the purging area 40 to predetermined temperature. The recycling fan 16a and the inverter 16b suck in the air passing through an upstream portion of processing passage 42 from the branching point so that the recycled air
25 flows along the processing passage 42.

[0022]

In addition, a portion of the recycling passage 44 from the branching point to the connected point with the heater 18, including the purging area 40, also acts as the purging passage.

5 In this purging passage, the dehumidification material passing through the purging area 40 is cooled by the pre-cooled processed air.

[0023]

10 FIG. 2 illustrates a structure of the shielding mechanism. FIG. 2A is a drawing illustrating a shielding mechanism with five processing area adjustment plates opened, FIG. 2B is a drawing illustrating a shielding mechanism with five processing area adjustment plates laminated, and FIG. 2C is a
15 drawing illustrating a shielding mechanism with two of five processing area adjustment plates laminated.

[0024]

The shielding mechanism 24 shaped in the form of a fan,
20 as shown in FIG.2, is arranged at the side of the purging area 40 in the processing area 36. The shielding mechanism 24 has processing area adjustment plates 24a - 24e, which are made of a plurality of an approximately triangle shaped thin plates, rotatably supported by a center of these plates. It is possible
25 to increase and decrease the size of the processing area 36 through which the processed air passes, by changing the angle

of the fan-shpaed shielding mechanism 24. As the present embodiment, a shielding mechanism with five processing area adjustment is shown as an example, but is not limited thereto.

5 [0025]

The shielding mechanism 24 has an actuator ACT by which a plurality of processing area adjustment plates 24a - 24e is able to slide (swing and displace) to a predetermined angle in direction to open or close the shielding mechanism 24. For
10 example, this actuator ACT may be configured by a swinging type rotary actuator, which has a plurarity of types such as a vane type in which vane is directly driven, a rack and pinion type in which linear movement is converted into rotational movement, a yoke type, a crank type, and a screw type, or a liner actuator.

15

[0026]

In addition, the actuator ACT may be configured by a fluid pressure cylinder. For example, the actuator ACT (see a dash line in FIG.2A) may be configured by a trunnion type cylinder
20 such that a tip part of a piston rod is connected with the side of the processing area adjustment plates 24a - 24e, and is able to move back and forward so as to integrally displace the processing area adjustment plates 24a - 24e, and such that an end of a cylinder tube is supported by a pin (not illustrated)
25 fitted in a bracket (not illustrated) so as to freely swing. In this case, an entire trunnion type cylinder may be configured

to swing with the pin corresponding to a quantity of sliding the processing area adjustment plates 24a - 24e.

In addition, each of the processing area adjustment plates 24a - 24e has a locking claw, which is engaged with the another adjacent processing area adjustment plate so as to slide the processing area adjustment plate and the another adjacent processing area adjustment plate together when the processing area adjustment plate slides along a circumferential direction.

10

[0027]

The size of processing area 36 shielded by the shielding mechanism 24 may be adjusted by sliding in direction to open or close the shielding mechanism 24. In addition, it is possible to slide in direction to open or close the shielding mechanism 24 by manual operation.

15

Furthermore, the number of the processing area adjustment plates of shielding mechanism 24 may be more than one, however preferably more than two. In addition, it is possible that a plurality of plates having different sizes are prepared and exchangeably mounted to the absorption roter 12 so as to have a single sliding plate with a predetermined size.

20

[0028]

In addition, the shielding mechanism 24 is arranged in the upstream side of processing passage 42 and at prior (upstream

25

side) to a point where the processed air passes through the absorption roter. In this case, it is more preferable by a smaller spacing distance between the shielding mechanism 24 and the absorption roter 12 where they are in a non-contact state.

5

[0029]

In addition, when the processing area 36 is shielded, the shielding mechanism 24 may have a plurality of the processing area adjustment plates 24a - 24e slide in the rotational
10 direction (direction of the arrow A) to open the shielding mechanism 24 by driving the actuator ACT so that the size of processing area 36 decreases by increasing area shielded by the processing area adjustment plates 24a - 24e (see FIG.2A).

In the opposite case, the shielding mechanism 24 may have
15 a plurality of the processing area adjustment plates 24a - 24e slide in the opposite rotational direction (opposite direction of the arrow A) to close the shielding mechanism 24 by driving the actuator ACT so that the size of processing area 36 increases by decreasing area shielded by the processing area
20 adjustment plates 24a - 24e (see FIG.2B and FIG.2C).

[0030]

In other words, the number of the processing area adjustment plates 24a - 24e slided by actuator ACT is able to
25 be adjusted so as to simply change the size of the shielded processing area 36.

[0031]

In addition, the shape of the shielding mechanism 24 is not limited to fan-like shape. For example, the shielding mechanism 24 has a manifold (not illustrated), which is arranged at prior to the absorption roter, such that the processing passage is branched to a plurality of branched passages at the manifold, and each of the branched passages has a valve by which each branched passage is controlled by a control signal outputted from the controller 32 so as to open or close any branched passage.

In this case, the processed air is supplied to the processing area 36 by passing through the branched passages with the valve opened. In other words, the processing area 36 is shielded by the branched passages with the valve closed.

[0032]

Furthermore, the shielding mechanism 24 has two shielding plates with more than one slits (not illustrated), which is arranged at prior to the absorption roter 12, such that the two shielding plates is overlapped so as to change the opening area of the slits by relatively displacing between the two shielding plates.

In this case, the processed air is supplied to the processing area 36 by passing through the opening area of the slits. In other words, the processing area 36 is shielded by

other portion of the opening area of the slits.

[0033]

Next, referring to FIG.3, actions and effects of the
5 shielding mechanism 24 are explained hereinafter.

FIG. 3A is an explanatory drawing illustrating a maximum
area example in which a processing area 36 of absorption roter
12 is maximized, and FIG. 3B is an explanatory drawing
illustrating a minimum area example in which a processing area
10 36 of absorption roter 12 is minimized.

There is no difference between the maximum area example
and the minimum area example except for the size of the
processing area 36 shielded by the processing area adjustment
plates 24a - 24e. The arrow A shown in the FIG.3 denotes the
15 rotational direction of the absorption roter 12.

In addition, in the maximum area example and the minimum
area example, both rotational speeds of the absorption roter
12 driven the motor 12 are set at the same speed as the rated
speed.

20 For convenience of explanation, a partial processing area
36A (a dot portion shown in the FIG.3), which is a part adjacent
to the purging area 40, is virtually set in the processing area
36 of the absorption roter 12. The actions and effects of the
shielding mechanism 24 are described below, when the partial
25 processing area 36A rotates in the direction of the arrow A.

[0034]

In the case of the maximum area example, as shown in the FIG.3A, the size of the processing area 36 is set to S1 (rated processing area) at the central angle θ_1 .

5 In the case of the the minimum area example, as shown in the FIG.3B, the size of the processing area 36 is set to S2 ($S_1 > S_2$) at the central angle θ_2 , which is smaller than the central angle θ_1 .

When the absorption roter 12 rotates in the direction of
10 the arrow A at the predetermined rotational speed, a processing area staying time, which is the time when the partial processing area 36A stays in the processing area 36, is T1 in the case of the maximum area example.

15 [0035]

On the other hand, a processing area staying time is T2, which is shorter than T1 ($T_1 > T_2$), in the case of the minimum area example.

20 [0036]

Thus, in this present embodiment, the size of the processing area 36 is able to changed by shielding mechanism 24 from a maximaum size to minimum size ($S_1 \rightarrow S_2$) so as to decrease the processing area staying time of the partial
25 processing area 36A ($T_1 \rightarrow T_2$).

For example, when the absorption roter 12 rotates at the

low rotational speed slower than predetermined rotational speed, saturation of moisture in the processing area 36 is able to be avoided so as to sufficiently maintain the ability of absorption of moisture in the processing area 36 in the case of the minimum area example, in comparison with a case in which the absorption roter 12 rotates at the predetermined rotational speed in the case of maximaum area example.

[0037]

In other words, in the case of the maximaum area example (as shown in FIG.3A), when the absorption roter 12 rotates at the low rotational speed, the ability of absorption of moisture of the partional processing area 36A has been saturated before the partial processing area 36A reaches the processing area 36 so that the processed air passes through the partional processing area 36A without the processed air dried. As a result, the lowering of the dew point of the supplied air is disturbed so that a dew point of the supplied air increases (gets worse). The smaller the rotational speed of absorption roter 12 is small, the larger this tendency is.

On the other hand, in the case of the minimum area example (as shown in FIG.3A), when the absorption roter 12 rotates at the low rotational speed, the ability of absorption of moisture of the partional processing area 36A is maintained so as to obtain the dry air with a desired dew point.

In the present invention, an example in which the size of

the processing area 36 is changed from S1 in the case of the maximum area example to S2 in the case of the minimum area example. However it is possible not to change the size.

5 [0038]

In addition, an area shielded by the processing area adjustment plates 24a - 24e of the shielding mechanism 24 is always kept in the state of high degree of dryness (dry state), since the processed air is prevented from passing through the
10 absorption roter 12.

Thus, for example, when the quantity of the supplied air is changed from small to large, the area shielded by the processing area adjustment plates is able to minimize by energizing the actuator ACT so as to avoid increasing the dew
15 point.

In addition, when the absorption roter 12 rotates at the lower rotational speed, a recycling ability of the recycling area 38 is higher so that the dehumidification material is able to be recycled in the recycling area 38.

20

[0039]

The dehumidifier 10 according to the present embodiment is basically configured as mentioned above. Next actions and effects of the shielding mechanism 24 are explained.

25

[0040]

First, referring to FIG.1, A flow of the air is explained.

After the outside air (open air) taken from the atmosphere passes along the processing passage 42, and is pre-dehumidified by passing through the cooling coil 22, the outside air is taken
5 into the processing area 36 of the absorption rotor 12 not shielded by the shielding mechanism 24. In the processing area 36, moisture in the air is absorbed and removed by the dehumidification material (e.g. silica gel, zeolite etc.) of the absorption rotor 12 so as to generate the dry by removing
10 moisture from the air.

The dry air passing through the processing area 36, which becomes the supplied air (SA) with a low dew point, is supplied into an air-conditioned room (not illustrated). Thus the pre-determined quantity of the supplied air is supplied into
15 the air-conditioned room corresponding to the pre-determined dew point of the supplied air so as to make an environment in the air-conditioned room with low degree of humidity at the desired dew point.

20 [0041]

At the same time, after the recycled air passes through the purging area 40, the recycled air, which passes through the recycling passage 44 diverging from the processing passage 42, is heated by the heater 18 upto the pre-determined temperature.

25 The recycled air heated upto the pre-determined temperature is able to remove the absorbed moisture, which the

absorption roter 12 abosorbs by passing through the recycling area 38, from the absorption roter 12 so as to recover the absorption ability of the absorption roter 12.

The recycled air passing through the recycling area 38,
5 which becomes exhaust air, is discharged into the atmosphere.

[0042]

By the way, regarding designs of the dehumidifier 10 in the prior art, the target quantity of the recycled air is
10 determined on the basis of a dew point needed in the air-conditioned room (dry room) and a load of humidity corresponding to the number of the people in the room. Thus the quantity of the recycling is determined so as to satisfy the dew point of the supplied air under summer conditions when the
15 outside air taken into the dehumidifier 10 is highest.

In addition, it has been proposed that the supplied air taken into the dehumidifier 10 is made to decrease by recycling another room's air from low humidity air in the room so as to improve energy conservation.

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[0043]

In this regard, for example, Japanese Patent Application Publication No. 2003-24737 discloses the control method of heating capacity (calorific value) by which a heater heats so
25 as to stabilize air temperature at a recycle outlet.

In the Japanese Patent Application Publication No.

2003-24737, this says that it is possible to improve energy conservation by controlling only the recycled air temperature and by fixing the quantity of the the recycled air.

5 [0044]

However, because a dew point of the processed air at the outlet is affected by the temperature of the recycled air, there are cases where the recycled air is not able to decrease when a dew point of the processed ait at the outlet (corresponding
10 to a dew point of the supplied air measured by the dew point sensor 30 in the present embodiment) is kept the predetermined value constant.

Especially, when the dew dew point of the processed air at the outlet is lowered, it is hard to decrease the temperature
15 of the recycled air. Thus there is little effect of improvement energy conservation.

[0045]

In other words, when the dew point of the processed air
20 at the outlet is lowered, it is hard to separate the absorbed moisture from the absorption roter if the temperature of the recycled air is lowered. Namely, when the temperature of the recycled air is lowered, it is hard to recycle the dehumidification material of the absorption roter 12 in the
25 recycling area 38. Thus, since it is necessary to increase the calorific value of the heater 18, there is little effect of

improvement energy conservation.

[0046]

Therefore, in the present embodiment, the size of the
5 processing area 36, through which the processed air passes, is
made to decrease by shielding a part of the processing area 36
of the absorption roter 12 by using the processing area
adjustment plates 24a - 24e of the shielding mechanism 24, and
the rotational speed of the absorption roter 12 is lowered than
10 the rated rotational speed. Furthermore, the quantity of the
recycled air is made to decrease.

Thus, in the present embodiment, it is able to avoid
saturation of moisture of the dehumidification material in the
processing area 36, to recycle the dehumidification material
15 in the recycling area 38, and further to improve energy
conservation.

In regard to this point, reffering to a flow chart shown
in the FIG.4, a control method of the dehumidifier 10 is
explained.

20

[0047]

FIG. 4 is a flow chart illustrating a procedure of
controlling a dehumidifier according to the present
embodiment.

25 At a step S1, many kinds of data are inputted to the
controller 32. These data, which comprise detected values

outputted from many kinds of sensors, include the dry-bulb temperature (T) and the relative humidity (RH) of the processed air which are measured by the humidity sensor 26 at prior (upstream side) to the absorption roter 12, the dew point of the supplied air (DPSA) of the supplied air (dry air) which is detected by the dew point sensor 30, and the differential pressure (ΔP) between the pressure of the processed air of the primary side and the secondary side which is measured by the differential pressure gauge 28. In addition, the controller 32 calculates a measured quantity of the supplied air (QSA).

In addition, as mentioned above, the target quantity of the recycled air is determined on the basis of a dew point needed in the air-conditioned room (dry room) and a load of humidity corresponding to the number of the people in the room. For example, by using feedback controller etc., the measured quantity of the supplied air (QSA) is controlled so as to be match with the target quantity of the supplied.

[0048]

In addition, operater inputs the set point value of the dew point (DPSET) and a rated drive state of the dehumidifier 10. For example, a passing surface speed of processing area 36, the size of the processing area 36, the value (θ) of the central angle, and a passing time passing through the processing area 36 are inputted so as to set the rated drive state.

[0049]

At a step S2, controller 32 calculates the opening level of the processing area adjustment plates 24a - 24e on the basis of the measured quantity of the supplied air (QSA) calculated
5 by the step S1 so as to set the the opening level of the processing area adjustment plates 24a - 24e.

More specifically, firstly the required size of processing area 36 is calculated by the passing surface speed of the processing area 36 and the size of the processing area
10 36. Secondly the size of the processing area 36 which is able to be shielded by the processing area adjustment plates 24a - 24e on the basis of the above required size is calculated so as to set the opening level (θ) of the processing area adjustment plates 24a - 24e.

15

[0050]

At a step S3, controller 32 calculates the rotational speed (V) of the absorption roter 12 on the basis of the quantity of the supplied air (QSA) calculated at the step S1 so as to
20 set the value of the the rotational speed (V).

More specifically, controller 32 sets the rotational speed (V) of the absorption roter 12 by the central angle (θ) of the processing area 36 so that the processing area staying time is equal to the predetermined processing area staying time
25 (T).

[0051]

Next, at a step S4, controller 32 decides whether the dew point of the supplied air (DPSA) detected by the dew point sensor 30 is lower than the preset value of the dew point of the supplied air (DPSET) pre-determined at step S1 or not.

[0052]

If the controller 32 decides that the dew point of the supplied air (DPSA) is higher than the preset value of the dew point of the supplied air (DPSET)[step S4 -> No] , the quantity of the recycled air is controlled by a control signal outputted to the inverter 16b, then the quantity of the recycled air is made to be equal to the maximum value (step S5), since the state of the supplied air is a wet state.

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[0053]

On the other hand, if the controller 32 decides that the dew point of the supplied air (DPSA) is lower than the preset value of the dew point of the supplied air (DPSET)[step S4 -> Yes] , the quantity of the recycled air is controlled by a control signal outputted to the inverter 16b then the controller makes a processing step go step S6, since the state of the supplied air is a dry state.

At a step S6, the controller 32 calculates absolute humidity X at prior to the absorption roter 12 on the basis of the dry-bulb temperature (T) and the relative humidity (RH) of

the processed air measured by the humidity sensor 26, and calculates the quantity of the supplied air (QSA) on the basis of the differential pressure (ΔP) measured by the differential pressure gauge 28.

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[0054]

Next, at step S7, the controller 32 calculates the quantity of the recycled air (Qh) on the basis of the set point value of the dew point given at the step S1, the absolute
10 humidity X at prior to the absorption roter 12 given at the step S6, and the quantity of the supplied air (QSA) given at the step S6.

In addition, the quantity of the recycled air (Qh) is able to be given on the basis of the database in which the data of
15 the relation between the quantities of the recycled air and of the supplied air (Qh and QSA).

At step S8, the controller 32 controls the recycling fan 16a on the basis of the quantity of the recycled air (Qh) given at the step S7. In addition, for example, the data of the
20 database may be given by pre-experimenting or executing computer simulation.

[0055]

At step S9, the controller 32 outputs control signals,
25 which comprise the rotational speed (V) of the absorption roter 12, to the driver of the motor 20. For example, the controller

32 makes the rotational speed of the motor 20 lowered than the speed of the rated driving state so that the moter slowly rotates compared to the rated driving state.

5 [0056]

At the step S9, the controller 32 outputs control signals, which comprise the opening level of the processing area adjustment plates 24a - 24e, to the actuator ATC, and slides the processing area adjustment plates 24a - 24e by driving the
10 actuator ATC so as to set the predetermined level of the opening (central angle θ).

[0057]

Futther, at the step S9, the controller 32 outputs control
15 signals, which comprise the quantity of the recycled air (Q_h). For example, the controller 32 controls the recycling fan 16a so that the quantity of the recycled air (Q_h) decreases compared to the rated driving state.

20 [0058]

As mentioned above, in the present embodiment, the processing area adjustment plates 24a - 24e of the shielding mechanism is slided on the basis of the absolute humidity X at prior to the absorption roter 12 so as to decrease the size of
25 the processing area 36 decreas, so as to decrease the rotational speed of the absorption roter 12 decrease corresponding to

above decrement of the size of the processing area 36, and so
as to decrease the quantity of the recycled air (Qh). As a result,
in the present embodiment, it is able to decrease the the
quantity of the recycled air (Qh) and to improve energy
5 conservation, compared to the rated driving state.

[0059]

In addition, in the present embodiment, the controller 32
calculates the quantity of the recycled air (Qh) on the basis
10 of the absolute humidity X, which is measured by the temperature
and humidity sensor, at prior to the absorption roter 12, and
the basis of the set point value of the dew point. It is able
to control the quantity of the recycled air (Qh) on the basis
of the above calculation result, thus to stabilize the dew point
15 of a secondary side without a complex control even though the
quantity of the recycled air is changed.

[0060]

In addition, in the present embodiment, it is possible to
20 change the size of the processing area 36. Further the shielding
mechanism 24, which is able to change the size of the processing
area 36 corresponding to the quantity of the supplied air (QSA).
Thus it is possible to avoid saturation of moisture in the
processing area 36 and further stabilize the dew point of the
25 supplied air (DPSA).

[0061]

Furthermore, in the present embodiment, it is possible to optimally control the rotational speed (V) of the absorption roter 12, the quantity of the supplied air (Qh), and the size (S) of the processing area 36, in response to the quantity of the supplied air (QSA) and the absolute humidity X. As a result, it is to improve energy conservation.

[0062]

Furthermore, in the present embodiment, the size (S) of the processing area 36 is set on the basis of the the quantity of the supplied air (QSA) so that the passing surface speed of the processing area is equal to a predetermined value, and the rotational speed (V) of the absorption roter 12 is set in response to the above set size (S) of the processing area so that the rotational speed (V) is equal to a predetermined value. As a result, it is able to stabilize the dew point of a secondary side in the rated driving state.

[0063]

Furthermore, in the present embodiment, since the processed air passing through the processing area 36 is shielded by the processing area adjustment plates 24a - 24e of the shielding mechanism 24 arranged in the upstream side of the processing area 36, the processed air never pass through this shielded portion. Thus the portion shielded by the shielding

mechanism 24 (processing area adjustment plates 24a - 24e) is always kept in a high humidity state.

Therefore, for example, when the quantity of the supplied air (QSA) is changed from small to large, the processed air
5 passes through the portion, which is shielded by the shielding mechanism 24, with high degree of humidity so as to avoid increasing the dew point.

[0064]

10 Furthermore, in the present embodiment, since a part of processing area adjacent to the purging area 40 is kept in the highest humidity state, for example, when the quantity of the supplied air (QSA) is changed from small to large, the size of the shielded area is decreased by displacing some of shielded
15 areas in the counter rotational direction of absorption rotator so as to avoid increasing the dew point of the supplied air (DPSA).

[0065]

20 Furthermore, in the present embodiment, it is possible to change the size of the processing area 36 in response to the quantity of the supplied air (QSA) supplied for the secondary side, by using the mechanism 24 (processing area adjustment plates 24a - 24e). In this case, since a part of processing area
25 adjacent to the purging area 40 is kept in the highest humidity state, for example, when the quantity of the supplied air (QSA)

is changed from small to large, the dew point of the supplied air (DPSA) is avoided increasing the dew point of the supplied air (DPSA) so as to stabilize the dew point of the supplied air (DPSA) in the secondary side.

5

[0066]

Furthermore, since the measured quantity of the supplied air (QSA) is controlled so as to be match with the target quantity of the supplied air, it is possible that the supplied
10 air (QSA) is replaced by the target quantity of the supplied air.

[0066]

As mentioned above embodiments, the size of the processing
15 area 36 is able to change. However, it is possible to fix the size. In other words, it is possible to control the dew point of the supplied air (dry air) by controlling the rotational speed (V) of the absorption roter 12 and by controlling the quantity of recycled air (Qh).

20 In addition, it is possible to control the dew point of the supplied air (dry air) by fixing the rotational speed (V) of the absorption roter 12 and the quantity of recycled air (Qh) and by changing the size of the processing area 36.

25 DESCRIPTION OF THE SYMBOLS

[0068]

10 dehumidifier
12 absorption roter
18 heater
20 motor (rotating means)
5 24 shielding mechanism
24a - 24e processing area adjustment plates
26 temperature and humidity sensor (humidity detector)
28 differential pressure gauge (supplied air quantity
detector)
10 32 controller (supplied air quantity detector, rotational
speed control means, recycled air quantity control means)
36 processing area
38 recycled aera
40 purging area
15 ACT actuator

WHAT IS CLAIMED IS:

1. A dehumidifier comprising:

an absorption roter to absorb moisture in processed air
5 wherein the absorption roter has a plurality of divided areas
of the absorption roter including a processing area, a
recycling area and a purging area;

a heater to heat recycled air so as to separate the
absorbed moisture from the absorption roter; and

10 a rotating means to rotationally drive the absorption
roter,

wherein the dehumidifier comprises:

a supplied air quantity detector configured to detect
quantity of supplied air for a secondary side;

15 a humidity detector configured to detect absolute
humidity of the processed air at prior to a point through which
the absorption roter passes;

a rotational speed control means configured to control
rotational speed of the absorption roter rotated by the
20 rotating means;

a recycled air quantity control means configured to
control a quantity of the recycled air on the basis of a
calculation result of the quantity of the recycled air wherein
the quantity of the recycled air is calculated on the basis of
25 the absolute humidity of processed air detected by the humidity
detector, a quantity of supplied air detected by the supplied

air quantity detector, and a predetermined dew point of the processed air.

2. The dehumidifier according to claim 1, furthermore
5 comprising:

a processing area control means arranged at prior to a point where the processed air passes through the absorption roter,

wherein a processing area control means is able to change
10 the size of the processing area, and is configured to control the processing area so as to increase or decrease the size of the processing area in response to the quantity of the recycled air.

15 3. The dehumidifier according to claim 2, wherein the rotational speed of the absorption roter controlled by the rotational speed control means,

the quantity of the recycled air controlled by recycled air quantity control means, and

20 the size of the processing area controlled by processing area control means

are respectively preset on the basis of the quantity of supplied air detected by the supplied air quantity detector and the absolute humidity of processed air detected by the humidity
25 detector.

4. The dehumidifier according to claim 2 or claim 3, wherein,
the processing area control means is configured to
determine the size of the processing area on the basis of the
quantity of supplied air detected by the supplied air quantity
5 detector so that passing surface speed of the processing area
is equal to a predetermined speed, and

the rotational speed control means is configured to set
the rotational speed up as predetermined speed corresponding
to the predetermined size of the processing area.

10

5. The dehumidifier according to claim 2, wherein,
the processing area control means comprises a shielding
mechanism arranged upstream from the processing area and
shielding the processing area, and wherein

15 the size of the processing area is configured to set in
response to increasing or decreasing the number of shielded
areas.

6. The dehumidifier according to claim 1, wherein

20 the size of the processing area is configured to decrease
by displacing some of shielded areas in the rotational
direction of absorption roter so as to increase the number of
shielded areas, and

the size of the processing area is configured to increase
25 by displacing some of shielded areas in the counter rotational
direction of absorption roter so as to increase the number of

shielded areas

the number of shielded areas decrease by displacing some of shielded areas in the counter rotational direction of absorption roter so that the size of processing area increases.

5

7. A dehumidifier comprising:

an absorption roter to absorb moisture in processed air wherein the absorption roter has a plurality of divided areas of the absorption roter including a processing area, a
10 recycling area and a purging area;

a heater to heat recycled air so as to separate the absorbed moisture from the absorption roter; and

a rotating means to rotationally drive the absorption roter,

15 wherein the dehumidifier comprises:

a processing area control means arranged at prior to a point where the processed air passes through the absorption roter wherein the processing area control means is configured to be able to change the size of the processing area by shielding
20 a part of the processing area of the absorption roter, and configured to control the processing area so as to increase or decrease the size of the processing area in response to a quantity of supplied air for a secondary side.

25 8. A control method of a dehumidifier,

the dehumidifier comprising:

an absorption roter to absorb moisture in processed air wherein the absorption roter has a plurality of divided areas of the absorption roter including a processing area, a recycling area and a purging area;

5 a heater to heat recycled air to separate the absorbed moisture from the absorption roter; and

a rotating means to rotationally drive the absorption roter,

wherein the control method has the steps comprising:

10 controlling a quantity of the recycled air on the basis of a calculation result of the quantity of the recycled air wherein the quantity of the recycled air is calculated on the basis of the absolute humidity of processed air at prior to a point through which the absorption roter passes, a quantity of
15 supplied air given by differential pressure between air in primary side of the absorption roter and air in secondary side of it, and a predetermined dew point of the processed air; and

controlling rotational speed of the absorption roter on the basis of a calculation result of the rotational speed
20 wherein the rotational speed of the absorption roter is calculated on the basis of the the quantity of the supplied air.

9. A control method of a dehumidifier,

the dehumidifier comprising:

25 an absorption roter to absorb moisture in processed air wherein the absorption roter has a plurality of divided areas

of the absorption roter including a processing area, a recycling area and a purging area;

a heater to heat recycled air so as to separate the absorbed moisture from the absorption roter; and

5 a rotating means to rotationally drive the absorption roter,

wherein the control method has the steps comprising:

calculating the size of the processing area which will be needed on the basis of a quantity of supplied air for secondary
10 side given by differential pressure between air in primary side before passing through the absorption roter and air in secondary side after passing through it; and

shielding a part of the processing area of the absorption roter on the basis of a calculation result of the size of the
15 processing area.