

DESCRIPTION

HUMIDITY CONTROL UNIT AND HUMIDITY CONTROL SYSTEM

5 TECHNICAL FIELD

[0001]

The present disclosure relates to a humidity control unit and a humidity control system.

BACKGROUND ART

10 [0002]

A humidity control apparatus of Patent Document 1 includes two adsorption heat exchangers. The humidity control apparatus dehumidifies outdoor air with one of the adsorption heat exchangers and supplies the dehumidified outdoor air into a room and regenerates an adsorbent of the other adsorption heat exchanger with room air, in parallel.

15

CITATION LIST

PATENT DOCUMENT

[0003]

Patent Document 1: Japanese Patent No. 4569150

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SUMMARY

TECHNICAL PROBLEM

[0004]

25 The humidity control apparatus of Patent Document 1 has a flow path for supplying the outdoor air into the room and another separate flow path for discharging the room air outside

the room. This configuration disadvantageously increases the size of the humidity control apparatus.

[0005]

It is an object of the present disclosure to downsize a humidity control unit.

5

SOLUTION TO THE PROBLEM

[0006]

A first aspect is directed to a humidity control unit including: an air passage (12) through which a first space (S1) which is a target space and a second space (S2) communicate with each other; a moisture absorber (30, 32) arranged in the air passage (12) and configured to absorb moisture from air and desorb the moisture to the air; a heat source (21, 22, 32) arranged in the air passage (12) and configured to at least cool or heat the moisture absorber (30, 32); an air transport mechanism (M) configured to allow the air in the air passage (12) to flow in reverse directions; and a controller (C) configured to control the heat source (21, 22, 32) and the air transport mechanism (M).

[0007]

In the first aspect, the air transport mechanism (M) is able to switch the direction of air flow between two directions. Thus, the air in the second space (S2) can be transported to the first space (S1) after passing through the moisture absorber (30, 32) and the heat source (21, 22, 32). The air in the first space (S1) can also be transported to the second space (S2) after passing through the moisture absorber (30, 32) and the heat source (21, 22, 32). Both of these two actions use the same air passage (12). This can downsize the humidity control unit (10).

[0008]

A second aspect is an embodiment of the first aspect. In the second aspect, the controller (C) performs a first action of allowing the heat source (21, 22, 32) to cool the moisture

absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1).

[0009]

The heat source (21, 22, 32) may directly cool the moisture absorber (30, 32), or may
5 indirectly cool the moisture absorber (30, 32) with the air cooled by the heat source (21, 22, 32).

[0010]

In the second aspect, the air in the second space (S2) is dehumidified by the moisture absorber (30, 32) and transported to the first space (S1) in the first action.

[0011]

10 A third aspect is an embodiment of the second aspect. In the third aspect, the controller (C) alternately performs the first action and a second action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2).

[0012]

15 The heat source (21, 22, 32) may directly heat the moisture absorber (30, 32), or may indirectly heat the moisture absorber (30, 32) with the air heated by the heat source (21, 22, 32).

[0013]

In the third aspect, the air in the second space (S2) is dehumidified by the moisture absorber (30, 32) and transported to the first space (S1) in the first action. The air in the first
20 space (S1) receives moisture from the moisture absorber (30, 32), and is then transported to the second space (S2) in the second action.

[0014]

A fourth aspect is an embodiment of the third aspect. In the fourth aspect, the controller (C) stops the air transport mechanism (M) for a predetermined period after the end
25 of the first action and before the start of the second action.

[0015]

In the fourth aspect, the air transport mechanism (M) stops after the end of the first action. During this period, low humidity air transported to the first space (S1) can be dispersed.

[0016]

5 A fifth aspect is an embodiment of the third or fourth aspect. In the fifth aspect, the controller (C) stops the air transport mechanism (M) for a predetermined period after the end of the second action and before the start of the first action.

[0017]

In the fifth aspect, the air transport mechanism (M) stops after the end of the second
10 action. During this period, high humidity air transported to the second space (S2) can be dispersed.

[0018]

A sixth aspect is an embodiment of any one of the first to fifth aspects. In the sixth aspect, the controller (C) performs a third action of allowing the heat source (21, 22, 32) to heat
15 the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1).

[0019]

In the sixth aspect, the air in the second space (S2) is humidified by the moisture absorber (30, 32) and transported to the first space (S1) in the third action.

20 [0020]

A seventh aspect is an embodiment of the sixth aspect. In the seventh aspect, the controller (C) alternately performs the third action and a fourth action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2).

25 [0021]

In the seventh aspect, the air in the second space (S2) is humidified by the moisture absorber (30, 32), and is then transported to the first space (S1) in the third action. The air in the first space (S1) gives moisture to the moisture absorber (30, 32), and is then transported to the second space (S2) in the fourth action.

5 [0022]

An eighth aspect is an embodiment of the seventh aspect. In the eighth aspect, the controller (C) stops the air transport mechanism (M) for a predetermined period after the end of the third action and before the start of the fourth action.

[0023]

10 In the eighth aspect, the air transport mechanism (M) stops after the end of the third action. During this period, high humidity air transported to the first space (S1) can be dispersed.

[0024]

A ninth aspect is an embodiment of the seventh or eighth aspect. In the ninth aspect, the controller (C) stops the air transport mechanism (M) for a predetermined period after the
15 end of the fourth action and before the start of the third action.

[0025]

In the ninth aspect, the air transport mechanism (M) stops after the end of the fourth action. During this period, low humidity air transported to the second space (S1) can be dispersed.

20 [0026]

A tenth aspect is an embodiment of any one of the first to ninth aspects. In the tenth aspect, the first space (S1) is an indoor space, and the second space (S2) is an outdoor space.

[0027]

In the tenth aspect, the air passage (12) allows the indoor space (S1) to communicate
25 with the outdoor space (S2). The air transport mechanism (M) is able to switch the action of

supplying the air in the outdoor space (S2) to the indoor space (S1) and the action of discharging the air in the indoor space (S1) to the outdoor space (S2).

[0028]

An eleventh aspect is an embodiment of any one of the first to tenth aspects. In the
5 eleventh aspect, the heat source (21, 22, 32) includes a heat exchange unit (21, 22, 32) in which
a heating medium flows.

[0029]

In the eleventh aspect, the air and the heating medium exchange heat in the heat
exchange unit (21, 22, 32).

10 [0030]

A twelfth aspect is an embodiment of the eleventh aspect. In the twelfth aspect, the
heat exchange unit includes: a first heat exchanger (21) arranged closer to the first space (S1)
than the moisture absorber (30) and configured to cool and heat the air; and a second heat
exchanger (22) arranged closer to the second space (S2) than the moisture absorber (30) and
15 configured to cool and heat the air.

[0031]

In the twelfth aspect, the air cooled or heated in the first heat exchanger (21) can pass
through the moisture absorber (30, 32). The air cooled or heated in the second heat exchange
part (21, 22, 32) can also pass through the moisture absorber (30, 32).

20 [0032]

A thirteenth aspect is an embodiment of the eleventh aspect. In the thirteenth aspect,
the heat exchange unit is an adsorption heat exchanger (32) having an adsorbent for adsorbing
and desorbing water and serving as the moisture absorber (30, 32).

[0033]

25 In the thirteenth aspect, the heating medium flowing through the adsorption heat

exchanger (32) cools or heats the adsorbent.

[0034]

A fourteenth aspect is an embodiment of any one of the eleventh to thirteenth aspects.

In the fourteenth aspect, the humidity control unit further includes a refrigerant circuit (R) for
5 circulating a refrigerant as the heating medium to perform a refrigeration cycle.

[0035]

A fifteenth aspect is an embodiment of the fourteenth aspect. In the fifteenth aspect,
the humidity control unit further includes an outdoor unit (20a) having a compressor (23) and
an outdoor heat exchanger (24) that are connected to the refrigerant circuit (R).

10 [0036]

A sixteenth aspect is an embodiment of any one of the first to fourteenth aspects. In
the sixteenth aspect, the air transport mechanism (M) is a fan capable of rotating in a forward
direction and a reverse direction.

[0037]

15 In the sixteenth aspect, the direction of rotation of the fan is switched between the
forward direction and the reverse direction, allowing the air in the air passage (12) to flow in
two directions.

[0038]

A seventeenth aspect is an embodiment of any one of the first to fourteenth aspects.

20 In the seventeenth aspect, the air transport mechanism (M) includes a first fan (44) for sending
the air to the first space (S1) and a second fan (45) for sending the air to the second space (S2).

[0039]

In the seventeenth aspect, operating the first fan (44) can transport the air in the
second space (S2) to the first space (S1). Operating the second fan (45) can transport the air in
25 the first space (S1) to the second space (S2).

[0040]

An eighteenth aspect is an embodiment of any one of the first to fourteenth aspects.

In the eighteenth aspect, the air transport mechanism (M) includes: at least one fan (46); and a flow path switching mechanism (D1, D2, D3) configured to switch a flow path of the air in the air passage (12) between a first state and a second state. The fan (46) allows the air to flow from the second space (S2) to the first space (S1) in the air passage (12) in the first state, and allows the air to flow from the first space (S1) to the second space (S2) in the air passage (12) in the second state.

[0041]

In the eighteenth aspect, the fan (46) transports the air. When the flow path switching mechanism (D1, D2, D3) switches the flow path of the air between the first state and the second state, the air can flow in reverse directions in the air passage (12).

[0042]

A nineteenth aspect is an embodiment of any one of the first to eighteenth aspects. In the nineteenth aspect, a center of an opening (13) to the first space (S1) in the air passage (12) and a center of an opening (14) to the second space (S2) in the air passage (12) substantially coincide with each other in a direction of the air flowing in the air passage (12).

[0043]

In the nineteenth aspect, the flow path resistance of the air passage (12) can be reduced.

[0044]

A twentieth aspect is an embodiment of any one of the first to nineteenth aspects. In the twentieth aspect, the air passage (12) is provided to penetrate a wall (W) that is a partition between the first space (S1) and the second space (S2).

[0045]

A twenty-first aspect is an embodiment of any one of the first to nineteenth aspects.

In the twenty first aspect, the air passage (12) is arranged in a window (5) or a window frame (6) between an indoor space (S1) as the first space and an outdoor space (S2) as the second space.

5 [0046]

A twenty-second aspect is an embodiment of any one of the first to twenty-first aspects. In the twenty-second aspect, the humidity control unit further includes a filter (38) arranged in the air passage (12) to be closer to the outdoor space (S2) as the second space than the moisture absorber (30, 32) and the heat source (21, 22, 32). The filter (38) is configured
10 such that dust adhering to the filter (38) is removed by the air flowing from the indoor space (S1) as the first space to the outdoor space (S2).

[0047]

In the twenty-second aspect, the filter (38) can collect the dust in the outdoor air. The air can release the dust adhering to the filter (38) to the outdoor space (S2).

15 [0048]

A twenty-third aspect is directed to a humidity control system including a plurality of humidity control units configured to control humidity of a target space. Each of the plurality of humidity control units is the humidity control unit of any one of the first to twenty-second aspects.

20 [0049]

In the twenty-third aspect, the plurality of humidity control units (10) can dehumidify and humidify the indoor space.

[0050]

A twenty-fourth aspect is an embodiment of the twenty-third aspect. The humidity
25 control system further includes an interlock control unit (C) configured to control the plurality

of humidity control units (10) in a coordinated manner.

[0051]

In the twenty-fourth aspect, the plurality of humidity control units (10) operate in a coordinated manner.

5 [0052]

A twenty-fifth aspect is an embodiment of the twenty-fourth aspect. In the twenty-fifth aspect, the plurality of humidity control units (10) include at least one first humidity control unit (10A) and at least one second humidity control unit (10B). The first humidity control unit (10A) and the second humidity control unit (10B) alternately perform: a first action of allowing
10 the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1); and a second action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2). The interlock control unit (C) controls the first humidity control unit (10A) and the
15 second humidity control unit (10B) so that the second humidity control unit (10B) performs the second action when the first humidity control unit (10A) performs the first action, and the second humidity control unit (10B) performs the first action when the first humidity control unit (10A) performs the second action.

[0053]

20 In the twenty-fifth aspect, the first space (S1) can be continuously dehumidified and ventilated.

[0054]

A twenty-sixth aspect is an embodiment of the twenty-fifth aspect. In the twenty-sixth aspect, at least one of the first humidity control unit (10A) or the second humidity control unit
25 (10B) is configured to stop the air transport mechanism (M) for a predetermined period between

the first action and the second action. The interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that one of the first humidity control unit (10A) or the second humidity control unit (10B) performs the first or second action while the other of the first humidity control unit (10A) or the second humidity control unit (10B) is stopped.

[0055]

In the twenty-sixth aspect, stopping the air transport mechanism (M) for a period between the first and second actions can disperse the air transported to the first space (S1) or the second space (S2). While one of the humidity control units (10) is stopped, the other humidity control unit (10) performs the first or second action. Thus, the first space (S1) can be ventilated while the air transport mechanism (M) of one of the humidity control unit (10) is stopped.

[0056]

A twenty-seventh aspect is an embodiment of the twenty-fifth or twenty-sixth aspect.

In the twenty-seventh aspect, the first humidity control unit (10A) and the second humidity control unit (10B) alternately perform: a third action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1); and a fourth action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2). The interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that the second humidity control unit (10B) performs the fourth action when the first humidity control unit (10A) performs the third action, and the second humidity control unit (10B) performs the third action when the first humidity control unit (10A) performs the fourth action.

[0057]

In the twenty-seventh aspect, the first space (S1) can be continuously humidified and ventilated.

[0058]

5 A twenty-eighth aspect is an embodiment of the twenty-seventh aspect. In the twenty-eighth aspect, at least one of the first humidity control unit (10A) or the second humidity control unit (10B) is configured to stop the air transport mechanism (M) for a predetermined period between the third action and the fourth action. The interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that one of the first
10 humidity control unit (10A) or the second humidity control unit (10B) performs the third or fourth action while the other of the first humidity control unit (10A) or the second humidity control unit (10B) is stopped.

[0059]

 In the twenty-eighth aspect, stopping the air transport mechanism (M) for a period
15 between the third and fourth actions can disperse the air transported to the first space (S1) or the second space (S2). While one of the humidity control units (10) is stopped, the other humidity control unit (10) performs the third or fourth action. Thus, the first space (S1) can be ventilated while the air transport mechanism (M) of one of the humidity control unit (10) is stopped.

20 [0060]

 A twenty-ninth aspect is an embodiment of any one of the twenty-fourth to twenty-eighth aspects. In the twenty-ninth aspect, the humidity control unit further includes a first determination unit (71) configured to determine a degree of pollution of the air in the second space (S2). When at least a condition that the first determination unit (71) determines that the
25 degree of pollution of the air exceeds a predetermined value is met, the interlock control unit

(C) controls the plurality of humidity control units (10) so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of air discharged by the humidity control units (10).

[0061]

5 In the twenty-ninth aspect, the total amount of the air supplied by the humidity control units (10) exceeds the total amount of the air discharged by the humidity control unit (10) when the air in the second space (S2) has a high degree of pollution. This can keep the air with the high degree of pollution from entering the first space (S1).

[0062]

10 A thirtieth aspect is an embodiment of the twenty-ninth aspect. In the thirtieth aspect, the humidity control system further includes an entry detector (70) configured to detect the entry of the air from the second space (S2) to the first space (S1). When at least a condition that the first determination unit (71) determines that the degree of pollution of the air exceeds a predetermined value and a condition that the entry detector (70) detects the entry of the air are
15 met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of air discharged by the humidity control units (10).

[0063]

 In the thirtieth aspect, when the air in the second space (S2) has a high degree of
20 pollution and the air enters the first space (S1) from the second space (S2), the total amount of the air supplied by the humidity control units (10) exceeds the total amount of the air discharged by the humidity control units (10). This can keep the air with the high degree of pollution from entering the first space (S1).

[0064]

25 A thirty-first aspect is an embodiment of any one of the twenty-fourth to thirtieth

aspects. In the thirty-first aspect, the humidity control system further includes a second determination unit (72) configured to determine a degree of pollution of the air in the first space (S1). When at least a condition that the second determination unit (72) determines that the degree of pollution of the air exceeds a predetermined value is met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air discharged by the humidity control units (10) exceeds the total amount of the air supplied by the humidity control units (10).

[0065]

In the thirty-first aspect, the total amount of air discharged by the humidity control units (10) exceeds the total amount of air supplied by the humidity control unit (10) when the air in the first space (S1) has a high degree of pollution. This can discharge the air with the high degree of pollution to the second space (S2).

[0066]

A thirty-second aspect is an embodiment of any one of the twenty-fourth to thirty-first aspects. In the thirty-second aspect, the humidity control system further includes an air volume detector (73) configured to detect the amount of air supplied or discharged by a ventilator (8) installed in the first space (S1). The interlock control unit (C) controls the plurality of humidity control units (10) based on the amount of the air supplied or discharged detected by the air volume detector (73) so that the total amount of the air supplied to the first space (S1) and the total amount of the air discharged from the first space (S1) become substantially identical to each other.

[0067]

In the thirty-second aspect, the amount of the air supplied and the amount of the air discharged can be kept in balance in both of the first space (S1) and the second space (S2), even when the ventilator (8) in the first space (S1) supplies or discharges the air.

BRIEF DESCRIPTION OF THE DRAWINGS

[0068]

FIG. 1 is a schematic plan view of a house to which a humidity control system of an
5 embodiment is applied.

FIG. 2 is a schematic configuration diagram of a humidity control unit of the
embodiment, illustrating the humidity control unit during a first action or a third action.

FIG. 3 is a schematic configuration diagram of the humidity control unit of the
embodiment, illustrating the humidity control unit during a second action or a fourth action.

10 FIG. 4 is a timing chart of a dehumidifying operation of the humidity control system
of the embodiment.

FIG. 5A is a schematic plan view of a house to which the humidity control system of
the embodiment is applied, illustrating the flow of air during the first or third action. FIG. 5B
is a schematic plan view of a house to which the humidity control system of the embodiment is
15 applied, illustrating the flow of air during the second or fourth action.

FIG. 6 is a timing chart of a humidifying operation of the humidity control system of
the embodiment.

FIG. 7 is a timing chart of a dehumidifying operation of a humidity control system of
a first variation.

20 FIG. 8 is a timing chart of a humidifying operation of the humidity control system of
the first variation.

FIG. 9 is a schematic configuration diagram of a humidity control unit of a third
variation.

FIG. 10 is a schematic configuration diagram of a humidity control unit of a fifth
25 variation.

FIG. 11 is a schematic configuration diagram of a moisture absorption unit of a sixth variation.

FIG. 12 is a schematic configuration diagram of a moisture absorption unit of a seventh variation.

5 FIG. 13 is a schematic configuration diagram of a moisture absorption unit of an eighth variation.

FIG. 14 is a schematic configuration diagram of a moisture absorption unit of a ninth variation.

FIG. 15 is a schematic configuration diagram of a humidity control unit of a tenth
10 variation, illustrating the humidity control unit during the first or third action.

FIG. 16 is a schematic configuration diagram of the humidity control unit of the tenth variation, illustrating the humidity control unit during the second or fourth action.

FIG. 17 is a schematic configuration diagram of a humidity control unit of an eleventh variation, illustrating the humidity control unit during the first or third action.

15 FIG. 18 is a schematic configuration diagram of the humidity control unit of the eleventh variation, illustrating the humidity control unit during the third or fourth action.

FIG. 19 is a schematic configuration diagram of a humidity control unit of a twelfth variation, illustrating the humidity control unit during the first or third action.

FIG. 20 is a schematic configuration diagram of the humidity control unit of the
20 twelfth variation, illustrating the humidity control unit during the second or fourth action.

FIG. 21 is a schematic plan view illustrating an enlarged part of a house to which a humidity control unit of a thirteenth variation is applied.

FIG. 22 is a schematic plan view of a house to which a humidity control system of a
fourteenth variation is applied.

25 FIG. 23 is a schematic plan view of a house to which a humidity control system of a

sixteenth variation is applied.

FIG. 24 is a schematic plan view of a house to which a humidity control system of a nineteenth variation is applied.

5 DESCRIPTION OF EMBODIMENTS

[0069]

An embodiment of the present disclosure will be described below with reference to the drawings. The following embodiment is merely an exemplary one in nature, and is not intended to limit the scope, applications, or use of the invention.

10 [0070]

«Embodiment»

A humidity control system (S) of an embodiment controls humidity of a target space. The humidity control system (S) also serves as a ventilation system for ventilating the target space.

[0071]

15 «General Configuration of Humidity Control System»

As illustrated in FIG. 1, the humidity control system (S) of the present embodiment is applied to a house. The humidity control system (S) has six humidity control units (10) and an interlock control unit (C). The number of humidity control units (10) is not limited to six, but is preferably two or more. The interlock control unit (C) controls the six humidity control units (10) in a coordinated manner.

20

[0072]

The six humidity control units (10) of this embodiment are classified into three first humidity control units (10A) and three second humidity control units (10B). The three first humidity control units (10A) basically perform the same action. The three second humidity control units (10B) basically perform the same action. The action performed by the first

25

humidity control units (10A) basically differs from that performed by the second humidity control units (10B).

[0073]

«General Configuration of Humidity Control Unit»

5 As illustrated in FIG. 2, each of the humidity control units (10) includes a casing (11). The casing (11) is attached to the wall (W) of the house to penetrate the wall (W). The casing (11) is formed in a horizontally oriented tubular shape. The casing (11) may have a cylindrical shape or a rectangular cylindrical shape. The casing (11) extends linearly to be perpendicular to the wall (W).

10 [0074]

 An air passage (12) is formed inside the casing (11). The air passage (12) makes a first space (S1) and a second space (S2) communicate with each other. The first space (S1) is a target space for which humidity control and ventilation are performed. The first space (S1) is an indoor space. The second space (S2) is a space different from the first space (S1). Specifically,
15 the second space (S2) is an outdoor space.

[0075]

 The plurality of humidity control units (10) may work for a single indoor space (S1) or different indoor spaces (S1) of the house.

[0076]

20 The air passage (12) has an indoor air port (13) that opens in the first space (S1). The air passage (12) has an outdoor air port (14) that opens in the second space (S2). The center (axis) of the indoor air port (13) and the center (axis) of the outdoor air port (14) substantially coincide with each other in the direction of air flow. This structure can reduce the flow path resistance of the air passage (12).

25 [0077]

Each of the humidity control units (10) includes a first heat exchanger (21), a moisture absorption unit (30), a second heat exchanger (22), and a reversible fan (40). The first heat exchanger (21), the moisture absorption unit (30), the second heat exchanger (22), and the reversible fan (40) are arranged in the air passage (12) in this order from the outdoor space (S2) toward the indoor space (S1). The reversible fan (40) may be arranged closer to the outdoor space (S2) than the first heat exchanger (21).

[0078]

The first heat exchanger (21) and the second heat exchanger (22) are included in a heat source device (20). The first heat exchanger (21) and the second heat exchanger (22) are heat sources that cool and heat the air. The first heat exchanger (21) and the second heat exchanger (22) are, for example, fin-and-tube heat exchangers.

[0079]

The moisture absorption unit (30) is a moisture absorber that absorbs moisture from the air and desorbs the moisture to the air. In other words, the moisture absorption unit (30) takes the moisture from the air and releases the moisture to the air. The moisture absorption unit (30) of the present embodiment is an adsorption unit having an adsorbent. The moisture absorption unit (30) includes a substrate having a plurality of holes through which the air flows and an adsorbent supported on a surface of the substrate. Any material that adsorbs or sorbs the moisture can be used as the adsorbent.

[0080]

The reversible fan (40) constitutes an air transport mechanism (M) for bidirectionally or reversibly transporting the air in the air passage (12). Details will be described later.

[0081]

«Heat Source Device»

As illustrated in FIG. 2, each of the humidity control units (10) includes a heat source

device (20) that cools and heats the air. The heat source device (20) includes a first heat exchanger (21), a second heat exchanger (22), and an outdoor unit (20a). The outdoor unit (20a) includes a compressor (23), an outdoor heat exchanger (24), and an outdoor fan (25). The outdoor unit (20a), the first heat exchanger (21), and the second heat exchanger (22) are connected together via refrigerant pipes. Thus, the heat source device (20) constitutes a refrigerant circuit (R) through which a refrigerant circulates. The compressor (23), the first heat exchanger (21), the second heat exchanger (22), and the outdoor heat exchanger (24) are connected to the refrigerant circuit (R). The refrigerant circuit (R) is connected to valves such as a four-way switching valve, an on-off valve, and an expansion valve, which are flow path switching mechanisms (not shown). Control of these components allows the refrigerant to circulate in the refrigerant circuit (R), thereby performing a refrigeration cycle.

[0082]

〈Details of Reversible Fan〉

The reversible fan (40) of the present embodiment is constituted of an axial fan. The reversible fan (40) includes a motor (41), a shaft (42) rotationally driven by the motor (41), and an impeller (43) connected to the shaft (42). The motor (41) rotationally drives the shaft (42) in a forward direction and a reverse direction. The impeller (43) has substantially the same shape in front view and rear view in an axial direction.

[0083]

When the motor (41) drives the drive shaft (42) to rotate in the forward direction, the impeller (43) rotates in a first rotation direction (see FIG. 2). This rotation causes the outdoor air (OA) in the outdoor space (S2) to be sucked into the air passage (12). The sucked outdoor air (OA) is supplied to the indoor space (S1) as supply air (SA). When the motor (41) drives the drive shaft (42) to rotate in the reverse direction, the impeller (43) rotates in a second rotation direction (see FIG. 3). This rotation causes the room air (RA) in the indoor space (S1)

to be sucked into the air passage (12). The sucked room air (RA) is discharged to the outdoor space (S2) as exhaust air (EA).

[0084]

〈Interlock Control Unit〉

5 As illustrated in FIG. 1, the interlock control unit (C) is a controller for controlling the plurality of humidity control units (10). The interlock control unit (C) includes a processor, e.g., a microcontroller, and a memory device, e.g., a semiconductor memory, that stores software for operating the processor. The interlock control unit (C) of the present embodiment also serves as a controller for controlling the heat source device (20) and air transport
10 mechanism (M) of each of the humidity control units (10).

[0085]

The interlock control unit (C) is connected to each of the humidity control units (10) via a wire or wirelessly. The interlock control unit (C) transmits and receives a signal, such as a control signal, to and from each of the humidity control units (10). The interlock control unit
15 (C) controls the heat source device (20) and reversible fan (40) of each of the humidity control units (10).

[0086]

—Operation—

How the humidity control system (S) operates will be described below. The humidity
20 control system (S) switches between a dehumidifying operation and a humidifying operation. The dehumidifying operation is performed under the condition that the outdoor air has high temperature and high humidity, e.g., in summer. The humidifying operation is performed under the condition that the outdoor air has low temperature and low humidity, e.g., in winter.

[0087]

25 〈Dehumidifying Operation〉

For the dehumidifying operation, the humidity control units (10) perform a first action and a second action. The first and second actions are alternately repeated. The interlock control unit (C) controls the switching between these actions.

[0088]

5 〈First Action〉

The first action shown in FIG. 2 is an action of allowing the first heat exchanger (21) to cool the moisture absorption unit (30) and allowing the reversible fan (40) to transport the air from the outdoor space (S2) to the indoor space (S1). The heat source device (20) performs a refrigeration cycle, i.e., a first refrigeration cycle, in which the first heat exchanger (21) serves
10 as an evaporator, the second heat exchanger (22) is stopped, and the outdoor heat exchanger (24) serves as a radiator (condenser).

[0089]

During the first action, the first heat exchanger (21) cools the outdoor air (OA) taken into the air passage (12). The cooled air flows through the moisture absorption unit (30). The
15 adsorbent of the moisture absorption unit (30) adsorbs moisture in the air. The air thus cooled and dehumidified is supplied to the indoor space (S1) as the supply air (SA).

[0090]

 〈Second Action〉

The second action shown in FIG. 3 is an action of allowing the second heat exchanger
20 (22) to heat the moisture absorption unit (30) and allowing the reversible fan (40) to transport the air from the indoor space (S1) to the outdoor space (S2). Specifically, the heat source device (20) performs a refrigeration cycle, i.e., a second refrigeration cycle, in which the second heat exchanger (22) serves as a radiator (condenser), the first heat exchanger (21) is stopped, and the outdoor heat exchanger (24) serves as an evaporator.

25 [0091]

During the second action, the second heat exchanger (22) heats the room air (RA) taken into the air passage (12). The heated air flows through the moisture absorption unit (30). The moisture absorption unit (30) regenerates the adsorbent using the air. The air used to regenerate the adsorbent is discharged to the outdoor space (S2) as the exhaust air (EA).

5 [0092]

〈Interlock Control for Dehumidifying Operation〉

The interlock control for the dehumidifying operation will be described in detail below with reference to FIGS. 4 and 5. For the dehumidifying operation, the first humidity control units (10A) and the second humidity control units (10B) are controlled in conjunction
10 with each other. In the present embodiment, each of the humidity control units (10) repeats the first action, first stop control, the second action, and second stop control in this order. The first action is performed for T1, the second action for T2, the first stop control for Tb1, and the second stop control for Tb2. For example, T1 and T2 are set to several tens of seconds, and Tb1 and Tb2 to several seconds. In this example, T1 and T2 are equal, and Tb1 and Tb2 are equal.

15 [0093]

In this example, when the first humidity control units (10A) perform the first action, the second humidity control units (10B) perform the second action in parallel. When the first humidity control units (10A) perform the second action, the second humidity control units (10B) perform the first action in parallel. When the first humidity control units (10A) perform
20 the first stop control, the second humidity control units (10B) perform the second stop control in parallel. When the first humidity control units (10A) perform the second stop control, the second humidity control units (10B) perform the first stop control in parallel.

[0094]

As illustrated in FIGS. 4 and 5A, when the three first humidity control units (10A)
25 perform the first action in the dehumidifying operation, the remaining three second humidity

control units (10B) perform the second action. Each of the first humidity control units (10A) supplies the air dehumidified by the moisture absorption unit (30) to the indoor space (S1). Each of the second humidity control units (10B) discharges the air used to regenerate the adsorbent of the moisture absorption unit (30) to the outdoor space (S2). Thus, the indoor space (S1) is ventilated and dehumidified in parallel.

[0095]

When the first humidity control units (10A) finish the first action, the first humidity control units (10A) perform the first stop control. During the first stop control by the first humidity control units (10A), the reversible fans (40) of the first humidity control units (10A) are stopped. When the second humidity control units (10B) finish the second action, the second humidity control units (10B) perform the second stop control. During the second stop control by the second humidity control units (10B), the reversible fans (40) of the second humidity control units (10B) are stopped.

[0096]

As illustrated in FIGS. 4 and 5B, when the three second humidity control units (10B) perform the first action in the dehumidifying operation, the remaining three first humidity control units (10A) perform the second action. Each of the second humidity control units (10B) supplies the air dehumidified by the moisture absorption unit (30) to the indoor space (S1). Each of the first humidity control units (10A) discharges the air used to regenerate the adsorbent of the moisture absorption unit (30) to the outdoor space (S2). Thus, the indoor space (S1) is ventilated and dehumidified in parallel.

[0097]

When the second humidity control units (10B) finish the first action, the second humidity control units (10B) perform the first stop control. During the first stop control by the second humidity control units (10B), the reversible fans (40) of the second humidity control

units (10B) are stopped. When the first humidity control units (10A) finish the second action, the first humidity control units (10A) perform the second stop control. During the second stop control by the first humidity control units (10A), the reversible fans (40) of the first humidity control units (10A) are stopped.

5 [0098]

In this manner, the humidity control system (S) allows the first humidity control units (10A) and the second humidity control units (10B) to alternately perform the first action and the second action so that the first and second actions do not coincide with each other. This can continuously ventilate and dehumidify the indoor space (S1).

10 [0099]

In the dehumidifying operation, the reversible fans (40) are stopped during the first stop control between the first and second actions. If each of the humidity control units (10) performs the second action immediately after the first action, low humidity air supplied to the indoor space (S1) in the first action may be discharged to the outdoor space (S2) in the second
15 action. In contrast, stopping the reversible fans (40) for a period between the first and second actions can disperse the low humidity air supplied to the indoor space (S1) in the first action in the indoor space (S1). This can keep the low humidity air supplied to the indoor space (S1) in the first action from being discharged to the outdoor space (S2) in the second action.

[0100]

20

Likewise, in the dehumidifying operation, the reversible fans (40) are stopped during the second stop control between the second and first actions. If each of the humidity control units (10) performs the first action immediately after the second action, high humidity air discharged to the outdoor space (S2) in the second action may be supplied to the indoor space (S1) in the first action. In contrast, stopping the reversible fans (40) for a period between the
25 second and first actions can disperse the high humidity air discharged to the outdoor space (S2)

in the second action in the outdoor space (S2). This can keep the high humidity air discharged to the outdoor space (S2) in the second action from being supplied to the indoor space (S1) in the first action.

[0101]

5 The compressor (23) may be stopped during the first stop control and the second stop control.

[0102]

⟨Humidifying Operation⟩

10 In the humidifying operation, each of the humidity control units (10) performs a third action and a fourth action. The third action and the fourth action are alternately repeated. The interlock control unit (C) controls the switching between these actions.

[0103]

⟨Third Action⟩

15 The third action shown in FIG. 2 is an action of allowing the first heat exchanger (21) to heat the moisture absorption unit (30) and allowing the reversible fan (40) to transport the air from the outdoor space (S2) to the indoor space (S1). The heat source device (20) performs a refrigeration cycle, i.e., a third refrigeration cycle, in which the first heat exchanger (21) serves as a radiator (condenser), the second heat exchanger (22) is stopped, and the outdoor heat exchanger (24) serves as an evaporator.

20 [0104]

 During the third action, the first heat exchanger (21) heats the outdoor air (OA) taken into the air passage (12). The heated air flows through the moisture absorption unit (30). The moisture absorption unit (30) releases the moisture in the adsorbent into the air. The air thus heated and humidified is supplied to the indoor space (S1) as the supply air (SA).

25 [0105]

«Fourth Action»

The fourth action shown in FIG. 3 is an action of allowing the second heat exchanger (22) to cool the moisture absorption unit (30) and allowing the reversible fan (40) to transport the air from the indoor space (S1) to the outdoor space (S2). Specifically, the heat source device (20) performs a refrigeration cycle, i.e., a fourth refrigeration cycle, in which the second heat exchanger (22) serves as an evaporator, the first heat exchanger (21) is stopped, and the outdoor heat exchanger (24) serves as a radiator (condenser).

[0106]

During the fourth action, the second heat exchanger (22) cools the room air (RA) taken into the air passage (12). The cooled air flows through the moisture absorption unit (30). The adsorbent of the moisture absorption unit (30) adsorbs moisture in the air. The air that has given the moisture to the adsorbent is discharged to the outdoor space (S2) as the exhaust air (EA).

[0107]

«Interlock Control for Humidifying Operation»

The interlock control for the humidifying operation will be described in detail below with reference to FIGS. 5A, 5B, and 6. In the humidifying operation, the first humidity control units (10A) and the second humidity control units (10B) are controlled in conjunction with each other. In the present embodiment, each of the humidity control units (10) repeats the third action, third stop control, fourth action, and fourth stop control in this order. The third action is performed for T3, the fourth action for T4, the third stop control for Tb3, and the fourth stop control for Tb4. The third action is performed for T3, the fourth action for T4, the third stop control for Tb3, and the fourth stop control for Tb4. For example, T3 and T4 are set to several tens of seconds, and Tb3 and Tb4 to several seconds. In this example, T3 and T4 are equal, and Tb3 and Tb4 are equal.

[0108]

In this example, when the first humidity control units (10A) perform the third action, the second humidity control units (10B) perform the fourth action in parallel. When the first humidity control units (10A) perform the fourth action, the second humidity control units (10B) perform the third action in parallel. When the first humidity control units (10A) perform the third stop control, the second humidity control units (10B) perform the fourth stop control in parallel. When the first humidity control units (10A) perform the fourth stop control, the second humidity control units (10B) perform the third stop control in parallel.

[0109]

As illustrated in FIGS. 5A and 6, when the three first humidity control units (10A) perform the third action in the humidifying operation, the remaining three second humidity control units (10B) perform the fourth action. Each of the first humidity control units (10A) supplies the air humidified by the moisture absorption unit (30) to the indoor space (S1). Each of the second humidity control units (10B) discharges the air that has given the moisture to the adsorbent of the moisture absorption unit (30) to the outdoor space (S2). This can ventilate and humidify the indoor space (S1) in parallel.

[0110]

When the first humidity control units (10A) finish the third action, the first humidity control units (10A) perform the third stop control. During the third stop control by the first humidity control units (10A), the reversible fans (40) of the first humidity control units (10A) are stopped. When the second humidity control units (10B) finish the third action, the second humidity control units (10B) perform the fourth stop control. During the fourth stop control by the second humidity control units (10B), the reversible fans (40) of the second humidity control units (10B) are stopped.

[0111]

As illustrated in FIGS. 5B and 6, when the three second humidity control units (10B) perform the third action in the humidifying operation, the remaining three first humidity control units (10A) perform the fourth action. Each of the second humidity control units (10B) supplies the air humidified by the moisture absorption unit (30) to the indoor space (S1). Each of the first humidity control units (10A) discharges the air that has given the moisture to the adsorbent of the moisture absorption unit (30) to the outdoor space (S2). This can ventilate and humidify the indoor space (S1) in parallel.

[0112]

When the second humidity control units (10B) finish the third action, the second humidity control units (10B) perform the third stop control. During the third stop control by the second humidity control units (10B), the reversible fans (40) of the second humidity control units (10B) are stopped. When the first humidity control units (10A) finish the fourth action, the first humidity control units (10A) perform the fourth stop control. During the fourth stop control by the first humidity control units (10A), the reversible fans (40) of the first humidity control units (10A) are stopped.

[0113]

In this manner, the humidity control system (S) allows the first humidity control units (10A) and the second humidity control units (10B) to alternately perform the third action and the fourth action so that the third and fourth actions do not coincide with each other. This can continuously ventilate and humidify the indoor space (S1).

[0114]

In the humidifying operation, the reversible fans (40) are stopped during the third stop control between the third and fourth actions. If each of the humidity control units (10) performs the fourth action immediately after the third action, high humidity air supplied to the indoor space (S1) in the third action may be discharged to the outdoor space (S2) in the fourth

action. In contrast, stopping the reversible fans for a period between the third and fourth actions can disperse the high humidity air supplied to the indoor space (S1) in the third action in the indoor space (S1). This can keep the high humidity air supplied to the indoor space (S1) in the third action from being discharged to the outdoor space (S2) in the fourth action.

5 [0115]

Likewise, the reversible fans (40) are stopped during the fourth stop control between the fourth and third actions in the humidifying operation. If each of the humidity control units (10) performs the third action immediately after the fourth action, low humidity air discharged to the outdoor space (S2) in the fourth action may be supplied to the indoor space (S1) in the
10 third action. In contrast, stopping the reversible fans (40) for a period between the fourth and third actions can disperse the low humidity air discharged to the outdoor space (S2) in the fourth action in the outdoor space (S2). This can keep the low humidity air discharged to the outdoor space (S2) in the fourth action from being supplied to the indoor space (S1) in the third action.
[0116]

15 The compressor (23) may be stopped during the third stop control and the fourth stop control.

[0117]

–Advantages of Embodiment–

A humidity control unit of the above embodiment includes: an air passage (12)
20 through which a first space (S1) which is a target space and a second space (S2) communicate with each other; a moisture absorber (30, 32) arranged in the air passage (12) and configured to absorb moisture from air and desorb the moisture to the air; a heat source (21, 22, 32) arranged in the air passage (12) and configured to at least cool or heat the moisture absorber (30, 32); an air transport mechanism (M) configured to allow the air in the air passage (12) to flow in reverse
25 directions; and a controller (C) configured to control the heat source (21, 22, 32) and the air

transport mechanism (M).

[0118]

In this configuration, the air transport mechanism (M) can switch the direction of the air flowing in the air passage (12) between two directions. This can downsize and simplify the humidity control unit (10) without providing a passage for supplying the air and another
5 separate passage for discharging the air.

[0119]

The controller (C) alternately performs a first action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to
10 transport the air in the second space (S2) to the first space (S1), and a second action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2).

[0120]

In this configuration, the outdoor air (OA) is dehumidified by the moisture absorber
15 (30, 32) and supplied to the indoor space (S1) which is the first space in the first action of the dehumidifying operation. In the second action of the dehumidifying operation, the room air (RA) that has received the moisture released from the moisture absorber (30, 32) is discharged to the outdoor space (S2) which is the second space. Alternately repeating the first action and the second action can intermittently dehumidify the indoor space (S1). This can also ventilate
20 the indoor space (S1).

[0121]

The controller (C) stops the air transport mechanism (M) for a predetermined period after the end of the first action and before the start of the second action.

[0122]

25 This configuration can keep the low humidity air supplied to the indoor space (S1) in

the first action of the dehumidifying operation from being discharged to the outdoor space (S2) in the second action. Thus, the humidity control unit (10) can be kept from decreasing in dehumidification capability.

[0123]

5 The controller (C) stops the air transport mechanism (M) for a predetermined period after the end of the second action and before the start of the first action.

[0124]

 This configuration can keep the high humidity air discharged to the outdoor space (S2) in the second action of the dehumidifying operation from returning to the indoor space
10 (S1) in the first action. Thus, the humidity control unit (10) can be kept from decreasing in dehumidification capability.

[0125]

 The controller (C) alternately performs a third action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to
15 transport the air in the second space (S2) to the first space (S1), and a fourth action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2).

[0126]

 In this configuration, the outdoor air (OA) can be humidified by the moisture absorber
20 (30, 32) and supplied to the indoor space (S1) which is the first space in the third action of the humidifying operation. In the fourth action of the humidifying operation, the room air that has given the moisture to the moisture absorber (30, 32) can be discharged to the outdoor space (S2). Alternately repeating the third action and the fourth action can intermittently dehumidify the indoor space (S1). This can also ventilate the indoor space (S1).

25 [0127]

The controller (C) stops the air transport mechanism (M) for a predetermined period after the end of the third action and before the start of the fourth action.

[0128]

This configuration can keep the high humidity air supplied to the indoor space (S1) in the third action of the humidifying operation from being discharged to the outdoor space (S2) in the fourth action. Thus, the humidity control unit (10) can be kept from decreasing in humidification capability.

[0129]

The controller (C) stops the air transport mechanism (M) for a predetermined period after the end of the fourth action and before the start of the third action.

[0130]

This configuration can keep the low humidity air discharged to the outdoor space (S2) in the fourth action of the humidifying operation from returning to the indoor space (S1) in the third action. Thus, the humidity control unit (10) can be kept from decreasing in humidification capability.

[0131]

The first space (S1) is the indoor space, and the second space (S2) is the outdoor space.

[0132]

This configuration can ventilate the indoor space (S1) with the air moving between the indoor space (S1) and the outdoor space (S2).

[0133]

The heat source (21, 22, 32) includes a heat exchange unit (21, 22, 32) in which a heating medium flows. The heat exchange unit includes a first heat exchanger (21) that is arranged closer to the first space (S1) than the moisture absorber (30) and that cools and heats

the air, and a second heat exchanger (22) that is arranged closer to the second space (S2) than the moisture absorber (30) and that cools and heats the air.

[0134]

In this configuration, the first heat exchanger (21) can cool the air upstream of the moisture absorption unit (30) in the first action of the dehumidifying operation. The second heat exchanger (22) can heat the air upstream of the moisture absorption unit (30) in the second action of the dehumidifying operation. The first heat exchanger (21) can heat the air upstream of the moisture absorption unit (30) in the third action of the humidifying operation. The second heat exchanger (22) can cool the air upstream of the moisture absorption unit (30) in the fourth action of the humidifying operation.

[0135]

The center of an opening (13) to the first space (S1) in the air passage (12) and the center of an opening (14) to the second space (S2) in the air passage (12) substantially coincide with each other in a direction of the air flowing in the air passage (12).

[0136]

This configuration can reduce the flow path resistance of the air passage (12) because the indoor air port (13) and the outdoor air port (14) coincide with each other in the axial direction. Thus, power required for the reversible fan (40) can be reduced.

[0137]

The air passage (12) is provided to penetrate a wall (W) that is a partition between the first space (S1) from the second space (S2).

[0138]

In this configuration, the humidity control unit (10) can be installed more easily than a humidity control unit (10) installed, for example, in the ceiling.

[0139]

The humidity control system (S) has a plurality of humidity control units (10). The interlock control unit (C) controls the plurality of humidity control units (10) in a coordinated manner.

[0140]

5 This configuration allows the plurality of humidity control units (10) to perform dehumidification, humidification, and ventilation suitable for the target space.

[0141]

 The plurality of humidity control units (10) include at least one first humidity control unit (10A) and at least one second humidity control unit (10B). The first humidity control unit
10 (10A) and the second humidity control unit (10B) are configured to alternately perform a first action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1), and a second action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first
15 space (S1) to the second space (S2). The interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that the second humidity control unit (10B) performs the second action when the first humidity control unit (10A) performs the first action, and the second humidity control unit (10B) performs the first action when the first humidity control unit (10A) performs the second action.

20 [0142]

 This configuration can substantially continuously dehumidify the indoor space (S1). The indoor space (S1) can also be ventilated in a first mode of ventilation.

[0143]

 The first humidity control unit (10A) and the second humidity control unit (10B) are
25 configured to alternately perform a third action of allowing the heat source (21, 22, 32) to heat

the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1), and a fourth action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2). The interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that the second humidity control unit (10B) performs the fourth action when the first humidity control unit (10A) performs the third action, and the second humidity control unit (10B) performs the third action when the first humidity control unit (10A) performs the fourth action.

10 [0144]

This configuration can substantially continuously humidify the indoor space (S1).

The indoor space (S1) can also be ventilated in a first mode of ventilation.

[0145]

«Variations of Embodiment»

15 The foregoing embodiment may be modified as the following variations.

[0146]

«First Variation (Variation of Interlock Control)»

A humidity control system (S) of a first variation differs from the humidity control system of the above embodiment in how the interlock control unit (C) controls the humidity control units (10).

20

[0147]

In the dehumidifying operation of the variation shown in FIG. 7, the first action by the first humidity control unit (10A) and the second action by the second humidity control unit (10B) are shifted in time from each other, and the second action by the first humidity control unit (10A) and the first action by the second humidity control unit (10B) are shifted in time

25

from each other. Each of the first humidity control unit (10A) and the second humidity control unit (10B) performs stop control for stopping the air transport mechanism (M) for a predetermined period between the first action and the second action. In the first variation, while one of the first humidity control unit (10A) or the second humidity control unit (10B) performs the stop control, the other humidity control unit (10) performs the first or second action.

[0148]

Specifically, for example, the first humidity control unit (10A) performs the first stop control after the first action. During the first stop control by the first humidity control unit (10A), the second humidity control unit (10B) continues the second action. Thus, the second humidity control unit (10B) can discharge the air while the air transport mechanism (M) of the first humidity control unit (10A) is stopped. In other words, a third mode of ventilation can be performed during the stop control by the first humidity control unit (10A).

[0149]

Then, the second humidity control unit (10B) performs the second stop control after the second action. During the second stop control by the second humidity control unit (10B), the first humidity control unit (10A) performs the second action. Thus, the first humidity control unit (10A) can discharge the air while the air transport mechanism (M) of the second humidity control unit (10B) is stopped. In other words, the third mode of ventilation can be performed during the stop control by the second humidity control unit (10B).

[0150]

Then, the first humidity control unit (10A) performs the second stop control after the second action. During the second stop control by the first humidity control unit (10A), the second humidity control unit (10B) continues the first action. Thus, the second humidity control unit (10B) can supply the air while the air transport mechanism (M) of the first humidity control unit (10A) is stopped. In other words, a second mode of ventilation can be performed during

the stop control by the first humidity control unit (10A).

[0151]

Then, the second humidity control unit (10B) performs the first stop control after the first action. During the first stop control by the second humidity control unit (10B), the first humidity control unit (10A) performs the first action. Thus, the first humidity control unit (10A) can supply the air while the air transport mechanism (M) of the second humidity control unit (10B) is stopped. In other words, the second mode of ventilation can be performed during the stop control by the second humidity control unit (10B).

[0152]

As described above, in the first variation, the first humidity control unit (10A) and the second humidity control unit (10B) do not perform the stop control in parallel. While one of the humidity control units (10) performs the stop control, the other humidity control unit (10) performs the first or second action. Thus, during the dehumidifying operation of the humidity control system (S), the ventilation can be always performed in any one of the first, second, or third mode.

[0153]

In the humidifying operation of the first variation shown in FIG. 8, the third action by the first humidity control unit (10A) and the fourth action by the second humidity control unit (10B) are shifted in time from each other, and the fourth action by the first humidity control unit (10A) and the third action by the second humidity control unit (10B) are shifted in time from each other. Each of the first humidity control unit (10A) and the second humidity control unit (10B) performs stop control for stopping the air transport mechanism (M) for a predetermined period between the third action and the fourth action. In the first variation, while one of the first humidity control unit (10A) or the second humidity control unit (10B) performs the stop control, the other humidity control unit (10) performs the third or fourth action.

[0154]

Specifically, for example, the first humidity control unit (10A) performs the third stop control after the third action. During the third stop control by the first humidity control unit (10A), the second humidity control unit (10B) continues the fourth action. Thus, the second humidity control unit (10B) can discharge the air while the air transport mechanism (M) of the first humidity control unit (10A) is stopped. In other words, a third mode of ventilation can be performed during the stop control by the first humidity control unit (10A).

[0155]

Then, the second humidity control unit (10B) performs the fourth stop control after the fourth action. During the fourth stop control by the second humidity control unit (10B), the first humidity control unit (10A) performs the fourth action. Thus, the first humidity control unit (10A) can discharge the air while the air transport mechanism (M) of the second humidity control unit (10B) is stopped. In other words, the third mode of ventilation can be performed during the stop control by the second humidity control unit (10B).

[0156]

Then, the first humidity control unit (10A) performs the fourth stop control after the fourth action. During the fourth stop control by the first humidity control unit (10A), the second humidity control unit (10B) continues the third action. Thus, the second humidity control unit (10B) can supply the air while the air transport mechanism (M) of the first humidity control unit (10A) is stopped. In other words, a second mode of ventilation can be performed during the stop control by the first humidity control unit (10A).

[0157]

Then, the second humidity control unit (10B) performs the third stop control after the third action. During the third stop control by the second humidity control unit (10B), the first humidity control unit (10A) performs the third action. Thus, the first humidity control unit

(10A) can supply the air while the air transport mechanism (M) of the second humidity control unit (10B) is stopped. In other words, the second mode of ventilation can be performed during the stop control by the second humidity control unit (10B).

[0158]

5 As described above, in the first variation, the first humidity control unit (10A) and the second humidity control unit (10B) do not perform the stop control in parallel. While one of the humidity control units (10) performs the stop control, the other humidity control unit (10) performs the third or fourth action. Thus, during the humidifying operation of the humidity control system (S), the ventilation can be always performed in any one of the first, second, or
10 third mode.

[0159]

«Second Variation (Variation (1) of Heat Source Device)»

The heat source device (20) of the above embodiment includes the outdoor heat exchanger (24) and the outdoor fan (25), and causes the air and the refrigerant to exchange heat
15 in the outdoor heat exchanger (24). The outdoor heat exchanger (24) may be replaced with an internal heat exchanger that causes the refrigerant and a suitable medium such as water or brine to exchange heat. A double-pipe heat exchanger or a shell-and-tube heat exchanger can be employed as the internal heat exchanger.

[0160]

«Third Variation (Variation (2) of Heat Source Device)»

20 As illustrated in FIG. 9, the heat source device (20) may be configured to directly supply water or brine to the first heat exchanger (21) and the second heat exchanger (22).

[0161]

The heat source device (20) of the third variation includes a first heating medium
25 circuit (50) and a second heating medium circuit (60). The first heating medium circuit (50)

sequentially connects a first pump (51), a first heat exchanger (21), and a first heat source-heat exchanger (52). The second heating medium circuit (60) sequentially connects a second pump (61), a second heat exchanger (22), and a second heat source-heat exchanger (62).

[0162]

5 The first pump (51) allows a heating medium (e.g., water) in the first heating medium circuit (50) to circulate. The first heat source-heat exchanger (52) exchanges heat between the heating medium in the first heating medium circuit (50) and the heating medium (e.g., water) in an associated secondary flow path (first secondary flow path (52a)). The second pump (61) allows the heating medium (e.g., water) in the second heating medium circuit (60) to circulate.

10 The second heat source-heat exchanger (62) exchanges heat between the heating medium in the second heating medium circuit (60) and the heating medium (e.g., water) in an associated secondary flow path (second secondary flow path (62a)). Cold or hot water is supplied to the first secondary flow path (52a) and the second secondary flow path (62a) in conjunction with the operation of the humidity control units (10).

15 [0163]

 Specifically, in the dehumidifying operation, the humidity control unit (10) performing the first action operates the first pump (51) to supply cold water to the first secondary flow path (52a) of the first heat source-heat exchanger (52). The first heat source-heat exchanger (52) cools the water in the first heating medium circuit (50), and the cooled

20 water is supplied to the first heat exchanger (21). Thus, the first heat exchanger (21) can cool the air. In the dehumidifying operation, the humidity control unit (10) performing the second action operates the second pump (61) to supply hot water to the second secondary flow path (62a) of the second heat source-heat exchanger (62). The second heat source-heat exchanger (62) heats the water in the second heating medium circuit (60), and the heated water is supplied

25 to the second heat exchanger (22). Thus, the second heat exchanger (22) can heat the air.

[0164]

In the humidifying operation, the humidity control unit (10) performing the third action operates the first pump (51) to supply hot water to the first secondary flow path (52a) of the first heat source-heat exchanger (52). The first heat source-heat exchanger (52) heats the water in the first heating medium circuit (50), and the heated water is supplied to the first heat exchanger (21). Thus, the first heat exchanger (21) can heat the air. In the humidifying operation, the humidity control unit (10) performing the second action operates the second pump (61) to supply cold water to the second secondary flow path (62a) of the second heat source-heat exchanger (62). The second heat source-heat exchanger (62) cools the water in the second heating medium circuit (60), and the cooled water is supplied to the second heat exchanger (22). Thus, the second heat exchanger (22) can heat the air.

[0165]

The cold or hot water may be supplied to the first secondary flow path (52a) and the second secondary side flow path (62a) from a heat supply facility shared in a predetermined area. The hot water may be generated using heat in the ground, for example. The cold or hot water may be generated using a heat pump chiller unit.

[0166]

Fourth Variation (Variation (3) of Heat Source Device)

Any other devices than the above-described ones may be used to heat or cool the moisture absorption unit (30). For example, an electric heater may be used to heat the moisture absorption unit (30). A Peltier element may be used to cool and heat the moisture absorption unit (30). The heat source device (20) may at least cool or heat the air using, for example, a magnetic cooling heat pump or an adsorption heat pump.

[0167]

25 ‹Fifth Variation (Variation (1) of Moisture Absorber)›

In a humidity control unit (10) of the fifth variation shown in FIG. 10, the moisture absorption unit (30) and the heat exchangers (21, 22) are configured as a single unit. An adsorption heat exchanger (32) having an adsorbent supported on the surface of the heat exchanger functions as the heat exchangers (21, 22) or the moisture absorption unit (30). The adsorbent is supported on the surfaces of the fins of the heat exchanger, for example. The adsorbent is made of a material that adsorbs moisture.

[0168]

The adsorption heat exchanger (32) is connected to the refrigerant circuit (R) of the heat source device (20) just like the heat exchanger of the above embodiment. The refrigerant circuit (R) switches between a refrigeration cycle, i.e., a fifth refrigeration cycle, in which the outdoor heat exchanger (24) serves as a radiator and the adsorption heat exchanger (32) as an evaporator, and a refrigeration cycle, i.e., a sixth refrigeration cycle, in which the adsorption heat exchanger (32) serves as a radiator and the outdoor heat exchanger (24) as an evaporator.

[0169]

In the first action of the dehumidifying operation, the adsorption heat exchanger (32) serves as an evaporator. The outdoor air (OA) taken into the air passage (12) by the air transport mechanism (M) passes through the adsorption heat exchanger (32). The adsorbent of the adsorption heat exchanger (32) adsorbs moisture in the air. Heat generated during the adsorption is used for the evaporation of the refrigerant. The air cooled and dehumidified by the adsorption heat exchanger (32) is supplied to the indoor space (S1) as the supply air (SA).

[0170]

In the second action of the dehumidifying operation, the adsorption heat exchanger (32) serves as a radiator. The room air (RA) taken into the air passage (12) by the air transport mechanism (M) passes through the adsorption heat exchanger (32). The adsorbent of the adsorption heat exchanger (32) releases the moisture into the air. The air used to regenerate the

adsorbent is discharged as the exhaust air (EA) to the outdoor space (S2).

[0171]

In the third action of the humidifying operation, the adsorption heat exchanger (32) serves as a radiator. The outdoor air (OA) taken into the air passage (12) by the air transport mechanism (M) passes through the adsorption heat exchanger (32). The adsorbent of the adsorption heat exchanger (32) releases the moisture into the air. The air heated and humidified by the adsorption heat exchanger (32) is supplied to the indoor space (S1) as the supply air (SA).

[0172]

In the fourth action of the humidifying operation, the adsorption heat exchanger (32) serves as an evaporator. The room air (RA) taken into the air passage (12) by the air transport mechanism (M) passes through the adsorption heat exchanger (32). The adsorbent of the adsorption heat exchanger (32) adsorbs moisture in the air. The air that has given the moisture to the adsorbent is discharged to the outdoor space (S2) as the exhaust air (EA).

[0173]

15 〈Sixth Variation (Variation (2) of Moisture Absorber)〉

As illustrated in FIG. 11, a moisture absorption unit (30) of the sixth variation is formed in a substantially cylindrical shape. The moisture absorption unit (30) has a cylindrical substrate (33) having a plurality of small pores and an adsorbent supported on the substrate (33). The moisture absorption unit (30) is arranged in the air passage (12) so that its axial direction coincides with the direction of air flow. The moisture absorption unit (30) is arranged between the first heat exchanger (21) and the second heat exchanger (22) just like the moisture absorption unit of the above embodiment.

[0174]

 〈Seventh Variation (Variation (3) of Moisture Absorber)〉

25 As illustrated in FIG. 12, a moisture absorption unit (30) of the seventh variation is

formed in a substantially rectangular cuboid shape. The moisture absorption unit (30) has a substrate (33) of a rectangular cuboid shape having a plurality of small pores and an adsorbent supported on the substrate (33). The moisture absorption unit (30) is arranged between the first heat exchanger (21) and the second heat exchanger (22) just like the moisture absorption unit of the above embodiment.

[0175]

«Eighth Variation (Variation (4) of Moisture Absorber)»

As illustrated in FIG. 13, a moisture absorption unit (30) of the eighth variation includes a mesh container (34) and a granular adsorbent (35) filling the container (34). The mesh container (34) is arranged in the air passage (12). The air in the air passage (12) passes through the mesh container (34) and flows around the adsorbent (35). The moisture absorption unit (30) is arranged between the first heat exchanger (21) and the second heat exchanger (22) just like the moisture absorption unit of the above embodiment.

[0176]

«Ninth Variation (Variation (5) of Moisture Absorber)»

As illustrated in FIG. 14, a moisture absorption unit (30) of the ninth variation has a storage tank (36). The storage tank (36) stores a liquid absorbent. The liquid absorbent is, for example, an aqueous lithium chloride solution. The moisture absorption unit (30) has a plurality of air flow pipes (37). The air flow pipes (37) penetrate the storage tank (36) in the direction of air flow in the air passage (12). Each of the air flow pipes (37) is formed of a cylindrical moisture permeable membrane. The moisture permeable membrane is a membrane that does not allow the liquid absorbent to penetrate and allows water vapor to permeate. The moisture absorption unit (30) is arranged between the first heat exchanger (21) and the second heat exchanger (22) just like the moisture absorption unit of the above embodiment.

[0177]

In the first action of the dehumidifying operation, the air cooled in the first heat exchanger (21) flows through the plurality of air flow pipes (37). The liquid absorbent absorbs the moisture in the air through the moisture permeable membrane. In the second action of the dehumidifying operation, the air heated in the second heat exchanger (22) flows through the plurality of air flow pipes (37). The liquid absorbent in the air flow pipes (37) gives the water vapor to the air through the moisture permeable membrane.

[0178]

In the third action of the humidifying operation, the air heated in the first heat exchanger (21) flows through the plurality of air flow pipes (37). The liquid absorbent in the air flow pipes (37) gives the water vapor to the air through the moisture permeable membrane. In the fourth action of the humidifying operation, the air cooled in the second heat exchanger (22) flows through the plurality of air flow pipes (37). The liquid absorbent absorbs the moisture in the air through the moisture permeable membrane.

[0179]

15 ‹Tenth Variation (Variation (1) of Air Transport Mechanism)›

As illustrated in FIGS. 15 and 16, humidity control units (10) of the tenth variation differ from those of the above embodiment in the configuration of the air transport mechanism (M). The air transport mechanism (M) of the tenth variation includes a first fan (44) and a second fan (45). Each of the first fan (44) and the second fan (45) transports the air only in one direction. The first fan (44) transports the air only to the indoor space (S1). The second fan (45) transports the air only to the outdoor space (S2).

[0180]

As illustrated in FIG. 15, in the first action of the dehumidifying operation, the first fan (44) is operated and the second fan (45) is stopped. Thus, the outdoor air (OA) in the outdoor space (S2) can be supplied to the indoor space (S1) as the supply air (SA). As illustrated in FIG.

16, in the second action of the dehumidifying operation, the second fan (45) is operated and the first fan (44) is stopped. Thus, the room air (RA) in the indoor space (S1) can be discharged to the outdoor space (S2) as the exhaust air (EA).

[0181]

5 As illustrated in FIG. 15, in the third action of the humidifying operation, the first fan (44) is operated and the second fan (45) is stopped. Thus, the outdoor air (OA) in the outdoor space (S2) can be supplied to the indoor space (S1) as the supply air (SA). As illustrated in FIG. 16, in the fourth action of the humidifying operation, the second fan (45) is operated and the first fan (44) is stopped. Thus, the room air (RA) in the indoor space (S1) can be discharged to
10 the outdoor space (S2) as the exhaust air (EA).

[0182]

«Eleventh Variation (Variation (2) of Air Transport Mechanism)»

As illustrated in FIGS. 17 and 18, humidity control units (10) of the eleventh variation differ from those of the above embodiment in the configuration of the air transport mechanism
15 (M). The air transport mechanism (M) of the eleventh variation includes a unidirectional fan (46). The unidirectional fan (46) transports the air only in one direction. The air transport mechanism (M) further includes a first damper (D1), a second damper (D2), and a third damper (D3). These dampers (D1, D2, D3) constitute a flow path switching mechanism. The flow path switching mechanism switches the air passage (12) between a first state and a second state. In
20 the air passage (12) in the first state shown in FIG. 17, the air transported by the unidirectional fan (46) flows from the outdoor space (S2) to the indoor space (S1). In the air passage (12) in the second state shown in FIG. 18, the air transported by the unidirectional fan (46) flows from the indoor space (S1) to the outdoor space (S2).

[0183]

25 The air passage (12) of the humidity control unit (10) includes a first passage (P1), a

second passage (P2), a third passage (P3), and a fourth passage (P4). In the first passage (P1), a first heat exchanger (21), a moisture absorption unit (30), and a second heat exchanger (22) are arranged in this order. The first passage (P1) can communicate with the outdoor air port (14), the indoor air port (13), the second passage (P2), and the fourth passage (P4). The second
5 passage (P2) can communicate with the first passage (P1) and the third passage (P3). The first fan (44) is arranged in the third passage (P3). The third passage (P3) can communicate with at least the outdoor air port (14), the first passage (P1), and the fourth passage (P4). The fourth passage (P4) can communicate with at least the indoor air port (13), the first passage (P1), and the third passage (P3).

10 [0184]

The first damper (D1) switches between a first state in which the indoor air port (13) is blocked from the first passage (P1), and a second state in which the indoor air port (13) and the first passage (P1) communicate with each other. The second damper (D2) switches between a first state in which the fourth passage (P4) and the third passage (P3) communicate with each
15 other and the outdoor air port (14) is blocked from the third passage (P3), and a second state in which the fourth passage (P4) is blocked from the third passage (P3) and the third passage (P3) and the outdoor air port (14) communicate with each other. The third damper (D3) switches between a first state in which the second passage (P2) is blocked from the outdoor air port (14), and a second state in which the first passage (P1) and the second passage (P2) communicate
20 with each other.

[0185]

As illustrated in FIG. 17, in the first action of the dehumidifying operation, the unidirectional fan (46) is operated, and the flow path switching mechanism switches the air passage (12) to the first state. Specifically, the first damper (D1), the second damper (D2), and
25 the third damper (D3) are switched to the first state. The outdoor air (OA) flows through the

first passage (P1), and is cooled and dehumidified in the first heat exchanger (21). The air sequentially flows through the third passage (P3) and the fourth passage (P4), and is supplied as the supply air (SA) to the indoor space (S1). As illustrated in FIG. 18, in the second action of the dehumidifying operation, the unidirectional fan (46) is operated, and the flow path switching mechanism switches the air passage (12) to the second state. Specifically, the first damper (D1), the second damper (D2), and the third damper (D3) are switched to the second state. The room air (RA) flows through the first passage (P1), and regenerates the adsorbent of the second heat exchanger (22). The air sequentially flows through the second passage (P2) and the third passage (P3), and is discharged as the exhaust air (EA) to the outdoor space (S2).

10 [0186]

As illustrated in FIG. 17, in the third action of the humidifying operation, the unidirectional fan (46) is operated, and the flow path switching mechanism switches the air passage (12) to the first state. Specifically, the first damper (D1), the second damper (D2), and the third damper (D3) are switched to the first state. The outdoor air (OA) flows through the first passage (P1), and is heated and humidified in the first heat exchanger (21). The air sequentially flows through the third passage (P3) and the fourth passage (P4), and is supplied as the supply air (SA) to the indoor space (S1).

[0187]

As illustrated in FIG. 18, in the fourth action of the humidifying operation, the unidirectional fan (46) is operated, and the flow path switching mechanism switches the air passage (12) to the second state. Specifically, the first damper (D1), the second damper (D2), and the third damper (D3) are switched to the second state. The room air (RA) flows through the first passage (P1), and gives the moisture to the adsorbent of the second heat exchanger (22). The air sequentially flows through the second passage (P2) and the third passage (P3), and is discharged as the exhaust air (EA) to the outdoor space (S2).

[0188]

«Twelfth Variation (Filter)»

As illustrated in FIGS. 19 and 20, a humidity control unit (10) of the twelfth variation has a filter (38). The filter (38) is arranged closer to the outdoor space (S2) than the moisture
5 absorption unit (30), the first heat exchanger (21), and the second heat exchanger (22). The filter (38) is arranged near the outdoor air port (14). The filter (38) collects dust in the outdoor air (OA) flowing into the air passage (12).

[0189]

The filter (38) is configured such that the dust adhering to the filter (38) is removed
10 by the air flowing from the outdoor space (S2) to the indoor space (S1).

[0190]

Specifically, as illustrated in FIG. 19, the filter (38) collects the dust on its outer surface in the first action of the dehumidifying operation. In this state, when the second action of the dehumidifying operation is performed as illustrated in FIG. 20, the exhaust air (EA)
15 passes through the filter (38). The exhaust air (EA) can release the dust adhering to the outer surface of the filter (38) to the outdoor space (S2). When the first and second actions are alternately performed in the dehumidifying operation, the amount of dust adhering to the filter (38) can be substantially reduced. This can extend the life of the filter (38).

[0191]

20 As illustrated in FIG. 19, the filter (38) collects the dust on its outer surface in the third action of the humidifying operation. In this state, when the fourth action of the humidifying operation is performed as illustrated in FIG. 20, the exhaust air (EA) passes through the filter (38). The exhaust air (EA) can release the dust adhering to the outer surface of the filter (38) to the outdoor space (S2). When the third and fourth actions are alternately
25 performed in the humidifying operation, the amount of dust adhering to the filter (38) can be

substantially reduced. This can extend the life of the filter (38).

[0192]

«Thirteenth Variation (Other Arrangement of Humidity Control Unit)»

The humidity control unit (10) of the embodiment is provided on the wall (W) of a
5 house. As illustrated in FIG. 21, the humidity control unit (10) may be arranged in a window
(5) or window frame (6) of the house.

[0193]

«Fourteenth Variation (First Example of Positive Pressure Control)»

A humidity control system (S) of the fourteenth variation shown in FIG. 22 controls
10 the plurality of humidity control units (10) based on how much the outdoor air is polluted and
whether or not the outdoor air has entered the indoor space.

[0194]

The humidity control system (S) includes an entry detector (70) configured to detect
the entry of the outdoor air from the outdoor space (S2) into the indoor space (S1), and a first
15 determination unit (71) configured to determine the degree of pollution of the outdoor air.

[0195]

The entry detector (70) of this variation is an opening/closing detector that detects the
opening and closing of a door (7) of the house. When the door (7) is opened, the entry detector
(70) outputs a signal indicating the entry of the outdoor air to the interlock control unit (C).

20 [0196]

The first determination unit (71) acquires information on the degree of pollution of
the outdoor air. The information on the degree of pollution of the outdoor air includes, for
example, pollutants in the outdoor air, such as pollen, suspended particulate matter, and odorous
components. The first determination unit (71) of this variation acquires information on the
25 pollen in the outdoor air as information indicating the degree of pollution of the outdoor air.

The first determination unit (71) receives information from an external agency such as the Meteorological Agency via the Internet. The first determination unit (71) may be a sensor that directly detects the degree of pollution, such as the amount of pollen in the outdoor air.

[0197]

5 The interlock control unit (C) controls the plurality of humidity control units (10) so that the indoor space (S1) has a positive pressure when a first condition and a second condition are met. The first condition is that the degree of pollution of the outdoor air exceeds a predetermined threshold value. The second condition is that the entry detector (70) detects the entry of the outdoor air. When these conditions are met, the pollen in the outdoor air enters the
10 indoor space (S1) through the open door. When these conditions are met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air supplied by the plurality of humidity control units (10) exceeds the total amount of the air discharged by the plurality of humidity control units (10).

[0198]

15 Specifically, the number of humidity control units (10) that supply the air is made larger than the number of humidity control units (10) that discharge the air. Alternatively, the humidity control units (10) for supplying the air are caused to supply more air. Conversely, the humidity control units (10) for discharging the air are caused to discharge less air. This control keeps the indoor space (S1) at a positive pressure. Thus, the pollen and other pollutants in the
20 outdoor air can be kept from entering the indoor space (S1).

[0199]

 When only the first condition is met, the interlock control unit (C) may control the plurality of humidity control units (10) so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of air discharged by the humidity control
25 units (10). When only the second condition is met, the interlock control unit (C) may control

the plurality of humidity control units (10) so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of air discharged by the humidity control units (10).

[0200]

5 〈Fifteenth Variation (Second Example of Positive Pressure Control)〉

A humidity control system (S) of the fifteenth variation runs in a positive-pressure operating mode in which the indoor space (S1) is always kept at a positive pressure regardless of the pollution or entry of the outdoor air. This positive-pressure operating mode is used in a place such as a clean room and an operating room. When the positive-pressure operating mode
10 is selected, the plurality of humidity control units (10) are controlled so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of the air discharged by the humidity control units (10). This can keep the air from entering the clean room or the operating room from the external space at any time.

[0201]

15 〈Sixteenth Variation (Negative Pressure Control)〉

A humidity control system (S) of the sixteenth variation shown in FIG. 23 controls a plurality of humidity control units (10) based on the degree of pollution of the air in the indoor space (S1).

[0202]

20 The humidity control system (S) includes a second determination unit (72) that determines the degree of pollution of the air in the indoor space (S1). The second determination unit (72) of this variation is an air quality sensor that is disposed in the indoor space (S1) and detects the indoor air quality. The air quality used as an index of the degree of pollution of the air indicates the amount of pollutants, such as dust, odorous components, formaldehyde, and
25 volatile organic compounds (VOC). The interlock control unit (C) receives information

detected by the second determination unit (72).

[0203]

When a third condition is met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the indoor space (S1) has a negative pressure. The third condition is that the degree of pollution of the air in the indoor space (S1) exceeds a predetermined threshold value. When this condition is met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air discharged by the humidity control units (10) exceeds the total amount of the air supplied by the humidity control units (10).

10 [0204]

Specifically, the number of humidity control units (10) that discharges the air is made larger than the number of humidity control units (10) that supplies the air. Alternatively, the humidity control units (10) for discharging the air are caused to discharge more air. Conversely, the humidity control units (10) for supplying the air is caused to supply less air. This control can quickly discharge the pollutants in the air in the indoor space (S1), such as the dust and the odorous components, to the outdoor space (S2).

[0205]

«Seventeenth Variation (Control based on CO₂ Concentration)»

A humidity control system (S) of the seventeenth variation includes a concentration sensor. The CO₂ concentration sensor is disposed in the indoor space (S1). The interlock control unit (C) controls the amounts of the air supplied and discharged by the plurality of humidity control units (10) so that the CO₂ concentration detected by the CO₂ concentration sensor is equal to or lower than a predetermined value.

[0206]

25 «Eighteenth Variation (Interlock Control with Air Conditioner)»

A humidity control system (S) of the eighteenth variation is operated in conjunction with the air conditioner. The air conditioner conditions the air in the indoor space (S1). The humidity control system (S) can perform, in a switchable manner, a first operation in which dehumidification by the humidity control unit (10) and cooling by the air conditioner are performed in parallel, and a second operation in which only the dehumidification by the humidity control unit (10) is performed with the air conditioner stopped. The interlock control unit (C) controls the air conditioner and the plurality of humidity control units (10) in a coordinated manner.

[0207]

A calculation unit of the interlock control unit (C) estimates the operating efficiency E1 during the first operation and the operating efficiency E2 during the second operation based on pieces of information, such as the outdoor air temperature, the indoor air temperature, the outdoor air humidity, and the indoor air humidity. When the calculation unit determines that E1 is higher than E2, the first operation is performed. When the calculation unit determines that E2 is higher than E1, the second operation is performed.

[0208]

The humidity control system (S) can perform, in a switchable manner, a third operation in which humidification by the humidity control unit (10) and heating by the air conditioner are performed in parallel, and a fourth operation in which only the humidification by the humidity control unit (10) is performed with the air conditioner stopped. The interlock control unit (C) controls the air conditioner and the plurality of humidity control units (10) in a coordinated manner.

[0209]

The calculation unit of the interlock control unit (C) estimates the operating efficiency E3 during the third operation and the operating efficiency E4 during the fourth operation based

on pieces of information, such as the outdoor air temperature, the indoor air temperature, the outdoor air humidity, and the indoor air humidity. When the calculation unit determines that E3 is higher than E4, the third operation is performed. When the calculation unit determines that E4 is higher than E3, the fourth operation is performed.

5 [0210]

«Nineteenth Variation (Air Volume Control)»

A humidity control system (S) of the nineteenth variation shown in FIG. 24 controls a plurality of humidity control units (10) so that the total amount of the air supplied to the indoor space (S1) and the total amount of the air discharged from the indoor space (S1) are
10 substantially equal. A range hood (8), which is the other ventilator, is provided in the indoor space (S1) of this variation. The humidity control system (S) includes an air volume detector (73) configured to detect the air volume of the range hood (8). The interlock control unit (C) receives the air volume (the amount of the air discharged in this example) of the range hood (8) detected by the air volume detector (73).

15 [0211]

The interlock control unit (C) controls the amount of the air supplied by the plurality of humidity control units (10) and the amount of the air discharged by the plurality of humidity control units (10) so that the total amount of air supplied by the range hood (8) and the humidity control units (10) is substantially equal to the total amount of air discharged by the range hood
20 (8) and the humidity control units (10). In other words, the plurality of humidity control units (10) are controlled so that the total amount of the air supplied to the indoor space (S1) and the total amount of the air discharged from the indoor space (S1) become substantially identical to each other. When the range hood (8) is turned on, the total amount of the air supplied to the indoor space (S1) and the total amount of the air discharged from the indoor space (S1) can be
25 kept in balance.

[0212]

The other ventilator may be an exhaust fan or an air supply fan other than the range hood (8).

[0213]

5 <<Other Embodiments>>

The above embodiment and variations thereof may be configured as follows.

[0214]

The humidity control system (S) of the above embodiment includes a plurality of humidity control units (10). However, only a single humidity control unit (10) may perform the
10 dehumidifying operation and the humidifying operation. In this case, the single humidity control unit (10) alternately repeats the first and second actions of the dehumidifying operation. In the humidifying operation, the single humidity control unit (10) alternately repeats the third and fourth actions.

[0215]

15 In the above embodiment, the controller for controlling the plurality of humidity control units (10) is also used as the interlock control unit (C). However, a controller may be provided for each of the humidity control units (10) to control the corresponding humidity control unit (10).

[0216]

20 In the above embodiment, the humidity control unit (10) is provided on the wall (W), window (5), or window frame (6) of the house. However, the humidity control unit (10) may be installed in a space above the ceiling to supply or discharge the air through a duct.

[0217]

In the dehumidifying operation of the above embodiment, the first stop control is
25 performed after the end of the first action and before the start of the second action, and the

second stop control is performed after the end of the second action and before the start of the first action. However, one or both of the first and second stop controls may be omitted.

[0218]

5 In the humidifying operation of the above embodiment, the third stop control is performed after the end of the third action and before the start of the fourth action, and the fourth stop control is performed after the end of the fourth action and before the start of the third action. However, one or both of the third and fourth stop controls may be omitted.

[0219]

10 While the embodiments and variations thereof have been described above, it will be understood that various changes in form and details may be made without departing from the spirit and scope of the claims. The embodiment, the variations thereof, and the other embodiments may be combined and replaced with each other without deteriorating intended functions of the present disclosure. The expressions of “first,” “second,” and “third” described above are used to distinguish the terms to which these expressions are given, and do not limit
15 the number and order of the terms.

INDUSTRIAL APPLICABILITY

[0220]

20 As can be seen from the foregoing description, the present disclosure is useful for a humidity control unit and a humidity control system.

DESCRIPTION OF REFERENCE CHARACTERS

[0221]

S1	Indoor Space (First Space)
25 S2	Outdoor Space (Second Space)

	5	Window
	6	Window Frame
	8	Ventilator
	10	Humidity Control Unit
5	10A	First Humidity Control Unit
	10B	Second Humidity Control Unit
	12	Air Passage
	13	Indoor Air Port (Opening)
	14	Outdoor Air Port (Opening)
10	20a	Outdoor Unit
	21	First Heat Exchanger (Heat Exchange Unit, Heat Source)
	22	Second Heat Exchanger (Heat Exchange Unit, Heat Source)
	23	Compressor
	24	Outdoor Heat Exchanger
15	30	Moisture Absorption Unit (Moisture Absorber)
	32	Adsorption Heat Exchanger (Moisture Absorber, Heat Source)
	38	Filter
	44	First Fan
	45	Second Fan
20	46	Unidirectional Fan (Fan)
	70	Entry Detector
	71	First Determination Unit
	72	Second Determination Unit
	73	Air Volume Detector
25	D1	First Damper (Flow Path Switching Mechanism)

D2	Second Damper (Flow Path Switching Mechanism)
D3	Third Damper (Flow Path Switching Mechanism)
M	Air Transport Mechanism

CLAIMS

1. A humidity control unit, comprising:

an air passage (12) through which a first space (S1) which is a target space and a
5 second space (S2) communicate with each other;

a moisture absorber (30, 32) arranged in the air passage (12) and configured to absorb
moisture from air and desorb the moisture to the air;

a heat source (21, 22, 32) arranged in the air passage (12) and configured to at least
cool or heat the moisture absorber (30, 32);

10 an air transport mechanism (M) configured to allow the air in the air passage (12) to
flow in reverse directions; and

a controller (C) configured to control the heat source (21, 22, 32) and the air transport
mechanism (M).

15 2. The humidity control unit of claim 1, wherein

the controller (C) performs a first action of allowing the heat source (21, 22, 32) to
cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport
the air in the second space (S2) to the first space (S1).

20 3. The humidity control unit of claim 2, wherein

the controller (C) alternately performs

the first action, and

a second action of allowing the heat source (21, 22, 32) to heat the moisture
absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first
25 space (S1) to the second space (S2).

4. The humidity control unit of claim 3, wherein
the controller (C) stops the air transport mechanism (M) for a predetermined period
after the end of the first action and before the start of the second action.

5

5. The humidity control unit of claim 3 or 4, wherein
the controller (C) stops the air transport mechanism (M) for a predetermined period
after the end of the second action and before the start of the first action.

10

6. The humidity control unit of any one of claims 1 to 5, wherein
the controller (C) performs a third action of allowing the heat source (21, 22, 32) to
heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport
the air in the second space (S2) to the first space (S1).

15

7. The humidity control unit of claim 6, wherein
the controller (C) alternately performs

the third action, and

a fourth action of allowing the heat source (21, 22, 32) to cool the moisture
absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first
space (S1) to the second space (S2).

20

8. The humidity control unit of claim 7, wherein

the controller (C) stops the air transport mechanism (M) for a predetermined period
after the end of the third action and before the start of the fourth action.

25

9. The humidity control unit of claim 7 or 8, wherein
the controller (C) stops the air transport mechanism (M) for a predetermined period
after the end of the fourth action and before the start of the third action.
- 5 10. The humidity control unit of any one of claims 1 to 9, wherein
the first space (S1) is an indoor space, and the second space (S2) is an outdoor space.
11. The humidity control unit of any one of claims 1 to 10, wherein
the heat source (21, 22, 32) includes a heat exchange unit (21, 22, 32) in which a
10 heating medium flows.
12. The humidity control unit of claim 11, wherein
the heat exchange unit includes:
a first heat exchanger (21) arranged closer to the first space (S1) than the
15 moisture absorber (30) and configured to cool and heat the air; and
a second heat exchanger (22) arranged closer to the second space (S2) than
the moisture absorber (30) and configured to cool and heat the air.
13. The humidity control unit of claim 11, wherein
20 the heat exchange unit is an adsorption heat exchanger (32) having an adsorbent for
adsorbing and desorbing water and serving as the moisture absorber (30, 32).
14. The humidity control unit of any one of claims 11 to 13, further comprising:
a refrigerant circuit (R) for circulating a refrigerant as the heating medium to perform
25 a refrigeration cycle.

15. The humidity control unit of claim 14, further comprising:

an outdoor unit (20a) having a compressor (23) and an outdoor heat exchanger (24) that are connected to the refrigerant circuit (R).

5

16. The humidity control unit of any one of claims 1 to 14, wherein

the air transport mechanism (M) is a fan capable of rotating in a forward direction and a reverse direction.

10

17. The humidity control unit of any one of claims 1 to 14, wherein

the air transport mechanism (M) includes a first fan (44) for sending the air to the first space (S1) and a second fan (45) for sending the air to the second space (S2).

18. The humidity control unit of any one of claims 1 to 14, wherein

15

the air transport mechanism (M) includes:

at least one fan (46); and

a flow path switching mechanism (D1, D2, D3) configured to switch a flow path of the air in the air passage (12) between a first state and a second state, and

the fan (46) allows the air to flow from the second space (S2) to the first space (S1)

20

in the air passage (12) in the first state, and allows the air to flow from the first space (S1) to the second space (S2) in the air passage (12) in the second state.

19. The humidity control unit of any one of claims 1 to 18, wherein

a center of an opening (13) to the first space (S1) in the air passage (12) and a center

25

of an opening (14) to the second space (S2) in the air passage (12) substantially coincide with

each other in a direction of the air flowing in the air passage (12).

20. The humidity control unit of any one of claims 1 to 19, wherein
the air passage (12) is provided to penetrate a wall (W) that is a partition between the
5 first space (S1) and the second space (S2).

21. The humidity control unit of any one of claims 1 to 19, wherein
the air passage (12) is arranged in a window (5) or a window frame (6) between an
indoor space (S1) as the first space and an outdoor space (S2) as the second space.

10

22. The humidity control unit of any one of claims 1 to 21, further comprising:
a filter (38) arranged in the air passage (12) to be closer to the outdoor space (S2) as
the second space than the moisture absorber (30, 32) and the heat source (21, 22, 32),
the filter (38) being configured such that dust adhering to the filter (38) is removed
15 by the air flowing from the indoor space (S1) as the first space to the outdoor space (S2).

23. A humidity control system comprising
a plurality of humidity control units configured to control humidity of a target space,
wherein
20 each of the plurality of humidity control units is the humidity control unit of any one
of claims 1 to 22.

24. The humidity control system of claim 23, further comprising:
an interlock control unit (C) configured to control the plurality of humidity control
25 units (10) in a coordinated manner.

25. The humidity control system of claim 24, wherein

the plurality of humidity control units (10) include at least one first humidity control unit (10A) and at least one second humidity control unit (10B),

5 the first humidity control unit (10A) and the second humidity control unit (10B) alternately perform:

a first action of allowing the heat source (21, 22, 32) to cool the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1); and

10 a second action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2), and

the interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that the second humidity control unit (10B) performs the
15 second action when the first humidity control unit (10A) performs the first action, and the second humidity control unit (10B) performs the first action when the first humidity control unit (10A) performs the second action.

26. The humidity control system of claim 25, wherein

20 at least one of the first humidity control unit (10A) or the second humidity control unit (10B) is configured to stop the air transport mechanism (M) for a predetermined period between the first action and the second action, and

the interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that one of the first humidity control unit (10A) or the
25 second humidity control unit (10B) performs the first or second action while the other of the

first humidity control unit (10A) or the second humidity control unit (10B) is stopped.

27. The humidity control system of claim 25 or 26, wherein

the first humidity control unit (10A) and the second humidity control unit (10B)

5 alternately perform:

a third action of allowing the heat source (21, 22, 32) to heat the moisture absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the second space (S2) to the first space (S1); and

a fourth action of allowing the heat source (21, 22, 32) to cool the moisture
10 absorber (30, 32) and allowing the air transport mechanism (M) to transport the air in the first space (S1) to the second space (S2), and

the interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that the second humidity control unit (10B) performs the fourth action when the first humidity control unit (10A) performs the third action, and the
15 second humidity control unit (10B) performs the third action when the first humidity control unit (10A) performs the fourth action.

28. The humidity control system of claim 27, wherein

at least one of the first humidity control unit (10A) or the second humidity control
20 unit (10B) is configured to stop the air transport mechanism (M) for a predetermined period between the third action and the fourth action, and

the interlock control unit (C) controls the first humidity control unit (10A) and the second humidity control unit (10B) so that one of the first humidity control unit (10A) or the second humidity control unit (10B) performs the third or fourth action while the other of the
25 first humidity control unit (10A) or the second humidity control unit (10B) is stopped.

29. The humidity control system of any one of claims 24 to 28, further comprising:

a first determination unit (71) configured to determine a degree of pollution of the air
5 in the second space (S2), wherein

when at least a condition that the first determination unit (71) determines that the degree of pollution of the air exceeds a predetermined value is met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of air discharged by the
10 humidity control units (10).

30. The humidity control system of claim 29, further comprising:

an entry detector (70) configured to detect the entry of the air from the second space (S2) to the first space (S1), wherein

15 when at least a condition that the first determination unit (71) determines that the degree of pollution of the air exceeds a predetermined value and a condition that the entry detector (70) detects the entry of the air are met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air supplied by the humidity control units (10) exceeds the total amount of air discharged by the humidity control
20 units (10).

31. The humidity control system of any one of claims 24 to 30, further comprising:

a second determination unit (72) configured to determine a degree of pollution of the
25 air in the first space (S1), wherein

when at least a condition that the second determination unit (72) determines that the degree of pollution of the air exceeds a predetermined value is met, the interlock control unit (C) controls the plurality of humidity control units (10) so that the total amount of the air discharged by the humidity control units (10) exceeds the total amount of the air supplied by the humidity control units (10).

32. The humidity control system of any one of claims 24 to 31, further comprising:

an air volume detector (73) configured to detect the amount of air supplied or discharged by a ventilator (8) installed in the first space (S1), wherein

the interlock control unit (C) controls the plurality of humidity control units (10) based on the amount of the air supplied or discharged detected by the air volume detector (73) so that the total amount of the air supplied to the first space (S1) and the total amount of the air discharged from the first space (S1) become substantially identical to each other.