

DESCRIPTION

Title of the Invention: DEHUMIDIFICATION/HUMIDIFICATION DEVICE

Technical Field

[0001] The present invention relates to a dehumidification/humidification device having both a dehumidification function and a humidification function.

Background Art

[0002] A conventional dehumidification/humidification device is described in Patent Document 1. This dehumidification/humidification device has a dehumidification function, a humidification function, and an air cleaning function, so as to perform one of an air cleaning operation for performing only air cleaning, a dehumidification operation for simultaneously performing air cleaning and dehumidification, and a humidification operation for simultaneously performing air cleaning and humidification. This dehumidification/humidification device has a main body and includes an air cleaning filter unit, a dehumidification unit, a humidification unit, and a fan disposed in the main body.

[0003] In the dehumidification/humidification device described above, there is a flow channel connecting a suction port disposed in a side surface of the main body and a blowout port disposed in an upper surface of the main body, and the fan generates an air flow from the suction port to the blowout port. Further in this flow channel, the air cleaning filter unit, the dehumidification unit, the humidification unit, and the fan are disposed in order from the upstream side. In the dehumidification/humidification device having the configuration described above, when the fan is driven, the air flow generated in the flow channel passes through the air cleaning filter unit, the dehumidification unit, and the humidification unit. Therefore, by switching operations of the dehumidification unit and the humidification unit, it is possible to selectively perform the air cleaning operation, the dehumidification operation, and the humidification operation described above. In this way, an air cleaning machine, a dehumidification machine, and a humidification machine can be integrated into one machine, and hence convenience for users can be enhanced.

List of Citations

Patent Literature

[0004] Patent Document 1: Japanese Patent 5626171

Summary of the Invention

Technical Problem

[0005] The conventional dehumidification/humidification device described above has a structure in which the same air flow passes through the dehumidification unit and the humidification unit. Further, the dehumidification unit and the humidification unit have efficiencies varying in accordance with a flow rate of the air flow passing through them, and have different air flow rates at which the efficiencies become highest. The dehumidification operation or the humidification operation is performed at a flow rate at which the efficiency of the dehumidification unit or the humidification unit becomes highest. Therefore, the flow rate of the air flow blown out from the blowout port may be low, and hence the dehumidified air or the humidified air may not be spread in the entire space.

[0006] Therefore, it is an object of the present invention to provide a dehumidification/humidification device that can perform humidification or dehumidification of a space at high efficiency by utilizing an air flow rate suitable for each operation.

Means for Solving the Problem

[0007] In order to achieve the above object, the present invention provides a dehumidification/humidification device comprising a cabinet including a first inlet port, a second inlet port, and a blowout port; a first air duct from the first inlet port to the blowout port; a second air duct from the second inlet port to the blowout port; a humidification unit disposed in one of the first air duct and the second air duct; a dehumidification unit disposed in the other of the first air duct and the second air duct; and a blower disposed in the first air duct and in the second air duct so as to generate air flows in the first air duct and in the second air duct.

[0008] With this structure, the air duct in which the dehumidification unit is disposed and the

air duct in which the humidification unit is disposed are arranged in parallel. Further, the air duct in which the dehumidification unit can be set to have a flow rate at which efficiency of the dehumidification by the dehumidification unit becomes high, while the air duct in which the humidification unit can be set to have a flow rate at which efficiency of the humidification by the humidification unit becomes high. In this way, when the dehumidification or the humidification is performed, efficiency of the dehumidification or the humidification can be increased.

[0009] In the dehumidification/humidification device having this structure, when the dehumidification is performed, the humidification unit is stopped while the air flow from the air duct in which the humidification unit is disposed is added, and the air flow is blown out from the blowout port. When the humidification is performed, the dehumidification unit is stopped while the air flow from the air duct in which the dehumidification unit is disposed is added, and the air flow is blown out from the blowout port. In this way, the air flow rate blown out from the blowout port can be higher than that when the dehumidification device or the humidification device is operated alone. Therefore, it is possible to perform the dehumidification or the humidification of a larger space than the case where the dehumidification device or the humidification device is operated alone.

[0010] In the structure described above, the apparatus may have a structure in which the blower includes a multiblade fan and a fan case, the fan case includes a first suction port for sucking the air flow flowing in the first air duct into the fan case, and a second suction port disposed on an opposite side of the first suction port with respect to the multiblade fan so as to suck the air flow flowing in the second air duct into the fan case, and the second air duct is formed to bypass the fan case.

[0011] In the structure described above, the dehumidification unit may be disposed adjacent to one of the first suction port and the second suction port.

[0012] In the structure described above, the humidification unit may be disposed adjacent to one of the first suction port and the second suction port.

[0013] In the structure described above, the dehumidification unit is disposed in the first air duct while the humidification unit is disposed in the second air duct, and the apparatus may include a third air duct from the second inlet port to the second suction port bypassing the humidification unit, and a first damper for adjusting flow rate of the air

flow flowing in the second air duct or the third air duct.

- [0014] In the structure described above, the apparatus may further include a bypass air duct for supplying air flow from the first air duct to the second air duct; and a second damper disposed on an upstream side of the first damper so as to open and close the bypass air duct, in which the second damper may open so that the air flow flows in the bypass air duct in a state where the first damper generates the air flow in the second air duct.
- [0015] In the structure described above, the apparatus may further include a partition member disposed in the cabinet so as to separate the first air duct from the second air duct.
- [0016] In the structure described above, the apparatus may further include a divider wall in the fan case so as to separate the first suction port side from the second suction port side.
- [0017] In the structure described above, the apparatus may have a structure in which the first inlet port and the second inlet port are disposed on the same surface of the cabinet, and an air cleaning filter covers the first inlet port and the second inlet port.

Advantageous Effects of the Invention

- [0018] According to the present invention, it is possible to provide a dehumidification/humidification device that can perform humidification or dehumidification of a space at high efficiency by utilizing an air flow rate suitable for each operation.

Brief Description of Drawings

- [0019] Fig. 1 is a perspective view of an example of a dehumidification/humidification device according to the present invention.
- Fig. 2 is a front view of the dehumidification/humidification device illustrated in Fig. 1 in a state without a front cover.
- Fig. 3 is a rear view of the dehumidification/humidification device illustrated in Fig. 1 in a state without a rear cover.
- Fig. 4 is a cross-sectional view of the dehumidification/humidification device illustrated in Fig. 1.
- Fig. 5 is a diagram illustrating air ducts of the dehumidification/humidification device

according to the present invention.

Fig. 6 is a cross-sectional view of another example of the dehumidification/humidification device according to the present invention.

Fig. 7 is a cross-sectional view of another example of the dehumidification/humidification device according to the present invention in a state where a first damper is opened.

Fig. 8 is a cross-sectional view of the dehumidification/humidification device illustrated in Fig. 7 in a state where a first damper is closed.

Fig. 9 is a diagram illustrating air flows when the first damper is opened.

Fig. 10 is a diagram illustrating air flows when the first damper is closed.

Description of Embodiments

[0020] Hereinafter, embodiments of the present invention are described with reference to the drawings.

[0021] Fig. 1 is a perspective view of an example of a dehumidification/humidification device according to the present invention, Fig. 2 is a front view of the dehumidification/humidification device illustrated in Fig. 1 in a state without a front cover, Fig. 3 is a rear view of the dehumidification/humidification device illustrated in Fig. 1 in a state without a rear cover, and Fig. 4 is a cross-sectional view of the dehumidification/humidification device illustrated in Fig. 1. Note that in the following description, the state illustrated in Fig. 1 is a using state of a dehumidification/humidification device A, in which the left side is the front while the right side is rear.

[0022] The dehumidification/humidification device A has an air cleaning function to suck air around it and eliminate foreign matters such as dust contained in the air, a dehumidification function to eliminate moisture contained in the air, and a humidification function to increase humidity in the air. The dehumidification/humidification device A includes a cabinet 1, a blower 2, an air cleaning unit 3, a dehumidification unit 4, and a humidification unit 5.

[0023] The cabinet 1 is an exterior member of the dehumidification/humidification device A, and includes a case 11, a front cover 12, a rear cover 13, a louver 14, a blowout port 15, a first inlet port 16, a second inlet port 17, and a partition member 18. The case

11 is a box-shaped member having a space inside, and has a rectangular shape in a front view. The case 11 can be formed using sheet metal, for example, but this is not a limitation.

[0024] As illustrated in Fig. 1, the case 11 is used in a vertically long state, and opposite sides are front and rear sides. Further, openings are formed in the front and rear sides. The front cover 12 and the rear cover 13 are attached to the front side and the rear side, respectively, in a detachable and attachable manner. The front cover 12 and the rear cover 13 are protection members for preventing user's hand or the like from unexpectedly entering inside the cabinet 1, and also work as strength members when mounted to the case 11. In addition, by removing the front cover 12 or the rear cover 13, the internal devices such as the blower 2, the air cleaning unit 3, the dehumidification unit 4, and the humidification unit 5 can be accessed. Here, "access" means repair, maintenance, inspection, or the like of the internal devices, though not limited to these.

[0025] The dehumidification/humidification device A eliminates foreign matters from air sucked through the first inlet port 16 and the second inlet port 17, and blows out the air from the blowout port 15 after humidification or dehumidification as necessary. When the dehumidification/humidification device A is installed in the using state, the blowout port 15 opens in an upper surface. Further, the louver 14 is disposed in the blowout port 15. The louver 14 is a fin for adjusting a flowing direction of the air blown out from the blowout port 15, namely, an air flow direction, and is also used as a flapper that can close the blowout port 15. In other words, in the dehumidification/humidification device A, the louver 14 is closed when the apparatus does not work, while it is opened when the apparatus starts to work. Note that the louver 14 may automatically or manually open and close in accordance with an operation of the dehumidification/humidification device A. In addition, it may automatically open to a certain angle and then may be manually adjusted to a desired angle.

[0026] As illustrated in Fig. 4, the rear side of the case 11 is provided with an opening 111 in which the air cleaning unit 3 is disposed. Further, the first inlet port 16 and the second inlet port 17 are formed in the opening 111. The first inlet port 16 and the second inlet port 17 are arranged in order from upper. The first inlet port 16 and the

second inlet port 17 are covered with an air cleaning filter 31 described later. The air after passing through the air cleaning filter 31 is sucked in through the first inlet port 16 and the second inlet port 17. Note that the first inlet port 16 is an air inlet of a first air duct R1 described later, and the second inlet port 17 is an air inlet of a second air duct R2 described later.

[0027] The partition member 18 is a divider for separating the first air duct R1 from the second air duct R2. An upper partition member 181 and a lower partition member 182 are disposed inside the case 11. In addition, when viewing the case 11 from the rear side, a part overlapping with a space between the upper partition member 181 and the lower partition member 182 of the opening is the first inlet port 16, and other part, namely, a part overlapping with an upper part of the upper partition member 181 or a part overlapping with a lower side of the lower partition member 182 is the second inlet port 17.

[0028] The blower 2 includes a multiblade fan 21, a fan case 22, a fan motor 23, and an exhaust port 24. The multiblade fan 21 is a fan that discharges air in a centrifugal direction, and it rotates to suck air from the central region and generates air flow directed toward its periphery. The multiblade fan 21 is a so-called double blade fan having a structure arranged and combined in an axis direction, and a structure capable of sucking air from central regions on both ends in an axial direction. In addition, the blower 2 is inclined so that the upper part becomes close to the rear side in Fig. 4, but it may be disposed not to be inclined.

[0029] The multiblade fan 21 is disposed inside the fan case 22 in a rotatable manner. The fan case 22 is connected to the exhaust port 24 and has a structure capable of blowing out the air flow generated in the circumferential direction of the multiblade fan 21 to the exhaust port 24. The fan case 22 has two surfaces disposed to face both ends of the multiblade fan 21 in the axial direction, and the surfaces have a first suction port 25 and a second suction port 26 for sucking air, respectively. As illustrated in Fig. 4, the fan case 22 is fixed inside the case 11 so that the first suction port 25 faces the rear side while the second suction port 26 faces the front side.

[0030] The multiblade fan 21 is fixed to an output shaft of the fan motor 23. The fan motor 23 is fixed to the fan case 22, and the multiblade fan 21 rotates when the fan motor 23 is driven to rotate. The exhaust port 24 is an opening to blow out air flow generated

by rotation of the multiblade fan 21. The exhaust port 24 has a cylindrical shape communicating to the inside of the fan case 22 in which the multiblade fan 21 is disposed. Further, the exhaust port 24 communicates to the blowout port 15. In other words, the air flow blown out from the exhaust port 24 passes through the blowout port 15 and is blown out to the outside of the dehumidification/humidification device A. Note that because the blowout port 15 is formed to have a certain length in the air flow direction, the blown out air flow can be straightened so that the air flow can reach far. In addition, although not illustrated, an ion generator may be disposed in the blowout port 15, so that the air flow contains ions as necessary.

[0031] The air cleaning unit 3 includes the air cleaning filter 31 and a mesh 32. The air cleaning unit 3 is disposed in the opening 111 provided to the rear side of the case 11. The mesh 32 is a mesh-like member, which is used as a protection member for preventing a hand, a tool, or the like from entering through the opening 111 and as a holder for holding the air cleaning filter 31 not to be deviated. The air cleaning filter 31 collects foreign matters such as dust or dirt in the passing air. The air cleaning filter 31 and the mesh 32 are mounted to the opening 111 in a detachable and attachable manner.

[0032] The air cleaning filter 31 can be a nonwoven fabric filter though this is not a limitation. The air cleaning filter 31 has higher efficiency of collecting foreign matters as the amount of passing air is larger, i.e. as the air flow rate is higher. In addition, when the amount of collected foreign matters is increased in the cleaning filter 31, it becomes hard for the air to pass through the air cleaning filter 31. Therefore, the structure is adopted in which the air cleaning filter 31 can be detached and attached only by removing the rear cover 13. In addition, the air cleaning filter 31 may be disposable or may be reused after cleaning. Both the first inlet port 16 and the second inlet port 17 may be covered with a single air cleaning filter 31 or may be covered with separately.

[0033] The dehumidification unit 4 includes an evaporator 41, a condenser 42, a dehumidification tray 43, and a dehumidification tank 44. The dehumidification unit 4 cools the passing air so that moisture contained in the air is condensed, and thus the moisture contained in the air is removed, i.e. the dehumidification is performed. The dehumidification unit 4 includes a refrigeration cycle device that cools air by

circulating refrigerant and utilizing phase change of the refrigerant. The refrigeration cycle device also includes a compressor and an expander that are not illustrated, in addition to the evaporator 41 and the condenser 42.

[0034] The evaporator 41 and the condenser 42 are heat exchangers using fins, for example, though not limited to this. The dehumidification unit 4 is disposed on the front side of the blower 2 in the case 11 and is positioned close to the second suction port 26. When the blower 2 is driven to suck air through the second suction port 26 to the fan case 22, an air flow is generated to flow in a gap between fins of the evaporator 41 and the condenser 42.

[0035] The evaporator 41 cools the passing air and decreases humidity in the air by condensing in the evaporator 41, i.e. mainly on the fins and pipes. In addition, the condenser 42 warms the passing air. In the dehumidification unit 4, the evaporator 41 is disposed on the upstream side of the air flow so as to cool the air, and the dehumidification is performed by condensation. Then, the air cooled by the evaporator 41 is warmed by heat exchange with high temperature refrigerant in the condenser 42, to be the same or substantially the same temperature as that when it entered the evaporator 41. As described above, in the dehumidification unit 4, the evaporator 41 is disposed on the upstream side of the condenser 42 in the air flow.

[0036] In addition, the dehumidification tray 43 is disposed below the evaporator 41 and receives water condensed on the surface of the evaporator 41, i.e. so-called drain water. Further, the water (drain water) received by the dehumidification tray 43 is sent to the dehumidification tank 44 through a not-shown pipe. The dehumidification tank 44 can be detached from and attached to the case 11 in a sliding manner. The dehumidification tank 44 can detect amount of accumulated drain water, i.e., a level thereof, for example. In the dehumidification/humidification device A, when a certain amount of drain water is accumulated in the dehumidification tank 44, an alarm is generated, and at least the dehumidification unit 4 of the dehumidification/humidification device A is stopped. When the user removes the dehumidification tank 44 and discharges the accumulated drain water in response to the alarm, the dehumidification unit 4 can be used again. Note that because the structure is capable of cleaning air, even if the dehumidification tank 44 is removed, it is possible to continuously operate the fan 21 similarly to the air cleaning operation.

- [0037] Note that in this embodiment, the dehumidification is performed by using the refrigeration cycle, but this is not a limitation. It is possible to use a dehumidification unit using materials such as desiccant for absorbing water.
- [0038] The humidification unit 5 includes a humidification rotor 51, a drive motor 52, a humidification tray 53, a humidification member 54, and a humidification tank 55. As illustrated in Fig. 3 and the like, the humidification rotor 51 includes a cylindrical part 511 in a peripheral portion and a support part 512 supporting an inner side of the cylindrical part 511, and is supported by the case 11 in a rotatable manner. The cylindrical part 511 can contain water inside, i.e. the humidification member 54 is disposed, which can hold water. The cylindrical part 511 and the support part 512 work as a holder member for holding the humidification member 54.
- [0039] The humidification rotor 51 is disposed in a rotatable manner, and the humidification rotor 51 is rotated by an axial force output from the drive motor 52 and is transmitted via a not-shown power transmission mechanism. The humidification rotor 51 and the humidification tray 53 are disposed so that a lower part of the humidification rotor 51 passes through inside of the humidification tray 53. Further, the cylindrical part 511 of the humidification rotor 51 is provided with buckets that can dip up water. When the humidification rotor 51 rotates, it dips up the water stored in the humidification tray 53 with the buckets, and lets the water flow from the upper part to the humidification member 54. In this way, the humidification member 54 is supplied with water. The humidification member 54 includes a member such as nonwoven fabric having numberless micropores, and the water is spread to the entire member by capillary action. Note that the humidification tray 53 and the humidification tank 55 are connected with a pipe, and water is supplied from the humidification tank 55 so that the humidification tray 53 stores a certain amount or more of water.
- [0040] It is possible to adopt a structure in which the humidification rotor 51 is rotated, and a plurality of humidification members 54 are held independently. By stopping rotation of the humidification rotor 51, water supply from the buckets can be stopped, and hence the humidification member 54 can be easily dried. In other words, when switching from the humidification function to the air cleaning function or the dehumidification function, it is possible to shorten the period of time in which high

humidity air flows. Note that the function after switching is not limited to the air cleaning function or the dehumidification function.

[0041] The humidification unit 5 is disposed on the rear side of the blower 2 in the case 11 and is positioned close to the first suction port 25. In other words, the end portion in the rotation axis direction of the humidification rotor 51 of the humidification unit 5 is positioned to face the first suction port 25. When air is sucked into the fan case 22 through the first suction port 25 by driving the blower 2, an air flow is generated to flow inside the cylindrical part 511 of the humidification rotor 51 in the axial direction. Inside the cylindrical part 511, the humidification member 54 is disposed so as to hold water. In other words, when the humidification member 54 is damped, it supplies moisture to the air flow, i.e., the flowing air is humidified. Note that the position of the humidification unit 5 is adjusted so that the air flow flowing in the humidification rotor 51 passes through the humidification member 54 holding water in the humidification operation.

[0042] In the dehumidification/humidification device A, the humidification unit 5 rotates the humidification rotor 51 and dips up water with the buckets, and lets the dipped water flow from the upper part to the humidification member 54, but this is not a limitation. For example, it is possible to adopt a structure in which the humidification member 54 contacts with the water stored in the humidification tray 53 so that the water spreads by capillary action. Note that the humidification tray 53 and/or the humidification tank 55 may be provided with a function of preventing the stored water from being deteriorated, such as a sterilization function, for example.

[0043] Next, there is described the air ducts in which the air flows in the dehumidification/humidification device A according to the present invention. Fig. 5 is a diagram illustrating the air ducts of the dehumidification/humidification device according to the present invention. Fig. 5 illustrates the first air duct and the second air duct using arrow lines.

[0044] As illustrated in Fig. 5, the dehumidification/humidification device A is provided with the first air duct R1 for the air after passing through the air cleaning filter 31 to flow from the first inlet port 16 to the blowout port 15 through the humidification unit 5, the first suction port 25, the fan case 22 and the exhaust port 24. The first air duct R1 includes a path through which the air sucked from the first inlet port 16 directly enters

the humidification unit 5 and passes the same so as to enter the fan case 22 from the first suction port 25.

[0045] In addition, there is formed the second air duct R2 for the air after passing through the air cleaning filter 31 to flow from the second inlet port 17 and bypass the blower 2 to the blowout port 15 through the dehumidification unit 4, the second suction port 26, the fan case 22, and the exhaust port 24. Note that the second air duct R2 includes an upper air duct R21 for the air entering from the upper second inlet port 17 to pass the upper part of the upper partition member 181 and flows downward along the front cover 12 so as to pass the dehumidification unit 4 and enter the fan case 22 from the second suction port 26. In addition, the second air duct R2 includes a lower air duct R22 for the air entering from the lower second inlet port 17 to pass the lower part of the lower partition member 182 and flows upward along the front cover 12 so as to pass the dehumidification unit 4 and enter the fan case 22 from the second suction port 26.

[0046] In the dehumidification/humidification device A, regardless of the operations of the dehumidification unit 4 and the humidification unit 5, the air flow is generated in the first air duct R1 and the second air duct R2 (R21 and R22) when the multiblade fan 21 is driven to rotate. The first inlet port 16 as a suction port of the first air duct R1 and the second inlet port 17 of the second air duct R2 (R21, R22) are both covered with the air cleaning filter 31, and the air flows that pass through the first inlet port 16 and the second inlet port 17 pass through the air cleaning filter 31.

[0047] Further, the dehumidification/humidification device A can selectively operate the dehumidification unit 4 and the humidification unit 5. In other words, it switches among three types of operations, including operation in which both the dehumidification unit 4 and the humidification unit 5 are stopped, operation in which only the dehumidification unit 4 is operated, and operation in which only the humidification unit 5 is operated. The three types of operations are described below.

[0048] When both the dehumidification unit 4 and the humidification unit 5 are stopped, the air cleaning operation is performed, in which only foreign matters are eliminated by the air cleaning filter 31 of the air cleaning unit 3. In other words, the air flow generated in the first air duct R1 passes through the humidification unit 5, but the humidification of the passing air is not performed because the humidification unit 5 is

stopped. In addition, the air flow generated in the second air duct R2 (R21, R22) passes through the dehumidification unit 4, but the dehumidification of the passing air is not performed because the dehumidification unit 4 is stopped. Therefore, the air sucked from the first inlet port 16 and the second inlet port 17 and blown out from the blowout port 15 is not dehumidified or humidified, although dust and dirt and the like in it are collected.

[0049] When only the dehumidification unit 4 is operated, the air flow flowing in the first air duct R1 passes through the humidification unit 5 that is not operating, and hence it is not humidified. In addition, the air flow flowing in the second air duct R2 (R21, R22) passes through the dehumidification unit 4 that is operating, and hence it is dehumidified. In other words, in the dehumidification operation in which the dehumidification unit 4 is operated, the air cleaning filter 31 collects foreign matters from the air flow (air), and the air flow flowing in the second air duct R2 (R21, R22) is dehumidified.

[0050] When only the humidification unit 5 is operated, the air flow flowing in the second air duct R2 (R21, R22) passes through the dehumidification unit 4 that is not operating, and hence it is not dehumidified. In addition, the air flow flowing in the first air duct R1 passes through the humidification unit 5 that is operating, and hence it is humidified. In other words, in the humidification operation in which the humidification unit 5 is operated, the air cleaning filter 31 collects foreign matters from the passing air, and the air flow flowing in the first air duct R1 is humidified.

[0051] As described above, the air cleaning operation, the dehumidification operation, and the humidification operation are performed. Next, the first air duct R1 and the second air duct R2 are described. The air cleaning unit 3, the dehumidification unit 4, and the humidification unit 5 perform different operations. Efficiency of each operation varies in accordance with the air flow rate. For example, in the air cleaning unit 3, the efficiency of collecting foreign matters becomes higher as the air flow rate is higher. On the other hand, in the dehumidification unit 4, when the air flow passes through the evaporator 41, the flowing air is cooled to be condensed, and thus the air is dehumidified. Therefore, it is preferred that the air flow be contacted with the evaporator 41 in the period while the air is cooled to the temperature at which the condensation occurs. On the contrary, if the contact period is too long, the air flow

after the condensation continues to contact with the evaporator 41, resulting in low efficiency. In other words, in the dehumidification unit 4, there is a flow speed or a flow rate at which the efficiency of the dehumidification becomes highest. In addition, in the same manner, the humidification unit 5 gives moisture to the air flow passing through the wet humidification member 54, and hence there is a flow speed or a flow rate at which the efficiency of the humidification becomes highest.

[0052] Further, in the dehumidification/humidification device A, regardless of the operation, the air flow is generated in the first air duct R1 and the second air duct R2. Therefore, the flow rate of the air flow passing through the air cleaning unit 3, the flow rate of the air flow flowing in the first air duct R1, and the flow rate of the air flow flowing in the second air duct R2 have the following relationship:

(flow rate of air flow passing through air cleaning unit 3) = (flow rate of air flow flowing in first air duct R1) + (flow rate of air flow flowing in second air duct R2).

[0053] When performing the humidification operation, the multiblade fan 21 is driven so as to have the air flow rate at which the efficiency of the humidification in the first air duct R1 by the humidification unit 5 becomes highest. In this case, because the air flow is generated also in the second air duct R2 (R21, R22), the flow rate of the air flow flowing in the air cleaning unit 3 becomes higher than the flow rate of the air flow flowing in the first air duct R1 in accordance with the above equation. In other words, the air flow is supplied to the humidification unit 5 at a flow rate at which the efficiency of the humidification becomes highest in the humidification operation, and the air flow can be supplied to the air cleaning unit 3 at a flow rate higher than the flow rate at which the efficiency becomes highest in the humidification operation. In addition, in the same manner, the air flow is supplied to the dehumidification unit 4 at a flow rate at which the efficiency of the dehumidification becomes highest in the dehumidification operation, and the air flow can be supplied to the air cleaning unit 3 at a flow rate higher than the flow rate at which the efficiency becomes highest in the dehumidification operation.

[0054] In this way, the efficiency of the dehumidification becomes highest in the dehumidification operation, or the efficiency of the humidification becomes highest in the humidification operation, while the efficiency of collecting foreign matters by the air cleaning unit 3 can be enhanced. In addition, in the

dehumidification/humidification device A, the air sucked through the first inlet port 16 and the second inlet port 17 flows in the first air duct R1 and the second air duct R2 (R21, R22), and is blown out from the blowout port 15. Therefore, when the dehumidification/humidification device A performs the dehumidification operation or the humidification operation, the flow rate of the air flow discharged outside is higher than that when a conventional dehumidification device or humidification device is used alone. Therefore, the air flow after the dehumidification or the humidification can be spread farther.

[0055] Note that, when the air flow flows in the first air duct R1 at a flow rate at which the efficiency of the humidification to the air flow by the humidification unit 5 becomes highest, it is possible to configure the blower 2, the dehumidification unit 4, the humidification unit 5, the first air duct R1, and the second air duct R2 (R21, R22) so that the air flow flows in the second air duct R2 (R21, R22) at a flow rate at which the efficiency of the dehumidification to the air flow by the dehumidification unit 4 becomes the highest. Thus, when the multiblade fan 21 of the blower 2 rotates at a constant speed, the efficiencies of the dehumidification and the humidification can be highest, and the efficiency of the air cleaning can be enhanced. In addition, when the air cleaning operation is performed, the multiblade fan 22 may be rotated at higher speed because the dehumidification and the humidification are not performed.

[0056] In this embodiment, in the dehumidification/humidification device A, the humidification unit 5 is disposed in the first air duct R1, i.e. on the first suction port 25 side of the blower 2, while the dehumidification unit 4 is disposed in the second air duct R2, i.e. on the second suction port 26 side of the blower 2, but this structure is not a limitation. The dehumidification unit 4 may be disposed apart from the second suction port 26, or the humidification unit 5 may be disposed apart from the first suction port 25. In addition, the dehumidification unit 4 may be disposed in the first air duct R1, while the humidification unit 5 may be disposed in the second air duct R2.

[0057] In this embodiment, the second air duct R2 of the dehumidification/humidification device A includes the upper air duct R21 and the lower air duct R22 that bypass the fan case 22 of the blower 2, but this structure is not a limitation. For example, only one of the upper air duct R21 and the lower air duct R22 may be disposed. When the upper air duct R21 and the lower air duct R22 are disposed like the second air duct R2

of the dehumidification/humidification device A of this embodiment, the air flow can flow in the wide range of the evaporator 41 without a bias, and hence the efficiency of the dehumidification can be enhanced.

[0058] In addition, although the second flow channel R2 bypasses the blower 2 in the up and down direction, it is possible to bypass the blower 2 in the left and right direction, i.e. in the lateral direction. In addition, it is possible to bypass the blower 2 both in the up and down direction and in the left and right direction. It is possible to widely adopt the air duct bypassing the blower 2, which is disposed in the second air duct R2 and can supply the air flow at a flow rate at which the dehumidification unit 4 or the humidification unit 5 can efficiently operate.

[0059] (Second embodiment)

Another example of the dehumidification/humidification device according to the present invention is described with reference to the drawings. Fig. 6 is a cross-sectional view of another example of the dehumidification/humidification device according to the present invention. A dehumidification/humidification device B illustrated in Fig. 6 has the same structure as that of the dehumidification/humidification device A except for a blowout port 15b and a blower 2b. Therefore, substantially the same part is denoted by the same reference numeral, and detailed description of the same part is omitted.

[0060] As illustrated in Fig. 6, the blowout port 15b is provided with a divider 150. The blowout port 15b is divided by the divider 150 into a first blowout portion 151 constituting a part of the first air duct R1, and a second blowout portion 152 constituting a part of the second air duct R2.

[0061] In addition, a divider portion 27 is disposed inside a fan case 22b of the blower 2b. The divider portion 27 is disposed so as to form a surface corresponding to a boundary between the first air duct R1 side and the second air duct R2 side of the multiblade fan 21. Note that the divider portion 27 does not contact with the multiblade fan 21 so as not to interrupt drive of the multiblade fan 21.

[0062] As described above, the divider 150 is disposed in the blowout port 15b while the divider portion 27 is disposed in the fan case 22b, and hence the air flow flowing in the first air duct R1 is not mixed with air flow flowing in the second air duct R2 (R21, R22) inside the dehumidification/humidification device A. Further, by appropriately

adjusting positions of the divider 150 and the divider portion 27, the flow rates of the air flows flowing in the first air duct R1 and in the second air duct R2 can be precisely adjusted to be optimized for the humidification and the dehumidification.

[0063] (Third embodiment)

Another example of the dehumidification/humidification device according to the present invention is described with reference to the drawings. Fig. 7 is a cross-sectional view of another example of the dehumidification/humidification device according to the present invention in a state where the first damper is opened, and Fig. 8 is a cross-sectional view of the dehumidification/humidification device illustrated in Fig. 7 in a state where the first damper is closed. In addition, Fig. 9 is a diagram illustrating air flows when the first damper is opened, and Fig. 10 is a diagram illustrating air flows when the first damper is closed.

[0064] A dehumidification/humidification device C illustrated in Figs. 7 and 8 includes a humidification unit 5c different from the humidification unit 5 of the dehumidification/humidification device A, and includes a first damper 61 and a second damper 62 for adjusting the air flow direction or the flow rate. In the example illustrated in Figs. 7 and 8, the shape of the cabinet 1 including the case 11, the front cover 12, the rear cover 13, and the like is different from that of the dehumidification/humidification device A for convenience sake, but they have substantially the same structure. In the following description of the dehumidification/humidification device C, substantially the same part as the dehumidification/humidification device A is denoted by the same numeral, and detailed description of the same part is omitted.

[0065] As illustrated in Figs. 7 and 8, the blower 2 is disposed so that the rotation axis of the multiblade fan 21 becomes horizontal, but it has substantially the same structure as the multiblade fan 2 of the dehumidification/humidification device A. In other words, the first suction port 25 is disposed on the rear side, while the second suction port 26 is disposed on the front side. Further, in the dehumidification/humidification device C, the dehumidification unit 4 is disposed adjacent to the first suction port 25.

[0066] As illustrated in Figs. 7 and 8, the partition member 18 is disposed below the dehumidification unit 4. In the dehumidification/humidification device C, the upper part than the partition member 18 in the opening 111 viewed from the rear side is the

first inlet port 16, while the lower part than the partition member 18 is the second inlet port 17. Further, the dehumidification unit 4 is disposed so that the air sucked from the first inlet port 16 enters the evaporator 41 of the dehumidification unit 4.

[0067] The humidification unit 5c includes a humidification member 56, a humidification tray 57, and a housing 58. The humidification member 56 can suck moisture by capillary action and is housed in the humidification tray 57. The humidification tray 57 can store water. The humidification tray 57 is supplied with water from a not-shown humidification tank. The humidification member 56 is housed in the humidification tray 57 so that the lower part thereof is positioned in the water.

[0068] Further, the humidification member 56 and the humidification tray 57 are housed in the housing 58, which is mounted to the case 11. The housing 58 is a cylindrical member made of airtight material, as a member for housing the humidification member 56 and the humidification tray 57, and also has a role as a holder member for holding the humidification member 56 not to be bent or flexed. In this way, the humidification unit 5c has a simpler structure than the humidification unit 5 used in the dehumidification/humidification device A and can be downsized. The housing 58 is disposed below the fan case 22 with a space therebetween.

[0069] As illustrated in Figs. 7 and 8, between the upper surface of the housing 58 and the lower surface of the fan case 22, there is formed a space through which the air flow can pass. The dehumidification/humidification device C has the first damper 61 disposed in this space. The first damper 61 has a curved surface 611, and a turning support part 612. The curved surface 611 is a part of a cylindrical shape and has a width in the depth direction of the paper plane. The first damper 61 is pivoted with the turning support part 612, and it turns about a center axis of the curved surface 611 so that the air duct is opened and closed. Note that the first damper 61 automatically turns in accordance with the operation of the dehumidification/humidification device C and is driven by power from a not-shown power source.

[0070] A receiving member 63 is disposed on the inner surface of the front cover 12. The receiving member 63 is a restricting member to prevent the damper from turning further. As illustrated in Fig. 7, when the first damper 61 turns most in a clockwise direction in Fig. 7, an end portion of the curved surface 611 abuts the receiving member 63 so that the turning is stopped. In addition, as illustrated in Fig. 9, in the

state where the end portion of the first damper 61 abuts the receiving member 63, the air flow passes through the space between the fan case 22 and the housing 58 and enters inside of the fan case 22 through the second suction port 26. In this case, the first damper 61 is in opened state. Note that in this case, the air flow does not flow in the second air duct R2.

[0071] As illustrated in Fig. 8, when the first damper 61 turns most in a counterclockwise direction in Fig. 8, the other end portion of the curved surface 611, opposite to the end portion that abuts the receiving member 63, abuts the fan case 22. As illustrated in Fig. 10, when the end portion of the first damper 61 abuts the fan case 22, the curved surface 611 blocks the space between the fan case 22 and the housing 58, and hence the air flow passes through the humidification unit 5c. In this case, the first damper 61 is in closed state. In this case, the air flow flows in the second air duct R2.

[0072] As illustrated in Figs. 7 and 8, there is formed a gap between the partition member 18 and the fan case 22. This gap is constituted so that a part of the air flow entering the first suction port 25 after passing through the dehumidification unit 4 can pass through the fan case 22 and the housing 58. Further, the dehumidification/humidification device C includes the second damper 62 that is provided to the partition member 18 in a rotatable manner and is a flat-plate member for opening and closing the gap. When the second damper 62 is in closed state, the air flow entering the first suction port 25 after passing through the dehumidification unit 4 does not flow to the fan case 22 and the housing 58 through the gap. On the other hand, when the second damper 62 is in opened state, the air flow entering the first suction port 25 after passing through the dehumidification unit 4 flows to the fan case 22 and the housing 58 through the gap. Note that the second damper 62 is automatically opened and closed in accordance with the operation of the dehumidification/humidification device C, and is driven by power from a not-shown power source. In addition, the first damper 61 and the second damper 62 may share the same power source.

[0073] The dehumidification/humidification device C has the same types of operations as the dehumidification/humidification device A, namely the air cleaning operation, the dehumidification operation, and the humidification operation. First, the dehumidification operation is described. When the dehumidification operation is performed, as illustrated in Fig. 9, the first damper 61 is opened, while the second

damper 62 is closed. In this state, when the multiblade fan 21 is driven, the air is sucked into the fan case 22 through the first suction port 25 and the second suction port 26 so that the air flows are generated. In the dehumidification/humidification device C, the air is sucked through each of the first inlet port 16 and the second inlet port 17. The air sucked through the first inlet port 16 flows in the first air duct R1 to the blowout port 15 through the dehumidification unit 4, the first suction port 25, the fan case 22, and the exhaust port 24.

[0074] On the other hand, the air sucked through the second inlet port 17 flows in a third air duct R3 to the blowout port 15 through the space between the fan case 22 and the housing 58, the second suction port 26, the fan case 22, and the exhaust port 24. The air flow flowing in the third air duct R3 is blown out to the outside from the blowout port 15 without passing through the humidification unit 5c.

[0075] Next, the humidification operation is described. As illustrated in Fig. 10, when the humidification operation is performed, the first damper 61 is closed while the second damper is opened. When the first damper 61 is closed, the space between the fan case 22 and the housing 58 as a part of the third air duct R3 is blocked by the first damper 61. Therefore, the air sucked through the second inlet port 17 flows in the second air duct R2 to the blowout port 15 through the humidification unit 5c, the second suction port 26, the fan case 22, and the exhaust port 24. In addition, because the second damper 62 is opened, a part of the air after passing through the first inlet port 16 flows in a bypass air duct R4 that branches from the first air duct R1 to the second air duct R2 so as to join the second air duct R2.

[0076] In other words, when the humidification operation is performed, the air sucked through the second inlet port 17 and the air that is sucked from the first inlet port 16 and passes through the bypass air duct R4 flow in the second air duct R2, are humidified, and are blown out to the outside from the blowout port 15. When the humidification operation is performed, because the dehumidification unit 4 is stopped, the air that has passed through the bypass air duct R4 and has joined the second air duct R2 is not dehumidified. Therefore, it has the same or substantially the same humidity as the air sucked from the second inlet port 17, and hence the flow rate of the air that humidifies while suppressing variation of the humidity can be increased.

[0077] In addition, when the air cleaning operation is performed, because the

dehumidification and the humidification are not performed, in the same manner as in the dehumidification operation, the first damper 61 is opened while the second damper 62 is closed so that the first air duct and the third air duct are formed.

[0078] In the dehumidification/humidification device C, when the air cleaning operation or the dehumidification operation is performed, the first damper 61 is opened while the second damper 62 is closed so that the air flow does not pass through the second air duct R2. In this way, it is possible to prevent a part of the air flow from being humidified when the air cleaning operation or the dehumidification operation is performed. For example, when switching to the air cleaning operation after humidity in the room is sufficiently increased by the humidification operation, undamped air, i.e. unhumidified air can be blown out just after the switching. Without waiting for the humidification member 56 being dried, unhumidified air can be blown out.

[0079] In addition, when the air cleaning operation or the dehumidification operation is performed, because the air flow does not pass through the humidification unit 5c, it is not necessary to dry the dehumidification member 56 every time when the operation is switched. In this way, just after switching from the air cleaning operation or the dehumidification operation to the humidification operation, humidified air can be blown out without waiting for the dehumidification member 56 being wet with water.

[0080] As understood from above, the dehumidification/humidification device C has a high response property when switching from the air cleaning operation or the dehumidification operation to the humidification operation, or from the humidification operation to the air cleaning operation or the dehumidification operation.

[0081] The dehumidification/humidification device A opens the second damper 62 when the humidification operation is performed, and hence the air is bypassed through the bypass air duct R4 from the first air duct R1 to the second air duct R2. This means that a part of the first inlet port 16 is used as the second inlet port 17 in accordance with the operation. In this way, even if the opening 111 is small, the air flow having high efficiency for performing the dehumidification or the humidification can flow in the dehumidification unit or the humidification unit. In other words, the dehumidification/humidification device can be downsized without deteriorating efficiency of the dehumidification or the humidification.

[0082] Note that if the second inlet port 17 has a size sufficient for generating the air flow at a

flow rate that can increase efficiency of the humidification, it is possible to perform the humidification operation in the state where the second damper 62 is closed. Further, if the second inlet port 17 has a size sufficient for generating the air flow at a flow rate that can increase efficiency of the humidification by the humidification unit 5c without the air from the bypass air duct R4, the second damper 62 may be eliminated.

[0083] In addition, the first damper 61 and the second damper 62 may have adjustable opening degrees. In this way, the air can be distributed to the second air duct R2 and the third air duct R3 in the humidification operation. In this way, amount of humidified air, i.e. amount of moisture given to the air can be adjusted so that humidity adjustment can be performed.

[0084] In this embodiment, the first damper 61 has the structure including the curved surface 611 like a part of a cylinder and the turning support part 612, but this structure is not a limitation. For example, the damper may have a flat plate that is turned to be opened and closed, so that the flow rate is adjusted. It is possible to widely adopt a damper that can adjust the flow rate of the air flow flowing in the humidification unit 5c.

[0085] Although the embodiments of the present invention are described above, the present invention is not limited to these embodiments. In addition, the embodiments of the present invention can be variously modified as long as the modification does not deviate from the spirit of the invention.

[0086] The dehumidification/humidification device according to the present invention described above includes a cabinet including a first inlet port, a second inlet port, and a blowout port; a first air duct from the first inlet port to the blowout port; a second air duct from the second inlet port to the blowout port; a humidification unit disposed in one of the first air duct and the second air duct; a dehumidification unit disposed in the other of the first air duct and the second air duct; and a blower disposed in the first air duct and in the second air duct so as to generate air flows in the first air duct and in the second air duct.

[0087] The dehumidification/humidification device described above may have a structure in which the blower includes a multiblade fan and a fan case, the fan case includes a first suction port for sucking the air flow flowing in the first air duct into the fan case, and a second suction port disposed on an opposite side of the first suction port with respect

to the multiblade fan so as to suck the air flow flowing in the second air duct into the fan case, and the second air duct is formed to bypass the fan case.

[0088] In the dehumidification/humidification device described above, the dehumidification unit may be disposed adjacent to one of the first suction port and the second suction port.

[0089] In the dehumidification/humidification device described above, the humidification unit may be disposed adjacent to one of the first suction port and the second suction port.

[0090] The dehumidification/humidification device described above may have a structure in which the dehumidification unit is disposed in the first air duct while the humidification unit is disposed in the second air duct, and the apparatus includes a third air duct from the second inlet port to the second suction port bypassing the humidification unit, and a first damper for adjusting flow rate of the air flow flowing in the second air duct or the third air duct.

[0091] The dehumidification/humidification device described above may further include a bypass air duct for supplying air flow from the first air duct to the second air duct; and a second damper disposed on an upstream side of the first damper so as to open and close the bypass air duct, in which the second damper may open so that the air flow flows in the bypass air duct in a state where the first damper generates the air flow in the second air duct.

[0092] The dehumidification/humidification device described above may include a partition member disposed in the cabinet so as to separate the first air duct from the second air duct.

[0093] The dehumidification/humidification device described above may include a divider wall in the fan case so as to separate the first suction port side from the second suction port side.

[0094] The dehumidification/humidification device described above may have a structure in which the first inlet port and the second inlet port are disposed on the same surface of the cabinet, and an air cleaning filter covers the first inlet port and the second inlet port.

List of Reference Signs

[0095]

A dehumidification/humidification device

1 cabinet

11 case

12 front cover

13 rear cover

14 louver

15 blowout port

16 first inlet port

17 second inlet port

18 partition member

181 upper partition member

182 lower partition member

2 blower

21 multiblade fan (double blade fan)

22 fan case

23 fan motor

24 exhaust port

25 first suction port

26 second suction port

3 air cleaning unit

31 air cleaning filter

32 mesh

4 dehumidification unit

41 evaporator

42 condenser

43 dehumidification tray

44 dehumidification tank

5 humidification unit

51 humidification rotor

52 drive motor

53 humidification tray

54 humidification member

55 humidification tank

CLAIMS

1. A dehumidification/humidification device comprising:
 - a cabinet including a first inlet port, a second inlet port, and a blowout port;
 - a first air duct from the first inlet port to the blowout port;
 - a second air duct from the second inlet port to the blowout port;
 - a humidification unit disposed in one of the first air duct and the second air duct;
 - a dehumidification unit disposed in the other of the first air duct and the second air duct; and
 - a blower disposed in the cabinet so as to generate air flows in the first air duct and in the second air duct.
2. The dehumidification/humidification device according to claim 1, wherein
 - the blower includes a multiblade fan and a fan case,
 - the fan case includes a first suction port for sucking the air flow flowing in the first air duct into the fan case, and a second suction port disposed on an opposite side of the first suction port with respect to the multiblade fan so as to suck the air flow flowing in the second air duct into the fan case, and
 - the second air duct is formed to bypass the fan case.
3. The dehumidification/humidification device according to claim 2, wherein
 - the dehumidification unit is disposed in the first air duct while the humidification unit is disposed in the second air duct, and
 - the apparatus includes a third air duct from the second inlet port to the second suction port bypassing the humidification unit, and a first damper for adjusting flow rate of the air flow flowing in the second air duct or the third air duct.
4. The dehumidification/humidification device according to claim 3, further comprising:
 - a bypass air duct for supplying air flow from the first air duct to the second air duct; and
 - a second damper disposed on an upstream side of the first damper so as to open and close the bypass air duct, wherein
 - the second damper opens so that the air flow flows in the bypass air duct in a state

where the first damper generates the air flow in the second air duct.

5. The dehumidification/humidification device according to any one of claims 1 to 4, wherein the first inlet port and the second inlet port are disposed on the same surface of the cabinet, and an air cleaning filter covers the first inlet port and the second inlet port.