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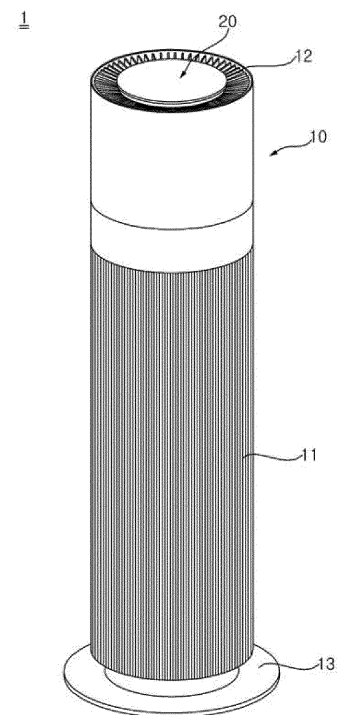
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(54) **HUMIDIFIER**

(57) The present disclosure relates to a humidifier. A humidifier according to one aspect of the present disclosure includes: a case with an intake opening; a fan disposed inside the case; and a humidification assembly that sprays supplied water, wherein the humidification assembly includes: a heating device including a heating chamber internally a heating space and a heater attached to the heating chamber; a humidification device including a humidification chamber internally having a humidification space and a vibrating device attached to the humidification chamber; an inlet disposed downstream of the fan and connected to the humidification space; and a connector through which air in the heating space flows, and that connects the heating space and the humidification space. Thus, warm humidified air can be supplied by combining humidified air and heated air.

FIG. 1



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Description

(Patent Document 0001) Korean Patent Document
10-2022-0105488

BACKGROUND

(Patent Document 0002) Korean Patent Document
10-2018-0094813

Field

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[0001] The present disclosure relates to a humidifier, and more particularly, to a humidifier that supplies clean humidified air.

Related Art

[0002] A humidifier is an appliance that supplies moisture-containing air within a room. The humidifier is equipped with a water reservoir for storing water, and is classified as ultrasonic humidifier, heated humidifier, natural evaporative humidifier, or hybrid humidifier depending on the method of humidification.

[0003] Ultrasonic humidifiers are equipped with a vibrator to create vibrations from ultrasonic waves, and convert water into fine particles using the vibrations from the vibrator and spray them.

[0004] Ultrasonic humidifiers have advantages such as converting the water stored in the water reservoir into fine particles and spraying large amounts of mist.

[0005] However, conventional humidifiers are problematic in that the device may have a poor state of cleanliness because of the stagnant water in the device. As such, air sprayed from the device can be highly contaminated.

[0006] Another problem with conventional humidifiers is that blown air containing fine dust or the like may cause degradation in the cleanliness of humidified air sprayed from them. The fine dust contained in the blown air is deposited in water droplets, thus leading to high contamination of the humidified air.

[0007] Prior Art Document 10-2022-0105488 discloses a humidifier. This humidifier, however, is problematic in that the device may have a poor state of cleanliness because of water remaining in a water reservoir. Another problem is that this humidifier is not capable of supplying clean air in mixture because of its monolithic flow path of humidified air.

[0008] Prior Art Document 10-2018-0094813 discloses a humidifier that supplies heated mummified air. However, his humidifier has the problem of the increased droplet size because a humidification flow path and a heating flow path are provided separately. Another problem with this humidifier is that, the heater operates continuously even with a small heating load, which leads to supply of humidified air that has an unnecessarily high temperature and excessive consumption of energy.

Prior Art Documents**Patent Documents**

[0009]

SUMMARY

[0010] The present disclosure is directed to overcoming the above problems and others.

10 **[0011]** Another aspect of the present disclosure is to supply clean humidified air.

[0012] Yet another aspect of the present disclosure is to separate and combine a humidification flow path and a cleaning flow path.

15 **[0013]** A further aspect of the present disclosure is to optimally mix humidified flow and cleaning flow.

[0014] A further aspect of the present disclosure is to improve the cleanliness of humidified flow.

20 **[0015]** A further aspect of the present disclosure is to combine air in a heating flow path and air in a humidification flow path.

[0016] A further aspect of the present disclosure is to simplify a flow path structure.

25 **[0017]** A further aspect of the present disclosure is to minimize flow resistance.

[0018] A further aspect of the present disclosure is to guide a flow of air in a given direction.

[0019] A further aspect of the present disclosure is to improve air heating and humidification efficiency.

30 **[0020]** The aspects of the present disclosure are not limited to the foregoing, and other aspects not mentioned herein will be able to be clearly understood by those skilled in the art from the following description.

35 **[0021]** To accomplish the foregoing aspects, a humidifier according to an aspect of the present disclosure includes: a case with an intake opening. The humidifier includes a fan disposed inside the case. The humidifier includes a humidification assembly that sprays supplied water. The humidification assembly includes a heating device including a heating chamber internally having a heating space and a heater attached to the heating chamber. The humidification assembly includes a humidification device including a humidification chamber internally having a humidification space and a vibrating device attached to the humidification chamber. The humidification assembly includes an inlet disposed downstream of the fan and connected to the humidification space. The humidification assembly includes a connector through which air in the heating space flows, and that connects the heating space and the humidification space. Thus, heated air in the heating space may be supplied in combination with humidified air.

45 **[0022]** Heated air in the heating chamber may flow into the humidification chamber through the connector.

50 **[0023]** The connector may connect the top of the heating chamber and the top of the humidification chamber.

[0024] The connector may be disposed in a position spaced from the inlet in a circumferential direction of the

humidification chamber.

[0025] The connector may include an extension body extending upward from the inside of the heating chamber. The connector may include a curved body extending from the extension body toward the humidification device. The connector may include a coupling body extending from the curved body toward the inside of the humidification chamber.

[0026] The humidification assembly may include an outlet port through which mist produced by the humidification device is discharged, that the outlet port may protrude upward from the humidification device,

[0027] The connector may be positioned lower than the outlet port.

[0028] The humidification assembly may include a chamber cover attached to the top of the humidification chamber and having an outlet port through which mist is discharged.

[0029] The connector may be removably attached to the chamber cover.

[0030] The humidification assembly may include a mist intake opening extending into the humidification chamber.

[0031] The connector may face the mist intake opening.

[0032] A communicating hole may be formed through the mist intake opening.

[0033] The mist intake opening may extend toward the bottom of the humidification chamber. A lower end of the mist intake opening may be positioned lower than the connector.

[0034] An outer wall of the mist intake opening may be spaced from an exit of the connector.

[0035] The humidifier may further include a valve that regulates the flow of water supplied to the heating chamber. The humidifier may further include a valve housing disposed inside the heating chamber and positioned lower than the connector.

[0036] The distance between the valve housing and an outer wall of the heating chamber may be smaller than the width of the connector.

[0037] A humidifier according to an aspect of the present disclosure includes: a case with an intake opening; a fan disposed inside the case; and a humidification assembly that sprays supplied water, wherein the humidification assembly includes: a heating device including a heating chamber internally having a heating space and a heater attached to the heating chamber; a humidification device including a humidification chamber internally having a humidification space and a vibrating device attached to the humidification chamber; and a mist intake opening extending from the humidification space to the outside of the humidification assembly, and including a communicating hole facing the heating space through which air in the heating space is admitted. Thus, mist produced by the humidification device may be supplied in combination with heated air.

[0038] The air in the heating space may combine with

air in the humidification space through the communicating hole.

[0039] The connector may face the communicating hole.

5 **[0040]** An end of the mist intake opening may be positioned below the communicating hole.

[0041] The communicating hole may be spaced from an outer wall of the heating chamber and an outer wall of the humidification chamber.

10 **[0042]** The humidifier may further include an inlet through which air blown by the fan enters, and that is connected to the humidification chamber.

[0043] An outer wall of the mist intake opening may be disposed between the communicating hole and the inlet to divide the communicating hole and the inlet.

[0044] The communicating hole may be positioned at a height corresponding to the inlet.

[0045] Specific details of other embodiments are included in the detailed description and the drawings.

20 **[0046]** According to at least one of the embodiments of the present disclosure, a humidifier may have various modes by providing different flow paths: a humidification flow path and a cleaning flow path.

25 **[0047]** According to at least one of the embodiments of the present disclosure, clean humidified air may be supplied since the humidification flow path and the cleaning flow path combine near the discharge opening.

30 **[0048]** According to at least one of the embodiments of the present disclosure, a simplified flow path structure can be provided since the humidification flow path branches off from the cleaning flow path and connects into the humidification assembly.

35 **[0049]** According to at least one of the embodiments of the present disclosure, a flow of air can be guided in a given direction with less flow resistance since the humidified air flows upward along a wall surface of the water reservoir.

40 **[0050]** According to at least one of the embodiments of the present disclosure, the cleanliness of water mist to be sprayed can be improved by heating water in a heating chamber.

45 **[0051]** According to at least one of the embodiments of the present disclosure, the temperature of the humidified air can be increased by allowing the heating chamber and a humidification chamber to communicate with each other.

50 **[0052]** According to at least one of the embodiments of the present disclosure, the direction of discharged air can be regulated by regulating the flow of air admitted to the humidification assembly by controlling the operation of the auxiliary fan.

55 **[0053]** According to at least one of the embodiments of the present disclosure, the air admitted to the humidification assembly can remain there for a longer period of time owing to a port structure of the humidification assembly, thereby improving humidification efficiency.

[0054] The effects of the present disclosure are not limited to the foregoing, and other effects not mentioned

herein will be able to be clearly understood by those skilled in the art from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0055]

FIG. 1 is a perspective view of a humidifier according to an embodiment of the present disclosure.
 FIG. 2 is an exploded view of a humidifier according to an embodiment of the present disclosure.
 FIG. 3 is a cross-sectional view of a humidifier according to an embodiment of the present disclosure.
 FIG. 4 is a partial cross-sectional view of a humidifier according to an embodiment of the present disclosure.
 FIG. 5 is a perspective view of a humidifier according to an embodiment of the present disclosure, part of which was removed.
 FIG. 6 is a partial cross-sectional view according to an embodiment of the present disclosure.
 FIG. 7 is a perspective view of a humidifier according to an embodiment of the present disclosure, part of which was removed.
 FIG. 8 is a perspective view of a humidifier according to an embodiment of the present disclosure, part of which was removed.
 FIG. 9 is a perspective view of a humidification assembly according to an embodiment of the present disclosure.
 FIG. 10 is an exploded view of a humidification assembly according to an embodiment of the present disclosure.
 FIG. 11 is a cross-sectional view of a humidification assembly according to an embodiment of the present disclosure.
 FIG. 12 shows part of a humidification assembly according to an embodiment of the present disclosure.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0056] Hereinafter, the embodiments disclosed in the present specification will be described in detail with reference to the accompanying drawings. The same or similar elements will be assigned the same reference numerals irrespective of the reference numerals, and redundant descriptions thereof will be omitted.

[0057] The suffixes "module" and "unit" for elements used in the following embodiments are given or interchangeably used in consideration of only the ease of drafting the specification and do not have a meaning or role distinct from each other.

[0058] In describing the embodiments disclosed in the present specification, a detailed description of a related known technology will be omitted when it is deemed that it may unnecessarily obscure the subject matter of the present disclosure. Also, it should be understood that the appended drawings are intended only to help understand

the embodiments disclosed in the present specification and do not limit the technical idea disclosed in the present disclosure; rather, it should be understood that all changes, equivalents, and substitutions included in the technical scope and spirit of the present disclosure are included.

[0059] Terms such as 'first', 'second', etc., may be used to describe various components, but the components are not to be construed as being limited to the terms. The terms are used only to distinguish one component from another component.

[0060] It is to be understood that when one element is referred to as being "connected to" or "coupled to" another element, it may be connected directly to or coupled directly to another element, having the other element intervening therebetween. On the other hand, it is to be understood that when one element is referred to as being "connected directly to" or "coupled directly to" another element, it may be connected to or coupled to another element without the other element intervening therebetween.

[0061] The singular expressions may include plural expressions unless the context clearly dictates otherwise.

[0062] Referring to FIG. 1, a humidifier 1 will be described.

[0063] FIG. 1 is a perspective view of the humidifier 1.

[0064] The humidifier 1 may include a case 10. The case 10 may internally have a space. The case 10 may be cylindrical.

[0065] The humidifier 1 may include an intake opening 11. The intake opening 11 may be formed around the circumference of the case 10. Air from outside the humidifier 1 may enter the case 10 through the intake opening 11.

[0066] The humidifier 1 may include a discharge opening 12. The discharge opening 12 may be formed on the top of the case 10. Air drawn into the case 10 may be discharged out of the case 10 through the discharge opening 12.

[0067] The humidifier 1 may include a base 13. The base 13 may be disposed at the bottom of the case 10. The base 13 may have a larger diameter than the case 10.

[0068] The humidifier 1 may include a water reservoir 20. The water reservoir 20 may be disposed inside the case 10. A space for storage of water may be formed inside the water reservoir 20. The discharge opening 12 may be formed radially outward from the water reservoir 20. The discharge opening 12 may be formed to surround the water reservoir 20.

[0069] Referring to FIG. 2, the humidifier 1 will be described.

[0070] FIG. 2 is an exploded view of the humidifier 1.

[0071] The humidifier 1 may include an intake grille 14. The intake grille 14 may be disposed around the circumference of the case 10. The intake grille 14 may form the intake opening 11. The intake grille 14 may be cylindrical.

[0072] The humidifier 1 may include a discharge grille 15. The discharge grille 15 may be disposed at an upper

part of the case 10. The discharge grille 15 may form the discharge opening 12. The discharge grille 15 may be ring-shaped.

[0073] The humidifier 1 may include a first outer case 16. The first outer case 16 may be cylindrical. The intake grille 14 may be attached to and detached from the first outer case 16. The first outer case 16 may form the exterior of the case 10.

[0074] The humidifier 1 may include a first inner case 17. The first inner case 17 may be cylindrical. The first inner case 17 may be disposed radially inward from the first outer case 16. The first outer case 16 and the first inner case 17 may be radially spaced apart from each other

[0075] The humidifier 1 may include a second outer case 19. The second outer case 19 may be cylindrical. The second outer case 19 may be disposed above the first outer case 16. The second outer case 19 may form the exterior of the case 10.

[0076] The humidifier 1 may include a second inner case 18. The second inner case 18 may be cylindrical. The second inner case 18 may be disposed above the first inner case 17. The second inner case 18 may be disposed radially inward from the second outer case 19. The second outer case 19 and the second inner case 18 may be radially spaced apart from each other.

[0077] The first outer case 16 and the second outer case 19 may be removably coupled together. Then again, the first outer case 16 and the second outer case 19 may be formed as a single body. The first outer case 16 and the second outer case 19 may be called "outer case".

[0078] The first inner case 17 and the second inner case 18 may be removably coupled together. Then again, the first inner case 17 and the second inner case 18 may be formed into a single body. The first inner case 17 and the second inner case 18 may be called "inner case".

[0079] The humidifier 1 may include a bucket 21. The bucket 21 may be cylindrical with an open top. The bucket 21 may internally have a space for storing water.

[0080] The humidifier 1 may include a bucket housing 22. The bucket housing 22 may surround the bucket 21. The bucket housing 22 may be cylindrical with an open top. The bucket 21 may be disposed inside the bucket housing 22.

[0081] The humidifier 1 may include a bucket cover 23. The bucket cover 23 may be disposed above the bucket 21. The bucket cover 23 may be removably attached to the discharge grille 15.

[0082] The water reservoir 20 may include the bucket 21, the bucket housing 22, and the bucket cover 23. The water reservoir 20 may be disposed inside the inner case 18. The water reservoir 20 and the inner case 18 may be radially spaced apart from each other.

[0083] Referring to FIG. 3, the humidifier 1 will be described.

[0084] FIG. 3 is a vertical cross-sectional view of the humidifier 1.

[0085] The humidifier 1 may include a filter 31. The

filter 31 may be disposed inside the intake grille 14. The filter 31 may be cylindrical.

[0086] The humidifier 1 may include a fan 32. The fan 32 may be disposed above the filter 31. The fan 32 may be disposed inside the intake grille 14.

[0087] The humidifier 1 may include a fan motor 33. The fan motor 33 may rotate the fan 32. The fan motor 33 may be disposed above the fan 32.

[0088] The humidifier 1 may include a controller 34. The controller 34 may be disposed inside the case 10. The controller 34 may be disposed between the fan motor 33 and a humidification assembly 40. The controller 34 may control the operation of the fan motor 33 and the humidification assembly 40. The controller 34 may include a plurality of PCB substrates.

[0089] The humidifier 1 may include an auxiliary fan 35. The auxiliary fan 35 may be disposed inside the case 10. The auxiliary fan 35 may be disposed at an entrance of the humidification assembly 40.

[0090] The humidifier 1 may include the humidification assembly 40. The humidification assembly 40 may be disposed inside the case 10. The humidification assembly 40 may be disposed between the water reservoir 20 and the fan 32. The humidification assembly 40 may cause water supplied from the water reservoir 20 to break up into tiny particles and deliver them to the discharge opening 12. Part of air blown by the fan 32 may enter the humidification assembly 40.

[0091] The discharge grille 15 may be disposed between the water reservoir 20 and the outer case 19. The inner case 18 may be disposed between the reservoir 20 and the outer case 19. The discharge grille 15 may be disposed above the inner case 18.

[0092] The discharge opening 12 may include a first discharge opening 121. The first discharge opening 121 may be formed between the outer case 19 and the inner case 18. The air blown by the fan 32 may flow upward through the first discharge opening 121. The first discharge opening 121 may extend in a ring shape. The first discharge opening 121 may be called "air flow path".

[0093] The discharge opening 12 may include a second discharge opening 122. The second discharge opening 122 may be formed between the inner case 18 and the water reservoir 20. Humidified air that has passed through the humidification assembly 40 may flow upward through the second discharge opening 122. The second discharge opening 122 may extend in a ring shape. The second discharge opening 122 may be called "humidification flow path".

[0094] The discharge opening 12 may include a mixing discharge opening 123. The mixing discharge opening 123 may be formed above the first discharge opening 121 and the second discharge opening 122. The mixing discharge opening 123 may be formed at the discharge grille 15. The mixing discharge opening 123 may extend in a ring shape. The mixing discharge opening 123 may be formed between the outer case 19 and the bucket cover 23. Air flowing in the first discharge opening 121

and air flowing in the second discharge opening 122 may be mixed together in the mixing discharge opening 123.

[0095] Conceptually, the discharge opening 12 may include the first discharge opening 121, the second discharge opening 122, and the mixing discharge opening 123. Then again, it may refer to a space open toward the outside of the case 10, separated from the above-mentioned components 121, 122, and 123. The discharge opening 12 may open toward the top of the case 10. The discharge opening 12 may be formed at the discharge grille 15. The discharge opening 12 may be formed to surround the water reservoir 20. The air blown by the fan 32 may flow through the discharge opening 12.

[0096] The air flow path 121 may be connected to the discharge opening 12. The humidification flow path 122 may be connected to the discharge opening 12. The air in the air flow path 121 and the air in the humidification flow path 122 may be mixed together in the discharge opening 12.

[0097] Air admitted into the case 10 through the intake grille 14 may pass through a filter 31 and be blown upward by the fan 32. Part of the air blown upward by the fan 32 may enter the humidification assembly 40, and the rest may flow upward through the first discharge opening 121. The air admitted to the humidification assembly 40, containing fine water drops, may flow upward through the second discharge opening 122. The air flowing through the first discharge opening 121 and the humidified air flowing through the second discharge opening 122 may be mixed together in the mixing discharge opening 123 and discharged upward of the humidifier 1.

[0098] Referring to FIG. 4, the humidifier 1 will be described.

[0099] FIG. 4 is a partial vertical cross-sectional view of the humidifier 1.

[0100] The humidifier 1 may include the humidification assembly 40. The humidification assembly 40 may be disposed below the water reservoir 20. Humidified air produced in the humidification assembly 40 may be discharged upward.

[0101] The humidification assembly 40 may include a heating device 41. The heating device 41 may heat water and air admitted into it.

[0102] The heating device 41 may include a heating chamber 411. The heating chamber 411 may internally have a space. The water stored in the water reservoir 20 may be admitted to the heating chamber 411.

[0103] The heating device 41 may include a heater 412. The heater 412 may be attached to the bottom of the heating chamber 411. The heater 412 may apply heat into the heating chamber 411. The heater 412 may heat the water and air admitted into the heating chamber 411.

[0104] The humidification assembly 40 may include a humidification device 42. The humidification device 42 may convert the admitted water into fine water drops and discharge them upward.

[0105] The humidification assembly 42 may include a humidification chamber 421. The humidification chamber

421 may internally have a space. The water heated in the heating device 41 may be admitted to the humidification chamber 421.

[0106] The humidification device 42 may include a vibrating device 422. The vibrating device 422 may be attached to the bottom of the humidification chamber 421. The vibrating device 422 may generate vibrations by using ultrasonic waves. By the operation of the vibrating device 422, the water in the humidification chamber 421 may be converted into fine water drops. The humidification device 42 may work on the same principle as well-known ultrasonic humidifiers.

[0107] The humidification assembly 40 may include a valve housing 43. The valve housing 43 may be attached to the heating device 41. The valve housing 43 may be disposed within the heating chamber 411.

[0108] The humidification assembly 40 may include a valve 44. The valve 44 may be a floating valve. The valve 44 may be movably disposed inside the valve housing 43. The valve 44 may be moved upward and downward within the valve housing 43 and selectively supply water into the heating chamber 411.

[0109] The humidification assembly 40 may include an inlet 45. The inlet 45 may be connected to the humidification device 42. The inlet 45 may be connected to the inside of the humidification chamber 421. Part of the air blown by the fan 32 (see FIG. 3) may enter the humidification chamber 421 through the inlet 45. The auxiliary fan 35 may be attached to the inlet 45. The auxiliary fan 35 may draw air flowing between the outer case 16 and the inner case 17 into the inlet 45.

[0110] The humidification assembly 40 may include an outlet 46. The outlet 46 may be connected to the humidification device 42. The outlet 46 may protrude toward the inside of the humidification chamber 421. Fine water drops produced by the humidification device 42 may flow upward through the outlet 46.

[0111] The humidification assembly 40 may include a connector 47. The connector 47 may connect the heating device 41 and the humidification device 42. The connector 47 may connect the heating chamber 411 and the humidification chamber 421. The connector 47 may face the outlet 46.

[0112] The humidification assembly 40 may include a supply port 48. The supply port 48 may connect the water reservoir 20 and the heating device 41. The water in the water reservoir 20 may be admitted into the heating device 41 through the supply port 48.

[0113] The supply port 48 may include a first supply port 481. The first supply port 481 may be connected to the water reservoir 20. The first supply port 481 may be connected to the bottom of the bucket housing 22.

[0114] The water reservoir 20 may include a discharge port 24. The discharge port 24 may be disposed at the bottom of the water reservoir 20. The discharge port 24 may be connected to the first supply port 481.

[0115] The supply port 48 may include a second supply port 482. The second supply port 482 may connect the

first supply port 481 and the valve housing 43. Water admitted into the first supply port 481 may be admitted into the valve housing 43 through the second supply port 482.

[0116] The humidification assembly 40 may include a connecting pipe 49. The connecting pipe 49 may connect the heating device 41 and the humidification device 42. The connecting pipe 49 may connect the heating chamber 411 and the humidification chamber 421. The water in the heating chamber 411 may be admitted into the humidification chamber 421 through the connecting pipe 49.

[0117] Part of the air flowing between the outer case 16 and the inner case 17 may be admitted to the humidification device 42 through the inlet 45. The air admitted to the humidification device 42, containing fine water drops produced within the humidification device 42, may flow upward through the outlet 46. The air flowing upward through the outlet 46 may flow upward between the water reservoir 20 and the inner case 18.

[0118] The water in the water reservoir 20 may be admitted into the valve housing 43 through the supply port 48. The water in the valve housing 43 may be admitted into the heating device 41 by movement of the valve 44. The water admitted into the heating device 41 may be heated by the heater 412. The water heated within the heating chamber 411 may be admitted into the humidification chamber 421 through the connecting pipe 49. The water admitted into the humidification chamber 421 may be converted into fine water drops by the vibrating device 422. The fine water drops, along with the air admitted through the inlet 45, may flow upward through the outlet 46.

[0119] Referring to FIG. 5, the humidifier 1 will be described.

[0120] FIG. 5 illustrates a humidifier 1 from which the first outer case 16 is removed.

[0121] The humidifier 1 may include a filter mounting space 311. The filter mounting space 311 may be formed inside the intake grille 14. The filter 31 (see FIG. 3) may be disposed in the filter mounting space 311. The air admitted through the intake grille 14 may pass through the filter mounting space 311 and flow upward.

[0122] The humidifier 1 may include a fan housing 321. The fan 32 (see FIG. 3) may be disposed inside the fan housing 321. The fan housing 321 may be disposed above the filter 31 (see FIG. 3).

[0123] The humidifier 1 may include a housing top 322. The housing top 322 may form the top of the fan housing 321. The housing top 322 may be spaced radially outward from the inner case 17. The air blown by the fan 32 (see FIG. 3) may flow upward through a space formed between the inner case 17 and the housing top 322.

[0124] The humidifier 1 may include a guide 171. The guide 171 may protrude radially outward from the inner case 17. The guide 171 may be disposed between the inlet 45 and the fan housing 321. A plurality of guides 171 may be spaced apart from each other in a circum-

ferential direction of the inner case 17. A space between the plurality of guides 171 may vertically face the inlet 45. A space between the plurality of guides 171 may vertically face the housing top 322.

[0125] The humidifier 1 may include an inner grille 59. The inner grille 59 may be disposed above the humidification assembly 40. The inner grille 59 may be disposed radially outward from the inner case 17. The inner grille 59 may be attached to the outer case 19.

[0126] Part of the air blown by the fan 43 (see FIG. 3) may enter the inlet 45. Part of the air blown by the fan 32 may enter the inlet 45 through the space between the plurality of guides 171. The air admitted to the humidification assembly 40 through the inlet 45, containing fine water drops, may be discharged through the discharge opening 12.

[0127] The auxiliary fan 35 may be disposed at the inlet 45. The auxiliary fan 35 may draw the air blown by the fan 32 (see FIG. 3) into the humidification assembly 40.

[0128] The auxiliary fan 35 may include a fan device 351. The fan device 351 may be a turbofan. The fan device 351 may be a sirocco fan.

[0129] The auxiliary fan 35 may include a supporter 352. The supporter 352 may be attached to the fan device 351. The supporter 352 may be fixed to the inlet 45. The supporter 352 may connect the fan device 351 and the inlet 45.

[0130] Part of the air blown by the fan 32 may flow upward through a space between the outer case 16 (see FIG. 3) and the inner case 17 and pass through the inner grille 59. The air that has passed through the inner grille 59 may flow upward and be discharged through the discharge opening 12.

[0131] Referring to FIG. 6, the humidifier 1 will be described.

[0132] FIG. 6 is a vertical cutaway view of the humidifier 1 when viewed obliquely.

[0133] Part of air flowing upward between the outer case 16 and the inner case 17 may enter the inlet 45.

[0134] The auxiliary fan 35 may draw the air between the outer case 16 and the inner case 17 into the humidification device 42 through the inlet 45.

[0135] The guide 171 may vertically face the inlet 45. The guide 171 may be disposed below the auxiliary fan 35.

[0136] The air admitted into the humidification chamber 421 through the inlet 45 may be mixed with water drops produced by the operation of the vibrating device 422. The humidified air mixed with the water drops may flow upward through the outlet 46.

[0137] The humidification chamber 421 may communicate with the heating chamber 411. The connector 47 may connect the humidification chamber 421 and the heating chamber 411.

[0138] Air in the heating chamber 411 may be mixed with the air admitted into the humidification chamber 421 and released to the outlet 46. Part of the water admitted into the heating chamber 411 may evaporate and enter

the humidification chamber 421 in the form of vapor. The vapor produced in the heating chamber 411 may be mixed with the humidified air in the humidification chamber 421 and released to the outlet 46.

[0139] The air flowing upward from the humidification chamber 421 through the outlet 46 may be admitted between the water reservoir 20 and the inner case 18. The humidified air discharged through the outlet 46 may flow upward between the water reservoir 20 and the inner case 18.

[0140] The humidifier 1 may include an inner cover 50. The inner cover 50 may be connected to the outlet 46. The inner cover 50 may be disposed between the water reservoir 20 and the humidification assembly 40. The air flowing through the outlet 46 may flow upward from the inner cover 50.

[0141] The water reservoir 20 may include a guide rim 25. The guide rim 25 may extend along the circumference of the water reservoir 20. The guide rim 25 may be spaced upward from the outlet 46. The guide rim 25 may be spaced upward from the inner cover 50. The air flowing through the outlet 46 may be dispersed in a circumferential direction of the water reservoir 20 by the guide rim 25. The humidified air dispersed in the circumferential direction of the water reservoir 20 may flow upward between the water reservoir 20 and the inner case 18.

[0142] Part of the air flowing between the outer case 16 and the inner case 17 may flow upward through the inner grille 59. The inner grille 59 may be disposed between the outer case 19 and the inner case 18. The air that has passed through the inner grille 59 may flow upward between the outer case 19 and the inner case 18.

[0143] Referring to FIG. 7, the humidifier 1 will be described.

[0144] FIG. 7 illustrates the humidifier 1, an upper portion of which, including the water reservoir 20, is removed.

[0145] The humidifier 1 may include an inner cover 50. The inner cover 50 may be disposed above the humidification assembly 40 (see FIG. 6). The inner cover 50 may be disposed below the water reservoir 20 (see FIG. 6). The inner cover 50 may be attached to the water reservoir 20 and the humidification assembly 40.

[0146] The inner cover 50 may include a cover plate 51. The cover plate 51 may be disc-shaped.

[0147] The inner cover 50 may include a port insertion portion 52. The port insertion portion 52 may protrude upward from the cover plate 51. The port insertion portion 52 may have a ring shape. The supply port 48 may be inserted into the port insertion portion 52. The discharge port 24 (see FIG. 6) of the water reservoir 20 (see FIG. 6) may be inserted into the port insertion portion 52 and attached to the supply port 48.

[0148] The inner cover 50 may include an outer rim 53. The outer rim 53 may protrude upward from the cover plate 51. The outer rim 53 may have a ring shape. The outer rim 53 may be spaced radially inward from the outer case 19. The inner grille 59 may be disposed between

the outer rim 53 and the outer case 19.

[0149] The inner cover 50 may include an outlet insertion opening 54. The outlet insertion opening 54 may be formed through the cover plate 51. The outlet 46 of the humidification assembly 40 may be inserted into the outlet insertion opening 54 and fixed in place. The outlet insertion opening 54 may be positioned between the port insertion portion 52 and the outer rim 53. The air flowing through the outlet 46 may flow upward from the inner cover 50.

[0150] The inner grille 59 may be disposed between the outer rim 53 and the outer case 19. The inner grille 59 may be part of the inner cover 50. The inner grille 59 may be formed integral with the outer rim 53. The inner cover 50 and the inner grille 59, as a single body, may be removed from the outer case 19.

[0151] The air flowing through the outlet 46 may flow upward from inside the outer rim 53. Air that has passed through the inner grille 59 may flow upward from outside the outer rim 53. The inner case 18 (see FIG. 6) may be attached to the top of the outer rim 53. The inner case 18 may divide an inner space and an outer space in a radial direction of the outer rim 53.

[0152] Referring to FIG. 8, the humidifier 1 will be described.

[0153] FIG. 8 is a perspective view of the structure in FIG. 7 from which the inner cover 50 is removed.

[0154] The inner cover 50 may be removably disposed above the humidification assembly 40. The inner cover 50 may be disposed inside the outer case 19.

[0155] The inner cover 50 may include a port insert hole 55. The port insert hole 55 may be formed through the center of the inner cover 50. The supply port 48 may be inserted into the port insert hole 55 and fixed in place.

[0156] The inner cover 50 may include an outlet penetrating hole 56. The outlet penetrating hole 56 may be formed between the port insertion portion 52 and the outer rim 53. The outlet 46 may penetrate upward through the outlet penetrating hole 56.

[0157] Part of the air admitted through the intake grille 14 may enter the humidification assembly 40 through the inlet 45. The air admitted to the humidification assembly 40 may be discharged upward through the outlet 46.

[0158] The air admitted through the intake grille 14 may flow upward through a space between the inner case 17 and the outer case 19.

[0159] The humidifier 1 may include a gap 192 formed between the humidification assembly 40 and the outer case 19. The gap 192 may be formed between the inner case 17 and the outer case 19. Part of the air blown by the fan 32 (see FIG. 3) that flows between the humidification assembly 40 and the outer case 19 may enter the humidification assembly 40 through the inlet 45. The rest of the air blown by the fan 32 (see FIG. 3) that flows between the humidification assembly 40 and the outer case 19 may flow upward through the gap 192. The inner grille 59 may be disposed above the gap 192.

[0160] Referring to FIG. 9, the humidifier 1 will be de-

scribed.

[0161] FIG. 9 is a separate view of the humidification assembly 40.

[0162] The humidification assembly 40 may include a support body 401. The support body 401 may be cylindrical with an open top. The support body 401 may be attached to the inner cover 50 (see FIG. 8). The inner cover 50 may be disposed above the support body 410.

[0163] The supply port 48 may be attached to the top of the support body 401. The first supply port 481 may protrude upward from the support body 401, and may be positioned in the center of the support body 401. The second supply port 482 may extend from the first supply port 481 radially outward of the support body 401 and penetrate downward through the support body 401.

[0164] The connector 47 may be disposed above the support body 401. The connector 47 above the support body 401 may be connected to the outlet 46.

[0165] The outlet body 46 may be disposed above the support body 401. The outlet 46 above the support body 401 may be attached to the connector 47 and the inlet 45.

[0166] The second support port 482 may be disposed on one side of the center of the support body 401, and the outlet 46 may be disposed on the other side. The first supply port 481 and the connector 47 may be disposed in the center of the support body 401.

[0167] The heating chamber 411 may be disposed below the support body 401. The heating chamber 411 below the support body 401 may be connected to the supply port 48.

[0168] The humidification chamber 421 may be disposed below the support body 401. The humidification chamber 421 below the support body 401 may be connected to the outlet 46.

[0169] The inlet 45 may be disposed on one side of the humidification chamber 421. The inlet 45 may be positioned radially outward from the support body 401. The inlet 45 radially outward from the support body 401. The inlet 45 may be attached to the outlet 46 at a position radially outward from the support body 401.

[0170] Referring to FIG. 10, the humidifier 1 will be described.

[0171] FIG. 10 is an exploded view of the humidification assembly 40.

[0172] The support body 401 may include a support plate 4011. The support plate 4011 may have the shape of a partially open disc.

[0173] The support body 401 may include a support rim 4012. The support rim 4012 may have a ring shape. The support rim 4012 may protrude upward from the support plate 4011.

[0174] The support body 401 may include a heating chamber coupling portion 4013. The heating chamber coupling portion 4013 may be formed through the support plate 4011. The heating device 41 may be inserted and fixed to the humidification chamber coupling portion 4014. The supply port 48 may be inserted into the heating chamber coupling portion 4013 and attached to the heat-

ing device 41.

[0175] The support body 41 may include a humidification chamber coupling portion 4014. The humidification chamber coupling portion 4014 may be formed through the support plate 4011. The humidification device 42 may be inserted in and fixed to the humidification chamber coupling portion 4014. The outlet 46 may be inserted in the humidification chamber coupling portion 4014 and attached to the heating device 42.

[0176] The heating chamber coupling portion 4013 and the humidification chamber coupling portion 4014 may be spaced apart from each other. The heating chamber coupling portion 4013 and the humidification chamber coupling portion 4014 may be formed radially inward from the support rim 4012.

[0177] The heating chamber 411 may be open at the top. The open top of the heating chamber 411 may communicate with the heating chamber coupling portion 4013. The supply port 48 may be inserted in the heating chamber coupling portion 4013 and extend into the heating chamber 411.

[0178] The supply port 48 may include a chamber connecting portion 483. The chamber connecting portion 483 may be disposed below the second supply port 482. The chamber connecting portion 483 may be inserted into the heating chamber coupling portion 4013. The chamber connecting portion 483 may supply water into the valve housing 43. The water supplied into the valve housing 43 may be supplied into the heating chamber 411 by operation of the valve 44.

[0179] The water supplied into the heating chamber 411 may be heated by the heater 412. The water heated by the heater 412 may be supplied into the humidification chamber 421. The water supplied into the humidification chamber 421 may be sprayed to the outlet 46 by the vibrating device 422.

[0180] The outlet 46 also may be called "chamber cover". The chamber cover 46 may include an outlet port 462.

[0181] The humidification device 42 may be open at the top. The open top of the humidification device 42 may communicate with the humidification chamber coupling portion 4014. The chamber cover 46 may be attached to the humidification chamber coupling portion 4014. The chamber cover 46 may cover the open top of the humidification device 42. The chamber cover 46 may be connected to the humidification device 42 and the inlet 45.

[0182] The chamber cover 46 may include a cover body 461. The cover body 461 may be inserted into the humidification chamber coupling portion 4014. The cover body 461 may extend into the humidification chamber 421.

[0183] The chamber cover 46 may include an outlet port 462. The outlet port 462 may protrude upward from the cover body 461. The outlet port 462 may be attached to the inner cover 50 (see

[0184] FIG. 8). The humidified air in the humidification chamber 421 may flow upward through the outlet port 462.

[0185] The chamber cover 46 may include a first coupling portion 463. The first coupling portion 463 may extend from the cover body 461 toward the heating device 41. The first coupling portion 463 may be connected to the connector 47. The first coupling portion 463 may be called "connecting body".

[0186] The chamber cover 46 may include a second coupling portion 464. The second coupling portion 464 may extend from the cover body 461 to the inlet 45. The second coupling portion 464 may be connected to the inlet 45. The second coupling portion 464 may be called "inlet coupling body".

[0187] The chamber cover 46 may include a mist intake opening 465. The mist intake opening 465 may extend from the cover body 461 into the humidification chamber 421. The mist intake opening 465 may be disposed inside the humidification chamber 421. The humidified air in the humidification chamber 421 may flow upward through the mist intake opening 465. The mist intake opening 465 may be connected to the outlet port 462.

[0188] The inlet 45 may include a first inlet body 451. The first inlet body 451 may be disposed on one side of the humidification chamber 421. The first inlet body 451 may extend vertically. As illustrated in FIG. 5, part of the air blown from the fan 32 may enter the first inlet body 451.

[0189] The inlet 45 may include a second inlet body 452. The second inlet body 452 may be connected to the first inlet body 451. The second inlet body 452 may extend in a curve toward the humidification chamber 421. The second inlet body 452 may be connected to the inlet coupling body 464.

[0190] The air admitted through the first inlet body 451 may be admitted into the humidification chamber 421 through the second inlet body 452.

[0191] Referring to FIG. 11, the humidifier 1 will be described.

[0192] FIG. 11 is a vertical cross-sectional view of the humidification assembly 40.

[0193] The heating device 41 may include a heating space 413. The heating space 413 may be formed inside the heating chamber 411. Water admitted into the heating space 413 may be heated by the heater 412.

[0194] The humidification device 42 may include a humidification space 423. The humidification space 423 may be formed inside the humidification chamber 421. Water admitted into the humidification chamber 421 may turn into droplets.

[0195] Air admitted to the inlet 45 may enter the humidification space 423. The air admitted to the humidification space 423 may combine with air in the heating space 413 and be discharged through the outlet 46.

[0196] The air in the heating space 413 may be admitted into the humidification space 423 through the connector 47.

[0197] The air admitted into the humidification space 423 through the inlet 45 may combine with the air admitted into the humidification space 423 through the connector 47. As such, air heated in the heating device 41

and air humidified in the humidification device 42 may combine together, and warm humidified air may be discharged through the outlet 46.

[0198] The valve housing 43 may protrude into the heating chamber 411. Part of the valve housing 43 may be disposed within the heating space 413.

[0199] The valve housing 43 may include a housing lower wall 431. The housing lower wall 431 may be spaced upward from the base of the heating chamber 411. The housing lower wall 431 may protrude into the heating space 413. The housing lower wall 431 may be partially open, and the valve 44 may open and close the open region of the housing lower wall 431.

[0200] The valve housing 43 may include a housing side wall 432. The housing side wall 432 may extend upward from the housing lower wall 431. The housing side wall 432 may be spaced from a side wall of the heating chamber 411. The valve 44 may be surrounded by the housing side wall 432.

[0201] The connector 47 may be disposed above the valve housing 43. The connector 47 above the valve housing 47 may be connected to the humidification device 42.

[0202] The connector 47 may include an extension body 471. The extension body 471 may extend vertically. The extension body 471 may extend upward from the top of the valve housing 43. The extension body 471 may be positioned between the supply port 48 and the side wall of the heating chamber 411.

[0203] The connector 47 may include a curved body 472. The curved body 472 may extend from the extension body 471 toward the humidification device 42. The curved body 472 may face the humidification space 423.

[0204] The connector 47 may include a coupling body 473. The coupling body 473 may extend from the curved body 472 toward the humidification device 42. The coupling body 473 may extend toward the humidification space 423, and an end thereof may be positioned within the humidification space 423. The coupling body 473 may face the chamber cover 46. The coupling body 473 may face the mist intake opening 465. The coupling body 473 may be inserted in the first coupling portion 463. The coupling body 473 may be inserted into and fixed to the first coupling portion 463.

[0205] The chamber cover 46 may include a communicating hole 466. The communicating hole 466 may be formed through a side wall of the mist intake opening 465. The communicating hole 466 may face the connector 47. The coupling body 473 may extend toward the communicating hole 466. The air in the heating space 413 may enter the communicating hole 466 through the connector 47. The heated air admitted to the communicating hole 466 may combine with the humidified air in the humidification space 423.

[0206] The chamber cover 46 may include an intake end 467. The intake end 467 may be positioned inside the humidification space 423. The intake end 467 may be positioned below the communicating hole 466. The

intake end 467 may be positioned lower than the connector 47.

[0207] The humidification assembly 40 may include a chamber upper end 453. The chamber upper end 453 may form an upper end of the humidification chamber 421. The chamber upper end 453 may be connected to the inlet 45. The chamber upper end 453 may be positioned lower than the second inlet body 452.

[0208] The humidification assembly 40 may include an air intake 464. The air intake 464 may be formed on one end of the inlet 45. The air intake 464 may communicate with the humidification space 423. The air intake 464 may be formed between the chamber upper end 453 and the second inlet body 452. The air intake 464 may be formed between the chamber upper end 453 and the second inlet body 452. The air intake 464 may be formed between the chamber upper end 453 and the second coupling portion 464. The air intake 464 may face an outer wall of the mist intake opening 465. The air intake 464 may be positioned higher than the intake end 467.

[0209] The mist intake opening 465 may extend into the humidification chamber 421. The mist intake opening 465 may include the intake end 467 positioned inside the humidification space 423.

[0210] The mist intake opening 465 may have a communicating hole 466. The communicating hole 466 of the mist intake opening 465 may face the connector 47.

[0211] The outer wall of the mist intake opening 465 may face an air intake 454. Air admitted through the air intake 454 may flow downward along the outer wall of the mist intake opening 465.

[0212] Air admitted to the inlet 45 may enter the humidification space 423 through the air intake 454. In this case, the air admitted through the air intake 454 may flow downward along the outer wall of the mist intake opening 465. The air admitted to the humidification space 423 may turn into mist by the vibrating device 422. The humidified air in the humidification space 423 may flow upward through the mist intake opening 465. In this case, the heated air in the heating space 413 may combine with the humidified air in the mist intake opening 465 through the connector 47 and the communicating hole 466 and flow through them.

[0213] The humidification chamber 411 may have a horizontal width D 1. The valve housing 43 is spaced from an outer wall of the heating chamber 411 by a distance D2. An entrance of the connector 47 may have a width D3.

[0214] The width D1 of the heating chamber 411 may be greater than the distance D2 between the valve housing 43 and the outer wall of the heating chamber 411. The width of the heating chamber 411 may be smaller at the top than at the bottom.

[0215] The distance D2 between the valve housing 43 and the heating chamber 411 may be smaller than the width D3 of the entrance of the connector 47. The width of a flow passage of air admitted from the heating chamber 411 to the connector 47 may become larger toward

the connector 47.

[0216] The width W1 and W2 of the inlet 45 may become smaller toward the top of the humidification chamber 421. The inlet 45 may extend upward toward the humidification chamber 421. The width W 1 of the entrance of the inlet 45 may be greater than the width W2 of an exit of the inlet 45.

[0217] The mist intake opening 465 may extend vertically. The intake end 467 may be spaced downward from the connector 47 by a predetermined distance H1. The intake end 467 may be spaced downward from the chamber upper end 454 by a predetermined distance H2. The communicating hole 466 and the intake end 467 may be vertically spaced apart from each other by the distance H1.

[0218] With the above-described structure, the air admitted to the humidification assembly 40 through the inlet 45 can be dispersed throughout the humidification space 423, and can be easily mixed with the heated air in the heating space 413.

[0219] Referring to FIG. 12, the humidifier 1 will be described.

[0220] FIG. 12 is an exploded view of the supply port 48, the connector 47, and the chamber cover 46.

[0221] The supply port 48, the connector 47, and the chamber cover 46 may be separated from one another. The connector 47 may be removably attached to the supply port 48 and the chamber cover 46. The chamber cover 46 may be removably attached to the connector 47.

[0222] The chamber connecting portion 483 may include an upper connecting portion 4831. The upper connecting portion 4831 may be removably attached to the second supply port 482.

[0223] The chamber connecting portion 483 may include a water outlet 4832. The water outlet 4832 may protrude downward from the upper connecting portion 4831. The water outlet 4832 may protrude into the valve housing 43 (see FIG. 11). Water admitted into the supply port 48 may enter the valve housing 43 through the water outlet 4832.

[0224] The chamber connecting portion 483 may include a side connecting portion 4833. The side connecting portion 4833 may be attached to the connector 47. The side connecting portion 4833 may extend from the upper connecting portion 4831 to a lateral side.

[0225] The connector 47 may be inserted into and coupled to the first coupling portion 463. The connector 47, the first coupling portion 463, and the second coupling portion 464 may be horizontally arranged.

[0226] It will be apparent that, although the exemplary embodiments have been shown and described above, the present disclosure is not limited to the above-described specific embodiments, and various modifications and variations can be made by those skilled in the art without departing from the gist of the appended claims. Thus, it is intended that the modifications and variations should not be understood independently of the technical spirit or prospect of the present disclosure

[0227] The present disclosure may be embodied in various modifications, and its scope of rights is not limited by the foregoing embodiments. Thus, the modifications should be construed as falling within the scope of this disclosure as long as they include components as claimed in the claims of this disclosure.

[0228] Certain embodiments or other embodiments of the disclosure described above are not mutually exclusive or distinct from each other. Any or all elements of the embodiments of the disclosure described above may be combined with another or combined with each other in configuration or function.

[0229] For example, a configuration "A" described in one embodiment of the disclosure and the drawings and a configuration "B" described in another embodiment of the disclosure and the drawings may be combined with each other. Namely, although the combination between the configurations is not directly described, the combination is possible except in the case where it is described that the combination is impossible.

[0230] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. A humidifier comprising:

a case with an intake opening;
a fan disposed inside the case; and
a humidification assembly that sprays supplied water,
wherein the humidification assembly includes:

a heating device including a heating chamber internally having a heating space and a heater attached to the heating chamber;
a humidification device including a humidification chamber internally having a humidification space and a vibrating device attached to the humidification chamber;
an inlet disposed downstream of the fan and connected to the humidification space; and
a connector through which air in the heating space flows, and that connects the heating space and the humidification space.

2. The humidifier of claim 1, wherein heated air in the heating chamber flows into the humidification chamber through the connector.

3. The humidifier according to any one of the preceding claims, wherein the connector connects the top of the heating chamber and the top of the humidification chamber.

4. The humidifier according to any one of the preceding claims, wherein the connector is disposed in a position spaced from the inlet in a circumferential direction of the humidification chamber.

5. The humidifier according to any one of the preceding claims, wherein the connector includes:

an extension body extending upward from the inside of the heating chamber;

a curved body extending from the extension body toward the humidification device; and

a coupling body extending from the curved body toward the inside of the humidification chamber.

6. The humidifier according to any one of the preceding claims, wherein the humidification assembly includes an outlet port through which mist produced by the humidification device is discharged, and that protrudes upward from the humidification device, wherein the connector is positioned lower than the outlet port.

7. The humidifier according to any one of the preceding claims, wherein the humidification assembly includes a chamber cover attached to the top of the humidification chamber and having an outlet port through which mist is discharged, wherein the connector is removably attached to the chamber cover.

8. The humidifier according to any one of the preceding claims, wherein the humidification assembly includes a mist intake opening extending into the humidification chamber, and the connector faces the mist intake opening.

9. The humidifier of claim 8, further comprising a communicating hole formed through the mist intake opening.

10. The humidifier of claim 8 or 9, wherein the mist intake opening extends toward the bottom of the humidification chamber, and a lower end of the mist intake opening is positioned lower than the connector.

11. The humidifier of claim 8, 9 or 10, wherein an outer wall of the mist intake opening is spaced from an exit of the connector.

12. The humidifier according to any one of the preceding claims, further comprising:

a valve that regulates the flow of water supplied to the heating chamber; and
a valve housing disposed inside the heating chamber and positioned lower than the connector.

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13. The humidifier of claim 12, wherein the distance between the valve housing and an outer wall of the heating chamber is smaller than the width of the connector.

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FIG. 1

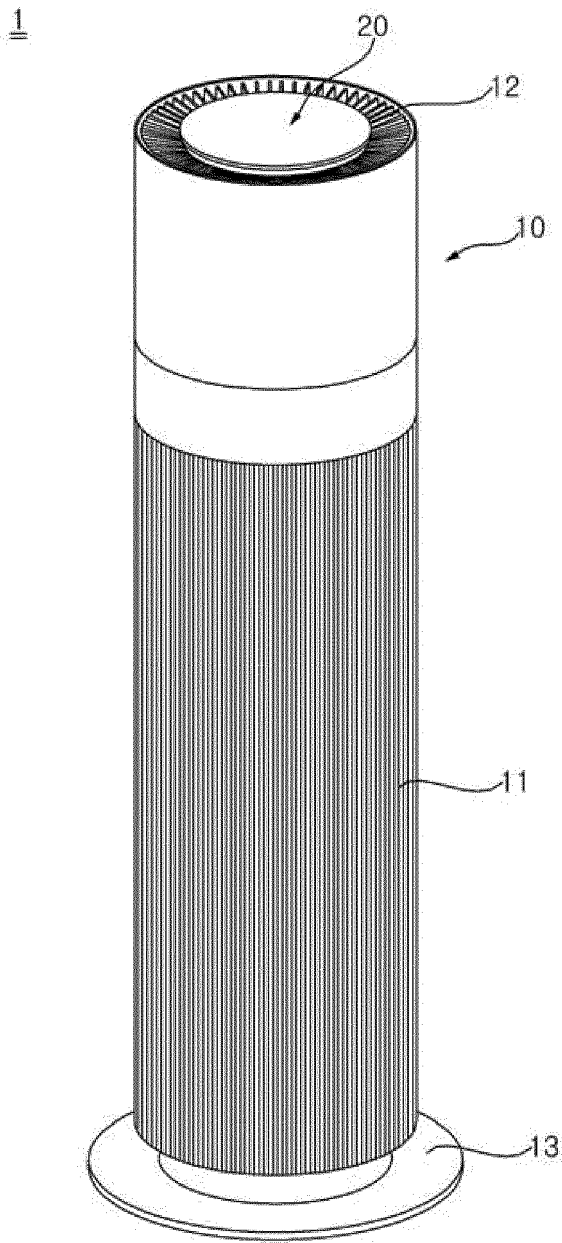


FIG. 2

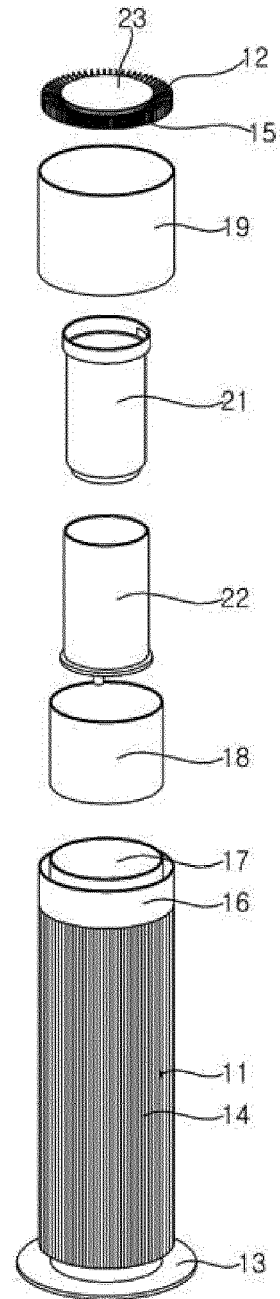


FIG. 3

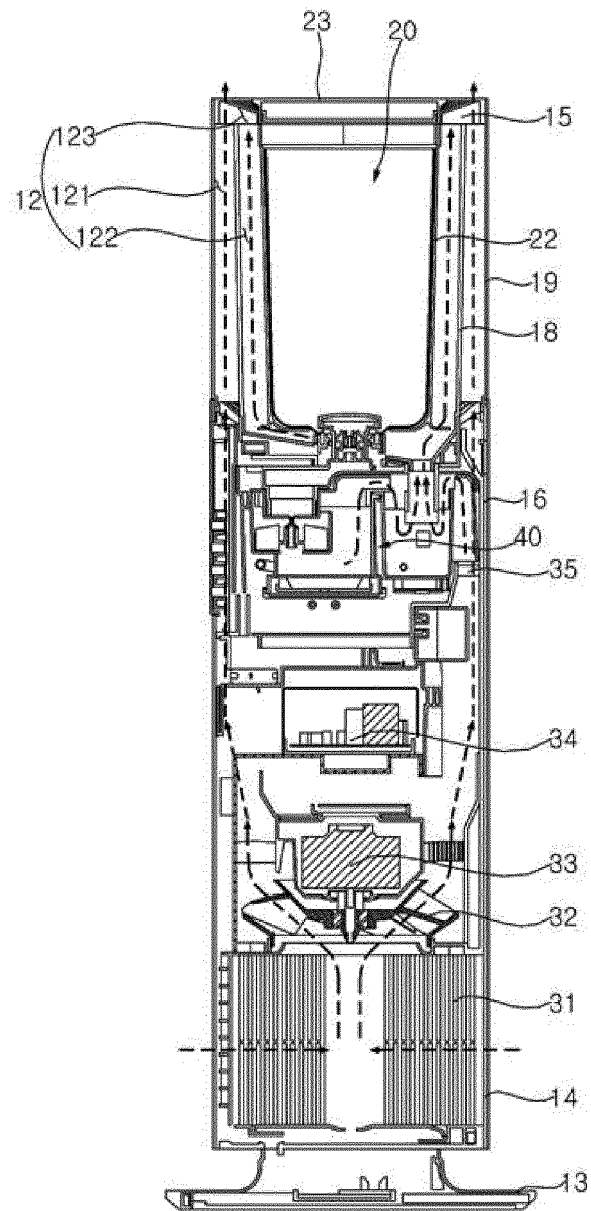


FIG. 4

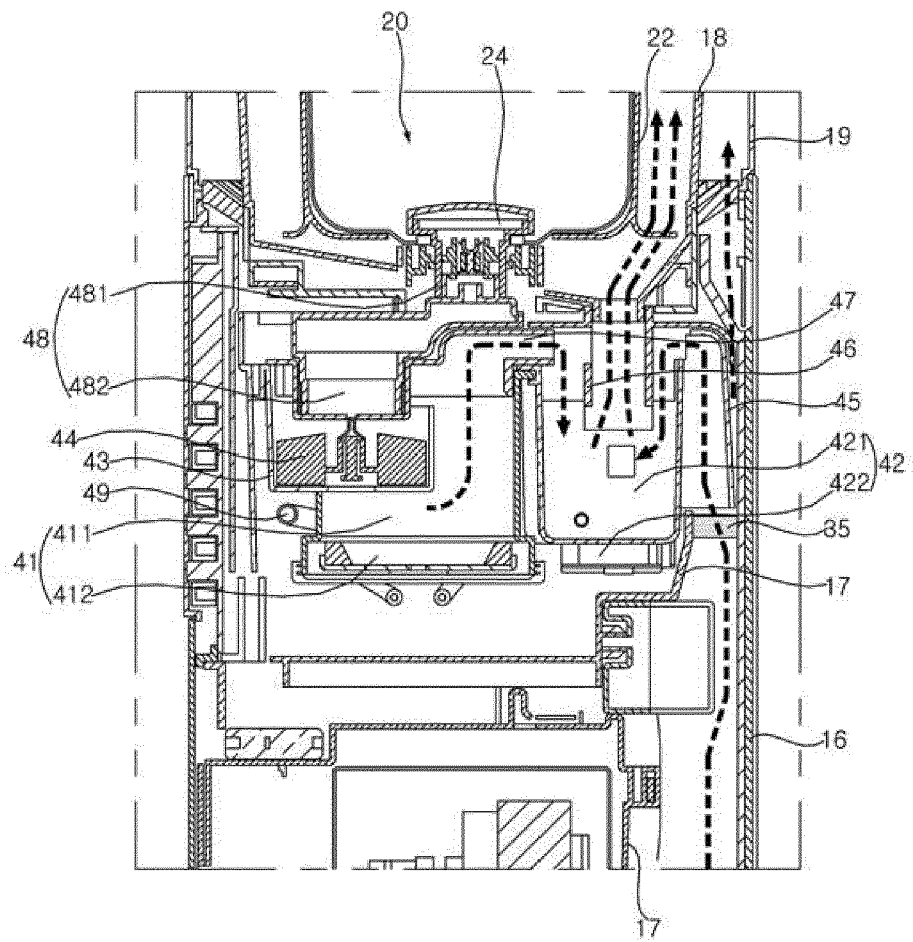


FIG. 5

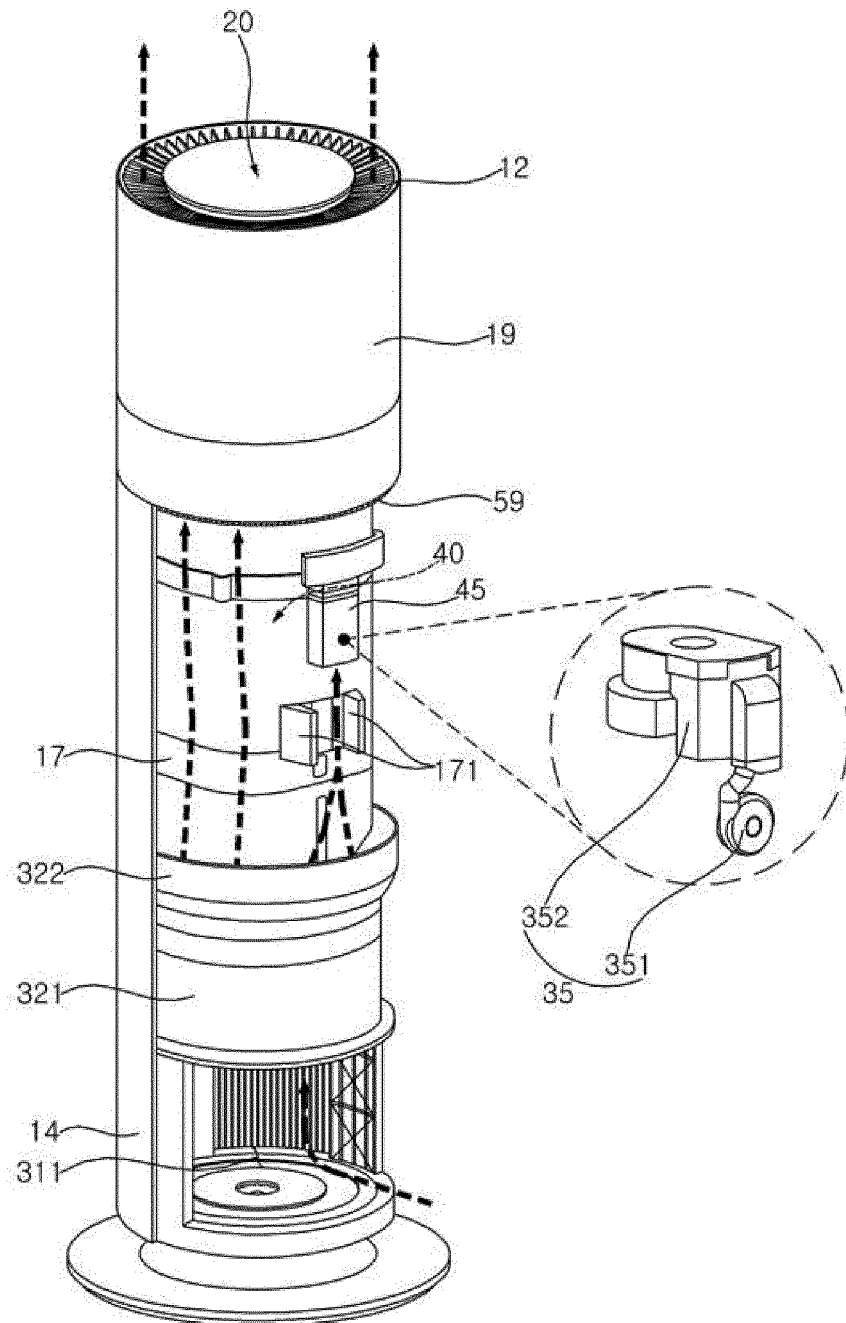


FIG. 6

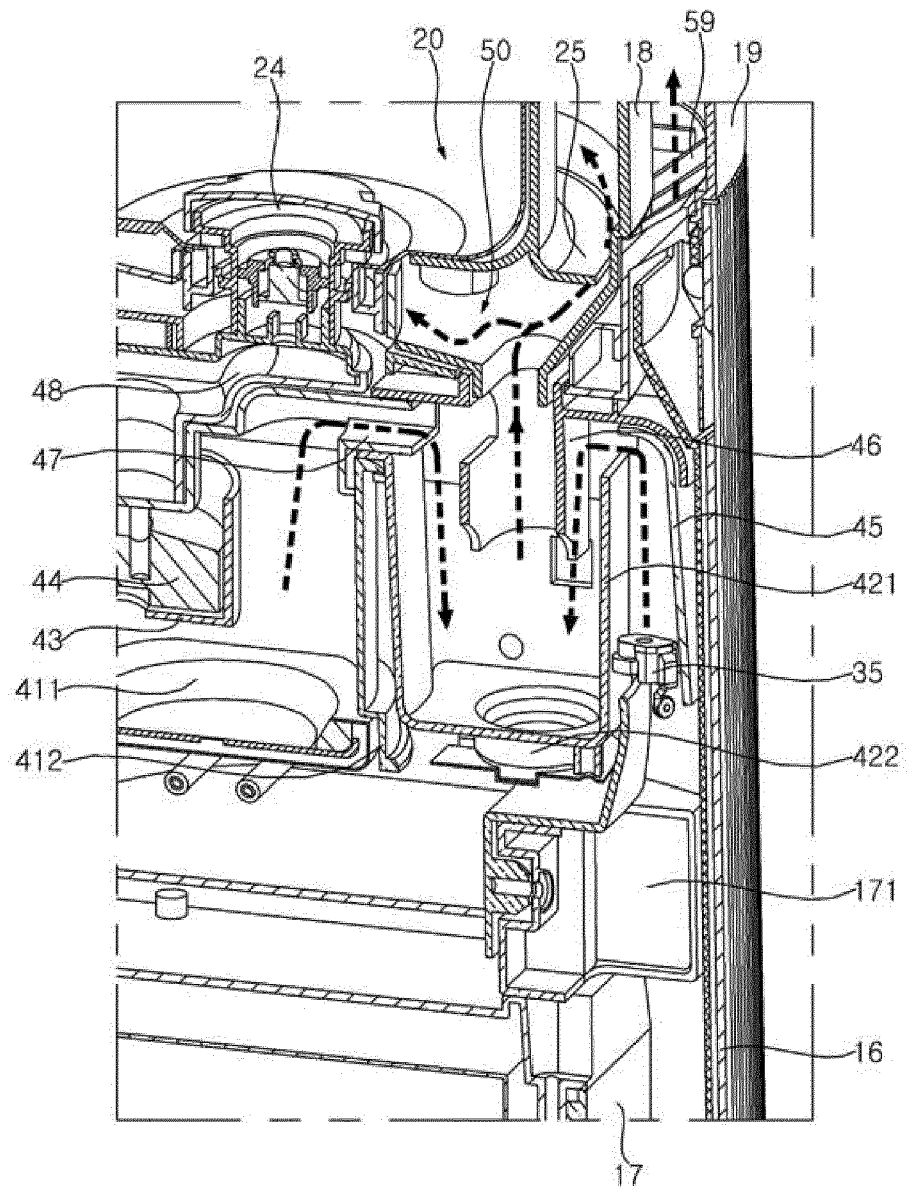


FIG. 7

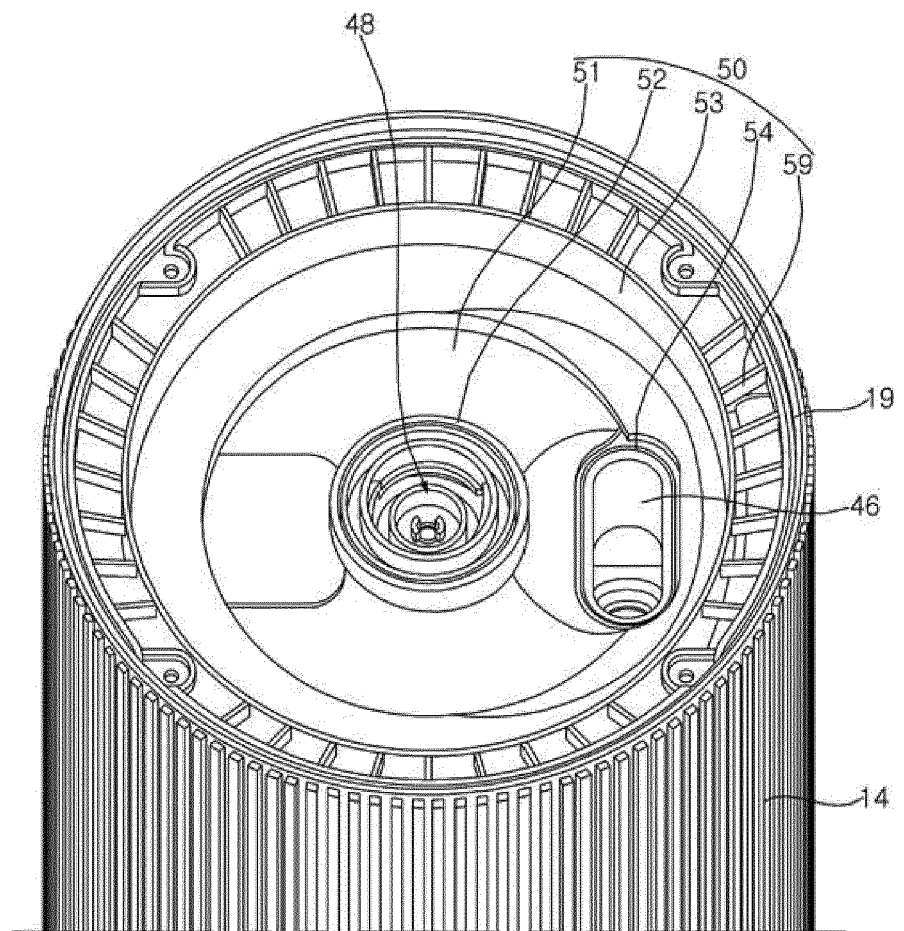


FIG. 8

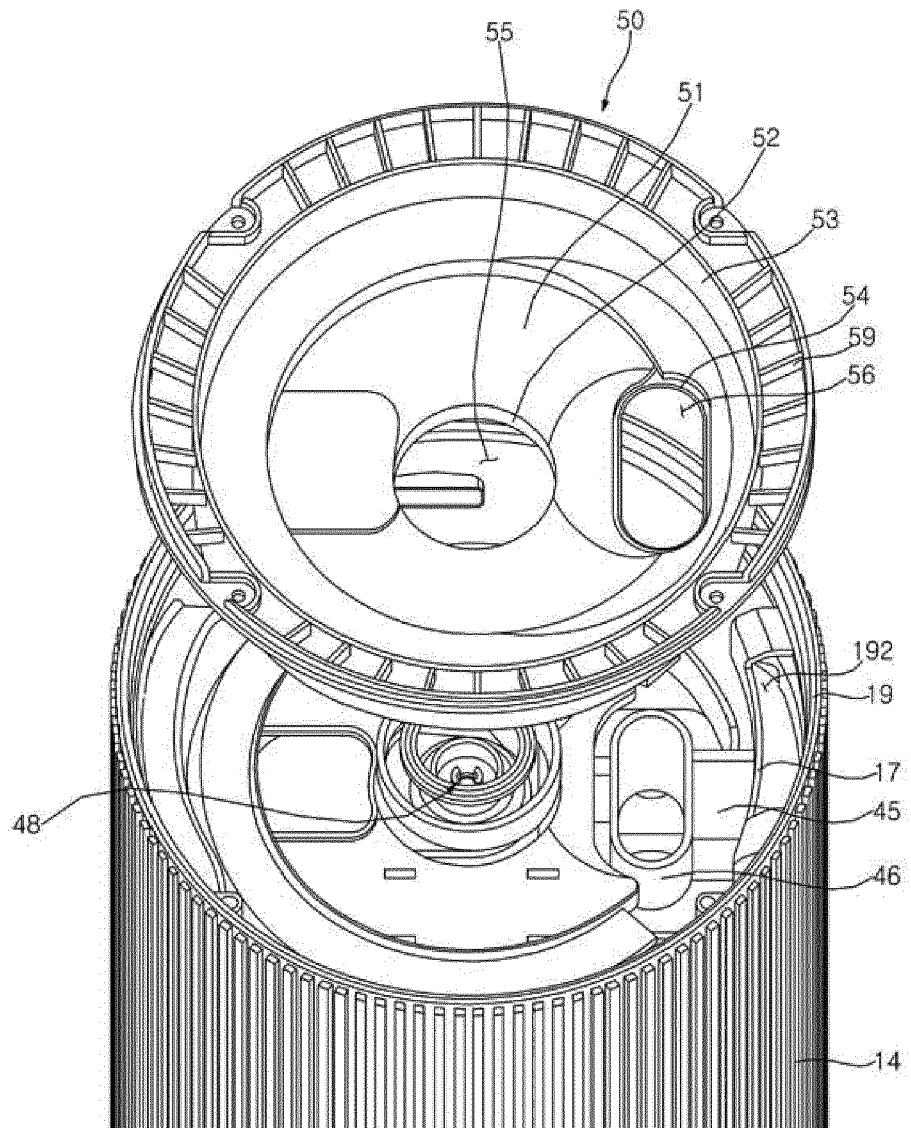


FIG. 9

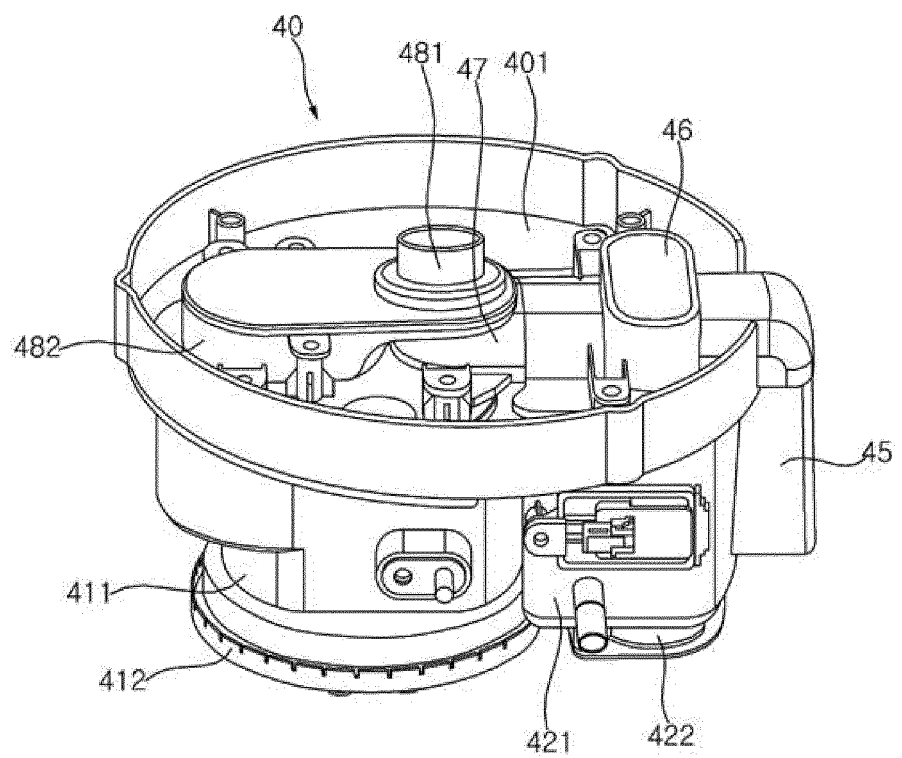


FIG. 10

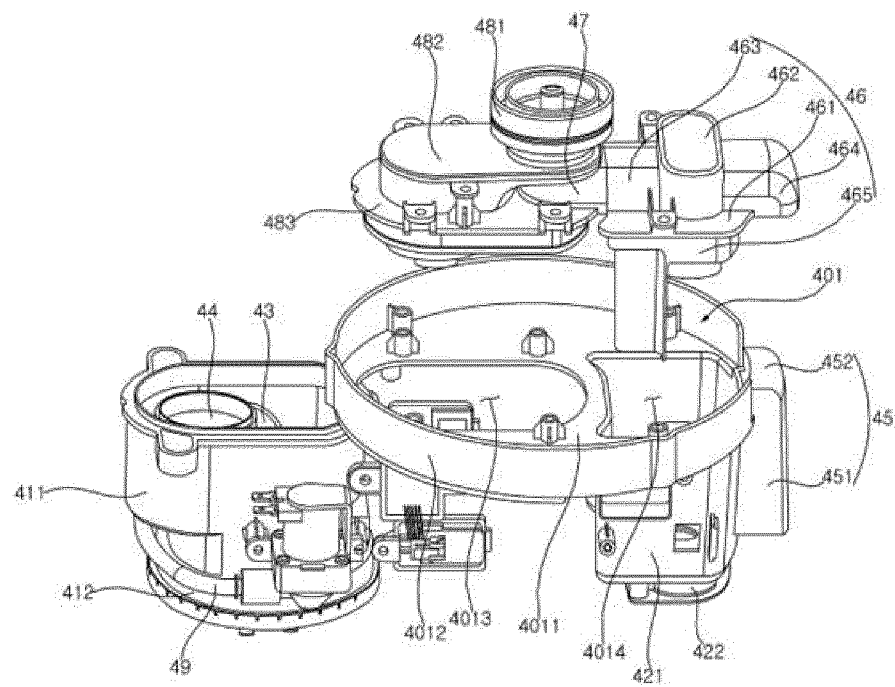


FIG. 11

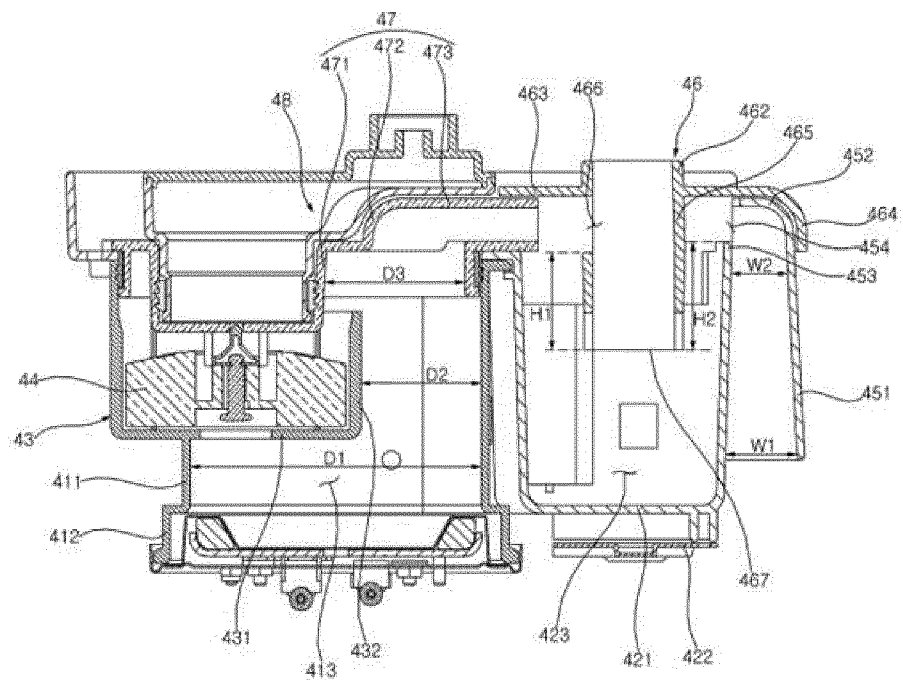
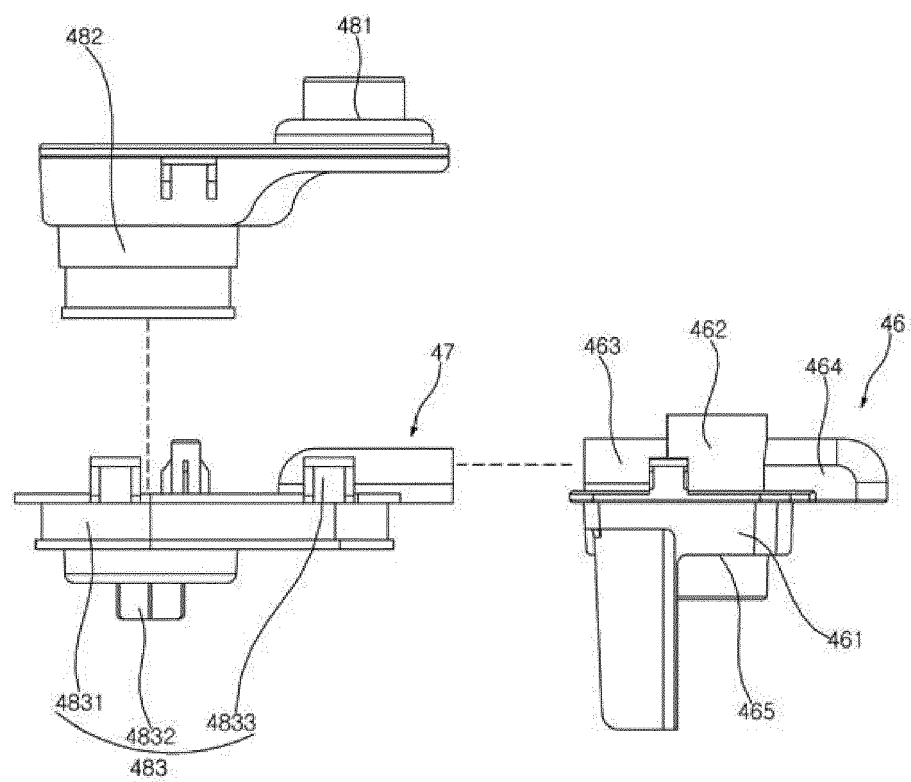


FIG. 12





EUROPEAN SEARCH REPORT

Application Number

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 April 2024	Examiner Mattias Grenbäck
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 21 7822

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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