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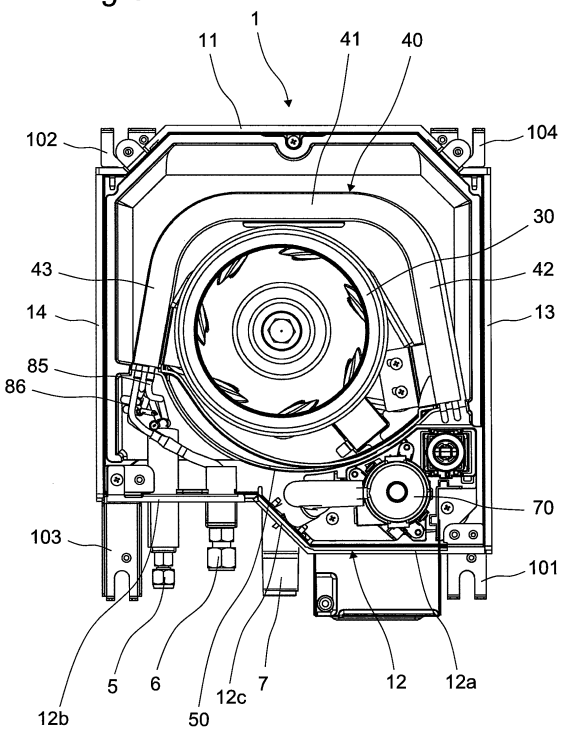
(54) INDOOR UNIT FOR AIR CONDITIONER

(57) An indoor unit for an air conditioner includes a heat exchanger (40) disposed between a centrifugal fan (30) and a first wall (11), a third wall (13), and a fourth wall (14) of a casing (1, 2, 3). The heat exchanger (40) includes a first extension part (42) located near the third wall (13) of the casing (1, 2, 3) and extending from the first wall (11) toward the second wall (12) in the casing (1, 2, 3), and a second extension part (43) located near the fourth wall (14) of the casing (1, 2, 3) and extending from the first wall (11) toward the second wall (12) in the casing (1, 2, 3). The first extension part (42) in the heat exchanger (40) extends beyond a distal end of the second extension part (43) in the heat exchanger (40) toward the second wall (12) of the casing (1, 2, 3).

Fig.5



EP 3 614 057 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an indoor unit for an air conditioner.

BACKGROUND ART

[0002] A conventional indoor unit for an air conditioner includes a heat exchanger disposed in a casing, the heat exchanger having a U shape in plan view (see, for example, JP 2015-81692 A (Patent Literature 1)).

[0003] More specifically, the heat exchanger includes a first heat exchange part and a second heat exchange part that extend in parallel to the first heat exchange part. The first and second heat exchange parts have distal ends each facing one of four walls of the casing. A distance between the wall and the distal end of the first heat exchange part is equal to a distance between the wall and the distal end of the second heat exchange part. In other words, the wall extends in a direction perpendicular to the direction in which the first and second heat exchange parts extend, such that the distance between the wall and each of the distal ends of the first and second heat exchange parts is fixed.

CITATION LIST

PATENT LITERATURE

[0004] Patent Literature 1: JP 2015-81692 A

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] In the conventional indoor unit for an air conditioner, since the distance between one of the walls of the casing and each of the distal ends of the first and second heat exchange parts is fixed, it is impossible to reduce a distance between the opposite walls, one of which faces the distal ends of the first and second heat exchange parts, of the casing, which hinders reduction in size of the casing.

[0006] Hence, the present invention provides an indoor unit for an air conditioner, the indoor unit being capable of achieving reduction in size of a casing.

SOLUTIONS TO PROBLEM

[0007] An aspect of the present invention provides an indoor unit for an air conditioner,
the indoor unit including:

a casing including
a first wall,
a second wall opposite to the first wall,
a third wall provided the first wall and the second wall, and
a fourth wall provided the first wall and the second wall and opposite to the third wall;

a centrifugal fan disposed in the casing; and
a heat exchanger disposed between the centrifugal fan and the first wall, third wall, and fourth wall of the casing, wherein
the heat exchanger includes

a first extension part located near the third wall of the casing and extending from the first wall toward the second wall in the casing, and
a second extension part located near the fourth wall of the casing and extending from the first wall toward the second wall in the casing, and
the first extension part in the heat exchanger extends beyond a distal end, or tip, of the second extension part in the heat exchanger toward the second wall of the casing.

[0008] According to the configuration described above, the first extension part in the heat exchanger extends beyond a distal end of the second extension part in the heat exchanger toward the second wall of the casing. Therefore, the distal end of the second extension part in the heat exchanger is closer to the first wall of the casing than the distal end of the first extension part in the heat exchanger is. Accordingly, for example, a portion of the second wall in the casing, the portion being located near the second extension part, is allowed to be recessed toward the first wall of the casing. In addition, for example, a portion of the fourth wall in the casing, the portion being located near the distal end of the second extension part, is recessed toward the third wall of the casing. This configuration thus enables reduction in size of the casing.

[0009] The indoor unit for an air conditioner according to an embodiment further includes:
a refrigerant pipe connection part connected to a refrigerant pipe and disposed on a portion of the second wall in the casing, the portion being located near the second extension part.

[0010] According to the embodiment described above, the portion of the second wall in the casing, the portion being located near the second extension part, is allowed to be recessed toward the first wall of the casing. Therefore, the refrigerant pipe connection part does not largely protrude outward (i.e., oppositely to the first wall) from the remaining portion of the second wall in the casing in such a manner that the refrigerant pipe connection part connected to the refrigerant pipe is disposed on the portion of the second wall in the casing, the portion being located near the second extension part.

[0011] The indoor unit for an air conditioner according to an embodiment further includes:
a refrigerant pipe connection part connected to a refrigerant pipe and disposed on a portion of the fourth wall in

the casing, the portion being located near the distal end of the second extension part.

[0012] According to the embodiment described above, the portion of the fourth wall in the casing, the portion being located near the distal end of the second extension part, is allowed to be recessed toward the third wall of the casing. Therefore, the refrigerant pipe connection part does not largely protrude outward (i.e., oppositely to the third wall) from the remaining portion of the fourth wall in the casing in such a manner that the refrigerant pipe connection part connected to the refrigerant pipe is disposed on the portion of the fourth wall in the casing, the portion being located near the distal end of the second extension part.

[0013] The indoor unit for an air conditioner according to an embodiment further includes:

a drain pump disposed between a portion of the second wall in the casing, the portion being located near the first extension part, and the distal end of the first extension part in the heat exchanger.

[0014] According to the embodiment described above, the drain pump is disposed between the portion of the second wall in the casing, the portion being located near the first extension part, and the distal end of the first extension part in the heat exchanger, which is allowed to eliminate a necessity to dispose the drain pump outside the casing. This configuration therefore reduces increase in required space around the casing.

[0015] The indoor unit for an air conditioner according to an embodiment further includes:

a partition with which the centrifugal fan is surrounded in conjunction with the heat exchanger,
the partition being connected to the distal end of the first extension part in the heat exchanger and the distal end of the second extension part in the heat exchanger.

[0016] According to the embodiment described above, the partition is connected to the distal end of the first extension part in the heat exchanger and the distal end of the second extension part in the heat exchanger to cause air from the centrifugal fan to flow toward the first and second extension parts, which is allowed to improve efficiency of heat exchange between the air from the centrifugal fan and the first and second extension parts.

ADVANTAGEOUS EFFECT OF INVENTION

[0017] The present invention provides an indoor unit for an air conditioner, the indoor unit being capable of achieving reduction in size of a casing.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

FIG. 1 is a perspective view of an indoor unit for an air conditioner according to a first embodiment of the present invention.
FIG. 2 is another perspective view of the indoor unit.
FIG. 3 is a bottom view of the indoor unit.
FIG. 4 is a sectional view taken along line IV-IV in FIG. 3.
FIG. 5 is a bottom view of the indoor unit from which a panel, a drain pan, and the like are detached.
FIG. 6 is a schematic bottom view of an indoor unit for an air conditioner according to a second embodiment of the present invention in a state in which a panel, a drain pan, and the like are detached from the indoor unit.

DESCRIPTION OF EMBODIMENTS

[0019] A specific description will be given of an indoor unit for an air conditioner according to the present invention, based on embodiments illustrated in the drawings.

[First Embodiment]

[0020] FIG. 1 is a perspective view of an indoor unit for an air conditioner according to a first embodiment of the present invention, the indoor unit being seen obliquely from below. FIG. 2 is a perspective view of the indoor unit seen obliquely from above.

[0021] As illustrated in FIGS. 1 and 2, the indoor unit according to the first embodiment is designed to be embedded in a ceiling, and includes a casing main body 1, a panel 2 having a quadrilateral shape, the panel 2 being mounted to a lower side of the casing main body 1, and a grille 3 detachably mounted to the panel 2. The casing main body 1, the panel 2, and the grille 3 constitute an example of a casing.

[0022] The indoor unit also includes a pipe connection part 5, a pipe connection part 6, and a drain socket 7 each protruding from a sidewall of the casing main body 1. In the casing main body 1, each of the pipe connection parts 5 and 6 is connected to an external refrigerant pipe (not illustrated). Also in the casing main body 1, the drain socket 7 is connected to an external drain hose (not illustrated).

[0023] The indoor unit also includes an electrical component 8 disposed on the sidewall of the casing main body 1 and juxtaposed with the pipe connection parts 5 and 6 and the drain socket 7.

[0024] The panel 2 has a blow-out port 10. The blow-out port 10 is located on one of longitudinally opposite sides of the grille 3 so as to extend along a shorter side of an outer edge of the panel 2. The panel 2 also has a flap 20 pivotably mounted thereto and configured to open and close the blow-out port 10. In FIG. 1, the flap 20 closes the blow-out port 10.

[0025] The indoor unit according to the first embodiment also includes hanger fittings 101, 102, 103, and 104 (the hanger fitting 104 is illustrated in FIG. 5). The hanger fittings 101, 102, 103, and 104 are secured to hanger

bolts (not illustrated) suspended from, for example, a framework in a roof-space. The indoor unit is thus suspended from a ceiling.

[0026] FIG. 3 is a bottom view of the indoor unit. In FIG. 3, the same constituent elements as those illustrated in FIGS. 1 and 2 are denoted with the same reference signs as those for the constituent elements illustrated in FIGS. 1 and 2.

[0027] The blow-out port 10 is an opening having a U shape as seen from below. More specifically, the blow-out port 10 has a shape that extends along one shorter side of the outer edge of the panel 2 and also extends along two longer sides of the outer edge of the panel 2. The flap 20 has a U shape as seen from below with the blow-out port 10 closed by the flap 20.

[0028] The casing main body 1 (see FIGS. 1 and 2) has in its center a suction port 1a. A filter 4 (see FIG. 4) is disposed between the suction port 1a and the grille 3.

[0029] FIG. 4 is a sectional view taken along line IV-IV in FIG. 3. In FIG. 4, the same constituent elements as those illustrated in FIGS. 1 to 3 are denoted with the same reference signs as those for the constituent elements illustrated in FIGS. 1 to 3.

[0030] The casing main body 1 houses therein a turbo fan 30. The turbo fan 30 is driven by a motor 31 to rotate in a predetermined rotation direction. The predetermined rotation direction corresponds to a counterclockwise direction when the turbo fan 30 is seen from below. The turbo fan 30 is an example of a centrifugal fan.

[0031] The casing main body 1 also houses therein a bell mouth 32 at a position between the suction port 1a and the turbo fan 30. The turbo fan 30 sucks in indoor air via a space inside the bell mouth 32.

[0032] The casing main body 1 also houses therein a heat exchanger 40 and a partition plate 50 at a position around the turbo fan 30. Air from the turbo fan 30 flows toward the blow-out port 10 via the heat exchanger 40. At this time, the partition plate 50 guides to the heat exchanger 40 the air from the turbo fan 30. The partition plate 50 is an example of a partition. The partition may constitute a part of the casing main body 1.

[0033] The casing main body 1 also houses therein a drain pan 60 at a position below the heat exchanger 40 and partition plate 50. The drain pan 60 thus receives dew condensation water caused by condensation at each of the heat exchanger 40 and the partition plate 50.

[0034] The casing main body 1 has an air flow path P for guiding air from the turbo fan 30 to the blow-out port 10 in the panel 2.

[0035] FIG. 5 is a bottom view of the indoor unit from which the panel 2, the drain pan 60, and the like are detached.

[0036] The casing main body 1 includes a first wall 11 located near the blow-out port 10, a second wall 12 opposite to the first wall 11, a third wall 13 connecting the first wall 11 and the second wall 12, and a fourth wall 14 connecting the first wall 11 and the second wall 12 and opposite to the third wall 13. Each of the third wall 13 and the fourth wall 14 has an end near the blow-out port 10, the end leading to the first wall 11. Each of the third wall 13 and the fourth wall 14 has an end opposite to the blow-out port 10, the end leading to the second wall 12.

[0037] The second wall 12 includes a third wall 13-side portion 12a and a fourth wall 14-side portion 12b. The fourth wall 14-side portion 12b is closer to the first wall 11 than the third wall 13-side portion 12a is. In the second wall 12, the fourth wall 14-side portion 12b where the pipe connection parts 5 and 6 are disposed is recessed toward the first wall 11. An intermediate portion 12 is located between the third wall 13-side portion 12a and the fourth wall 14-side portion 12b, and is tilted relative to each of the third wall 13-side portion 12a and the fourth wall 14-side portion 12b. The third wall 13-side portion 12a of the second wall 12 is an example of a portion of a second wall in a casing, the portion being located near a first extension part. The fourth wall 14-side portion 12b of the second wall 12 is an example of a portion of a second wall in a casing, the portion being located near a second extension part.

[0038] The heat exchanger 40 is disposed between the turbo fan 30 and the first wall 11, third wall 13, and fourth wall 14 of the casing main body 1.

[0039] More specifically, the heat exchanger 40 includes a first heat exchange part 41, a second heat exchange part 42, and a third heat exchange part 43. The first heat exchange part 41, the second heat exchange part 42, and the third heat exchange part 43 are formed integrally. The second heat exchange part 42 is an example of a first extension part. The third heat exchange part 43 is an example of a second extension part. The first heat exchange part 41, the second heat exchange part 42, and the third heat exchange part 43 may be formed separately. For example, the first heat exchange part 41, the second heat exchange part 42, and the third heat exchange part 43 may be spaced apart from one another.

[0040] The first heat exchange part 41 is disposed opposite the first wall 11 of the casing main body 1, and extends along the first wall 11.

[0041] The second heat exchange part 42 is disposed opposite the third wall 13 of the casing main body 1, and extends from the first wall 11 toward the second wall 12. The second heat exchange part 42 is located upstream of the first heat exchange part 41 in the rotation direction of the turbo fan 30. The drain pump 70 is disposed between a distal end, or tip, of the second heat exchange part 42 and the third wall 13-side portion of the second wall 12.

[0042] The drain pump 70 sucks in dew condensation water and the like retained in the drain pan 60, and discharges the sucked dew condensation water and the like toward the drain socket 7. In other words, the drain pump 70 is a pump for discharging, from the casing main body 1, dew condensation water and the like in the casing main body 1.

[0043] The third heat exchange part 43 is disposed op-

posite the fourth wall 14 of the casing main body 1, and extends from the first wall 11 toward the second wall 12. The third heat exchange part 43 is located downstream of the first heat exchange part 41 in the rotation direction of the turbo fan 30. The distal end of the second heat exchange part 42 is closer to the second wall 12 than a distal end, or tip, of the third heat exchange part 43 is. In other words, the distal end of the second heat exchange part 42 is located at a place that is relatively far from the blow-out port 10, and the distal end of the third heat exchange part 43 is located at a place that is relatively close to the blow-out port 10.

[0044] The distal end of the third heat exchange part 43 is connected to the pipe connection part 5 with a refrigerant pipe 85. The distal end of the third heat exchange part 43 is connected to the pipe connection part 6 with a refrigerant pipe 86.

[0045] The pipe connection parts 5 and 6 respectively connect the refrigerant pipes 85 and 86 inside the casing main body 1 to refrigerant pipes outside the casing main body 1. The pipe connection parts 5 and 6 allow a refrigerant to flow into the heat exchanger 40.

[0046] A distance between the second heat exchange part 42 and the third heat exchange part 43 gradually increases from the blow-out port 10 in a direction away from the blow-out port 10. Specifically, the heat exchanger 40 has a U shape in plan view. The distance between the second heat exchange part 42 and the third heat exchange part 43 may be fixed or may be substantially fixed. The heat exchanger 40 may have, for example, a V shape or a circular shape in plan view.

[0047] The partition plate 50 and the heat exchanger 40 surround the turbo fan 30. The partition plate 50 is connected to the distal end of the second heat exchange part 42 in the heat exchanger 40 and the distal end of the third heat exchange part 43 in the heat exchanger 40.

[0048] According to the indoor unit having the configuration described above, the second heat exchange part 42 in the heat exchanger 40 extends beyond the distal end of the third heat exchange part 43 in the heat exchanger 40 toward the second wall 12 of the casing main body 1 . Therefore, the distal end of the third heat exchange part 43 in the heat exchanger 40 is closer to the first wall 11 of the casing main body 1 than the distal end of the second heat exchange part 42 in the heat exchanger 40 is. With this configuration, the fourth wall 14-side portion 12b of the second wall 12 in the casing main body 1 is recessed toward the first wall 11 of the casing main body 1, so that the second wall 12 of the casing main body 1 is formed into a bent plate shape. This configuration thus enables reduction in size of the casing main body 1.

[0049] The fourth wall 14-side portion 12b of the second wall 12 in the casing main body 1 is recessed toward the first wall 11 of the casing main body 1, which suppresses upsizing of a product.

[0050] The refrigerant pipe connection parts 5 and 6 are disposed on the fourth wall 14-side portion 12b of the second wall 12 in the casing main body 1. Therefore, the refrigerant pipe connection parts 5 and 6 are substantially entirely accommodated in a space located outside the casing main body 1 and adjoining the fourth wall 14-side portion 12b.

[0051] In connecting the refrigerant pipes to the refrigerant pipe connection parts 5 and 6 from the outside of the casing main body 1, the space located outside the casing main body 1 and adjoining the fourth wall 14-side portion 12b serves as a work space for connection of the refrigerant pipes.

[0052] The drain pump 70 is disposed between the portion of the second wall 12 in the casing main body 1, the portion being located near the second heat exchange part 42, and the distal end of the second heat exchange part 42 in the heat exchanger 40, which eliminates a necessity to dispose the drain pump 70 outside the casing main body 1. This configuration therefore reduces increase in required space around the casing main body 1.

[0053] The partition plate 50 is connected to the distal end of the second heat exchange part 42 in the heat exchanger 40 and the distal end of the third heat exchange part 43 in the heat exchanger 40 to cause air from the turbo fan 30 to flow toward the first and third heat exchange parts 43, which improves efficiency of heat exchange between the air from the turbo fan 30 and the first and third heat exchange parts 43.

[Second Embodiment]

[0054] FIG. 6 is a schematic bottom view of an indoor unit for an air conditioner according to a second embodiment of the present invention. FIG. 6 illustrates the indoor unit from which a panel 2, a drain pan 60, and the like are detached. In FIG. 6, the same constituent elements as those illustrated in FIG. 5 are denoted with the same reference signs as those for the constituent elements illustrated in FIG. 5.

[0055] The indoor unit according to the second embodiment includes a casing main body 201 different in shape from the casing main body 1 according to the first embodiment. The casing main body 201 includes a first wall 11, a second wall 212 opposite to the first wall 11, a third wall 13 connecting the first wall 11 and the second wall 212, and a fourth wall 214 connecting the first wall 11 and the second wall 212 and opposite to the third wall 13. Each of the third wall 13 and the fourth wall 214 has an end near a blow-out port 10, the end leading to the first wall 11. Each of the third wall 13 and the fourth wall 214 has an end opposite to the blow-out port 10, the end leading to the second wall 212.

[0056] The fourth wall 214 includes a first wall 11-side portion 214a and a second wall 212-side portion 214b. The second wall 212-side portion 214b is closer to the third wall 13 than the first wall 11-side portion 214a is. In the fourth wall 214, the second wall 212-side portion 214b where pipe connection parts 5 and 6 are disposed is recessed toward the third wall 13. The second wall 212-

side portion 214b of the fourth wall 214 is an example of a portion of a fourth wall in a casing, the portion being located near a distal end, or tip, of a second extension part.

[0057] The indoor unit having the configuration described above produces functions and effects similar to those of the indoor unit according to the first embodiment.

[0058] The second wall 212-side portion 214b of the fourth wall 214 in the casing main body 201 is recessed toward the third wall 13 of the casing main body 201, which suppresses upsizing of a product.

[0059] The refrigerant pipe connection parts 5 and 6 are disposed on the second wall 212-side portion 214b of the fourth wall 214 in the casing main body 201. Therefore, the refrigerant pipe connection parts 5 and 6 are substantially entirely accommodated in a space located outside the casing main body 201 and adjoining the second wall 212-side portion 214b.

[0060] In connecting refrigerant pipes to the refrigerant pipe connection parts 5 and 6 from the outside of the casing main body 201, the space located outside the casing main body 201 and adjoining the second wall 212-side portion 214b serves as a work space for connection of the refrigerant pipes.

[0061] In the first and second embodiments, the casing of the indoor unit has a rectangular parallelepiped shape and is constituted of the casing main body 1, 201, the panel 2, and the grille 3; however, the shape of the casing is not limited thereto.

[0062] Also in the first and second embodiments, the indoor unit is designed to be embedded in a ceiling; however, the indoor unit is not limited thereto. Alternatively, the present invention is also applicable to an indoor unit designed to be suspended from a ceiling.

[0063] Also in the first and second embodiments, the indoor unit has the blow-out port 10 through which air is blown out in one direction via the heat exchanger 40. Alternatively, the indoor unit may have blow-out ports through which air is blown out in two directions or in three directions via the heat exchanger 40.

[0064] The foregoing description concerns specific embodiments of the present invention; however, the present invention is not limited to the first and second embodiments, and various modifications and variations may be made within the scope of the present invention. For example, an appropriate combination of the configurations described in the first and second embodiments may be regarded as an embodiment of the present invention.

REFERENCE SIGNS LIST

[0065]

1, 201	casing main body
1a	suction port
2	panel
3	grille
4	filter
5, 6	pipe connection part
7	drain socket
8	electrical component
10	blow-out port
11	first wall
12, 212	second wall
13	third wall
14, 214	fourth wall
20	flap
30	turbo fan
31	motor
32	bell mouth
40	heat exchanger
41	first heat exchange part
42	second heat exchange part
43	third heat exchange part
50	partition plate
60	drain pan
70	drain pump

Claims

1. An indoor unit for an air conditioner, comprising:

a casing (1, 2, 3, 201) including

a first wall (11),
a second wall (12, 212) opposite to the first wall (11),
a third wall (13) provided the first wall (11) and the second wall (12, 212), and
a fourth wall (14, 214) provided the first wall (11) and the second wall (12, 212) and opposite to the third wall (13);

a centrifugal fan (30) disposed in the casing (1, 2, 3, 201); and
a heat exchanger (40) disposed between the centrifugal fan (30) and the first wall (11), third wall (13), and fourth wall (14, 214) of the casing (1, 2, 3, 201),
wherein
the heat exchanger (40) includes

a first extension part (42) located near the third wall (13) of the casing (1, 2, 3, 201) and extending from the first wall (11) toward the second wall (12, 212) in the casing (1, 2, 3, 201), and
a second extension part (43) located near the fourth wall (14, 214) of the casing (1, 2, 3, 201) and extending from the first wall (11) toward the second wall (12, 212) in the casing (1, 2, 3, 201), and
the first extension part (42) in the heat exchanger (40) extends beyond a distal end

of the second extension part (43) in the heat exchanger (40) toward the second wall (12, 212) of the casing (1, 2, 3, 201).

2. The indoor unit for an air conditioner according to claim 1, further comprising:
a refrigerant pipe connection part (5, 6) connected to a refrigerant pipe (85, 86) and disposed on a portion (12b) of the second wall (12) in the casing (1, 2, 3), the portion (12b) being located near the second extension part (43).

3. The indoor unit for an air conditioner according to claim 1, further comprising:
a refrigerant pipe connection part (5, 6) connected to a refrigerant pipe (85, 86) and disposed on a portion (214b) of the fourth wall (214) in the casing (2, 3, 201), the portion (214b) being located near the distal end of the second extension part (43).

4. The indoor unit for an air conditioner according to any one of claims 1 to 3, further comprising:
a drain pump (70) disposed between a portion of the second wall (12, 212) in the casing (1, 2, 3, 201), the portion being located near the first extension part (42), and the distal end of the first extension part (42) in the heat exchanger (40).

5. The indoor unit for an air conditioner according to any one of claims 1 to 4, further comprising:

a partition (50) with which the centrifugal fan (30) is surrounded in conjunction with the heat exchanger (40),
the partition (50) being connected to the distal end of the first extension part (42) in the heat exchanger (40) and the distal end of the second extension part (43) in the heat exchanger (40).

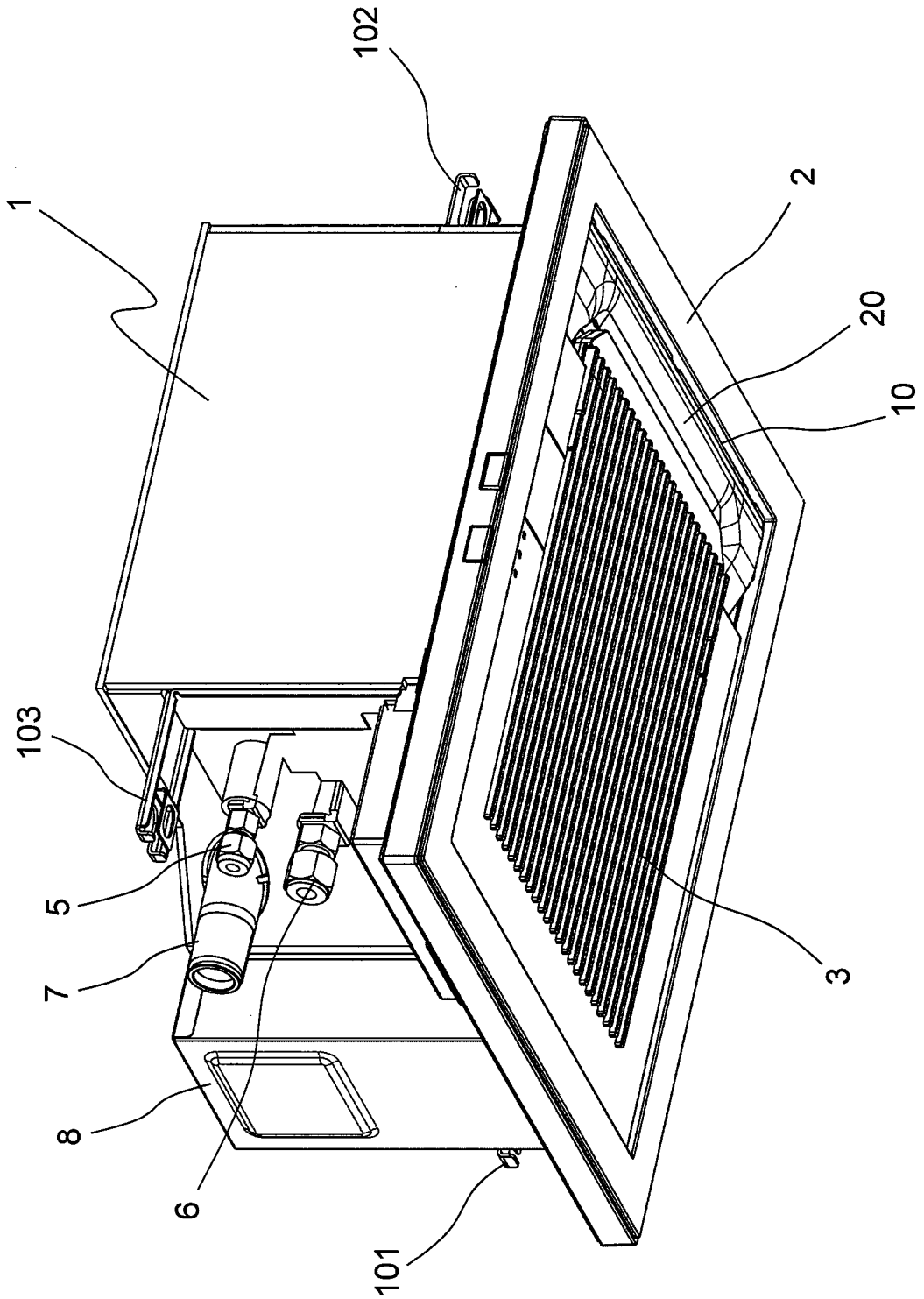


Fig.1

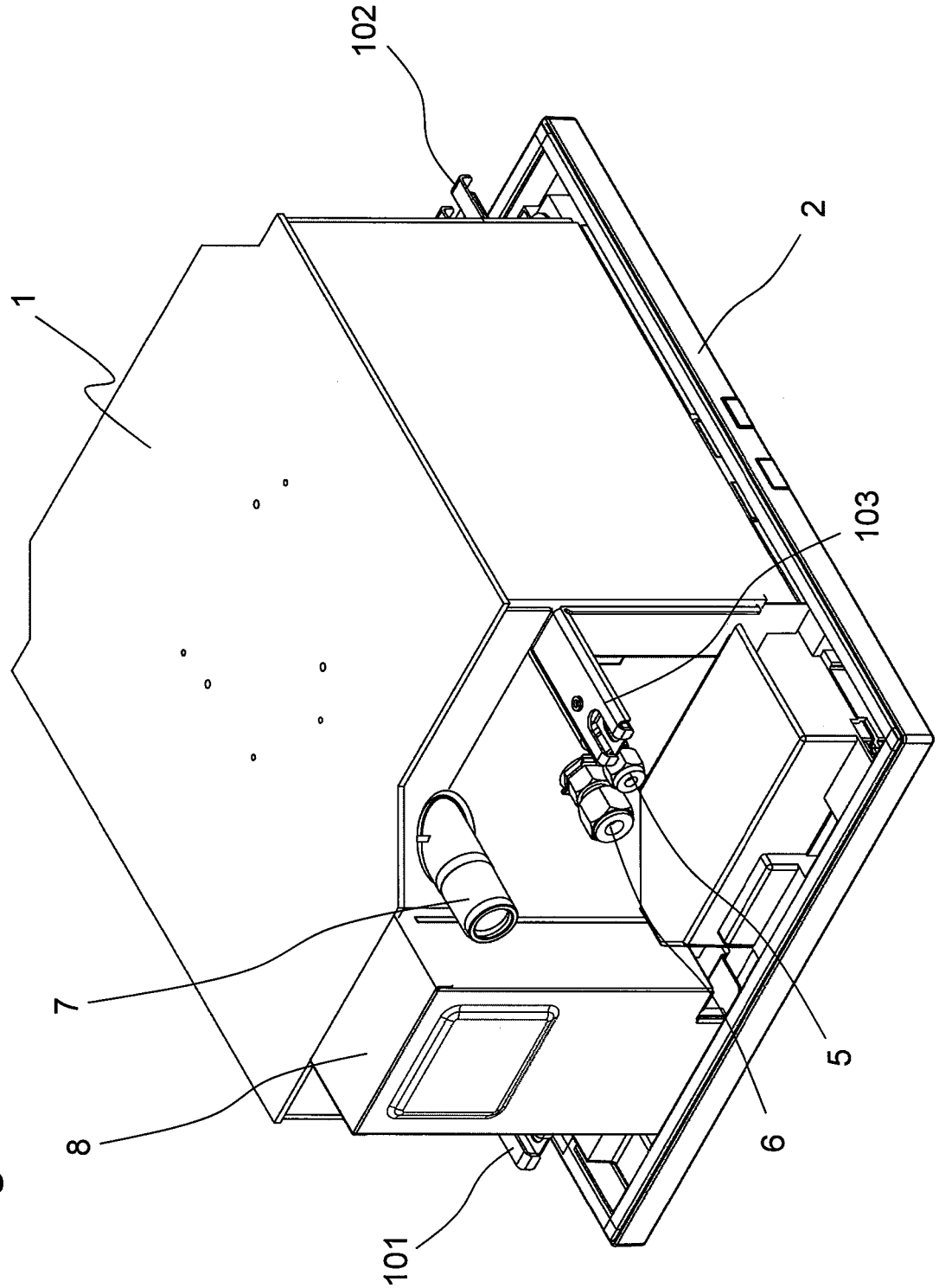
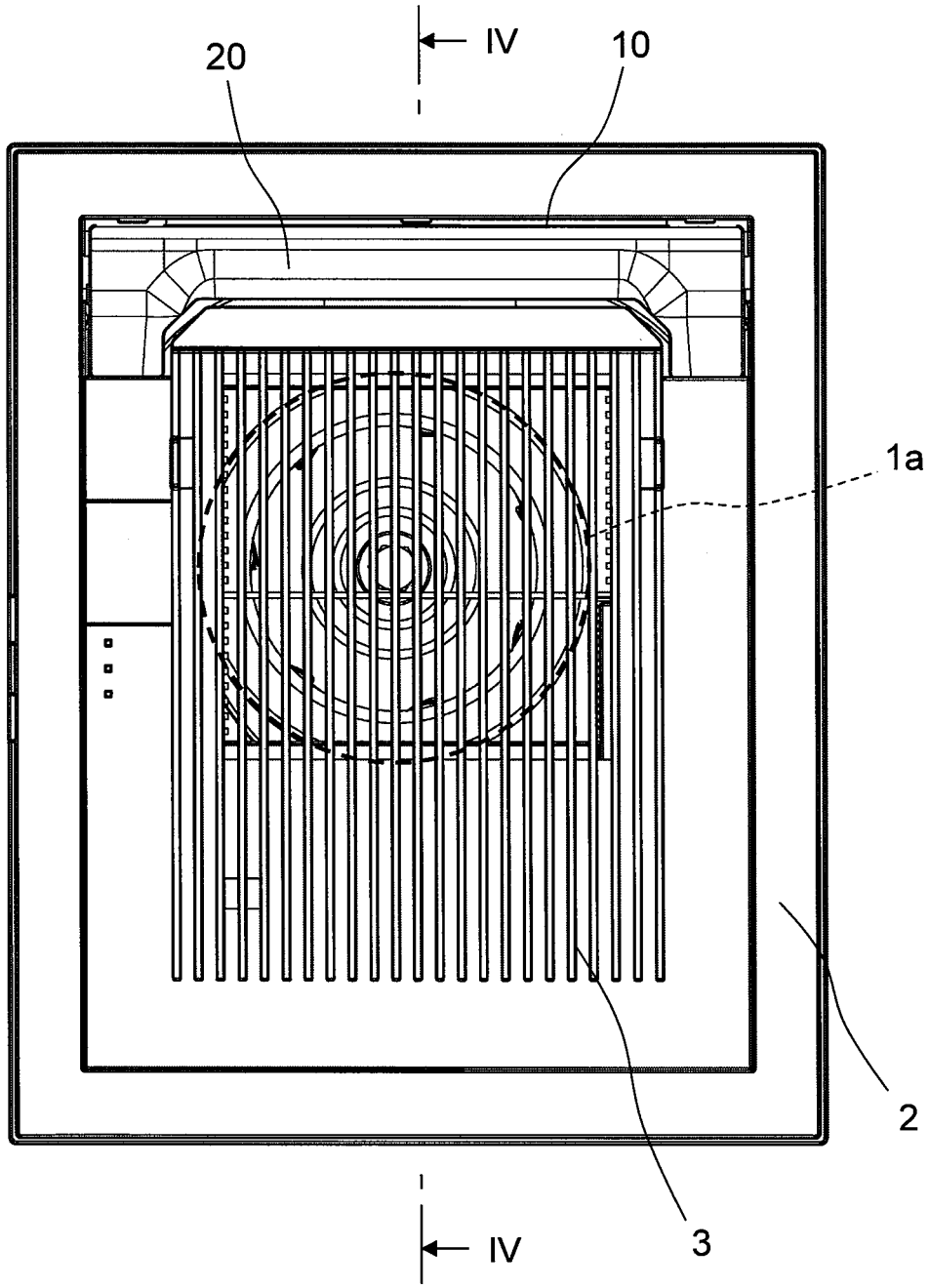


Fig.2

Fig.3



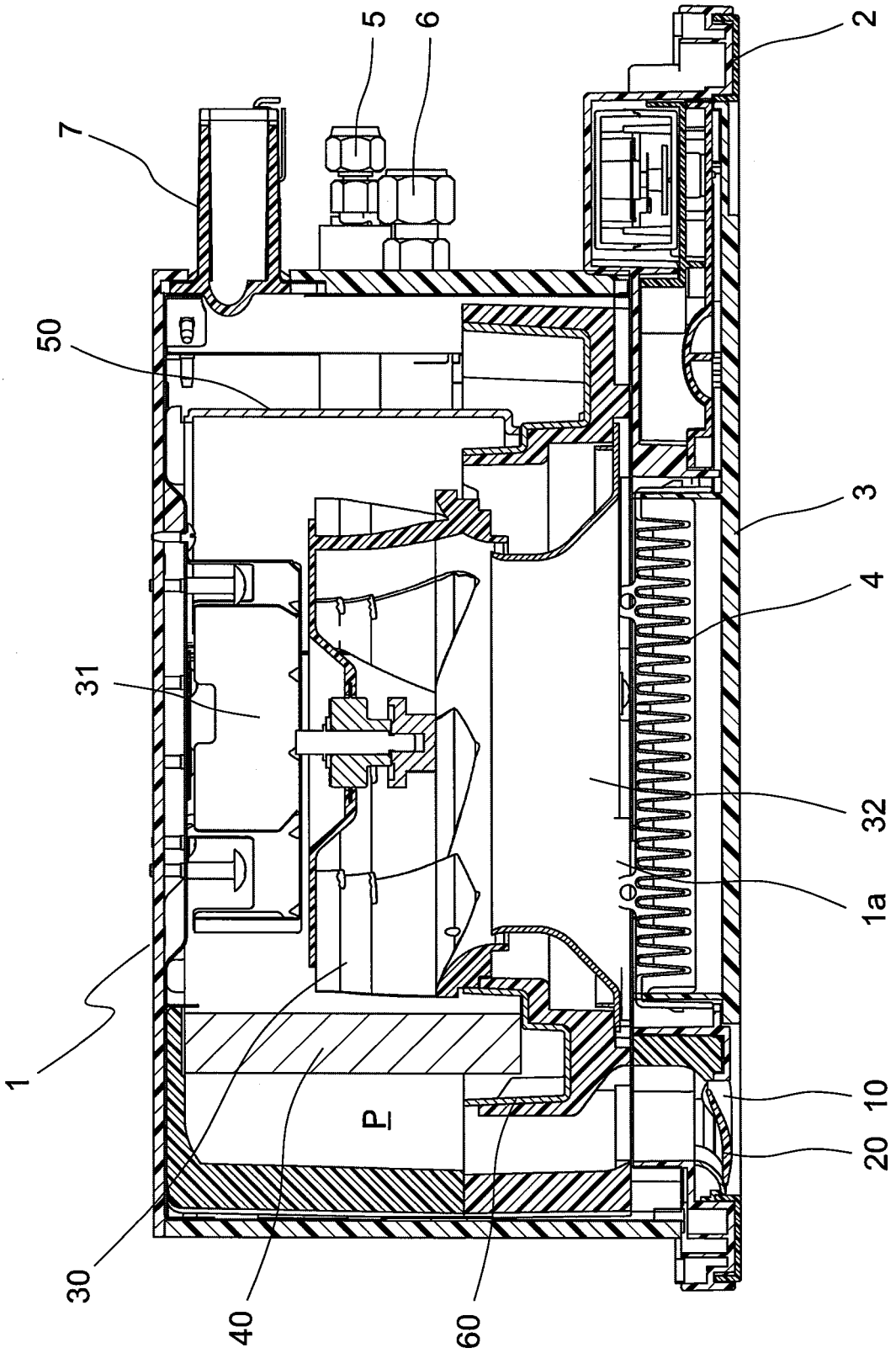
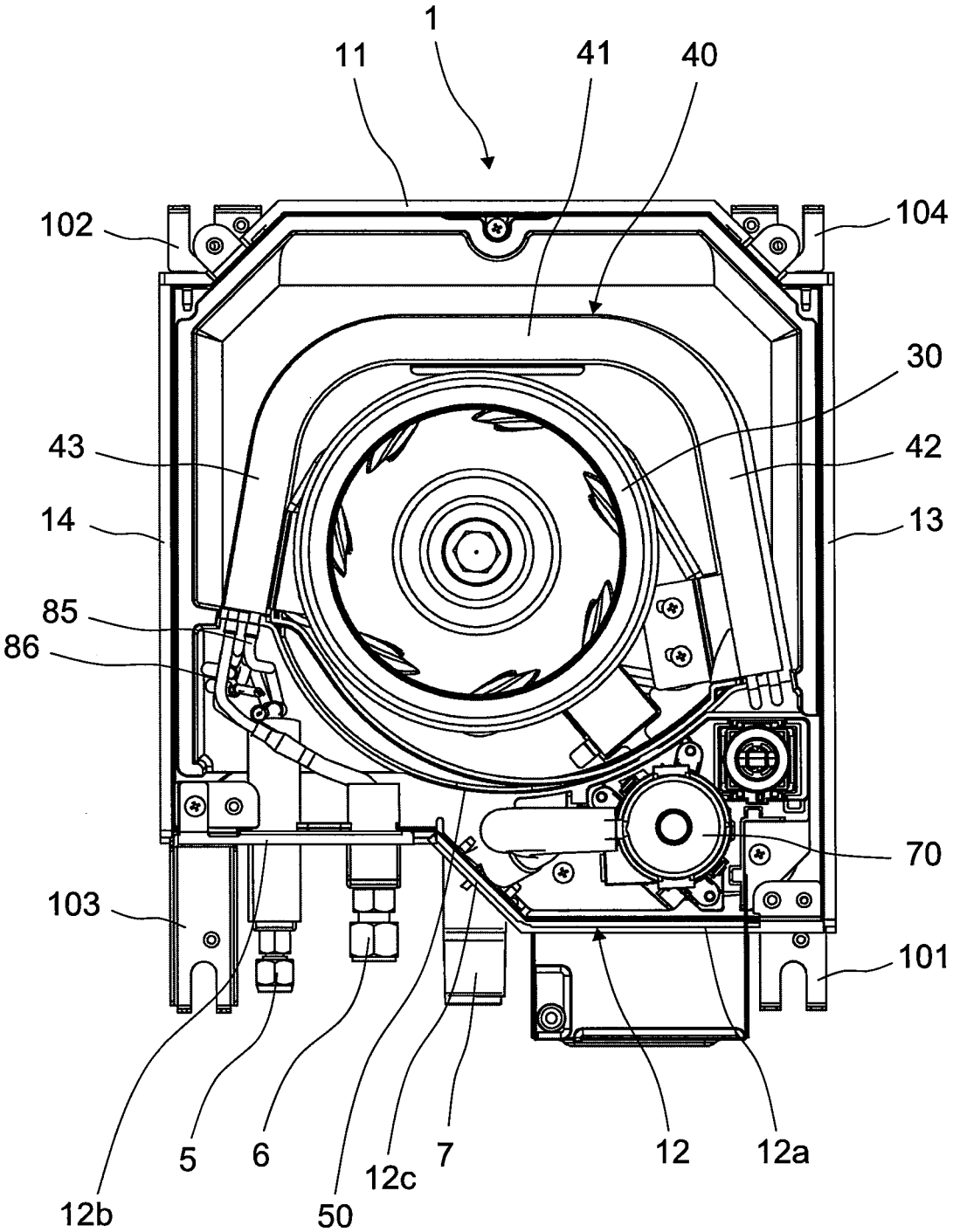


Fig.4

Fig.5


1
11
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101
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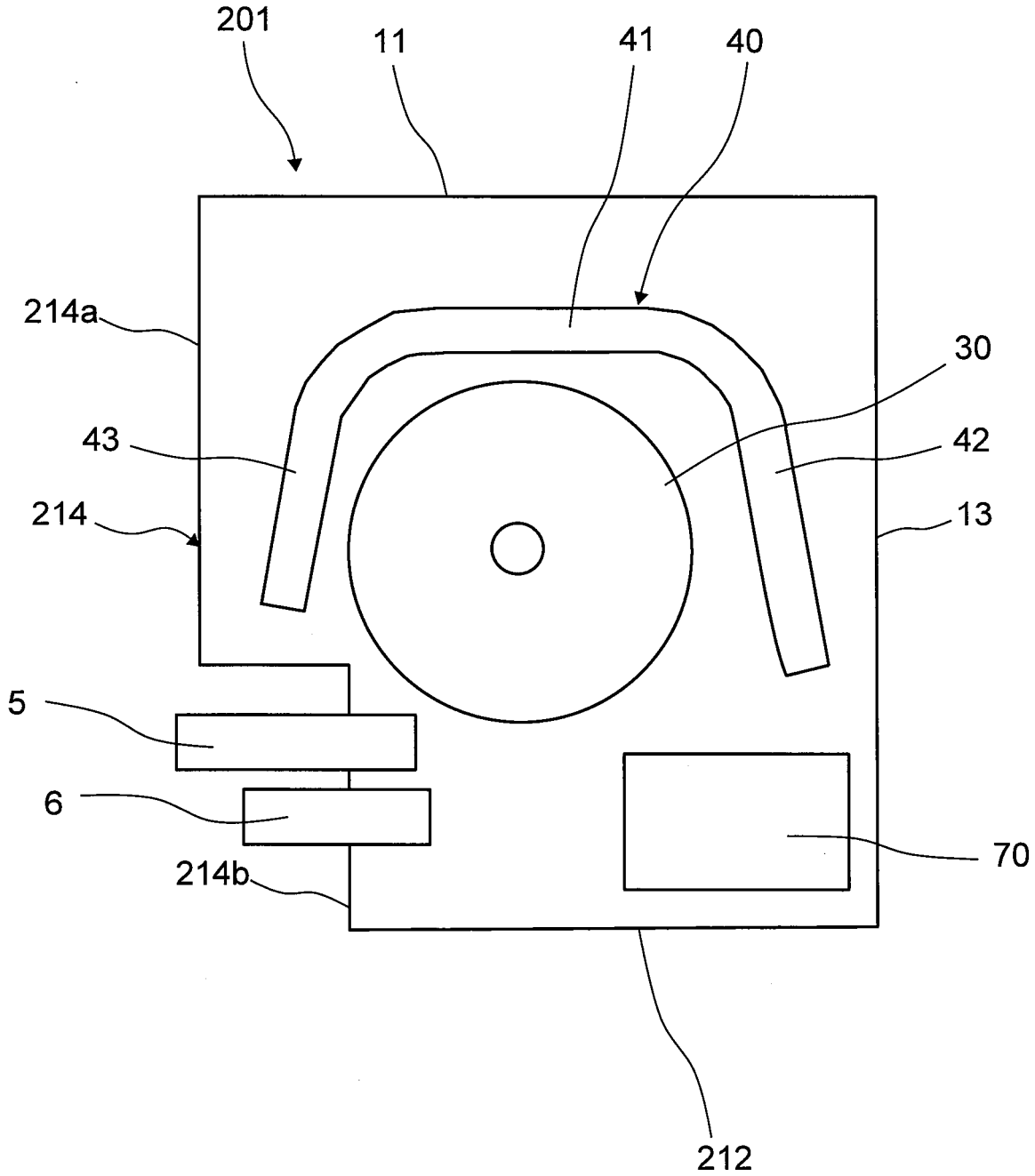
7
12
12a
12b
50

Fig.6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/015547

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F24F1/00(2011.01)i, F24F13/20(2006.01)i, F24F13/22(2006.01)i, F24F13/30(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F24F1/00, F24F13/20, F24F13/22, F24F13/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2000-046360 A (HITACHI, LTD.) 18 February 2000, paragraphs [0041]-[0049], fig. 3-5, 8-11 & US 2002/0023455 A1, paragraphs [0057]-[0065], fig. 3-5, 8-11 & EP 985889 A2 & ES 2224557 T & CN 1244647 A	1 2-5
Y	JP 11-223380 A (DAIKIN INDUSTRIES, LTD.) 17 August 1999, paragraphs [0039]-[0042], fig. 1, 2 (Family: none)	2, 4-5

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

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Date of the actual completion of the international search 20.06.2018	Date of mailing of the international search report 03.07.2018
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/015547

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-315670 A (DAIKIN INDUSTRIES, LTD.) 06 December 2007, paragraphs [0029]-[0034], fig. 1-3 (Family: none)	3-5
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 027003/1987 (Laid-open No. 134315/1988) (DAIKIN INDUSTRIES, LTD.) 02 September 1988, specification, page 7, line 5 to page 8, line 11, fig. 1, 2 (Family: none)	4-5
A	US 2017/0045240 A1 (LG ELECTRONICS INC.) 16 February 2017, paragraphs [0024]-[0093], fig. 1-8 & EP 3130866 A1 & KR 10-2017-0020146 A & CN 106468460 A	1-5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2015081692 A **[0002] [0004]**