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(71) Applicant: **Fujikoki Corporation**
Tokyo 158-0082 (JP)

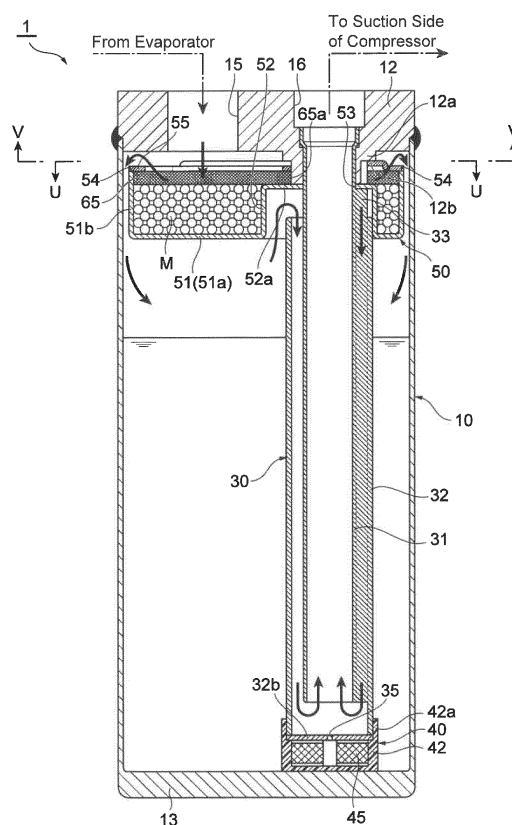
(72) Inventors:
• **HOSOKAWA, Kouji**
Tokyo 158-0082 (JP)
• **OZAWA, Takeharu**
Tokyo 158-0082 (JP)

(74) Representative: **Ter Meer Steinmeister & Partner**
Patentanwälte mbB
Artur-Ladebeck-Strasse 51
33617 Bielefeld (DE)

(54) **ACCUMULATOR**

(57) Provided is an accumulator that can reduce the number of components to reduce assembling processes, weight, cost, and the like and can also efficiently absorb moisture in a refrigerant by increasing the moisture absorption rate of desiccants. A desiccant container (desiccant housing portion) 50 housing desiccants M is fixedly disposed below an inlet port 15 and opposite the inlet port 15, and is adapted to receive from the upper face side thereof (from circulation openings 61 on the upper face side) a refrigerant that has flowed into a tank 10 from the inlet port 15 and then allow the refrigerant to flow downward to below the desiccant container 50

Fig. 1



Description

Technical Field

[0001] The present invention relates to accumulators (i.e., gas-liquid separators) for use in the heat pump refrigeration cycles of car air conditioners, room air conditioners, refrigerators, and the like.

Background Art

[0002] Examples of this type of accumulator include the one that includes a closed-bottomed cylindrical tank having an open upper face that is hermetically closed by a cap member having an inlet port and an outlet port; a gas-liquid separator in the shape of a conical hat or an inverted wide bowl that has a slightly smaller diameter than the inside diameter of the tank; an outlet pipe with a double-pipe structure of an inner pipe, which is coupled at its upper end to the outlet port and extending downward, and an outer pipe; a strainer provided around the bottom of the outlet pipe (or the outer pipe thereof), for trapping or removing foreign matter contained in a liquid-phase refrigerant and oil (i.e., oil for the refrigerator) mixed therewith; a bag containing desiccants for absorbing and removing the moisture in the refrigerant; and the like (see, for example, Patent Literature 1 and 2 below).

[0003] A refrigerant (or a gas-liquid two-phase refrigerant) introduced into the accumulator collides with the gas-liquid separator and is radially diffused to be separated into a liquid-phase refrigerant and a gas-phase refrigerant. Then, the liquid-phase refrigerant (including oil) flows downward along the inner peripheral face of the tank and accumulates in the lower portion of the tank, while the gas-phase refrigerant flows downward through a space (i.e., a gas-phase-refrigerant downward-feed flow channel) formed between the inner pipe and the outer pipe of the outlet pipe, so that the gas-phase refrigerant rises through a space inside the inner pipe and is suctioned to the suction side of the compressor so as to be circulated.

Citation List

Patent Literature

[0004]

Patent Literature 1: JP 2014-202440 A

Patent Literature 2: JP 2008-32269 A

Summary of Invention

Technical Problem

[0005] By the way, in the above-described conventional accumulator, a gas-liquid separator that has been produced through press working of metal sheet material, for

example, and a bag made of a fabric, such as felt, need to be separately prepared and disposed in a tank. This increases the number of components and thus may increase assembling processes, weight, cost, and the like.

[0006] In addition, although the refrigerant introduced into the accumulator is separated into a liquid-phase refrigerant and a gas-phase refrigerant by the gas-liquid separator, it is concerned that depending on how desiccants are disposed, such as when the desiccants are packaged in a vertically long shape and arranged in the tank, the proportion of desiccants that absorb only the moisture in the separated gas-phase refrigerant may increase and instead, the absorption rate of the moisture in the liquid-phase refrigerant by the desiccants may become low.

[0007] The present invention has been made in view of the foregoing, and it is an object of the present invention to provide an accumulator that can reduce the number of components to reduce assembling processes, weight, cost, and the like and can also increase the moisture absorption rate of desiccants so that the moisture in the refrigerant can be efficiently absorbed.

Solution to Problem

[0008] Accordingly, an accumulator in accordance with the present invention basically includes a tank having an inlet port and an outlet port, an outlet pipe that is coupled at one end to the outlet port and is open at the other end inside the tank, and a desiccant housing portion adapted to house desiccants, in which the desiccant housing portion is fixedly disposed below the inlet port and opposite the inlet port, and is adapted to receive from the upper face side of the desiccant housing portion a refrigerant that has flowed into the tank from the inlet port and then allow the refrigerant to flow downward to below the desiccant housing portion.

[0009] In a preferred embodiment, the desiccant housing portion is adapted to cover an opening at the other end of the outlet pipe.

[0010] In another preferred embodiment, the desiccant housing portion is securely sandwiched between the tank and the outlet pipe

[0011] In another preferred embodiment, a refrigerant that has been received into the desiccant housing portion passes through a gap formed between the outer periphery of the desiccant housing portion and the inner periphery of the tank and flows downward to below the desiccant housing portion.

[0012] In a further preferred embodiment, the desiccant housing portion includes a box shaped holding member having an open upper face, and a cap-like pressure member attached to the open upper face of the box shaped holding member, and the cap-like pressure member includes a circulation opening, the circulation opening being adapted to pass a refrigerant that has flowed into the tank from the inlet port and allow the refrigerant that has been received into the desiccant housing portion to

spill out of the desiccant housing portion.

[0013] In a further preferred embodiment, the box shaped holding member and the cap-like pressure member are coupled together in a snap-fit manner.

[0014] In a further preferred embodiment, a refrigerant that has been received into the desiccant housing portion passes through a hole provided in a bottom of the desiccant housing portion and flows downward to below the desiccant housing portion.

[0015] In a further preferred embodiment, the desiccant housing portion includes a plate-like holding member having the hole, and a cap-like pressure member disposed above the plate-like holding member, and the cap-like pressure member includes a circulation opening, the circulation opening being adapted to pass a refrigerant that has flowed into the tank from the inlet port.

[0016] In a further preferred embodiment, the hole is formed to be evenly distributed in the bottom of the desiccant housing portion.

[0017] In a further preferred embodiment, the hole is formed in the outer peripheral portion of the bottom of the desiccant housing portion.

[0018] In a further preferred embodiment, the cap-like pressure member includes a protruding rib for reinforcement and positioning.

[0019] In a further preferred embodiment, the outlet pipe has a double-pipe structure of an inner pipe and an outer pipe, the inner pipe being adapted to be coupled to the outlet port and extend downward inside the tank, and the outer pipe being arranged on the outer periphery of the inner pipe.

Advantageous Effects of Invention

[0020] In the accumulator in accordance with the present invention, a desiccant housing portion housing desiccants is fixedly disposed below the inlet port and opposite the inlet port, and is adapted to receive from the upper face side of the desiccant housing portion a refrigerant that has flowed into the tank from the inlet port and then allow the refrigerant to flow downward to below the desiccant housing portion. While flowing downward, the refrigerant is separated into a liquid-phase refrigerant and a gas-phase refrigerant. Therefore, the number of components can be reduced as compared to the conventional accumulator separately having a gas-liquid separator and a bag containing desiccants, and assembling processes, weight, cost, and the like can thus be reduced.

[0021] Furthermore, since the refrigerant that has flowed into the tank from the inlet port surely passes through the desiccants in the desiccant housing portion, the moisture absorption rate of the desiccants can be increased and the moisture in the refrigerant can be efficiently absorbed.

Brief Description of Drawings

[0022]

Fig. 1 is a longitudinal sectional view of a first embodiment of the accumulator in accordance with the present invention.

Fig. 2 is a cross-sectional view in the direction of the arrow U-U in Fig. 1.

Fig. 3 is a cross-sectional view in the direction of the arrow V-V in Fig. 1.

Fig. 4A is a longitudinal sectional view of a box shaped holding member of a desiccant container illustrated in Fig. 1.

Fig. 4B is a top view of the box shaped holding member of the desiccant container illustrated in Fig. 1.

Fig. 5A is a longitudinal sectional view of a cap-like pressure member of the desiccant container illustrated in Fig. 1.

Fig. 5B is a top view of the cap-like pressure member of the desiccant container illustrated in Fig. 1.

Fig. 6A is a longitudinal sectional view of a sheet fabric of the desiccant container illustrated in Fig. 1.

Fig. 6B is a top view of the sheet fabric of the desiccant container illustrated in Fig. 1.

Fig. 7 is a longitudinal sectional view of a second embodiment of the accumulator in accordance with the present invention.

Fig. 8 is a cross-sectional view in the direction of the arrow U-U in Fig. 7.

Fig. 9 is a cross-sectional view in the direction of the arrow V-V in Fig. 7.

Fig. 10A is a longitudinal sectional view of a plate-like holding member of a desiccant container illustrated in Fig. 7.

Fig. 10B is a top view of the plate-like holding member of the desiccant container illustrated in Fig. 7.

Fig. 11A is a longitudinal sectional view of a cap-like pressure member of the desiccant container illustrated in Fig. 7.

Fig. 11B is a top view of the cap-like pressure member of the desiccant container illustrated in Fig. 7.

Fig. 12A is a longitudinal sectional view of another example of the plate-like holding member of the desiccant container of the accumulator illustrated in Fig. 7.

Fig. 12B is a top view of another example of the plate-like holding member of the desiccant container of the accumulator illustrated in Fig. 7.

Description of Embodiments

[0023] Hereinafter, embodiments of the present invention will be described with reference to the drawings.

[First Embodiment]

[0024] Fig. 1 is a longitudinal sectional view of a first

embodiment of the accumulator in accordance with the present invention. Fig. 2 is a cross-sectional view in the direction of the arrow U-U in Fig. 1. Fig. 3 is a cross-sectional view in the direction of the arrow V-V in Fig. 1.

[0025] An accumulator 1 of the first embodiment illustrated in the drawing is used as an accumulator in the refrigeration cycle that forms a car air conditioner for electric vehicles, for example. The accumulator 1 includes a closed-bottomed cylindrical tank (or an accumulator body) 10 made of metal, such as stainless steel or aluminum alloy, and having an open upper face that is hermetically closed by a cap member 12 made of the same metal. It should be noted that the accumulator 1 of this embodiment is placed in a vertical, upright position as illustrated, for example. That is, the cap member 12 is located on the upper (top) side, and the bottom 13 of the tank 10 is located on the lower (bottom) side. It should be also noted that the tank 10 and the cap member 12 may be collectively referred to as a tank.

[0026] The cap member 12 has an inlet port 15 and a stepped outlet port 16 that are arranged side by side. A desiccant container (or a desiccant housing portion) 50, which has a slightly smaller diameter than the inside diameter of the tank 10 and contains desiccants M, is arranged below the cap member 12 so as to absorb and remove the moisture in the refrigerant. The upper end of an outlet pipe 30 is coupled to the lower portion of the outlet port 16. A stepped cylindrical portion 12a, which forms the lower portion of the outlet port 16, protrudes from the lower face of the cap member 12. The cylindrical portion 12a has on its stepped portion positioning recesses 12b for determining the rotating position (or the angle) of the desiccant container 50 (or a cap-like pressure member 55 thereof) (see Fig. 3, in particular). The desiccant housing portion is a surrounding area defined by the desiccant container 50 and houses and holds the desiccants M therein.

[0027] The outlet pipe 30 has a double-pipe structure of an inner pipe 31 that is coupled at its upper end to the lower portion of the outlet port 16 through pipe expansion, swaging, press-fitting, screwing, and the like and extends downward through a through-hole 53 provided in the desiccant container 50 (i.e., a ceiling portion 52a of a hat-like portion 52) inside the tank 10 and a closed-bottomed outer pipe 32 arranged on the outer periphery of the inner pipe 31. The outlet pipe 30 also has a plate-like rib 33 to provide a predetermined gap between the inner pipe 31 and the outer pipe 32. In the illustrated example, three ribs 33 are provided along the longitudinal direction (i.e., the vertical direction) of the inner pipe 31 and the outer pipe 32 and at equiangular intervals (120° intervals). In this embodiment, the inner pipe 31, the outer pipe 32, and the ribs 33 forming the outlet pipe 30 are integrally formed by extrusion using synthetic resin material, aluminum material, or the like. That is, the double-pipe structure is an integrally molded component made of aluminum extruded material, for example.

[0028] It should be noted that the inner pipe 31 and the

outer pipe 32 forming the outlet pipe 30 may be formed as separate components, and the ribs 33 may be provided on at least one of the inner pipe 31 or the outer pipe 32. For example, a plurality of plate-like ribs may be radially disposed outside the inner pipe 31 (i.e., on a portion below the ceiling portion 52a of the hat-like portion 52 of the desiccant container 50) in an outwardly protruding manner and at equiangular intervals along the longitudinal direction (i.e., the vertical direction), and the outer pipe 32 that has been formed as a component separate from the inner pipe 31 may be fixed to the outer peripheral side of the plurality of plate-like ribs in a press-fit manner. Alternatively, the ribs 33 may be omitted.

[0029] The lower end of the outer pipe 32 is securely fitted into an upper portion 42a with a stepped inner periphery of a case 42 of the strainer 40 (which is described below) through press fitting or the like. The lower end of the inner pipe 31 is located slightly above the bottom 32b of the outer pipe 32. The upper end of the outer pipe 32 is located slightly below the cap member 12 (and inside the hat-like portion 52 of the desiccant container 50 (which is described below)). An oil return hole 35 is formed in the center of the bottom 32b of the outer pipe 32. The diameter of the oil return hole 35 is set to about 1 mm, for example.

[0030] It should be noted that the bottom 32b of the outer pipe 32 may be integrally formed with the cylindrical portion of the outer pipe 32 or may be formed as a component separate from the cylindrical portion, and the component may be securely sandwiched between the cylindrical portion and the case 42 of the strainer 40.

[0031] The strainer 40 is fixedly disposed on the bottom 13 of the tank 10 and includes a closed-bottomed cylindrical case 42 made of synthetic resin, and a cylindrical mesh filter 45 integrally formed with the case 42 through insert molding or the like. The mesh filter 45 is made of a metallic mesh or a mesh member of synthetic resin, for example.

[0032] The desiccant container 50 has a box shaped holding member 51 having an open upper face and having the shape of a generally wide bowl or a cup. The cap-like pressure member 55 is attached to the open upper face of the box shaped holding member 51. The desiccant container 50 is fixedly disposed below the inlet port 15 so as to cover an opening formed by the inner pipe 31 and the outer pipe 32 (or the upper end thereof) of the outlet pipe 30 (i.e., an opening at the other end of the outlet pipe 30).

[0033] More specifically, the box shaped holding member 51 is made of synthetic resin, for example. As clearly seen in Fig. 4A and Fig. 4B in conjunction with Fig. 1, the box shaped holding member 51 has a disk-shaped bottom wall 51a that has a slightly smaller diameter than the inside diameter of the tank 10 and is disposed opposite the inlet port 15 and a peripheral wall 51b in a short cylindrical shape that extends upward from the outer periphery of the bottom wall 51a. The hat-like portion 52, which has a greater diameter than the outside diameter

of the outlet pipe 30 (or the outer pipe 32 thereof) and having a length shorter (in the vertical direction) than the peripheral wall 51b, protrudes (upward) from the bottom wall 51a, below the outlet port 16. The hat-like portion 52 has on its ceiling portion 52a the through-hole 53 through which the upper end of the outlet pipe 30 (or the inner pipe 31 thereof) is adapted to be inserted. The upper portion of the inner pipe 31 and the upper end of the outer pipe 32 of the outlet pipe 30 are located inside the hat-like portion 52. The hat-like portion 52 covers the opening formed by the inner pipe 31 and the outer pipe 32 (or the upper end thereof) of the outlet pipe 30 (i.e., the opening at the other end of the outlet pipe 30). The peripheral wall 51b has on its top a fitting recess 54 (four fitting recesses 54 provided at equiangular intervals in the illustrated example) that is adapted to engage a tongue-like piece 59 provided on the outer periphery of the cap-like pressure member 55 (which will be described later).

[0034] Meanwhile, the cap-like pressure member 55 is made of metal, such as stainless steel or aluminum alloy. As clearly seen in Fig. 5A and Fig. 5B in conjunction with Fig. 1 and Fig. 2, the cap-like pressure member 55 has an inner ring 56 into which the lower portion of the stepped cylindrical portion 12a of the cap member 12 is adapted to be fitted, a plurality of (five in the illustrated example) coupling arms 57 extending (radially) outward from the inner ring 56, and an outer ring 58 having a slightly smaller diameter than the inside diameter of the tank 10 and coupling the outer ends of the plurality of coupling arms 57. Protruding ribs 60 for reinforcement, which protrude upward, extend (radially from the center of the inner ring 56) across an area of from the inner ring 56 to the coupling arms 57. Fitting the inner ends of the protruding ribs 60 into the positioning recesses 12b provided on the stepped portion of the cylindrical portion 12a of the cap member 12 can determine the rotating position of the desiccant container 50 (or the cap-like pressure member 55 thereof) with respect to the cap member 12. A circulation opening 61 through which the refrigerant introduced into the tank 10 via the inlet port 15 is adapted to pass is provided between the adjacent coupling arms 57 extending between the inner ring 56 and the outer ring 58 (which will be described later). In this embodiment, the coupling arms 57 are provided such that one of five circulation openings 61 formed between the adjacent coupling arms 57 is located below the inlet port 15 (in particular, see Fig. 2). The tongue-like piece 59 (four tongue-like pieces 59 provided at equiangular intervals in the illustrated example) having a size to be fitted into the fitting recess 54 of the box shaped holding member 51 extends (outward) from the outer edge of the outer ring 58.

[0035] Engaging the tongue-like piece 59 of the cap-like pressure member 55 with the fitting recess 54 of the box shaped holding member 51 allows the box shaped holding member 51 and the cap-like pressure member 55 to be securely coupled together in a snap-fit manner. Needless to say, the box shaped holding member 51 and

the cap-like pressure member 55 may be coupled together by means other than the snap-fitting using the fitting recess 54 and the tongue-like piece 59, such as swaging, welding, deposition, and the like.

[0036] In this embodiment, as clearly seen in Fig. 6A and Fig. 6B in conjunction with Fig. 1, a sheet fabric 65 made of, for example, felt with a ventilation property and a water permeation property is placed on the lower face side of the cap-like pressure member 55 and around the lower portion of the stepped cylindrical portion 12a of the cap member 12. The sheet fabric 65 has a thickness corresponding to the difference in height between the peripheral wall 51b and the hat-like portion 52 of the box shaped holding member 51 and has an insertion hole 65a through which the lower portion of the stepped cylindrical portion 12a of the cap member 12 is adapted to be inserted.

[0037] In the desiccant container 50 with such a configuration, the inside of the box shaped holding member 51 (more specifically, an annular space formed between the hat-like portion 52 and the peripheral wall 51b of the box shaped holding member 51) is filled with (or has encapsulated therein) granular desiccants M such that the desiccants M are slightly compressed by the sheet fabric 65.

[0038] To attach the desiccant container 50 (the desiccant container 50 assembled from the box shaped holding member 51, the desiccants M, the sheet fabric 65, and the cap-like pressure member 55) and the outlet pipe 30 to the cap member 12, the desiccant container 50 is attached to the lower face of the cap member 12 so that the cap-like pressure member 55 and the sheet fabric 65 of the desiccant container 50 are mounted around the lower portion of the cylindrical portion 12a of the cap member 12. At the same time, the rotating position of the desiccant container 50 with respect to the cap member 12 is determined by the positioning recesses 12b of the cylindrical portion 12a of the cap member 12 and the protruding ribs 60 on the upper face of the cap-like pressure member 55. Then, the upper end of the inner pipe 31 (i.e., a portion above the portion where the ribs 33 are formed) is passed through the through-hole 53 provided in the desiccant container 50 (or the ceiling portion 52a of the hat-like portion 52 thereof) and is then fixed to the outlet port 16 from the lower side by press-fitting or pipe expansion. Accordingly, the desiccant container 50 is securely sandwiched between the ribs 33 of the outlet pipe 30 and the lower end face of the cap member 12 (or the cylindrical portion 12a thereof).

[0039] It should be noted that a flanged portion molded by compression such as bulge forming may be provided near the upper end of the inner pipe 31, and the desiccant container 50 may be securely sandwiched between the flanged portion and the lower end face of the cap member 12 (or the cylindrical portion 12a thereof).

[0040] In the accumulator 1 with such a configuration, a low-temperature, low-pressure refrigerant in a gas-liquid mixed state from an evaporator is introduced into the

tank 10 via the inlet port 15, and the introduced refrigerant is received into the desiccant container 50 via the circulation openings 61 formed in the cap-like pressure member 55 of the desiccant container 50 while accumulating in the box shaped holding member 51 after passing through the sheet fabric 65 and the desiccants M. If the amount of the refrigerant that has accumulated in the box shaped holding member 51 exceeds a predetermined amount, the refrigerant spills out of the desiccant container 50 beyond the peripheral wall 51b (or the upper end thereof) of the box shaped holding member 51 via the circulation openings 61 (or the outer peripheral portions thereof), and then flows downward (i.e., drops) below the desiccant container 50 while passing through a space (or a cylindrical gap formed) between the outer periphery of the desiccant container 50 (or the peripheral wall 51b of the box shaped holding member 51 thereof) and the inner periphery of the tank 10. While flowing downward, the refrigerant is diffused and separated into a liquid-phase refrigerant and a gas-phase refrigerant. The liquid-phase refrigerant (including oil) flows downward in the tank 10 and accumulates in the lower space of the tank 10, while the gas-phase refrigerant is suctioned into the suction side of a compressor via the space (i.e., a gas-phase-refrigerant downward-feed flow channel) formed between the inner pipe 31 and the outer pipe 32 of the outlet pipe 30 → the space inside the inner pipe 31 so as to be circulated.

[0041] Oil that has accumulated in the lower space of the tank 10 together with the liquid-phase refrigerant moves toward the bottom 13 of the tank 10 due to the difference in specific gravity, properties, and the like between the oil and the liquid-phase refrigerant, and is absorbed into the gas-phase refrigerant to be suctioned to the suction side of the compressor via the outlet pipe 30. Then, the oil passes through the mesh filter 45 of the strainer 40 → the oil return hole 35 → the space inside the inner pipe 31 and thus is returned to the suction side of the compressor together with the gas-phase refrigerant so as to be circulated. When the oil passes through the mesh filter 45, foreign matter, such as sludge, is trapped and thus is removed from the circulating refrigerant (including oil).

[0042] As described above, in the accumulator 1 of this embodiment, the desiccant container (or the desiccant housing portion) 50 housing the desiccants M is fixedly disposed below the inlet port 15 and opposite the inlet port 15, and is adapted to receive from the upper face side thereof (i.e., from the circulation openings 61 on the upper face side) the refrigerant that has flowed into the tank 10 from the inlet port 15 and then allow the refrigerant to flow downward to below the desiccant container 50. While flowing downward, the refrigerant is separated into a liquid-phase refrigerant and a gas-phase refrigerant. Therefore, the number of components can be reduced as compared to the conventional accumulator separately having a gas-liquid separator and a bag containing desiccants, and thus, assembling processes, weight, cost,

and the like can be reduced.

[0043] Furthermore, since the refrigerant that has flowed into the tank 10 from the inlet port 15 surely passes through the desiccants M in the desiccant container 50, the moisture absorption rate of the desiccants M can be increased and the moisture in the refrigerant can be efficiently absorbed.

[Second Embodiment]

[0044] Fig. 7 is a longitudinal sectional view of a second embodiment of the accumulator in accordance with the present invention. Fig. 8 is a cross-sectional view in the direction of the arrow U-U in Fig. 7. Fig. 9 is a cross-sectional view in the direction of the arrow V-V in Fig. 7.

[0045] An accumulator 2 of the second embodiment illustrated in the drawing differs from the accumulator 1 of the aforementioned first embodiment only in the configuration of the desiccant container 50 housing the desiccants M. The other configurations are the same. Thus, the following embodiment mainly describes only the difference. It should be noted that in the drawings illustrating the accumulator 2 of the second embodiment, portions corresponding to the same components of the accumulator 1 of the aforementioned first embodiment are denoted by the same reference numerals.

[0046] In the present embodiment, a desiccant container (or a desiccant housing portion) 70, which is fixedly disposed below the cap member 12 and houses desiccants M, has a plate-like holding member 71 having a generally disk shape. The plate-like holding member 71 has on its upper side a cap-like pressure member 75 attached thereto. The desiccant housing portion is a surrounding area defined by the desiccant container 70 and houses and holds the desiccants M therein.

[0047] More specifically, the plate-like holding member 71 is made of synthetic resin, for example. As clearly seen in Fig. 10A and Fig. 10B in conjunction with Fig. 7, the plate-like holding member 71 has substantially the same diameter as the inside diameter of the tank 10 and is disposed opposite the inlet port 15. A hat-like portion 72 having the same shape as the hat-like portion 52 of the first embodiment (i.e., a hat-like portion 72 having on its ceiling portion 72a a through-hole 73 through which the upper end of the outlet pipe 30 (or the inner pipe 31 thereof) is adapted to be inserted) protrudes (upward) below the outlet port 16. That is, in the second embodiment, the peripheral wall 51b having the fitting recesses 54 of the first embodiment is omitted.

[0048] In the present embodiment, in addition to the above configurations, the plate-like holding member 71 (in particular, portions other than the hat-like portion 72) has a plurality of open pores 71c. Herein, the plurality of pores 71c is formed to be substantially evenly distributed in the plate-like holding member 71 (to have a substantially uniform hole density).

[0049] Meanwhile, the cap-like pressure member 75 is made of metal, such as stainless steel or aluminum

alloy. As clearly seen in Fig. 11A and Fig. 11B in conjunction with Fig. 7 and Fig. 8, the basic shapes of the cap-like pressure member 75 (specifically, the shapes of an inner ring 76, coupling arms 77, and protruding ribs 80 for reinforcement that extend across an area of from the inner ring 76 to the coupling arms 77) are the same as the shapes of the cap-like pressure member 55 of the first embodiment. However, the diameter (the outside diameter) of an outer ring 78 of the cap-like pressure member 75 is substantially equal to the inside diameter of the tank 10. That is, the tongue-like piece 59 of the first embodiment is omitted in the present embodiment.

[0050] In this embodiment, a sheet fabric 85 having the same shape as the sheet fabric 65 of the first embodiment is disposed on the lower face side of the cap-like pressure member 75, while a sheet fabric 86 made of, for example, felt with a ventilation property and a water permeation property is disposed on the upper face side of the plate-like holding member 71 (in particular, the outer peripheral portion of the hat-like portion 72). It should be noted that in the illustrated example, the thickness of the sheet fabric 86 disposed on the lower side is slightly smaller than that of the sheet fabric 85 disposed on the upper side.

[0051] In the desiccant container 70 with such a configuration, a space defined by the plate-like holding member 71, the cap-like pressure member 75, and the inner wall of the tank 10 (more specifically, an annular space outside the hat-like portion 72, between the plate-like holding member 71, the cap-like pressure member 75, and the inner wall of the tank 10) is filled with (or has encapsulated therein) granular desiccants M such that the desiccants M are slightly compressed (vertically) by the sheet fabric 85 and the sheet fabric 86. That is, in this embodiment, the desiccants M are sandwiched between the plate-like holding member 71 and the cap-like pressure member 75 with the sheet fabrics 85 and 86 interposed therebetween.

[0052] To attach the desiccant container 70 (i.e., the desiccant container 70 in which the plate-like holding member 71, the sheet fabric 86, the desiccants M, the sheet fabric 85, and the cap-like pressure member 75 are stacked in this order from the bottom) and the outlet pipe 30 to the cap member 12, the desiccant container 70 is attached to the lower face of the cap member 12 so that the cap-like pressure member 75 and the sheet fabric 85 of the desiccant container 70 are mounted around the lower portion of the cylindrical portion 12a of the cap member 12. At the same time, the rotating position of the desiccant container 70 with respect to the cap member 12 is determined by the positioning recesses 12b of the cylindrical portion 12a of the cap member 12 and the protruding ribs 80 on the upper face of the cap-like pressure member 75. Then, the upper end of the inner pipe 31 (i.e., a portion above the portion where the ribs 33 are formed) is passed through the through-hole 73 provided in the desiccant container 70 (i.e., the ceiling portion 72a of the hat-like portion 72 thereof) and is then

fixed to the outlet port 16 from the lower side by press-fitting or pipe expansion. Accordingly, the desiccant container 70 is securely sandwiched between the ribs 33 of the outlet pipe 30 and the lower end face of the cap member 12 (or the cylindrical portion 12a thereof).

[0053] It should be noted that a flanged portion molded by compression such as bulge forming may be provided near the upper end of the inner pipe 31 and the desiccant container 70 may be securely sandwiched between the flanged portion and the lower end face of the cap member 12 (or the cylindrical portion 12a thereof).

[0054] In the accumulator 2 with such a configuration, a low-temperature, low-pressure refrigerant in a gas-liquid mixed state from an evaporator is introduced into the tank 10 via the inlet port 15, and the introduced refrigerant is received into the desiccant container 70 via circulation openings 81 formed in the cap-like pressure member 75 of the desiccant container 70, and passes through the sheet fabric 85, the desiccants M, and the sheet fabric 86 and further through the pores 71c formed in the plate-like holding member 71, and then flows downward (i.e., drops) below the desiccant container 70. While flowing downward, the refrigerant is diffused and separated into a liquid-phase refrigerant and a gas-phase refrigerant. The liquid-phase refrigerant (including oil) flows downward in the tank 10 and accumulates in the lower space of the tank 10, while the gas-phase refrigerant is suctioned into the suction side of a compressor via the space (i.e., a gas-phase-refrigerant downward-feed flow channel) formed between the inner pipe 31 and the outer pipe 32 of the outlet pipe 30 → the space inside the inner pipe 31 so as to be circulated.

[0055] Oil that has accumulated in the lower space of the tank 10 together with the liquid-phase refrigerant moves toward the bottom 13 of the tank 10 due to the difference in specific gravity, properties, and the like between the oil and the liquid-phase refrigerant, and is absorbed into the gas-phase refrigerant to be suctioned to the suction side of the compressor via the outlet pipe 30. Then, the oil passes through the mesh filter 45 of the strainer 40 → the oil return hole 35 → the space inside the inner pipe 31 and thus is returned to the suction side of the compressor together with the gas-phase refrigerant so as to be circulated. When the oil passes through the mesh filter 45, foreign matter, such as sludge, is trapped and thus is removed from the circulating refrigerant (including oil).

[0056] As described above, also in the accumulator 2 of this embodiment like the accumulator 1 of the aforementioned first embodiment, the desiccant container (or the desiccant housing portion) 70 housing the desiccants M is fixedly disposed below the inlet port 15 and opposite the inlet port 15, and is adapted to receive from the upper face side thereof (from the circulation openings 81 on the upper face side) the refrigerant that has flowed into the tank 10 from the inlet port 15 and then allow the refrigerant to flow downward to below the desiccant container 70. While flowing downward, the refrigerant is separated into

a liquid-phase refrigerant and a gas-phase refrigerant. Therefore, the number of components can be reduced as compared to the conventional accumulator separately having a gas-liquid separator and a bag containing desiccants, and thus, assembling processes, weight, cost, and the like can be reduced.

[0057] Furthermore, since the refrigerant that has flowed into the tank 10 from the inlet port 15 surely passes through the desiccants M in the desiccant container 70, the moisture absorption rate of the desiccants M can be increased and the moisture in the refrigerant can be efficiently absorbed.

[0058] It should be noted that in the second embodiment, the plurality of pores 71c is formed to be substantially evenly distributed in almost the entire area of the plate-like holding member 71 forming the bottom of the desiccant container 70, so that the refrigerant that has been introduced into the desiccant container 70 flows downward to below the desiccant container 70. However, the position, shape, size, number of the pores, and the like are not limited to those in the illustrated example. For example, to simplify the step of machining the plate-like holding member 71, an elongated hole 71d (four elongated holes 71d formed at equiangular intervals in the illustrated example), which has a shape along the circumferential direction, may be formed in the outer peripheral portion of the plate-like holding member 71 (i.e., the portion in the vicinity of the outer edge) as illustrated in Fig. 12A and Fig. 12B.

[0059] It is needless to say that holes similar to those of the aforementioned second embodiment (that is, holes that allow the refrigerant having passed through the desiccants M and the like to spill out of the desiccant container) may be formed in the bottom wall 51a and the peripheral wall 51b of the box shaped holding member 51 of the desiccant container 50 of the aforementioned first embodiment.

[0060] In the aforementioned first and second embodiments, the box shaped holding member 51 and the plate-like holding member 71 that are adapted to hold the desiccants M from the lower side of the desiccant containers 50 and 70, respectively are made of resin, and the cap-like pressure members 55 and 75 that are adapted to hold the desiccants M from the upper side are made of metal. However, it is needless to say that the material of the box shaped holding member 51, the plate-like holding member 71, the cap-like pressure members 55 and 75, and the like may be appropriately selected.

[0061] Although the aforementioned first and second embodiments adopt the outlet pipe having a double-pipe structure of the inner pipe and the outer pipe, it is needless to say that the present invention can also be applied to an accumulator with, for example, a U-shaped outlet pipe that is coupled at one end to the outlet port and that is open at the other end near the lower face of the gas-liquid separator.

Reference Signs List

[0062]

5	1	Accumulator (First Embodiment)
	2	Accumulator (Second Embodiment)
	10	Tank
	12	Cap member
	12a	Cylindrical portion
10	12b	Positioning recess
	13	Bottom of tank
	15	Inlet port
	16	Outlet port
	30	Outlet pipe
15	31	Inner pipe
	32	Outer pipe
	33	Rib
	35	Oil return hole
	40	Strainer
20	50	Desiccant container (desiccant housing portion) (First Embodiment)
	51	Box shaped holding member
	51a	Bottom wall
	51b	Peripheral wall
25	52	Hat-like portion
	52a	Ceiling portion of hat-like portion
	53	Through-hole
	54	Fitting recess
	55	Cap-like pressure member
30	56	Inner ring
	57	Coupling arm
	58	Outer ring
	59	Tongue-like piece
	60	Protruding rib
35	61	Circulation opening
	65	Sheet fabric
	70	Desiccant container (desiccant housing portion) (Second Embodiment)
	71	Plate-like holding member
40	72	Hat-like portion
	72a	Ceiling portion of hat-like portion
	73	Through-hole
	75	Cap-like pressure member
	80	Protruding rib
45	81	Circulation opening
	85	Sheet fabric
	86	Sheet fabric
	M	Desiccant

Claims

1. Accumulator comprising:

- 55 a tank having an inlet port and an outlet port; an outlet pipe that is coupled at one end to the outlet port and is open at another end inside the tank; and

- a desiccant housing portion adapted to house desiccants, wherein
the desiccant housing portion is fixedly disposed below the inlet port and opposite the inlet port, and is adapted to receive from an upper face side of the desiccant housing portion a refrigerant that has flowed into the tank from the inlet port and then allow the refrigerant to flow downward to below the desiccant housing portion.
2. The accumulator according to claim 1, wherein the desiccant housing portion is adapted to cover an opening at the other end of the outlet pipe.
 3. The accumulator according to claim 1 or 2, wherein the desiccant housing portion is securely sandwiched between the tank and the outlet pipe.
 4. The accumulator according to any one of claims 1 to 3, wherein a refrigerant that has been received into the desiccant housing portion passes through a gap formed between an outer periphery of the desiccant housing portion and an inner periphery of the tank and flows downward to below the desiccant housing portion.
 5. The accumulator according to claim 4, wherein the desiccant housing portion includes a box shaped holding member having an open upper face, and a cap-like pressure member attached to the open upper face of the box shaped holding member, and the cap-like pressure member includes a circulation opening, the circulation opening being adapted to pass a refrigerant that has flowed into the tank from the inlet port and allow the refrigerant that has been received into the desiccant housing portion to spill out of the desiccant housing portion.
 6. The accumulator according to claim 5, wherein the box shaped holding member and the cap-like pressure member are coupled together in a snap-fit manner.
 7. The accumulator according to any one of claims 1 to 3, wherein a refrigerant that has been received into the desiccant housing portion passes through a hole provided in a bottom of the desiccant housing portion and flows downward to below the desiccant housing portion.
 8. The accumulator according to claim 7, wherein the desiccant housing portion includes a plate-like holding member having the hole, and a cap-like pressure member disposed above the plate-like holding member, and the cap-like pressure member includes a circulation opening, the circulation opening being adapted to pass a refrigerant that has flowed into the tank from
- the inlet port.
9. The accumulator according to claim 7 or 8, wherein the hole is formed to be evenly distributed in a bottom of the desiccant housing portion.
 10. The accumulator according to claim 7 or 8, wherein the hole is formed in an outer peripheral portion of a bottom of the desiccant housing portion.
 11. The accumulator according to claim 5 or 8, wherein the cap-like pressure member includes a protruding rib for reinforcement and positioning.
 12. The accumulator according to any one of claims 1 to 11, wherein the outlet pipe has a double-pipe structure of an inner pipe and an outer pipe, the inner pipe being adapted to be coupled to the outlet port and extend downward inside the tank, and the outer pipe being arranged on the outer periphery of the inner pipe.

Fig. 1

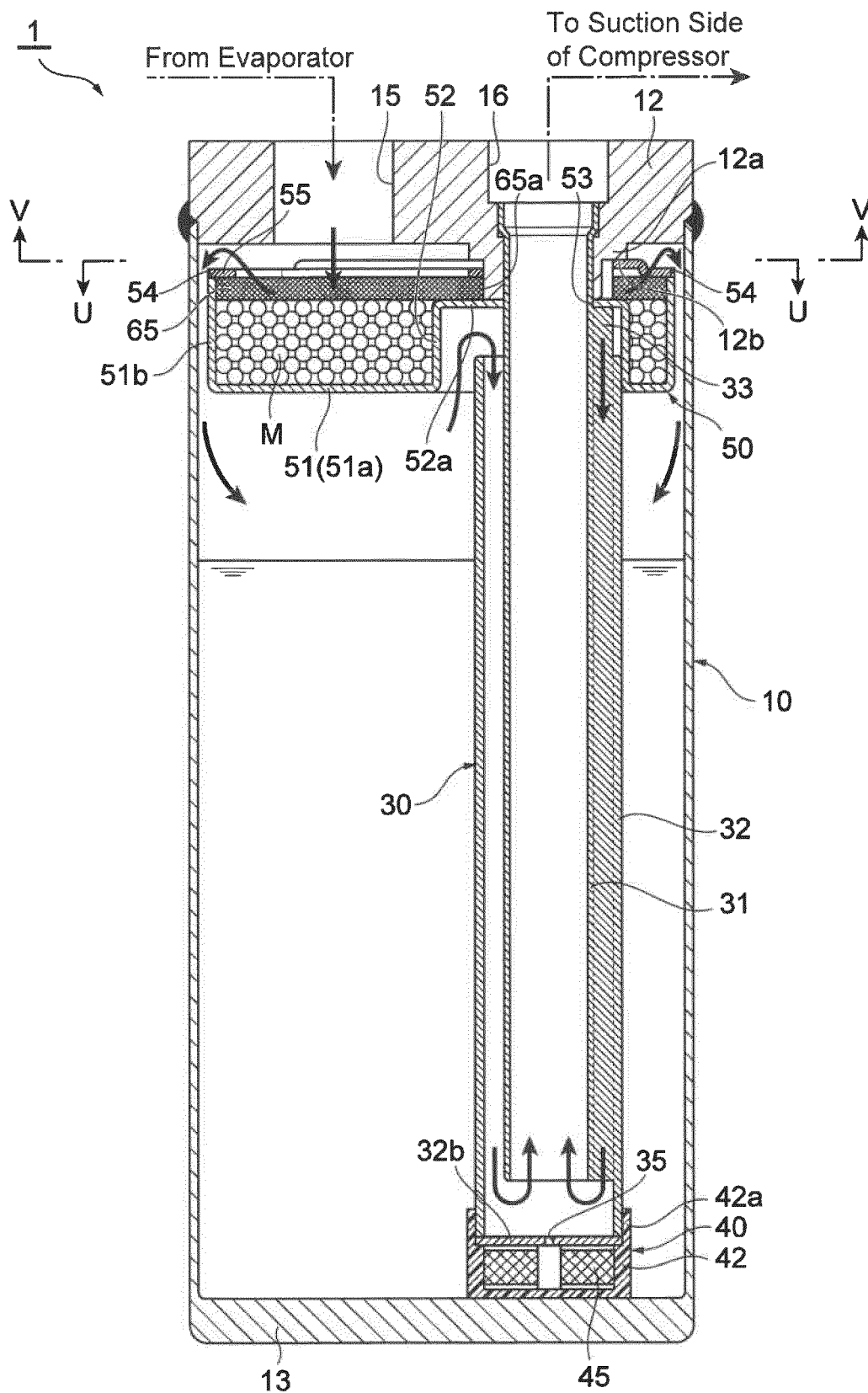
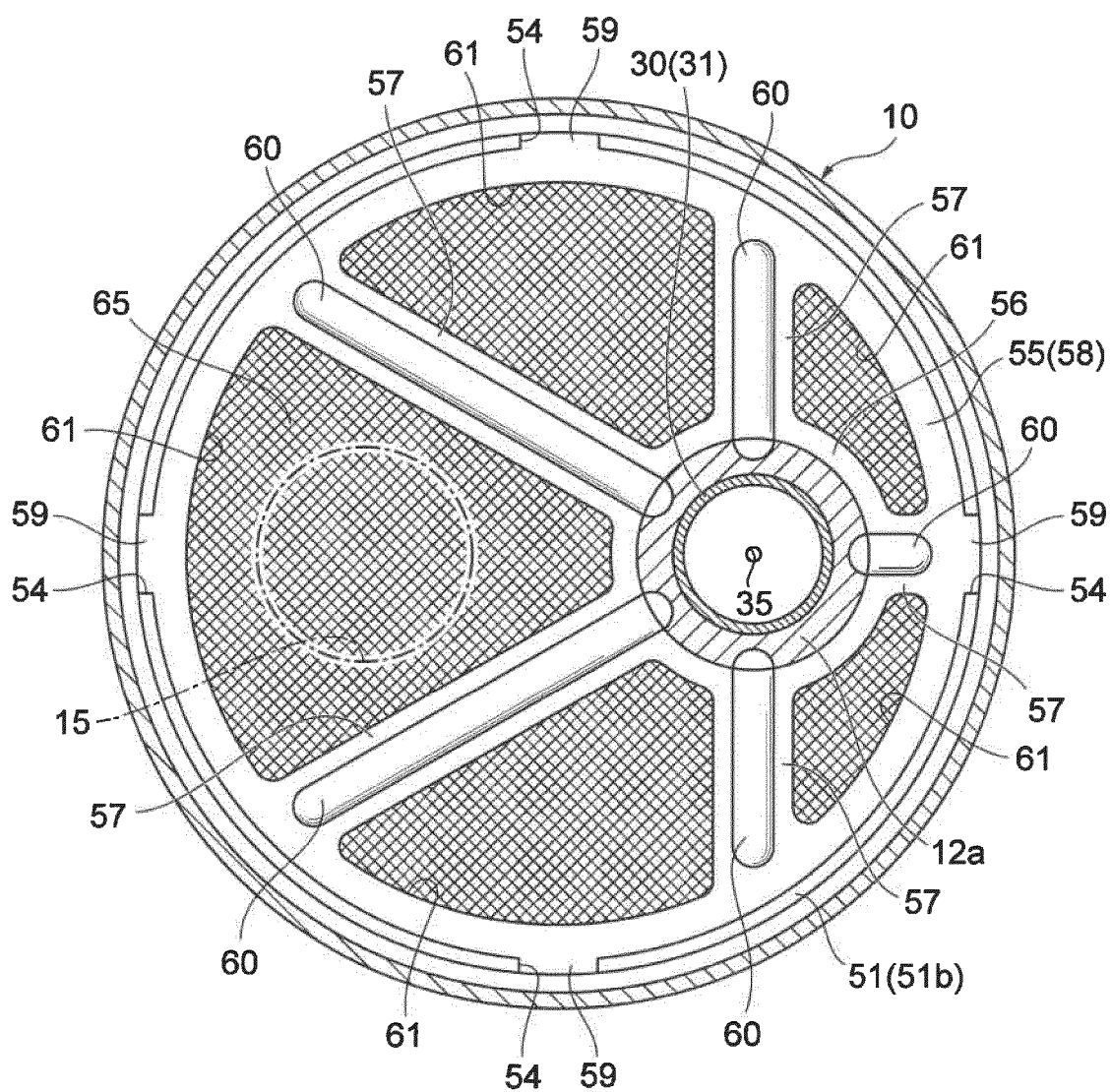
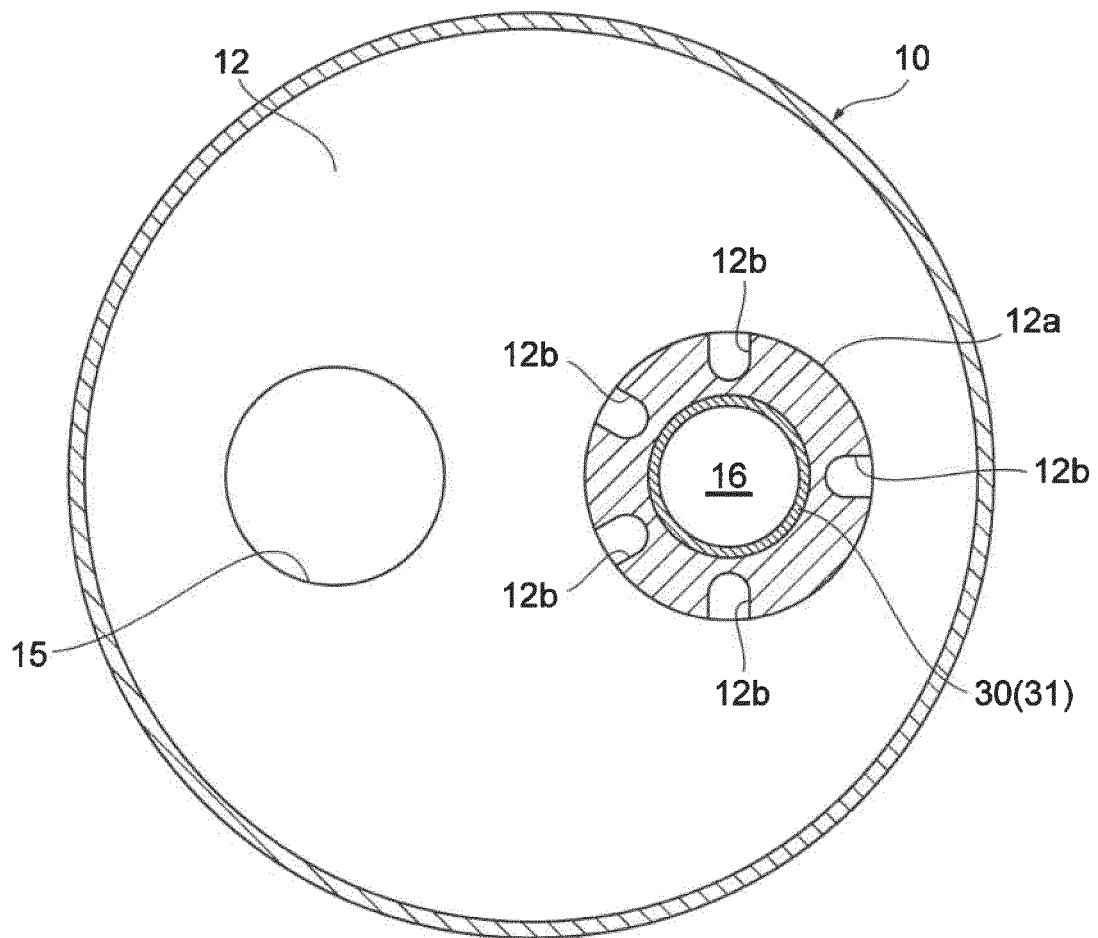


Fig. 2



U-U Cross-Section

Fig. 3



V-V Cross-Section

Fig. 4A

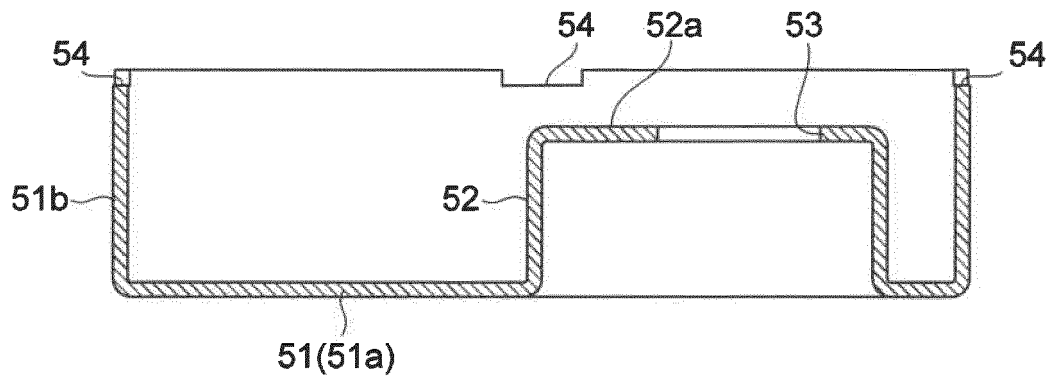


Fig. 4B

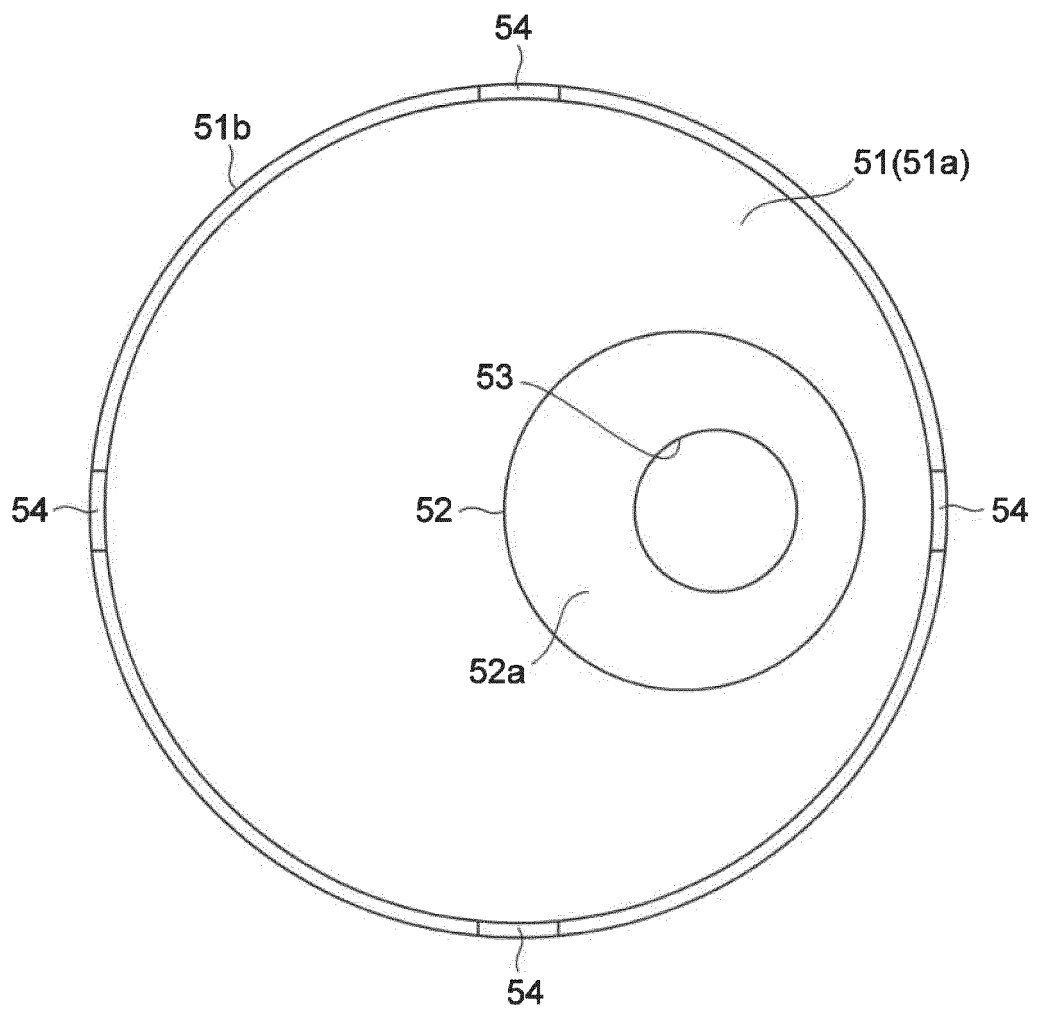


Fig. 5A

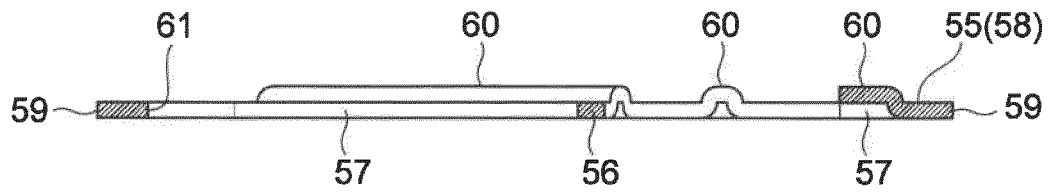


Fig. 5B

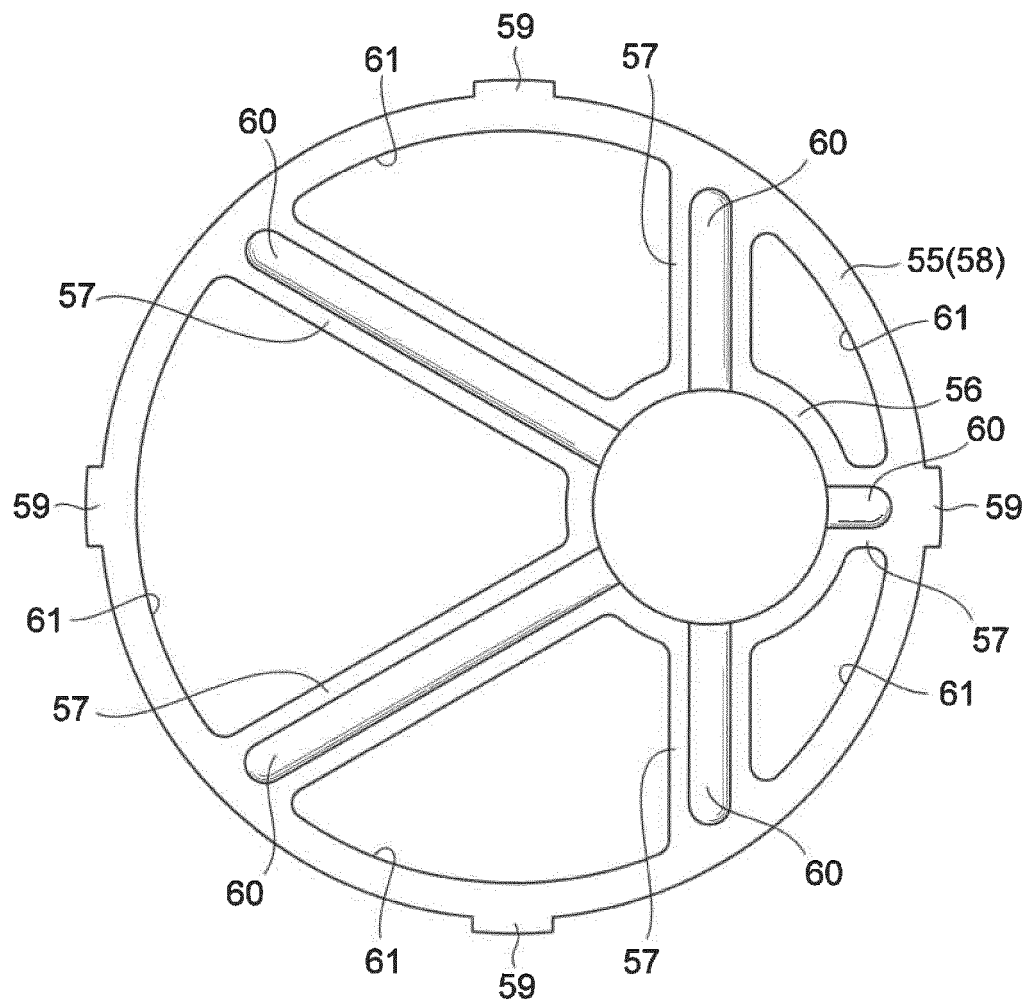


Fig. 6A

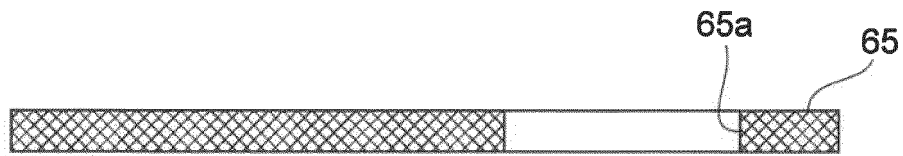


Fig. 6B

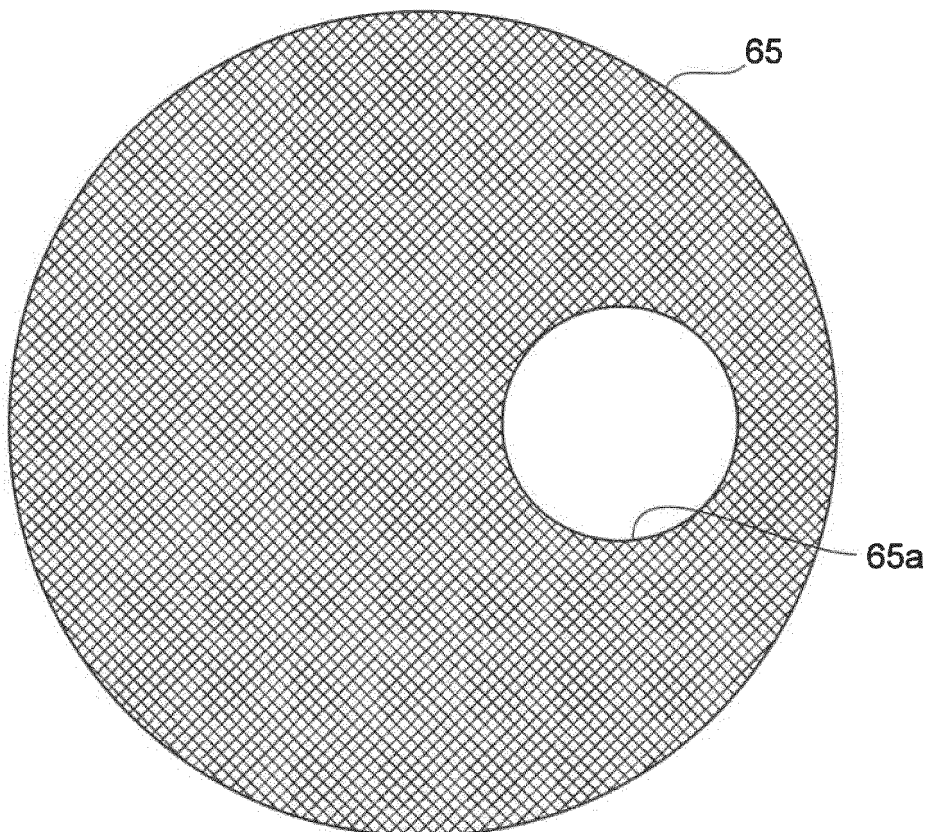


Fig. 7

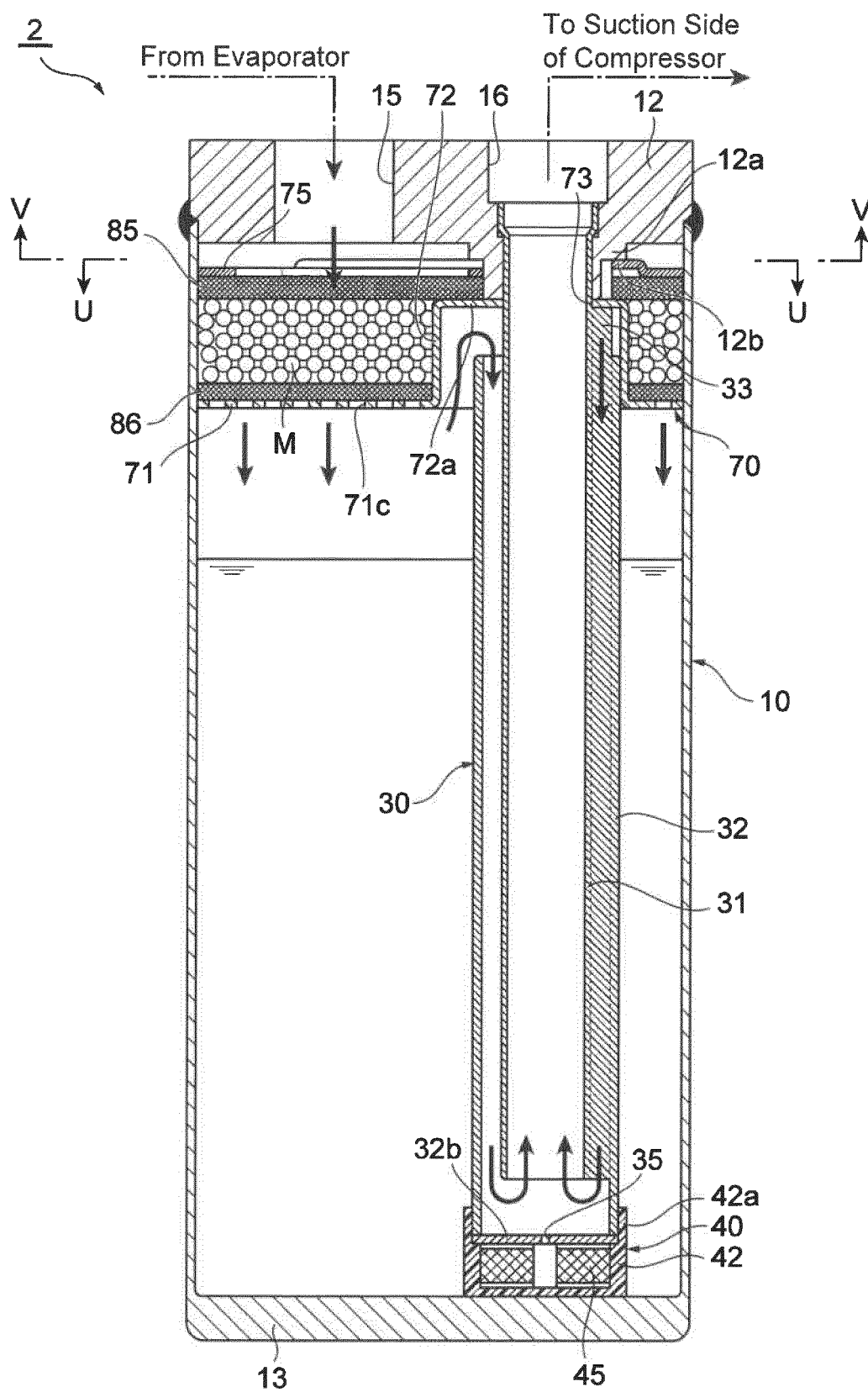
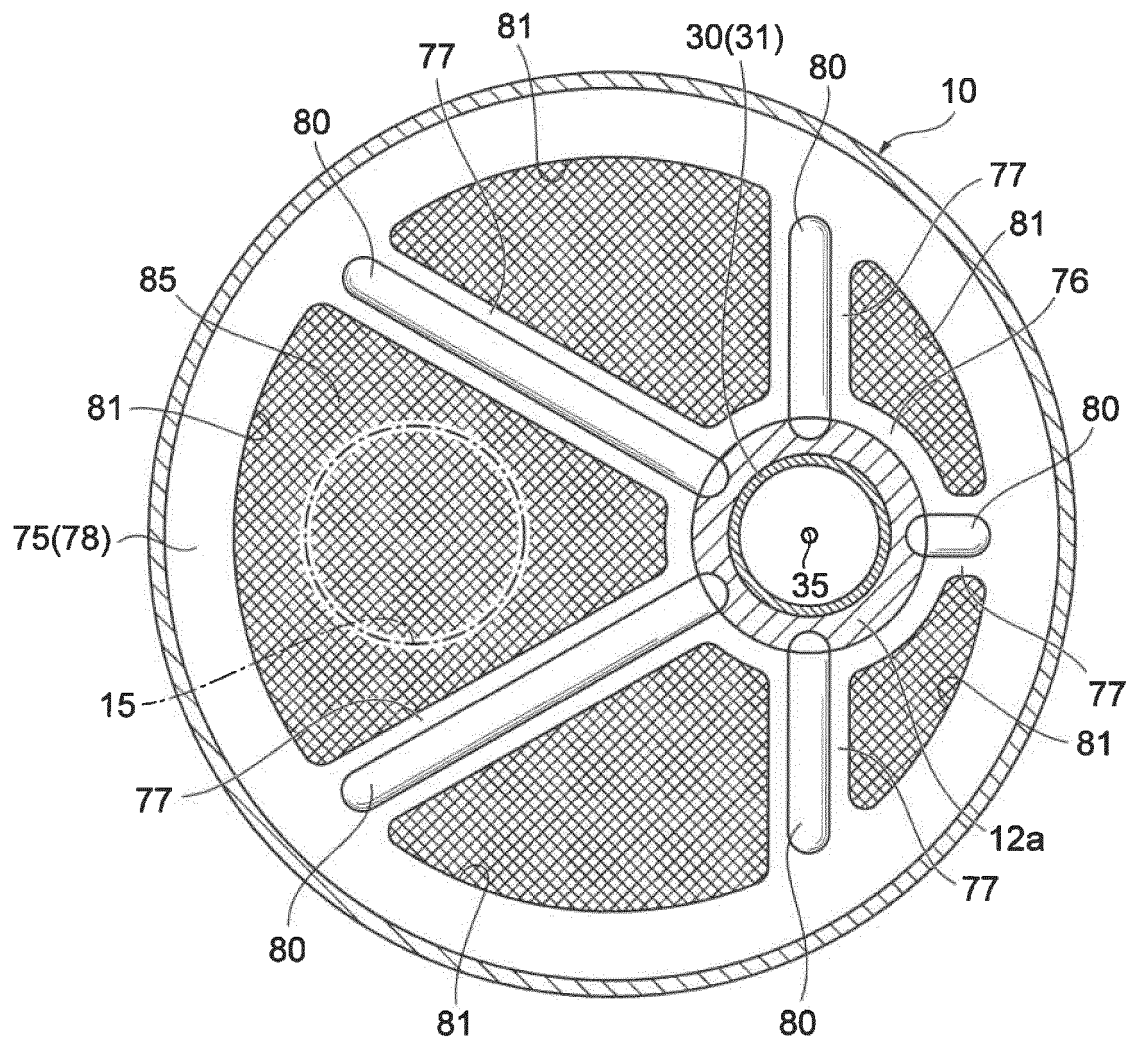
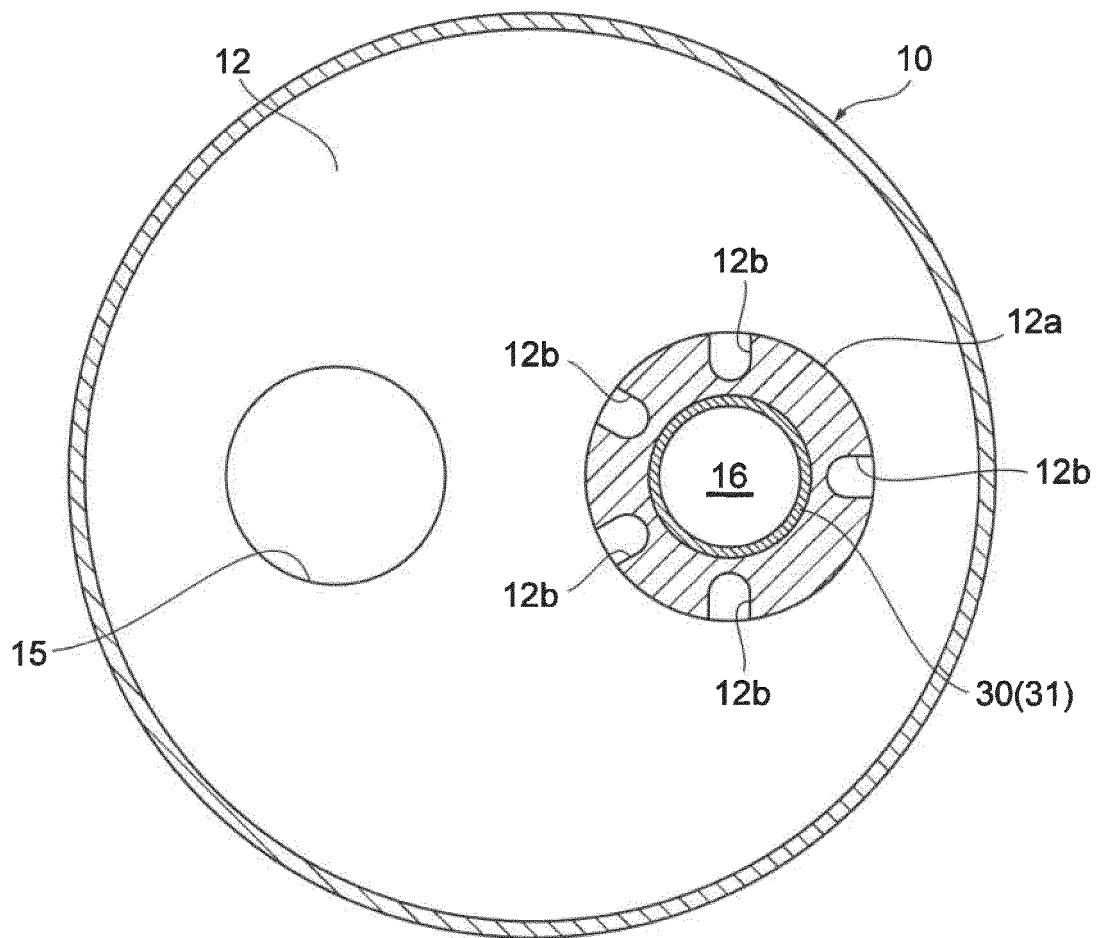


Fig. 8



U-U Cross-Section

Fig. 9



V-V Cross-Section

Fig. 10A

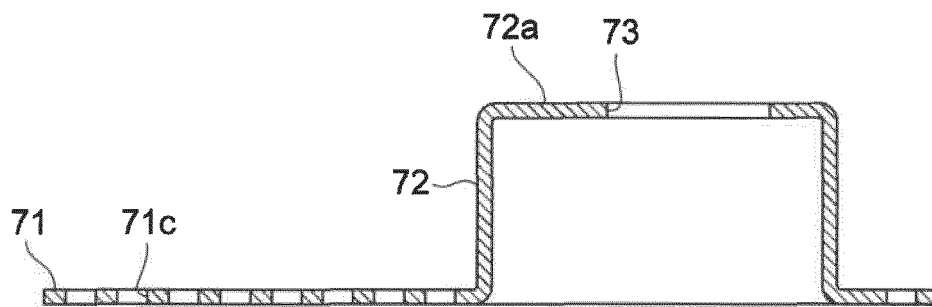


Fig. 10B

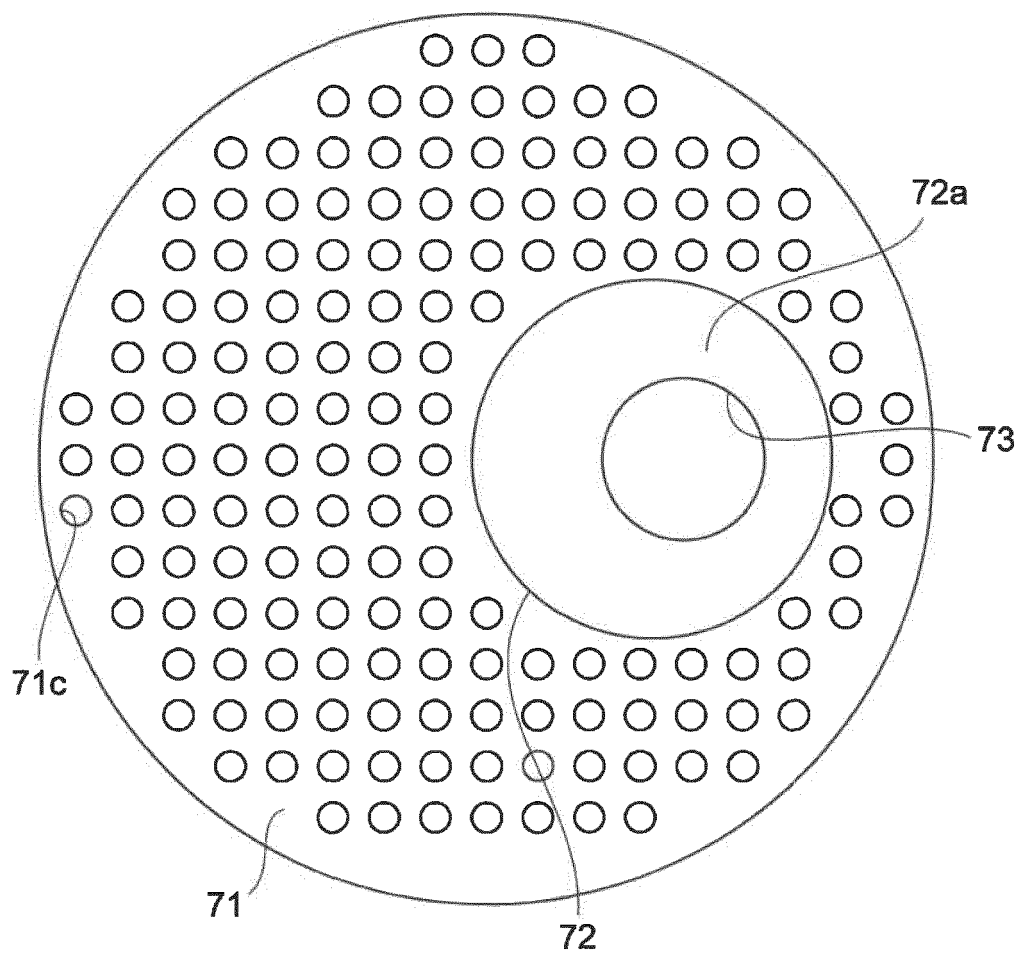


Fig. 11A

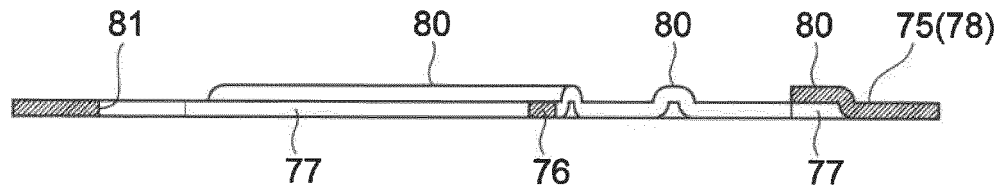


Fig. 11B

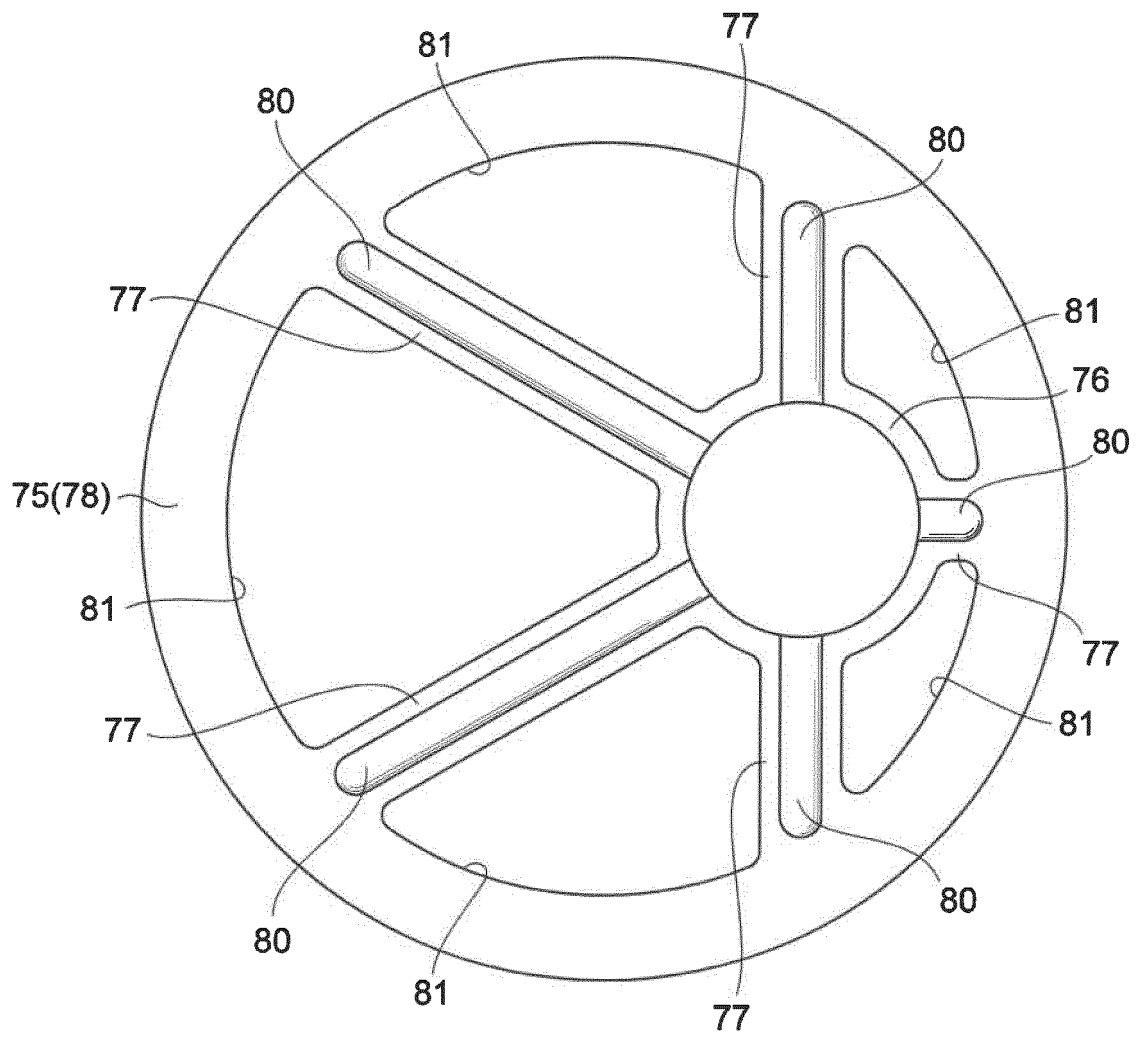


Fig. 12A

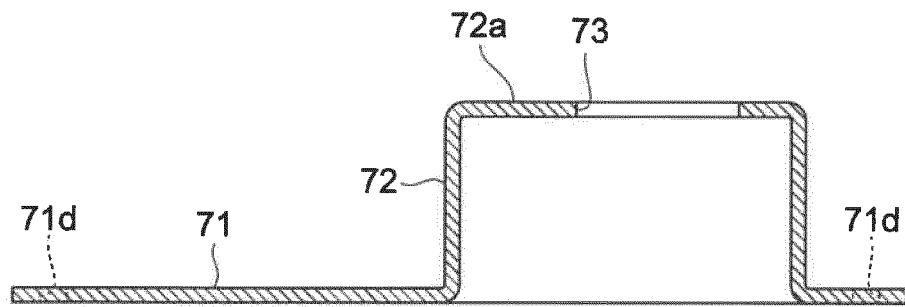
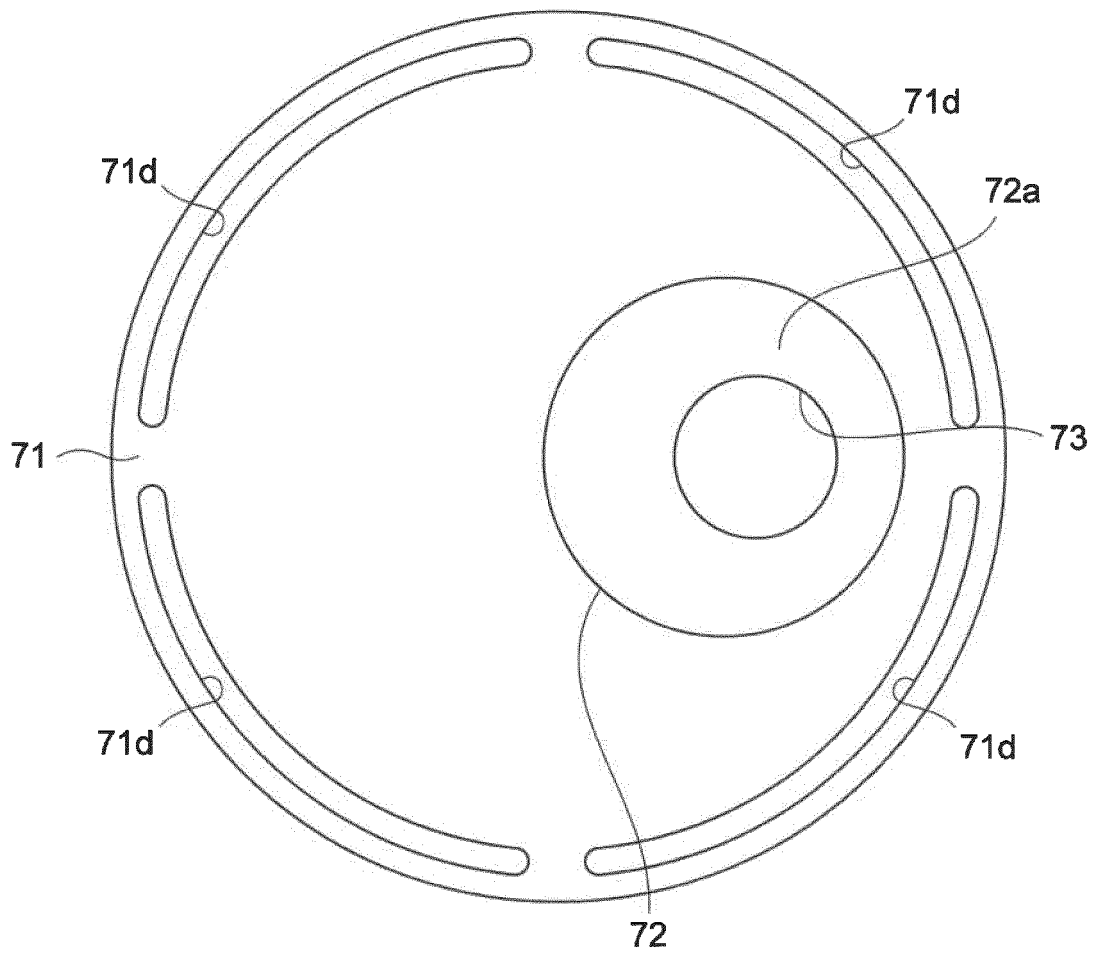


Fig. 12B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/033612

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F25B43/00 (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. F25B43/00

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

Published 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 A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 72106/1989 (Laid-open No. 13074/1991) (MITSUBISHI ELECTRIC CORPORATION) 08 February 1991, specification, page 1, line 10 to page 4, line 15, fig. 1 (Family: none)	1, 7 2, 7-12 3-6
X Y A	JP 10-232071 A (SHOWA ALUMINUM CORPORATION) 02 September 1998, paragraphs [0014]-[0027], fig. 1, 5 & US 6122929 A, column 3, line 20 to column 5, line 18, fig. 1, 5 & EP 849549 A2	1, 7, 9 2, 7-12 3-6



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
25.10.2018

Date of mailing of the international search report
13.11.2018

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Japan Patent Office
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Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/033612

5	C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	X	US 2003/0079610 A1 (HAYES) 01 May 2003, paragraphs	1, 7
	Y	[0002], [0051], fig. 8	2, 7-12
10	A	(Family: none)	3-6
	Y	JP 59-20611 Y2 (HOWA MACHINERY LTD.) 15 June 1984,	2, 7-12
	A	column 2, line 37 to column 4, line 44, fig. 2, 3	4
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15	Y	JP 2014-95491 A (FUJI KOKI KK) 22 May 2014,	8-12
		paragraphs [0012], [0015], [0021]-[0023], [0032],	
		fig. 1-3	
		& CN 103808088 A	
	Y	JP 2002-71242 A (CALSONIC KANSEI CORPORATION) 08	10-12
20		March 2002, paragraph [0033], fig. 1, 6	
		(Family: none)	
	Y	US 7003978 B2 (KNECHT) 28 February 2006, column 5,	10-12
		lines 35-58, fig. 3, 5	
25		(Family: none)	
	Y	JP 10-267473 A (SHOWA ALUMINUM CORPORATION) 09	11-12
		October 1998, paragraph [0009], fig. 1-3	
		(Family: none)	
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REFERENCES CITED IN THE DESCRIPTION

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- JP 2008032269 A [0004]