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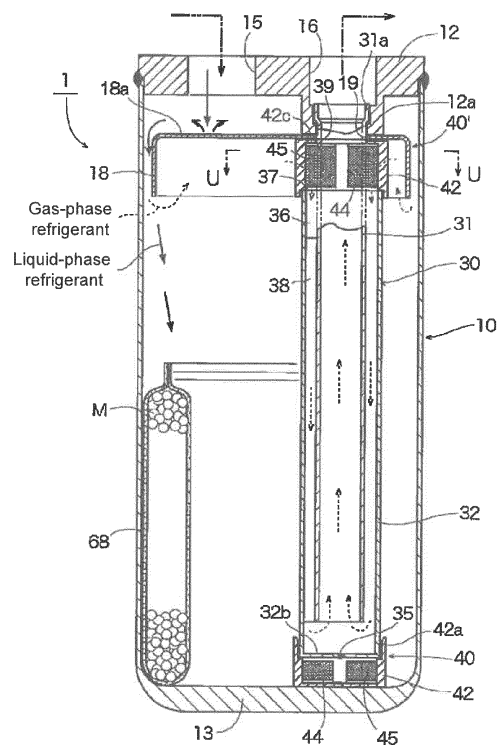
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(54) **ACCUMULATOR**

(57) Provided is an accumulator having a reliable and inexpensive configuration that can prevent foreign matter included in liquid-phase refrigerant from flowing into an outlet pipe for the refrigerant due to liquid backflow. The accumulator includes a tank 10 having an inlet port 15 and an outlet port 16, and an outlet pipe 30 coupled at one end to the outlet port 16 and having a gas-phase refrigerant suction port 37 that is open upward in the tank 10. The gas-phase refrigerant suction port 37 of the outlet pipe 30 includes a filter member.

Fig. 1A



Description

Technical Field

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

Background Art

[0002] A typical refrigeration cycle that forms a car air conditioner or the like includes an accumulator in addition to a compressor, an outdoor heat exchanger, an indoor heat exchanger, an expansion valve, and the like, as disclosed in Patent Literature 1, for example.

[0003] 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 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 a closed-bottomed outer pipe, which is arranged on the outer periphery of the inner pipe, and the like.

[0004] A refrigerant introduced into the accumulator (or a refrigerant including oil as a lubricant for a sliding portion of a compressor and the like) collides with the gas-liquid separator and is radially diffused to be separated into a liquid-phase refrigerant (including oil) and a gas-phase refrigerant. The liquid-phase refrigerant 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 the inside of the outer pipe from its opening at the upper end to the bottom, and then turns around at the bottom and rises through the inside of the inner pipe from its opening at the lower end so as to be guided to the outlet port. At the same time, oil that has accumulated in the lower portion of the tank is absorbed into the gas-phase refrigerant through an oil return hole provided at the bottom of the outer pipe, and then, as the gas-phase refrigerant including the oil components, suctioned from the outlet port to the suction side of the compressor so as to be circulated.

[0005] By the way, having high viscosity, the liquid-phase refrigerant including oil may be suctioned upward around the outlet pipe (or the outer pipe), and the liquid level may rise. Furthermore, when the accumulator is used as a car air conditioner for electric vehicles, for example, the liquid level of the liquid-phase refrigerant may heave and rise due to the vibrations generated during vehicle travel, the traveling on slopes, and the like. Furthermore, when the refrigeration cycle is started (that is, when the compressor is started), the liquid level of the liquid-phase refrigerant may temporarily rise due to the

sudden boiling (which is also referred to as bumping) of the liquid-phase refrigerant. Accordingly, in the structure of the conventional accumulator, it is concerned that the liquid-phase refrigerant, which has been separated from the gas-phase refrigerant by the gas-liquid separator and has accumulated in the tank, may flow directly into the outer pipe together with the gas-phase refrigerant from its opening at the upper end (i.e., a gas-phase refrigerant suction port) to be consequently suctioned into the suction side of a compressor (such a phenomenon shall be hereinafter referred to as liquid backflow).

[0006] Furthermore, the liquid backflow may cause foreign matter, such as sludge and metal powder included in the liquid-phase refrigerant (hereinafter simply referred to as foreign matter), to be flowed into the compressor.

[0007] As a measure to prevent the foreign matter in the liquid-phase refrigerant from being flowed into the compressor caused by the aforementioned liquid backflow or to avoid the liquid backflow, Patent Literature 2, for example, proposes providing a liquid backflow prevention plate around the outlet pipe (or the outer pipe).

Citation List

Patent Literature

[0008]

Patent Literature 1: JP 2014-077606 A

Patent Literature 2: JP 2017-020670 A

Summary of Invention

Technical Problem

[0009] However, in the conventional technique disclosed in Patent Literature 2, the outlet pipe needs to be machined to provide the liquid backflow prevention plate, resulting in high machining costs. Furthermore, it is impossible to completely avoid the liquid backflow. As a result, it is also difficult to remove the foreign matter included in the flowed back liquid-phase refrigerant.

[0010] The present invention has been made in view of the foregoing, and it is an object of the present invention to provide an accumulator having a reliable and inexpensive configuration that can prevent foreign matter included in liquid-phase refrigerant from flowing into an outlet pipe for the refrigerant due to liquid backflow.

Solution to Problem

[0011] Accordingly, an accumulator in accordance with the present invention basically includes a tank having an inlet port and an outlet port, and an outlet pipe coupled at one end to the outlet port and having a gas-phase refrigerant suction port that is open in the tank, wherein the gas-phase refrigerant suction port is provided with a filter member.

[0012] The filter member may include a strainer having a mesh filter.

[0013] In some embodiments, the strainer is securely sandwiched between the outlet pipe and a gas-liquid separator disposed to face the inlet port.

[0014] In some other embodiments, the strainer is securely sandwiched between the outlet pipe and the tank.

[0015] The filter member may include a bag-like body or a tubular body made of a fabric with a water permeation property and a ventilation property.

[0016] In some embodiments, the bag-like body or the tubular body includes a desiccant housing portion that houses desiccants for absorbing and removing moisture in a refrigerant.

[0017] The filter member may include a bag-like body or a tubular body made of waterproof-breathable material.

[0018] In some embodiments, the bag-like body or the tubular body is sandwiched between the outlet pipe and a gas-liquid separator disposed to face the inlet port.

[0019] In some other embodiments, the bag-like body or the tubular body is sandwiched between the outlet pipe and the tank.

[0020] In some other embodiments, the outlet port is provided in a cap member of the tank, and the outlet pipe has a double-pipe structure of an inner pipe and an outer pipe, the inner pipe being coupled to the outlet port and extending downward, and the outer pipe being disposed on the outer periphery of the inner pipe.

[0021] In some other embodiments, the outlet port is provided in a cap member of the tank, and the outlet pipe is a U-shaped pipe coupled at one end to the outlet port.

[0022] In some other embodiments, the outlet port is provided in a bottom cap member of the tank, and the outlet pipe includes a straight pipe coupled to the outlet port and extending upward.

Advantageous Effects of Invention

[0023] In the accumulator in accordance with the present invention, the gas-phase refrigerant suction port of the outlet pipe is provided with a filter member. The filter member provided at the gas-phase refrigerant suction port traps foreign matter included in the liquid-phase refrigerant and thus can prevent the foreign matter from entering the outlet pipe for the refrigerant even when liquid backflow occurs due to a rise in the liquid level of the liquid-phase refrigerant, such as when the liquid-phase refrigerant is suctioned and the liquid level thereof rises, when the liquid level of the liquid-phase refrigerant heaves and rises due to the vibrations, the traveling on slopes, and the like, or when bumping of the liquid-phase refrigerant occurs and the liquid level thereof temporarily rises. Thus, the stable operation of the refrigeration cycle can be maintained.

Brief Description of Drawings

[0024]

- 5 Fig. 1A is a longitudinal sectional view of a first embodiment of the accumulator in accordance with the present invention.
- Fig. 1B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 1A.
- 10 Fig. 2A is an enlarged cross-sectional view of a main part of Fig. 1A.
- Fig. 2B is a cross-sectional view in the direction of the arrow V-V in Fig. 2A.
- Fig. 3A is a partially cutaway half-longitudinal sectional view of a second embodiment of the accumulator in accordance with the present invention.
- 15 Fig. 3B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 3A.
- Fig. 3C is a cross-sectional view in the direction of the arrow V-V in Fig. 3A.
- 20 Fig. 4A is a longitudinal sectional view of a third embodiment of the accumulator in accordance with the present invention.
- Fig. 4B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 4A.
- 25 Fig. 5A is a partially cutaway longitudinal sectional view of a fourth embodiment of the accumulator in accordance with the present invention.
- Fig. 5B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 5A.
- 30 Fig. 6A is a partially cutaway half-longitudinal sectional view of a fifth embodiment of the accumulator in accordance with the present invention.
- Fig. 6B is a partial side view of an upper end of an outlet pipe (i.e., a gas-phase refrigerant suction port) of the fifth embodiment of the accumulator in accordance with the present invention.
- 35 Fig. 6C is a view of a bag-like body as a filter member of the fifth embodiment of the accumulator in accordance with the present invention.
- Fig. 6D is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 6A.
- Fig. 7 is a longitudinal sectional view of a sixth embodiment of the accumulator in accordance with the present invention.

Description of Embodiments

[0025] Hereinafter, embodiments of the present invention will be described with reference to the drawings.

[First Embodiment]

[0026] Fig. 1A and Fig. 1B illustrate a first embodiment of the accumulator in accordance with the present invention. Fig. 1A is a longitudinal sectional view thereof. Fig. 1B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 1A.

[0027] An accumulator 1 of the embodiment illustrated in the drawings is used in the refrigeration cycle that forms a car air conditioner for vehicles, for example. The accumulator 1 includes a closed-bottomed cylindrical tank 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 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.

[0028] The cap member 12 has an inlet port 15 and a stepped outlet port 16 that are arranged side by side. The lower portion of the outlet port 16 includes a stepped portion formed inside of a downward protrusion 12a that protrudes downward in the cap member 12. On the lower face of the downward protrusion 12a, a gas-liquid separator 18, which is 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 10, is disposed such that the upper face of the gas-liquid separator 18 partially abuts the lower face of the downward protrusion 12a. The upper end of an outlet pipe 30 (described later) is coupled to the lower portion of the outlet port 16.

[0029] The outlet pipe 30 has a double-pipe structure of an inner pipe 31 and an outer pipe 32, the inner pipe 31 being fixed at its upper end 31a to the lower portion of the outlet port 16 through pipe expansion and extending downward, and the closed-bottomed outer pipe 32 being arranged on the outer periphery of the inner pipe 31. A gas-phase-refrigerant downward-feed flow channel 36 is formed between the outer pipe 32 and the inner pipe 31, and the upper end of the outer pipe 32 (i.e., a space between the upper end of the outer pipe 32 and the inner pipe 31) serves as a gas-phase refrigerant suction port 37.

[0030] More specifically, the upper end 31a of the inner pipe 31 (before pipe expansion) is inserted into the stepped portion inside of the downward protrusion 12a through a through-hole 39 provided in an upper strainer 40' (a base plate 42c thereof), which functions as a filter member (described later), at the gas-phase refrigerant suction port 37 of the outlet pipe 30 and also through a through-hole 19 provided in a ceiling face 18a of the gas-liquid separator 18, and then is expanded to be fixedly disposed. Accordingly, the gas-liquid separator 18 (the ceiling face 18a thereof) is locked between the downward protrusion 12a of the cap member 12 and the upper strainer 40', and the outlet pipe 30 (the inner pipe 31 thereof) is securely fixed to the cap member 12.

[0031] The lower end of the outer pipe 32 is fixedly fitted into an upper portion 42a with a stepped inner periphery of a case 42 of an oil strainer 40 (described later; hereinafter referred to as a lower strainer 40) 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

below the cap member 12 by a predetermined distance. 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.

[0032] As clearly seen in Fig. 1B in conjunction with Fig. 1A, the inner pipe 31 has a plurality of (three in the illustrated example) plate-like ribs 38 radially protruding along the longitudinal direction (i.e., the vertical direction) and at equiangular intervals. The outer pipe 32 is fixed outside of the plurality of plate-like ribs 38 in a press-fit manner. In this embodiment, each of the plate-like ribs 38 has a length from the lower end of the inner pipe 31 to a predetermined position of the outer pipe 32 in the vertical direction. However, the upper end of the plate-like rib 38 may extend beyond the upper end of the outer pipe 32 such that the upper end face of the plate-like rib 38 abuts the base plate 42c of the upper strainer 40'. Accordingly, a predetermined gap is formed between the inner pipe 31 and the outer pipe 32 to form the gas-phase-refrigerant downward-feed flow channel 36.

[0033] It should be noted that the plate-like ribs 38 may be provided on at least one of the inner pipe 31 or the outer pipe 32. For example, the plate-like ribs 38 may be disposed on the outer pipe 32 (the inner periphery thereof), and the inner pipe 31 may be fixedly inserted inside of the plate-like ribs 38 by press-fitting.

[0034] The inner pipe 31, the outer pipe 32, and the plate-like ribs 38 may be integrally formed by extrusion using synthetic resin material, aluminum material, or the like. That is, the double-pipe structure may be an integrally molded component made of aluminum extruded material, for example.

[0035] The lower strainer 40 is fixedly disposed on the bottom 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 as clearly seen in Fig. 2A and Fig. 2B. The mesh filter 45 is made of a metallic mesh or a mesh member of synthetic resin, for example.

[0036] The case 42 of the lower strainer 40 includes the upper portion 42a with a stepped inner periphery into which the lower end of the outer pipe 32 is securely fitted, the base plate 42c, four columnar portions 42b disposed upright on the outer periphery of the base plate 42c at equiangular intervals, and annular mesh end molded-in portions 42d, 42d each having a predetermined thickness and width and including the upper end and the lower end of the columnar portion 42b. The upper and lower mesh end molded-in portions 42d, 42d are integrally formed with the upper and lower ends of the mesh filter 45 through insert molding and thus sealing is achieved. The mesh filter 45 is also integrally formed with the columnar portions 42b at its portions corresponding to the columnar portions 42b through insert molding and thus sealing is achieved. That is, four windows 44 that are rectangular as seen in side view are defined between the four respective columnar portions 42b and the upper and lower mesh end molded-in portions 42d, 42d, and the mesh

filter 45 is stretched over the respective windows 44.

[0037] It should be noted that in the present embodiment, one side of the lower portion of the tank 10 has disposed thereon a bag 68 filled with desiccants M that absorb and remove the moisture in the refrigerant along the inner periphery of the tank 10. The bag 68 is made of a fabric, such as felt with a ventilation property, a water permeation property, and a desired shape retention property, and is filled with granular desiccants M almost entirely

[0038] In the present embodiment, in addition to the aforementioned configuration, the upper strainer 40' is provided at the gas-phase refrigerant suction port 37 of the outlet pipe 30 as a filter member capable of passing the gas-phase refrigerant but substantially blocking foreign matter in the liquid-phase refrigerant. More specifically, the upper strainer 40' having the same basic configuration as (but slightly longer in the vertical direction than) the lower strainer 40 disposed at the lower end of the outlet pipe 30 is provided at the upper end of the outer pipe 32 of the outlet pipe 30. It should be noted that portions of the upper strainer 40' corresponding to the portions of the lower strainer 40 are denoted by the same reference numerals.

[0039] The upper strainer 40' has in its base plate 42c the through-hole 39 through which the upper end 31a of the inner pipe 31 passes. With the base plate 42c placed on top, that is, with the upper strainer 40' placed vertically opposite to the lower strainer 40, the upper strainer 40' is externally fitted around and securely fixed to the upper portion of the inner pipe 31 and to the upper end of the outer pipe 32 in a press-fit manner and sandwiched between the upper end of the outer pipe 32 of the outlet pipe 30 and the gas-liquid separator 18.

[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 via the inlet port 15, and the introduced refrigerant collides with the gas-liquid separator 18 and is radially diffused to be separated into a liquid-phase refrigerant and a gas-phase refrigerant, as in the conventional art. The liquid-phase refrigerant (including oil) flows downward along the inner peripheral face of the tank 10 and accumulates in the lower space of the tank 10, while the gas-phase refrigerant passes through the mesh filter 45 of the upper strainer 40' provided above the outer pipe 32 so as to be suctioned to the suction side of the compressor via the gas-phase-refrigerant downward-feed flow channel 36 formed between the inner pipe 31 and the outer pipe 32 → the space inside of 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. The liquid-phase refrigerant including oil at the bottom 13 of the tank 10 is gradually absorbed into the gas-phase refrigerant

to be suctioned to the suction side of the compressor via the outlet pipe 30 and then passes through the mesh filter 45 of the lower strainer 40 → the oil return hole 35 → the space inside of 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 liquid-phase refrigerant passes through the mesh filter 45, foreign matter, such as sludge and metal powder, is trapped and thus is removed from the circulating refrigerant (including oil).

[0042] As described above, in the accumulator 1 in accordance with the present embodiment, the upper strainer 40' having the same basic configuration as the lower strainer 40, which is usually used, is provided at the gas-phase refrigerant suction port 37 of the outlet pipe 30 as a filter member. The upper strainer 40' (the mesh filter 45 thereof) can substantially trap the foreign matter in the liquid-phase refrigerant. Since the upper strainer 40' traps the foreign matter in the liquid-phase refrigerant, it is possible to prevent the foreign matter from entering the gas-phase refrigerant suction port 37 even when the liquid level of the liquid-phase refrigerant rises, such as when the liquid-phase refrigerant is suctioned and the liquid level thereof rises, when the liquid level of the liquid-phase refrigerant heaves and rises due to the vibrations, the traveling on slopes, and the like, or when bumping of the liquid-phase refrigerant occurs and the liquid level thereof temporarily rises. Thus, there is no concern that the accumulator 1 in accordance with the present embodiment would have an adverse effect on the compressor, or the service life of the refrigeration cycle would become shorter.

[0043] In addition, the function of the filter member (i.e., the upper strainer 40') can also reduce the amount of the liquid-phase refrigerant that flows into the outlet pipe 30 from the gas-phase refrigerant suction port 37 thereof (i.e., the amount of liquid backflow).

[Second Embodiment]

[0044] Fig. 3A to Fig. 3C illustrate a second embodiment of the accumulator in accordance with the present invention. Fig. 3A is a partially cutaway half-longitudinal sectional view thereof. Fig. 3B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 3A. Fig. 3C is a cross-sectional view in the direction of the arrow V-V in Fig. 3A. In an accumulator 2 of the second embodiment, portions corresponding to the same components of the accumulator 1 of the first embodiment are denoted by the same reference numerals, and the descriptions thereof will be omitted. The following embodiment mainly describes the differences therebetween.

[0045] The accumulator 2 in the embodiment illustrated in the drawings includes a cylindrical tank 10 made of metal, such as stainless steel or aluminum alloy, and having a ceiling portion 14, which has an open lower face. The open lower face of the tank 10 is hermetically closed by a bottom cap member 12 made of the same metal. It

should be noted that in the accumulator 2 of the present embodiment, the tank 10 and the like are disposed vertically opposite to those of the accumulator 1 of the first embodiment. For example, as illustrated, the bottom cap member 12 is located on the lower (bottom) side, and the ceiling portion 14 of the tank 10 is located on the upper (top) side.

[0046] The bottom cap member 12 includes an inlet port 15 and a stepped outlet port 16 that are arranged side by side such that the inlet port 15 and the outlet port 16 penetrate the bottom cap member 12 and are open at their top and bottom. Herein, the outlet port 16 is provided in the center of the bottom cap member 12 (i.e., on the center line O of the tank 10), and the inlet port 15 is provided on the left side thereof.

[0047] The outlet port 16 is provided with an outlet pipe 30 made of a straight pipe (i.e., a linear pipe arranged along the center line) and extending continuously from the outlet port 16 for guiding a gas-phase refrigerant from the upper portion of the tank 10 to the outlet port 16. An opening on the upper end side (i.e., a gas-phase refrigerant suction port 37) of the outlet pipe 30 is located slightly below the ceiling portion 14 of the tank 10. The outlet pipe 30 may be either integrally formed with the bottom cap member 12 or be formed separately from the bottom cap member 12 but then attached thereto through swaging or the like.

[0048] The upper face side of the bottom cap member 12 has, in its center portion (which includes the outlet port 16 in the center), an inner fit-in coupling portion 19 in a short cylindrical shape that has an external thread portion to which an internal unit 20 (described below) is adapted to be screwed so that the internal unit 20 and the bottom cap member 12 are coupled together.

[0049] The internal unit 20 is disposed inside of the tank 10. The internal unit 20 is made of synthetic resin, for example, and includes in its lower portion a gas-liquid separation accelerating plate 22 in an annular disk shape. The gas-liquid separation accelerating plate 22 radially diffuses a refrigerant that has flowed into the tank 10 via the inlet port 15 and collided with the gas-liquid separation accelerating plate 22. The gas-liquid separation accelerating plate 22 has an annular disk shape with its outside diameter slightly smaller than the inside diameter of the tank 10 and with its inside diameter approximately equal to the inside diameter of a lower strainer 40 (described later) so that the refrigerant that has collided with the gas-liquid separation accelerating plate 22 and diffused can flow upward through a gap between the inner peripheral face of the tank 10 and the outer peripheral face of the gas-liquid separation accelerating plate 22. The gas-liquid separation accelerating plate 22 is located above the upper face of the bottom cap member 12 (or the inlet port 15 therein) by a predetermined distance so that the lower face of the gas-liquid separation accelerating plate 22 is opposite the inlet port 15.

[0050] The lower face side of the gas-liquid separation accelerating plate 22 has in its center an outer fit-in cou-

pling portion 29 in a short cylindrical shape that protrudes downward and has an internal thread portion adapted to be screwed to the external thread portion of the inner fit-in coupling portion 19 provided on the bottom cap member 12. Accordingly, the bottom cap member 12 and the internal unit 20 can be coupled together through screwing, thus facilitating the assembly.

[0051] The upper face side of the gas-liquid separation accelerating plate 22 has in its center a lower strainer 40 that surrounds the lower end of the outlet pipe 30, and four reinforcing upright plates 23 disposed upright on the outer periphery of the upper face side of the gas-liquid separation accelerating plate 22 at equiangular intervals (that is, at intervals of 90°). The outer peripheries of the reinforcing upright plates 23 abut the inner periphery of the tank 10. In the example illustrated in the drawings, the reinforcing upright plates 23 are disposed on the front, rear, right, and left on the outer periphery of the upper face side of the gas-liquid separation accelerating plate 22, and one of the reinforcing upright plates 23 is arranged such that it is directly above the inlet port 15 provided in the bottom cap member 12.

[0052] A bobbin-shaped bag holding portion 24, which has a long cylindrical portion 27 with a slightly smaller diameter than those of the outlet port 16 and the lower strainer 40, and is adapted to have the outlet pipe 30 inserted therein, is integrally formed above the lower strainer 40 and on the inner peripheral side of the reinforcing upright plates 23. The bobbin-shaped bag holding portion 24 is obtained by winding a bag 69, which contains desiccants M, in a cylindrical shape or in a C-shape as seen in plan view around the long cylindrical portion 27, and further winding a cable tie 28 around the outer periphery of the bag 69 so as to securely hold it. In such a case, the upper and lower ends of the bag 69 held are slightly pressed against a pair of upper and lower flanges 25a and 25b of the bag holding portion 24, respectively. It should be noted that the bag 69 housed in the bag holding portion 24 is made of a fabric, such as felt with a ventilation property, a water permeation property, and a desired shape retention property, and is filled with granular desiccants M almost entirely. Herein, the bag 69 has a height of about half to 2/3 of that of the tank 10.

[0053] Meanwhile, the lower strainer 40 is integrally formed with the upper side of the gas-liquid separation accelerating plate 22. The lower strainer 40 basically has substantially the same configurations as that of the first embodiment (the corresponding portions are denoted by the same reference numerals), and includes a cylindrical mesh filter 45 and a case 42 to which the mesh filter 45 is securely attached. The mesh filter 45 is made of a metallic mesh or a mesh member of synthetic resin, for example. The case 42 includes upper and lower annular disk portions and inner peripheral edges (four portions) of the reinforcing upright plates 23 located therebetween. That is, four windows 44 that are rectangular as seen in side view are defined between the four respective columnar portions (i.e., the inner peripheral edges of the rein-

forcing upright plates 23) 42b, and the mesh filter 45 is stretched over the respective windows 44. It should be noted that the mesh filter 45 may be integrally formed with the case 42 (i.e., the internal unit 20) through insert molding when the case 42 is molded.

[0054] An oil return hole 35 is provided near the lower end of the outlet pipe 30, which is integrally molded with the bottom cap member 12 or provided in an integral manner with the bottom cap member 12 through swaging or the like. The diameter of the oil return hole 35 is set to about 1 mm, for example.

[0055] In the present embodiment, in addition to the aforementioned configuration, an upper strainer 40' having the same basic configuration as that of the first embodiment is provided at the upper end of the outlet pipe 30, that is, the gas-phase refrigerant suction port 37 of the outlet pipe 30, as a filter member capable of passing the gas-phase refrigerant but substantially blocking foreign matter in the liquid-phase refrigerant. More specifically, the upper strainer 40' is securely sandwiched between the upper end of the outlet pipe 30 and the ceiling portion 14 of the tank 10. With the base plate 42c allowed to abut or be pressure-pressed to the ceiling portion 14, that is, with the upper strainer 40' placed vertically opposite to the lower strainer 40, the upper strainer 40' is externally fitted around and securely fixed to the upper end of the outlet pipe 30 (i.e., the gas-phase refrigerant suction port 37).

[0056] 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 upward into the tank 10 via the inlet port 15 so that the introduced refrigerant is diffused radially while accumulating on the lower face of the gas-liquid separation accelerating plate 22, and the diffused refrigerant moves upward through a gap between the inner peripheral face of the tank 10 and the outer peripheral face of the gas-liquid separation accelerating plate 22. Accordingly, the refrigerant is rectified and effectively separated into a liquid-phase refrigerant and a gas-phase refrigerant. In such a case, the liquid-phase refrigerant (including oil) accumulates in the lower space of the tank 10, and the gas-phase refrigerant rises toward the upper space of the tank 10 so as to be suctioned to the suction side of the compressor via the upper space of the tank 10 → the mesh filter 45 of the upper strainer 40' → the space inside of the outlet pipe 30 → the outlet port 16 so as to be circulated.

[0057] Oil that has accumulated in the lower space of the tank 10 together with the liquid-phase refrigerant moves toward the bottom cap member 12 of the tank 10 due to the difference in specific gravity, properties, and the like between the oil and the liquid-phase refrigerant, and the liquid-phase refrigerant is absorbed into the gas-phase refrigerant to be suctioned to the suction side of the compressor via the outlet pipe 30. Then, the liquid-phase refrigerant passes through the mesh filter 45 of the lower strainer 40 → the oil return hole 35 and thus is returned to the suction side of the compressor together

with the gas-phase refrigerant so as to be circulated. When the liquid-phase refrigerant passes through the mesh filter 45, foreign matter, such as sludge and metal powder, is trapped and thus is removed from the circulating refrigerant (including oil).

[0058] As described above, in the accumulator 2 of the present embodiment, a refrigerant in a gas-liquid mixed state is introduced upward into the tank 10 via the inlet port 15 provided in the lower portion of the tank 10 so that the introduced refrigerant is diffused radially while accumulating on the lower face side of the gas-liquid separation accelerating plate 22, and the diffused refrigerant moves upward through a gap between the inner peripheral face of the tank 10 and the outer peripheral face of the gas-liquid separation accelerating plate 22. Thus, gas-liquid separation is accelerated. In addition, the liquid-phase refrigerant is agitated because the gas-phase refrigerant rises through the liquid, in particular, above the gas-liquid separation accelerating plate 22. Therefore, a bumping phenomenon in which the liquid-phase refrigerant suddenly boils explosively when the compressor is started and impact noise associated therewith can be suppressed.

[0059] In such a case, it is basically acceptable as long as the inlet port 15 is disposed in the lower portion of the tank 10, and the gas-liquid separation accelerating plate 22 is disposed above the inlet port 15 inside of the tank 10. Therefore, the configuration of the accumulator 2 can be simplified, and the cost and size can be reduced.

[0060] In addition to the above, also in the accumulator 2 of the present embodiment, the upper strainer 40' having the same basic configuration as the lower strainer 40, which is usually used, is provided at the gas-phase refrigerant suction port 37 of the outlet pipe 30 as a filter member. The upper strainer 40' (the mesh filter 45 thereof) can substantially trap the foreign matter in the liquid-phase refrigerant. Since the upper strainer 40' traps the foreign matter in the liquid-phase refrigerant, it is possible to prevent the foreign matter from entering the gas-phase refrigerant suction port 37 even when the liquid level of the liquid-phase refrigerant rises, such as when the liquid-phase refrigerant is suctioned and the liquid level thereof rises, when the liquid level of the liquid-phase refrigerant heaves and rises due to the vibrations, the traveling on slopes, and the like, or when bumping of the liquid-phase refrigerant occurs and the liquid level thereof temporarily rises. Thus, there is no concern that the accumulator 2 in accordance with the present embodiment would have an adverse effect on the compressor, or the service life of the refrigeration cycle would become shorter.

[0061] In addition, the function of the filter member (i.e., the upper strainer 40') can also reduce the amount of the liquid-phase refrigerant that flows into the outlet pipe 30 from the gas-phase refrigerant suction port 37 thereof (i.e., the amount of liquid backflow).

[Third Embodiment]

[0062] Fig. 4A and Fig. 4B illustrate a third embodiment of the accumulator in accordance with the present invention. Fig. 4A is a longitudinal sectional view thereof. Fig. 4B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 4A. In an accumulator 3 of the third embodiment, portions corresponding to the same components of the accumulator 1 of the first embodiment are denoted by the same reference numerals, and the descriptions thereof will be omitted. The following embodiment mainly describes the differences therebetween.

[0063] The accumulator 3 of the embodiment illustrated in the drawings includes a U-shaped pipe made of metal, such as aluminum, stainless steel, or copper, as an outlet pipe 60. A gas-liquid separator 18, which is in the shape of a conical hat or an inverted wide bowl that has a smaller diameter than the inside diameter of the tank 10, is externally fitted around one end 61 of the U-shaped outlet pipe 60, which is coupled to the lower portion of the outlet port 16, and also, an annular protrusion 61f, which has been obtained through compression bending, such as bulge forming, is provided at the one end 61 of the U-shaped outlet pipe 60. The one end 61 of the U-shaped outlet pipe 60 is provided at its upper end with a purification strainer 65 made of, for example, stainless steel and having a hemispherical mesh filter 66 with a flanged portion 65a.

[0064] To attach the gas-liquid separator 18 and the outlet pipe 60 to the cap member 12, the portion of the outlet pipe 60 above the annular protrusion 61f of the one end 61 is passed through the through-hole 19 provided in the ceiling face 18a of the gas-liquid separator 18, and the purification strainer 65 is disposed at the upper end of the one end 61 using the flanged portion 65a and is then fixed to the downward protrusion 12a of the outlet port 16 from the lower side in a press-fit manner, such that the annular protrusion 61f is pushed up by the gas-liquid separator 18 (the ceiling face 18a thereof). At the same time, the flanged portion 65a of the mesh filter 66 of the purification strainer 65 is sandwiched between the one end 61 of the outlet pipe 60 and the stepped portion on the downward protrusion 12a.

[0065] In such a case, a plurality of (for example, four at intervals of 90°) rod-like portions protrudes downward on the lower face side of the downward protrusion 12a, and the same number of round holes (for example, four at intervals of 90°) through which the rod-like portions may be passed are formed in the ceiling face 18a of the gas-liquid separator 18.

[0066] To securely attach the gas-liquid separator 18 and the outlet pipe 60 to the cap member 12, the rod-like portions are individually passed through the respective round holes and then are melted and flattened using an ultrasonic welder, for example, so as to be riveted (a riveted flattened portion 64).

[0067] The U-shaped outlet pipe 60 has an oil return hole 63 at the bottom end thereof.

[0068] Meanwhile, the other end (i.e., an upward facing opening) 62 of the U-shaped outlet pipe 60 serves as a gas-phase refrigerant suction port 67, which is provided with an upper strainer 40' having the same basic configuration as that of the first embodiment as a filter member capable of passing the gas-phase refrigerant but substantially blocking the liquid-phase refrigerant. More specifically, the upper strainer 40' is securely sandwiched between the upper end of the other end 62 of the outlet pipe 60 and the ceiling face 18a of the gas-liquid separator 18. With the base plate 42c allowed to abut or be pressure-pressed to the ceiling face 18a of the gas-liquid separator 18, the upper strainer 40' is externally fitted around and securely fixed to the other end 62 of the outlet pipe 60 (i.e., the gas-phase refrigerant suction port 67).

[0069] In the accumulator 3 with such a configuration, as in the conventional art, a low-temperature, low-pressure refrigerant in a gas-liquid mixed state from an evaporator is introduced via the inlet port 15 so that the introduced refrigerant collides with the gas-liquid separator 18 and then is radially diffused to be separated into a liquid-phase refrigerant and a gas-phase refrigerant. The liquid-phase refrigerant (including oil) flows downward along the inner peripheral face of the tank 10 and accumulates in the lower space of the tank 10, and the gas-phase refrigerant passes through the upper strainer 40' (the mesh filter 45 thereof) provided at the other end 62 of the outlet pipe 60 so as to be suctioned to the suction side of the compressor via the space inside of the outlet pipe 60 → the purification strainer 65 (the mesh filter 66 thereof) so as to be circulated.

[0070] 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. The liquid-phase refrigerant including oil at the bottom 13 of the tank 10 is gradually absorbed into the gas-phase refrigerant to be suctioned to the suction side of the compressor via the outlet pipe 60. Then, the liquid-phase refrigerant passes through the oil return hole 63 → the space inside of the outlet pipe 60 → the purification strainer 65 and thus is returned to the suction side of the compressor together with the gas-phase refrigerant so as to be circulated. When the liquid-phase refrigerant passes through the purification strainer 65, foreign matter, such as sludge and metal powder, is trapped and thus is removed from the circulating refrigerant (including oil).

[0071] Also in the accumulator 3 of the present embodiment with such a configuration, the upper strainer 40' is provided at the gas-phase refrigerant suction port 67 of the outlet pipe 60 as a filter member. The upper strainer 40' (the mesh filter 45 thereof) can substantially trap the foreign matter in the liquid-phase refrigerant. Since the upper strainer 40' traps the foreign matter in the liquid-phase refrigerant, it is possible to prevent the foreign matter from entering the compressor even when the liquid level of the liquid-phase refrigerant rises, such

as when the liquid-phase refrigerant is suctioned and the liquid level thereof rises, when the liquid level of the liquid-phase refrigerant heaves and rises due to the vibrations, the traveling on slopes, and the like, or when bumping of the liquid-phase refrigerant occurs and the liquid level thereof temporarily rises. Thus, there is no concern that the accumulator 3 in accordance with the present embodiment would have an adverse effect on the compressor, or the service life of the refrigeration cycle would become shorter.

[0072] In addition, the function of the filter member (i.e., the upper strainer 40') can also reduce the amount of the liquid-phase refrigerant that flows into the outlet pipe 60 from the gas-phase refrigerant suction port 67 thereof (i.e., the amount of liquid backflow).

[Fourth Embodiment]

[0073] Fig. 5A and Fig. 5B illustrate a fourth embodiment of the accumulator in accordance with the present invention. Fig. 5A is a partially cutaway longitudinal sectional view thereof. Fig. 5B is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 5A. In an accumulator 4 of the fourth embodiment, portions corresponding to the same components of the accumulator 1 of the first embodiment are denoted by the same reference numerals, and the descriptions thereof will be omitted. The following embodiment mainly describes the differences therebetween.

[0074] As clearly seen in Fig. 5B in conjunction with Fig. 5A, the inner pipe 31 of the accumulator 4 of the present embodiment has a plurality of (three in the illustrated example) plate-like ribs 38 radially disposed along the longitudinal direction (i.e., the vertical direction) and at equiangular intervals. The outer pipe 32 is externally arranged around and fixed outside of the plurality of plate-like ribs 38 in a press-fit manner. In this embodiment, the upper end of the plate-like rib 38 may extend beyond the upper end of the outer pipe 32 such that the upper end face of the plate-like rib 38 may abut the ceiling face 18a of the gas-liquid separator 18.

[0075] In this embodiment, the lower end of the outer pipe 32 is funnel shaped and narrowed by spinning and the like, and has in its center an oil return hole 35.

[0076] In addition to the aforementioned configuration, the accumulator 4 of the present embodiment includes, instead of the lower strainer 40 and the upper strainer 40' of the first embodiment, a fabric body 70, which is made of felt and the like, covers the entire outer periphery of the outer pipe 32, and has a length from the ceiling face 18a of the gas-liquid separator 18 to the bottom face of the bottom 13 of the tank 10. The fabric body 70 is wound around or externally arranged around the outer pipe 32. The fabric body 70 includes a tubular pipe fitting portion 72 to be externally and securely arranged around the outer periphery of the outer pipe 32, and a cylindrical desiccant housing portion 75 with a closed top and bottom that houses desiccants M for absorbing and remov-

ing the moisture in the refrigerant.

[0077] The pipe fitting portion 72 is adapted to maintain its substantially cylindrical shape. A bag-like body or a tubular body in the lower portion of the pipe fitting portion 72 (the portion covering the surrounding of the oil return hole 35) serves as the lower strainer 40 of the first embodiment.

[0078] That is, since the fabric body 70 made of felt and the like has a water permeation property, a ventilation property, and a shape retention property, the lower portion of the pipe fitting portion 72 can serve as the lower strainer 40.

[0079] Meanwhile, a bag-like body or a tubular body (which is located above the upper end of the outer pipe 32) in the upper portion of the pipe fitting portion 72 can serve as the upper strainer 40' of the first embodiment.

[0080] That is, a low-temperature, low-pressure refrigerant in a gas-liquid mixed state from an evaporator is introduced via the inlet port 15 so that the introduced refrigerant collides with the gas-liquid separator 18 and then is radially diffused to be separated into a liquid-phase refrigerant and a gas-phase refrigerant. The liquid-phase refrigerant (including oil) flows downward along the inner peripheral face of the tank 10 and accumulates in the lower space of the tank 10, and the gas-phase refrigerant passes through the upper portion (i.e., the bag-like body or the tubular body) of the pipe fitting portion 72, which surrounds the gas-phase refrigerant suction port 37 of the outlet pipe 30, so as to be suctioned to the suction side of the compressor via the gas-phase-refrigerant downward-feed flow channel 36 formed between the inner pipe 31 and the outer pipe 32 → the space inside of the inner pipe 31 so as to be circulated.

[0081] 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. The liquid-phase refrigerant including oil at the bottom 13 of the tank 10 is gradually absorbed into the gas-phase refrigerant to be suctioned to the suction side of the compressor via the outlet pipe 30 and then passes through the lower portion of the pipe fitting portion 72 including the fabric body 70 made of felt and the like → the oil return hole 35 → the space inside of 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 liquid-phase refrigerant passes through the lower portion of the pipe fitting portion 72, foreign matter, such as sludge and metal powder, is trapped and thus is removed from the circulating refrigerant (including oil).

[0082] Herein, since the fabric body 70 made of felt and the like has a ventilation property and a water permeation property, as long as the fabric body 70 is provided with the desiccant housing portion 75 that houses desiccants M for absorbing and removing the moisture in the refrigerant in addition to the pipe fitting portion 72 as in the present embodiment and because the desiccant

housing portion 75 serves as a bag, there is no need to separately prepare a bag or fixing means (e.g., a cable tie), thus further increasing cost effectiveness.

[0083] It should be noted that foamed material may be used instead of the fabric body 70. Examples of the foamed material include commercially available material such as synthetic resin, rubber, and ceramic.

[0084] In the accumulator 4 of the present embodiment, the fabric body 70, which is wound around or externally arranged around the outer periphery of the outer pipe 32, serves as a boiling stone. That is, when the compressor is activated, the fabric body 70 (i.e., a gas therein) serves as the starting point for boiling and evaporation of the liquid-phase refrigerant, and reaches a state where bubbles gradually form, that is, a state where the liquid-phase refrigerant gradually evaporates. Thus, the boiling of the liquid-phase refrigerant slowly proceeds, and consequently, a bumping phenomenon in which the liquid-phase refrigerant suddenly boils explosively and impact noise associated therewith may be effectively suppressed.

[0085] In such a case, the accumulator 4 of the present embodiment only needs to have added thereto a simple configuration of winding or externally arranging the fabric body 70 around the outer periphery of the outer pipe 32. This simple configuration would not lead to complexity and the cost and size increase, for example, thereby achieving excellent cost effectiveness.

[0086] In addition to the above, in the accumulator 4 of the present embodiment, the pipe fitting portion 72 of the fabric body 70 (upper and lower bag-like bodies or tubular bodies thereof) serves also as the lower strainer 40 and the upper strainer 40'. Since the pipe fitting portion 72 of the fabric body 70 traps the foreign matter in the liquid-phase refrigerant, it is possible to prevent the foreign matter from entering the gas-phase refrigerant suction port 37 even when the liquid level of the liquid-phase refrigerant rises, such as when the liquid-phase refrigerant is suctioned and the liquid level thereof rises, when the liquid level of the liquid-phase refrigerant heaves and rises due to the vibrations, the traveling on slopes, and the like, or when bumping of the liquid-phase refrigerant occurs and the liquid level thereof temporarily rises, as in the aforementioned embodiments. In addition, as in the aforementioned embodiments, the accumulator 4 in accordance with the present embodiment can have a reduced amount of liquid backflow.

[Fifth Embodiment]

[0087] Fig. 6A to Fig. 6D illustrate a fifth embodiment of the accumulator in accordance with the present invention. Fig. 6A is a partially cutaway half-longitudinal sectional view thereof. Fig. 6B is a partial side view of an upper end of an outlet pipe (i.e., a gas-phase refrigerant suction port). Fig. 6C is a view of a bag-like body as a filter member. Fig. 6D is an enlarged cross-sectional view in the direction of the arrow U-U in Fig. 6A. In an accu-

mulator 5 of the fifth embodiment, portions corresponding to the same components of the accumulator 2 of the second embodiment are denoted by the same reference numerals, and the descriptions thereof will be omitted. The following embodiment mainly describes the differences therebetween.

[0088] The accumulator 5 of the embodiment illustrated in the drawings is different from the accumulator 2 of the second embodiment in that, as illustrated in Fig. 6B and Fig. 6D, four cutouts 30s that are substantially rectangular as seen in side view are arranged at the upper end of the outlet pipe 30 at equiangular intervals as a gas-phase refrigerant suction port 37, and as a filter member, a bag-like body (or a tubular body) 80 as illustrated in Fig. 6C is provided instead of the upper strainer 40'. The bag-like body 80, which is made of fabric waterproof-breathable material, such as GORE-TEX (registered trademark), and woven into a bag shape (or a tubular shape), covers the upper end of the outlet pipe 30 over all of the cutouts 30s and the upper-face opening of the outlet pipe 30. The upper face of the bag-like body 80 presses against the ceiling portion 14 of the tank 10. That is, the bag-like body 80 is sandwiched between the upper end of the outlet pipe 30 and the ceiling portion 14 of the tank 10.

[0089] As described above, since the bag-like body (or the tubular body) 80 made of waterproof-breathable material, as a filter member, covers the outlet pipe 30 made of a straight pipe over all of the cutouts 30s and the upper-face opening of the outlet pipe 30, it is possible to prevent the foreign matter from entering the gas-phase refrigerant suction port 37 and reduce the amount of liquid backflow as in the aforementioned embodiments.

[0090] In particular, since the present embodiment simply uses the bag-like body 80 for covering the outlet pipe 30, cost for the components can be significantly low, and assembling procedures can be simplified.

[Sixth Embodiment]

[0091] Fig. 7 is a longitudinal sectional view of a sixth embodiment of the accumulator in accordance with the present invention. In an accumulator 6 of the sixth embodiment, portions corresponding to the same components of the accumulator 3 of the third embodiment are denoted by the same reference numerals, and the descriptions thereof will be omitted. The following embodiment mainly describes the differences therebetween.

[0092] The accumulator 6 of the embodiment illustrated in the drawing is different from the accumulator 3 of the third embodiment in that, four cutouts 60s that are substantially rectangular as seen in side view are arranged at the other end 62 of the outlet pipe 60 at equiangular intervals as a gas-phase refrigerant suction port 67 as in the fifth embodiment, and a bag-like body (or a tubular body) 80 having the same configuration as that of the fifth embodiment is provided as a filter member, instead of the upper strainer 40'. The bag-like body 80,

which is made of fabric waterproof-breathable material, such as GORE-TEX (registered trademark), and woven into a bag shape (or a tubular shape), covers the other end 62 of the outlet pipe 60 over all of the cutouts 60s and the upper-face opening of the outlet pipe 60. The upper face of the bag-like body 80 presses against the ceiling face 18a of the gas-liquid separator 18. That is, the bag-like body 80 is sandwiched between the other end 62 of the outlet pipe 60 and the ceiling face 18a of the gas-liquid separator 18.

[0093] As described above, since the bag-like body (or the tubular body) 80 made of waterproof-breathable material, as a filter member, covers the outlet pipe 60 made of a U-shaped pipe over all of the cutouts 60s and the upper-face opening of the outlet pipe 60, it is possible to trap the foreign matter in the liquid-phase refrigerant, prevent the foreign matter from entering the gas-phase refrigerant suction port 67, and reduce the amount of liquid backflow as in the aforementioned embodiments.

[0094] In particular, since the present embodiment simply uses the bag-like body 80 for covering the outlet pipe 60, cost for the components can be significantly low, and assembling procedures can be simplified.

[0095] It should be noted that the filter member may be other than the upper strainer 40' including a mesh filter, the pipe fitting portion 72 made of a fabric, such as felt with a water permeation property and a ventilation property, the bag-like body 80 made of waterproof-breathable material such as GORE-TEX (registered trademark) as adopted in the aforementioned embodiments, for example. Needless to say, various modifications may be applied to the configurations thereof. It is also needless to say that the configuration of the outlet pipe may be other than the double-pipe structure, the straight pipe, and the U-shaped pipe.

Reference Signs List

[0096]

- 1 Accumulator (First Embodiment)
- 2 Accumulator (Second Embodiment)
- 3 Accumulator (Third Embodiment)
- 4 Accumulator (Fourth Embodiment)
- 5 Accumulator (Fifth Embodiment)
- 6 Accumulator (Sixth Embodiment)
- 10 Tank
- 12 Cap member, bottom cap member
- 13 Bottom
- 14 Ceiling portion
- 15 Inlet port
- 16 Outlet port
- 18 Gas-liquid separator
- 19 Through-hole
- 30 Outlet pipe
- 31 Inner pipe
- 32 Outer pipe
- 35 Oil return hole

- 36 Gas-phase-refrigerant downward-feed flow channel
- 37 Gas-phase refrigerant suction port
- 38 Plate-like rib
- 5 40 Oil strainer (lower strainer)
- 42 Case
- 45 Mesh filter
- 40' Upper strainer (filter member)
- 60 Outlet pipe
- 10 63 Oil return hole
- 65 Purification strainer
- 66 Mesh filter
- 67 Gas-phase refrigerant suction port
- 68 Bag
- 15 69 Bag
- 70 Fabric body
- 72 Pipe fitting portion (filter member)
- 75 Desiccant housing portion
- 80 Bag-like body (filter member)

Claims

1. An accumulator comprising:

a tank having an inlet port and an outlet port; and an outlet pipe coupled at one end to the outlet port and having a gas-phase refrigerant suction port that is open in the tank, wherein the gas-phase refrigerant suction port is provided with a filter member.

2. The accumulator according to claim 1, wherein the filter member includes a strainer having a mesh filter.

3. The accumulator according to claim 2, wherein the strainer is securely sandwiched between the outlet pipe and a gas-liquid separator disposed to face the inlet port.

4. The accumulator according to claim 2, wherein the strainer is securely sandwiched between the outlet pipe and the tank.

5. The accumulator according to claim 1, wherein the filter member includes a bag-like body or a tubular body made of a fabric with a water permeation property and a ventilation property.

6. The accumulator according to claim 5, wherein the bag-like body or the tubular body includes a desiccant housing portion that houses desiccants for absorbing and removing moisture in a refrigerant.

7. The accumulator according to claim 1, wherein the filter member includes a bag-like body or a tubular body made of waterproof-breathable material.

8. The accumulator according to claim 7, wherein the bag-like body or the tubular body is sandwiched between the outlet pipe and a gas-liquid separator disposed to face the inlet port. 5
9. The accumulator according to claim 7, wherein the bag-like body or the tubular body is sandwiched between the outlet pipe and the tank.
10. The accumulator according to any one of claims 1 to 9, wherein the outlet port is provided in a cap member of the tank, and the outlet pipe has a double-pipe structure of an inner pipe and an outer pipe, the inner pipe being coupled to the outlet port and extending downward, and the outer pipe being disposed on an outer periphery of the inner pipe. 10 15
11. The accumulator according to any one of claims 1 to 9, wherein the outlet port is provided in a cap member of the tank, and the outlet pipe is a U-shaped pipe coupled at one end to the outlet port. 20 25
12. The accumulator according to any one of claims 1 to 9, wherein the outlet port is provided in a bottom cap member of the tank, and the outlet pipe includes a straight pipe coupled to the outlet port and extending upward. 30

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Fig. 1A

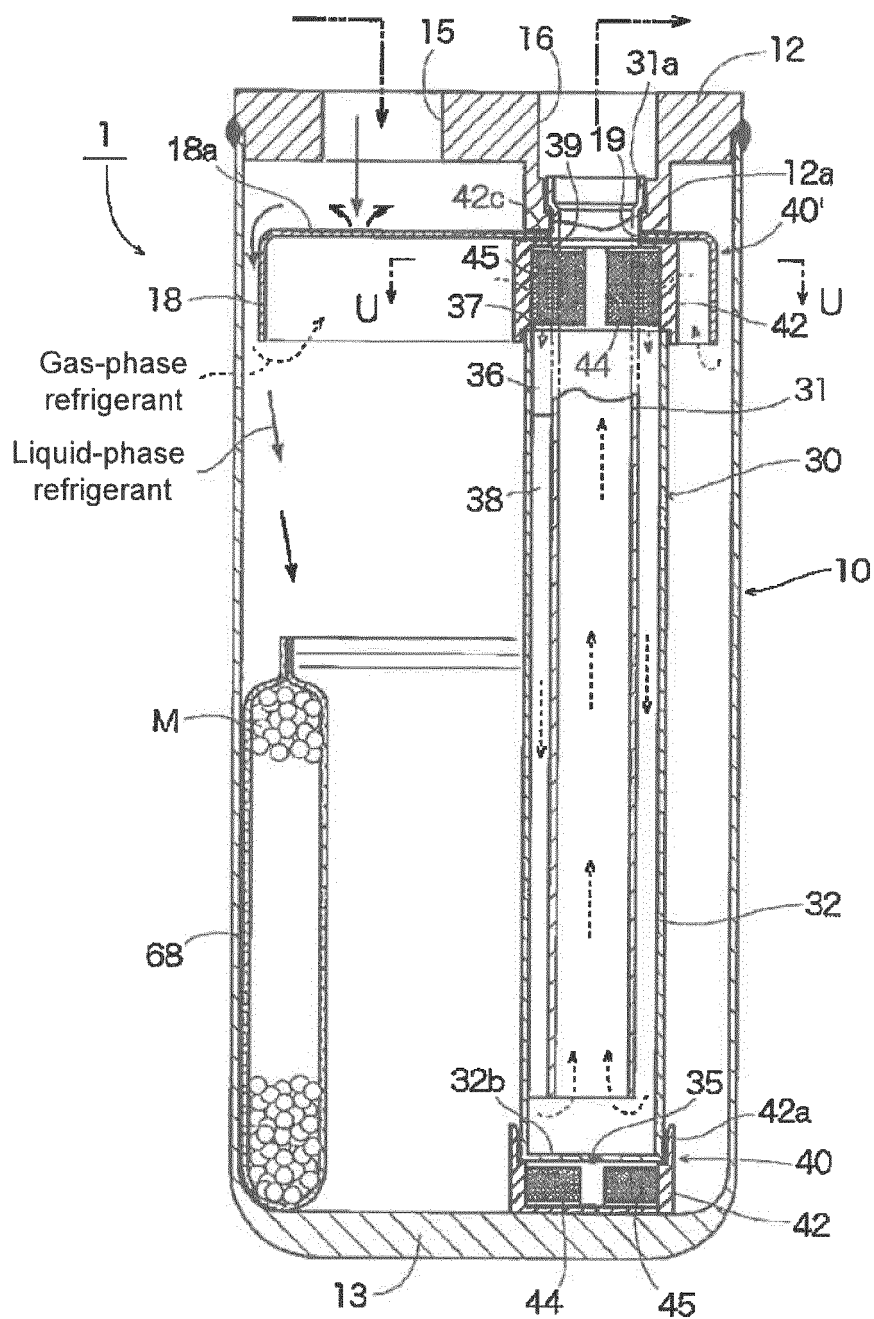


Fig. 1B

U-U Enlarged Cross-Section

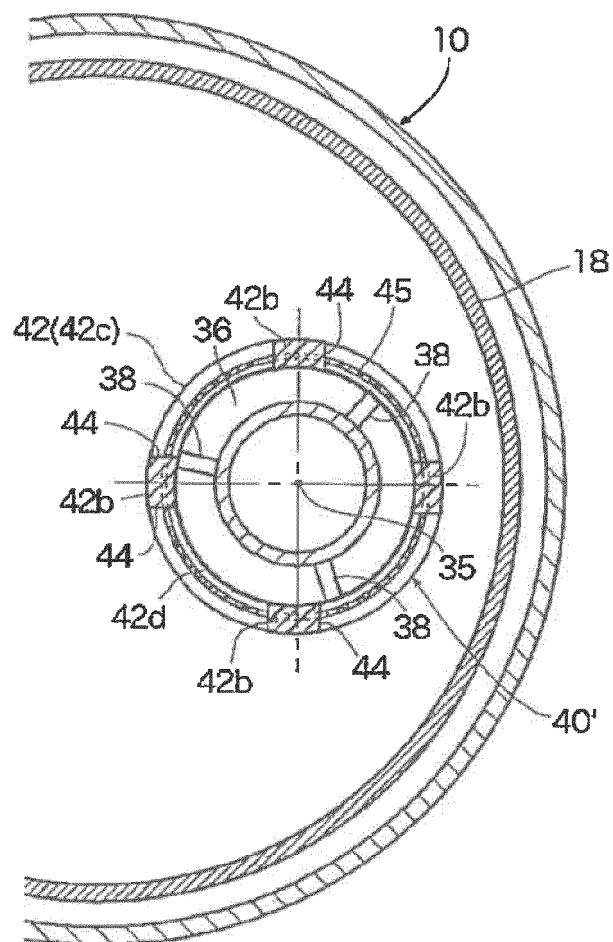


Fig. 2A

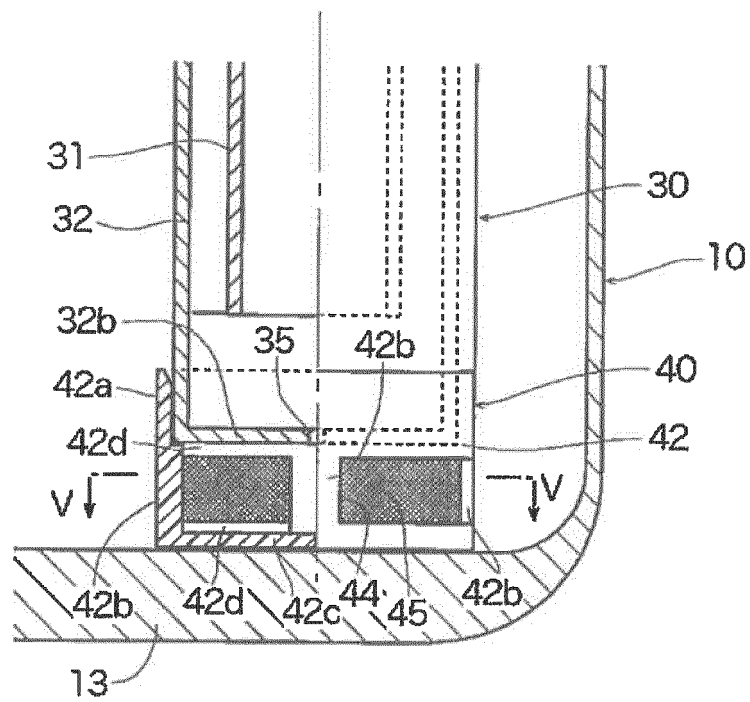


Fig. 2B

V-V Cross-Section

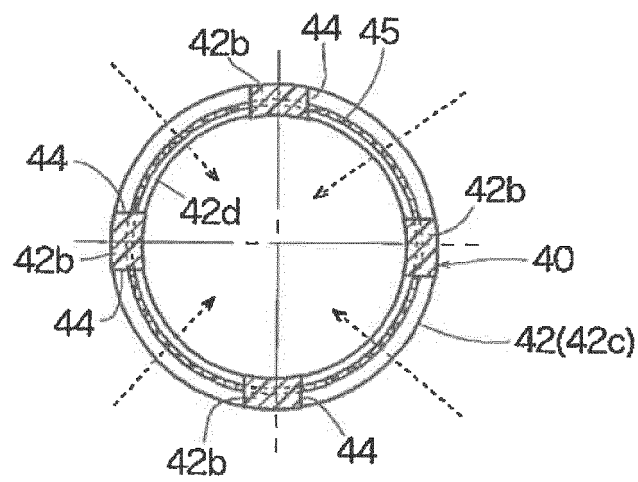


Fig. 3A

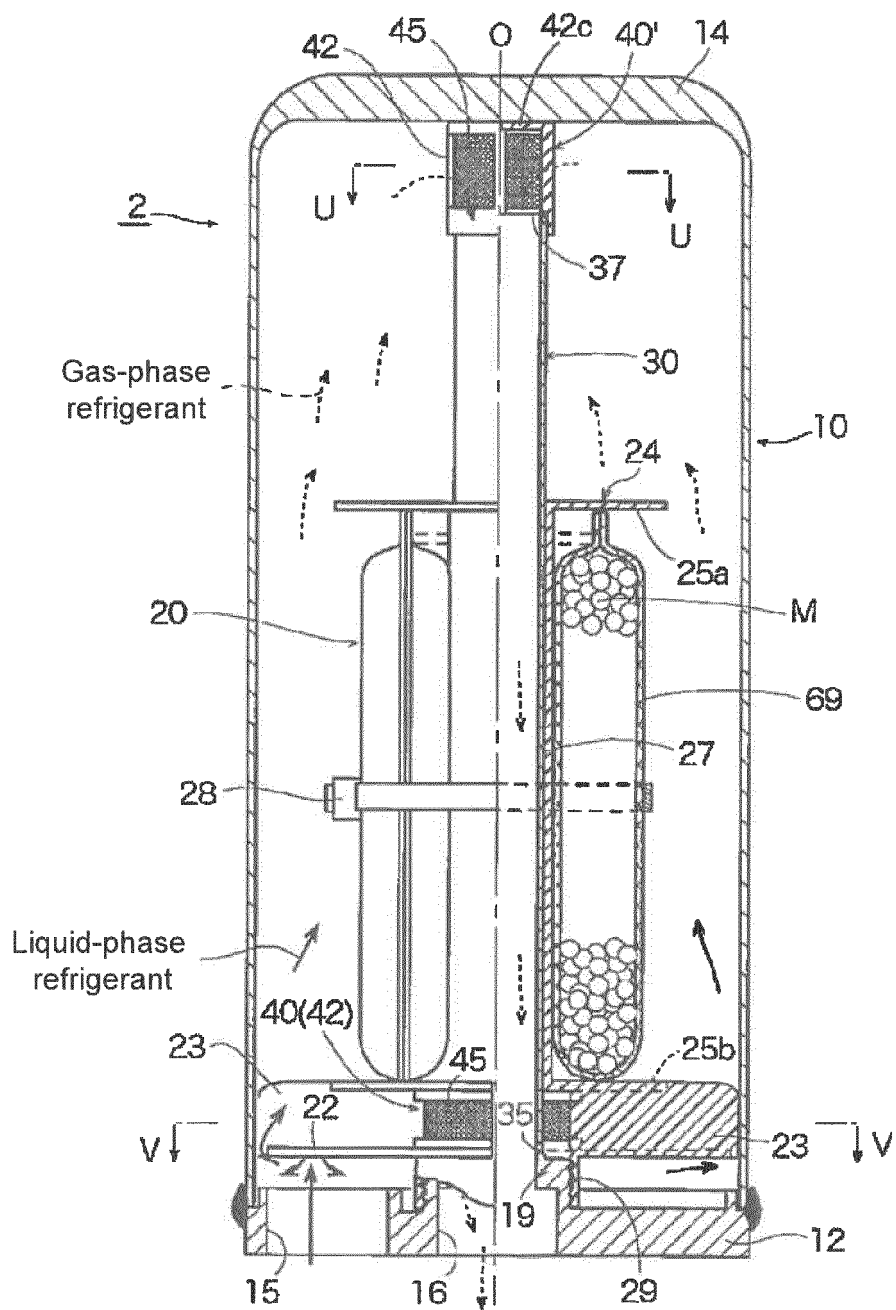


Fig. 3B

U-U Enlarged Cross-Section

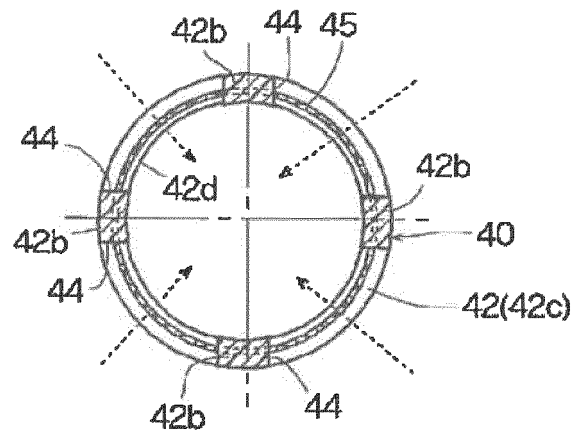


Fig. 3C

V-V Cross-Section

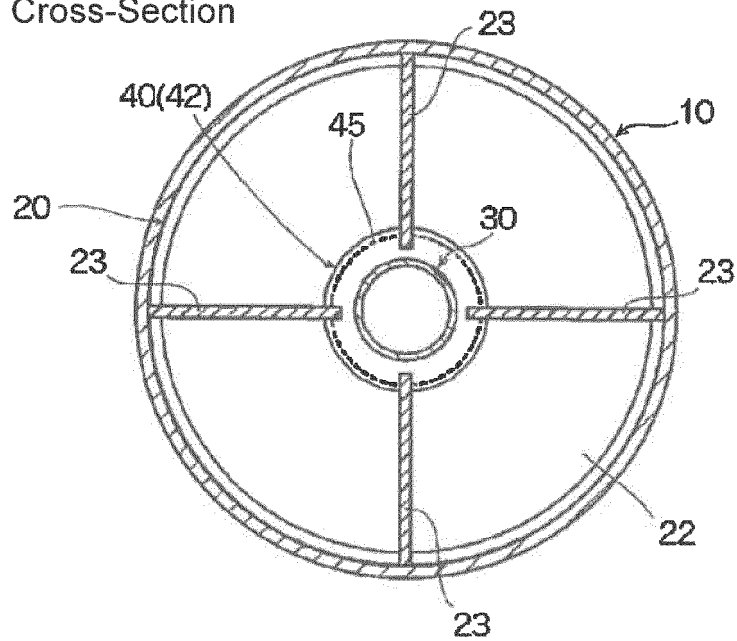


Fig. 4A

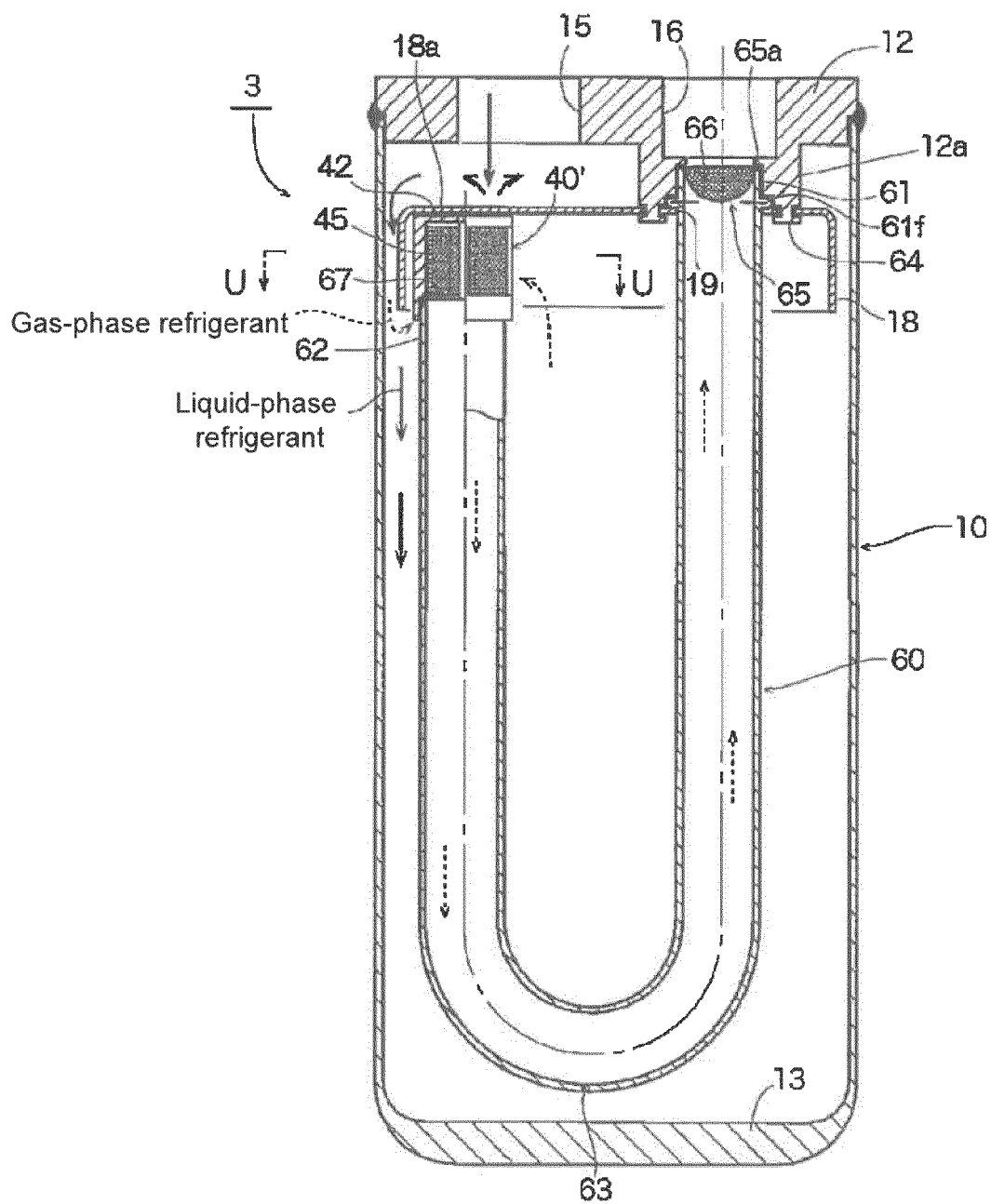


Fig. 4B

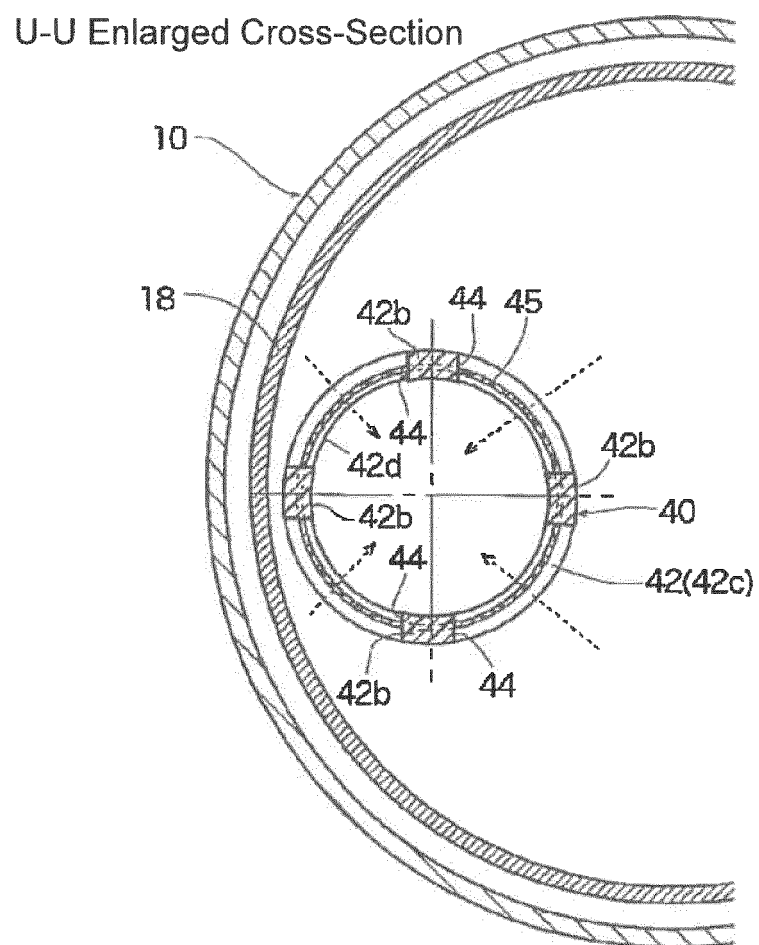


Fig. 5A

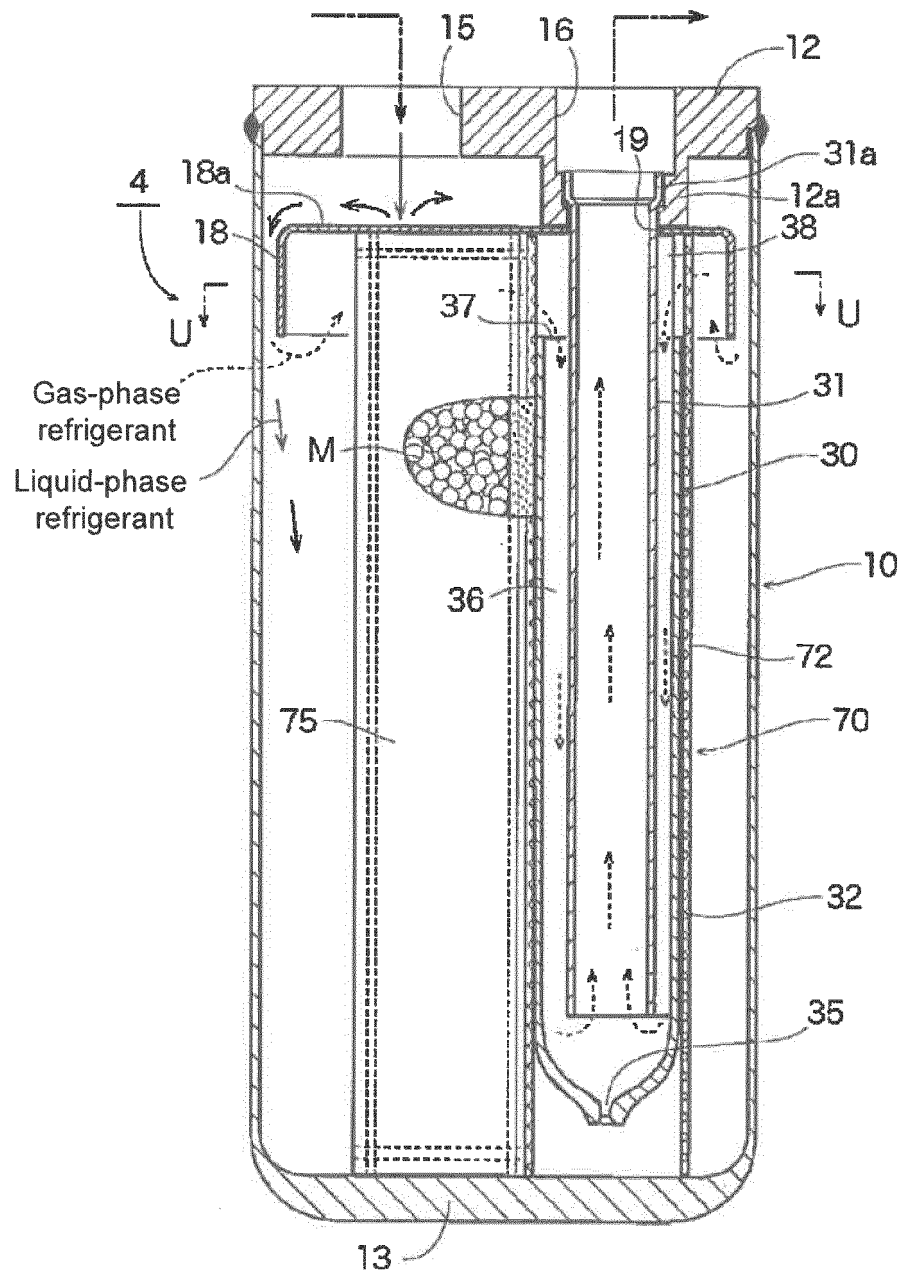


Fig. 5B

U-U Enlarged Cross-Section

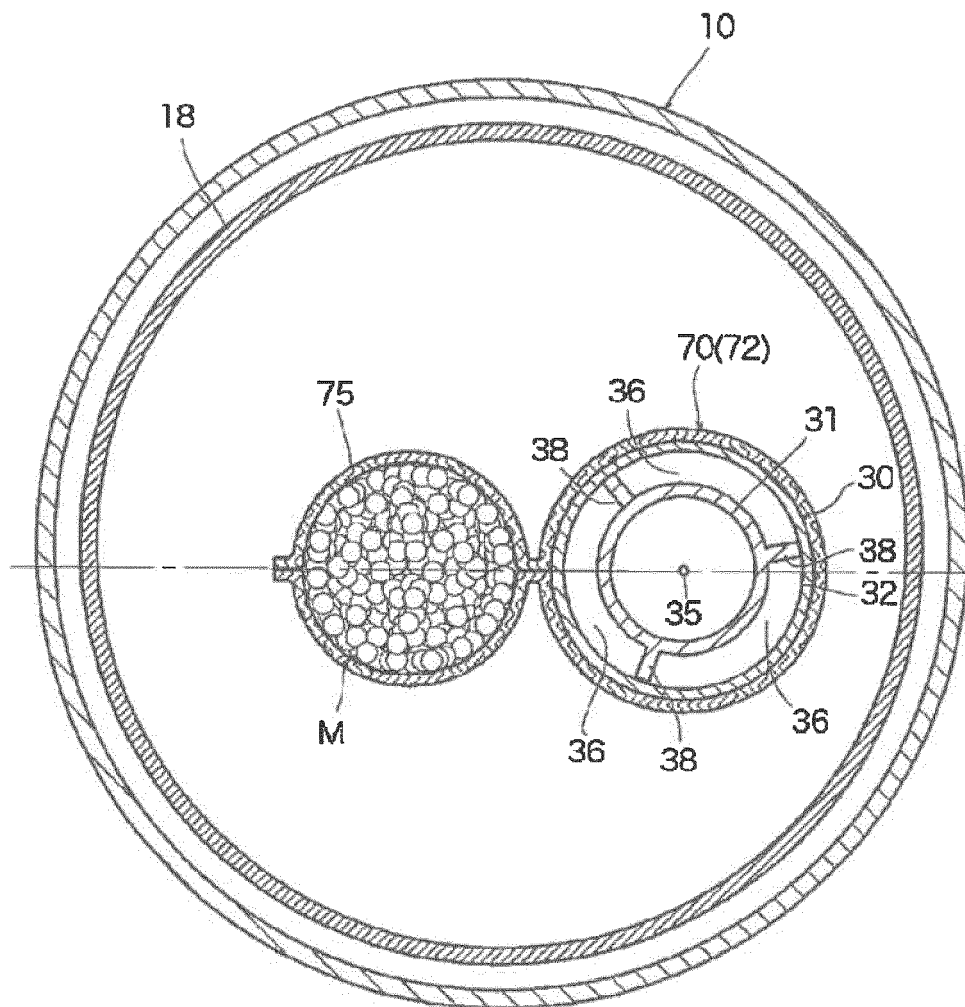


Fig. 6A

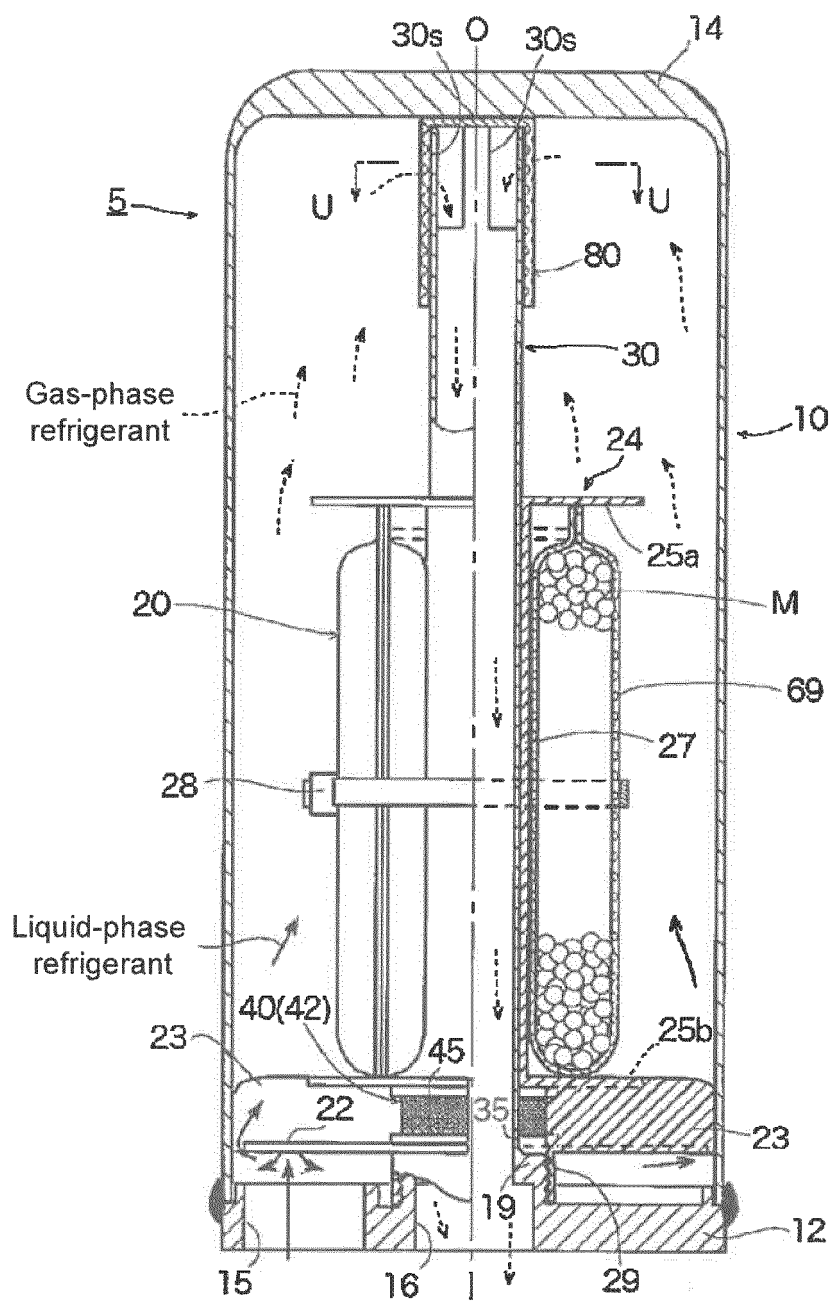


Fig. 6B

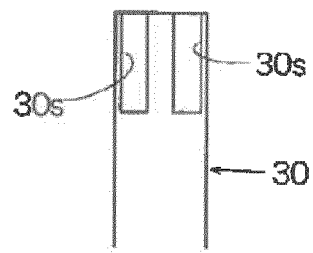


Fig. 6C

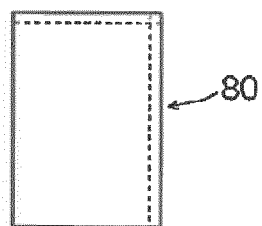


Fig. 6D

U-U Enlarged Cross-Section

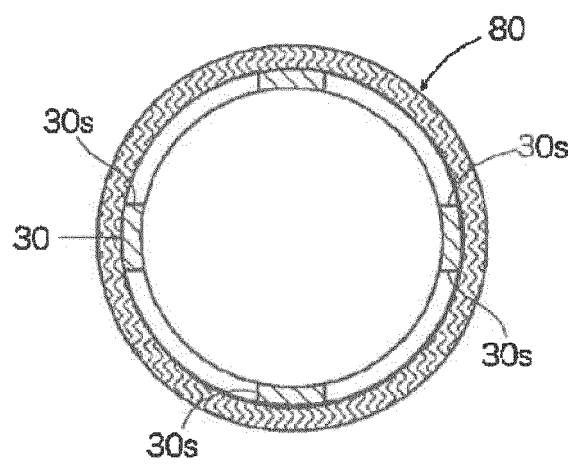
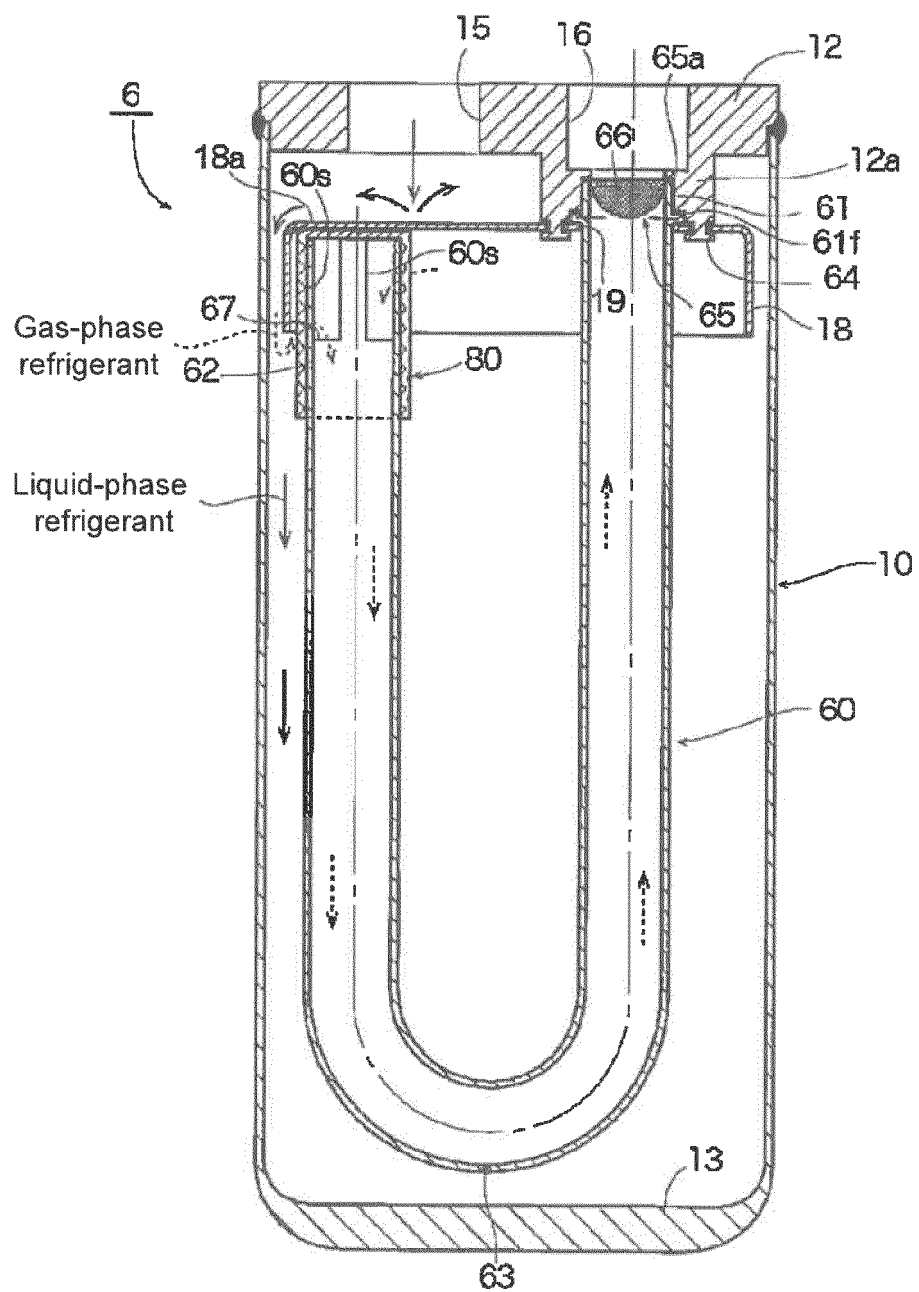


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/039210

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. F25B43/00 (2006.01) i, F25B43/02 (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, F25B43/02

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 1971-2019

Registered utility model specifications of Japan 1996-2019

Published registered utility model applications of Japan 1994-2019

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	DE 102007028591 A1 (BEHR GMBH & CO. KG) 24 December 2008, paragraphs [0016], [0038], fig. 1-7 (Family: none)	1-4, 11 1, 5-6, 10, 12 7-9
X Y A	US 2006/0196219 A1 (HALLA CLIMATE CONTROL CANADA INC.) 07 September 2006, paragraphs [0096]-[0101], fig. 10a-10e (Family: none)	1-3, 11 1, 5-6, 10, 12 4, 7-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
07.01.2019Date of mailing of the international search report
15.01.2019Name and mailing address of the ISA/
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