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(72) Inventors:
• **Kamiyama, Naohisa**
Saitama-shi, Saitama 331-8501 (JP)
• **Kawamura, Takeharu**
Saitama-shi, Saitama 331-8501 (JP)

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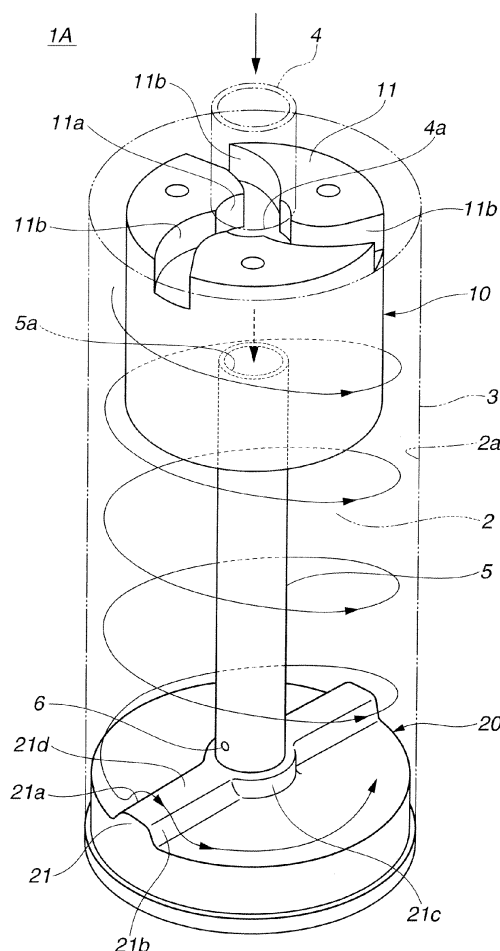
(74) Representative: **Grünecker, Kinkeldey, Stockmair & Schwanhäusser**
Leopoldstrasse 4
80802 München (DE)

(71) Applicant: **Calsonic Kansei Corporation**
Saitama 331-8501 (JP)

(54) **Accumulator for refrigeration cycle system**

(57) An accumulator (1A, 1B) for use in a refrigeration cycle system is constructed to have a liquid accumulating chamber (2) in which refrigerant is accumulated, a refrigerant inlet port (4) through which the refrigerant is led into the liquid accumulating chamber (2), a refrigerant outlet pipe (5) that has an upstream open end (5a) exposed to an upper part of the liquid accumulating chamber (2) to discharge the refrigerant from the liquid accumulating chamber (2) to the outside of the chamber, an oil return opening provided in a given part of the refrigerant outlet pipe to return oil, which is contained in the refrigerant in the lower part of the liquid accumulating chamber, to a compressor of the refrigeration cycle system, a refrigerant flow generating structure that provides the refrigerant from the refrigerant inlet port with a given flow, the given flow being produced by a drive force possessed by the refrigerant; and a refrigerant flow mixing structure that provides the given flow of refrigerant from the refrigerant flow generating structure with an upward-and-downward movement thereby to mix the refrigerant.

FIG.1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates in general to a refrigeration cycle system and more particularly to an accumulator installed in the refrigeration cycle system at a position between an evaporator and a compressor.

2. Description of the related Art

[0002] In a refrigeration cycle system of vapor-compression type (or heat pump type), there is arranged an accumulator in a refrigerant flow line at a position between an evaporator and a compressor. The accumulator has basically two functions, one being to feed the compressor with gaseous refrigerant to prevent the compressor from effecting compression against liquid refrigerant, and the other being to return oil, which circulates in the refrigeration cycle circuit together with the refrigerant, to the compressor. Actually, the oil is applied to the compressor for lubricating rotating parts of the compressor. However, under operation of the refrigeration cycle system, the oil leaks into the refrigerant.

[0003] One of the accumulators having such two functions is shown in Japanese Laid-open Patent Application (Tokkai) 2004-324899.

[0004] In order to clarify the feature of the present invention, the accumulator of this Japanese Laid-open Patent Application will be briefly described with the aid of Fig. 8 that shows schematically the known accumulator.

[0005] In Fig. 8, denoted by numeral 50 is the known accumulator. When in use, the known accumulator 50 is arranged to stand upright as is shown in the drawing.

[0006] The known accumulator 50 comprises a cylindrical case 52 which has a liquid accumulating chamber 51 formed therein, a refrigerant inlet pipe 53 through which refrigerant is led into the liquid accumulating chamber 51, a refrigerant outlet pipe 54 through which the refrigerant is discharged from the liquid accumulating chamber 51 to the outside (viz., to a compressor), stirring vanes 60 which are placed in the liquid accumulating chamber 51 and rotatably disposed around the refrigerant outlet pipe 54, and an electric drive mechanism (not shown) which turns the stirring vanes 60 with electric power. The refrigerant inlet pipe 53 has an outlet end 53a that is exposed to an upper part of the liquid accumulating chamber 51, as shown. The refrigerant outlet pipe 54 has an inlet end 54a that is exposed to the upper part of the liquid accumulating chamber 51. The refrigerant outlet pipe 54 is formed with a plurality of small openings 55 which serve as oil returning openings.

[0007] In operation of an associated refrigeration cycle system, refrigerant is led into the liquid accumulating chamber 51 from the refrigerant inlet pipe 53 as is indicated by an arrow. The refrigerant is then temporarily

accumulated in the liquid accumulating chamber 51. During the temporal accumulation, liquid refrigerant is forced to take a lower position due to its higher specific gravity and gaseous refrigerant is forced to take a higher position due to its lower specific gravity. Since the inlet end 54a of the refrigerant outlet pipe 54 is kept exposed to the upper gaseous part of the liquid accumulating chamber 51, the inlet end 54a sucks only the gaseous refrigerant. The gaseous refrigerant thus led into the refrigerant outlet pipe 54 is led to the compressor (not shown). During this, the liquid refrigerant placed in the lower part (which will be referred to lower liquid part hereinafter) of the liquid accumulating chamber 51 is stirred by the stirring vanes 60. Thus, oil in the liquid refrigerant is sufficiently mixed with the liquid refrigerant. Then, a small amount of oil-mixed liquid refrigerant is led into the refrigerant outlet pipe 54 from the small openings 55 and then led to the compressor.

[0008] Usually, when it is very cold, for example, when the outside air temperature is lower than -25°C , it tends to occur that oil is separated from the oil-mixed liquid refrigerant due to difference in specific gravity and viscosity. In the known accumulator, such undesired separation is suppressed by the stirring work of the stirring vanes 60. Thus, in the known accumulator, a sufficient oil circulation rate (OCR) can be obtained in the refrigeration cycle system.

SUMMARY OF THE INVENTION

[0009] However, in the above-mentioned known accumulator, an electric drive mechanism is used for driving the stirring vanes 60. This means that it is necessary to provide an electric power source (or motor), a link mechanism extending between the power source and each stirring vane 60 and an electrically insulated construction for electric power transmission. Thus, the known accumulator tends to be complicated in construction and high in cost.

[0010] Accordingly, it is an object of the present invention to provide an accumulator for a refrigeration cycle system, which is free of the above-mentioned drawbacks.

[0011] That is, an object of the present invention is to provide an accumulator for a refrigeration cycle system, which can exhibit its essential function without the aid of electric power.

[0012] Another object of the present invention is to provide an accumulator for a refrigeration cycle system, which can exhibit its essential function without inducting complicated and high cost construction.

[0013] A still another object of the present invention is to provide an accumulator for a refrigeration cycle system, which can exhibit a sufficient oil circulation rate (OCR) even in a low temperature condition of an associated refrigeration cycle system.

[0014] In accordance with the present invention, there is provided an accumulator (1A, 1B) for use in a refrigeration cycle system, which comprises a liquid accumu-

lating chamber (2) in which refrigerant is accumulated; a refrigerant inlet port (4a) through which the refrigerant is led into the liquid accumulating chamber (2); a refrigerant outlet pipe (5) that has an upstream open end (5a) exposed to an upper part of the liquid accumulating chamber (2) to discharge the refrigerant from the liquid accumulating chamber (2) to the outside of the chamber (2); an oil return opening (6) provided in a given part of the refrigerant outlet pipe (5) to return oil, which is contained in the refrigerant in the lower part of the liquid accumulating chamber (2), to a compressor of the refrigeration cycle system; a refrigerant flow generating structure (10, 30a, 30b) that provides the refrigerant from the refrigerant inlet port (4a) with a given flow, the given flow being produced by a drive force possessed by the refrigerant; and a refrigerant flow mixing structure (21, 31, 32) that provides the given flow of refrigerant from the refrigerant flow generating structure (10, 30a, 30b) with an upward-and-downward movement thereby to mix the refrigerant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other objects and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

- Fig. 1 is a perspective view of an accumulator of a first embodiment of the present invention;
- Fig. 2 is a sectional view of the accumulator of the first embodiment of the present invention;
- Fig. 3 is a plan view of a flow guide device employed in the accumulator of the first embodiment;
- Fig. 4A is an enlarged sectional view of an interference ridge portion employed in the accumulator of the first embodiment;
- Fig. 4B is a view similar to Fig. 4A, but showing a modified interference ridge portion;
- Fig. 5 is a horizontally sectional view of an accumulator of a second embodiment of the present invention;
- Fig. 6 is a vertically sectional view taken along the line VI-VI of Fig. 5;
- Fig. 7 is a perspective view of a part of the accumulator of the second embodiment showing an arrangement of flow guide members; and
- Fig. 8 is a vertically sectional view of a known accumulator.

DETAILED DESCRIPTION OF THE INVENTION

[0016] In the following, the present invention will be described in detail with reference to the accompanying drawings.

[0017] For ease of understanding, in the following description, various directional terms, such as, upper, lower, right, left, upward and the like, are used. However, such terms are to be understood with respect to only a

drawing or drawings on which corresponding portion or part is shown.

FIRST EMBODIMENT:

[0018] Referring to Figs. 1 to 4, there is shown an accumulator 1A of a first embodiment of the present invention for a refrigeration cycle system.

[0019] Like the above-mentioned known accumulator 50 of Fig. 8, the accumulator 1A of the first embodiment is arranged to stand upright when in use.

[0020] As is well shown in Figs. 1 and 2, the accumulator 1A comprises a cylindrical case 3 that has a cylindrical liquid accumulating chamber 2 formed therein, a refrigerant inlet pipe 4 through which refrigerant is led into the liquid accumulating chamber 2 from an evaporator (not shown), a refrigerant outlet pipe 5 through which the refrigerant is discharged from the liquid accumulating chamber 2 to the outside (viz., compressor), a flow guide device 10 which provides the refrigerant from the refrigerant inlet pipe 4 with a whirling movement and an interference ridge portion 21 which provides the whirled flow of refrigerant from the flow guide device 10 with up-and-down movement (or stirs the whirled flow of refrigerant in up-and-down direction). The refrigerant outlet pipe 5 is a straight pipe, as shown.

[0021] As is seen from Figs. 1 and 2, the cylindrical case 3 has an upper end closed by a circular head wall (no numeral) and a cylindrical inner surface 2a that constitutes an inner side wall of the liquid accumulating chamber 2.

[0022] As is seen from Fig. 2, the refrigerant inlet pipe 4 is integral with the upper head wall of the cylindrical case 3 and has an outlet end 4a exposed to an upper part of the liquid accumulating chamber 2.

[0023] As is seen from Figs. 1 and 2, the outlet end 4a of the refrigerant inlet pipe 4 is positioned at a center of the upper head wall of the cylindrical case 3. The refrigerant inlet pipe 4 is connected to a refrigerant outlet port of the evaporator (not shown).

[0024] As is seen from Figs. 1 and 2, the straight refrigerant outlet pipe 5 is arranged to pass through a center of the liquid accumulating chamber 2 and through a center of a circular bottom member 20 that is press-fitted into the lower open end of the cylindrical case 3 and fitted to the case 3 by a known connector (not shown).

[0025] As is seen from Fig. 1, the above-mentioned interference ridge portion 21 is integrally formed on the circular bottom member 20. The refrigerant outlet pipe 5 has an inlet end 5a that is exposed to the upper part of the liquid accumulating chamber 2.

[0026] As shown, the inlet end 5a of the refrigerant outlet pipe 5 is directed to the outlet end 4a of the refrigerant inlet pipe 4 keeping a given clearance therebetween.

[0027] The refrigerant outlet pipe 5 is formed at a portion near the interference ridge portion 21 with a small opening 6 which serves as an oil returning opening. The

refrigerant outlet pipe 5 is connected to a refrigerant inlet port of the compressor (not shown).

[0028] As is seen from Figs. 1, 2 and 3, the flow guide device 10 is a cylindrical member with an engraved upper head. As shown, the cylindrical flow guide device 10 is concentrically disposed in the upper part of the liquid accumulating chamber 2 and fixed to the circular head of the cylindrical case 3 through three screws (no numerals). Upon tight installation of the flow guide device 10, there is defined an annular clearance "d" between the cylindrical flow guide device 10 and the cylindrical inner surface 2a of the case 3, as shown.

[0029] More specifically, the flow guide device 10 comprises a cylindrical side wall 12 and a circular upper head 11.

[0030] As is seen from Figs. 1 to 3, the circular upper head 11 is formed at its upper surface with a recessed flow guide portion which comprises a circular center recess 11a that faces the outlet end 4a of the refrigerant inlet pipe 4 and three equally spaced curved grooves 11b that extend radially outward from the circular center recess 11a to the annular clearance "d".

[0031] As will be seen from Fig. 2, in operation of the associated refrigeration cycle system, refrigerant is led to the circular center recess 11a from the refrigerant inlet pipe 4 and then guided to flow radially outward by the three curved grooves 11b. The refrigerant then falls into the annular clearance "d" and then into the lower part of the liquid accumulating chamber 2.

[0032] As is seen from Fig. 1, the interference ridge portion 21 extends diametrically on the circular bottom member 20. The ridge portion 21 has at a middle position thereof an enlarged circular part 21c through which a lower part of the refrigerant outlet pipe 5 passes.

[0033] As is seen from Fig. 4A, the interference ridge portion 21 has a trapezoidal cross section and comprises a top wall 21d and first and second inclined side walls 21a and 21b which extend obliquely downward from the top wall 21d, as shown. Each of the first and second inclined side walls 21a and 21b defines an obtuse angle to a base surface defined by an upper flat surface of the circular bottom member 20.

[0034] In the following, operation will be described with the aid of Figs. 1, 2 and 4A.

[0035] Under operation of the associated refrigeration cycle system, refrigerant from the evaporator (not shown) is led into the liquid accumulating chamber 2 of the accumulator 1A through the refrigerant inlet pipe 4. As will be easily understood from Figs. 1 and 2, during this flow, the refrigerant is at first led or dropped into the circular center recess 11a of the flow guide device 10 and then forced to flow in the three curved grooves 11b by the force of its kinetic energy and its own weight. The refrigerant flowing in each curved groove 11b is then dropped into the liquid accumulating chamber 2 through the annular clearance "d".

[0036] Because of the curved shape of the grooves 11b, the refrigerant having just passed through the

grooves 11b shows a whirling movement along the cylindrical inner surface 2a of the case 3 and thus, in the lower part of the case 3, the refrigerant is whirled, as is shown in Fig. 1.

[0037] As will be understood from Fig. 4A, due to provision of the interference ridge portion 21, the whirled flow of refrigerant is forced to move upward and downward thereby moving the whirled flow of refrigerant in up-and-down direction. More specifically, due to provision of the first inclined side wall 21a, the whirled flow of refrigerant is moved upward and then due to provision of the second inclined side wall 21b, the flow is moved downward. With such upward and downward movement of the whirled flow, the refrigerant in the lower part of the liquid accumulating chamber 2 is enforcedly mixed or stirred.

[0038] Even when the outside air temperature is very low (for example, lower than -25°C) which would induce a possibility of separation of oil from the oil-mixed liquid refrigerant in the liquid accumulating chamber 2, such undesired oil separation is suppressed due to the enforced mixing of the oil-mixed liquid refrigerant.

[0039] As is seen from Fig. 2, under such very cold condition, a small amount of the oil-mixed liquid refrigerant placed in the lower part of the liquid accumulating chamber 2 is permitted to flow into the refrigerant outlet pipe 5 from the small opening 6 and then led or returned to the compressor (not shown), and the gaseous refrigerant placed at the upper part of the liquid accumulating chamber 2 is led into the refrigerant outlet pipe 5 from the inlet end 5a and led to the refrigerant inlet port of the compressor.

[0040] As will be understood from the above, in the first embodiment of the present invention, the oil-mixed liquid refrigerant in the lower part of the accumulator 1A is effectively stirred or mixed without the aid of electric power. That is, the accumulator 1A can be produced without inducing complicated and high cost construction, and can exhibit a sufficient oil circulation rate (OCR) even in a low temperature condition of the refrigeration cycle system.

[0041] In the first embodiment, the flow guide device 10 provides the refrigerant led into the accumulator 1A with a whirling movement by practically using the force of kinetic energy and the own weight of the refrigerant. That is, in the first embodiment, such whirling flow of refrigerant is produced by a simple construction.

[0042] Because of the cylindrical inner surface 2a of the case 3, the whirling flow of refrigerant produced by the flow guide device 10 is smoothly promoted.

[0043] Due to provision of interference ridge portion 21, the whirling flow of refrigerant is forced to move upward and downward and thus, the refrigerant in the liquid accumulating chamber 2 is effectively stirred and mixed.

[0044] It is to be noted that the small opening 6 is provided near the interference ridge portion 21. This is because mixing of refrigerant is most effectively carried out near the interference ridge portion 21. Thus, the oil-mixed

liquid refrigerant can be assuredly led to the compressor together with a certain amount of oil.

[0045] Referring to Fig. 4B, there is shown a modified interference ridge portion 21A. In this modification, the second inclined side wall 21b' has a vertical surface, as shown. Substantially same function as the above-mentioned interference ridge portion 21 is expected.

SECOND EMBODIMENT:

[0046] Referring to Figs. 5 to 7, there is shown an accumulator 1B of a second embodiment of the present invention for a refrigeration cycle system.

[0047] The accumulator 1B of the second embodiment is arranged to stand upright when in use, like in such a posture as shown in Figs. 6 and 7.

[0048] As will be understood from Fig. 5 which is a horizontally sectional view of the accumulator 1B, the accumulator 1B comprises a rectangular case 3 that has a rectangular liquid accumulating chamber 2 formed therein, first and second partition walls 30a and 30b that are alternately arranged in the chamber 2 to define therein first, second and third flow passages 2a, 2b and 2c that are connected in series in zigzag manner, a refrigerant inlet pipe 4 through which refrigerant is led into an upstream part of the first flow passage 2a, a refrigerant outlet pipe 5 through which the refrigerant is discharged from a downstream part of the third flow passage 2c to the outside, and a plurality of flow guide members 31 and 32 that are arranged in the third flow passage 2c.

[0049] As will be seen from Fig. 6, the refrigerant inlet pipe 4 is connected to an upper position of one side wall of the case 3 so that the refrigerant from an outlet end 4a of the inlet pipe 4 is fed to the first flow passage 2a from an upper position. Although not shown in the drawing, the refrigerant inlet pipe 4 is connected to an outlet port of an evaporator.

[0050] As is best shown in Fig. 7, the refrigerant outlet pipe 5 is connected to a lower position of the other side wall of the case 3. The pipe 5 has an upright portion 5b placed in the downstream part of the third flow passage 2c. An inlet end 5a of the upright portion 5b is exposed to an upper part of the downstream part of the third flow passage 2c, as shown.

[0051] As is seen from Figs. 6 and 7, the refrigerant outlet pipe 5 is formed at a position near a base part of the upright portion 5b with a small opening 6 which serves as an oil returning opening. The refrigerant outlet pipe 5 is connected to a refrigerant inlet port of a compressor (not shown).

[0052] As is seen from Fig. 5, the first partition wall 30a is connected at its left end to the left side wall of the case 3 leaving the right end thereof from the right side wall of the case 3, and the second partition wall 30b is connected at its right end to the right side wall of the case 3 leaving the left end thereof from the left side wall of the case 3. With this, a sufficiently long zigzag flow passage including the first, second and third flow passages 2a, 2b and

2c is provided.

[0053] As is understood from Figs. 5 to 7, the flow guide members 31 and 32 are arranged in the third flow passage 2c. The flow guide members 31 are secured to a larger wall of the case 3 and the other flow guide members 32 are secured to the second partition wall 30b.

[0054] As is well shown in Fig. 7, each flow guide member 31 or 32 is inclined in such a manner that a height of the member 31 or 32 relative to a bottom wall of the case 3 increases as a distance to the refrigerant outlet pipe 5 reduces, as shown. As is seen from the drawings, the flow guide members 31 and 32 are alternately arranged with respect a direction in which the refrigerant flows.

[0055] As will be seen from Fig. 5, in operation of the associated refrigeration cycle system, refrigerant is led to the first flow passage 2a from the refrigerant inlet pipe 4 and then guided to flow in the second and third flow passages 2b and 2c in zigzag manner. That is, due to provision of the first and second partition walls 30a and 30b, the refrigerant led into the liquid accumulating chamber 2 is forced to have a zigzag flow as is seen from the arrows shown in the drawing.

[0056] As will be seen from Figs. 6 and 7, the refrigerant led to the third flow passage 2c is forced to move upward and downward due to provision of the flow guide members 31 and 32. With such upward and downward movement, the refrigerant in the third flow passage 2c is enforcedly mixed or stirred.

[0057] Even when the outside air temperature is very low (for example, lower than -25°C) which would induce a possibility of separation of oil from the oil-mixed liquid refrigerant in the liquid accumulating chamber 2, such undesired oil separation is suppressed due to the enforced mixing of the oil-mixed liquid refrigerant.

[0058] As is seen from Fig. 7, under such very cold condition, a small amount of the oil-mixed liquid refrigerant placed in the lower part of the third flow passage 2c is permitted to flow into the refrigerant outlet pipe 5 from the small opening 6 and then led or returned to the compressor (not shown), and the gaseous refrigerant placed at the upper part of the third flow passage 2c is led into the refrigerant outlet pipe 5 from the inlet end 5a and led to the refrigerant inlet port of the compressor.

[0059] As will be understood from the above, also in the second embodiment of the present invention, the oil-mixed liquid refrigerant in the accumulator 1B is effectively stirred or mixed without the aid of electric power.

[0060] In the second embodiment, the zigzag flow of the refrigerant is easily produced by the two partition walls 30a and 30b. That is, in the second embodiment, such zigzag flow of refrigerant is produced by a simple construction.

[0061] Due to provision of the flow guide members 31 and 32, the zigzag flow of refrigerant led into the third flow passage 2c is forced to move upward and downward and thus, the refrigerant in the liquid accumulating chamber 2 is effectively stirred and mixed.

[0062] That is, the accumulator 1B of the second em-

bodiment can be produced without inducing complicated and high cost construction and can exhibit a sufficient oil circulation rate (OCR) even in a low temperature condition of the refrigeration cycle system.

[0063] In the above-mentioned first and second embodiments 1A and 1B, the flow guide device 10 and the two partition walls 30a and 30b are used for providing the flow of refrigerant with a whirling movement and zig-zag movement respectively. However, if desired, such movement may be produced by other devices.

[0064] In the above-mentioned first and second embodiments 1A and 1B, the interference ridge portion 21 and the flow guide members 31 and 32 are used to move the flow of refrigerant upward and downward for effectively mixing the refrigerant in the liquid accumulating chamber 2. However, if desired, such upward and downward movement may be produced by other devices.

[0065] Although the invention has been described above with reference to the embodiments of the invention, the invention is not limited to such embodiments as described above. Various modifications and variations of such embodiments may be carried out by those skilled in the art, in light of the above description.

Claims

1. An accumulator (1A, 1B) for use in a refrigeration cycle system, comprising:

a case (3) having a liquid accumulating chamber (2) defined therein, the liquid accumulating chamber (2) forming a gaseous part in an upper portion thereof and a liquid part in a lower portion thereof when the refrigeration cycle system is in operation;

a refrigerant inlet pipe (4) through which refrigerant is led into the liquid accumulating chamber (2);

a refrigerant outlet pipe (5) having an upstream open end (5a) exposed to the gaseous part of the liquid accumulating chamber (2), a middle part placed in the liquid part of the liquid accumulating chamber (2) and a downstream open end exposed to the outside of the case (3);

a first flow guide device (10, 30a, 30b) installed in the liquid accumulating chamber (2) at a position near the refrigerant inlet pipe (4) to provide the refrigerant from the refrigerant inlet pipe (4) with a predetermined flow, the predetermined flow being produced by a kinetic energy possessed by the refrigerant;

a second flow guide device (21, 31, 32) installed in the liquid accumulating chamber (2) at a position remote from the refrigerant inlet pipe (4) to provide the flow of refrigerant from the first flow guide device (10, 30a, 30b) with an upward and downward movement; and

an opening (6) formed in the middle part of the refrigerant outlet pipe (5) at a position near the second flow guide device (21, 31, 32) to discharge a certain small amount of refrigerant in the liquid part to the outside through the refrigerant outlet pipe (5).

2. An accumulator (1A) as claimed in Claim 1, in which the first flow guide device (10) is constructed and arranged to provide the refrigerant from the refrigerant inlet pipe (4) with a whirling flow.

3. An accumulator (1A) as claimed in Claim 1 or 2, in which the liquid accumulating chamber (2) is defined by a cylindrical inner surface (2a) of the case (3), and in which the first flow guide device (10) is cylindrical and concentrically disposed in the gaseous part of the liquid accumulating chamber (2).

4. An accumulator (1A) as claimed in Claim 1, 2 or 3, in which the refrigerant outlet pipe (5) is a straight pipe which extends coaxially in the cylindrical liquid accumulating chamber (2) with its inlet end (5a) connected to an outlet end (4a) of the refrigerant inlet pipe (4) and its outlet end exposed to the outside of the case (3).

5. An accumulator (1A) as claimed in Claim 1, 2, 3 or 4, in which the first flow guide device (10) comprises:

a cylindrical side wall (12) concentrically disposed in the gaseous part of the cylindrical liquid accumulating chamber (2) leaving an annular clearance "d" between the cylindrical side wall (12) and the cylindrical inner wall (2a) of the case (3), the annular clearance "d" being connected to the liquid part of the liquid accumulating chamber (2); and

a circular upper head (11) connected to an upper portion of the case (3) and formed with a recessed flow guide portion by which the whirling flow of refrigerant is produced.

6. An accumulator (1A) as claimed in Claim 5, in which the recessed flow guide portion of the circular upper head (11) comprises:

a circular center recess (11a) that faces the outlet end (4a) of the refrigerant inlet pipe (4); and a plurality of mutually spaced curved grooves (11b) that extends radially outward from the circular center recess (11a) to the annular clearance (d).

7. An accumulator (1A) as claimed in Claim 6, in which the mutually spaced curved grooves (11b) are equally spaced three curved grooves (11b).

8. An accumulator (1A) as claimed in Claim 2, in which the second flow guide device (21) comprises an interference ridge portion integrally formed on a bottom member (20) of the case (3) at a position near the opening (6) of the middle part of the refrigerant outlet pipe (5). 5
9. An accumulator (1A) as claimed in Claim 8, in which the interference ridge portion has a generally trapezoidal cross section. 10
10. An accumulator (1B) as claimed in Claim 1, 2, 3, 4, 5, 6, 7, 8 or 9, in which the first guide device (30a, 30b) are constructed to provide the refrigerant from the refrigerant inlet pipe (4) with a zigzag flow. 15
11. An accumulator (1B) as claimed in Claim 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, in which the liquid accumulating chamber (2) is rectangular in shape, and in which the first flow guide device (30a, 30b) comprises first and second partition walls (30a, 30b) that are alternately arranged in the chamber (2) to define therein first, second and third flow passages (2a, 2b, 2c) which are connected in series, the refrigerant inlet pipe (4) being connected to an upstream part of the first flow passage (2a), and the refrigerant outlet pipe (5) being connected to a downstream part of the third flow passage (2c). 20 25
12. An accumulator (1B) as claimed in Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11, in which the second flow guide device (31, 32) comprises: 30
- first flow guide members (31) that are secured to one side wall of the third flow passage; and 35
- second flow guide members (32) that are secured to the other side wall of the third flow passage,
- wherein the first and second guide members (31, 32) are alternately arranged with respect to a direction in which the refrigerant flows, and 40
- wherein each of the first and second guide members (31, 32) is inclined in such a manner that a height of the member (31, 32) relative to a bottom wall of the case increases as a distance to the refrigerant outlet pipe (5) reduces. 45

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FIG.1

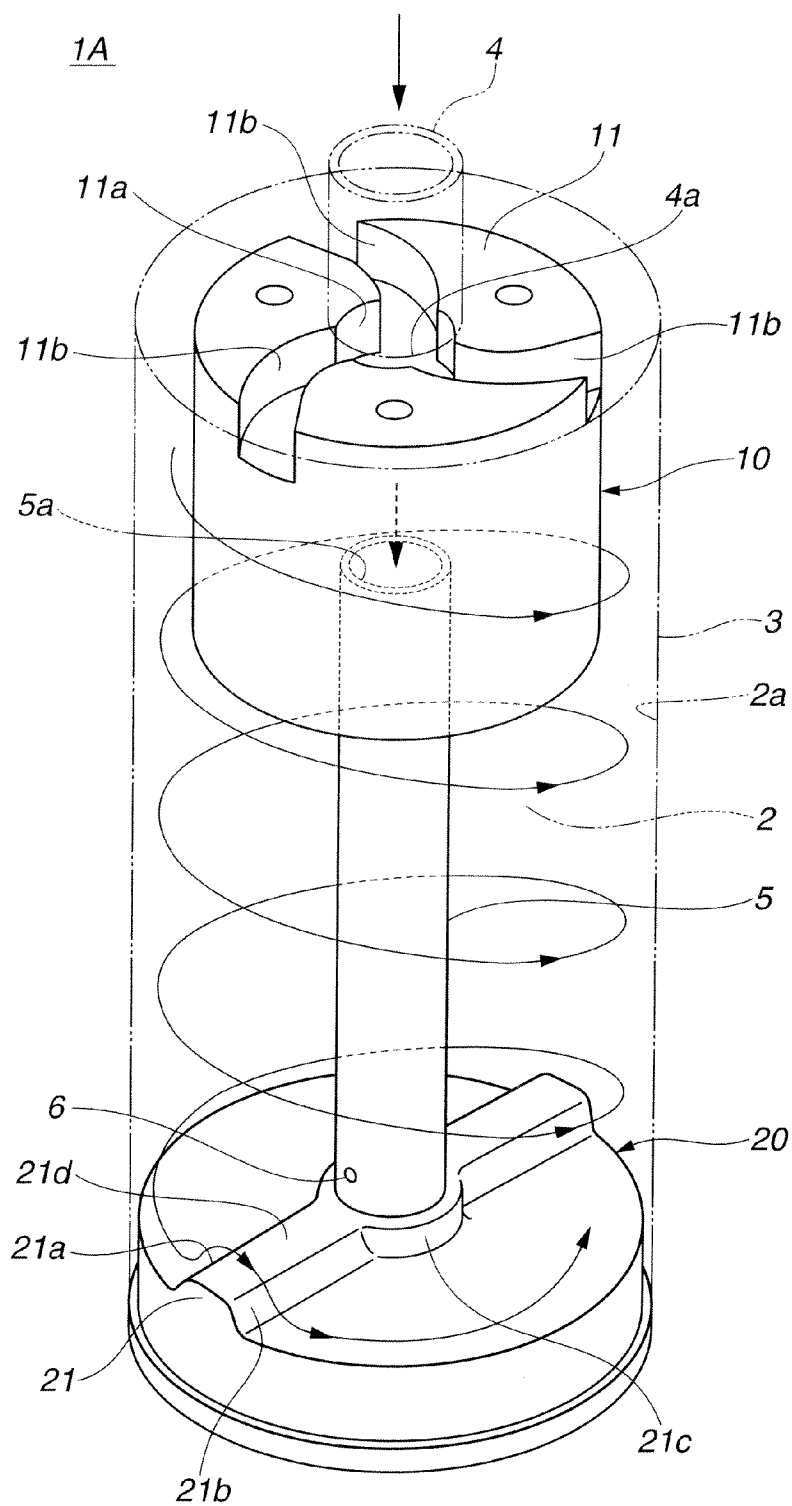


FIG.2

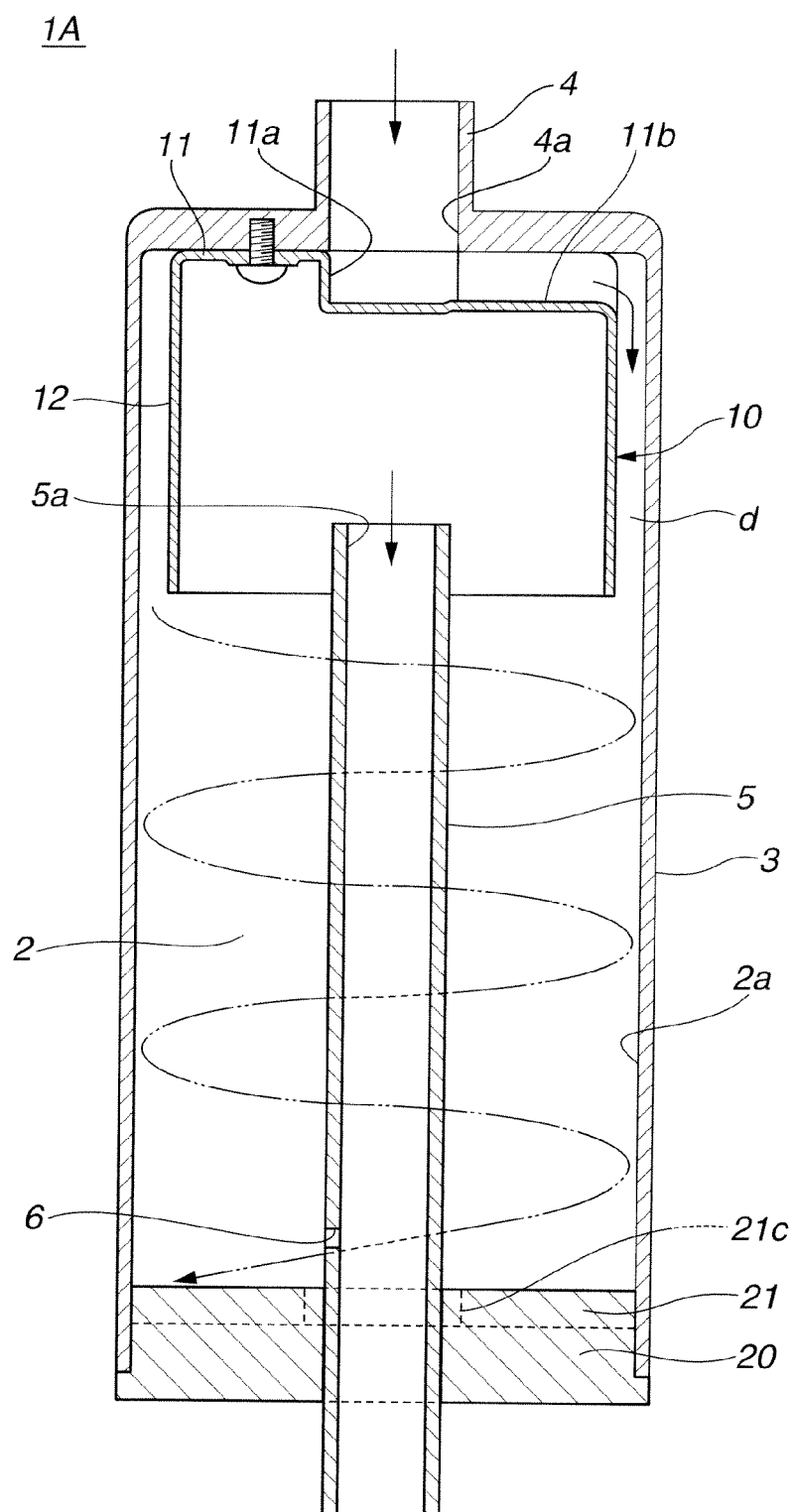


FIG.3

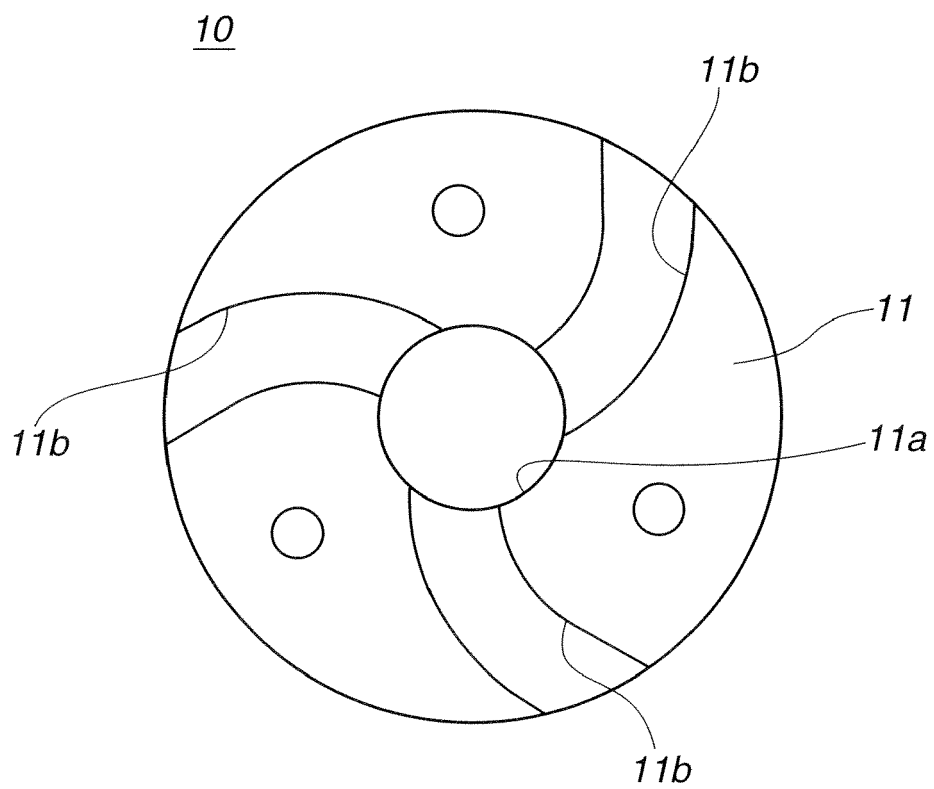


FIG.4A

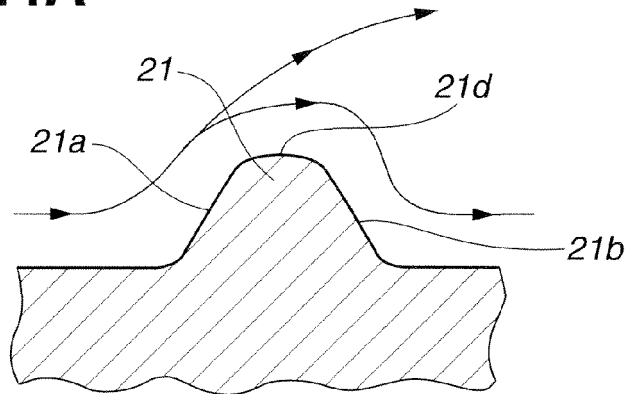


FIG.4B

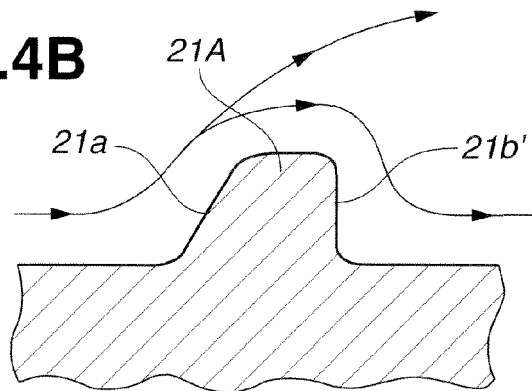


FIG.5

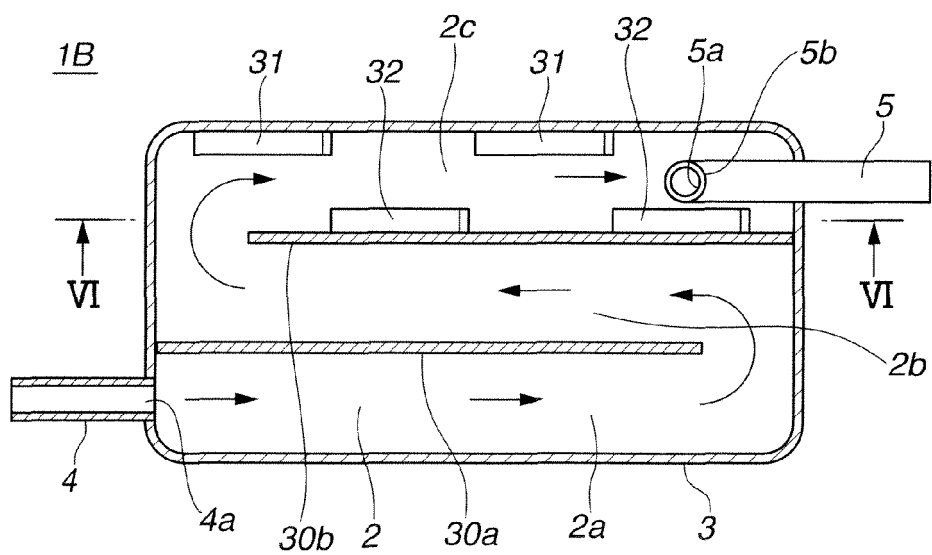


FIG.6

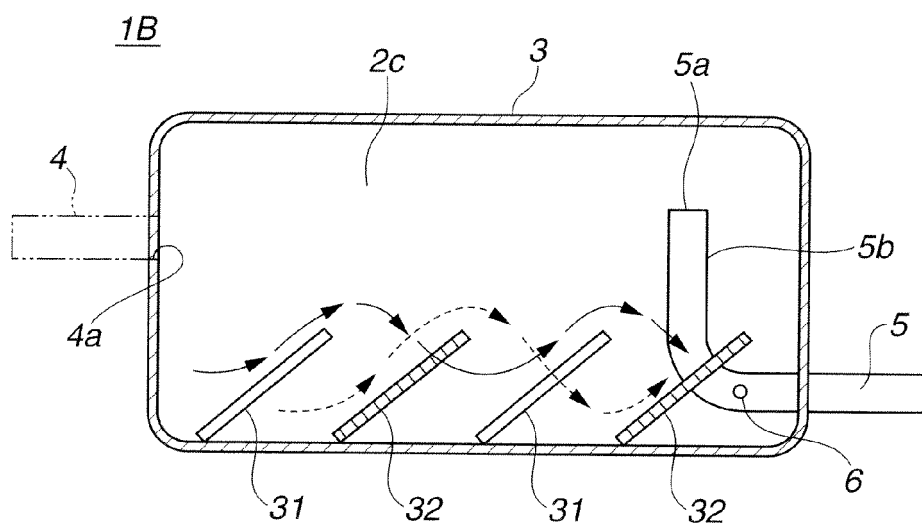


FIG.7

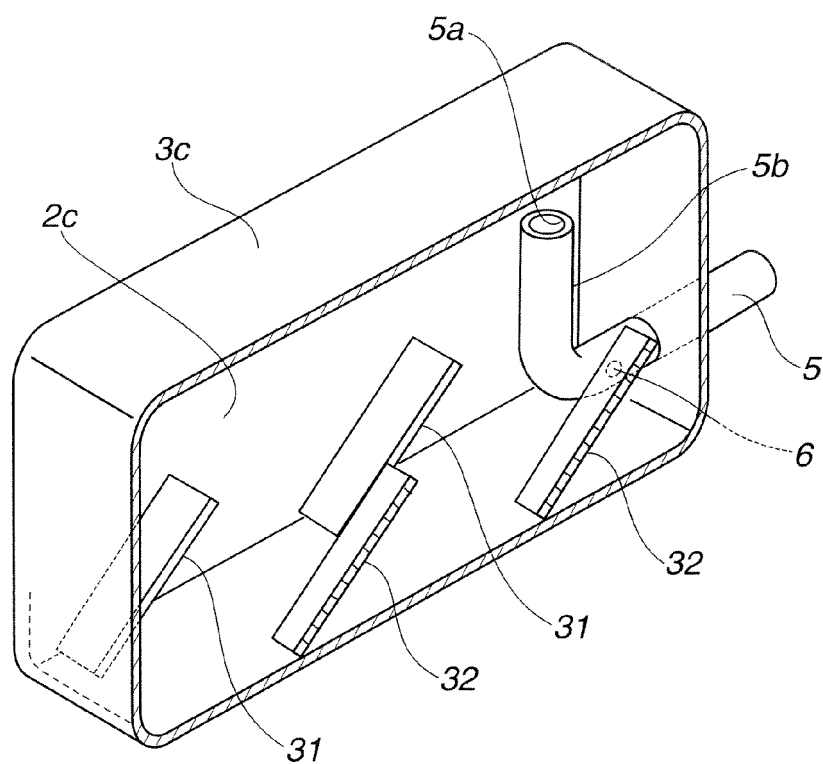
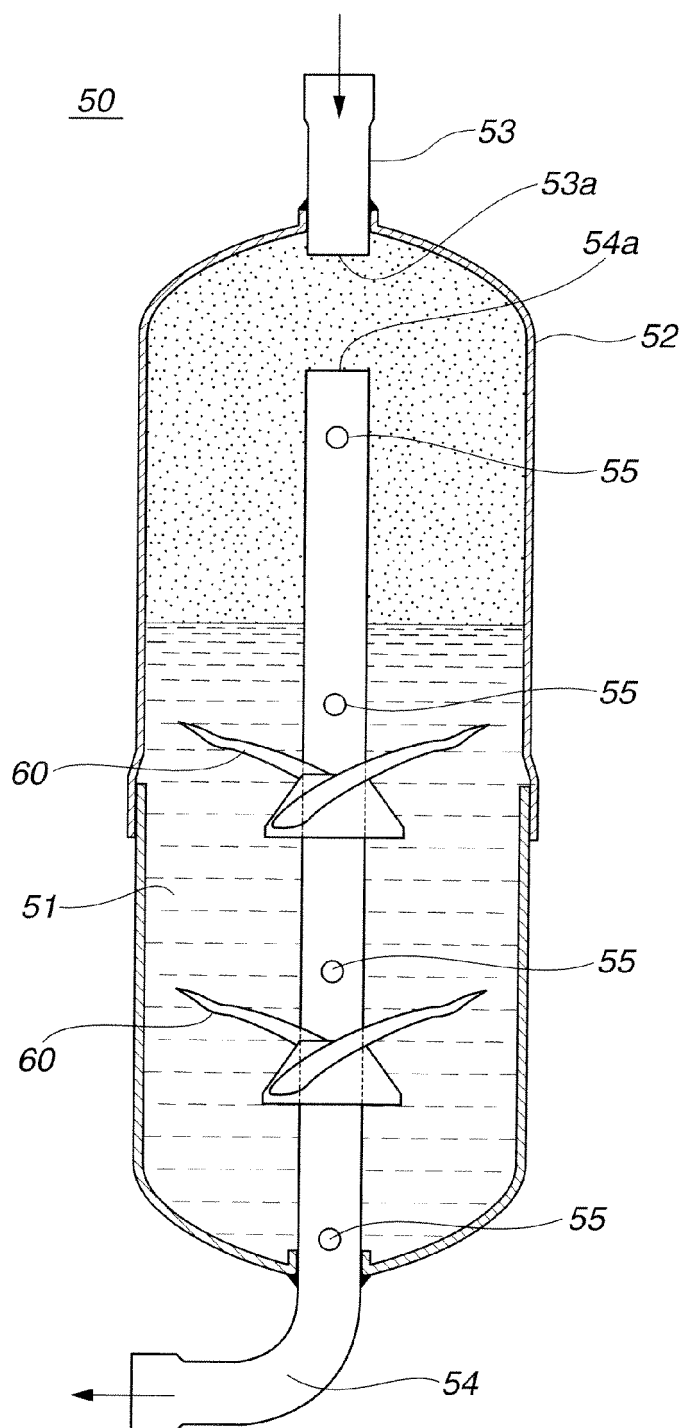


FIG.8



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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