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(54) **Air conditioner**

Klimaanlage

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EP-A2- 0 485 979
GB-A- 2 159 260

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EP 2 728 279 B1

Description

Technical Field

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

Background Art

[0002] A known technique uses an HFC (Hydro Fluorocarbon) refrigerant as a refrigerant for an air conditioner and PVE (Polyvinylether) oil compatible with the refrigerant as refrigerating machine oil (Patent Literature 1). In addition, considering the fact that the temperature of R32 serving as an HFC refrigerant discharged from a compressor becomes higher than a conventional refrigerant R410A by 10 to 15°C, a known technique sets refrigerant quality on the suction side of the compressor at 0.65 or more and 0.85 or less to reduce the discharge temperature (Patent Literature 2).

Citation List

Patent Literature

[0003]

Patent Literature 1: JP 11-325620 A
Patent Literature 2: JP 3956589 B2

Summary of Invention

[0004] Because of its low GWP (Global Warming Potential) level, R32 serving as an HFC refrigerant has been expected to be an environmentally-friendly refrigerant. However, as to the mixing characteristics of a refrigerant R32 and a lubricant, the compatibility of the refrigerant R32 reduces with a low lubricant mixing ratio, which causes an area where the mixture of the refrigerant R32 and the lubricant is separated into the two layers of the lubricant and a liquid refrigerant.

[0005] In addition, a refrigerant R32 is controlled to have less refrigerant quality on the suction side of a compressor than a conventional refrigerant R410A. Accordingly, when the R32 is used, a lubricant mixing ratio in the mixture of a liquid refrigerant and a lubricant inside an accumulator provided on the suction side of the compressor becomes low. For this reason, two-layer separation is likely to occur between the liquid refrigerant and the lubricant inside the accumulator, which makes it difficult to return the lubricant to the compressor. Thus, due to a shortage of the lubricant in the compressor, a problem such as improper lubrication is caused. As a result, reliability is decreased.

[0006] Further, EP 0 485 979 A2 describes a refrigerating apparatus with a refrigerant composed mainly of a fluorocarbon type refrigerant containing no chlorine and having a critical temperature of 40 DEG C or higher, and a refrigerating machine oil comprising as base oil an ester oil of one or more fatty acids.

[0007] EP 1 174 665 A1 describes that moisture in a refrigeration circuit is absorbed by means of a polyvinyl ether oil that has hygroscopicity and serves as a refrigerating machine oil.

[0008] EP 1 275 912 A1 describes a refrigerant circuit. The refrigerant circuit is charged with a single refrigerant of R32 or with an R32/R125 mixed refrigerant whose R32 content is not less than 75% by weight. As an insulating material of an electric motor of the compressor, a resin material is used, and as an refrigeration oil a synthetic oil is used.

[0009] GB 2 159 260 A describes a heat pump having a plurality of compressors operated in parallel. The heat pump has an improved supply of oil to the compressors.

[0010] Accordingly, it is an object of the present invention to provide an air conditioner capable of preventing the two-layer separation between a liquid refrigerant and a lubricant and reducing the occurrence of improper lubrication.

[0011] The object is solved by the invention according to claim 1. Further preferred developments are described by the dependent claims. According to an aspect, an air conditioner according to the present invention is the air conditioner in which an indoor unit and an outdoor unit are connected to each other via a pipe to circulate a refrigerant, characterized in that a refrigerant made of only R32 or a mixed refrigerant containing a predetermined mass percent or more of the R32 is used as the refrigerant, and the refrigerant mixed with a predetermined level or more of a lubricant to prevent an occurrence of two-layer separation between a liquid refrigerant and the lubricant is supplied to a compressor of the outdoor unit.

[0012] According to an embodiment of the present invention, it is possible to prevent the occurrence of the two-layer separation between a liquid refrigerant and a lubricant and reduce improper lubrication to enhance reliability.

Brief Description of Drawings

[0013]

FIG. 1 is a circuit configuration diagram of an air conditioner.
FIG. 2 is a vertical cross-sectional view of an accumulator.
FIG. 3 is a graph showing the mixing characteristics of a refrigerant R32 and a lubricant.

Description of Embodiment

[0014] Hereinafter, a description will be given of an embodiment of the present invention with reference to the drawings. In the embodiment, as will be described in detail below, a refrigerant mixed with a predetermined level or more of a lubricant is supplied to a compressor in a

case in which the refrigerant containing at least predetermined mass percent or more of R32 serving as an HFC refrigerant is used. Specifically, in a mixture (mixture of a liquid refrigerant and the lubricant) accumulated in an accumulator connected to the inflow side of the compressor, the mixing ratio of the lubricant is set at the predetermined level or more. In order to control the mixing ratio of the lubricant in the mixture inside the accumulator, the lubricant separated by an oil separator connected to the discharge side of the compressor is returned to the accumulator so as to satisfy a predetermined condition. Here, in the embodiment, the mixed refrigerant containing 70 mass percent or more of the R32 is used. This is because the mixed refrigerant with a ratio of 70 mass percent or more of the R32 becomes equal to the R32 in characteristics such as GWP levels, suction wetness, and compatibility with the oil.

[0015] According to the embodiment, with the control of the mixing ratio of the lubricant in the mixture of the refrigerant R32 and the lubricant inside the accumulator, it is possible to prevent the two-layer separation between the liquid refrigerant and the lubricant inside the accumulator. This results in an increase in the amount of the lubricant contained in the refrigerant supplied from the accumulator to the compressor, which makes it possible to reduce the shortage of the lubricant inside the compressor and improve the reliability of the compressor and an air conditioner.

(First Embodiment)

[0016] The embodiment will be described with reference to FIGS. 1 to 3. FIG. 1 shows a configuration example of the refrigeration cycle of an air conditioner 1 according to the embodiment.

[0017] The refrigeration cycle of the air conditioner 1 includes at least one outdoor unit 100 and at least one indoor unit 200. A plurality of indoor units 200A and 200B are shown in FIG. 1, but they are called the indoor units 200 unless otherwise classified. FIG. 1 shows a case in which one outdoor unit 100 and two indoor units 200 are connected to each other. However, without being limited to this, the refrigerant cycle may include two or more outdoor units 100 and three or more indoor units 200 connected to each other.

[0018] The outdoor unit 100 includes, for example, an outdoor heat exchanger 101, an outdoor fan 102, an outdoor expansion valve 103, a compressor 104, an accumulator 105, an oil separator 106, an oil return capillary 107, a four-way valve 108, a supercooling heat exchanger 109, a supercooling bypass expansion valve 110, and pipes 112 to 117.

[0019] Each of the indoor units 200 includes, for example, an indoor heat exchanger 201, an indoor fan 202, and an indoor expansion valve 203. The outdoor unit 100 and the indoor units 200 are connected to each other by a liquid pipe 121 and a gas pipe 302.

[0020] Here, in the embodiment, a refrigerant made of only R32 or a mixed refrigerant containing 70 mass percent or more of the R32 is used. Next, the operations will be described.

[0021] The compressor 104 includes, for example, a crankcase and a compressor main body (both not shown) provided inside the crankcase, and a lubricant is accumulated at the bottom of the crankcase. During the compressing operation of the compressor main body, the lubricant inside the crankcase is pumped up by the pumping action and supplied to a part where lubrication is required. Some of the lubricant is discharged to the discharge pipe 112 together with the refrigerant.

[0022] A low-pressure gaseous refrigerant flows in the compressor 104 from the accumulator 105 via the pipe 117. The compressor 104 compresses the refrigerant to discharge a high-temperature and high-pressure gaseous refrigerant from the discharge port. The high-pressure gaseous refrigerant discharged from the discharge port of the compressor 104 into the pipe 112 flows in the oil separator 106 via the pipe 112. The high-temperature and high-pressure gaseous refrigerant discharged from the compressor 104 contains the lubricant.

[0023] The oil separator 106 collects the lubricant contained in the high-pressure gaseous refrigerant and returns the collected lubricant to the accumulator 105 via the oil return capillary 107 and the pipe 116. The pipe 116 is a pipe used to connect the port on the compressor inflow port side of the four-way valve 108 and the inflow port of the accumulator 105 to each other. The oil return capillary 107 as an example of a "supply oil amount control unit" is a unit used to control the flow and pressure of the lubricant returned from the oil separator 106 to the accumulator 105.

[0024] The four-way valve 108 is a direction switch valve used to select whether the high-pressure gaseous refrigerant is introduced into the outdoor heat exchanger 101 or the indoor heat exchangers 201 inside the indoor units 200. During a cooling operation, the four-way valve 108 causes the high-pressure gaseous refrigerant to flow in a direction as indicated by an arrow C in FIG. 1. The high-pressure gaseous refrigerant flows in the outdoor heat exchanger 101 serving as a condenser via the pipe 113 that connects the port on the outdoor heat exchanger side of the four-way valve 108 and the suction side of the outdoor heat exchanger 101 to each other.

[0025] When passing through the outdoor heat exchanger 101, the high-temperature and high-pressure gaseous refrigerant is heat-exchanged with outdoor air supplied by the outdoor fan 102 for condensation and converted to a high-temperature and high-pressure liquid refrigerant (liquid refrigerant). The high-temperature and high-pressure liquid refrigerant flows in the outdoor expansion valve 103 via the pipe 114 connected to the exit side of the outdoor heat exchanger 101. A low-pressure liquid refrigerant flowing out from the outdoor expansion valve 103 is branched off. Among the branched liquid refrigerant, some flows in the supercooling bypass expansion valve 110 while other flows in a pipe 301 after

being further cooled via the supercooling heat exchanger 109. The pipe 301 is a pipe used to connect the heat exchanger 101 of the outdoor unit 100 and the heat exchangers 201 of the indoor units 200 to each other.

[0026] The liquid refrigerant flowing in the supercooling bypass expansion valve 110 is depressurized by the supercooling bypass expansion valve 110 and flows in the supercooling heat exchanger 109. When passing through the supercooling heat exchanger 109, the liquid refrigerant flowing in the supercooling heat exchanger 109 is heat-exchanged with another liquid refrigerant for evaporation and converted to a low-pressure gaseous refrigerant. The low-pressure gaseous refrigerant flows in the accumulator 105 via the return pipe 115 connected to the pipe 116.

[0027] The low-pressure liquid refrigerant supplied to the indoor units 200 is depressurized by the indoor expansion valves 203 and flows in the indoor heat exchangers 201. When passing through the indoor heat exchangers 201, the low-pressure liquid refrigerant flowing in the indoor heat exchangers 201 is heat-exchanged with indoor air supplied by the indoor fans 202 for evaporation and converted to a gaseous refrigerant (gas refrigerant).

[0028] When the low-pressure liquid refrigerant is evaporated inside the indoor heat exchangers 201, air inside a room is refrigerated to cool the room. The gas refrigerant flowing out from the indoor heat exchangers 201 is supplied to the outdoor unit 100 via the gas pipe 302.

[0029] The gas refrigerant flowing in the outdoor unit 100 flows in the accumulator 105 via the four-way valve 108 and the pipe 116. The accumulator 105 accumulates a non-evaporated liquid refrigerant to prevent the liquid refrigerant from flowing in the compressor 104. This is because there is a likelihood of damage or the like to the parts of the compressor 104 when the compressor 104 compresses the liquid refrigerant.

[0030] The gaseous refrigerant, the liquid refrigerant, and the lubricant returned from the oil separator 106 flow in the accumulator 105. The gas refrigerant and the lubricant are mixed together inside the accumulator 105 and supplied to the compressor 104. The liquid refrigerant remains in the accumulator 105.

[0031] Next, a heating operation will be described. The flow of a refrigerant at the heating operation is indicated by an arrow H. After the separation of a lubricant by the oil separator 106, a high-temperature and high-pressure gas refrigerant discharged from the compressor 104 is supplied to the gas pipe 302 via the four-way valve 108. The lubricant separated by the oil separator 106 is supplied to the accumulator 105 via the oil return capillary 107.

[0032] The high-temperature and high-pressure gas refrigerant from the outdoor unit 100 is supplied to the indoor units 200 via the gas pipe 302. When flowing through the indoor heat exchangers 201, the high-temperature gas refrigerant supplied to the indoor units 200 is heat-exchanged with indoor air supplied by the indoor fans 202 for condensation and converted to a liquid refrigerant. The liquid refrigerant flows out from the indoor units 200 via the indoor expansion valves 203. The high-temperature and high-pressure gas refrigerant is heat-exchanged with the indoor air at the indoor heat exchangers 201 to perform the heating operation.

[0033] The liquid refrigerant flowing out from the indoor units 200 flows in the outdoor unit 100 via the liquid pipe 301. After passing through the outdoor expansion valve 103, the liquid refrigerant flowing in the outdoor unit 100 is branched off into two liquid refrigerants. Among the branched liquid refrigerants, some flows in the supercooling bypass expansion valve 110 and is supplied to the accumulator 105 via the pipes 115 and 116.

[0034] While, other liquid refrigerant is depressurized by the outdoor expansion valve 103 and then flows in the outdoor heat exchanger 101. When flowing through the outdoor heat exchanger 101, the liquid refrigerant is heat-exchanged with outdoor air supplied by the outdoor fan 102 for evaporation and converted to a gas refrigerant. The gas refrigerant flows in the accumulator 105 via the four-way valve 108 and the pipe 116. As described above, the gas refrigerant and the lubricant flow in the accumulator 105 to be mixed together, and the gas refrigerant containing the lubricant is supplied to the compressor 104.

[0035] FIG. 2 shows the accumulator 105 inside the outdoor unit 100 of the refrigeration cycle in FIG. 1.

[0036] Inside the accumulator 105, the pipe 116 for introduction (introduction pipe) and the pipe 117 for delivery (delivery pipe) are inserted and attached. The introduction pipe 116 is a pipe used to introduce the gas refrigerant and/or the lubricant into the accumulator 105.

[0037] The delivery pipe 117 has a substantially U-shape on the tip end side thereof and is a pipe used to supply the gas refrigerant mixed with the lubricant from the accumulator 105 to the compressor 104. The delivery pipe 117 is attached to the accumulator 105 with the U-shaped curve thereof positioned on the bottom side of the accumulator 105. Thus, the U-shaped curve of the delivery pipe 117 is soaked in the liquid refrigerant accumulated in the accumulator 105.

[0038] The delivery pipe 117 has a first liquid return port 121A at the U-shaped curve thereof. In addition, the delivery pipe 117 has a second liquid return port 121B positioned on an upper side than the first liquid return port 121A. Moreover, the delivery pipe 117 has, on the upper side thereof, a pressure equalization hole 122 positioned on the upper side of the accumulator 105 and used to control pressure inside the delivery pipe 117.

[0039] The refrigerant and lubricant flowing in the accumulator 105 via the introduction pipe 116 are separated into the liquid and gas. The gas refrigerant is supplied to the compressor 104 via the delivery pipe 117. With the circulation of the gas refrigerant, the liquid is sucked in the delivery pipe 117 from the first liquid return port 121A and supplied from the accumulator 105 to the compressor 104 at a predetermined liquid mixing ratio.

[0040] If the liquid level of the accumulator 105 is above the second liquid return port 121B, the liquid is also sucked from the second liquid return port 121B, which increases the liquid mixing ratio. The liquid mixing ratio is controlled by the hole diameters of the two liquid return ports 121A and 121B and the hole diameter of the pressure equalization hole 122.

[0041] Here, in the embodiment, a conventional refrigerant R410A is replaced with the refrigerant R32 having a lower GWP. The use of the R32 as a refrigerant results in an increase in the discharge temperature of the compressor 104 by 10 to 15°C. In the embodiment, the suction quality of the compressor 104 is kept at a lower level than in the past to prevent the increase in the discharge temperature.

[0042] To this end, the accumulator 105 of the embodiment accumulates a greater amount of the liquid refrigerant than the conventional refrigerant R410A. When the accumulator 105 accumulates a greater amount of the liquid refrigerant than in the past, the lubricant mixing ratio in the mixture accumulated at the lower part of the accumulator 105 becomes low.

[0043] FIG. 3 shows the mixing characteristics of the refrigerant and the lubricant in a case in which the R32 is used as a refrigerant. If the lubricant mixing ratio becomes 40% or less in the refrigerant R32, a two-layer separation area including the layers of the liquid refrigerant and the lubricant occurs at low temperature. That is, the liquid refrigerant is accumulated on the lower side of the accumulator 105, and the layer of the lubricant is formed on the layer of the liquid refrigerant.

[0044] When the occurrence condition of the two-layer separation area is met, the mixture is separated into the liquid refrigerant and the lubricant on the lower side of the accumulator 105. If the density of the lubricant is lower than that of the liquid refrigerant, the lubricant floats on the upper side. When floating on the upper side of the liquid refrigerant, the lubricant is not sucked in the delivery pipe 117 from the first liquid return port 121A, which reduces the amount of the lubricant supplied to the compressor 104. The reduction in the amount of the lubricant supplied to the compressor 104 causes a problem such as improper lubrication. As a result, reliability may be decreased.

[0045] In view of this, in the embodiment, the shape (such as the pipe area and pipe length) of the oil return capillary 107 is designed such that a predetermined amount or more of the lubricant collected by the oil separator 106 is returned to the accumulator 105. A method for setting the design is as follows.

[0046] The ratio of the liquid flowing from the accumulator 105 to the compressor 104 is expressed as R (= (the flow of the refrigerant liquid + the flow of the lubricant) /(the total flow of the refrigerant)). The lubricant mixing ratio at a two-layer separation limit (the boundary between a soluble area and a separation area in the mixture) in the mixture of the liquid refrigerant and the lubricant inside the accumulator 105 is expressed as n (= the amount of the lubricant/the amount of the refrigerant liquid). The oil return ratio of the lubricant flowing through the oil return capillary 107 is expressed as x (= the flow of the lubricant/the total flow of the refrigerant) . The circulation ratio of the lubricant flowing from the oil separator 106 to the refrigeration cycle is expressed as y (= the flow of the lubricant/the total flow of the refrigerant) is expressed as y.

[0047] The oil return ratio x of the lubricant flowing through the oil return capillary 107 is found by the following formula (1) .

$$x \geq n \times R - y \qquad (1)$$

[0048] As to the characteristics shown in FIG. 3, it seems that the occurrence of the two-layer separation can be prevented if the lubricant mixing ratio is set at 40% (n = 0.4) or more and preferably 50% (n = 0.5) or more. Therefore, the following formula (2) is established.

$$x \geq 0.5 \times R - y \qquad (2)$$

[0049] Note that the ratio R of the liquid flowing from the accumulator 105 to the compressor 104 is controlled by the hole diameters of the liquid return ports 121A and 121B and the hole diameter of the pressure equalization hole 122 of the delivery pipe 117 of the accumulator 105. In addition, the circulation ratio y of the lubricant flowing from the oil separator 106 to the refrigeration cycle depends on the characteristics of the compressor 104 and the oil separator 106.

[0050] Thus, the use of the R32 as a refrigerant requires an increase in the amount of the liquid refrigerant accumulated in the accumulator 105, which reduces the lubricant mixing ratio. However, in the embodiment, a greater amount of the lubricant collected by the oil separator 106 is returned to the accumulator 105 than in the past. Therefore, the lubricant mixing ratio in the accumulator 105 can be increased to a predetermined level (40% or more and preferably 50% or more). As a result, according to the embodiment, it is possible to hinder the occurrence condition of the two-layer separation area in the accumulator 105 from being met, prevent the separation between the liquid refrigerant and the lubricant, and supply a sufficient amount of the lubricant to the compressor 104.

[0051] Note that the present invention is not limited to the embodiment described above. Persons skilled in the art could make various additions, modifications, and the like, within the scope of the claims. For example, means for returning the lubricant from the oil separator to the accumulator is not limited to the oil return capillary but may be replaced by other means. In addition, the present invention can be expressed as, for example, "the outdoor unit for the air conditioner that uses the refrigerant made

of only the R32 or the mixed refrigerant containing a predetermined mass percent or more of the R32 as a refrigerant and supplies to the compressor the refrigerant mixed with a predetermined level or more of the lubricant to prevent the occurrence of the two-layer separation between the liquid refrigerant and the lubricant."

Reference Signs List

[0052]

1: Air conditioner
100: Outdoor unit
101: Heat exchanger
103: Outdoor expansion valve
104: Compressor
105: Accumulator
106: Oil separator
107: Oil return capillary
108: Four-way valve
109: Supercooling heat exchanger

Claims

1. An air conditioner in which an indoor unit and an outdoor unit (100) are connected to each other via a pipe (301, 302) to circulate a refrigerant,
a refrigerant made of only R32 or a mixed refrigerant containing a predetermined mass percent or more of the R32 is used as the refrigerant, and **characterized in that** the refrigerant mixed with a predetermined level or more of a lubricant to prevent an occurrence of two-layer separation between a liquid refrigerant and the lubricant is supplied to a compressor (104) of the outdoor unit (100),
wherein
the outdoor unit (100) includes

the compressor (104),
an oil separator (106) connected to an discharge side of the compressor (104) and configured to separate and collect oil from the refrigerant discharged from the compressor (104),
an accumulator (105) connected to an inflow side of the compressor (104), configured to separate the liquid refrigerant from the refrigerant and accumulate the same, and configured to supply a gas refrigerant to the compressor (104), and
a supply oil amount control unit configured to return the lubricant separated by the oil separator (106) to the accumulator (105) to control a lubricant mixing ratio in a mixture of the liquid refrigerant and the lubricant accumulated in the accumulator (105) to said predetermined level or more.

2. The air conditioner according to claim 1, **characterized in that**
$x \geq n \times R - y$ is established when
an oil return ratio of the lubricant returned from the oil separator (106) to the accumulator by the supply oil amount control unit is expressed as x (where x = a flow of the lubricant/a total flow of the refrigerant),
a ratio of the mixture flowing from the accumulator (105) to the compressor (104) is expressed as R (where R = (a flow of the liquid refrigerant + the flow of the lubricant)/the total flow of the refrigerant),
the lubricant mixing ratio at a limit at which the mixture of the liquid refrigerant and the lubricant inside the accumulator (105) is separated into two layers is expressed as n (where n = an amount of the lubricant/an amount of the liquid refrigerant), and
a circulation ratio of the lubricant collected by the oil separator (106) and circulating in a refrigeration cycle is expressed as y (where y = the flow of the lubricant/the total flow of the refrigerant).

3. The air conditioner according to claim 2, **characterized in that** a value of the n is set at 0.4 or more.

Patentansprüche

1. Klimaanlage, in der eine Inneneinheit und eine Außeneinheit (100) über ein Rohr (301, 302) miteinander verbunden sind, um ein Kühlmittel zirkulieren zu lassen, wobei als das Kühlmittel ein Kühlmittel, das nur aus R32 hergestellt ist, oder ein gemischtes Kühlmittel, das einen vorgegebenen Anteil in Massenprozent oder mehr an R32 enthält, verwendet wird,
dadurch gekennzeichnet, dass
das Kühlmittel, das mit einem vorgegebenen Anteil oder mehr eines Schmiermittels gemischt ist, um das Auftreten einer Zweischichttrennung zwischen einem flüssigen Kühlmittel und dem Schmiermittel zu verhindern, einem Kompressor (104) der Außeneinheit (100) zugeführt wird,
wobei die Außeneinheit (100) Folgendes umfasst:

den Kompressor (104),
einen Ölabscheider (106), der mit einer Förderseite des Kompressors (104) verbunden ist und konfiguriert ist, Öl von dem Kühlmittel, das von dem Kompressor (104) ausgegeben wird, abzuscheiden und zu sammeln,
einen Akkumulator (105), der mit einer Einströmseite des Kompressors (104) verbunden ist und konfiguriert ist, das flüssige Kühlmittel von dem Kühlmittel abzuscheiden und zu sammeln, und konfiguriert ist, dem Kompressor (104) ein gasförmiges Kühlmittel zuzuführen, und
eine Zufuhrölmengen-Steuereinheit, die konfi-

guriert ist, das durch den Ölabscheider (106) abgeschiedene Schmiermittel zu dem Akkumulator (105) zurückzuleiten, um ein Schmiermittelmischungsverhältnis in einem Gemisch des flüssigen Kühlmittels und des Schmiermittels, die in dem Akkumulator (105) gesammelt sind, auf einen vorgegebenen Pegel oder mehr einzustellen.

2. Klimaanlage nach Anspruch 1, **dadurch gekennzeichnet, dass**
$x \geq n \times R - y$ gilt, wenn ein Ölrückleitungsverhältnis des Schmiermittels, das von den Ölabscheider (106) zu dem Akkumulator durch die Zufuhrölmengen-Steuereinheit zurückgeleitet wird, durch x gegeben ist (wobei x = eine Strömung des Schmiermittels/eine Gesamtströmung des Kühlmittels ist),
ein Verhältnis des Gemisches, das von dem Akkumulator (105) zu dem Kompressor (104) strömt, durch R gegeben ist (wobei R = (eine Strömung des flüssigen Kühlmittels + die Strömung des Schmiermittels)/Gesamtströmung des Kühlmittels ist),
das Schmiermittelmischungsverhältnis an einer Grenze, an der das Gemisch des flüssigen Kühlmittels und des Schmiermittels in dem Akkumulator (105) in zwei Schichten getrennt wird, durch n gegeben ist (wobei n = Menge des Schmiermittels/Menge des flüssigen Kühlmittels), und
ein Zirkulationsverhältnis des Schmiermittels, das durch den Ölabscheider (106) gesammelt wird und in einem Kühlungszyklus zirkuliert, durch y gegeben ist (wobei y = Strömung des Schmiermittels/Gesamtströmung des Kühlmittels).

3. Klimaanlagenanspruch 2, **dadurch gekennzeichnet**, dassein Wert von n auf 0,4 oder höher gesetzt ist.

Revendications

1. Appareil de conditionnement d'air dans lequel une unité intérieure et une unité extérieure (100) sont connectées l'une à l'autre via un tube (300, 302) pour faire circuler un réfrigérant,
un réfrigérant constitué uniquement de R32 ou d'un réfrigérant mélangé contenant un pourcentage en masse prédéterminé ou plus de M32 est utilisé à titre de réfrigérant, et
caractérisé en ce que
le réfrigérant, mélangé avec un niveau prédéterminé ou plus de lubrifiant pour prévenir une apparition d'une séparation en deux couches entre un réfrigérant liquide et le lubrifiant, est alimenté à un compresseur (104) de l'unité extérieure (100),
dans lequel
l'unité extérieure (100) inclut
le compresseur (104),
un séparateur d'huile (106) connecté à un côté de refoulement du compresseur (104) et configuré pour séparer et collecter l'huile hors du réfrigérant refoulé depuis le compresseur (104),
un accumulateur (105) connecté à un côté du flux entrant du compresseur (100), configuré pour séparer le réfrigérant liquide vis-à-vis du réfrigérant et accumuler celui-ci, et configuré pour alimenter un réfrigérant gazeux au compresseur (104), et
une unité de commande de quantité d'huile alimentée, configuré pour retourner le lubrifiant séparé par le séparateur d'huile (106) vers l'accumulateur (105) pour commander un rapport de mélange de lubrifiant dans un mélange de réfrigérant liquide et de lubrifiant accumulé dans l'accumulateur (105) audit niveau prédéterminé ou plus.

2. Appareil de conditionnement d'air selon la revendication 1, **caractérisé en ce que**
la condition $x \geq n \times R - y$ est établie quand
un rapport de retour d'huile du lubrifiant retourné depuis le séparateur d'huile (106) vers l'accumulateur par l'unité de commande de quantité d'huile alimentée est exprimé par x (x étant égal au débit de lubrifiant sur un débit total de réfrigérant),
un rapport du mélange s'écoulant depuis l'accumulateur (105) vers le compresseur (104) est exprimé par R (R étant égal au rapport [débit de réfrigérant liquide + débit de lubrifiant] sur débit total de réfrigérant),
le rapport de mélange de lubrifiant, à une limite à laquelle le mélange de réfrigérant liquide de lubrifiant à l'intérieur de l'accumulateur (105) est séparé en deux couches, est exprimé par n (n étant égal à une quantité de lubrifiant sur une quantité de réfrigérant liquide), et
un rapport de circulation du lubrifiant collecté par le séparateur d'huile (106) et circulant dans un cycle de réfrigération est exprimé par y (y étant égal au rapport du débit de lubrifiant sur le débit total de réfrigérant).

3. Appareil de conditionnement d'air selon la revendication 2, **caractérisé en ce qu'**une valeur de n est fixée à 0,4 ou plus.

FIG. 1

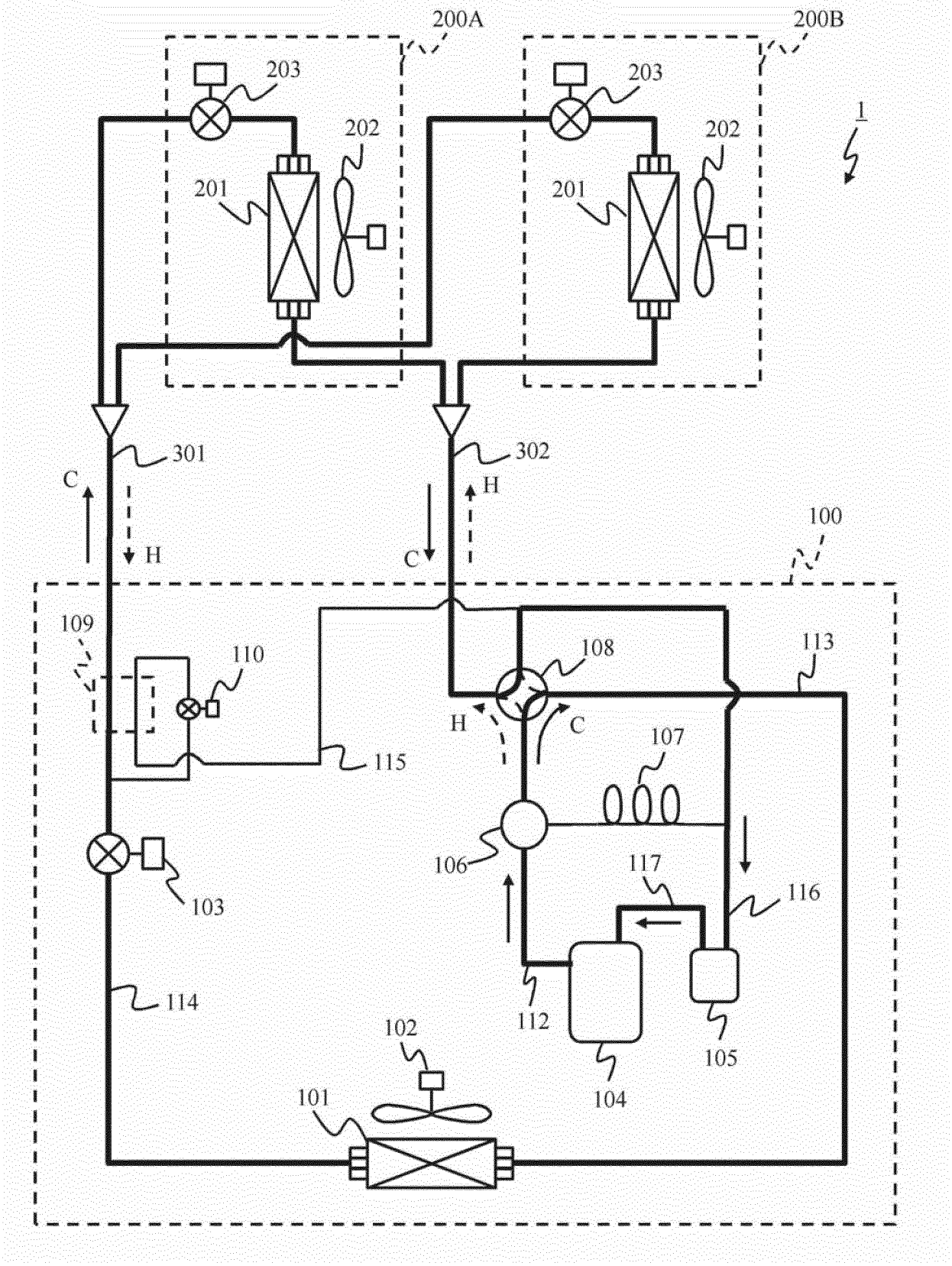

200A
200B
203
203
202
202
201
201
1
301
302
C
H
H
C
100
109
110
108
113
H
C
107
115
106
117
116
103
114
112
105
102
104
101

FIG. 2

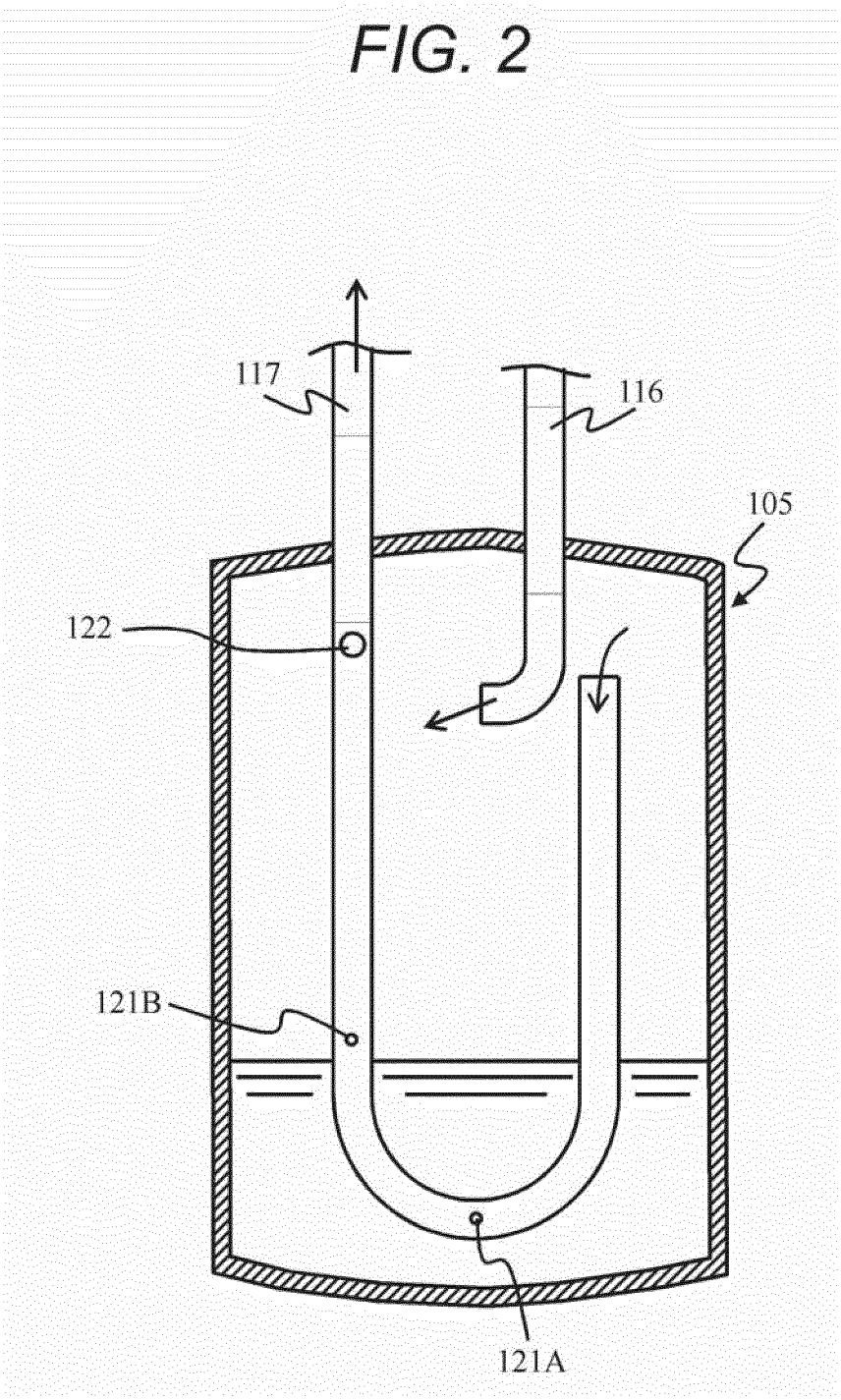
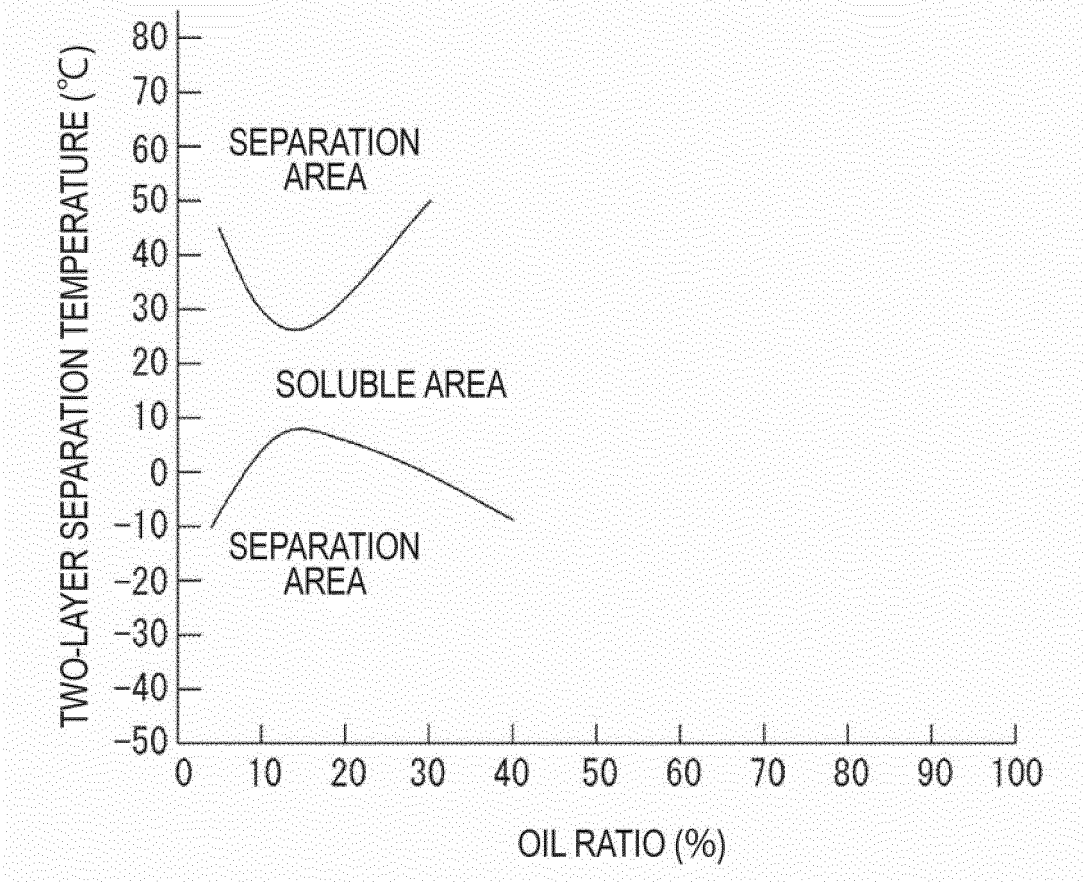


FIG. 3


TWO-LAYER SEPARATION TEMPERATURE (°C)
80
70
60
50
40
30
20
10
0
−10
−20
−30
−40
−50
SEPARATION AREA
SOLUBLE AREA
SEPARATION AREA
0
10
20
30
40
50
60
70
80
90
100
OIL RATIO (%)

REFERENCES CITED IN THE DESCRIPTION

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