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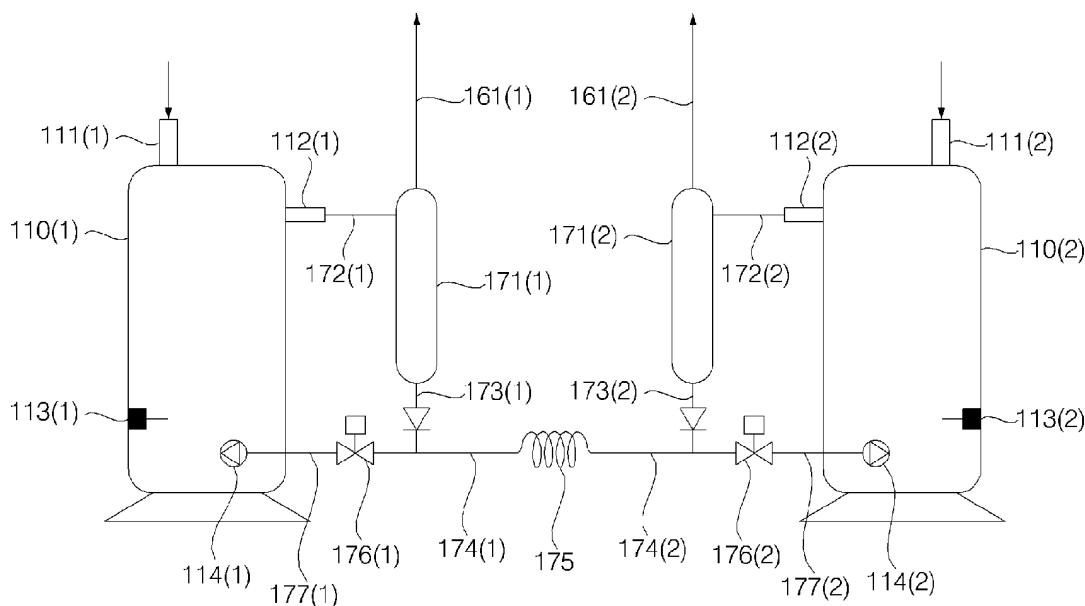
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(54) **Air conditioner**

(57) Disclosed is an air conditioner in which a plurality of compressors (110) retains a constant oil level. The air conditioner includes a plurality of compressors (110) configured to compress a refrigerant, a plurality of oil separators (171) connected respectively to the plurality of compressors and serving to separate oil contained in the refrigerant compressed in and discharged from the com-

pressors, a plurality of oil return pipes (177) configured to allow the oil separated in the plurality of oil separators to be returned into the plurality of compressors, a plurality of oil return valves (176) installed respectively to the plurality of oil return pipes to open or close the plurality of oil return pipes respectively, and a resistor (175) configured to connect the plurality of oil return pipes to each other.

FIG. 2



Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Korean Patent Application No. 10-2011-0047170 filed on May 19, 2011, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the invention

[0002] The present invention relates to an air conditioner, and more particularly, to an air conditioner in which a plurality of compressors retains a constant oil level.

2. Description of the Related Art

[0003] Generally, an air conditioner is an apparatus to cool and/or heat an indoor space via heat exchange between indoor air and a refrigerant that undergoes a refrigerant cycle including compression, condensation, expansion and evaporation. Air conditioners may be classified into a cooling air conditioner to supply cold air to a room by driving a refrigerant cycle in a given direction, and a cooling and heating air conditioner to supply cold air or warm air to a room by driving a refrigerant cycle selectively and bidirectionally.

[0004] In addition, air conditioners may be classified into a general air conditioner in which a single indoor unit is connected to a single outdoor unit, and a multi-type air conditioner in which a plurality of indoor units is connected to at least one outdoor unit.

[0005] The multi-type air conditioner is typically used to selectively control, e.g., the temperature of a plurality of spaces partitioned in a building. To this end, in the multi-type air conditioner, a required number of a plurality of compressors may be selectively operated according to the entire air conditioning load. In particular, if the compressors are inverter compressors, adjusting a compression capability thereof is possible.

[0006] When operating a plurality of inverter compressors together, the respective compressors have different oil discharge rates according to operating modes thereof and thus, have a difference in the level of oil. A shortage of oil may cause compressor failure due to insufficient oil supply, whereas an oversupply of oil may increase power consumption of an internal motor of the compressor, resulting in efficiency deterioration. For this reason, retaining a plurality of compressors at a constant oil level is an important problem.

SUMMARY OF THE INVENTION

[0007] Therefore, the present invention has been made in view of the above problems, and it is one object

of the present invention to provide an air conditioner in which a plurality of compressors retains a constant oil level.

[0008] It is another object of the present invention to provide an air conditioner in which oil to be returned into each compressor is controlled according to the oil level of a plurality of compressors.

[0009] Effects of the present invention are not limited to the aforementioned effects, and other effects not mentioned above will be clearly understood by those skilled in the art from the disclosure of the accompanying claims.

[0010] In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of an air conditioner including a plurality of compressors configured to compress a refrigerant, a plurality of oil separators connected respectively to the plurality of compressors and serving to separate oil contained in the refrigerant compressed in and discharged from the compressors, a plurality of oil return pipes configured to allow the oil separated in the plurality of oil separators to be returned into the plurality of compressors, a plurality of oil return valves installed respectively to the plurality of oil return pipes to open or close the plurality of oil return pipes respectively, and a resistor configured to connect the plurality of oil return pipes to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagram illustrating the configuration of an air conditioner in accordance with an embodiment of the present invention;

FIG. 2 is a partial detailed diagram of an air conditioner in accordance with one embodiment of the present invention; and

FIG. 3 is a partial detailed diagram of an air conditioner in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The advantages and features of the present invention and the way of attaining them will become apparent with reference to embodiments described below in detail in conjunction with the accompanying drawings. Embodiments, however, may be embodied in many different forms and should not be constructed as being limited to example embodiments set forth herein. Rather, these example embodiments are provided so that this disclosure will be through and complete and will fully convey the scope to those skilled in the art. The scope of the present invention should be defined by the claims. Where-

ever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0013] Hereinafter, an air conditioner in accordance with the embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0014] FIG. 1 is a diagram illustrating the configuration of an air conditioner in accordance with an embodiment of the present invention.

[0015] An outdoor unit OU includes a compressor 110, an outdoor heat exchanger 140, an outdoor expansion valve 132, and a supercooler 180. The air conditioner may include a single or a plurality of outdoor units OU and, in the present embodiment, a single outdoor unit OU is provided.

[0016] The compressor 110 serves to compress an introduced low-temperature and low-pressure refrigerant into a high-temperature and high-pressure refrigerant. The compressor 110 may have one of various configurations, and an inverter compressor or a constant-speed compressor may be adopted. In the present embodiment, the outdoor unit OU includes a plurality of compressors 110 and more particularly, a plurality of inverter compressors, a compression capability of which is variable according to an operating mode thereof. In the present embodiment, two inverter compressors 110 are provided.

[0017] An accumulator 187 may be connected to suction pipes 162 of the compressors 110, to prevent a liquid-phase refrigerant from entering the compressors 110.

[0018] The plurality of compressors 110 is connected respectively to a plurality of refrigerant discharge pipes 172, from which the compressed refrigerant is discharged. The plurality of refrigerant discharge pipes 172 is connected respectively to a plurality of oil separators 171, which separate oil from the discharged refrigerant. The refrigerant having passed through the plurality of oil separators 171 is guided to a 4-way valve 160 through a plurality of discharge pipes 161. Detailed configurations of the plurality of compressors 110 and the plurality of oil separators 171 will be described later with reference to FIG. 2.

[0019] The 4-way valve 160 is a flow-path switching valve to switch the flow of a refrigerant upon cooling and heating. The 4-way valve 160 may guide a refrigerant compressed in the compressors 110 to the outdoor heat exchanger 140 through an inflow pipe 168 during a cooling operation, or may guide the compressed refrigerant to an indoor heat exchanger 120 through a gas pipe 169 during a heating operation. The 4-way valve 160 is located in a state B during the cooling operation and is located in a state A during the heating operation.

[0020] The gas pipe 169 guides a refrigerant evaporated in the indoor heat exchanger 120 to the 4-way valve 160 during the cooling operation, enabling the flow of the refrigerant to the compressors 110. Also, the gas pipe 169 guides the refrigerant compressed in the compressors 110 to flow to the indoor heat exchanger 120 by way of the 4-way valve 160 during the heating operation.

[0021] The outdoor heat exchanger 140 is placed in an outdoor space and a refrigerant passing through the outdoor heat exchanger 140 exchanges heat with outdoor air. The outdoor heat exchanger 140 functions as a condenser during the cooling operation and functions as an evaporator during the heating operation. The outdoor heat exchanger 140 is connected to a liquid pipe 165 via an outflow pipe 166.

[0022] The outdoor expansion valve 132 serves to throttle an introduced refrigerant during the heating operation and is installed on the outflow pipe 166. A first bypass pipe 167 is installed to the outflow pipe 166 to allow the refrigerant to bypass the outdoor expansion valve 132 and in turn, a check valve 133 is installed on the first bypass pipe 167.

[0023] The check valve 133 allows the refrigerant to flow from the outdoor heat exchanger 140 to a plurality of indoor units IU during the cooling operation, but interrupts the flow of the refrigerant during the heating operation.

[0024] The supercooler 180 includes a supercooling heat exchanger 184, a second bypass pipe 181, a supercooling expansion valve 182 and a discharge pipe 185. The supercooling heat exchanger 184 is located on the outflow pipe 166. During the cooling operation, the second bypass pipe 181 may function to bypass a refrigerant discharged from the supercooling heat exchanger 184, directing the refrigerant into the supercooling expansion valve 182.

[0025] The supercooling expansion valve 182 is located on the second bypass pipe 181 and serves to throttle a liquid-phase refrigerant introduced into the second bypass pipe 181 so as to lower a pressure and temperature of the refrigerant and thereafter, direct the resulting refrigerant into the supercooling heat exchanger 184. The supercooling expansion valve 182 is any one of various types and a linear expansion valve may be adopted for user convenience.

[0026] During the cooling operation, the supercooling heat exchanger 184 performs heat exchange between a condensed refrigerant having passed through the outdoor heat exchanger 140 and a low-temperature refrigerant directed from the second bypass pipe 181, whereby the resulting supercooled refrigerant flows to the plurality of indoor units IU through the liquid pipe 165.

[0027] After the refrigerant having passed through the second bypass pipe 181 is heat exchanged in the supercooling heat exchanger 184, the refrigerant is introduced into the accumulator 187 through the discharge pipe 185.

[0028] In the air conditioner in accordance with the embodiment of the present invention, the plurality of indoor units IU each includes the indoor heat exchanger 120, an indoor blower 125, and an indoor expansion valve 131. The air conditioner may include a single or a plurality of indoor units IU and, in the present embodiment, a first indoor unit IU(1) to a third indoor unit IU(3) are provided.

[0029] The indoor heat exchanger 120 is placed in an indoor space and a refrigerant passing through the indoor

heat exchanger 120 exchanges heat with indoor air. The indoor heat exchanger 120 functions as an evaporator during the cooling operation and functions as a condenser during the heating operation. The indoor heat exchanger 120 is connected to the gas pipe 169 via an indoor exit pipe 164 and is connected to the liquid pipe 165 via an indoor entrance pipe 163.

[0030] The indoor blower 125 serves to blow the indoor air heat exchanged in the indoor heat exchanger 120.

[0031] The indoor entrance pipe 163 is provided with an indoor expansion valve 131. The indoor expansion valve 131 serves to throttle an introduced refrigerant during the cooling operation. The indoor expansion valve 131 is installed to the indoor entrance pipe 163 of the indoor unit IU. The indoor expansion valve 131 is any one of various types and a linear expansion valve may be adopted for user convenience.

[0032] FIG. 2 is a partial detailed diagram of an air conditioner in accordance with one embodiment of the present invention.

[0033] The air conditioner in accordance with one embodiment of the present invention includes the plurality of compressors 110 to compress a refrigerant, the plurality of oil separators 171 connected respectively to the plurality of compressors 110 to separate oil contained in the compressed refrigerant discharged from the compressors 110, a plurality of oil return pipes 177 through which the oil separated in the plurality of oil separators 171 is returned to the plurality of compressors 110, a plurality of oil return valves 176 installed respectively to the plurality of oil return pipes 177 to open or close the plurality of oil return pipes 177 respectively, and a resistor 175 to connect the plurality of oil return pipes 177 to each other.

[0034] The plurality of compressors 110 compresses an introduced low-temperature and low-pressure refrigerant into a high-temperature and high-pressure refrigerant as described above. In the present embodiment, the plurality of compressors 110 includes a first compressor 110(1) and a second compressor 110(2). The first compressor 110(1) and the second compressor 110(2) are preferably inverter compressors, a compression capability of which is variable according to an operating mode thereof.

[0035] The compressor 110 includes a refrigerant inlet port 111 into which a refrigerant is introduced, a refrigerant outlet port 112 from which the compressed refrigerant is discharged, an oil level sensor 113 to measure the height of oil within the compressor 110, and an oil pump 114 to forcibly introduce the oil into the compressor 110.

[0036] The refrigerant inlet port 111 serves to receive a refrigerant to be introduced into the compressor 110 and is connected to the suction pipe 162. The refrigerant inlet port 111 receives a refrigerant, having passed through the accumulator 187, from the suction pipe 162. The first compressor 110(1) includes a first refrigerant inlet port 111(1) and the second compressor 110(2) in-

cludes a second refrigerant inlet port 111(2).

[0037] The refrigerant outlet port 112 serves to discharge the refrigerant compressed in the compressor 110. The refrigerant outlet port 112 is connected to the refrigerant discharge pipe 172. The refrigerant outlet port 112 also discharges oil from the compressor 110 simultaneously with discharge of the compressed refrigerant. The refrigerant containing the oil, discharged from the refrigerant outlet port 112, flows to the oil separator 171 through the refrigerant discharge pipe 172. The first compressor 110(1) includes a first refrigerant outlet port 112(1) and the second compressor 110(2) includes a second refrigerant outlet port 112(2).

[0038] The oil level sensor 113 measures the height of oil within the compressor 110. The compressor 110 accommodates oil therein and the oil serves to lubricate and cool a mechanical device required to compress a refrigerant. The oil fills a bottom region of the compressor 110 and is pumped during driving of the compressor 110. The oil level sensor 113 measures the height of oil filling the bottom region of the compressor 110. Whether to open or close the oil return valve 176 is determined according to the height of oil measured by the oil level sensor 113. The first compressor 110(1) includes a first oil level sensor 113(1) and the second compressor 110(2) includes a second oil level sensor 113(2).

[0039] The oil pump 114 is connected to the oil return pipe 177 to introduce the oil into the compressor 110. The oil pump 114 is placed within the compressor 110 to fill the bottom region of the compressor 110 with the oil. The oil pump 114 is preferably located lower than the oil level sensor 113 within the compressor 110. The first compressor 110(1) includes a first oil pump 114(1) and the second compressor 110(2) includes a second oil pump 114(2).

[0040] Preferably, the oil pump 114 is a trochoid pump to propel oil. The oil pump 114 is preferably provided in the case of a high-pressure compressor and may be omitted in the case of a low-pressure compressor. If the compressor 110 is a low-pressure compressor, preferably, the oil return pipe 177 is directly connected to the compressor 110.

[0041] Alternatively, the oil pump 114 may be integrally formed within the compressor 110 to pump oil upward from the bottom of the compressor 110, other than being provided separately. The pump is preferably a trochoid pump to propel oil upward. As the oil is propelled upward within the compressor 110, additional oil is suctioned from the oil return pipe 177 into the compressor 110. In this case, the oil return pipe 177 is not directly connected to the oil pump 114.

[0042] The oil separator 171 separates the oil contained in the refrigerant discharged from the compressor 110. The plurality of oil separators 171 is provided to correspond respectively to the plurality of compressors 110. The plurality of oil separators 171 includes a first oil separator 171(1) corresponding to the first compressor 110(1) and a second oil separator 171(2) corresponding

to the second compressor 110(2).

[0043] The oil separator 171 and the compressor 110 are connected to the refrigerant discharge pipe 172. The plurality of refrigerant discharge pipes 172 is provided to correspond respectively to the plurality of compressors 110. The plurality of refrigerant discharge pipes 172 is connected respectively to the refrigerant outlet ports 112 of the plurality of compressors 110. The plurality of refrigerant discharge pipes 172 includes a first refrigerant discharge pipe 172(1) to connect the first compressor 110(1) and the first oil separator 171(1) to each other and a second refrigerant discharge pipe 172(2) to connect the second compressor 110(2) and the second oil separator 171 (2) to each other.

[0044] The refrigerant, from which the oil has been separated in the oil separator 171, is discharged into a discharge pipe 161. A plurality of discharge pipes 161 is provided and is connected respectively to the plurality of oil separators 171. The plurality of discharge pipes 161 includes a first discharge pipe 161(1) connected to the first oil separator 171(1) and a second discharge pipe 161(2) connected to the second oil separator 171(2).

[0045] The oil separated in the oil separator 171 is discharged into an oil discharge pipe 173. The oil discharge pipe 173 is diverged into the oil return pipe 177 and an oil confluence pipe 174. The oil discharge pipe 173 is preferably provided with a check valve to prevent back-flow of oil.

[0046] A plurality of oil discharge pipes 173 is provided and is connected respectively to the plurality of oil separators 171 so as to discharge the oil separated in the plurality of oil separators 171 respectively. The plurality of oil discharge pipes 173 includes a first oil discharge pipe 173(1) connected to the first oil separator 171(1) and a second oil discharge pipe 173(2) connected to the second oil separator 171(2).

[0047] The oil return pipe 177 is a pipe, through which the oil separated in the oil separator 171 flows and is returned to the compressor 110. The oil return pipe 177 connects the oil discharge pipe 173 and the compressor 110 to each other. The oil return pipe 177 may be connected to the compressor 110 so as to be directly connected to the oil pump 114.

[0048] A plurality of oil return pipes 177 is provided and is connected respectively to the plurality of oil discharge pipes 173. The plurality of oil return pipes 177 includes a first oil return pipe 177(1) to connect the first oil discharge pipe 173(1) and the first compressor 110(1) to each other, and a second oil return pipe 177(2) to connect the second oil discharge pipe 173(2) and the second compressor 110(2) to each other.

[0049] The oil return valve 176 is installed to the oil return pipe 177 to open or close the oil return pipe 177. The oil return valve 176 allows or interrupts return of the oil separated in the oil separator 171 to the compressor 110. The oil return valve 176 is controlled by the oil level sensor 113. More specifically, the oil level sensor 130 controls the oil return valve 176 to open the oil return pipe

177 if the level of oil within the corresponding compressor 110 is lower than the oil level sensor 113, and to close the return pipe 177 if the level of oil within the corresponding compressor 110 is higher than the oil level sensor 113.

[0050] A plurality of oil return valves 176 is provided. The oil return valves 176 include a first oil return valve 176(1) installed to the first oil return pipe 177(1) and a second oil return valve 176(2) installed to the second oil return pipe 177(2).

[0051] The first oil return valve 176(1) is opened if the level of oil within the first compressor 110(1) is lower than the first oil level sensor 113(1) and is closed if the level of oil is higher than the first oil level sensor 113(1). Likewise, the second oil return valve 176(2) is opened if the level of oil within the second compressor 110(2) is lower than the second oil level sensor 113(2) and is closed if the level of oil is higher than the second oil level sensor 113(2).

[0052] The resistor 175 connects the plurality of oil return pipes 177 to each other. More specifically, the resistor 175 connects the first oil return pipe 177(1) and the second oil return pipe 177(2) to each other. The resistor 175 is connected to the oil return pipes 177 via the oil confluence pipes 174.

[0053] A plurality of oil confluence pipes 174 is provided and is respectively connected at one end thereof to the plurality of oil discharge pipes 173 and at the other end thereof to the resistor 175. The plurality of oil confluence pipes 174 includes a first oil confluence pipe 174 (1) to connect the first oil return pipe 177(1) and the resistor 175 to each other and a second oil confluence pipe 174(2) to connect the second oil return pipe 177(2) and the resistor 175 to each other.

[0054] The first oil confluence pipe 174(1) allows the oil separated in the first oil separator 171(1) to flow to the second oil return pipe 177(2), and the second oil confluence pipe 174(2) allows the oil separated in the second oil separator 171(2) to flow to the first oil return pipe 177 (1).

[0055] The resistor 175 preferably takes the form of a capillary element to prevent confluence of the oil from the plurality of oil return pipes 177 when all of the plurality of oil return valves 176 is opened. If only one of the plurality of oil return valves 176 is opened and the other one is closed, the resistor 175 allows the oil discharged from the plurality of oil discharge pipes 173 to flow together into the oil return pipe 177 to which the opened return valve 176 is installed.

[0056] Hereinafter, operation of the air conditioner having the above described configuration in accordance with the present invention will be described.

[0057] The refrigerant compressed in the plurality of compressors 110 is discharged through the respective refrigerant outlet ports 112 along with the oil. The refrigerant and the oil, discharged from the refrigerant outlet ports 112 of the plurality of compressors 110, are introduced into the plurality of oil separators 171 through the

plurality of refrigerant discharge pipes 172.

[0058] The plurality of oil separators 171 separates the refrigerant and the oil from each other. The refrigerant, from which the oil has been separated in the plurality of oil separators 171, is discharged into the plurality of discharge pipes 161. The oil separated in the plurality of oil separators 171 is discharged into the plurality of oil discharge pipes 173.

[0059] The oil discharged into the plurality of oil discharge pipes 173 exhibits different flow behaviors according to the height of oil within the compressors 110 measured by the oil level sensors 113.

[0060] If the height of oil within the first compressor 110(1) is lower than the first oil level sensor 113(1) and the height of oil within the second compressor 110(2) is higher than the second oil level sensor 113(2), the first oil return valve 176(1) is opened and the second oil return valve 176(2) is closed. In this case, the oil separated in the plurality of oil separators 171 is wholly returned into the first compressor 110(1). That is, the first oil pump 114 (1) is operated to return the oil separated in the first oil separator 171(1) into the first compressor 110(1) by way of the first oil discharge pipe 173(1) and the first oil return pipe 177(1). The first oil pump 114(1) is also operated to return the oil separated in the second oil separator 171 (2) into the first compressor 110(1) by way of the second oil discharge pipe 173(2), the second oil confluence pipe 174(2), the resistor 175, the first oil confluence pipe 174 (1) and the first oil return pipe 177(1).

[0061] If the height of oil within the first compressor 110(1) is higher than the first oil level sensor 113(1) and the height of oil within the second compressor 110(2) is lower than the second oil level sensor 113(2), the first oil return valve 176(1) is closed and the second oil return valve 176(2) is opened. In this case, the oil separated in the plurality of oil separators 171 is wholly returned into the second compressor 110(2). That is, the second oil pump 114(2) is operated to return the oil separated in the second oil separator 171(2) into the second compressor 110(2) by way of the second oil discharge pipe 173 (3) and the second oil return pipe 177(2). Also, the second oil pump 114(2) is operated to return the oil separated in the first oil separator 171(1) into the second compressor 110(2) by way of the first oil discharge pipe 173(1), the first oil confluence pipe 174(1), the resistor 175, the second oil confluence pipe 174(2) and the second oil return pipe 177(2).

[0062] If the height of oil within the first compressor 110(1) is lower than the first oil level sensor 113(1) and the height of oil within the second compressor 110(2) is lower than the second oil level sensor 113(2), the first oil return valve 176(1) is opened and the second oil return valve 176(2) is also opened. In this case, since the resistor 175 prevents confluence of the oil returned from the plurality of oil return pipes 177, the oil separated in the plurality of oil separators 171 is returned to the respective corresponding compressors 110.

[0063] Although the oil separated in the first oil separator 171(1) may flow to the first oil confluence pipe 174 (1) through the first oil discharge pipe 173(1), this flow of the oil is limited by the resistor 175 and thus, by operation of the first oil pump 114(1), the oil is returned into the first compressor 110(1) through the first oil return pipe 177 (1) in an open state of the first oil return valve 176(1). Also, although the oil separated in the second oil separator 171(2) may flow to the second oil confluence pipe 174(2) through the second oil discharge pipe 173(2), this flow of the oil is limited by the resistor 175 and thus, by operation of the second oil pump 114(2), the oil is returned into the second compressor 110(2) through the second oil return pipe 177(2) in an open state of the second oil return valve 176(2).

[0064] FIG. 3 is a partial detailed diagram of an air conditioner in accordance with another embodiment of the present invention.

[0065] In the air conditioner of the present embodiment, a plurality of oil return pipes 277 is connected respectively to the refrigerant inlet ports 111 of the plurality of compressors 110. The plurality of oil return pipes 277 includes a first oil return pipe 277(1) connected to the first refrigerant inlet port 111(1) of the first compressor 110(1) and a second oil return pipe 277(2) connected to the second refrigerant inlet port 111(2) of the second compressor 110(2).

[0066] The refrigerant inlet port 111 is connected to both the oil return pipe 277 and the suction pipe 162. Thus, the refrigerant moved from the accumulator 187 to the suction pipe 162 and the oil moved from the oil separator 171 to the oil return pipe 277 are introduced into the refrigerant inlet port 111.

[0067] In this case, the compressor 110 is a low-pressure compressor and does not need the oil pump 114.

[0068] In some embodiments, the plurality of oil return pipes 277 may be connected to the accumulator 187.

[0069] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. An air conditioner comprising:

- a plurality of compressors configured to compress a refrigerant;
- a plurality of oil separators connected respectively to the plurality of compressors and serving to separate oil contained in the refrigerant compressed in and discharged from the compressors;
- a plurality of oil return pipes configured to allow the oil separated in the plurality of oil separators to be returned into the plurality of compressors;

- a plurality of oil return valves installed respectively to the plurality of oil return pipes to open or close the plurality of oil return pipes respectively; and
a resistor configured to connect the plurality of oil return pipes to each other. 5
2. The air conditioner according to claim 1, wherein the compressors each includes an oil level sensor configured to measure the height of oil within the compressor. 10
 3. The air conditioner according to claim 2, wherein the oil return valve connected to the compressor is opened if the height of oil within the compressor is lower than the oil level sensor. 15
 4. The air conditioner according to claim 2, wherein the oil return valve connected to the compressor is closed if the height of oil within the compressor is higher than the oil level sensor. 20
 5. The air conditioner according to claim 1, further comprising a plurality of oil discharge pipes connected respectively to the plurality of oil separators such that the oil separated in the plurality of oil separators are discharged into the oil discharge pipes. 25
 6. The air conditioner according to claim 5, wherein the plurality of oil return pipes is connected respectively to the plurality of oil discharge pipes. 30
 7. The air conditioner according to claim 5, further comprising a plurality of oil confluence pipes connected respectively to the plurality of oil discharge pipes, the oil confluence pipes also being connected to the resistor. 35
 8. The air conditioner according to claim 1, wherein the compressors each includes an oil pump connected to the oil return pipe to introduce the oil into the compressor. 40
 9. The air conditioner according to claim 8, wherein the oil pump is placed within the compressor. 45
 10. The air conditioner according to claim 1, wherein:
the compressors respectively include refrigerant inlet ports into which the refrigerant is introduced; and
the oil return pipes are connected respectively to the refrigerant inlet ports. 50
 11. The air conditioner according to claim 10, wherein:
the compressors respectively include refrigerant outlet ports from which the compressed re- 55
- frigerant is discharged; and
the air conditioner further comprises a plurality of refrigerant discharge pipes connected respectively to the refrigerant outlet ports of the plurality of compressors.
12. The air conditioner according to claim 1, wherein the resistor is a capillary element.
 13. The air conditioner according to claim 1, wherein the resistor prevents confluence of the oil returned from the plurality of oil return pipes if all of the plurality of oil return valves is opened.
 14. The air conditioner according to claim 1, wherein if some of the plurality of oil return valves are opened and the others are closed, the resistor allows the oil separated in the oil separator connected to the closed oil return valve to flow to the oil return pipe connected to the opened oil return valve.
 15. The air conditioner according to claim 1, further comprising a plurality of discharge pipes connected respectively to the plurality of oil separators such that the refrigerant, from which the oil has been separated in the plurality of oil separators, is be discharged into the discharge pipes.

FIG. 1

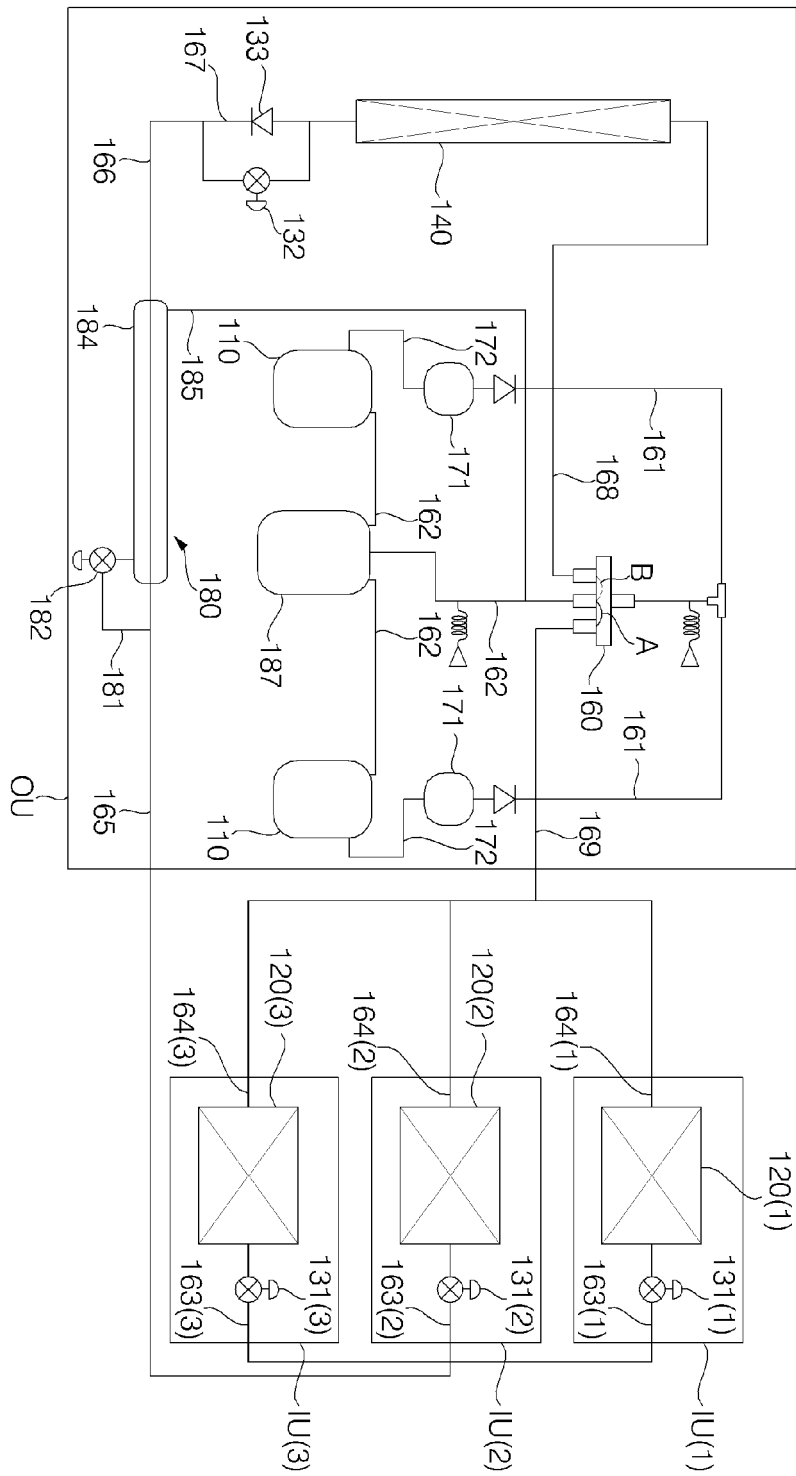


FIG. 2

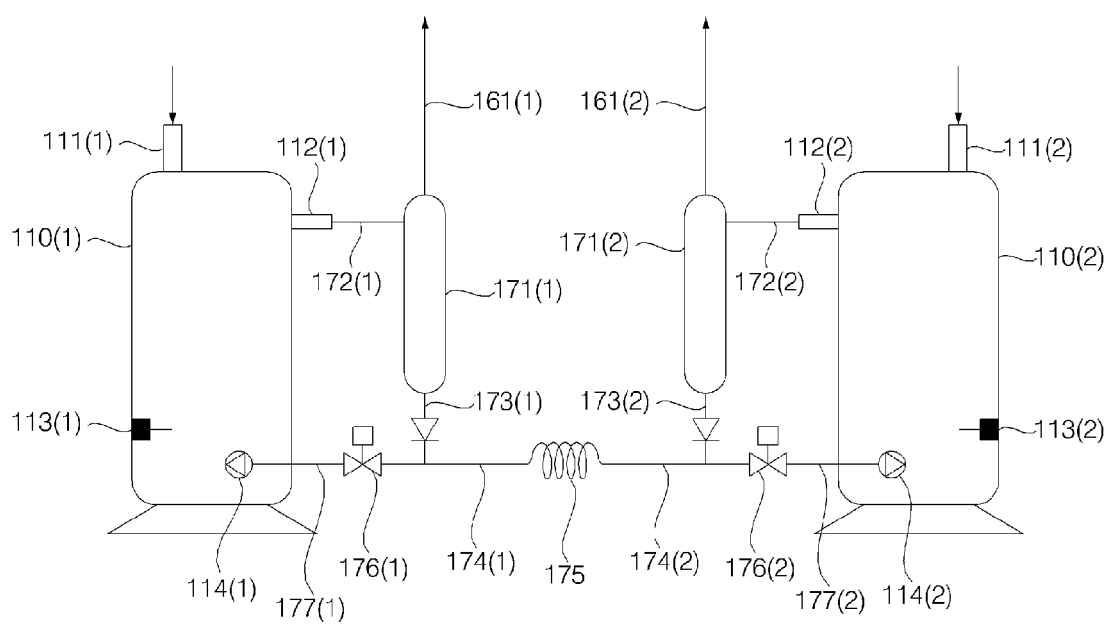
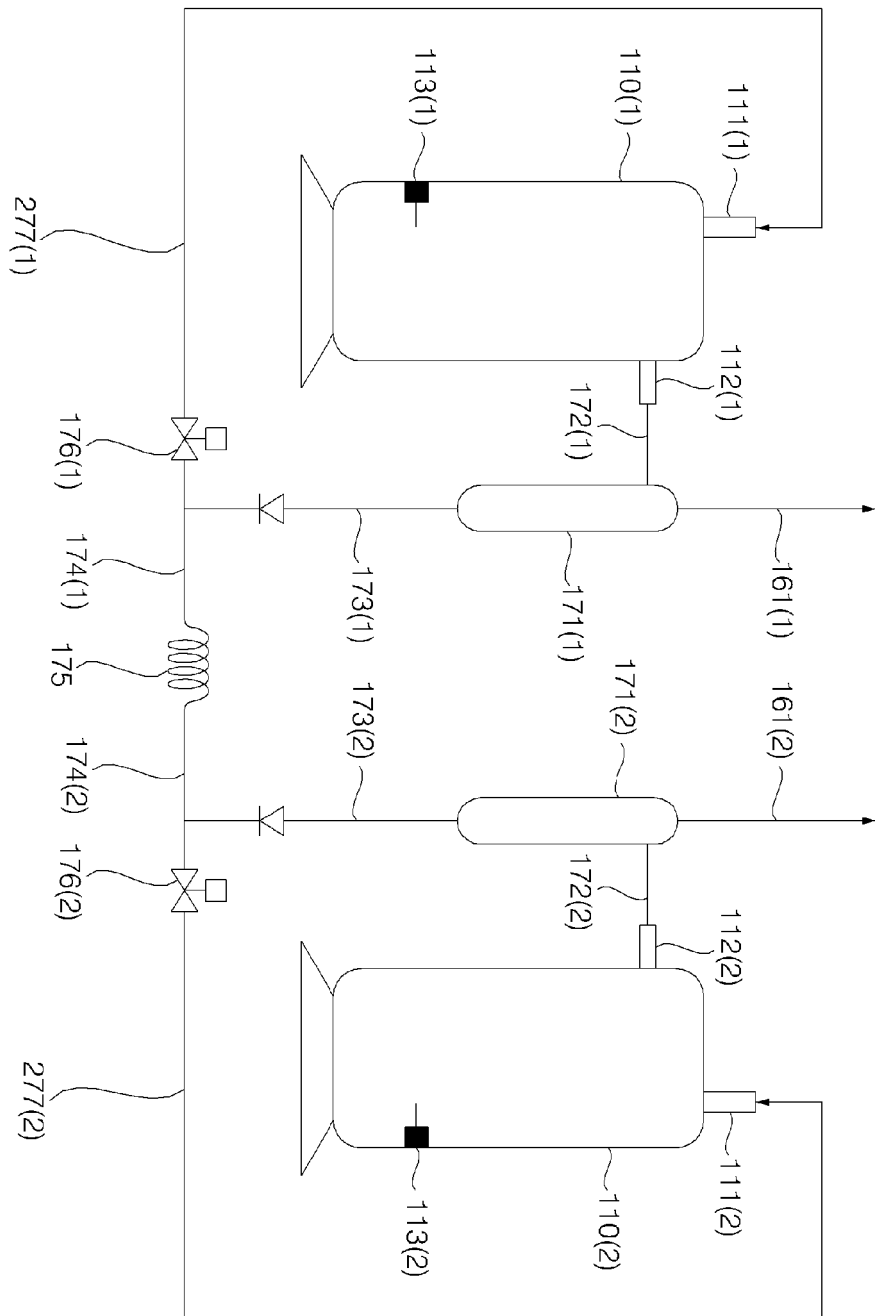


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 12 16 7765

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2008/044807 A2 (LG ELECTRONICS INC [KR]; SONG CHI WOO [KR]; CHO NAM JOON [KR]; CHUNG B) 17 April 2008 (2008-04-17)	1-9, 12-15	INV. F25B43/02 F25B31/00
Y	* paragraphs [0051], [0063] - [0077]; figures 2-5 *	10,11	
Y	WO 2009/054571 A1 (LG ELECTRONICS INC [KR]; YOON PIL-HYUN [KR]; OH SAI-KEE [KR]; CHOI SUN) 30 April 2009 (2009-04-30) * figures 1,4 *	10,11	
A	EP 1 659 351 A2 (LG ELECTRONICS INC [KR]) 24 May 2006 (2006-05-24) * the whole document *	1-15	
A	EP 1 657 505 A1 (LG ELECTRONICS INC [KR]) 17 May 2006 (2006-05-17) * figure 1 *	1-15	
A	EP 1 659 350 A1 (LG ELECTRONICS INC [KR]) 24 May 2006 (2006-05-24) * the whole document *	2-4	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 2 204 621 A2 (LG ELECTRONICS INC [KR]) 7 July 2010 (2010-07-07) * figure 1 *	1-15	F25B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 September 2012	Examiner Ritter, Christoph
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