



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**30.08.2006 Bulletin 2006/35**

(51) Int Cl.:  
**F25B 13/00 (2006.01)** **F25B 31/00 (2006.01)**  
**F25B 43/00 (2006.01)**

(21) Application number: **05004194.6**

(22) Date of filing: **25.02.2005**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**  
Designated Extension States:  
**AL BA HR LV MK YU**

(71) Applicant: **LG ELECTRONICS INC.**  
**Seoul (KR)**

(72) Inventors:  
• **Kim, Cheol-Min**  
**Manan-Gu**  
**Anyang**  
**Gyeonggi-Do (KR)**  
• **Cho, Eun-Jun,**  
**Hyundai Hometown Apt. 102-1304**  
**Bucheon, Gyeonggi-Do (KR)**  
• **Hwang, Yoon-Jei**  
**Yongsan-Gu**  
**Seoul (KR)**

• **Ryu, Yun-Ho**  
**Seoul (KR)**  
• **Song, Chan-Ho**  
**Duckyang-Gu, Goyang, Gyeonggi-Do (KR)**  
• **Lee, Won-Hee**  
**Seoul (KR)**  
• **Choi, Chang-Min**  
**Gwanak-Gu**  
**Seoul (KR)**

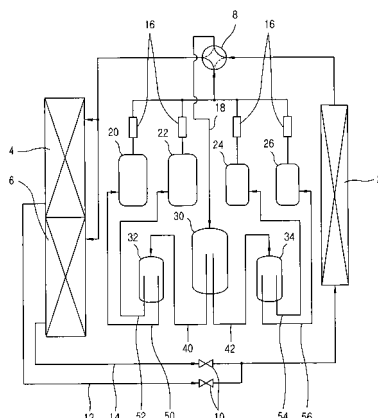
(74) Representative: **Schippan, Ralph**  
**COHAUSZ & FLORACK**  
**Patent- und Rechtsanwälte**  
**Bleichstrasse 14**  
**40211 Düsseldorf (DE)**

Remarks:  
Amended claims in accordance with Rule 86 (2) EPC.

(54) **Air-conditioner having multiple compressors**

(57) An air-conditioner having multiple compressors (20,22,24,26) includes: an indoor heat-exchanger (2) disposed indoors and heat-exchanging indoor air; an outdoor heat-exchanger (4,6) disposed outdoors and heat-exchanging a refrigerant with external air; four compressors (20,22,24,26) for compressing the refrigerant to change the refrigerant to have a high temperature and high pressure; and three accumulators (30,32,34) disposed at a suction side of the four compressors (20,22,24,26) and separating the refrigerant into a gas and a liquid to supply a gaseous refrigerant to the compressors (20,22,24,26). Oil can be uniformly supplied to each compressor (20,22,24,26), thereby enhancing reliability of compressors (20,22,24,26), and since the three accumulators (30,32,34) are small with low capacities, their installation space can be easily secured.

FIG. 3



**Description****BACKGROUND OF THE INVENTION**

## 1. Field of the Invention

**[0001]** The present invention relates to an air-conditioner and, more particularly, to an air-conditioner having four compressors and three accumulators.

## 2. Description of the Background Art

**[0002]** In general, a heat-pump type air-conditioner can be operable both for air-cooling and air-heating. Namely, including an indoor heat exchanger and an outdoor heat exchanger, the heat-pump type air-conditioner can be used both as an air-cooling device and as an air-heating device by making a refrigerant of a refrigerating cycle to flow reversely.

**[0003]** Figure 1 shows the construction of a refrigerating cycle of the heat-pump type air-conditioner in accordance with a conventional art.

**[0004]** The conventional heat-pump type air-conditioner includes an indoor heat exchanger 102 installed indoors and performing air-cooling or air-heating, an outdoor heat exchanger 104 disposed outdoors and heat-exchanged with outdoor air; a four-way valve 106 for switching a flow of a refrigerant in a forward direction or a backward direction; an expansion valve 110 installed at a refrigerant pipe connecting the outdoor heat exchanger 104 and the indoor heat exchanger 102 and changing a refrigerant gas to have a low temperature and low pressure, compressors 112, 114, 116 and 118 for compressing a refrigerant to have a high temperature and high pressure, and an accumulator 130 connected to the compressors 112, 114, 116 and 118 by discharge pipes 120, 122, 124 and 126, separating the refrigerant into a gas and a liquid, and supplying the gaseous refrigerant to each compressor 112, 114, 116 and 118.

**[0005]** The compressors are the first compressor 112, the second compressor 114, the third compressor 116 and the fourth compressor 118, and check valves 140 are installed at discharge sides of each compressor 112, 114, 116 and 118 to prevent the refrigerant from flowing backward.

**[0006]** The accumulator 130 having a large capacity separates the refrigerant sucked through the refrigerant pipe 142 into a gas and a liquid and distributes the gaseous refrigerant to the first to fourth compressors 112, 114, 116 and 118.

**[0007]** As shown in Figure 2, the accumulator 130 includes a case 150 connected to the refrigerant pipe 142 through which the refrigerant is sucked thereinto and having a hermetic space, first to fourth discharge tubes 160, 162, 164 and 166 inserted for as long as a prescribed length into the case 150 from the lower side of the case 150 and supplying a gas refrigerant gasificated inside the case 150 to each compressor 112, 114, 116 and 118, a screen 152 installed at an upper portion inside the case 150, and a tube holder 154 for supporting the discharge tubes 160, 162, 164 and 166 inserted inside the case 150.

**[0008]** Oil contained in the refrigerant introduced through the refrigerant pipe 142 is stored at the side portion of the case 150, and oil retrieval holes 156 are formed respectively at one portion of the first to fourth discharge tubes 160, 162, 164. and 166. Accordingly, the oil stored at the lower portion of the case 150 is sucked into the oil retrieval holes 156 by virtue of a pressure of the refrigerant flowing in the first to fourth discharge tubes 160, 162, 164 and 166, and retrieved to each compressor 112, 114, 116 and 118, thereby performing a lubricating operation of the compressors.

**[0009]** However, the conventional heat-pump type air-conditioner has the following problems.

**[0010]** That is, since the first to fourth discharge tubes 160, 162, 164 and 166, which are respectively connected to the four compressors 112, 114, 116 and 118, are installed in one accumulator 130, the amount of oil sucked through each discharge tube 160, 162, 164 and 166 differs, and thus, some compressor(s) to which relatively less oil is retrieved can be damaged due to oil shortage.

**[0011]** In addition, since the four compressors are connected to one accumulator, a relatively large capacity accumulator is required. Then, it is not easy to secure an installation space for the large accumulator.

**SUMMARY OF THE INVENTION**

**[0012]** Therefore, one object of the present invention is to provide an air-conditioner having multiple compressors in which three accumulators are provided to uniformly supply oil to four compressors, thereby enhancing reliability of compressors.

**[0013]** Another object of the present invention is to provide an air-conditioner having multiple compressors capable of easily securing an installation space for three low-capacity small accumulators.

**[0014]** To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided an air-conditioner having multiple compressors including: an indoor heat-exchanger disposed indoors and heat-exchanging indoor air; an outdoor heat-exchanger disposed outdoors

and heat-exchanging a refrigerant with external air; an expansion valve installed at a refrigerant pipe connecting the indoor heat-exchanger and the outdoor heat-exchanger and changing the refrigerant to have a low temperature and low pressure; four compressors for compressing the refrigerant to change the refrigerant to have a high temperature and high pressure; and three accumulators disposed at a suction side of the four compressors and separating the refrigerant into a gas and a liquid to supply a gaseous refrigerant to the compressors.

[0015] The compressors are first, second, third and fourth compressors. Each compressor can have the same capacity or compressors with different capacities are applied at various rates.

[0016] The accumulators include a first accumulator for receiving the refrigerant and separating it into a gas and a liquid; a second accumulator connected to the first accumulator by a refrigerant pipe and connected to the first and second compressors; and a third accumulator connected to the first accumulator by a refrigerant pipe and connected to the third and fourth compressors.

[0017] The second accumulator is connected to the first compressor by a first pipe and to the second compressor by a second pipe, separates the refrigerant supplied to the first accumulator into a gas and a liquid, and supplies the gaseous refrigerant to the first and second compressors.

[0018] The third accumulator is connected to the third compressor by a third pipe and to the fourth compressor by a fourth pipe, separates the refrigerant supplied to the first accumulator into a gas and a liquid, and supplies the gaseous refrigerant to the third and fourth compressors.

[0019] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0021] In the drawings:

Figure 1 shows the construction of a refrigerant cycle of a heat-pump type air-conditioner in accordance with a conventional art;

Figure 2 is a sectional view showing an accumulator in accordance with the conventional art;

Figure 3 shows the construction of a refrigerant cycle of a heat-pump type air-conditioner in accordance with the present invention; and

Figure 4 is a sectional view of an accumulator in accordance with the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0023] There can be plural embodiments for the air-conditioner having multiple compressors in accordance with the present invention, of which the most preferred one will now be described.

[0024] Figure 3 shows the construction of a refrigerant cycle of a heat-pump type air-conditioner in accordance with the present invention.

[0025] The air-conditioner of the present invention includes an indoor heat-exchanger 2 disposed indoors and heat-exchanged with indoor air; outdoor heat-exchangers 4 and 6 disposed outdoors and heat-exchanged with external air; a four-way valve 8 for switching a flow of a refrigerant in a forward direction or a backward direction; compressors 20, 22, 24 and 26 for compressing the refrigerant to change it to have a high temperature and high pressure; and a plurality of accumulators 30, 32 and 35 for separating the refrigerant supplied to the compressors 20, 22, 24 and 26 into a gas and a liquid.

[0026] The outdoor heat-exchangers 4 and 6 are first outdoor heat exchanger 4 and second outdoor heat exchanger 6.

[0027] Expansion valves 10 are installed at refrigerant pipes 12 and 14 connecting the outdoor heat exchangers 4 and 6 and the indoor heat exchanger 2 in order to change the refrigerant to a low temperature and low pressure state.

[0028] The compressors refer to the first compressor 20, the second compressor 22, the third compressor 24 and the fourth compressor 26. The compressors 20, 22, 24 and 26 may have the same capacity. Or, compressors having different capacities at several rates can be adopted.

[0029] Check valves 16 are installed at each discharge side of the compressors 20, 22, 24 and 26 in order to prevent the refrigerant from flowing backward.

[0030] The accumulators 30, 32 and 34 include a first accumulator 30 connected to a four-way valve 8 by a refrigerant

pipe 18 and separating the refrigerant introduced into the refrigerant pipe 18 into a gas and a liquid; a second accumulator 32 connected to the first accumulator 30 by the refrigerant pipe 40 and connected to the first and second compressors 20 and 22, and a third accumulator 34 connected to the first accumulator 30 by a refrigerant pipe 42 and connected to the third and fourth compressors 24 and 26.

**[0031]** The second accumulator 32 is connected to the first compressor 20 by a first pipe 50 and to the second compressor 22 by a second pipe 52, so that it can separate the refrigerant supplied to the first accumulator 30 into a gas and a liquid and supply the gaseous refrigerant to the first and second compressors 20 and 22.

**[0032]** The third accumulator 34 is connected to the third compressor 24 by a third pipe 54 and to the fourth compressor 26 by a fourth pipe 56, so that it can separate the refrigerant supplied to the first accumulator 30 into a gas and a liquid and supply the gaseous refrigerant to the third and fourth compressors 24 and 26.

**[0033]** The first, second and third accumulators have the same structure and may differ in their sizes depending on capacities of the compressors.

**[0034]** Of the accumulators 30, 32 and 34, the first accumulator 30 has the following structure.

**[0035]** As shown in Figure 4, the first accumulator 30 includes a case 60 connected to the four-way valve 8 by the refrigerant pipe 18 and having a hermetic space into which the refrigerant is sucked, first and second discharge tubes 62 and 64 inserted for as long as a prescribed length into the case 60 from the lower side of the case 60 and supplying a gaseous refrigerant gasified inside the case 60 to the second and third accumulators 32 and 34, a screen 66 installed at an upper portion inside the case 60, and a tube holder 68 supporting the discharge tubes 62 and 64 installed inside the case 60.

**[0036]** Oil contained in the refrigerant sucked into the case 60 is stored at a lower portion inside the case 60, and oil retrieving holes 70 and 72 are formed at one portion of the first and second discharge tubes 62 and 64 sunk in the oil, so that oil stored at the lower portion of the case 60 is sucked through the oil retrieving holes 70 and 72 and retrieved to each compressor.

**[0037]** The oil stored in the case 60 has a suction force by virtue of a pressure of the refrigerant passing the first and second discharge tubes 62 and 64.

**[0038]** The air-conditioner constructed as described above in accordance with the present invention operates as follows.

**[0039]** When the compressors 20, 22, 24 and 26 are driven, a low temperature and low pressure refrigerant which has passed the indoor heat-exchanger 2 is introduced into the first accumulator 30 after passing through the four-way valve 8.

**[0040]** The refrigerant is gasified and separated into a liquid and a gas in the first accumulator 30, and oil contained in the refrigerant is stored at a lower portion of the first accumulator 30.

**[0041]** The gaseous refrigerant which has been gasified in the first accumulator is supplied to the second accumulator 32 through the first discharge tube 62 and the refrigerant pipe 40, and also to the third accumulator 34 through the second discharge tube 64 and the refrigerant pipe 42.

**[0042]** At this time, the oil stored at the lower portion of the first accumulator 30 is sucked through the oil retrieving holes 70 and 72 formed at the first and second discharge tubes 62 and 64 and supplied together with the gaseous refrigerant to the second and third accumulators 32 and 34.

**[0043]** The refrigerant which has been supplied in the second accumulator 32 is separated into a gas and a liquid, and the gaseous refrigerant after being gasified in the second accumulator is supplied to the first compressor 20 through the first pipe 50 and to the second compressor 22 through the second pipe 52. At this time, the oil stored in the second accumulator 32 is retrieved together with the gaseous refrigerant into the first and second compressors 20 and 22 through the first and second pipes 50 and 52, to perform a lubricating operation of the compressors.

**[0044]** In this manner, the refrigerant and the oil are supplied only the two compressors 20 and 22 from the second accumulator 32, so that the amount of oil supplied to the first and second compressors 20 and 22 can be maintained constantly.

**[0045]** The refrigerant supplied to the third accumulator 34 is separated into a gas and a liquid, and the gaseous refrigerant after being gasified in the third accumulator 34 is supplied together with the oil stored in the third accumulator 34 to the third compressor 24 through the third pipe 54 and also to the fourth compressor 26 through the fourth pipe 56.

**[0046]** Herein, since the oil is supplied only to the two compressors 24 and 26 from the third accumulator 34, the amount of oil supplied to the third and fourth compressors 24 and 26 can be maintained constantly.

**[0047]** The process, in which the refrigerant supplied to the first to fourth compressors 20, 22, 24 and 26 is compressed to be changed to have a high temperature and high pressure, supplied to the outdoor heat-exchangers 4 and 6 for heat-exchanging with external air, changed to have a low temperature and low pressure while passing the expansion valve 10, and then supplied to the indoor heat-exchanger 2, is repeatedly performed.

**[0048]** As so far described, the air-conditioner having multiple compressors in accordance with the present invention has the following advantages.

**[0049]** That is, for example, since the three accumulators and four compressors are provided and one accumulator

is connected to two compressors, an interference generated in sucking oil or non-uniformity of the amount of oil supplied to each compressor due to a performance defection of compressors can be relatively reduced, and thus, reliability of the compressors can be enhanced.

[0050] In addition, since the three accumulators are small with a low capacity, their installation space can be easily secured.

[0051] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

## Claims

1. An air-conditioner having multiple compressors comprising:

an indoor heat-exchanger disposed indoors for heat-exchanging indoor air;  
 an outdoor heat-exchanger disposed outdoors for heat-exchanging a refrigerant with external air;  
 an expansion valve installed at a refrigerant pipe connecting to between the indoor heat-exchanger and the outdoor heat-exchanger;  
 four compressors for compressing the refrigerant to change the refrigerant to have a high temperature and high pressure; and  
 three accumulators disposed at a suction passage of the four compressors for separating the refrigerant into gas and liquid so as to supply a gaseous refrigerant to the compressors.

2. The air-conditioner of claim 1, wherein the compressors are first compressor, second compressor, third compressor and fourth compressor, and each compressors can have the same capacity or compressors with different capacities are adopted at various rates.

3. The air-conditioner of claim 2, wherein check valves are installed at each discharge passage of the compressors for preventing a refrigerant from flowing backward.

4. The air-conditioner of claim 2, wherein the accumulators comprises:

a first accumulator for receiving the refrigerant and separating refrigerant into a gas and a liquid;  
 a second accumulator connected to the first accumulator by a refrigerant pipe and connected to the first compressor and the second compressor; and  
 a third accumulator connected to the first accumulator by a refrigerant pipe and connected to the third compressor and the fourth compressor.

5. The air-conditioner of claim 4, wherein the second accumulator is connected to the first compressor by a first pipe and connected to the second compressor by a second pipe for separating the refrigerant supplied to the first accumulator into gas and liquid so as to supply the gaseous refrigerant to the first compressor and the second compressor.

6. The air-conditioner of claim 4, wherein the third accumulator is connected to the third compressor by a third pipe and to the fourth compressor by a fourth pipe for separating the refrigerant supplied to the first accumulator into a gas and a liquid so as to supply the gaseous refrigerant to the third compressor and the fourth compressor.

7. The air-conditioner of claim 4, wherein accumulator comprises:

a housing connected to a refrigerant pipe for sucking the refrigerant and storing oil contained in the refrigerant at a lower portion of the housing; and  
 two discharge tubes inserted into the housing from a lower portion of the housing and discharging a gaseous refrigerant after being gasificated inside the housing,

wherein oil sucking holes are formed at each lower portion of the two discharge tubes inserted in the housing in order to suck oil stored in the housing.

8. A heat-pump type air-conditioner having multiple compressors comprising:

an indoor heat-exchanger installed indoors for performing air-cooling or air-heating;  
 an outdoor heat-exchanger disposed outdoors for heat-exchanging refrigerant with external air;  
 an expansion valve installed at a refrigerant pipe connecting to between the indoor heat-exchanger and the outdoor heat-exchanger;  
 a four-way valve for switching a flow of the refrigerant in a forward direction or backward direction;  
 four compressors for compressing the refrigerant to be changed to have a high temperature and high pressure;  
 and  
 three accumulators disposed at each suction passage of the four compressors for separating the refrigerant into gas and liquid in order to supply a gaseous refrigerant to the compressors.

9. The air-conditioner of claim 8, wherein the compressors are first compressor, second compressor, third compressor and fourth compressor, and each compressors can have the same capacity or compressors with different capacities are adopted at various rates.

10. The air-conditioner of claim 9, wherein check valves are installed at each discharge passage of the compressors for preventing a refrigerant from flowing backward.

11. The air-conditioner of claim 9, wherein the accumulators comprises:

a first accumulator for receiving the refrigerant and separating refrigerator into gas and liquid;  
 a second accumulator connected to the first accumulator by a refrigerant pipe and connected to the first compressor and the second compressors; and  
 a third accumulator connected to the first accumulator by a refrigerant pipe and connected to the third compressor and the fourth compressors.

12. The air-conditioner of claim 11, wherein the second accumulator is connected to the first compressor by a first pipe and connected to the second compressor by a second pipe for separating the refrigerant supplied to the first accumulator into a gas and a liquid so as to supply the gaseous refrigerant to the first compressor and the second compressor.

13. The air-conditioner of claim 11, wherein the third accumulator is connected to the third compressor by a third pipe and to the fourth compressor by a fourth pipe for separating the refrigerant supplied to the first accumulator into a gas and a liquid so as to supply the gaseous refrigerant to the third compressor and the fourth compressor.

14. The air-conditioner of claim 11, wherein each accumulator comprises:

a housing connected to a refrigerant pipe for sucking the refrigerant and storing oil contained in the refrigerant at a lower portion of the housing; and  
 two discharge tubes inserted into the housing from a lower portion of the housing for discharging a gaseous refrigerant after being gasificated inside the housing,

wherein oil sucking holes are formed at each lower portion of the two discharge tubes inserted in the housing in order to suck oil stored in the housing.

# Amended claims in accordance with Rule 86(2) EPC.

1. An air-conditioner having multiple compressors comprising:

an indoor heat-exchanger (2) disposed indoors for heat-exchanging indoor air;  
 an outdoor heat-exchanger (4, 6) disposed outdoors for heat-exchanging a refrigerant with external air;  
 an expansion valve (8) installed at a refrigerant pipe connecting to between the indoor heat-exchanger and the outdoor heat-exchanger;  
 four compressors (20, 22, 24, 26) for compressing the refrigerant to change the refrigerant to have a high temperature and high pressure; and  
 three accumulators (30, 32, 35) disposed at each suction passage of the four compressors (20, 22, 24, 26) for

separating the refrigerant into gas and liquid so as to supply a gaseous refrigerant to the compressors.

2. The air-conditioner of claim 1, wherein the compressors are first compressor (20), second compressor (22), third compressor (24) and fourth compressor (26), and each compressors (20, 22, 24, 26) can have the same capacity or compressors (20, 22, 24, 26) with different capacities are adopted at various rates.

3. The air-conditioner of claim 2, wherein check valves (16) are installed at each discharge passage of the compressors for preventing a refrigerant from flowing backward.

4. The air-conditioner of claim 2, wherein the accumulators (30, 32, 34) comprises:

a first accumulator (30) for receiving the refrigerant and separating refrigerant into a gas and a liquid;  
a second accumulator (32) connected to the first accumulator (30) by a refrigerant pipe (40) and connected to the first compressor (20) and the second compressor (22); and  
a third accumulator (34) connected to the first accumulator (30) by a refrigerant pipe (42) and connected to the third compressor (24) and the fourth compressor (26).

5. The air-conditioner of claim 4, wherein the second accumulator (32) is connected to the first compressor (20) by a first pipe (50) and connected to the second compressor (22) by a second pipe (52) for separating the refrigerant supplied to the first accumulator (30) into gas and liquid so as to supply the gaseous refrigerant to the first compressor (20) and the second compressor (22).

6. The air-conditioner of claim 4, wherein the third accumulator (34) is connected to the third compressor (24) by a third pipe (54) and to the fourth compressor (26) by a fourth pipe (56) for separating the refrigerant supplied to the first accumulator (30) into a gas and a liquid so as to supply the gaseous refrigerant to the third compressor (24) and the fourth compressor (26).

7. The air-conditioner of claim 4, wherein accumulator (30, 32, 34) comprises: a housing (60) connected to a refrigerant pipe (18, 40, 42) for sucking the refrigerant and storing oil contained in the refrigerant at a lower portion of the housing; and  
two discharge tubes (62, 64) inserted into the housing (60) from a lower portion of the housing (60) and discharging a gaseous refrigerant after being gasified inside the housing (60),  
wherein oil sucking holes (70, 72) are formed at each lower portion of the two discharge tubes (62, 64) inserted in the housing (60) in order to suck oil stored in the housing (60).

8. The air-conditioner of claim 1, wherein the indoor heat-exchanger (2) performs air-cooling or air-heating, and wherein said air-conditioner further comprises:

a four-way valve (8) for switching a flow of the refrigerant in a forward direction or backward direction.

9. The air-conditioner of claim 8, wherein the compressors (20, 22, 24, 26) are first compressor (20), second compressor (22), third compressor (24) and fourth compressor (26), and each compressors (20, 22, 24, 26) can have the same capacity or compressors with different capacities are adopted at various rates.

10. The air-conditioner of claim 9, wherein check valves (16) are installed at each discharge passage of the compressors (20, 22, 24, 26) for preventing a refrigerant from flowing backward.

11. The air-conditioner of claim 9, wherein the accumulators comprises:

a first accumulator (30) for receiving the refrigerant and separating refrigerant into gas and liquid;  
a second accumulator (32) connected to the first accumulator (30) by a refrigerant pipe (40) and connected to the first compressor (20) and the second compressor (22); and  
a third accumulator (34) connected to the first accumulator (30) by a refrigerant pipe (42) and connected to the third compressor (24) and the fourth compressor (26).

12. The air-conditioner of claim 11, wherein the second accumulator (32) is connected to the first compressor (20) by a first pipe (50) and connected to the second compressor (22) by a second pipe (52) for separating the refrigerant supplied to the first accumulator (30) into a gas and a liquid so as to supply the gaseous refrigerant to the first

compressor (20) and the second compressor (22).

5       **13.** The air-conditioner of claim 11, wherein the third accumulator (34) is connected to the third compressor (24) by a third pipe (54) and to the fourth compressor (26) by a fourth pipe (56) for separating the refrigerant supplied to the first accumulator (30) into a gas and a liquid so as to supply the gaseous refrigerant to the third compressor (24) and the fourth compressor (26).

**14.** The air-conditioner of claim 11, wherein each accumulator (30, 32, 34) comprises:

10       a housing (60) connected to a refrigerant pipe (18, 40, 42) for sucking the refrigerant and storing oil contained in the refrigerant at a lower portion of the housing (60); and  
two discharge tubes (62, 64) inserted into the housing (60) from a lower portion of the housing (60) for discharging a gaseous refrigerant after being gasificated inside the housing (60),  
15       wherein oil sucking holes (70, 72) are formed at each lower portion of the two discharge tubes (62, 64) inserted in the housing (60) in order to suck oil stored in the housing (60).



FIG. 1

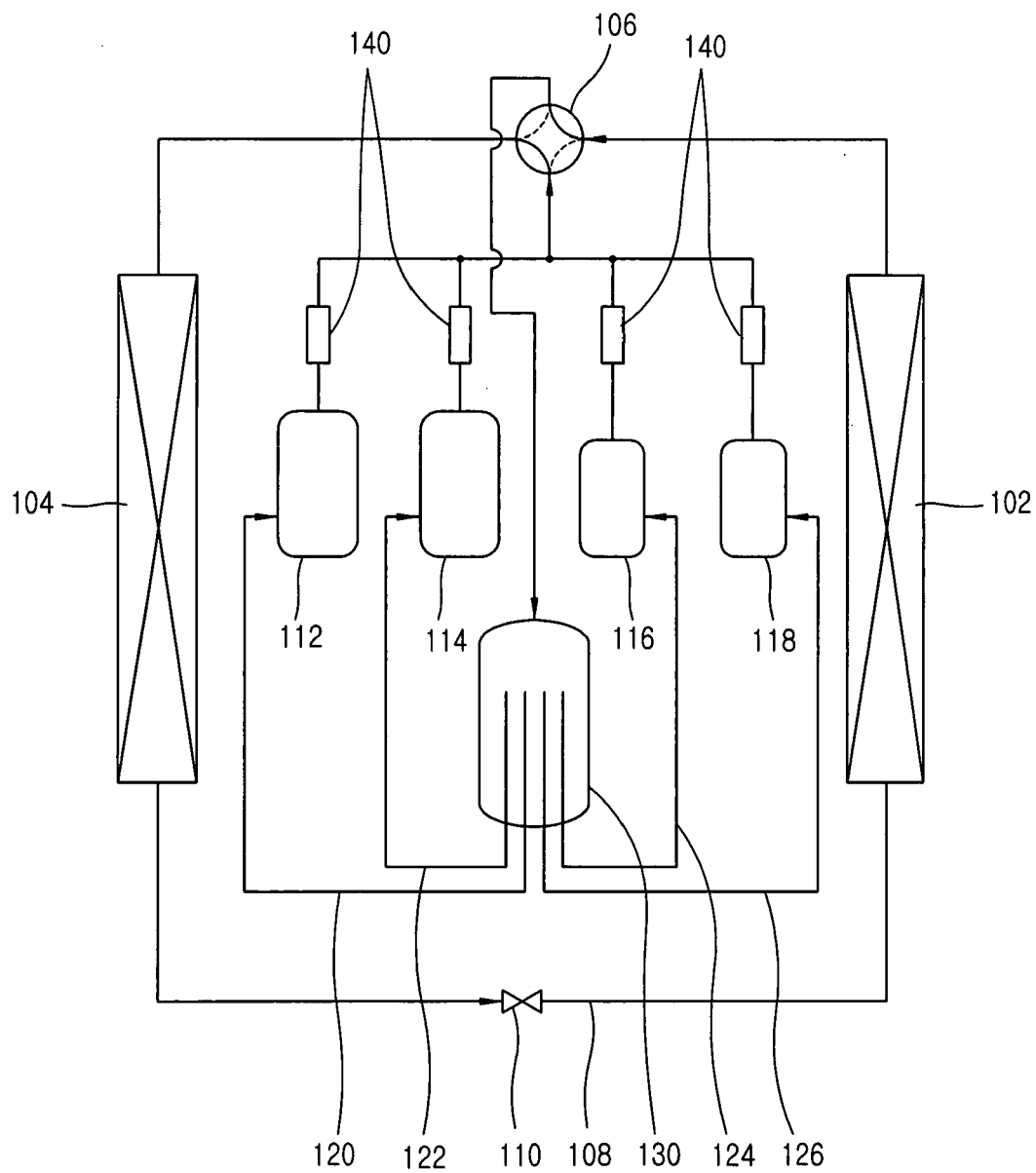


FIG. 2

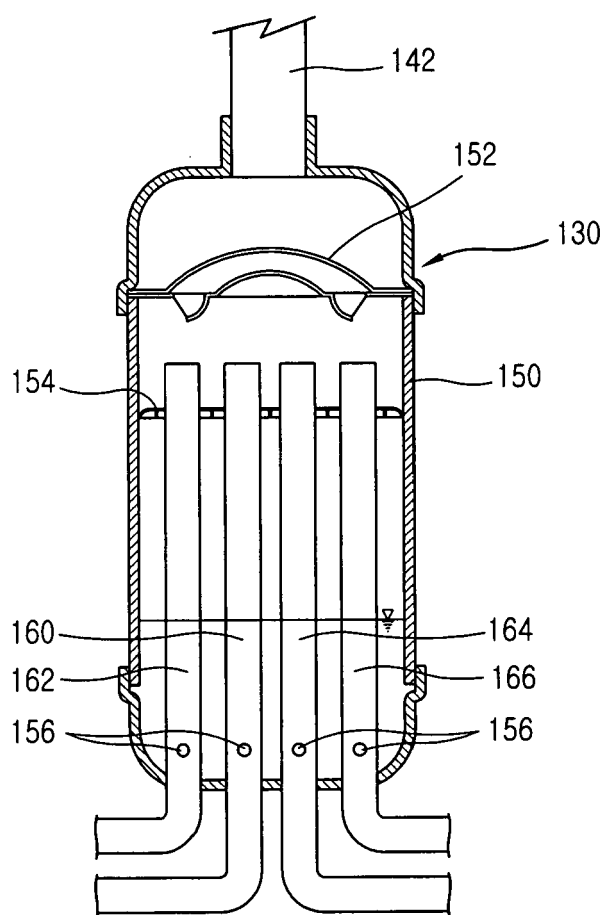


FIG. 3

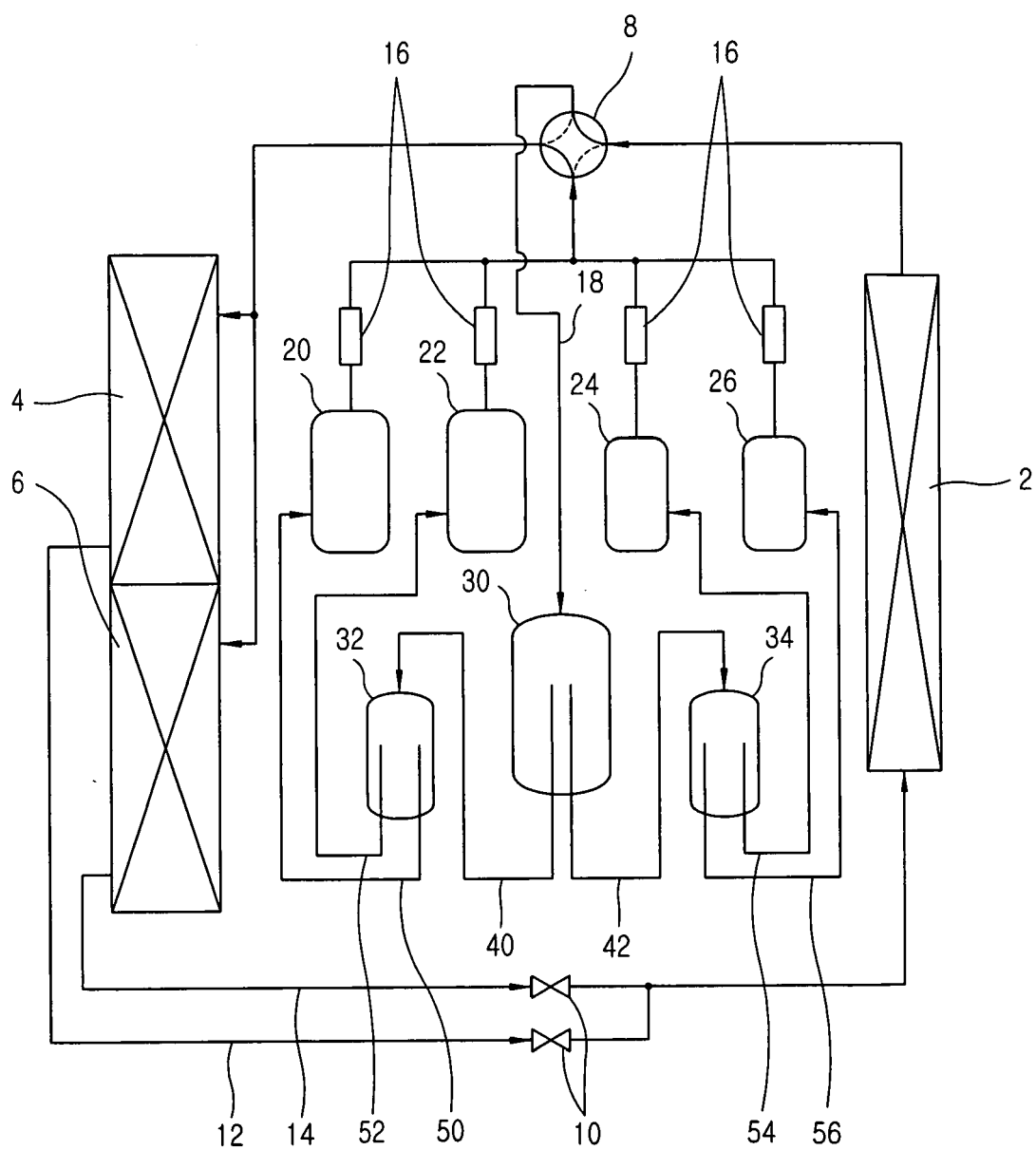
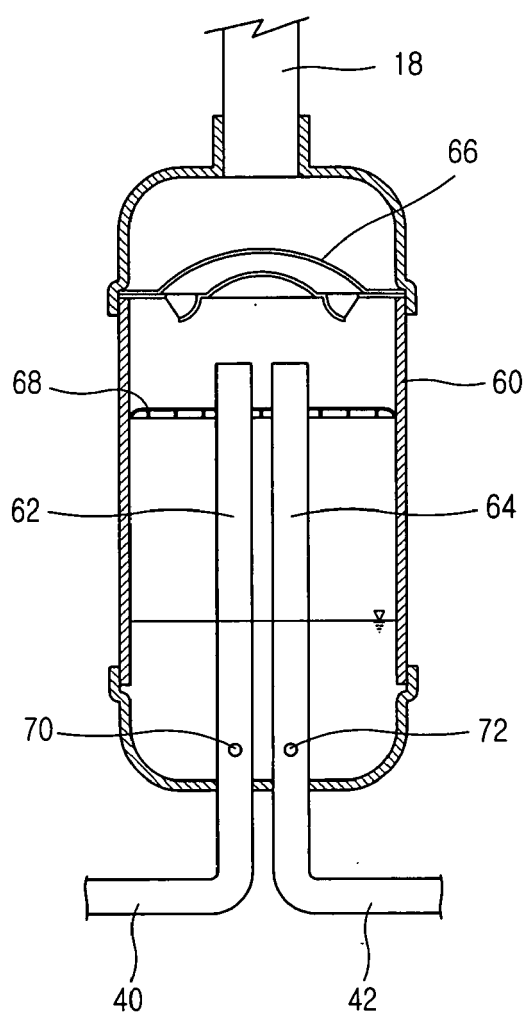


FIG. 4





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 05 00 4194

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 10, 31 October 1996 (1996-10-31) -& JP 08 159580 A (SANYO ELECTRIC CO LTD), 21 June 1996 (1996-06-21) * abstract * * figures 1-3 *	1-14	F25B13/00 F25B31/00 F25B43/00
Y	----- PATENT ABSTRACTS OF JAPAN vol. 2000, no. 08, 6 October 2000 (2000-10-06) -& JP 2000 146324 A (MITSUBISHI ELECTRIC CORP), 26 May 2000 (2000-05-26) * abstract * * figures 1,4,8,9,16,18,20 *	1-14	
A	----- PATENT ABSTRACTS OF JAPAN vol. 1996, no. 12, 26 December 1996 (1996-12-26) -& JP 08 200892 A (MITSUBISHI ELECTRIC CORP), 6 August 1996 (1996-08-06) * abstract * * figures 1-7 *	1,2,4, 7-9,11, 14	TECHNICAL FIELDS SEARCHED (Int.Cl.7)  F25B
A	----- PATENT ABSTRACTS OF JAPAN vol. 1998, no. 14, 31 December 1998 (1998-12-31) -& JP 10 232056 A (HITACHI LTD; HITACHI SHIMIZU ENG KK), 2 September 1998 (1998-09-02) * abstract * * figures 1,9,10,13 *	1,2,8,9	
		-/--	
The present search report has been drawn up for all claims			
Place of search <b>The Hague</b>		Date of completion of the search <b>9 September 2005</b>	Examiner <b>CORREIA DOS REIS, I</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

3  
EPO FORM 1503 03.82 (P04C01)



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 05 00 4194

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 01, 14 January 2003 (2003-01-14) -& JP 2002 277077 A (FUJITSU GENERAL LTD), 25 September 2002 (2002-09-25) * abstract * * figure 1 *	1,8	
A	----- PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) -& JP 2003 240367 A (HITACHI LTD), 27 August 2003 (2003-08-27) * abstract * * figures 1-9 *	1	
A	----- PATENT ABSTRACTS OF JAPAN vol. 1999, no. 01, 29 January 1999 (1999-01-29) -& JP 10 267435 A (MITSUBISHI HEAVY IND LTD), 9 October 1998 (1998-10-09) * abstract * * figures 1-3 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
<div>3</div> <div>The present search report has been drawn up for all claims</div>			
Place of search <b>The Hague</b>		Date of completion of the search <b>9 September 2005</b>	Examiner <b>CORREIA DOS REIS, I</b>
<div>CATEGORY OF CITED DOCUMENTS</div> <div> X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document </div> <div> T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  .....  &amp; : member of the same patent family, corresponding document </div>			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 00 4194

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-09-2005

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 08159580	A	21-06-1996	JP 3197768 B2	13-08-2001
JP 2000146324	A	26-05-2000	NONE	
JP 08200892	A	06-08-1996	NONE	
JP 10232056	A	02-09-1998	JP 3413044 B2	03-06-2003
JP 2002277077	A	25-09-2002	NONE	
JP 2003240367	A	27-08-2003	NONE	
JP 10267435	A	09-10-1998	JP 3649548 B2	18-05-2005