(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 329 675 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.07.2003 Bulletin 2003/30

(51) Int Cl.[7]: **F25B 13/00**, F25B 40/00, F25B 43/00

(21) Application number: **02023361.5**

(22) Date of filing: **18.10.2002**

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

(30) Priority: **21.01.2002 KR 2002003326**

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

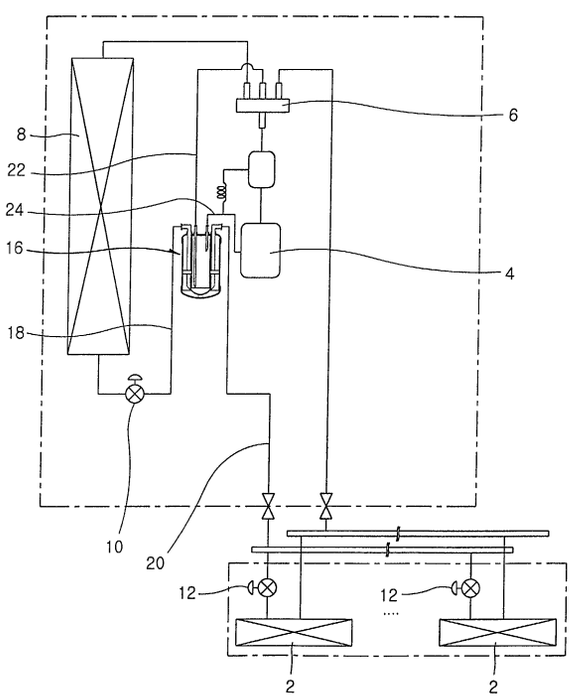
(72) Inventors:
- **Jang, Won-Jae**
  Sosa-Ku, Bucheon, Gyeonggi-Do (KR)
- **Choi, Chang-Min**
  Gwanak-Ku, Seoul (KR)

(74) Representative: **Cohausz & Florack**
Patentanwälte
Kanzlerstrasse 8a
40472 Düsseldorf (DE)

(54) Refrigerating cycle of air-conditioner

(57) A refrigerating cycle of an air-conditioner includes: a compressor 4 for compressing a refrigerant; an outdoor heat exchanger 8 disposed outdoors and used as a condenser or an evaporator; indoor heat exchangers 2 disposed indoors and performing an air-cooling/heating operation; expansion valves 10 and 12 installed between the outdoor heat exchanger 8 and the indoor heat exchanger 2 and changing a refrigerant to a low temperature and a low pressure state; and an accumulator/receiver assembly 16 in which a receiver unit 30 for separating oil contained in the refrigerant supplied to the evaporator and an accumulator unit 42 for supplying only a gas refrigerant to the compressor 4 are formed as one body for a heat exchange. As the liquid refrigerant supplied to the evaporator is overcooled and the gas refrigerant supplied to the compressor is overheated, even if the refrigerant pipe is formed long, the compression lowering of the refrigerant can be prevented and thus the compressor can be protected.

FIG. 2



EP 1 329 675 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a refrigerating cycle of a heat-pump type air-conditioner, and more particularly, to a refrigerating cycle of an air-conditioner in which an accumulator and a receiver are constructed as one body.

2. Description of the Background Art

[0002] In general, a heat pump type air-conditioner is available for a cooling and heating operation. Namely, the heat pump type air-conditioner can be used as a cooling device by having an evaporator and a condenser, and also used as a heating device by reversing a refrigerant flowing of a refrigerating cycle.

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

[0004] The conventional heat pump type air-conditioner includes indoor heat exchangers 102 disposed indoors and performing air cooling or heating, a four-way valve 106 for changing refrigerant flowing to a forward direction or to a backward direction, an outdoor heat exchanger 108 used as a condenser in air cooling and as a evaporator in heating, and expansion valves 110 and 112 installed between the outdoor heat exchanger 108 and the indoor heat exchanger 102 and changing a refrigerant to a low temperature and low pressure liquid refrigerant.

[0005] The outer expansion valve 110 is installed at one side of the outer heat exchanger 108 and operated in a heating mode, and the indoor expansion valve 112 is installed at one side of the indoor heat exchanger 102 and operated in an air cooling mode.

[0006] A receiver 116 is installed between the outdoor expansion valve 110 and the indoor expansion valve 112 to separate an oil contained in the refrigerant.

[0007] The receiver 116, mostly used for a large scale air-conditioner, serves to separate oil contained in the refrigerant supplied to the evaporator to prevent oil from collecting in a refrigerant pipe of the evaporator.

[0008] An accumulator 118 for supplying only a refrigerant in a gas state to the compressor 104 is installed at the refrigerant pipe 122 for supplying the refrigerant, and an oil separator 120 is installed at a refrigerant pipe 124 which discharges a refrigerant compressed in the compressor 104.

[0009] The accumulator 118 separates a liquid refrigerant from the refrigerant supplied to the compressor 104 in order to prevent the liquid refrigerant from being compressed by the compressor 104, thereby protecting the compressor 104.

[0010] However, the refrigerating cycle of the air-conditioner in accordance with the conventional art has the following problems. That is, as the air-conditioner is increased in its size, the refrigerant pipe is formed long. Then, the compression of the liquid refrigerant evaporated in the evaporator is degraded, and since the accumulator and the receiver are separately installed, the refrigerating cycle can become hardly compact.

SUMMARY OF THE INVENTION

[0011] Therefore, an object of the present invention is to provide a refrigerating cycle of an air-conditioner that is capable of preventing degradation in compression of a refrigerant even though a refrigerant pipe is long and protecting the compressor by constructing an accumulator and a receiver as one body to thereby over-cool a liquid refrigerant supplied to an evaporator and overheat a gas refrigerant supplied to the compressor.

[0012] Another object of the present invention is to provide a refrigerating cycle of an air-conditioner that is capable of accomplishing a compact refrigerating cycle by constructing an accumulator and a receiver as one body to thereby reduce a space for its installation

[0013] 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 a refrigerating cycle of an air-conditioner including: a compressor 4 for compressing a refrigerant; an outdoor heat exchanger 8 disposed outdoors and used as a condenser or an evaporator; indoor heat exchangers 2 disposed indoors and performing an air-cooling/heating operation; expansion valves 10 and 12 installed between the outdoor heat exchanger 8 and the indoor heat exchanger 2 and changing a refrigerant to a low temperature and a low pressure state; and an accumulator/receiver assembly 16 in which a receiver unit 30 for separating oil contained in the refrigerant supplied to the evaporator and an accumulator unit 42 for supplying only a gas refrigerant to the compressor 4 are formed as one body for a heat exchange.

[0014] In the refrigerating cycle of an air-conditioner of the present invention, the accumulator/receiver assembly includes a first casing 32 having a first pipe 34 connected to the condenser and a second pipe 36 connected to the expansion valve mounted therein and having a certain closed space; and a second casing 42 having a third pipe 44 and a fourth pipe 46 respectively connected to a refrigerant pipe supplying a gas refrigerant to the compressor 4 mounted therein and being installed inside the first casing 32.

[0015] In the refrigerating cycle of an air-conditioner of the present invention, an upper cover 38 and a lower cover 39 of the accumulator/receiver assembly are hermetically mounted at an upper portion and a lower portion of the first casing 32, and through holes 60 and 62 for formed at the upper cover 38, through which first, second, third and fourth pipes hermetically pass.

[0016] In the refrigerating cycle of an air-conditioner

of the present invention, the first pipe 34 and the second pipe 36 are, respectively, formed at an outer circumferential surface of the second casing 42 and the inner circumferential surface of the first casing 32 with an interval of 180° so that a space for mounting the second casing 42 can be obtained inside the first casing 32, and the first pipe 34 and the second pipe 36 are disposed so that each lower end is separated from the bottom of the first casing 32 with a certain interval therebetween.

[0017] In the refrigerating cycle of an air-conditioner of the present invention, the second casing 42 of the accumulator/receiver assembly is formed in a cylindrical shape with its upper surface and lower surface closed, and there are formed holes at the upper surface of the second casing 42, through which the third pipe 44 and the fourth pipe 46 penetrate.

[0018] In the refrigerating cycle of an air-conditioner of the present invention, an upper side of the second casing 42 of the accumulator/receiver assembly is attached at an upper inner side of the first casing 32, a lower side of the second casing 42 is supported at the bottom of the first casing by a first support member 50, and a second support member 52 is installed between an outer circumferential surface of the second casing 42 and the inner circumferential surface of the first casing 32.

[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 is a view showing the construction of a refrigerating cycle of a heat pump-type air-conditioner in accordance with a conventional art;

Figure 2 is a view showing the construction of a refrigerating cycle of a heat pump-type air-conditioner in accordance with the present invention; and

Figure 3 is a sectional view of an accumulator/receiver assembly 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 may exist a plurality of embodiment of a refrigerating cycle of an air-condition in accordance with the present invention, of which the most preferred one will now be described.

[0024] Figure 2 is a view showing the construction of a refrigerating cycle of a heat pump-type air-conditioner in accordance with the present invention.

[0025] A refrigerating cycle of a heat pump-type air-conditioner includes indoor heat exchangers 2 disposed indoors and performing an air cooling or heating operation; a compressor 4 for compressing a gas refrigerant; a four-way valve 6 for changing a flow of a refrigerant to a forward direction or to a backward direction; an outdoor heat exchanger 8 used as a condenser in air cooling and used as an evaporator in heating; expansion valves 10 and 12 installed between the outdoor heat exchanger 8 and the indoor heat exchangers 2 and changing a liquid refrigerant to a low temperature and low pressure; and an accumulator/receiver assembly 16 in which an accumulator for supplying only a gas refrigerant to the compressor and a receiver for separating oil contained in a refrigerant supplied to the evaporator are formed as one body.

[0026] The outer expansion valve 10 is installed at one side of the outer heat exchanger 8 and operated in a heating mode, and the indoor expansion valve 12 is installed at one side of the indoor heat exchanger 2 and operated in an air cooling mode.

[0027] The accumulator/receiver assembly 16 is installed at one side of indoors or outdoors, to which a first refrigerant pipe 18 connected to the outer expansion valve and a second refrigerant pipe 20 connected to the indoor expansion valve 10 are connected and third and fourth refrigerant pipes 22 and 24 through which the refrigerant is supplied to the compressor 4 are connected thereto.

[0028] Namely, as shown in Figure 3, the accumulator/receiver assembly 16 includes a receiver unit 30 having a certain closed space and separating oil contained in a liquid refrigerant introduced into the evaporator as the first refrigerant pipe 18 and the second refrigerant pipe 20 are, respectively, connected thereto, and an accumulator unit 40 installed inside the receiver unit 30 and supplying a refrigerant in a gas state to the compressor 4 as the third refrigerant pipe and the fourth refrigerant pipe 24 are, respectively, connected thereto.

[0029] The receiver unit 30 includes a first casing 32 having a closed space with a certain size, a first pipe 34 hermetically inserted from an upper portion of the first casing 32 and connected to the first refrigerant pipe 18, and a second pipe 36 inserted at an upper portion of the first casing 32 with a certain space therebetween and connected to the second refrigerant pipe 20.

[0030] The first casing 30 is formed in a cylindrical shape and the upper cover 38 and the lower cover 39 are hermetically mounted at the upper portion and the lower portion of the first casing 30. Through holes 60 are formed at the upper cover 38, through which the first

pipe 34 and the second pipe 36 hermetically pass.

[0031] The first pipe 34 and the second pipe 36 are disposed close to the inner wall of the first case with an interval of about 180° therebetween so as to obtain a space where the accumulator 40 is installed at the internal center of the first casing 32, and their lower ends are positioned with a certain distance from the internal bottom surface of the first casing 32 in order to prevent oil discharged through the first pipe 34 from flowing into the second pipe 36.

[0032] The accumulator unit 40 includes a second casing 42 inserted at the center of the first casing 32 and having a closed space, a third pipe 44 vertically mounted from the upper surface of the second casing 42 and connected to the third refrigerant pipe 22, and a fourth pipe 46 vertically mounted from the upper surface of the second casing 42 with a certain interval from the third pipe 44.

[0033] The second casing 42 is formed in a cylindrical shape with its upper and lower sides closed, the third and fourth pipes penetrates the second casing from the upper surface thereof, and through holes 62 are formed at the upper cover of the first casing, through which the third and fourth pipes pass.

[0034] The upper surface of the second casing 42 is attached on an inner surface of the upper cover 38 of the first casing 32, and a lower surface of the second casing 42 is supported by an inner surface of the lower cover 39 of the first casing 32 by means of the first support member 50. The second support member 52 is installed between an outer side of the second casing 42 and an inner side of the first casing 32, supporting the second casing 42.

[0035] The third pipe 34 is formed long and the fourth pipe 46 is formed short, so that when a liquid refrigerant is introduced through the third pipe 34, it is gathered at the bottom of the second casing 42 and only an evaporated gas refrigerant is supplied to the compressor 4 through the fourth pipe 46.

[0036] The operation of the refrigerating cycle of an air-conditioner in accordance with the present invention will now be described.

[0037] First, in air-cooling operation, when the gas refrigerant compressed in the compressor 4 passes through the four-way valve 6 and the outdoor heat exchanger 8, it is changed to a middle temperature and low pressure gas refrigerant, and as the middle temperature and low pressure gas refrigerant passes through the indoor expansion valve 12, it is changed to a low temperature and low pressure liquid refrigerant and introduced into the indoor heat exchanger 2.

[0038] The refrigerant gas evaporated from the indoor heat exchanger 2 is heat-exchanged with indoor air, performing an indoor air-cooling, and supplied through the four-way valve 6 to and compressed in the compressor 4, and then supplied to the outdoor heat exchanger 8.

[0039] Conversely, in case of a heating operation, the four-way valve 6 is operated to change the flowing of refrigerant to a backward direction. Then, the gas refrigerant compressed in the compressor 4 is introduced into the indoor heat-exchanger 2 through the four-way valve 6, evaporated and heat-exchanged with the indoor air, performing the indoor heating. Thereafter, after passing the indoor heat-exchanger 2, the refrigerant passes through the outdoor expansion valve 10, during which it is changed to a low temperature and low pressure liquid refrigerant state and then evaporated while passing through the outdoor heat-exchanger 8. The thusly evaporated refrigerant gas is sucked again into the compressor 4 by way of the four-way valve 6 and circulated.

[0040] The operation of the accumulator/receiver assembly in the air-cooling/heating operation will now be described in detail.

[0041] A middle temperature and high pressure gas refrigerant is supplied from the evaporator through the first pipe 34 to the first casing 32, oil contained in the gas refrigerant is separated and gathered at the bottom of the first casing 32, and only the gas refrigerant is supplied to the expansion valves 10 and 12 through the second pipe 36 so as to prevent the liquid refrigerant compression by the compressor 4, thereby protecting the compressor.

[0042] And, the low temperature and low pressure gas refrigerant is introduced into the second casing 42 from the evaporator through the third pipe 22, and the liquid refrigerant contained in the gas refrigerant is gathered at the bottom fo the second casing 42 and only the evaporated gas refrigerant is supplied to the compressor 4.

[0043] At this time, the middle temperature and high pressure gas refrigerant supplied to the first casing 32 and the low temperature and low pressure supplied to the second casing 42 are heat-exchanged, so that a high temperature gas refrigerant is supplied to the compressor 4 and a cooled liquid refrigerant is supplied to the evaporator. Thus, a pressure lowering of the refrigerant possibly caused in case that the refrigerant pipe is formed long is prevented and a performance of the refrigerating cycle is improved.

[0044] As so far described, the refrigerating cycle of the air-conditioner of the present invention has the following advantages.

[0045] That is, the receiver unit separating oil contained in the refrigerant supplied to the evaporator and the accumulator unit supplying only the gas refrigerant to the compressor are formed as one body for a mutual heat-exchanging, Accordingly, as the liquid refrigerant supplied to the evaporator is overcooled and the gas refrigerant supplied to the compressor is overheated, even if the refrigerant pipe is formed long, the compression lowering of the refrigerant can be prevented and thus the compressor can be protected.

[0046] In addition, as the accumulator and the receiver are formed integrally, a space for their installation can be reduced to realize a compact refrigerant cycle.

[0047] 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 meets and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. A refrigerating cycle of an air-conditioner comprising:

a compressor for compressing a refrigerant;
an outdoor heat exchanger disposed outdoors and used as a condenser or an evaporator;
indoor heat exchangers disposed indoors and performing an air-cooling/heating operation;
expansion valves installed between the outdoor heat exchanger and the indoor heat exchanger and changing a refrigerant to a low temperature and a low pressure state; and
an accumulator/receiver assembly 16 in which a receiver unit for separating oil contained in the refrigerant supplied to the evaporator and an accumulator unit for supplying only a gas refrigerant to the compressor are formed as one body for a heat exchange.

2. The refrigerating cycle of claim 1, wherein the accumulator/receiver assembly comprises

a first casing having a first pipe connected to the condenser and a second pipe connected to the expansion valve mounted therein and having a certain closed space; and

a second casing having a third pipe 44 and a fourth pipe respectively connected to a refrigerant pipe supplying a gas refrigerant to the compressor mounted therein and being installed inside the first casing.

3. The refrigerating cycle of claim 2, wherein an upper cover and a lower cover of the accumulator/receiver assembly are hermetically mounted at an upper portion and a lower portion of the first casing, and through holes for formed at the upper cover, through which first, second, third and fourth pipes hermetically pass.

4. The refrigerating cycle of claim 2, wherein the first pipe and the second pipe are, respectively, formed at an outer circumferential surface of the second casing and the inner circumferential surface of the first casing with an interval of 180° so that a space for mounting the second casing can be obtained inside the first casing, and the first pipe and the second pipe are disposed so that each lower end is separated from the bottom of the first casing with a certain interval therebetween.

5. The refrigerating cycle of claim 2, wherein the second casing of the accumulator/receiver assembly is formed in a cylindrical shape with its upper surface and lower surface closed, and the third pipe and the fourth pipe penetrate the upper surface of the second casing.

6. The refrigerating cycle of claim 5, wherein an upper side of the second casing of the accumulator/receiver assembly is attached at an upper inner side of the first casing, a lower side of the second casing is supported at the bottom of the first casing by a first support member, and a second support member is installed between an outer circumferential surface of the second casing and the inner circumferential surface of the first casing.

FIG. 1

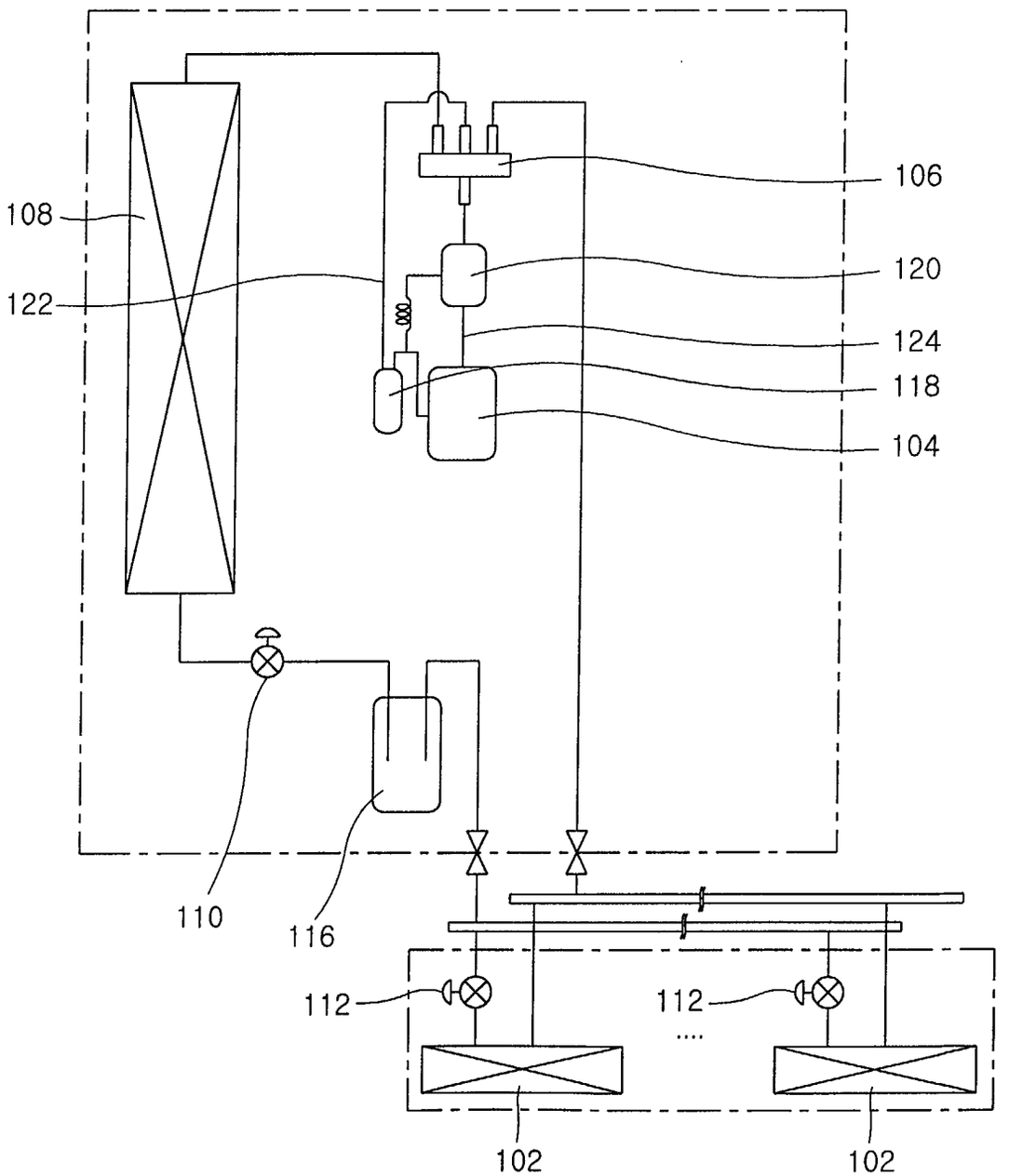


FIG. 2

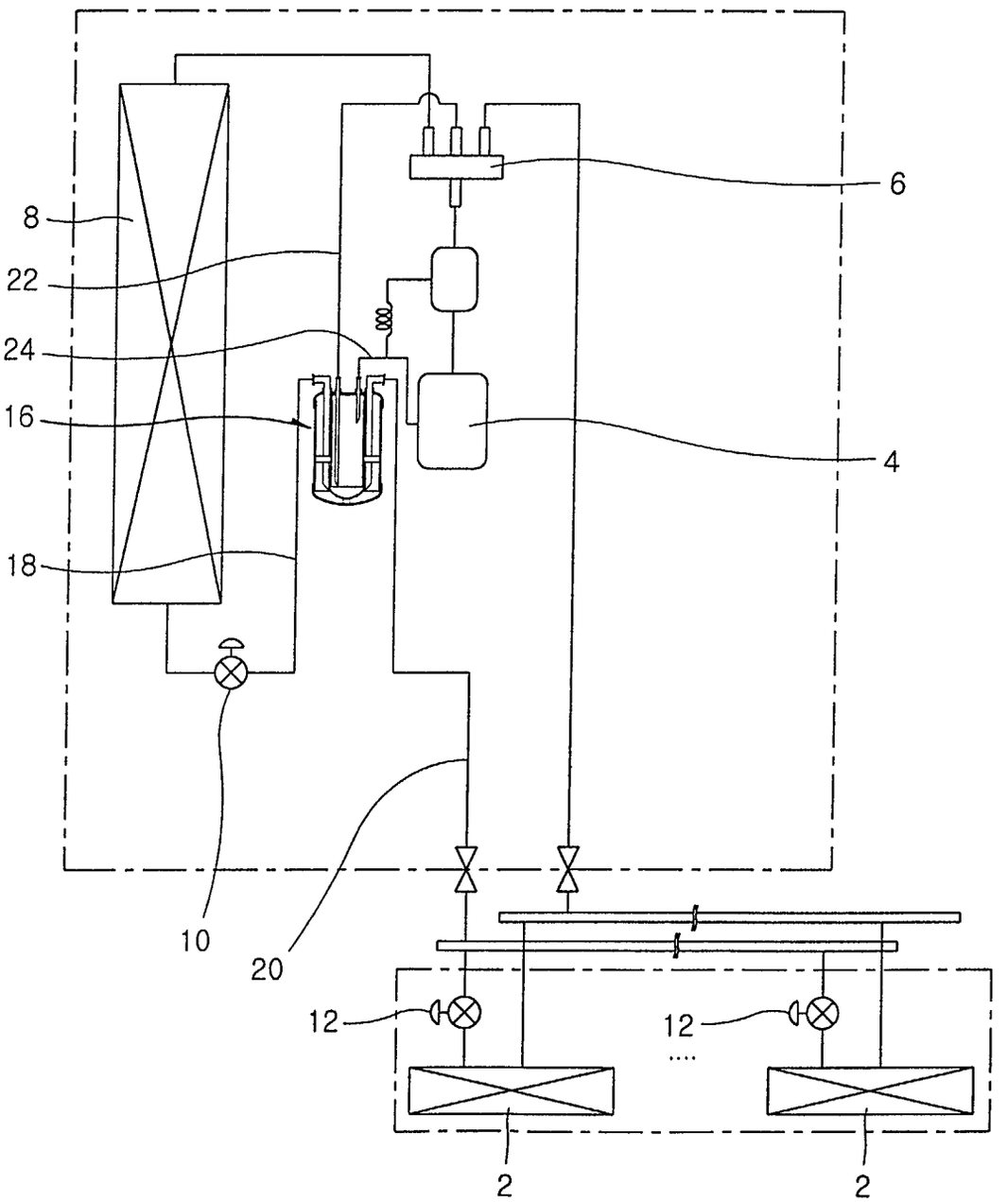


FIG. 3