



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 589 293 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.10.2005 Bulletin 2005/43

(51) Int Cl.7: **F24F 1/00**

(21) Application number: **05101251.6**

(22) Date of filing: **18.02.2005**

(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

- **Lee, Jung Woo**
Seoul (KR)
- **Jung, In Hwa**
Seoul (KR)
- **Bae, Seong Won**
Seoul (KR)

(30) Priority: **22.04.2004 KR 2004027969**

(71) Applicant: **LG ELECTRONICS INC.**
Seoul 150-875 (KR)

(74) Representative: **Ekström, Nils**
Albihns Göteborg AB
P.O. Box 142
401 22 Göteborg (SE)

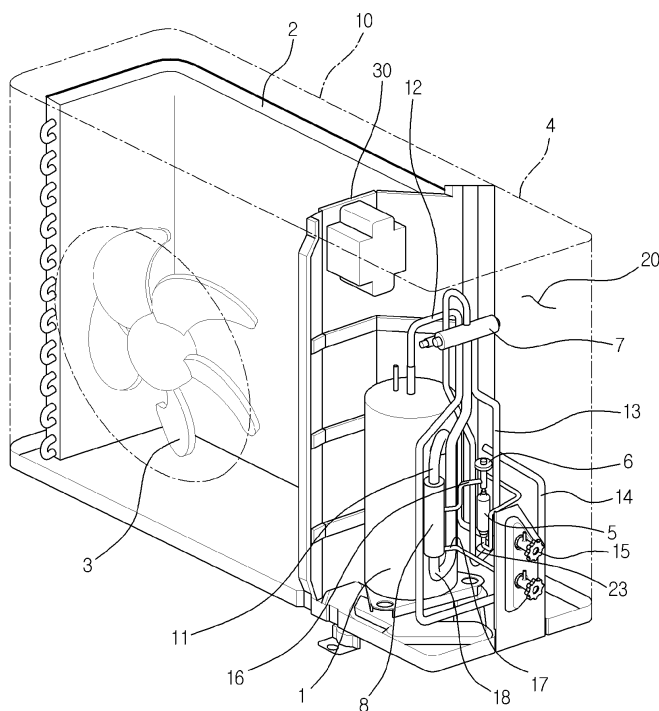
(72) Inventors:
• **Chin, Sim Won**
Kyeonggi-do (KR)

(54) **Outdoor unit of air conditioning system**

(57) An outdoor unit of an air conditioning system includes a compressor, an intake tube connected to an intake port of the compressor, a liquid-to-suction heat exchanger having an exhausting end connected to the

intake tube, and an expansion valve connected to the liquid-to-suction heat exchanger. A disposition angle between an imaginary line connecting the intake tube to the liquid-to-suction heat exchanger and a central axis of the expansion valve is less than 90 °.

FIG.1



EP 1 589 293 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an outdoor unit of an air conditioning system, and more particularly, to an outdoor unit of an air conditioning system, which is optimized in its internal structure (i.e., an arrangement of a liquid -to-suction heat exchanger, an intake tube, a linear expansion valve (LEV), and a dryer) by increasing its integration.

Description of the Related Art

[0002] Generally, an air conditioning system is designed to perform a series of processes such as compression, condensation, expansion and vaporization processes for the refrigerant, thereby regulating a temperature and/or a humidity of a limited place.

[0003] Such an air conditioning system comprises an indoor unit disposed in an interior side and an outdoor unit disposed in an exterior side to dissipate heat or cool air. The outdoor unit is comprised of an outdoor heat exchanger, an outdoor fan for forcedly creating a current of air, and a compressor for forcedly circulating a refrigerant in a cooling cycle. The compressor is disposed in an apparatus room of the outdoor unit. An LEV for expanding a refrigerant, a dryer for eliminating moisture contained in the refrigerant, a liquid-to-suction heat exchanger for increasing vaporability of the refrigerant introduced into the compressor, and a plurality of pipes are further disposed in the apparatus room. The liquid -to-suction heat exchanger is designed to allow the refrigerant used for heat -exchanging in the outdoor heat exchanger and the refrigerant directed to the compressor to heat-exchange with each other, thereby eliminating liquid out of the refrigerant being directed to the compressor to normally operate the compressor.

[0004] In recent years, with the residential space being reduced, it has become a trend that a size of household appliances including the outdoor unit of the air conditioning system is miniaturized. However, as the apparatuses are disorderly arranged in the apparatus room, it has been difficult to reduce the size of the outdoor unit.

[0005] That is, the structure of the apparatus room of the outdoor unit is too complicated to apply a vibration absorbing member due to the space limitation, deteriorating the reliability of the final product.

[0006] The large-sized outdoor unit causes the increase of the manufacturing costs.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to an outdoor unit of an air conditioning system that substantially obviates one or more problems due to limitations

and disadvantages of the related art.

[0008] An object of the present invention is to provide an outdoor unit of an air conditioning system, which has a miniaturized apparatus room, thereby saving the manufacturing time and costs.

[0009] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0010] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, there is provided an outdoor unit of an air conditioning system, including: a compressor; an intake tube connected to an intake port of the compressor; a liquid -to-suction heat exchanger having an exhausting end connected to the intake tube; and an expansion valve connected to the liquid -to-suction heat exchanger, wherein a disposition angle between an imaginary line connecting the intake tube to the liquid -to-suction heat exchanger and a central axis of the expansion valve is less than 90°.

[0011] In another aspect of the present invention, there is provided an outdoor unit of an air conditioning system, including: a compressor; an intake tube connected to an intake port of the compressor; a liquid-to-suction heat exchanger having an exhausting end connected to the intake tube; and an linear expansion valve for expanding a refrigerant exhausted from an outdoor heat exchanger, an indoor passage connecting the linear expansion valve to the liquid-to-suction heat exchanger, wherein a disposition angle between an imaginary line extending from the intake tube and an imaginary line connecting the liquid -to-suction heat exchanger to the linear expansion valve is in a range of 15-90°.

[0012] In still another aspect of the present invention, there is provided an outdoor unit of an air conditioning system, including: an apparatus room defined by a barrier in an outer case of the outdoor unit; a compressor disposed in the apparatus room; an intake tube connected to an intake port of the compressor; a liquid-to-suction heat exchanger having an exhausting end connected to the intake tube; and an linear expansion valve connected to the liquid -to-suction heat exchanger, wherein a disposition angle between an imaginary line connecting the intake tube to the liquid-to-suction heat exchanger and a central axis of the expansion valve is in a range of 15 -90°.

[0013] According to the present invention, since the apparatus room can be designed in the more compact structure, an overall size of the outdoor unit can be minimized, saving the manufacturing costs and time.

[0014] Furthermore, the vibration generated in the apparatus room of the outdoor unit can be effectively at-

tenuated.

[0015] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0017] Fig. 1 is a perspective view of an outdoor unit of an air conditioning system according to an embodiment of the present invention;

[0018] Fig. 2 is a view illustrating an internal structure of an apparatus room depicted in Fig. 1;

[0019] Fig. 3 is a sectional view of a liquid-to-suction heat exchange;

[0020] Fig. 4 is a plane view of an internal structure of an apparatus room depicted in Fig. 2; and

[0021] Fig. 5 is a graph illustrating a compact rate of an outdoor unit having an arrangement angle according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[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] Fig. 1 shows a perspective view of an outdoor unit of an air conditioning system according to an embodiment of the present invention.

[0024] Referring to Fig. 1, the inventive outdoor unit comprises a case 10 and an apparatus room 20. The apparatus room 20 is divided into first and second chambers by a barrier 30. That is, an outdoor fan 3 and an outdoor heat exchanger 2 are installed in the first chamber. A compressor 1, a four-way valve 7, intake tubes 11 and 18, an exhaust tube 12, an indoor connecting tube 13, and an outdoor connecting tube 14 are disposed in the second chamber.

[0025] The compressor 1 functions to compress a refrigerant and the outdoor heat exchanger 2 functions to heat-exchange at the exterior side. The outdoor fan 3 forcibly apply air current to the outdoor heat exchanger 2 and the four-way valve 7 is used for converting the system into an air condition mode or a heating mode by changing a flow direction of the refrigerant in the cooling cycle. The intake tubes 11 and 18 connect the four-way valve 7 to an intake portion of the compressor 1 while the exhaust tube 12 connects the four-way valve 7 to an exhaust portion of the compressor 1. The indoor connecting tube 13 connects the four-way valve 7 to a service valve 15 while the outdoor connecting tube 14 con-

nects the four-way valve 7 to the outdoor heat exchanger 2.

[0026] The refrigerant flow in the outdoor unit will be described with reference to the four-way valve 7.

[0027] A direction of the refrigerant flow in the intake tubes 11 and 18, the exhaust tube 12, the indoor connecting tube 13, and the outdoor connecting tube 14 are controlled by the four-way valve 7. That is, when the exhaust tube 12 is connected to the outdoor connecting tube 14 and the intake tubes 11 and 18 are connected to the outdoor connecting tube 13, the system is operated as a cooling mode. When the exhaust tube 12 is connected to the indoor connecting tube 13 and the intake tubes 11 and 18 are connected to the outdoor connecting tube 14, the system is operated as a heating mode. The service valve 15 functions to form vacuum in a tube, temporarily stop the system operation, and inject and exhaust the refrigerant. The service valve 15 is projected out of the outdoor unit case 10.

[0028] A liquid-to-suction heat exchanger 8 for eliminating moisture from the refrigerant introduced into the compressor 1 is disposed on a passage of the intake tube 11. The intake tube 18 is disposed on an upstream side of the heat exchanger 8 while the intake tube 11 is disposed on a downstream side thereof. The liquid-to-suction heat exchanger 8 is vertically disposed to simplify the structure of the outdoor unit and reduce the vibration.

[0029] The exhaust portion of the outdoor heat exchanger 2 is provided with an exhaust pipe connected to the indoor unit by the service valve 22. The exhaust pipe of the outdoor heat exchanger 2 is provided with a dryer 5 for preventing the pipe from corroding by moisture removed from the refrigerant used for the heat exchange and a linear expansion valve 6 for expanding the refrigerant used for the heat exchange. Particularly, the dryer 5 and the linear expansion valve 6 are vertically disposed to minimize the outdoor unit and attenuate the vibration.

[0030] According to a feature of the present invention, an arrangement of the dryer 5, the linear expansion valve 6 and the liquid-to-suction heat exchanger 8 is improved to make the outdoor unit compact.

[0031] Fig. 2 shows an internal structure of the apparatus room depicted in Fig. 1.

[0032] Referring to Fig. 2, there are shown the compressor 1, the liquid-to-suction heat exchanger 8, the dryer 5, and the linear expansion valve 6. The liquid-to-suction heat exchanger 8 is vertically disposed to make the internal structure of the apparatus room compact. The dryer 5 and the linear expansion valve 6 are vertically arranged along a common vertical line, thereby further making the internal structure of the apparatus room compact and reducing the vibration.

[0033] The interconnection of the liquid-to-suction heat exchanger 8, the dryer and the linear expansion valve 5 will be described hereinafter in more detail.

[0034] A first indoor passage 23 is provided to direct

the refrigerant exhausted from the outdoor heat exchanger 2 to a lower portion of the dryer 5. The linear expansion valve 6 is disposed above the dryer 5 along the common vertical line. A second indoor passage 16 is provided to connect an exhaust portion of the linear expansion valve 6 to the liquid-to-suction heat exchanger 8. A third indoor passage 16 is provided to exhaust the refrigerant directed into the liquid-to-suction heat exchanger. The refrigerant is directed to the service valve 22, successively flowing along the indoor passages 23, 16 and 17

[0035] The refrigerant exhausted from the four-way valve 7 is directed into the liquid-to-suction heat exchanger 8 through the first intake tube 18, used for the heat-exchange in the liquid-to-suction heat exchanger 8, and then directed into the compressor 1 through the second intake tube 11.

[0036] To effectively use an inner space of the apparatus room and attenuate the vibration, the liquid-to-suction heat exchanger 8, the dryer 5 and the expansion valve 6 are vertically arranged in parallel with each other.

[0037] Fig. 3 shows the liquid-to-suction heat exchanger in more detail.

[0038] Referring to Fig. 3, the liquid-to-suction heat exchanger 8 comprises an outer tube 21 along which the refrigerant used for the heat-exchange and exhausted from the outdoor heat exchanger 2 flows and an inner tube 25 along which the refrigerant is directed to the compressor 1. That is, the inner tube 25 is connected either the first intake tube 18 or the second intake tube 11 to allow the low pressure/low temperature refrigerant to flow. The outer tube 21 is connected to the second indoor passage 16. In this state, since gas flowing along the inner tube 25 is subject to heat from the refrigerant of the outer tube 21, no liquid is remained in the gaseous refrigerant flowing along the inner tube 25. In addition, the refrigerant flowing along the inner and outer tubes 25 and 21 flows in an opposite direction to each other as indicated by an arrow, thereby further improving the heat exchange efficiency.

[0039] The arrangement of the liquid-to-suction exchanger 8, the linear expansion valve 6 and the dryer 5 will be described hereinafter.

[0040] Fig. 4 is a plane view of the internal structure of the apparatus room.

[0041] Referring to Fig. 4, there are shown the compressor 1, the second intake tube 11, the liquid-to-suction heat exchanger 8, the linear expansion valve 6, and the second indoor passage 16. To make the apparatus room compact and reduce the vibration, a disposition angle between the elements is limited in a predetermined range. Here, when it is assumed that a central axis of the liquid-to-suction heat exchanger 8 is a central point B, the disposition angle θ means an angle between a first imaginary line linearly extending toward the second intake tube 11 and a second imaginary line linearly extending toward the linear expansion valve 6 and the

dryer 5.

[0042] In the present invention, the disposition angle θ is limited in a range of 15-90°. The reason for limiting the disposition angle θ to such a range will be described hereinafter.

[0043] As the compressor 1 is operated to generate rotational torsion, the pipes arranged around the compressor 1 may be vibrated. Therefore, in order to prevent the vibration, it is preferable that an angle between a horizontal extending line of the second intake tube 11 and the central point B of the compressor 1 is less than 90°. As a length of the intake tube 11 is increased, the more vibration is applied to the intake tube 11. Particularly, since the rigidity of the intake tube 11 is high and disposed close to the compressor, the intake tube 11 is applied with the higher vibration.

[0044] Therefore, the disposition angle θ (15-90°) proposed above reduces the vibration applied to the second intake tube 11 and makes the apparatus room compact. When the disposition angle θ is less than 15°, there may be an interference between the elements (components). That is, when the vibration is generated by the compressor 1, the elements may collide with each other, thereby generating noise. When the disposition angle θ is greater than 90°, since the distance from the linear expansion valve 6 and the dryer 5 from the liquid-to-suction heat exchanger 8 is too far, the vibration of the intake tubes 11 and 18 may be magnified through the second and third indoor passages 16 and 17, making it difficult to make the apparatus room compact.

[0045] As described above, the dryer 5 is vertically connected to the linear expansion valve 6 to make the apparatus room compact. The liquid-to-suction heat exchanger 8 is also vertically disposed. By disposing the liquid-to-suction heat exchanger 8 and the linear expansion valve 6 such that an angle between the linear expansion valve 6 and an upper portion of the liquid-to-suction heat exchanger 8 is in the above proposed disposition angle range, the vibration which may be transmitted through the second intake tube 11 disposed close to the compressor 1 can be effectively attenuated.

[0046] Fig. 5 shows a graph illustrating a compact rate of the outdoor unit with the elements arranged with the above-proposed disposition angle.

[0047] In the graph, an X-axis indicates a disposition angle while a Y-axis indicates a compact rate of the outdoor unit. The graph shows a comparison of a component mounting space of the apparatus room to an amount of the component mounting space and a non-mounting space.

[0048] As shown in the graph, the compact rate is steeply varied based on critical angles 15° and 90°.

[0049] The above-described arrangement of the present invention can be applied to an outdoor unit of a cooling-only air conditioning system, an outdoor unit of a multi-type air conditioning system, and an outdoor unit of an accumulator type air conditioning system as well as the outdoor unit of the cooling-heating type air con-

ditioning system.

[0050] According to the type of refrigerant, the dryer 5 may be omitted. Even in this case, the disposition angle proposed by the present invention is identically applied. In addition, although an outdoor unit with a four-way valve is exemplified as an embodiment of the present invention, the concept of the present invention can be identically applied to the outdoor unit without the four-way valve.

[0051] According to the present invention, since the apparatus room can be designed in the more compact structure, an overall size of the outdoor unit can be minimized, saving the manufacturing costs and time.

[0052] Furthermore, the vibration generated in the apparatus room of the outdoor unit can be effectively attenuated.

[0053] 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 outdoor unit of an air conditioning system, comprising:

a compressor;
an intake tube connected to an intake port of the compressor;
a liquid-to-suction heat exchanger having an exhausting end connected to the intake tube;
and
an expansion valve connected to the liquid -to-suction heat exchanger,

wherein a disposition angle between an imaginary line connecting the expansion valve to the liquid-to-suction heat exchanger and an horizontally imaginary extending line from the intake tube is less than 90°.

2. The outdoor unit according to claim 1, further comprising a dryer connected to the expansion valve.

3. The outdoor unit according to claim 1, further comprising a dryer disposed on a common vertical line along which the expansion valve is disposed.

4. The outdoor unit according to claim 1, wherein the intake tube extends from the compressor in a direction within 90 ° with respect to a central point of the compressor.

5. The outdoor unit according to claim 1, wherein the liquid-to-suction heat exchanger and the expansion

valve are vertically arranged in parallel with each other.

6. The outdoor unit according to claim 1, wherein the intake tube extends from a top and bottom of the liquid -to-suction heat exchanger.

7. The outdoor unit according to claim 1, wherein the liquid-to-suction heat exchanger has an intake end connected to a four-way valve for converting an operational mode.

8. The outdoor unit according to any one of claim 1 to claim 7, wherein the disposition angle is greater than 15°.

9. The outdoor unit according to any one of claim 1 to claim 7, wherein the disposition angle is defined between the linear expansion valve and an upper portion of the liquid-to-suction heat exchanger.

10. The outdoor unit according to any one of claim 1 to claim 7, wherein the indoor passage is linearly formed in a horizontal direction.

11. An outdoor unit of an air conditioning system, comprising:

a compressor;
an intake tube connected to an intake port of the compressor;
a liquid-to-suction heat exchanger having an exhausting end connected to the intake tube;
an linear expansion valve for expanding a refrigerant exhausted from an outdoor heat exchanger; and
an indoor passage connecting the linear expansion valve to the liquid-to-suction heat exchanger,

wherein a disposition angle between an imaginary line connecting the intake tube to the liquid -to-suction heat exchanger and an imaginary line connecting the liquid-to-suction heat exchanger to the linear expansion valve is in a range of 15 - 90°.

FIG.1

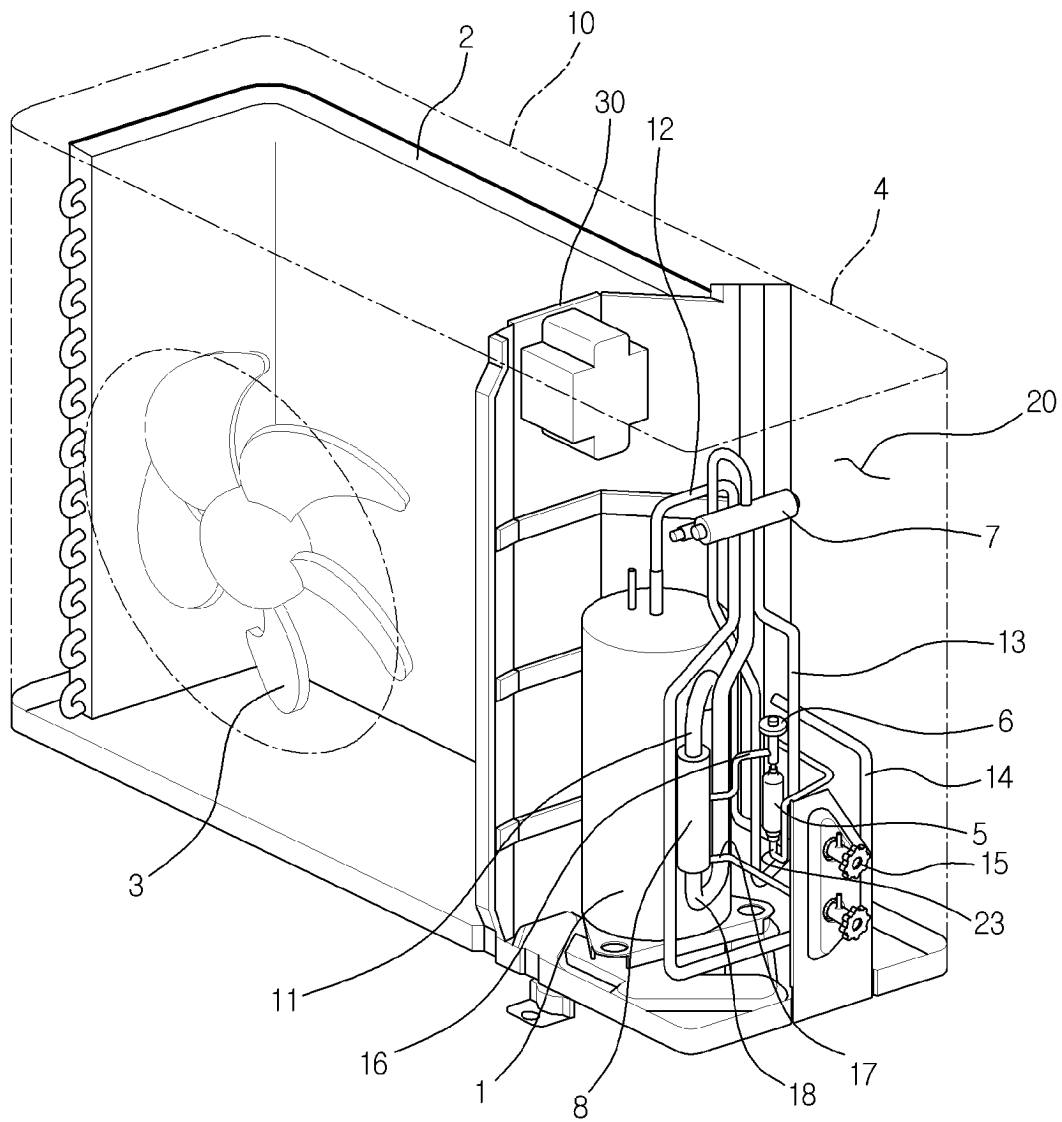


FIG.2

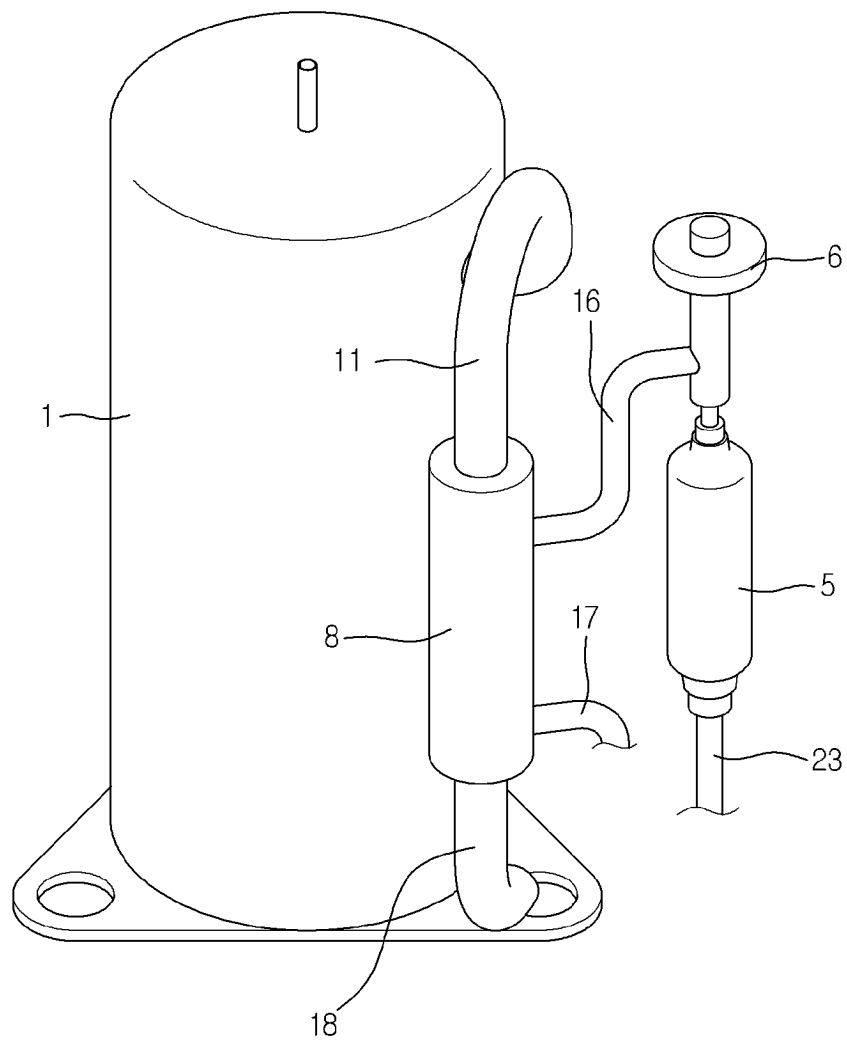


FIG.3

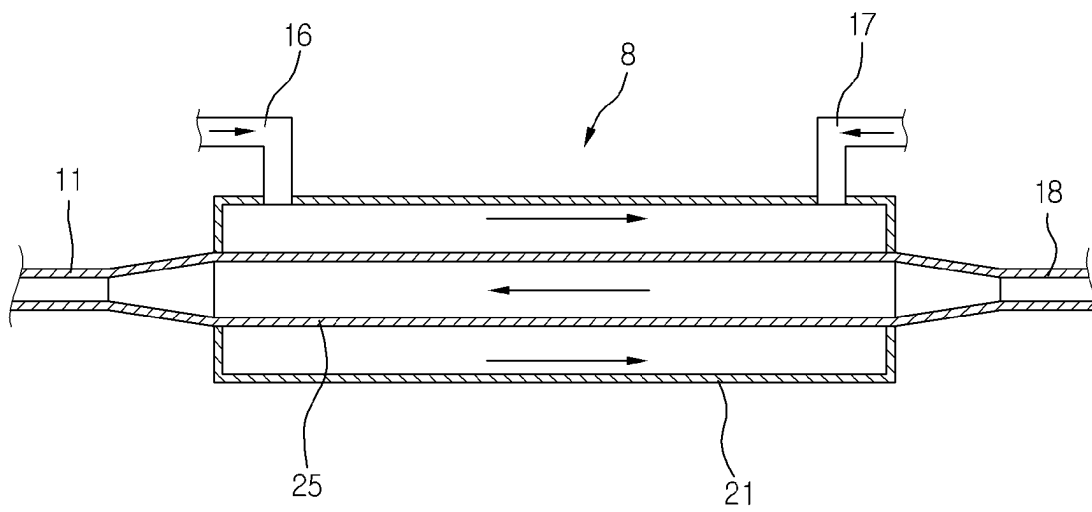


FIG.4

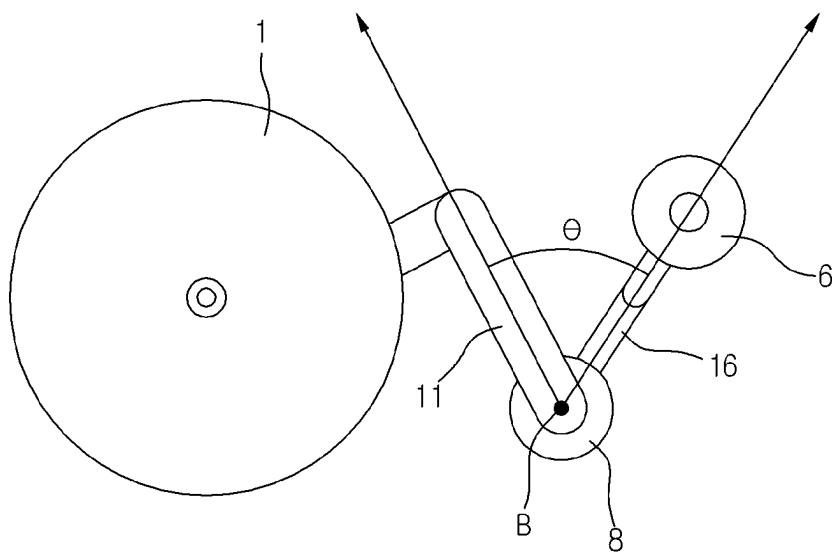


FIG.5

