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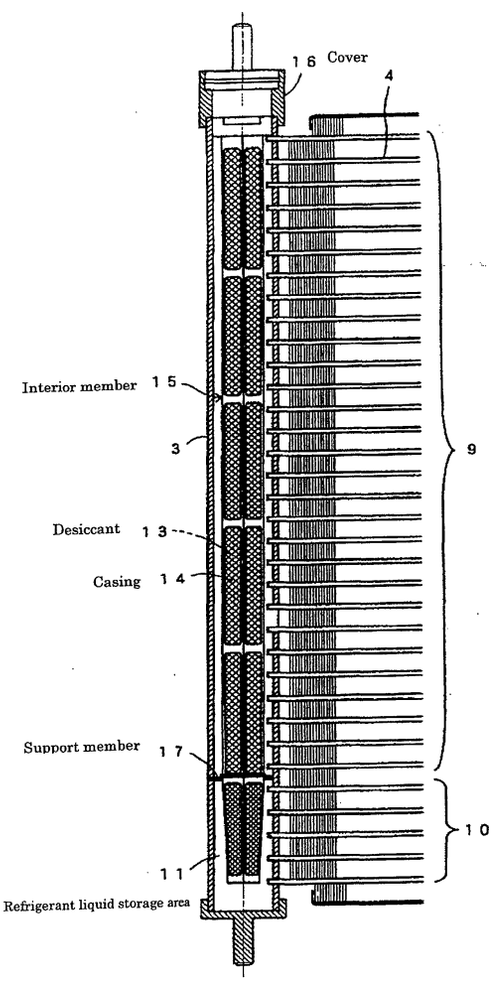
(54) Heat exchanger

(57) A heat exchanger (1) includes an interior member (15,19,21,31). The interior member (15,19,21,31) functions as at least a filter for flowing a heat exchange medium and is accommodated in a refrigerant route. The interior member (15,19,21,31) is supported by the support portion (17,20) of the refrigerant route. An elastic member (24,25,34,35) is provided between the interior member (15,19,21,31) and the support member (17,20). The elastic member (24,25,34,35) seals said interior member (15,19,21,31) to prevent the heat exchange medium from bypassing between the interior member and the refrigerant route.

[Fig. 2]



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Description

[0001] The present invention relates to a heat exchanger for use in an air conditioner for a vehicle. In particular, the present invention relates to the heat exchanger, e.g., a subcool type condenser or the like, which has a function as a receiver and has an interior member including a filter and a desiccant.

[0002] A heat exchanger, for example, a subcool type condenser that has the function as a conventional receiver, is known in the art. Such a subcool type condenser accommodates an interior member including at least a filter, particularly a filter and a desiccant in a condenser. The interior member, such as a packed-desiccant having a cylindrical shape, is pushed into a receiver or the interior member, such as a desiccant integrally formed with a filter that is packed by a netcasing, is pushed into the condenser.

[0003] Such an interior member may be accommodated to be able to be exchanged, and the condenser maintains the interior member in its fixed position, as necessary. When an interior member is accommodated, in case of it being deformed by a heat of refrigerant, the condenser provides the interior member with a certain amount of strength.

[0004] As shown in Fig. 1 (Fig. 1 is also used in explanation of the present invention), a subcool type condenser 1 is also known in the art. A subcool type condenser 1 comprises a second header 2 and a first header 3 which are vertically arranged in parallel with each other, and a plurality of heat exchanger tubes 4 which extend in parallel with each other, communicating between both the headers 2 and 3. Pluralities of corrugated fins 5 are provided between heat exchanger tubes 4 and on their outer layers. The second header 2 has an inlet pipe 6 for introducing refrigerant and an outlet pipe 7 for discharging refrigerant at the lower portion in a vertical direction.

[0005] A partition board 8 is provided within the second header 2. The partition board 8 divides the inside of the second header 2 into an upper compartment (an upper header section 2a) and a lower compartment (a lower header section 2b). This partition board 8 also divides the area in which the plurality of heat exchange tubes 4 are located, into a refrigerant condensing core 9 and a subcool core 10. The condensing core 9 condenses the refrigerant introduced into the condenser 1 and the subcool core 10 supercools the condensed refrigerant from refrigerant condensing core 9. In other words, the partition board 8 provided in integrally formed the second header 2 divides the entire core of the condenser 1 into a refrigerant condensing core 9 and a subcool core 10. In this subcool type condenser 1, there is a single refrigerant path formed of heat exchange tubes 4 extending in parallel with each other in the refrigerant condensing core 9. Therefore, the refrigerant introduced through the inlet pipe 6 into the second header 2 passes through the heat exchange tubes 4 of the refrigerant condensing core 9 which constitute one path route and flows into the first header 3. Subsequently, after the refrigerant flows downwardly within the first header 3, the refrigerant is directly introduced into the inlet of the subcool core 10. Moreover, the refrigerant passes through each heat exchange tube 4 of the subcool core 10, and flows out through the outlet pipe 7. Alternatively, the refrigerant condensing core 9 may consist of two or more path routes.

[0006] Moreover, in this sub cool type condenser 1, at least the lower section 3b of the first header 3 which serves as an inlet to the subcool core 10 constitutes a refrigerant liquid storage area 11. As shown in Figs. 2 and 3, refrigerant from the refrigerant condensing core 9, namely refrigerant coming from the upper section 3a of the first header 3, is stored in this liquid storage area 11. Subsequently, the refrigerant flows into each heat exchange tube 4 of the subcool core 10.

[0007] Moreover, in this subcool type condenser 1, an interior member 15 is accommodated within the first header 3. The interior member 15 comprises a liquid-permeable casing 14. A desiccant 13 is disposed in casing 14. In other words, the casing 14 has a function of holding a desiccant 13 and a function as a filter. The interior member 15 is accommodated in the first header 3 so as to be exchangeable with a cover 16.

[0008] Interior member 15 has a connecting step 15a. When interior member 15 is inserted from an upper side of the first header 3, connecting step 15a abuts to a support board 17 formed within first header 3, such that interior member 15 is fixed.

[0009] Alternatively, as shown in Figs. 4 and 5, an interior member 19 has a connecting step 19a. When interior member 19 is inserted from a lower side of the first header 3 into first header 3, connecting step 19a abuts to a support board 20 formed within first header 3, such that interior member 19 is fixed.

[0010] However, in such interior members 15 and 19, if a high atmospheric temperature or a high refrigerant temperature influences interior members 15 and 19, interior members 15 and 19 may be deformed (e.g., interior members 15 and 19 may contract in a vertical direction). Therefore, a space may be created between each connecting step 15a and 19a and each support board 17 and 20, respectively, and such space may cause vibration because interior members 15 and 19 come into collision with support boards 17 and 20. As a result, noise may occur, or interior members 15 and 19 may be damaged. Moreover, connecting portions between connecting steps 15a and 19a and support boards 17 and 20 may prevent the refrigerant from flowing from condensing core 9 to subcool core 10. Nevertheless, if the space is created between the connecting portion, the refrigerant may shortcut the connecting portion, and a foreign body other material (e.g., pieces of a desiccant) may not be caught by interior members 15 and 19. Therefore, such foreign body may circulate into a refrigerant cycle with the heat exchange medium, and com-

ponents in the refrigerant cycle may be damaged. In addition, if the space is created, interior members 15 and 19 may not remove the water in the heat exchange medium. Therefore, such a subcool type condenser may not perform properly.

[0011] Therefore, a need has arisen for heat exchangers for use in air conditioning systems for vehicles that overcome these and other shortcomings of the related art. A technical advantage of the present invention is that a connecting portion between an interior member and a header of the heat exchanger may be sealed.

[0012] According to the present invention, there is provided a heat exchanger comprising:

an interior member including at least a filter for a heat exchange medium and accommodated, in use in a refrigerant route and supported by a support portion formed at said refrigerant route; and
an elastic member for sealing said interior member and said support member, the elastic member being provided between said interior member and said support member.

[0013] In the above heat exchanger, the heat exchanger may have two headers communicated with each other by a plurality of heat exchanger tubes extending between the headers in parallel with each other. The refrigerant route is formed from the header and the tubes.

[0014] Alternatively, the heat exchanger may be a refrigerant condenser and further comprises a refrigerant condensing core and a subcool core. The refrigerant condensing core condenses the heat exchange medium. The subcool core supercools the heat exchange medium condensed by the refrigerant condensing core. The refrigerant condensing core and the subcool core are divided each other. In a first header, namely one of said two headers which is located on the subcool core inlet side, its section serving at least as an inlet to the subcool core constitutes a refrigerant liquid storage area.

[0015] Moreover, the interior member may be a liquid-permeable casing that is filled with a desiccant. Also, all or a part of the liquid-permeable casing may be formed from filter.

[0016] In addition, the elastic seal may be one of an o-ring or felt or a bellows.

[0017] Other objects, features, and advantages of embodiments of this invention will be apparent to, and understood by, persons of ordinary skill in the art from the following description of preferred embodiments with reference to the accompanying drawings, in which;

Fig. 1 is a front view of a subcool type condenser, according to embodiments of the present invention;
Fig. 2 is an enlarged fragmentary longitudinal, cross-sectional view of the subcool type condenser depicted in Fig. 1;
Fig. 3 is an exploded perspective view of an interior member provided in a first header of the subcool type condenser depicted in Fig. 2;
Fig. 4 is an enlarged fragmentary longitudinal, cross-sectional view, which corresponds to Fig. 2, of a subcool type condenser, according to an alternative embodiment of the present invention;
Fig. 5 is an exploded perspective view of an interior member provided in a first header of the subcool type condenser depicted in Fig. 4;
Fig. 6 is an enlarged fragmentary longitudinal, cross-sectional view of the area around a support member of the subcool type condenser according to a first embodiment of the present invention;
Fig. 7 is an enlarged fragmentary longitudinal, cross-sectional view of the interior member depicted in Fig. 6;
Fig. 8 is an enlarged fragmentary longitudinal, cross-sectional view, which corresponds to Fig. 7, of an interior member, according to an alternative of the first embodiment of the present invention;
Fig. 9 is an enlarged fragmentary longitudinal, cross-sectional view of the area around a support member of a subcool type condenser according to a second embodiment of the present invention;
Fig. 10 is an enlarged fragmentary longitudinal, cross-sectional view of an interior member depicted in Fig. 9; and
Fig. 11 is an enlarged fragmentary longitudinal, cross-sectional view, which corresponds to Fig. 10, of an interior member, according to an alternative of the second embodiment of the present invention.

[0018] Referring to Figs. 6 and 7, a substantial part of a heat exchanger of the present invention according to a first embodiment is described. Further, in this embodiment of the present invention, the structure of the heat exchanger is substantially same as subcool type condenser 1 depicted in Fig. 1. Therefore, in this embodiment, in the same parts used in the related art, the same number is given and the explanation is omitted. Similarly as shown in Fig. 1, in this embodiment, the condenser 1 is divided into refrigerant condensation core 9 and subcooling core 10. In particular, support board 17 for supporting and fixing interior member 21 is provided within first header 3.

[0019] Interior member 21 includes casing 22, and a part of casing 22 is formed of a net and desiccant 23 disposed in casing 22. In other words, casing 22 has the function of holding desiccant 23 and as a filter.

[0020] Casing 22 has a connecting step 21a, a small diameter portion 21b, and a large diameter portion 21c. Connecting step 21a abuts to a support board 17. Small diameter portion 21b is disposed into a lower section 3b of subcool type condenser 1. A large diameter portion 21c is disposed into an upper section 3a of subcool type condenser 1. A small diameter portion 21b penetrates an opening 17a formed through support board 17. In this

embodiment, a part of casing 22, namely, a small diameter portion 21b, is formed of a net including the function of a filter. A bellows 24 for sealing between connecting step 21a and support board 17 is formed integrally with connecting step 21a. Alternatively, bellows 24 may be formed integrally with support board 17.

[0021] In such a structure, if interior member 21 is contracted in a vertical direction because of a high atmospheric temperature or a high refrigerant temperature, bellows 24 extends toward the vertical direction, and absorbs a contracted portion of interior members 21 because bellows 24 is provided in a contractable condition. Therefore, a space between each connecting step 21a and support board 17 is created, and vibration and noise when interior member 21 comes into collision with support board 17 does not occur. As a result, a connecting portion between connecting step 21a and support board 17 prevents the refrigerant from shortcutting the connecting portion. A foreign body can be caught by interior member 21, and desiccant 23 removes the water in the heat exchange medium. Therefore, circulation of such a foreign body and heat exchange medium including water in a refrigerant circuit is reduced or eliminated, and components in the refrigerant cycle avoid damage.

[0022] As shown in Fig. 8, according to an alternative of the first embodiment of interior member 21 is described. Interior member 21 includes an o-ring 25 as an elastic sealing member instead of bellows 24 of Figs. 6 and 7. Alternatively, interior member 21 may include felt 25 as an elastic sealing member instead of o-ring 25. Further, the structure of the heat exchanger other than the elastic sealing members in this embodiment of the present invention is substantially the same as that of subcool type condenser 1 depicted in Figs. 6 and 7.

[0023] As shown in Figs. 9 and 10, an area around a support member 20 of a subcool type condenser 1 and a substantial part of an interior member 31 are described, respectively, according to a second embodiment of the present invention. In this embodiment of the present invention, the structure of the heat exchanger is substantially the same as subcool type condenser 1 depicted in Fig. 4 and 5 except that interior member 31 is inserted from a lower side of the first header 3 into first header 3.

[0024] Interior member 31 includes a casing 32 formed entirely of a net and a desiccant 33 disposed in casing 32. In other words, casing 32 has the function of holding desiccant 33 and as a filter.

[0025] Casing 32 has a connecting step 31a, a small diameter portion 31b, and a large diameter portion 31c. Connecting step 31a abuts a support board 20. A small diameter portion 31b disposed into an upper section 3a of subcool type condenser 1, and a large diameter portion 31c disposed into a lower section 3b of subcool type condenser 1. A small diameter portion 31b penetrates an opening 20a formed through support board 20. In this embodiment, casing 32, namely, both small diameter portion 31b and large diameter portion 31c are formed of a net including the function of a filter. An o-ring 34 for sealing between connecting step 31a and support board 20 is formed integrally with connecting step 31a. Alternatively, interior member 31 may include a felt 34 instead of o-ring 34.

[0026] As shown in Fig. 11, an alternative of the second embodiment of interior member 31 is described. Interior member 31 includes a bellows 35 as an elastic sealing member instead of o-ring and felt 34 of Fig. 10. Bellows 35 for sealing between connecting step 31a and support board 20 is formed integrally with connecting step 31a. Alternatively, bellows 35 may be formed integrally with support board 20. Further, in this embodiment of the present invention, the structure of the heat exchanger other than the described above is substantially the same as subcool type condenser 1 depicted in Figs. 9 and 10.

Claims

1. A heat exchanger comprising:

an interior member including at least a filter for a heat exchange medium and accommodated, in use in a refrigerant route and supported by a support portion formed at said refrigerant route; and

an elastic member for sealing said interior member and said support member, the elastic member being provided between said interior member and said support member.

2. The heat exchanger of claim 1, further comprising:

two headers communicated with each other by a plurality of heat exchanger tubes extending between said two headers in parallel with each other,

wherein said refrigerant route is formed by said headers and said tubes.

3. The heat exchanger of claim 2, wherein said heat exchanger is a refrigerant condenser, said refrigerant condenser comprising:

a refrigerant condensing core for condensing refrigerant; and

a subcool core for supercooling the refrigerant condensed from said refrigerant condensing core, wherein both said refrigerant condensing core and said subcool condensing core are divided, wherein in a first one of said two headers, which is located on a subcool core inlet side, has a section serving at least as an inlet to the subcool core and providing a refrigerant liquid storage area.

4. The heat exchanger of any of claims 1 to 3, wherein said interior member is a liquid-permeable casing, which is filled with a desiccant.

5. The heat exchanger of claim 4, wherein said liquid-permeable casing is formed entirely of a filter.

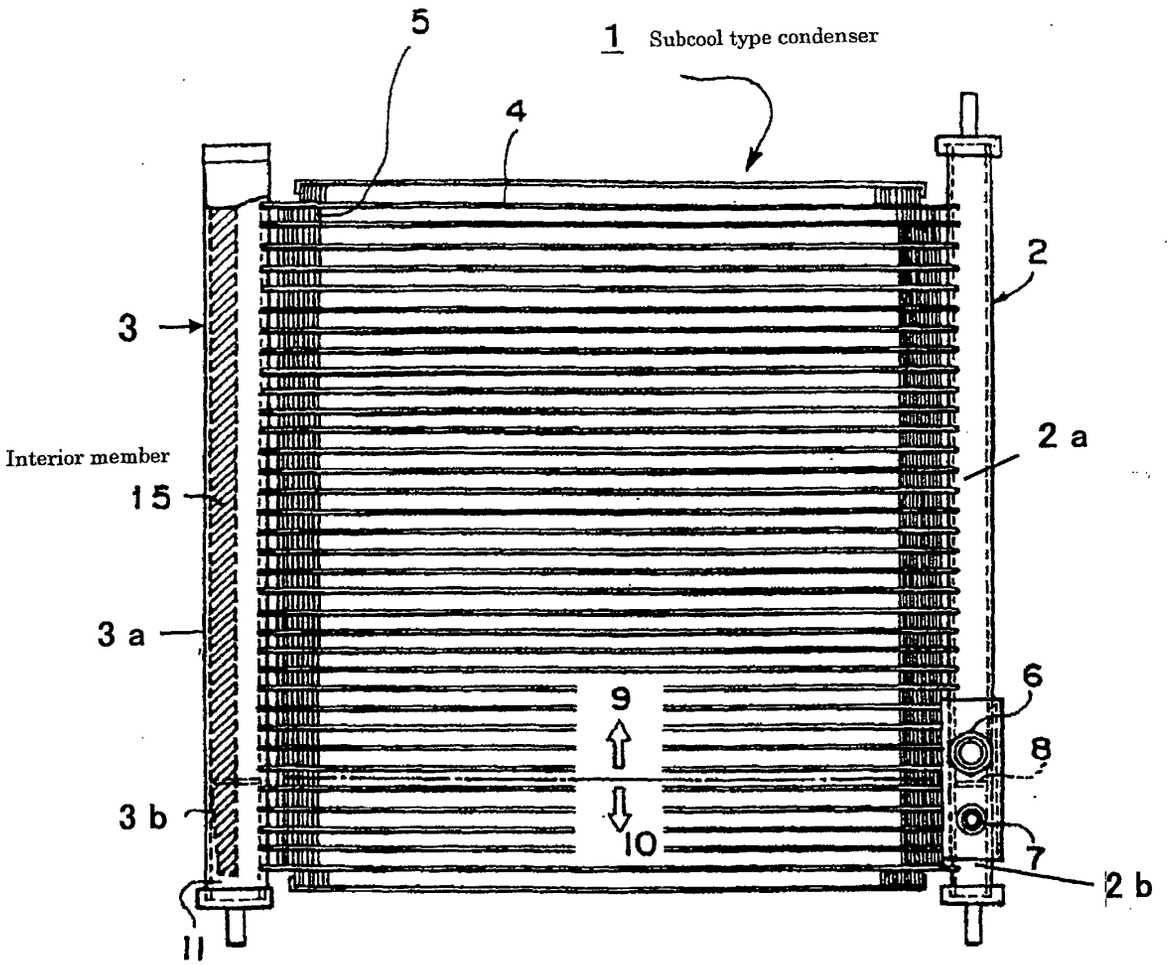
6. The heat exchanger of in claim 4, wherein a part of said liquid-permeable casing is formed by a filter.

7. The heat exchanger of any of claims 1 to 6, wherein said elastic member is an o-ring

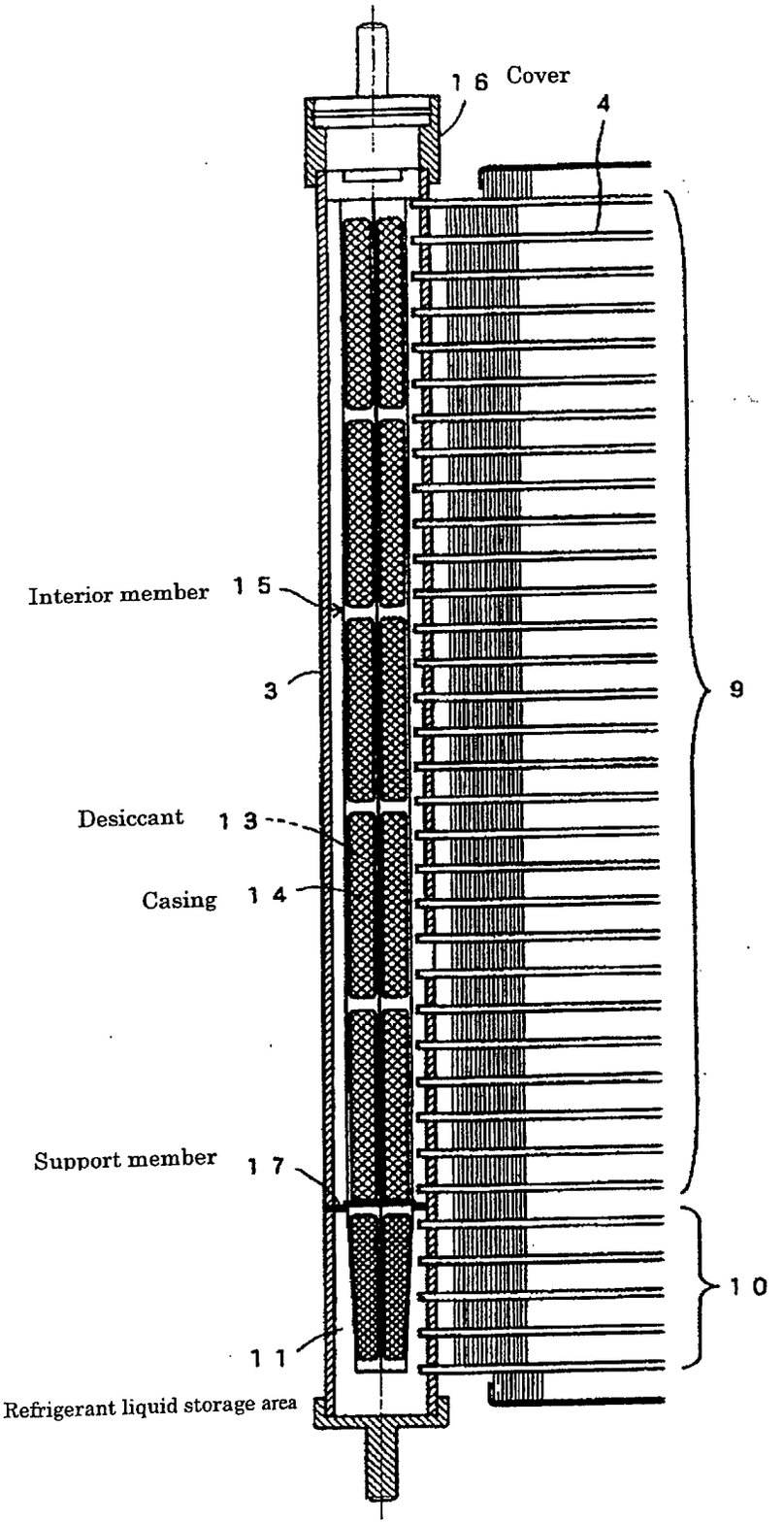
8. The heat exchanger of any of claims 1 to 6, wherein said elastic member is felt.

9. The heat exchanger of any of claims 1 to 6, wherein said elastic member is bellows.

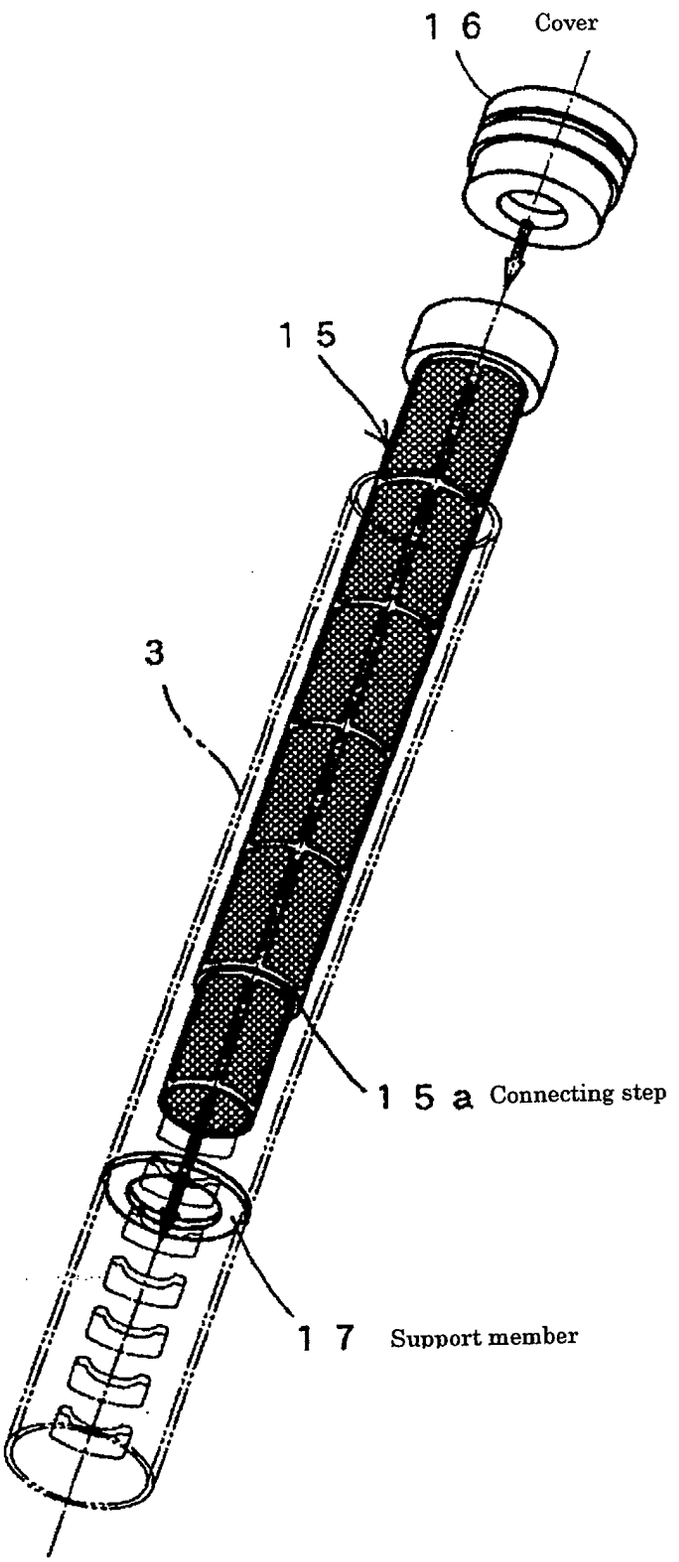
【Fig. 1】


5
1 Subcool type condenser
4
2
3
Interior member
15
2 a
3 a
9
6
8
3 b
10
7
2 b
11

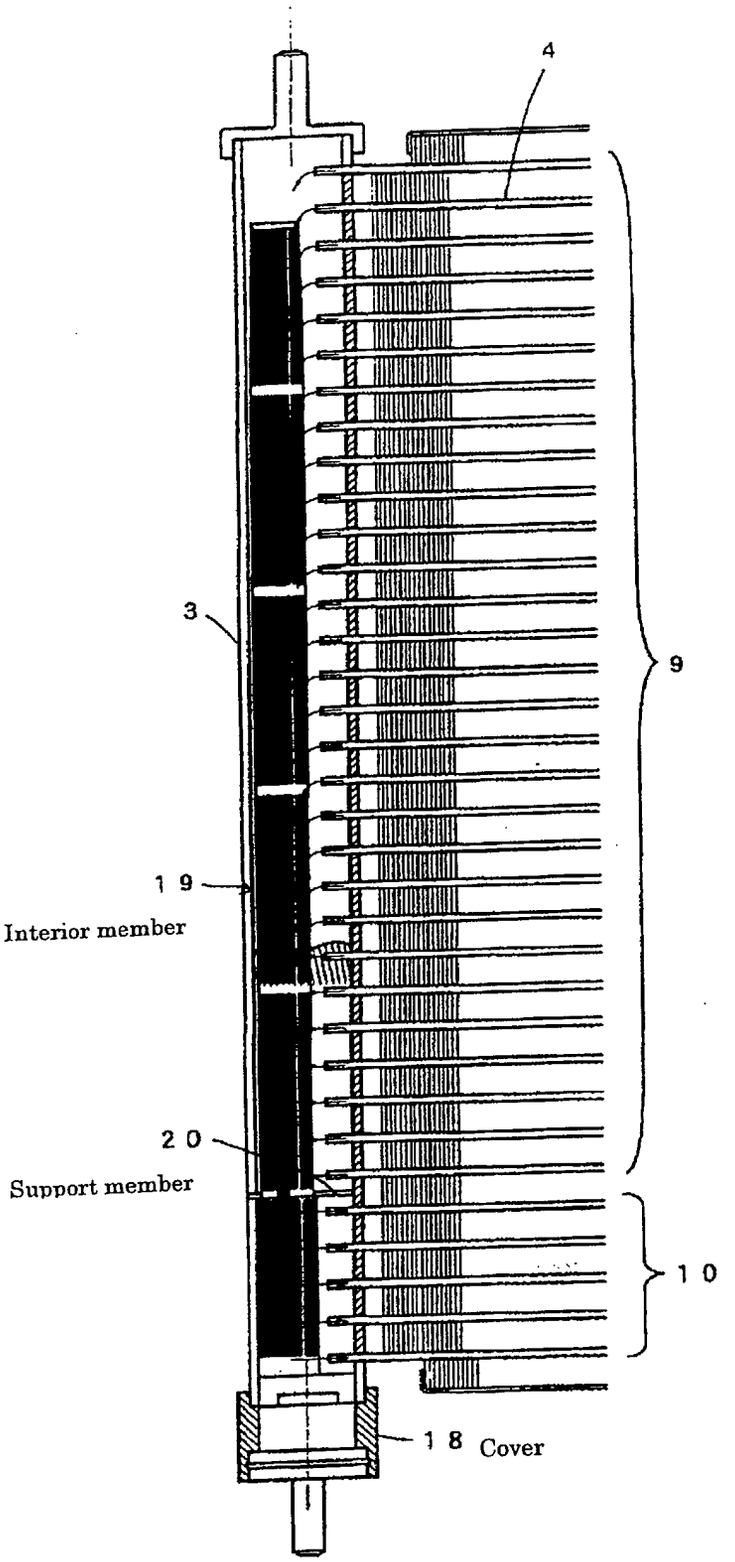
【Fig. 2】


16 Cover
4
Interior member 15
3
9
Desiccant 13
Casing 14
Support member 17
10
11
Refrigerant liquid storage area

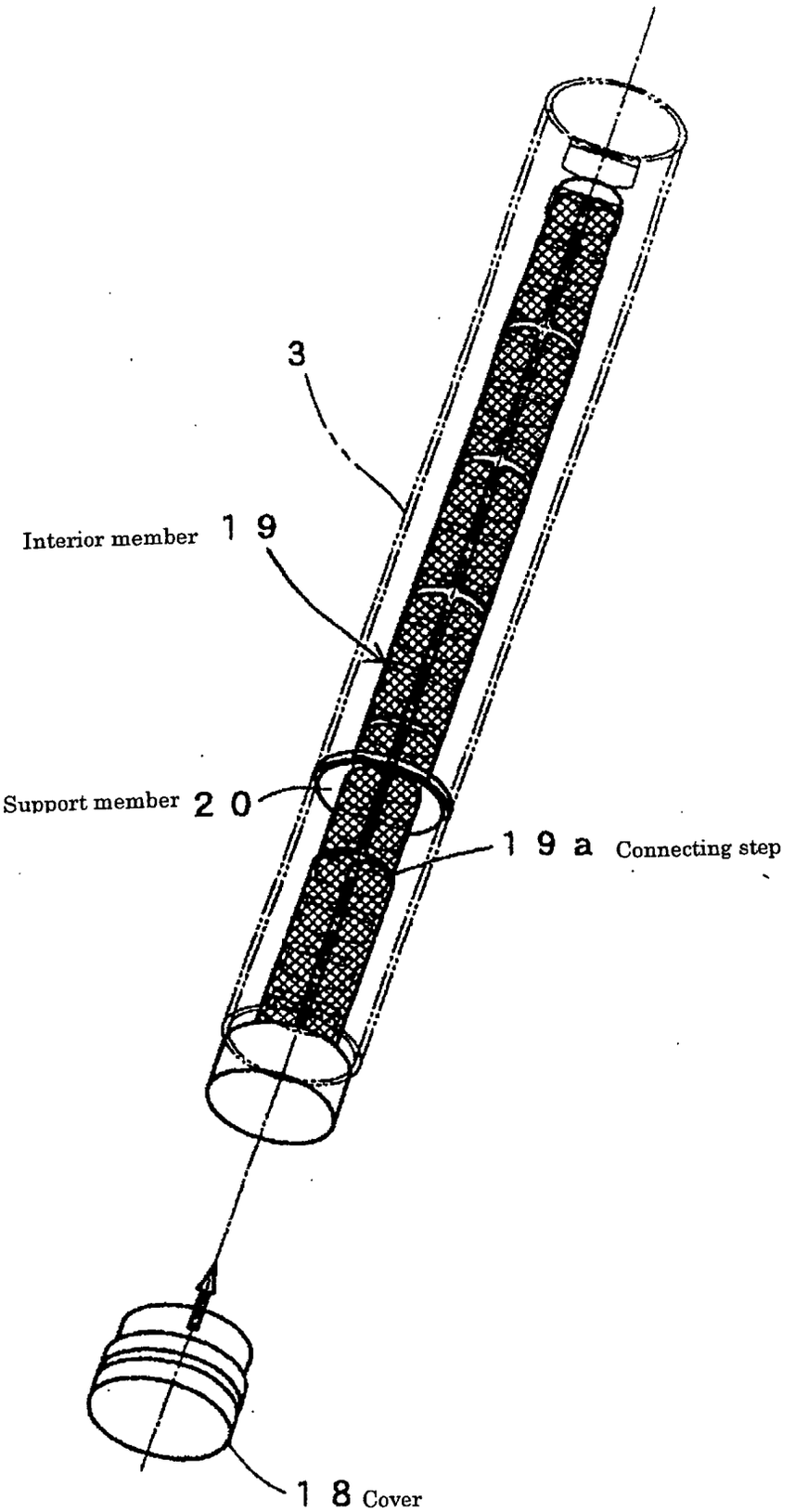
【Fig. 3】



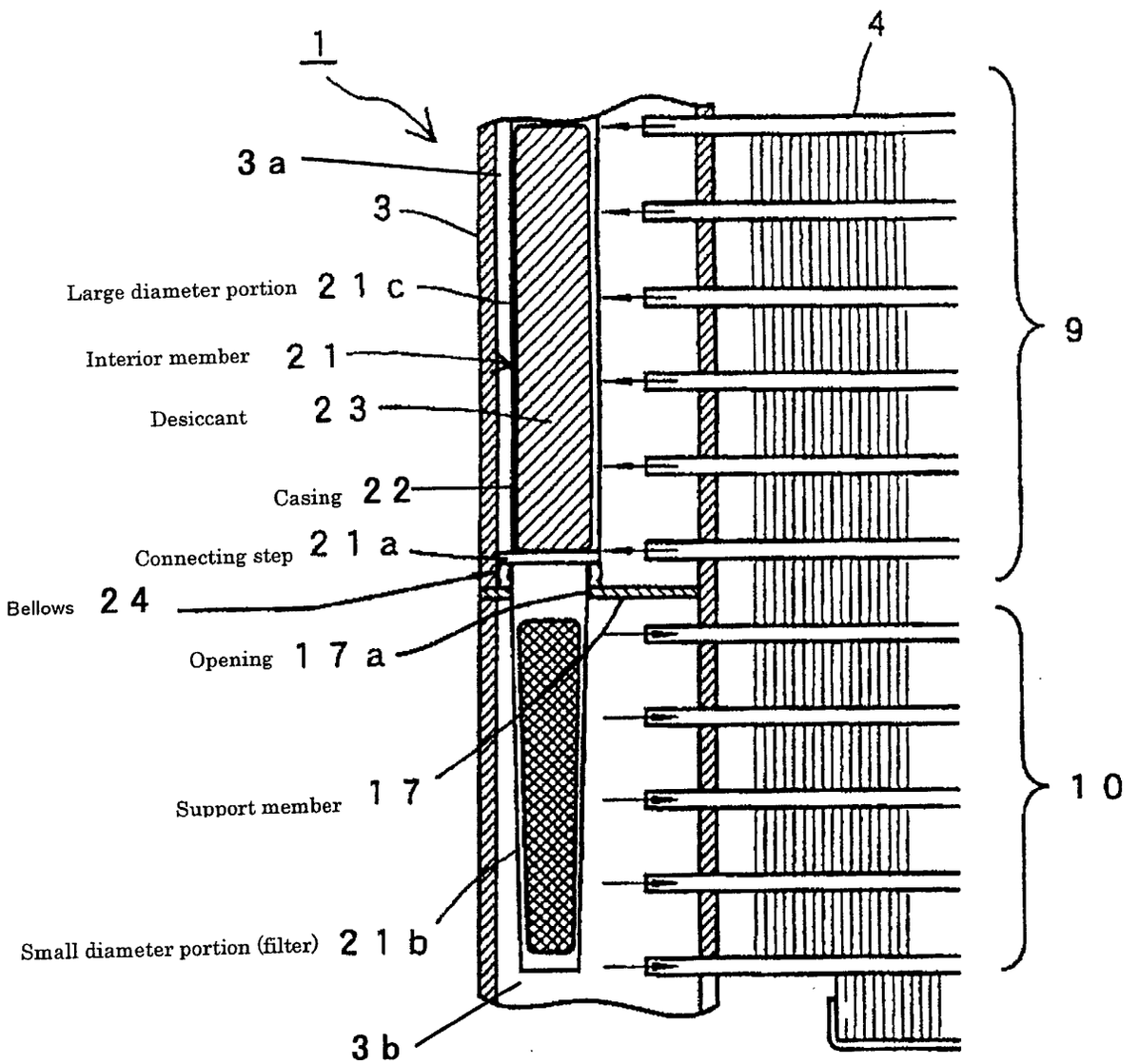
【Fig. 4】



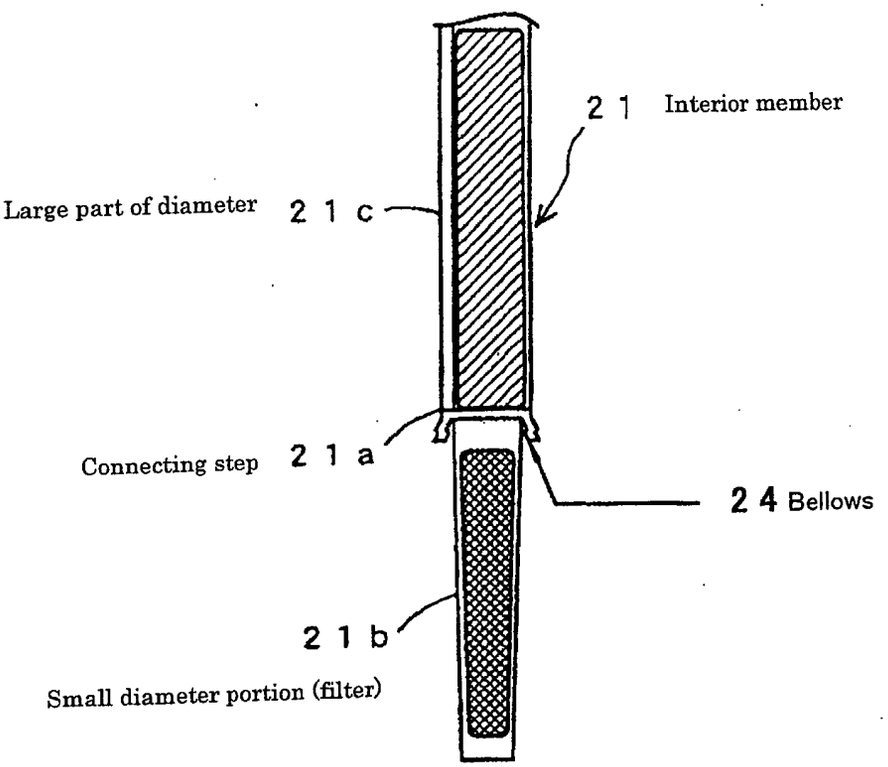
【Fig. 5】


3
Interior member 19
Support member 20
19a Connecting step
18 Cover

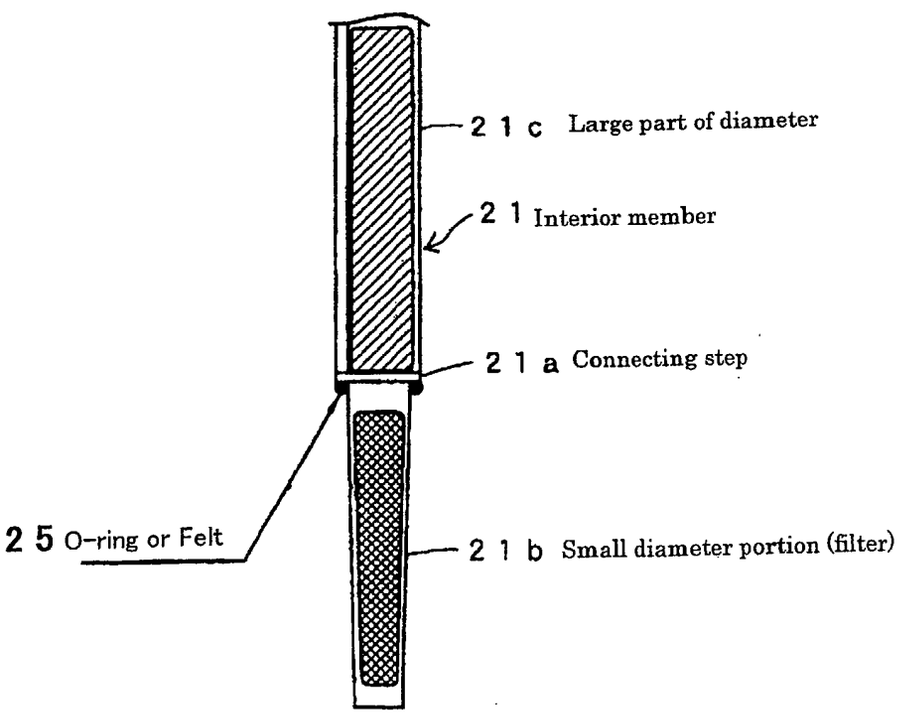
【Fig. 6】


1
4
3 a
3
Large diameter portion 2 1 c
Interior member 2 1
Desiccant 2 3
Casing 2 2
Connecting step 2 1 a
Bellows 2 4
Opening 1 7 a
Support member 1 7
Small diameter portion (filter) 2 1 b
3 b
9
1 0

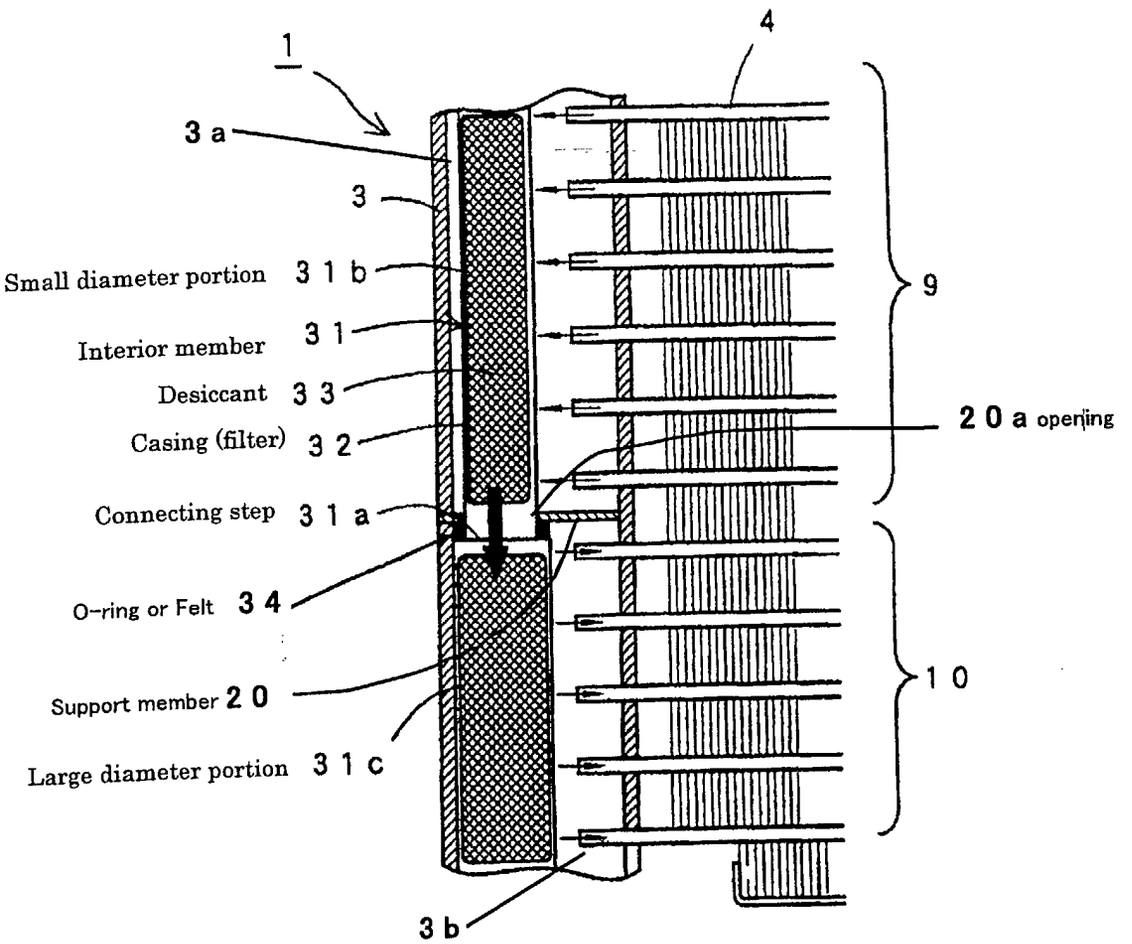
【Fig. 7】


21 Interior member
Large part of diameter 21c
Connecting step 21a
24 Bellows
21b
Small diameter portion (filter)

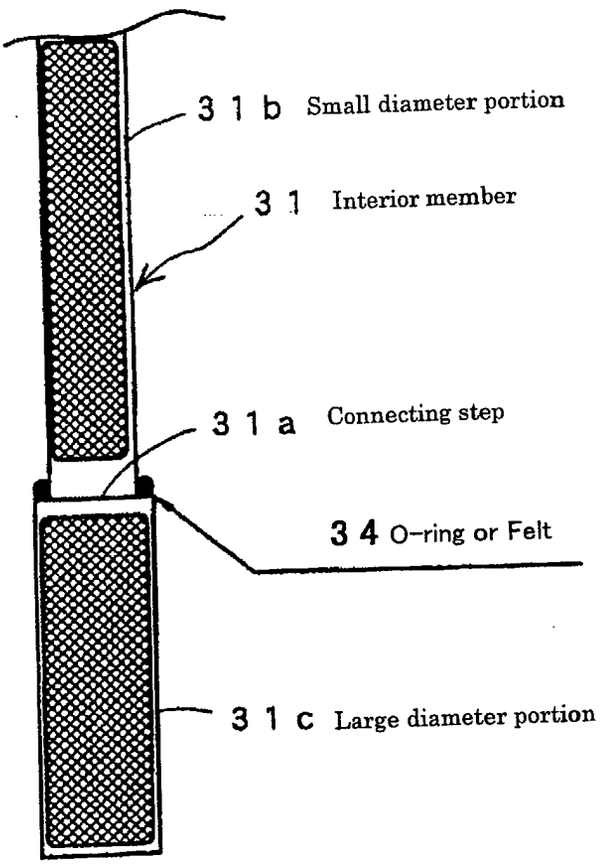
【Fig. 8】


21c Large part of diameter
21 Interior member
21a Connecting step
25 O-ring or Felt
21b Small diameter portion (filter)

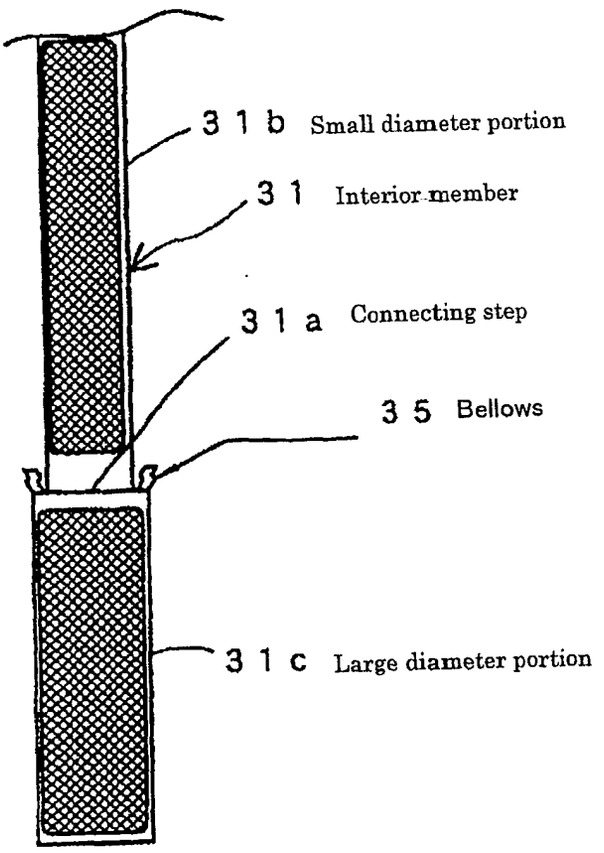
【Fig. 9】


1
4
3 a
3
Small diameter portion 3 1 b
Interior member 3 1
Desiccant 3 3
Casing (filter) 3 2
Connecting step 3 1 a
O-ring or Felt 3 4
Support member 2 0
Large diameter portion 3 1 c
3 b
9
2 0 a opening
1 0

【Fig. 10】


31b Small diameter portion
31 Interior member
31a Connecting step
34 O-ring or Felt
31c Large diameter portion

[Fig. 11]


31b Small diameter portion
31 Interior member
31a Connecting step
35 Bellows
31c Large diameter portion