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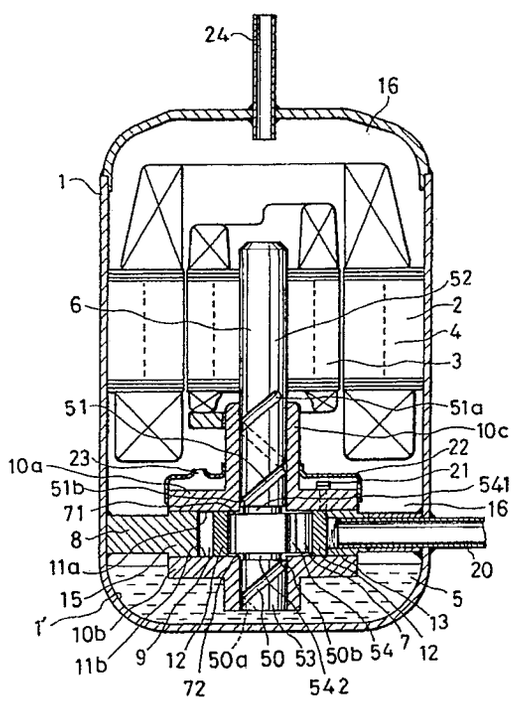
(54) Vertical rotary compressor.

(57) According to the present invention, the substantially spiral lower oil groove (50) on outside face of the lower extended part (53) of the shaft (6) brings up the lubrication oil (5) to the upper oil groove (51) through the connecting groove (54), which is formed on the outer circumference of the eccentric cam part (7). The lubrication oil (5) is certainly circulated to sufficiently lubricate the shaft (6).

FIG.1



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FIELD OF THE INVENTION AND RELATED ART STATEMENT

1. FIELD OF THE INVENTION

The present invention relates to a vertical rotary compressor which is to be used in an air conditioner, a refrigerator or the like, and more particularly a lubrication oil feeding mechanism therefor.

2. DESCRIPTION OF THE RELATED ART

Recently, in freezing and an air conditioning apparatuses or in freezing industry, a rotary compressor has been spreading rapidly in a market taking the place of a reciprocating compressor.

Hereafter, a conventional vertical type rotary compressor is described with reference to the accompanying drawing of FIG.3, which is a cross-sectional side view showing the conventional vertical rotary compressor.

A motor 4 which comprises a stator 2 and a rotor 3 is arranged in a closed tank 1. A compressor unit 15 which is operated by the motor 4 is also positioned in the closed tank 1. The bottom of the closed tank 1 is used as an oil reservoir 1', which contains lubrication oil 5 therein. Numeral 16 designates an interior hollow space in the closed tank 1. A shaft 6 which is fixed to the rotor 3 of the motor 4 has an eccentric cam part 7, which is positioned in a compression room 9 of a cylinder 8. The center of the compression room 9 which is formed in cylindrical shape is arranged co-centrically with the rotation axis of the shaft 6. A first bearing 10a and a second bearing 10b are provided to closely contact the upper and the lower face of the cylinder 8, respectively, as shown in FIG.3. A ring-shaped piston roller 12 slidably embraces on the eccentric cam part 7 and moves to roll contacting on a circular inner wall of the compression room 9. A slide vane 13, which slidably contacts the surface of the piston roller 12 by a force of spring (not shown), partitions the compression room 9 into a low pressure room and a high pressure room, which are of suction side and discharge side, respectively. A suction tube 20 with one end open in the low pressure room of the compression room 9 is fixed to the cylinder 8 by press-fitting. The other end of the suction tube 20 is connected to a low pressure side of a coolant circuit which is arranged on the outside area of the closed tank 1. A discharge valve 21 which is a one way valve for preventing a back flow of the coolant is provided on the first bearing 10a. A discharge muffler 22 which is mounted on the first bearing 10a has a discharging opening 23. The opening 23 of the discharge muffler 22 is open in the interior hollow space 16 of the closed tank 1. One end of a discharge tube 24 is open in the interior hollow space 16 of the closed tank 1, and the other end thereof is connected to a high pressure side of the above-mentioned coolant circuit. An oil passage hole 30 is formed in the bottom end part of the shaft 6, extended on axis of the shaft 6. An oil-feed fin 31 which is made by twisting a small piece of metal sheet is provided in the oil passage hole 30. A connection passage 33a is formed on the outer face of the eccentric cam part 7. The connection passage 33a and the oil passage hole 30 are communicated through an oil-feed hole 33b, which is arranged at the circular wall of the oil passage hole 30. An oil-feed groove 32, which is formed on an outer face of the shaft 6, is communicated with the oil passage hole 30 through a connection passage 33a. One end 32a of the oil-feed groove 32 is open in the interior hollow space 16 of the closed tank 1.

In the above-mentioned conventional rotary compressor, the rotation of the rotor 3 which is moved by the motor 4 is transmitted to the eccentric cam part 7 of the shaft 6. The piston roller 12, which is slidably and rotatably mounted on the eccentric cam part 7, moves circularly contacting the circular inner wall of the compression room 9. By the partitioning of the compression room 9 by the slide vane 13 into the high pressure room and the low pressure room and by the circular motion of the piston roller 12, the coolant suctioned from the suction tube 20 to the compression room 9 is continuously compressed. The compressed coolant is discharged from the discharge valve 21 to a discharge muffler 22. The coolant in the discharge muffler 22 is introduced to the interior hollow space 16 of the closed tank 1 through the opening 23. The coolant in the interior hollow space 16 is discharged from the discharge tube 24 to the coolant circuit.

In the above-mentioned operation, the oil-feed fin 31 which is positioned in the oil passage hole 30 scoops up the lubrication oil 5 in the oil reservoir 1' as the shaft 6 rotates. The lubrication oil in the oil passage hole 30 is brought upwards in the oil-feed groove 32 through the connection passage 33a. And the lubrication oil 5 is discharged from the upper end 32a of the oil-feed groove 32 out of upper brim of the bearing hub 10c into the interior hollow space 16 of the closed tank 1.

In the above-mentioned conventional vertical rotary compressor, the oil-feed fin 31 is fixed to the oil passage hole 30 within the shaft 6 by the press-fit of oil-feed fin 31 in the oil passage hole 30. Accordingly, the oil-feed fin 31 and the oil passage hole 30 must be made in accurate shapes, and the production cost increases. If a size of the oil-feed fin 31 is larger than that designed, the oil-feed fin

31 can not be inserted into the oil passage hole 30 or distort the outside shape of the end part of the shaft 6, thereby hindering smooth rotation of the piston roller 12. On the contrary, if the size of the oil-feed fin 31 is smaller than that designed, it drops off during operation of the rotary compressor.

OBJECT AND SUMMARY OF THE INVENTION

An object of the present invention is to offer a vertical rotary compressor which dispenses with an oil-feed fin, whereby conventional troubles caused by the oil-feed fin is eliminated.

In order to achieve the above-mentioned object, the vertical rotary compressor of the present invention comprises:

a closed tank having an oil reservoir at its bottom part;

a shaft to be driven by a motor having

(a) a lower extended part which has a spiral lower oil groove on its outer surface, the lowest end of the lower oil groove is open in the oil reservoir,

(b) a principal part which has a spiral upper oil groove on its outer surface, a top end of the upper oil groove is open in the closed tank, and

(c) an eccentric cam part which has on its outer surface a connecting groove for communicating the lower oil groove and the upper oil groove;

a cylinder having therein a circular compression room which has a circular inner wall in a concentric relation to the shaft;

a lower bearing and an upper bearing which fixedly contact a lower face and an upper face of the cylinder, respectively;

a piston roller which is rotatably held on the eccentric cam part, and is driven circularly contacting said circular inner wall of the compression room at rotation of the shaft;

a partition member which is slidably contact outer face of the piston roller and partitions the compression room into a high pressure room and a low pressure room.

According to the present invention, the substantially spiral lower oil groove on outside face of the lower extended part of the shaft brings up the lubrication oil to the upper oil groove through the connecting groove, which is formed on the outer circumference of the eccentric cam part. The lubrication oil is certainly circulated to sufficiently lubricate the shaft.

While the novel features of the invention are set forth particularly in the appended claims, the invention, both as to organization and content, will be better understood and appreciated, along with other objects and features thereof, from the following detailed description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is a cross-sectional side view showing a vertical rotary compressor of the present invention.

FIG.2 is a perspective view showing a shaft shown in FIG.1.

FIG.3 is a cross-sectional side view showing the conventional vertical rotary compressor.

It will be recognized that some or all of the Figures are schematic representations for purposes of illustration and do not necessarily depict the actual relative sizes or locations of the elements shown.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereafter, preferred embodiment of the present invention is described with reference to the accompanying drawings FIG.1 and FIG.2. FIG.1 is a cross-sectional side view showing a vertical rotary compressor of the present invention. FIG.2 is a perspective view showing a shaft shown in FIG.1.

In FIG.1, a motor 4 which comprises a stator 2 and a rotor 3 is arranged in a closed tank 1. A compressor unit 15 which is operated by the motor 4 is also positioned in the closed tank 1. The bottom of the closed tank 1 is used as an oil reservoir 1', which contains lubrication oil 5 therein. Numeral 16 designates an interior hollow space in the closed tank 1. A shaft 6 which is fixed to the rotor 3 of the motor 4 has an eccentric cam part 7, which is positioned in a compression room 9 of a cylinder 8. The center of the compression room 9 which is formed in cylindrical shape is arranged cocentrically with the rotation center of the shaft 6. A first bearing 10a and a second bearing 10b are provided to closely contact the upper and the lower face of the cylinder 8, respectively, as shown in FIG.1. The height of the eccentric cam part 7 is selected such as to form gaps in the compression room 9, namely an upper gap between the lower face 11a of the first bearing 10a and the upper face 71 of the eccentric cam part 7, and a lower gap between the upper face 11b of the second bearing 10b and the lower face 72 of the eccentric cam part 7. A ring-shaped piston roller 12 slidably embraces on the eccentric cam part 7 and moves to roll contacting on a circular wall of the compression room 9. A slide vane 13, which slidably contacts the surface of the piston roller 12 by a face of spring (not shown), partitions the compression room 9 into a low pressure room and a high pressure room, which are of suction side and discharge side, respectively. A suction tube 20 with one end open in the low pressure room of the

compression room 9 is fixed to the cylinder 8 by press-fitting. The other end of the suction tube 20 is connected to a low pressure side of a coolant circuit which is arranged on the outside area of the closed tank 1. A discharge valve 21 which is a one way valve for preventing a back flow of the coolant is provided on the first bearing 10a. A discharge muffler 22 which is mounted on the first bearing 10a has a discharging opening 23. The opening 23 of the discharge muffler 22 is open in the interior hollow space 16 of the closed tank 1. One end of a discharge tube 24 is open in the interior hollow space 16 of the closed tank 1, and the other end thereof is connected to a high pressure side of the above-mentioned coolant circuit.

As shown in FIG.2, a lower oil groove 50 is formed in substantial spiral shape on the outer cylindrical surface of a lower extended part 53 of the shaft 6. The lowest end 50a of the lower oil groove 50 is communicated with lubrication oil 5 at the lower part of a closed tank 1, that is in the oil reservoir 1'. An upper oil groove 51 is formed in substantial spiral shape on an outer cylindrical surface of a principal shaft part 52. The upper oil groove 51 is communicated with an interior hollow space 16 at the upper part of the closed tank 1. As shown in FIG.2, a connecting groove 54 is formed substantially in parallel to the shaft 6 on an outer cylindrical surface of an eccentric cam part 7. Configuration of the spiral oil grooves 50, 51 are determined so as to generate pump-up action utilizing viscosity of lubrication oil 5 during forward-rotation. The upper oil groove 51, the lower oil groove 50 and the connecting groove 54 are communicated as follows. Two ring shaped recesses 541, 542 are made on the upper and lower sides of the eccentric cam part 7, respectively. The upper ring shaped recess 541 is connected to the lower end 51b of the upper oil groove 51, and the lower ring shaped recess 542 is connected to the upper end 50b of the lower oil groove 50.

In the above-mentioned vertical rotary compressor, the rotation of the rotor 3 which is moved by a motor 4 is transmitted to the shaft 6. The lubrication oil 5 is pumped up by the lower oil groove 50 from the lowes end 50a of the lower oil groove 50. The lubrication oil 5 flows in the passage formed between the lower oil groove 50 and the inside face of the second bearing 10b, and reaches the upper end 50b of the lower oil groove 50. The lubrication oil 5 flows in the connecting groove 54 of the eccentric cam part 7, along with the inner face of the piston roller 12. Further, the lubrication oil 5 is brought up from the lower end 51b of the upper oil groove 51, passes through the upper oil groove 51. And the lubrication oil 5 is discharged from the upper end 51a of the upper oil groove 51 out of upper brim of the bearing hub 10c into the interior hollow space 16 of the closed tank 1.

Accordingly, the vertical rotary compressor can pump up the lubrication oil 5 along the grooves 50, 54 and 51 formed outside the shaft 6. Since no oil-feed fin of the press-fitted twisted sheet is used, there is no fear of dropping out of the fin from the shaft or distorting the shape of the shaft.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been changed in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

Claims

1. A vertical rotary compressor comprising:

a closed tank (1) having an oil reservoir (1') at its bottom part;

a shaft (6) to be driven by a motor (4) having

(a) a lower extended part (53) which has a spiral lower oil groove (50) on its outer surface, a lowest end (50a) of said spiral lower oil groove (50) is open in said oil reservoir (1'),

(b) a principal part (52) which has a spiral upper oil groove (51) on its outer surface, a top end (51a) of said spiral upper oil groove (51) is open in said closed tank (1), and

(c) an eccentric cam part (7) which has on its outer surface a connecting groove (54) for communicating said lower oil groove (50) and said upper oil groove (54);

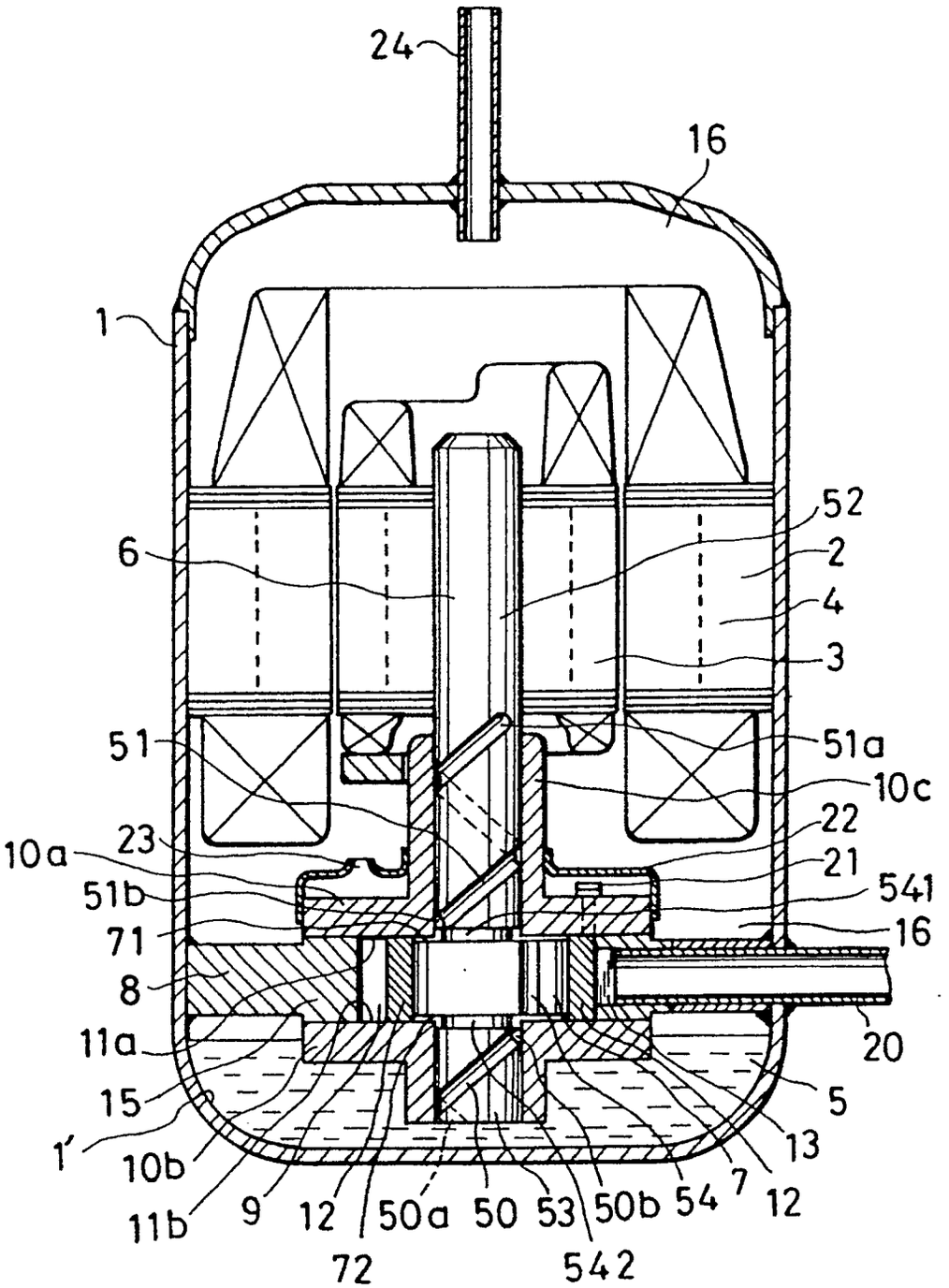
a cylinder (8) having therein a circular compression room (9) which has a circular inner wall in a concentric relation to said shaft (6);

a lower bearing (10b) and an upper bearing (10a) fixedly contact a lower face and an upper face of said cylinder (8), respectively;

a piston roller (12) which is rotatably held on said eccentric cam part (7), and is driven circularly contacting said circular inner wall of said compression room (9) at rotation of said shaft (6);

a partition member (13) which is slidably contact outer face of said piston roller (12) and partitions said compression room (9) into a high pressure room and a low pressure room.

FIG.1


24
16
1
52
6
2
4
3
51
51a
10c
22
10a
23
21
541
51b
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8
11a
20
15
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11b
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12
50a
50
53
50b
54
72
542

FIG. 2

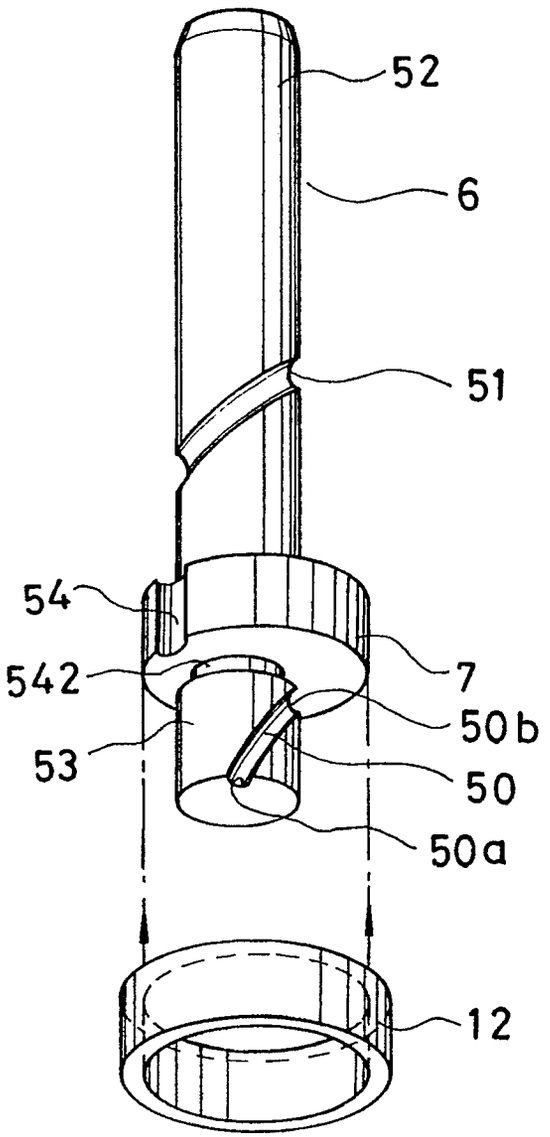
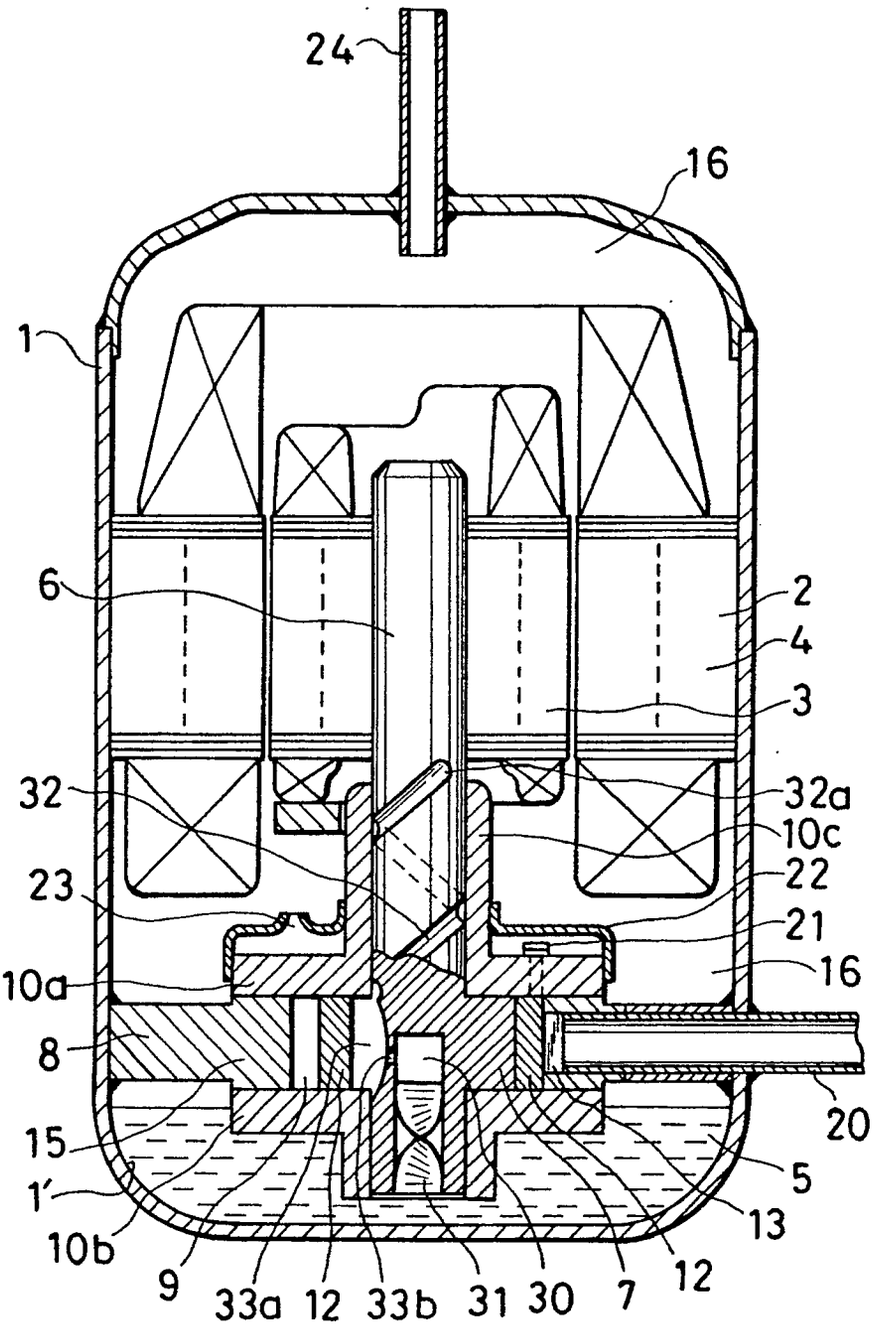


FIG. 3 (Prior Art)



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EUROPEAN SEARCH REPORT

Application Number

EP 90 10 3735

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.5)
X	US-A-2764342 (DILLS) * column 1, line 57 - column 2, line 11; figures * * column 2, line 67 - column 3, line 9 * -----	1	F04C29/02
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 OCTOBER 1990	KAPOULAS T.

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
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D : document cited in the application
L : document cited for other reasons

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