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

(11) EP 2 115 302 B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
16.03.2016 Bulletin 2016/11

(21) Application number: **07793786.0**

(22) Date of filing: **31.08.2007**

(51) Int Cl.:
F04C 18/02 *(2006.01)* ***F04C 29/02*** *(2006.01)*
F04C 23/00 *(2006.01)* ***F04C 29/00*** *(2006.01)*

(86) International application number:
PCT/KR2007/004216

(87) International publication number:
WO 2008/088112 (24.07.2008 Gazette 2008/30)

(54) **COMPRESSOR AND OIL BLOCKING DEVICE THEREFOR**

VERDICHTER UND ÖLSPERRVORRICHTUNG DAFÜR

COMPRESSEUR ET DISPOSITIF DE BLOCAGE D'HUILE POUR CELUI-CI

(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 LV MC MT NL PL PT RO SE SI SK TR

(30) Priority: **19.01.2007 KR 20070006267**
19.04.2007 KR 20070038514

(43) Date of publication of application:
11.11.2009 Bulletin 2009/46

(73) Proprietor: **LG Electronics Inc.**
Seoul 150-721 (KR)

(72) Inventors:
- **JUNG, Chul-Su**
  Seoul 153-023 (KR)
- **KIEM, Myung-Kyun**
  Seoul 153-023 (KR)
- **JANG, Ki-Tae**
  Seoul 153-023 (KR)
- **LEE, Byeong-Chul**
  Seoul 153-023 (KR)
- **CHOI, Se-Heon**
  Seoul 153-023 (KR)
- **HWANG, Seon-Woong**
  Seoul 153-023 (KR)
- **YOO, Byung-Kil**
  Seoul 153-023 (KR)

(74) Representative: **Vossius & Partner**
Patentanwälte Rechtsanwälte mbB
Siebertstrasse 3
81675 München (DE)

(56) References cited:
EP-A2- 1 286 052
JP-A- 5 149 274
JP-A- 05 149 274
JP-A- 06 235 387
JP-A- 2002 138 961
JP-A- 2003 003 974
JP-A- 2003 293 955
JP-A- 2003 293 955
US-A- 5 304 045
US-A- 5 591 018
US-A- 5 593 297

EP 2 115 302 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Technical Field

[0001] A compressor with an oil blocking device therefor are disclosed herein.

Background Art

[0002] Compressors are known. However, they suffer from various disadvantages.

[0003] Generally, a compressor is a device for converting mechanical energy into compression energy to compress a fluid. Compressors are divided into various kinds including a reciprocating compressor, a rotary compressor, a vane compressor, and a scroll compressor according to the method for compressing a fluid.

[0004] A scroll compressor may be provided with a driving motor that generates a driving force in a hermetic casing, and a compression device that compresses a refrigerant by receiving the driving force generated by the driving motor. The compression device may include an orbiting scroll coupled to a driving or rotational shaft of the driving motor that performs an orbit motion with respect to a fixed scroll to form a pair of compression chambers. As the compression chambers move towards a center, a refrigerant is consecutively compressed and then discharged.

[0005] Document US5591018 discloses a compressor with an oil blocking device similar to the one defined in claim 1. Document EP1286052 discloses a compressor having the features of the preamble with the exception of an oil blocking device.

Disclosure of Invention

Technical Problem

[0006] When the driving motor rotates, oil contained in the inner space of the casing is sucked along the driving shaft to lubricate the compression device and cool the driving motor. However, such scroll compressors, when the driving motor rotates at a low speed, a pumping force for the oil is weak and vapor in the oil blocks an oil passage in the rotational shaft. Accordingly, an amount of oil supplied to the compression chambers is decreased increasing friction between the fixed scroll and the orbiting scroll. On the other hand, when the driving motor rotates at a high speed, an amount of spread oil is increased, supplying a large amount of oil to the compression chambers along with the refrigerant. Accordingly, a leakage amount of oil is increased, lowering reliability of the compressor. Also, as an amount of the supplied oil increases, a suction amount of the refrigerant decreases, lowering the reliability of the compressor.

Technical Solution

[0007] Embodiments disclosed herein provide a scroll compressor capable of always maintaining a predetermined amount of oil regardless of a rotational speed of a driving motor.

[0008] In accordance with an embodiment broadly described herein, there is provided a scroll compressor that includes the features as defined in claim 1.

Advantageous Effects

[0009] A compressor and oil blocking device therefor are provided which are capable of preventing oil from spreading onto, for example, a balance weight, which are capable of preventing oil from being excessively sucked into a compression device by a separating device disposed between a driving motor and the compression device, and which are capable of constantly maintaining a predetermined amount of oil in compression chambers regardless of a rotational speed of the driving motor by directly supplying oil to a bearing surface and the compression chambers and by easily discharging gas from an oil drain passage. A trochoid gear pump may be used to smoothly supply oil to the compression device. Further, a synchronous reluctance motor may be used to enhance a performance of the compressor and to expand a driving region of the compressor.

Brief Description of the Drawings

[0010] Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, and wherein:

FIG. 1 is a longitudinal sectional view of a scroll compressor according to an example not falling within the scope of the claims;
FIG. 2 is a longitudinal sectional view of an oil blocking device of the scroll compressor of FIG. 1 according to one example;
FIG. 3 is a longitudinal sectional view of an oil blocking device of the scroll compressor of FIG. 1 according to another example;
FIG. 4 is a longitudinal sectional view of a separating device provided in an oil blocking device similar to FIG. 1;
FIGS. 5 and 6 are perspective views showing a separating device provided in an oil blocking device similar to Fig 4, of which the one shown in Fig. 6 is not in accordance with the claims;
FIG. 7 is a perspective view of a rotor and a rotation shaft of a driving motor of FIG. 1;
FIG. 8 is a perspective view of an oil pump of FIG. 1;
FIG. 9 is a longitudinal sectional view showing a structure for supplying oil to a compression chamber of FIG. 1;
FIGS. 10 and 11 are a graph showing an energy

efficiency ratio (EER) and an oil circulation rate (OCR) of the compressor of FIG. 1; and

FIGS. 12-14 are exemplary installations of a compressor having an oil blocking device according to embodiments disclosed herein.

Best Mode for Carrying Out the Invention

[0011] Hereinafter, a scroll compressor and oil blocking device therefor according to embodiments will be explained in detail. Embodiments are disclosed herein implemented in a scroll compressor. However, embodiments may be implemented in other type compressors as well. Further, the scroll compressor may be a high side type scroll compressor or a low side type compressor.

[0012] As shown in FIG. 1, the scroll compressor 1 includes a casing 10 hermetically formed so as to contain oil therein, and to which a refrigerant suction pipe SP and a refrigerant discharge pipe DP may be connected, a driving motor 20 disposed in the casing 10 that generates a rotational force, and a compression device 30 disposed in the casing 10 that compresses a refrigerant by receiving the rotational force by from the driving motor 20.

[0013] The casing 10 includes a body 11, which may have having a cylindrical shape. The driving motor 20 and the compression device 30 may be installed at upper and lower portions of an inner circumferential surface of the casing 10. The casing 10 may further include an upper cap 12 and a lower cap 13 that hermetically cover upper and lower sides of the body 11.

[0014] A main frame 14 and a sub-frame 15 having axial holes 14a and 15a that support a rotational shaft 23 of the driving motor 20, respectively, may be fixed to upper and lower sides of the body 11. An oil level pipe 16a and an oil collecting pipe 16b, which each may be connected to a refrigerating cycle system, and that maintaining a pre-determined amount of oil may be communicated with a lower portion of the body 11.

[0015] The oil collecting pipe 16b may be positioned to be lower than the oil level pipe 16a.

[0016] The main frame 14 may include an axial hole 14a penetratingly formed at a center thereof, an oil pocket 14b, which may be disposed on an upper end of the axial hole 14a to collect oil sucked through the rotational shaft 23, an oil collecting hole 14c, which may be disposed at one side on an outer circumferential surface of the oil pocket 14b to collect the oil inside the oil pocket 14b to the casing 10, and an oil supplying hole 14d, which may be disposed at another side on the outer circumferential surface of the oil pocket 14b to partially supply the oil inside the oil pocket 14b to the compression chambers P. An oil blocking device or unit 17 that prevents oil from spreading onto a balance weight 24 by receiving the axial hole 14a may be disposed adjacent a lower surface of the main frame 14.

[0017] The oil blocking device 17 may have a cylindrical shape, as shown in FIG. 2, or may have a conical shape having a section downwardly extending, as shown in FIG. 3. Further, the oil blocking device 17 may be formed to have an area wide enough to receive certain mechanical parts, such as balance weight 24, so as to prevent oil from spreading there onto. The oil blocking device 17 may be formed to have an area wide enough to receive a coil 21a of a stator 21, or an area wide enough to overlap with the coil 21a in a vertical direction so that oil collected by contacting the oil blocking d evice 17 may be directly supplied onto the coil 21a in drop form. As shown in FIG. 3, one or more oil guiding portions 17a may extend from a lower surface of the oil blocking device 17 to supply collected oil onto the coil 21a.

[0018] A separating device 18 that separates the driving motor 20 and the compression device 30 is provided on the outer circumference of the oil blocking device 17, which may be disc shaped. As shown in FIG. 4, the separating device 18 is formed so that an inner circumferential surface thereof may be integrally extended from an upper outer circumferential surface of the oil blocking device 17, or so that an outer circumferential surface thereof may be adhered to an inner circumferential surface of the casing 10. Accordingly, oil inside the driving motor 20 may be prevented from being introduced into the compression chambers. An oil drain passage 18a through which oil supplied to the compression device 30 may be drained to the driving motor 20 is concavely formed at one side on an outer circumferential surface of the separating device 18. An oil drain guide member 19 disposed towards a lower side of the casing 10 is connected to the oil drain passage 18a, thereby preventing oil drained from the compression device 30 from spreading in the casing 10.

[0019] As shown in FIG. 5, the oil drain guide member 19 may have a rectangularly shaped sectional surface, and is coupled to the casing 10 by welding so that an opening thereof forms the oil drain path 19a together with an inner circumferential surface of the casing 10. The oil drain guide member 19 may be formed to be tapered so that oil collected through the oil drain passage 18a may be smoothly drained. Also, an outlet of the oil drain guide member 19 may extend lower than an upper end of the coil 21a of the driving motor 20 so that drained oil may be prevented from being mixed with spread oil or refrigerant.

[0020] As shown in FIG. 6, an oil drain guide member 19 not in accordance with the claims may be formed in a pipe shape. The oil drain passage 18a may be a hole, not a groove, so as to be tightly coupled to the oil drain guide member 19.

[0021] A refrigerant passage 18b that passes a refrigerant by connecting upper and lower sides of the casing 10 to each other on the basis of the separating device 18 may be formed at another side on the outer circumferential surface of the separating device 18. An oil separating plate (not shown) that separates oil from refrigerant sucked through the suction pipe SP may be inserted or communicated to/with the refrigerant passage 18b.

The refrigerant passage 18b may be formed in a lower pressure type scroll compressor where the inner space of the casing 10 is filled with suction pressure, but may not be formed in a higher pressure type scroll compressor where the inner space of the casing 10 is filled with discharge pressure.

[0022] When the separating device 18 is provided with the oil blocking device 17, an oil drain guide passage (not shown) through which oil discharged from a discharge port 31c of the fixed scroll 31 together with a refrigerant may be guided to the oil drain passage 18a may be formed in the main frame 14 or the fixed scroll 31.

[0023] As shown in FIG. 1, the driving motor 20 may include a stator 21 fixed to the casing 10 that receives power from outside, a rotor 22 disposed in the stator 21 with a pre-determined air gap therebetween and rotate by being interworked with the stator 21, and a rotational shaft 23 coupled to the rotor 22 by, for example, shrinkage fit to transmit a rotational force generated by the driving motor 20 to the compression device 30.

[0024] As shown in FIGS. 1 to 7, the rotor 22 may be provided with an axial hole 22a that receives the rotational shaft 23 at a center thereof. The rotor 22 may be a cylindrical rotor laminator formed as a plurality of thin steel plates laminated in a shaft lengthwise direction by, for example, shrinkage fit. A plurality of magnetic flux barriers 22b, which may be arc-shaped, may be penetratingly formed in a radial direction of the axial hole 22a along a circumferential direction of the rotor 22.

[0025] One or more oil collecting grooves 22c that enhance a heat emitting effect by passing collected oil into the rotor 22 may be formed on a circumferential surface of the axial hole 22a. The oil collecting grooves 22c may be formed in a shaft lengthwise direction, or in a direction inclined from a central longitudinal axis of the shaft. When being slantingly formed, the oil collecting groove 22c may be formed in a rotational direction of the rotational shaft 23 so as to smoothly collect oil.

[0026] The rotational shaft 23 may be provided with an oil passage 23a therein penetratingly formed in a shaft lengthwise direction. Oil passing holes 23b through which sucked oil may be supplied to the axial holes 14a and 15a of the main frame 14 and the sub-frame 15 may be formed in a radial direction at upper and lower sides of the oil passage 23a. One or more gas discharge holes 23c through which gas sucked through the oil passage 23a together with oil may be discharged outside the oil passage 23a may be formed between the oil passing holes 23b.

[0027] As shown in FIG. 1, the gas discharge hole 23c may be disposed at a lower side of the balance weight 24, thereby being prevented from being blocked by the balance weight 24 coupled to the rotational shaft 23. Also, the gas discharge hole 23c may be disposed inside the oil blocking device 17 so that oil leaked through the gas discharge hole 23c may be blocked by the oil blocking device 17.

[0028] As shown in FIG. 1, an oil pump 25 that pumps oil inside the casing 10 may be disposed at a lower end of the rotational shaft 23. The oil pump 25 may be a trochoid gear pump that forms a capacity by an inner gear 25a and an outer gear 25b applied so as to reduce time during which oil supply is stopped due to a suction pressure change and a liquid refrigerant vaporization.

[0029] A pump driving device 23e coupled to the inner gear 25a of the trochoid gear pump may be integrally formed at a lower end of the rotational shaft 23. A driving surface 23f that rotates the inner gear 25a by being engaged with the inner gear 25a may be disposed on an outer circumferential surface of the pump driving device 23e.

[0030] As shown in FIG. 8, the trochoid gear pump may include the inner gear 25a, the outer gear 25b, a pump cover 25c, and a mesh box 25d. A thrust plate 25e may be installed between the rotational shaft 23 and the oil pump 25. The thrust plate 25e may be fixed to a through hole 15b of the sub frame 15.

[0031] The trochoid gear pump may have a plurality of inlets with height differences so that a predetermined amount of oil may always be pumped regardless of a mixed degree between oil and refrigerant. For instance, when oil and refrigerant are mixed with each other at an acceptable state, both the oil and the refrigerant are pumped through both inlets. On the contrary, when the refrigerant and the oil are mixed with each other at an inferior state in which the refrigerant is disposed below the oil, only the refrigerant may be pumped through an inlet disposed at a lower side resulting in oil deficiency. However, if the inlets are disposed with height differences, the oil disposed at an upper side may be pumped together with the refrigerant, thus enhanceing a lubricating performance.

[0032] As shown in FIG. 1, the compression device 30 includes a fixed scroll 31 fixed to an upper surface of the main frame 14, an orbiting scroll 32 orbitably disposed on the upper surface of the main frame 14 so as to form a plurality of compression chambers P by being engaged with the fixed scroll 31, and an Oldham's ring 33 disposed between the orbiting scroll 32 and the main frame 14 that orbits the orbiting scroll 32 and prevents the orbiting scroll 32 from rotating about its central axis. The compression device 30 further includes a high-low pressure separating plate 34 disposed on a rear surface of a plate portion 31d of the fixed scroll 31 that divides an inside of the casing 10 into a suction space S1 and a discharge space S2, and a backflow preventing valve 35 that prevents backflow of discharge gas by opening and closing the discharge port 31c of the fixed scroll 31. The fixed scroll 31 may be formed so that a fixed wrap 31a that forms the compression chambers P may have an involute shape at a lower surface of the plate portion 31d. A suction port 31b that communicates with the suction space S1 of the casing 10 may be formed at a side surface of the plate portion 31d. The discharge port 31c through which a compressed refrigerant may be discharged to the discharge space S2 may be formed at a center of an upper surface of the plate portion 31d.

[0033] The orbiting scroll 32 may be formed so that an orbiting wrap 32a forming the pair of compression chambers P together with the fixed wrap 31a of the fixed scroll 31 may have an involute shape at an upper surface of the plate portion 31d of the orbiting scroll 32. A boss portion 32b coupled to the rotational shaft 23 and receiving a rotational force generated by the driving motor 20 may be formed at a center of the lower surface of the plate portion 32d.

[0034] As shown in FIG. 9, an oil injecting hole 32c that communicates with the oil supplying hole 14d of the main frame 14 to spray oil supplied through the oil supplying hole 14d to the compression chambers P may be formed at the plate portion 32d of the orbiting scroll 32. The oil injecting hole 32c may be formed before the orbiting wrap 32a starts a compression operation so as to prevent a refrigerant leakage therethrough. An oil storing groove 14e that stores a predetermined amount of oil may be formed at an end of the oil supplying hole 14d of the main frame 14 so that oil may be smoothly supplied through the oil injecting hole 32c.

[0035] Operation of a scroll compressor according to an embodiment disclosed herein will be explained herein below.

[0036] When power is supplied to the driving motor 20, the rotional shaft 23 rotates together with the rotor 22 to transmit a rotational force to the orbiting scroll 32. Then, the orbiting scroll 32 performs an orbiting motion on an upper surface of the main frame 14 due to the Oldham's ring 33 by an eccentric distance. Accordingly, the compression chambers P that consecutively move are formed between the fixing wrap 31b of the fixed scroll 31 and the orbiting wrap 32b of the orbiting scroll 32. As the orbiting scroll 32 continuously performs the orbiting motion, the compression chambers P move towards the center thus to have a decreased volume, thereby compressing a sucked refrigerant. Then, the compressed refrigerant is discharged to the discharge space S2 of the casing 10 through the discharge port 31c of the fixed scroll 31, to the refrigerating cycle system through the refrigerant discharge pipe DP, and the above processes are repeated.

[0037] The trochoid gear pump 25 disposed at a lower side of the rotational shaft 23 pumps oil contained in the casing 10 using a capacity formed between the inner gear 25a and the outer gear 25b thereof. Then, the oil is sucked to an upper end of the rotational shaft 23 through the oil passage 23a. Some of the oil is supplied to the axial holes 14a and 15a of the main frame 14 and the sub frame 15 through the oil passage holes 23b, and the other is spread from the upper end of the rotational shaft 23. Then, the oil spread from the upper end of the rotational shaft 23 is stored in the oil pocket 14b of the main frame 14. Some of the oil is collected in the oil collecting hole 14c of the casing 10, and the other is moved to a thrust bearing surface of the main frame 14 through the oil supplying hole 14d to be supplied to the compression chambers P through the oil injecting hole 32c of the orbiting scroll 32.

[0038] While the rotational shaft 23 rotates or the trochoid gear pump pumps oil, foam generated from the oil may be introduced into the oil passage 23a, preventing the oil from being sucked to the compressor. However, the gas is discharged from the oil passage 23a through the gas discharge hole 23c disposed in the middle portion of the rotational shaft 23. Accordingly, the oil may be smoothly supplied or sucked to the compressor.

[0039] Oil collected after being used to lubricate the axial hole 14a of the main frame 14 may be spread by being stirred by the balance weight 24. However, the oil is not spread into the casing 10 by the oil blocking device 17 disposed at a lower surface of the main frame 14, and then is separated from refrigerant and collected. The collected oil is supplied to the coil 21a of the stator 21 by the oil blocking device 17 or the oil guiding portion 17 a of the oil blocking device 17, thereby cooling the coil 21a. As shown in FIG. 4, when the separating device 18 is further provided at the oil blocking device 17, oil spread from the inner space of the casing 10 is not easily moved to the compression device 30 from the driving motor 20 due to the separating device 18. The oil is constantly supplied to the compression chambers P or between the main frame 14 and the orbiting scroll 32 from the oil pocket 14b of the main frame 14 through the oil supplying hole 14d and the oil injecting hole 32c of the orbiting scroll 32.

[0040] Accordingly, when the driving motor is rotated at a high speed, oil is prevented from being excessively supplied to the compression chamber of the compression device. As a result, an amount of a refrigerant sucked to the compression chamber is increased, enhancing efficiency of the compressor.

[0041] Also, even when the driving motor is rotated at a low speed, an amount of oil supplied to the compression chamber through the oil supplying hole and the oil injecting hole may always be constant. Accordingly, abrasion of the fixed scroll and the orbiting scroll due to oil deficiency may be prevented, and a performance of the compressor enhanced by reducing frictional loss. When the rotational shaft of the driving motor is rotated at a high speed, oil stirred by the balance weight may be prevented from spreading by the oil blocking device. Accordingly, oil mixed with refrigerant may be prevented from being excessively introduced into the compression chamber. As a result, an amount of oil leaked to the refrigerating cycle system together with compressed refrigerant may be reduced, thereby preventing reduced performance of the compressor due to oil deficiency.

[0042] FIG. 10 is a graph showing an energy efficiency ratio (EER) and an oil circulation rate (OCR) of the compressor of FIG. 1 according to whether the oil blocking device is provided or not. Referring to FIG. 10, the compressor having the oil blocking device has a higher EER than the compressor not having the oil blocking device by 0.5~0.6, and shows a low oil circulation rate than that of the compressor not having the oil blocking device by approximately 12~13wt%. The effects become more distinct when the compressor is rotated at a high speed of more than 60Hz.

[0043] Since the driving motor may be implemented as a synchronous reluctance motor, the compressor may have an enhanced performance when rotated at a low speed. Herein, a heat emitting amount of the motor may be decreased, expanding a driving region of the compressor.

[0044] Further, since the balance weight may be coupled to the rotational shaft, transformation of the rotational shaft due to an eccentric load of the driving motor may be prevented. Also, the eccentric load of the driving motor may be effectively compensated with a reduced weight of the balance weight.

[0045] Since a trochoid gear pump may be used as the oil pump, time during which oil supply is stopped due to a suction pressure change and a liquid refrigerant vaporization may be reduced. Also, the trochoid gear pump may be directly coupled to the rotational shaft, reducing the number of components and assembly processes.

[0046] Embodiments disclosed herein provide a scroll compressor capable of always maintaining a predetermined amount of oil regardless of a rotational speed of a driving motor.

[0047] In accordance with an embodiment broadly described herein, there is provided a scroll compressor that includes a casing having a hermetic inner space for contain oil therein a driving motor disposed at the inner space of the casing a compression device or unit coupled to a rotational shaft of the driving motor, disposed at the inner space of the casing, and forming a compression chamber as a fixing scroll and an orbiting scroll are engaged to each other, a frame fixedly disposed between the driving motor and the compression unit, for supporting the rotational shaft of the driving motor and the compression unit, an oil blocking device or unit disposed between the driving motor and the compression unit, for preventing oil from being introduced into the compression chamber, and an oil supplying device or unit for supplying oil sucked through the rotational shaft to the compression chamber.

[0048] Although an exemplary scroll compressor is presented herein, for ease of discussion, it is well understood that this can be equably applied to other types of compressors, or another application in which this type of oil blocking is required and/or advantageous.

[0049] More specifically, the compressor and oil blocking device therefor according to embodiments disclosed herein has numerous applications in which compression of fluid is required, and in different types of compressors. Such applications may include, for example, air conditioning and refrigeration applications. One such exemplary application is shown in FIG. 12, in which a compressor 710 having an oil blocking device according to embodiments disclosed herein is installed in a refrigerator/freezer 700. Installation and functionality of a compressor in a refrigerator is discussed in detail in U.S. Patent Nos. 7,082,776, 6,955,064, 7,114,345, 7,055,338, and 6,772,601.

[0050] Another such exemplary application is shown in FIG. 13, in which a compressor 810 having an oil blocking device according to embodiments disclosed herein is installed in an outdoor unit of an air conditioner 800. Installation and functionality of a compressor in a refrigerator is discussed in detail in U.S. Patent Nos. 7,121,106, 6,868,681, 5,775,120, 6,374,492, 6,962,058, 6,951,628, and 5,947,373.

[0051] Another such exemplary application is shown in FIG. 14, in which a compressor 910 having an oil blocking device according to embodiments disclosed herein is installed in a single, integrated air conditioning unit 900. Installation and functionality of a compressor in a refrigerator is discussed in detail in U.S. Patent Nos. 7,032,404. 6,412,298, 7,036,331, 6,588,228, 6,182,460, and 5,775,123 .

[0052] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment" etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0053] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of claims. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. A compressor, comprising:

a casing (10) connected to a suction pipe (SP) and to a discharge pipe (DP);
a compression device (30) having a compression chamber (P) and configured to receive, compress, and discharge a refrigerant;
a drive motor (20) disposed in the casing (10);
the casing including a body (11) and a main frame (14) fixed to the body (11);
a fixed scroll (31) fixed to an upper surface of the main frame (14), and having a suction port

(31 b) that communicates with the casing (10) and a discharge port (31 c) that communicates with the casing,

an orbiting scroll (32) orbitably disposed on the upper surface of the main frame (14), the orbiting scroll (32) forming a plurality of compression chambers (P) by being engaged with the fixed scroll (31);

a high-low pressure separating plate (34) disposed on the fixed scroll (31), the high-low pressure separating plate (34) dividing an inside of the casing (10) into a suction space (S1) and a discharge space (S2); and

an oil blocking device (17) configured to block oil from the compression device from spreading onto certain mechanical parts disposed thereunder and from being introduced into the compression chamber (P),

characterised

in that the oil blocking device comprises a blocking plate (18) with at least one oil flow path (18a) adjacent an outer circumference of the blocking plate (18), the outer circumferential surface of the blocking plate (18) being adhered onto an inner circumferential surface of the casing (10), wherein the at least one oil flow path (18a) comprises at least one passage concavely formed at an outer periphery of the blocking plate (18), wherein the at least one concavely formed passage is disposed adjacent to the casing (10) to form an enclosed oil passage therewith,

wherein a guide member (19) is disposed towards a lower side of the casing (10) so as to be connected to the oil flow path (18a), and

wherein the guide member (19) is coupled to the casing (10) by welding so that an opening thereof forms the oil flow path (18a) together with an inner circumferential surface of the casing (10).

2. The compressor of claim 1, wherein the drive motor (20) is configured to drive the compression device (30), and wherein the certain mechanical parts comprise a balance weight attached to a rotational shaft (23) connecting the motor to the compression device.

3. The compressor of claim 2, wherein an oil supply hole (14d) is formed in the rotational shaft through which oil is supplied to the compression device.

4. The compressor of claim 3, further comprising a pump (25) attached to the rotational shaft configured to pump oil within the oil supply hole (14d).

5. The compressor of claim 4, wherein the pump (25) comprises a trochoid gear pump.

6. The compressor of claim 4, further comprising at least one discharge hole (23c) formed in the rotational shaft (23) in communication with the oil passage (23a).

7. The compressor of claim 3, wherein a hole (14a) formed in the main frame (14) is in communication with the oil passage (23a) formed in the rotational shaft (23).

Patentansprüche

1. Kompressor mit:

einem mit einem Ansaugrohr (SP) und einem Abflussrohr (DP) verbundenen Gehäuse (10),

einer Verdichtungsvorrichtung (30), die eine Verdichtungskammer (P) aufweist und dazu ausgebildet ist, ein Kühlmittel aufzunehmen, zu verdichten und abzuführen,

einem im Gehäuse (10) vorgesehenen Antriebsmotor (20),

wobei das Gehäuse einen Körper (11) und einen am Körper (11) angebrachten Hauptrahmen (14) aufweist,

einer an einer Oberseite des Hauptrahmens (14) angebrachten feststehenden Schnecke (31), die einen mit dem Gehäuse (10) verbundenen Ansaugstutzen (31b) und einen mit dem Gehäuse verbundenen Auslaufstutzen (31 c) aufweist,

einer umlaufenden Schnecke (32), die an der Oberseite des Hauptrahmens (14) so angeordnet ist, dass sie umlaufen kann, und dadurch, dass sie mit der feststehenden Schnecke in Eingriff steht, eine Vielzahl von Verdichtungskammern (P) bildet,

einer an der feststehenden Schnecke (31) angebrachten Hoch-/Niederdruck-Trennwand (34), die ein Inneres des Gehäuses (10) in einen Ansaugbereich (S1) und einen Abflussbereich (S2) teilt, und

einer Ölsperrvorrichtung (17), die dazu ausgebildet ist zu verhindern, dass Öl aus der Verdichtungsvorrichtung sich auf bestimmte darunter angeordnete mechanische Teile verteilt und in die Verdichtungskammer (P) eindringt,

dadurch gekennzeichnet, dass die Ölsperrvorrichtung eine Sperrwand (18) aufweist, in der Nähe deren Außenumfangs sich mindestens ein Öldurchflussweg (18a) befindet,

wobei die Außenumfangsfläche der Sperrwand (18) auf eine Innenumfangsfläche des Gehäuses (10) aufgebracht ist,

wobei der mindestens eine Öldurchflussweg (18a) mindestens einen konkav am Außenumfang der Sperrwand (18) ausgebildeten Durchlass aufweist,

wobei der mindestens eine konkav ausgebildete Durchlass in der Nähe des Gehäuses (10) angeordnet ist, um mit diesem einen umschlossenen Öldurchlass zu bilden, wobei zu einer Unterseite des Gehäuses (10) hin ein Führungselement (19) ausgebildet ist, um mit dem Öldurchflussweg (18a) verbunden zu werden, und
wobei das Führungselement (19) an das Gehäuse (10) so angeschweißt ist, dass eine Öffnung davon mit einer Innenumfangsfläche des Gehäuses (10) den Öldurchflussweg (18a) bildet.

2. Kompressor nach Anspruch 1, wobei der Antriebsmotor (20) dazu ausgebildet ist, die Verdichtungsvorrichtung (30) anzutreiben, und wobei die bestimmten mechanischen Teile ein Ausgleichsgewicht aufweisen, das an einer Drehwelle (23) angebracht ist, die den Motor mit der Verdichtungsvorrichtung verbindet.

3. Kompressor nach Anspruch 2, wobei in der Drehwelle eine Ölzufuhröffnung (14d) ausgebildet ist, durch die der Verdichtungsvorrichtung Öl zugeführt wird.

4. Kompressor nach Anspruch 3, der ferner eine an der Drehwelle angebrachte Pumpe (25) aufweist, die dazu ausgebildet ist, Öl in die Ölzufuhröffnung (14d) zu pumpen.

5. Kompressor nach Anspruch 4, wobei die Pumpe (25) eine Trochoid-Zahnradpumpe umfasst.

6. Kompressor nach Anspruch 4, ferner mit mindestens einer Abflussöffnung (23c), die in der Drehwelle (23) ausgebildet ist und mit dem Öldurchlass (23a) verbunden ist.

7. Kompressor nach Anspruch 3, wobei eine im Hauptrahmen (14) ausgebildete Öffnung (14a) mit dem in der Drehwelle (23) ausgebildeten Öldurchlass (23a) verbunden ist.

Revendications

1. Compresseur comprenant :

un boîtier (10) relié à un tuyau d'aspiration (SP) et à un tuyau d'évacuation (DP) ;
un dispositif de compression (30) présentant une chambre de compression (P) et configuré pour recevoir, compresser et évacuer un réfrigérant ;
un moteur d'entraînement (20) agencé dans le boîtier (10) ;
le boîtier incluant un corps (11) et un cadre principal (14) fixé au corps (11) ;
une spirale fixe (31) fixée à une surface supérieure du cadre principal (14) et présentant un orifice d'aspiration (31b) qui communique avec le boîtier (10) et un orifice d'évacuation (31c) qui communique avec le boîtier,
une spirale en orbite (32) agencée en orbite sur la surface supérieure du cadre principal (14), la spirale en orbite (32) formant une pluralité de chambres de compression (P) en étant engagée avec la spirale fixe (31) ;
une plaque de séparation haute-basse pression (34) agencée sur la spirale fixe (31), la plaque de séparation haute-basse pression (34) divisant un intérieur du boîtier (10) en un espace d'aspiration (S1) et un espace d'évacuation (S2) ; et
un dispositif de blocage d'huile (17) configuré pour bloquer la dispersion de l'huile du dispositif de compression sur certaines parties mécaniques agencées dessous et son introduction dans la chambre de compression (P),
caractérisé en ce que le dispositif de blocage d'huile comprend une plaque de blocage (18) avec au moins une voie d'écoulement d'huile (18a) adjacente à une circonférence extérieure de la plaque de blocage (18), la surface circonférentielle extérieure de la plaque de blocage (18) étant collée sur une surface circonférentielle intérieure du boîtier (10),
dans lequel l'au moins une voie d'écoulement d'huile (18a) comprend au moins un passage formé de manière concave sur une périphérie extérieure de la plaque de blocage (18),
dans lequel l'au moins un passage formé de manière concave est agencé de manière adjacente au boîtier (10) pour former un passage d'huile fermé avec celui-ci,
dans lequel un élément de guidage (19) est agencé vers un côté inférieur du boîtier (10) de sorte à être relié à la voie d'écoulement d'huile (18a) et
dans lequel l'élément de guidage (19) est couplé au boîtier (10) par soudage de sorte qu'une ouverture de celui-ci forme la voie d'écoulement d'huile (18a) conjointement avec une surface circonférentielle intérieure du boîtier (10).

2. Compresseur selon la revendication 1, dans lequel le moteur d'entraînement (20) est configuré pour entraîner le dispositif de compression (30) et dans lequel les certaines parties mécaniques comprennent un contrepoids attaché à un arbre de rotation (23) reliant le moteur au dispositif de compression.

3. Compresseur selon la revendication 2, dans lequel un trou d'alimentation d'huile (14d) est formé dans l'arbre de rotation, par lequel de l'huile est amenée au dispositif de compression.

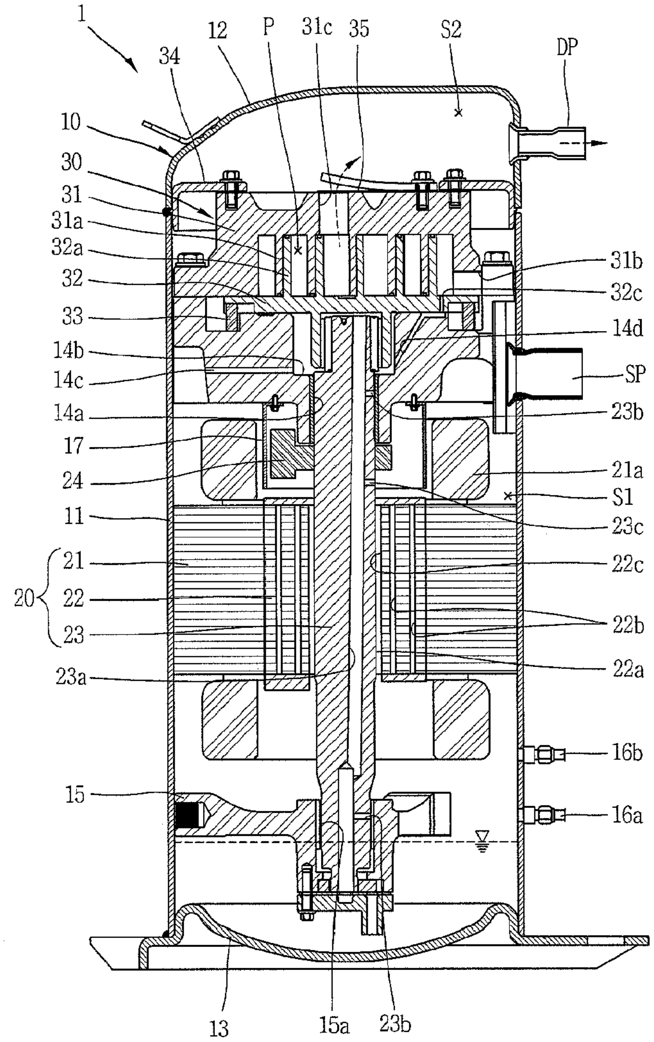
4. Compresseur selon la revendication 3, comprenant en outre une pompe (25) attachée à l'arbre de rotation configurée pour pomper de l'huile dans le trou d'alimentation d'huile (14d).

5. Compresseur selon la revendication 4, dans lequel la pompe (25) comprend une pompe à engrenage trochoïde.

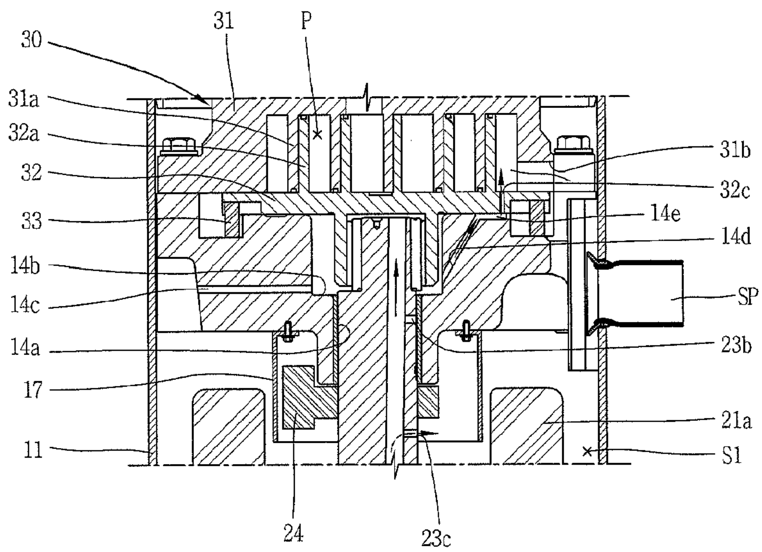
6. Compresseur selon la revendication 4, comprenant en outre au moins un trou d'évacuation (23c) formé dans l'arbre de rotation (23) en communication avec le passage d'huile (23a).

7. Compresseur selon la revendication 3, dans lequel un trou (14a) formé dans le cadre principal (14) est en communication avec le passage d'huile (23a) formé dans l'arbre de rotation (23).

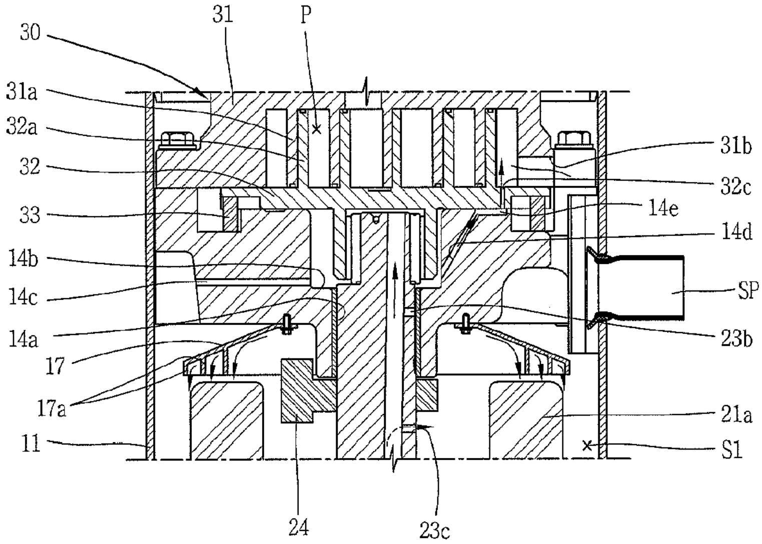
[Fig. 1]


1
12
P
31c
35
S2
DP
34
10
30
31
31a
32a
32
33
14b
14c
14a
17
24
11
21
20
22
23
23a
15
13
15a
23b
31b
32c
14d
SP
23b
21a
S1
23c
22c
22b
22a
16b
16a

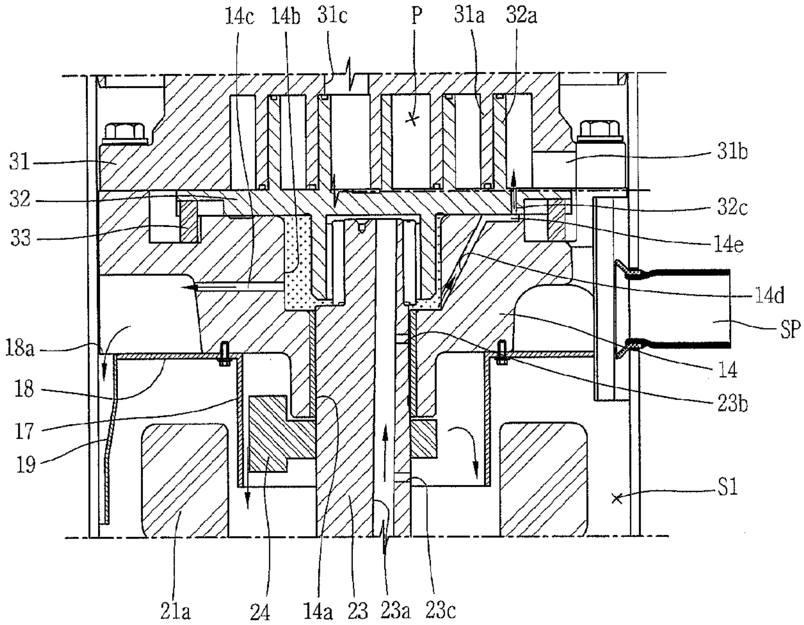
[Fig. 2]


30
31
P
31a
32a
32
33
14b
14c
14a
17
11
24
23c
31b
32c
14e
14d
SP
23b
21a
S1

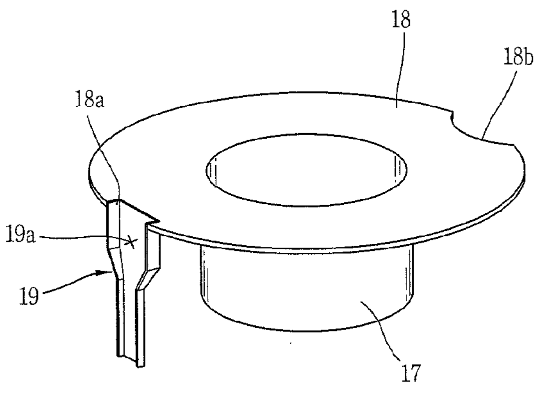
[Fig. 3]



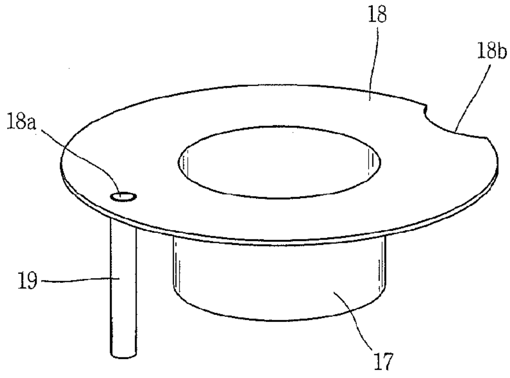
[Fig. 4]



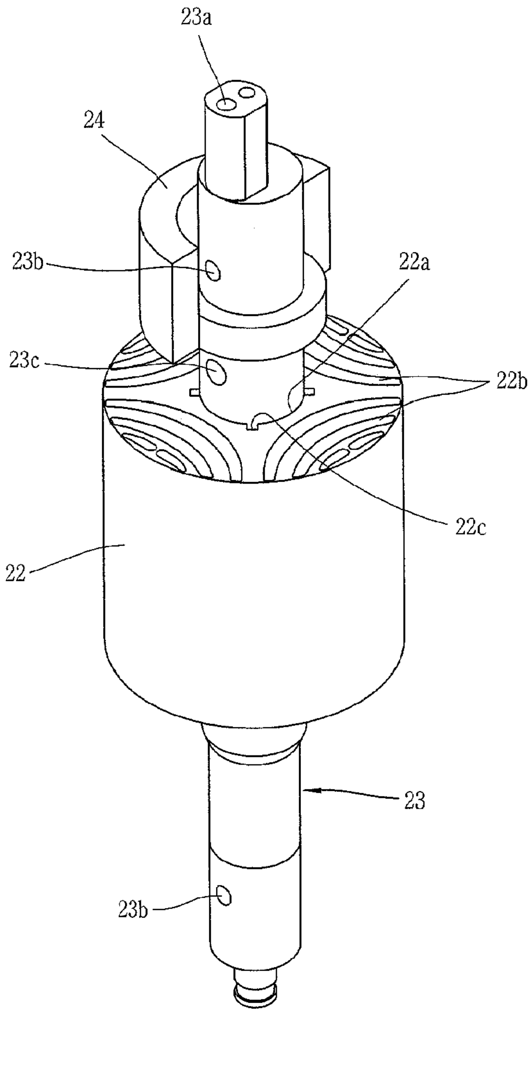
[Fig. 5]



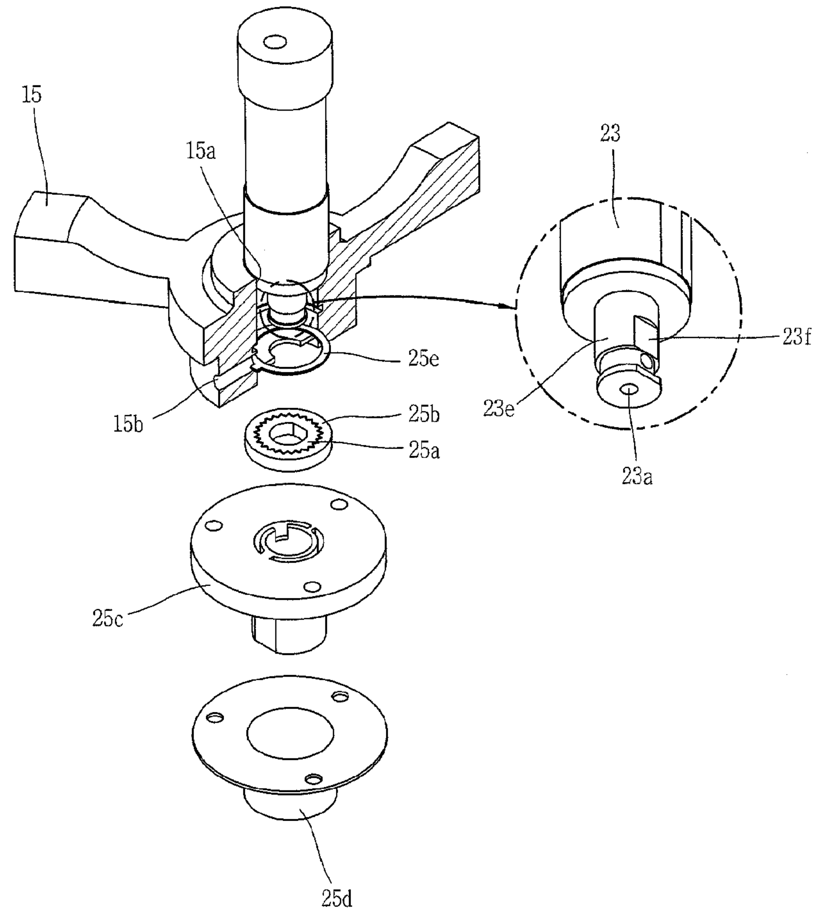
[Fig. 6]



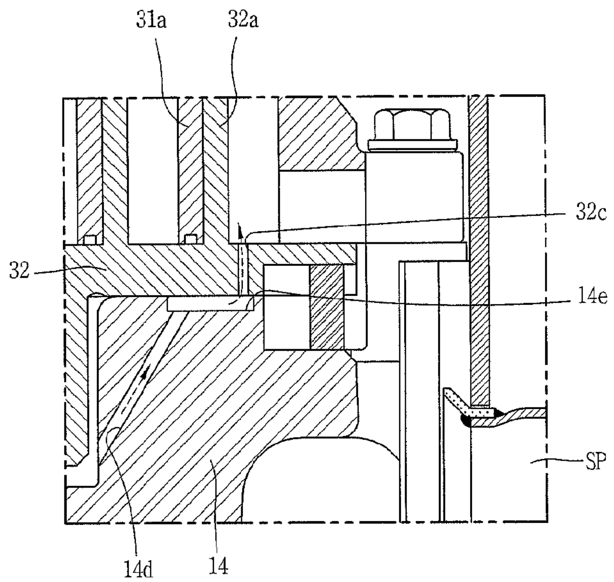
[Fig. 7]



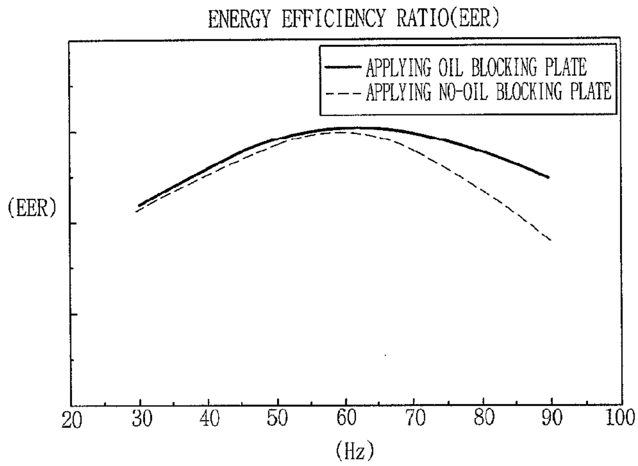
[Fig. 8]


15
15a
23
23f
25e
23e
15b
25b
25a
23a
25c
25d

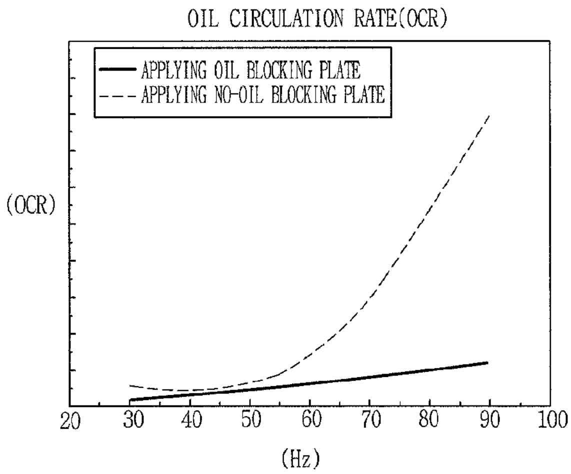
[Fig. 9]


31a
32a
32c
32
14e
SP
14d
14

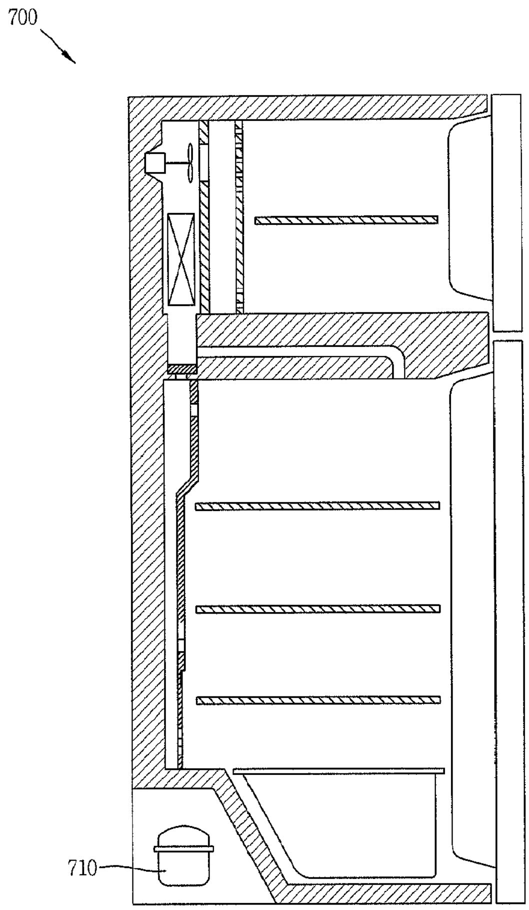
[Fig. 10]


ENERGY EFFICIENCY RATIO(EER)
APPLYING OIL BLOCKING PLATE
APPLYING NO-OIL BLOCKING PLATE
(EER)
20
30
40
50
60
70
80
90
100
(Hz)

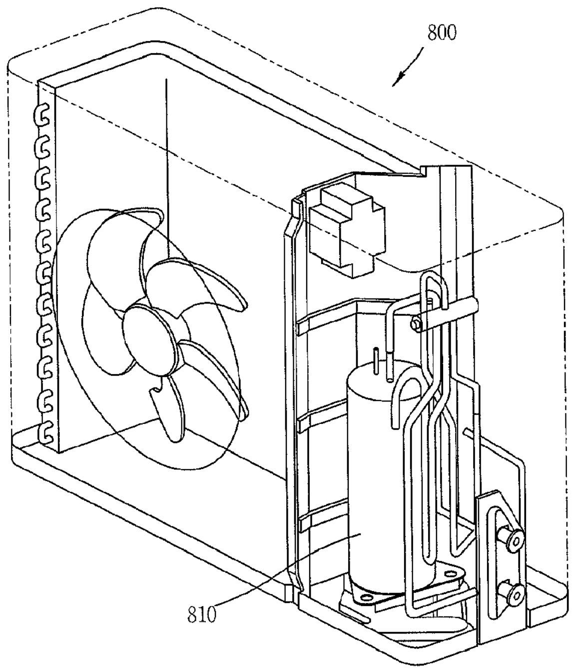
[Fig. 11]


OIL CIRCULATION RATE(OCR)
APPLYING OIL BLOCKING PLATE
APPLYING NO-OIL BLOCKING PLATE
(OCR)
20
30
40
50
60
70
80
90
100
(Hz)

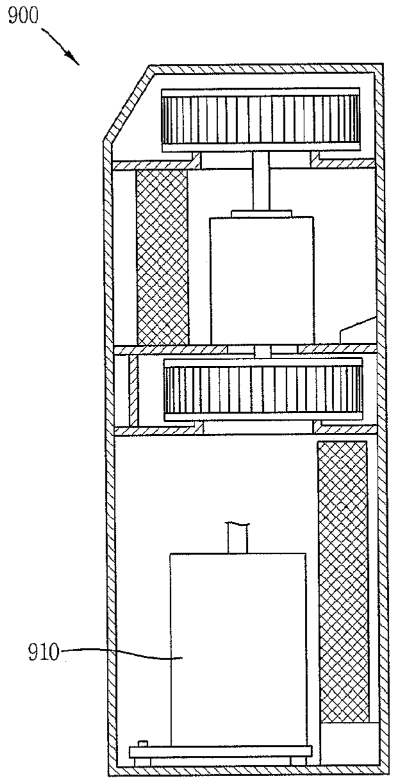
[Fig. 12]



[Fig. 13]



[Fig. 14]



REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US 5591018 A **[0005]**
- EP 1286052 A **[0005]**
- US 7082776 B **[0049]**
- US 6955064 B **[0049]**
- US 7114345 B **[0049]**
- US 7055338 B **[0049]**
- US 6772601 B **[0049]**
- US 7121106 B **[0050]**
- US 6868681 B **[0050]**
- US 5775120 A **[0050]**
- US 6374492 B **[0050]**
- US 6962058 B **[0050]**
- US 6951628 B **[0050]**
- US 5947373 A **[0050]**
- US 7032404 B **[0051]**
- US 6412298 B **[0051]**
- US 7036331 B **[0051]**
- US 6588228 B **[0051]**
- US 6182460 B **[0051]**
- US 5775123 A **[0051]**