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

(11) **EP 3 575 605 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
04.12.2019 Bulletin 2019/49

(21) Application number: **18743943.5**

(22) Date of filing: **17.01.2018**

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

(86) International application number:
PCT/JP2018/001200

(87) International publication number:
WO 2018/139308 (02.08.2018 Gazette 2018/31)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(30) Priority: **27.01.2017 JP 2017012607**

(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

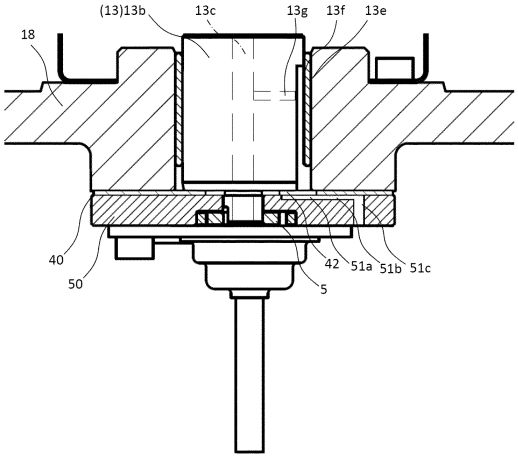
(72) Inventors:
- **KON, Tsutomu**
  Osaka-shi,
  Osaka 540-6207 (JP)
- **IITSUKA, Satoshi**
  Osaka-shi,
  Osaka 540-6207 (JP)

(74) Representative: **Eisenführ Speiser**
Patentanwälte Rechtsanwälte PartGmbB
Postfach 31 02 60
80102 München (DE)

(54) HERMETIC COMPRESSOR

(57) In a hermetic compressor of the present invention, a rotation shaft oil support hole 13c is formed in a rotation shaft 13, a lower end 13b of the rotation shaft 13 includes an oil groove 13f and a lateral hole 13g, a plate-side oil passage 42 is formed in a thrust-receiving plate 40, and a housing-side oil passage 51 is formed in an oil pump housing 50. At a location higher than the oil groove 13f, lubricant oil supplied from the lateral hole 13g moves downward in the oil groove 13f by bringing an upper portion of the sliding bearing 13e and the rotation shaft 13 into abutment against each other, and the lubricant oil in the oil groove 13f is discharged below the auxiliary bearing 18 through the plate-side oil passage 42 and the housing-side oil passage 51. According to this configuration, it is possible to prevent the lubricant oil from being discharged to the upper portion of the auxiliary bearing 18.

[Fig. 2]



EP 3 575 605 A1

Description

[TECHNICAL FIELD]

[0001] The present invention relates to a hermetic compressor used for an air conditioner, a hot water supplying system and a freezing machine such as a refrigerator.

[BACKGROUND TECHNIQUE]

[0002] A hermetic compressor is used in a freezing machine and an air conditioner. The hermetic compressor sucks gas refrigerant evaporated by an evaporator, compresses the gas refrigerant up to pressure required for condensing the gas refrigerant by a condenser, and sends out the high temperature and high pressure gas refrigerant into a refrigerant circuit.

[0003] According to such a hermetic compressor, a compressing mechanism for compressing refrigerant and an electric mechanism for driving the compressing mechanism by a rotation shaft are placed in a hermetic container, and an oil storage section for storing lubricant oil therein is formed in a bottom of the hermetic container. An upper portion of the rotation shaft is supported by a main bearing and a lower portion of the rotation shaft is supported by an auxiliary bearing.

[0004] A rotation shaft oil support hole extending from a lower end to an upper end of the rotation shaft is formed in the rotation shaft. The lower end of the rotation shaft includes an oil groove and a lateral hole through which the rotation shaft oil support hole and the oil groove are in communication with each other.

[0005] According to such a configuration, lubricant oil stored in the bottom of the hermetic container is guided to the main bearing and the auxiliary bearing through the rotation shaft oil support hole.

[0006] Concerning lubrication of the auxiliary bearing, patent document 1 discloses such a configuration that a through hole is formed in a pump cover and lubricant oil which lubricates the auxiliary bearing is returned to an oil storage section, and patent document 2 discloses such a configuration that a through hole is formed in a thrust plate and lubricant oil which lubricates the auxiliary bearing is returned to an oil storage section.

[PRIOR ART DOCUMENT]

[Patent Document]

[0007]

[Patent Document1] Japanese Patent Application Laid-open No.H5-231357
[Patent Document2] Japanese Patent Application Laid-open No.H11-182473

[SUMMARY OF THE INVENTION]

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0008] However, if lubricant oil which is guided to the auxiliary bearing is made to flow out from an upper portion of the auxiliary bearing, lubricant oil is scattered by rotation of an electric motor, and an amount of lubricant oil which is discharged outside from the hermetic container is increased.

[0009] In patent documents 1 and 2, lubricant oil which lubricates the auxiliary bearing is guided downward by forming the through hole in the pump cover or the thrust plate, but lubricant oil flows out also from the upper portion of the auxiliary bearing.

[0010] Hence, it is an object of the present invention to provide a hermetic compressor capable of preventing lubricant oil from being discharged to an upper portion of an auxiliary bearing.

[MEANS FOR SOLVING THE PROBLEM]

[0011] A first aspect of the present invention provides a hermetic compressor in which a compressing mechanism for compressing refrigerant, and an electric mechanism for driving the compressing mechanism by a rotation shaft are placed in a hermetic container, an oil storage section for storing lubricant oil is formed in a bottom of the hermetic container, the hermetic compressor includes; a main bearing for supporting an upper portion of the rotation shaft, an auxiliary bearing for supporting a lower end of the rotation shaft, a sliding bearing placed between the auxiliary bearing and the rotation shaft, a thrust-receiving plate placed below the auxiliary bearing and receiving a thrust force of the rotation shaft, an oil pump housing placed below the thrust-receiving plate, and a displacement oil pump stored in a lower surface of the oil pump housing, wherein a rotation shaft oil support hole extending from the lower end of the rotation shaft to the upper portion of the rotation shaft is formed in the rotation shaft, the lower end of the rotation shaft is provided with an oil groove formed by notching the rotation shaft in its axial direction, and a lateral hole through which the rotation shaft oil support hole and the oil groove are in communication with each other, a plate-side oil passage which is intermittently brought into communication with the oil groove is formed in the thrust-receiving plate, a housing-side oil passage which is in communication with the plate-side oil passage is formed in the oil pump housing, at a location higher than the oil groove, the lubricant oil supplied from the lateral hole moves downward in the oil groove by bringing the upper portion of the sliding bearing and the rotation shaft into abutment against each other, and the lubricant oil in the oil groove is discharged below the auxiliary bearing through the plate-side oil passage and the housing-side oil passage.

[0012] According to a second aspect of the invention, in the hermetic compressor of the first aspect, an oil stor-

ing space for storing the lubricant oil discharged from the oil pump is formed in a center of the thrust-receiving plate, the plate-side oil passage is brought into communication with the oil storing space, and the plate-side oil passage is formed by extending the same from the oil storing space in its radial direction.

[0013] According to a third aspect of the invention, in the hermetic compressor of the second aspect, the housing-side oil passage is composed of an inner groove and an outer groove formed in an upper surface of the oil pump housing, and a discharge hole formed in an outer end of the outer groove, the inner groove and the plate-side oil passage are superposed on each other and brought into communication with each other, and the outer groove is covered with the thrust-receiving plate.

[0014] According to a fourth of the invention, in the hermetic compressor of the third aspect, the outer groove covered with the thrust-receiving plate has a cross-section area which is equal to or smaller than the lateral hole.

[0015] According to a fifth aspect of the invention, in the hermetic compressor of the third or fourth aspect, the discharge hole is formed such that it penetrates the upper and lower surfaces of the oil pump housing.

[EFFECT OF THE INVENTION]

[0016] According to the present invention, it is possible to prevent lubricant oil from being discharged to an upper portion of an auxiliary bearing by bringing an upper portion of a sliding bearing and a rotation shaft into abutment against each other at a location higher than an oil groove, and by discharging, to a location lower than the auxiliary bearing, lubricant oil supplied from a lateral hole.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0017]

Fig. 1 is a vertical sectional view of a hermetic compressor according to an embodiment of the present invention;

Fig. 2 is an enlarged sectional view of essential portions of a compressing mechanism shown in Fig. 1; and

Fig. 3(a) is a plane view of a thrust-receiving plate used for the hermetic compressor, and Fig. 3(b) is a plane view of an oil pump housing used for the hermetic compressor.

[MODE FOR CARRYING OUT THE INVENTION]

[0018] In a hermetic compressor of the first aspect of the invention, a rotation shaft oil support hole extending from the lower end of the rotation shaft to the upper portion of the rotation shaft is formed in the rotation shaft, the lower end of the rotation shaft is provided with an oil groove formed by notching the rotation shaft in its axial direction, and a lateral hole through which the rotation shaft oil support hole and the oil groove are in communication with each other, a plate-side oil passage which is intermittently brought into communication with the oil groove is formed in the thrust-receiving plate, a housing-side oil passage which is in communication with the plate-side oil passage is formed in the oil pump housing, at a location higher than the oil groove, the lubricant oil supplied from the lateral hole moves downward in the oil groove by bringing the upper portion of the sliding bearing and the rotation shaft into abutment against each other, and the lubricant oil in the oil groove is discharged below the auxiliary bearing through the plate-side oil passage and the housing-side oil passage. According to the first aspect, the upper portion of the sliding bearing and the rotation shaft are brought into abutment against each other at a location higher than the oil groove, and lubricant oil supplied from the lateral hole is discharged to a location lower than the auxiliary bearing. Therefore, it is possible to prevent the lubricant oil from being discharged to the upper portion of the auxiliary bearing. Hence, it is possible to prevent lubricant oil from being scattered from the upper portion of the auxiliary bearing and thus, it is possible to reduce the amount of lubricant oil discharged outside from the hermetic container.

[0019] According to the second aspect of the invention, in addition to the first aspect, an oil storing space for storing the lubricant oil discharged from the oil pump is formed in a center of the thrust-receiving plate, the plate-side oil passage is brought into communication with the oil storing space, and the plate-side oil passage is formed by extending the same from the oil storing space in its radial direction. According to the second aspect, lubricant oil which directly flows into the thrust-receiving plate from the oil pump through a space between an outer periphery of a lower end of the rotation shaft and a center hole of the oil pump housing is also guided to a plate-side oil passage.

[0020] According to the third aspect of the invention, in addition to the second aspect, the housing-side oil passage is composed of an inner groove and an outer groove formed in an upper surface of the oil pump housing, and a discharge hole formed in an outer end of the outer groove, the inner groove and the plate-side oil passage are superposed on each other and brought into communication with each other, and the outer groove is covered with the thrust-receiving plate. According to the third aspect, it is easy to discharge impurities mixed into an oil storing space, and a discharge amount of lubricant oil can be adjusted by a depth and a groove width of the outer groove covered with the thrust-receiving plate.

[0021] According to the fourth aspect of the invention, in addition to the third aspect, the outer groove covered with the thrust-receiving plate has a cross-section area which is equal to or smaller than the lateral hole. According to the fourth aspect, lubricant oil supplied from the lateral hole can appropriately be held by the auxiliary bearing or the thrust-receiving plate.

[0022] According to the fifth aspect of the invention, in

addition to the third or fourth aspect, the discharge hole is formed such that it penetrates the upper and lower surfaces of the oil pump housing. According to the fifth aspect, since the discharge amount of lubricant oil can be adjusted by the outer groove, it is unnecessary to maintain size precision of the discharge hole, and it is easy to discharge lubricant oil.

[EMBODIMENT]

[0023] An embodiment of the present invention will be described below with reference to the drawings. The invention is not limited to the embodiment.

[0024] Fig. 1 is a vertical sectional view of a hermetic compressor according to the embodiment.

[0025] A compressing mechanism 10 for compressing refrigerant and an electric mechanism 20 for driving the compressing mechanism 10 are placed in a hermetic container 1.

[0026] The hermetic container 1 is composed of a cylindrical torso 1a extending along a vertical direction, an upper lid 1c for closing an upper opening of the torso 1a, and a lower lid 1b for closing a lower opening of the torso 1a.

[0027] The hermetic container 1 is provided with a refrigerant suction pipe 2 for introducing refrigerant into the compressing mechanism 10, and a refrigerant discharge pipe 3 for discharging refrigerant compressed by the compressing mechanism 10 to a location outside the hermetic container 1.

[0028] The compressing mechanism 10 includes a fixed scroll 11 and an orbiting scroll 12.

[0029] A rotation shaft 13 drives the orbiting scroll 12 in an orbiting manner.

[0030] The electric mechanism 20 includes a stator 21 fixed to the hermetic container 1 and a rotor 22 placed on an inner side of the stator 21. The rotation shaft 13 is fixed to the rotor 22. An eccentric shaft 13a which is decentered eccentrically with respect to the rotation shaft 13 is formed on an upper end of the rotation shaft 13.

[0031] A main bearing 30 for supporting the fixed scroll 11 and the orbiting scroll 12 is provided below the fixed scroll 11 and the orbiting scroll 12.

[0032] A bearing 31 for pivotally supporting the rotation shaft 13 and a boss storing section 32 are formed on the main bearing 30. The main bearing 30 is fixed to the hermetic container 1 by welding or shrinkage fitting.

[0033] The fixed scroll 11 includes a disk-like fixed scroll mirror plate 11a, a fixed spiral lap 11b standing on the fixed scroll mirror plate 11a, and an outer peripheral wall 11c standing such that it surrounds a periphery of the fixed spiral lap 11b. A discharge port 14 is formed in a substantially center portion of the fixed scroll mirror plate 11a.

[0034] The orbiting scroll 12 includes a disk-like orbiting scroll mirror plate 12a, an orbiting spiral lap 12b standing on a lap-side end surface of the orbiting scroll mirror plate 12a, and a cylindrical boss portion 12c formed on an end surface of the orbiting scroll mirror plate 12a on an opposite side from the lap side.

[0035] The fixed spiral lap 11b of the fixed scroll 11 and the orbiting spiral lap 12b of the orbiting scroll 12 mesh with each other, and a plurality of compression chambers 15 are formed between the fixed spiral lap 11b and the orbiting spiral lap 12b.

[0036] The boss portion 12c is formed at a substantially central portion of the orbiting scroll mirror plate 12a. The eccentric shaft 13a is inserted into the boss portion 12c, and the boss portion 12c is stored in the boss storing section 32.

[0037] The fixed scroll 11 is fixed to the main bearing 30 at the outer peripheral wall 11c through a plurality of bolts 16. The orbiting scroll 12 is supported on the fixed scroll 11 through a rotation restraining member 17 such as an Oldham ring. The rotation restraining member 17 which restrains rotation of the orbiting scroll 12 is provided between the fixed scroll 11 and the main bearing 30. According to this, the orbiting scroll 12 orbits without rotating with respect to the fixed scroll 11.

[0038] A lower end 13b of the rotation shaft 13 is pivotally supported by an auxiliary bearing 18 placed on a lower portion of the hermetic container 1.

[0039] An oil storage section 4 for storing lubricant oil is formed in a bottom portion of the hermetic container 1.

[0040] A lower end of the rotation shaft 13 is provided with a displacement oil pump 5. The oil pump 5 is placed such that its suction port exists in the oil storage section 4. The oil pump 5 is driven by the rotation shaft 13. The oil pump 5 can reliably pump up lubricant oil existing in the oil storage section 4 provided in a bottom of the hermetic container 1 irrespectively of pressure condition or operation speed, and fear of shortage of oil is resolved.

[0041] A rotation shaft oil support hole 13c extending from the lower end 13b of the rotation shaft 13 to the eccentric shaft 13a is formed in the rotation shaft 13.

[0042] Lubricant oil pumped up by the oil pump 5 is supplied into a bearing of the auxiliary bearing 18, the bearing 31 and the boss portion 12c through the rotation shaft oil support hole 13c formed in the rotation shaft 13.

[0043] Refrigerant sucked from the refrigerant suction pipe 2 is guided from the suction port 15a into the compression chambers 15. The compression chambers 15 move while reducing their volumes from an outer peripheral side toward a central portion, refrigerant whose pressure reaches a predetermined value in the compression chambers 15 is discharged from a discharge port 14 provided in a central portion of the fixed scroll 11 into the discharge chamber 6. The discharge port 14 is provided with a discharge reed valve (not shown). The refrigerant whose pressure reaches a predetermined value in the compression chamber 15 pushes and opens the discharge reed valve and is discharged into the discharge chamber 6. The refrigerant which is discharged into the discharge chamber 6 is derived into an upper portion in the hermetic container 1, the refrigerant passes through a refrigerant passage (not shown) formed in the com-

pressing mechanism 10, reaches a periphery of the electric mechanism 20, and is discharged from the refrigerant discharge pipe 3.

[0044] Fig. 2 is an enlarged sectional view of essential portions of the compressing mechanism shown in Fig. 1, Fig. 3(a) is a plane view of a thrust-receiving plate used for the hermetic compressor, and Fig. 3(b) is a plane view of an oil pump housing used for the hermetic compressor.

[0045] A sliding bearing 13e is placed between the auxiliary bearing 18 and the lower end 13b of the rotation shaft 13.

[0046] The lower end 13b of the rotation shaft 13 is provided with an oil groove 13f formed by notching the rotation shaft 13 in an axial direction of the rotation shaft 13, and a lateral hole 13g through which the rotation shaft oil support hole 13c and the oil groove 13f are in into communication with each other.

[0047] A thrust-receiving plate 40 is placed below the auxiliary bearing 18, and receives a thrust force of the rotation shaft 13. An oil pump housing 50 is placed below the thrust-receiving plate 40. The oil pump 5 is stored in a lower surface of the oil pump housing 50.

[0048] An oil storing space 41 for storing lubricant oil discharged from the oil pump 5, and a plate-side oil passage 42 which is in communication with the oil groove 13f are formed in the thrust-receiving plate 40. The plate-side oil passage 42 extends more outward than an outer diameter of the lower end 13b. The oil storing space 41 is formed at a center of the thrust-receiving plate 40. The plate-side oil passage 42 is in communication with the oil storing space 41, and extends in a radial direction from the oil storing space 41. An outer groove 51b covered with the thrust-receiving plate 40 has a cross-section area which is equal to or smaller than the lateral hole 13g.

[0049] A housing-side oil passage 51 which is in communication with the plate-side oil passage 42 is formed in the oil pump housing 50. The housing-side oil passage 51 is composed of an inner groove 51a and the outer groove 51b formed in an upper surface of the oil pump housing 50, and a discharge hole 51c formed in an outer end of the outer groove 51b.

[0050] The inner groove 51a is superposed and placed on the plate-side oil passage 42. Therefore, the inner groove 51a and the plate-side oil passage 42 are in communication with each other. The outer groove 51b is covered with the thrust-receiving plate 40. The discharge hole 51c penetrates upper and lower surfaces of the oil pump housing 50. The discharge hole 51c may be formed such that the outer end of the outer groove 51b extends toward the outer periphery of the oil pump housing 50.

[0051] Lubricant oil discharged from the oil pump 5 is supplied to the rotation shaft oil support hole 13c from a lower surface of the lower end 13b, and lubricant oil also flows into the plate-side oil passage 42 from between the outer periphery of the lower end 13b and a center hole of the oil pump housing 50.

[0052] At a location higher than the oil groove 13f, lubricant oil in the oil groove 13f is prevented from being scattered from an upper portion of the auxiliary bearing 18 by abutting an upper portion of the sliding bearing 13e and the lower end 13b of the rotation shaft 13 against each other.

[0053] Lubricant oil supplied from the lateral hole 13g moves downward in the oil groove 13f. Lubricant oil existing in the oil groove 13f is discharge to a location below the auxiliary bearing 18 through the plate-side oil passage 42 and the housing-side oil passage 51.

[0054] According to the embodiment, since lubricant oil supplied from the lateral hole 13g is discharged to a location below the auxiliary bearing 18, it is possible to prevent lubricant oil from being discharged to the upper portion of the auxiliary bearing 18. Therefore, since it is possible to prevent lubricant oil from being scattered from the upper portion of the auxiliary bearing 18, it is possible to reduce the amount of lubricant oil discharged outside from the hermetic container 1.

[0055] Further, according to the embodiment, lubricant oil which flows, from the oil pump 5, directly into the thrust-receiving plate 40 through a space between the outer periphery of the lower end 13b and the center hole of the oil pump housing 50 is also guided to the plate-side oil passage 42.

[0056] Furthermore, according to the embodiment, it is easy to discharge impurities which are mixed into the oil storing space 41, and a discharge amount of lubricant oil can be adjusted by the depth and the groove width of the outer groove 51b which is covered with the thrust-receiving plate 40.

[0057] According to the embodiment, lubricant oil supplied from the lateral hole 13g can appropriately be held by the auxiliary bearing 18 and the thrust-receiving plate 40.

[0058] According to the embodiment, since the discharge amount of lubricant oil can be adjusted by the outer groove 51b, it is unnecessary to maintain size precision of the discharge hole 51c, and it is easy to discharge lubricant oil.

[0059] As the refrigerant of the present invention, it is possible to use R32, carbon dioxide, and refrigerant having carbon-carbon double bond.

[INDUSTRIAL APPLICABILITY]

[0060] The hermetic compressor of the present invention is useful for a refrigeration cycle device of a hot water heater, an air conditioner, a hot water supplying system, a freezing machine and the like.

[EXPLANATION OF SYMBOLS]

[0061]

1	hermetic container
2	refrigerant suction pipe
3	refrigerant discharge pipe
4	oil storage section

5	oil pump
6	discharge chamber
10	compressing mechanism
11	fixed scroll
12	orbiting scroll
13	rotation shaft
13a	eccentric shaft
13b	lower end
13c	rotation shaft oil support hole
13e	sliding bearing
13f	oil groove
13g	lateral hole
14	discharge port
15	compression chamber
16	bolt
17	rotation restraining member
18	auxiliary bearing
20	electric mechanism
21	stator
22	rotor
30	main bearing
31	bearing
32	boss storing section
40	thrust-receiving plate
41	oil storing space
42	plate-side oil passage
50	oil pump housing
51	housing-side oil passage
51a	inner groove
51b	outer groove
51c	discharge hole

Claims

1. A hermetic compressor in which a compressing mechanism for compressing refrigerant, and an electric mechanism for driving the compressing mechanism by a rotation shaft are placed in a hermetic container,
an oil storage section for storing lubricant oil is formed in a bottom of the hermetic container,
the hermetic compressor includes;
a main bearing for supporting an upper portion of the rotation shaft,
an auxiliary bearing for supporting a lower end of the rotation shaft,
a sliding bearing placed between the auxiliary bearing and the rotation shaft,
a thrust-receiving plate placed below the auxiliary bearing and receiving a thrust force of the rotation shaft,
an oil pump housing placed below the thrust-receiving plate, and
a displacement oil pump stored in a lower surface of the oil pump housing, wherein
a rotation shaft oil support hole extending from the lower end of the rotation shaft to the upper portion of the rotation shaft is formed in the rotation shaft,
the lower end of the rotation shaft is provided with an oil groove formed by notching the rotation shaft in its axial direction, and a lateral hole through which the rotation shaft oil support hole and the oil groove are in communication with each other,
a plate-side oil passage which is intermittently brought into communication with the oil groove is formed in the thrust-receiving plate,
a housing-side oil passage which is in communication with the plate-side oil passage is formed in the oil pump housing,
at a location higher than the oil groove, the lubricant oil supplied from the lateral hole moves downward in the oil groove by bringing an upper portion of the sliding bearing and the rotation shaft into abutment against each other, and
the lubricant oil in the oil groove is discharged below the auxiliary bearing through the plate-side oil passage and the housing-side oil passage.

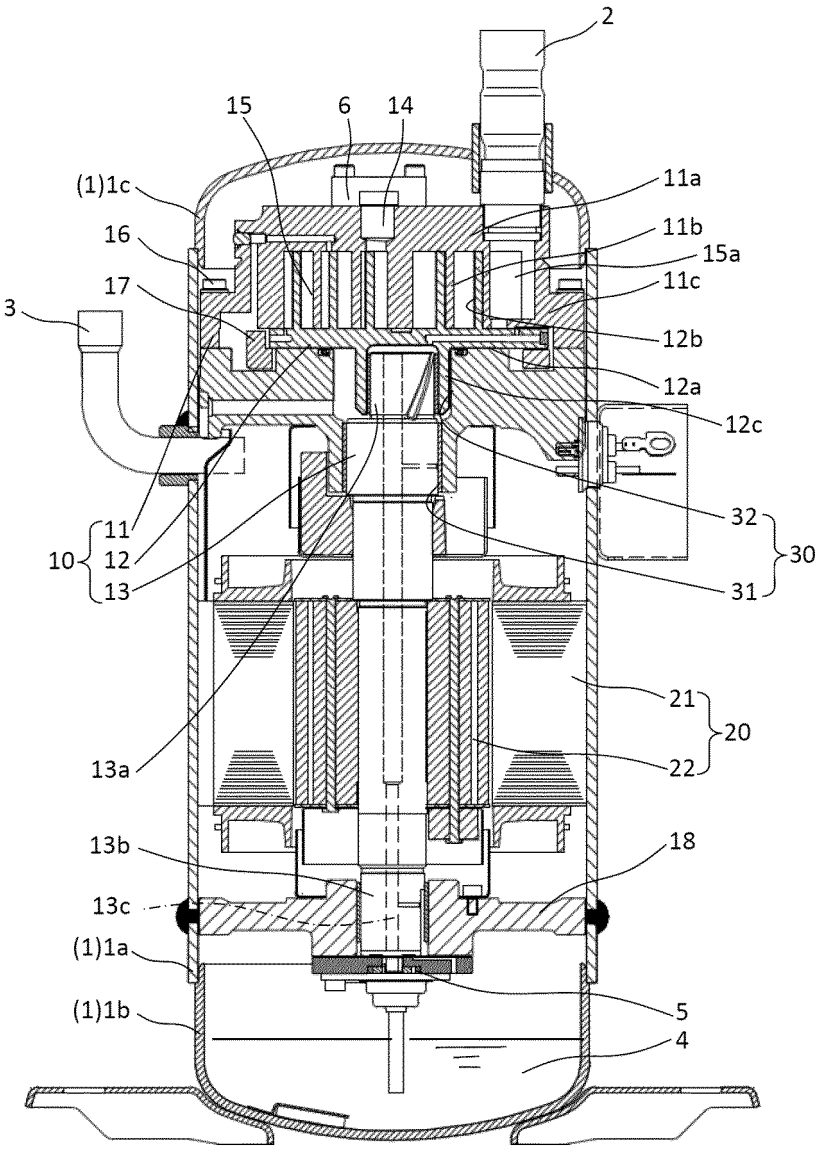
2. The hermetic compressor according to claim 1, wherein an oil storing space for storing the lubricant oil discharged from the oil pump is formed in a center of the thrust-receiving plate,
the plate-side oil passage is brought into communication with the oil storing space, and
the plate-side oil passage is formed by extending the same from the oil storing space in its radial direction.

3. The hermetic compressor according to claim 2, wherein
the housing-side oil passage is composed of an inner groove and an outer groove formed in an upper surface of the oil pump housing, and a discharge hole formed in an outer end of the outer groove,
the inner groove and the plate-side oil passage are superposed on each other and brought into communication with each other, and
the outer groove is covered with the thrust-receiving plate.

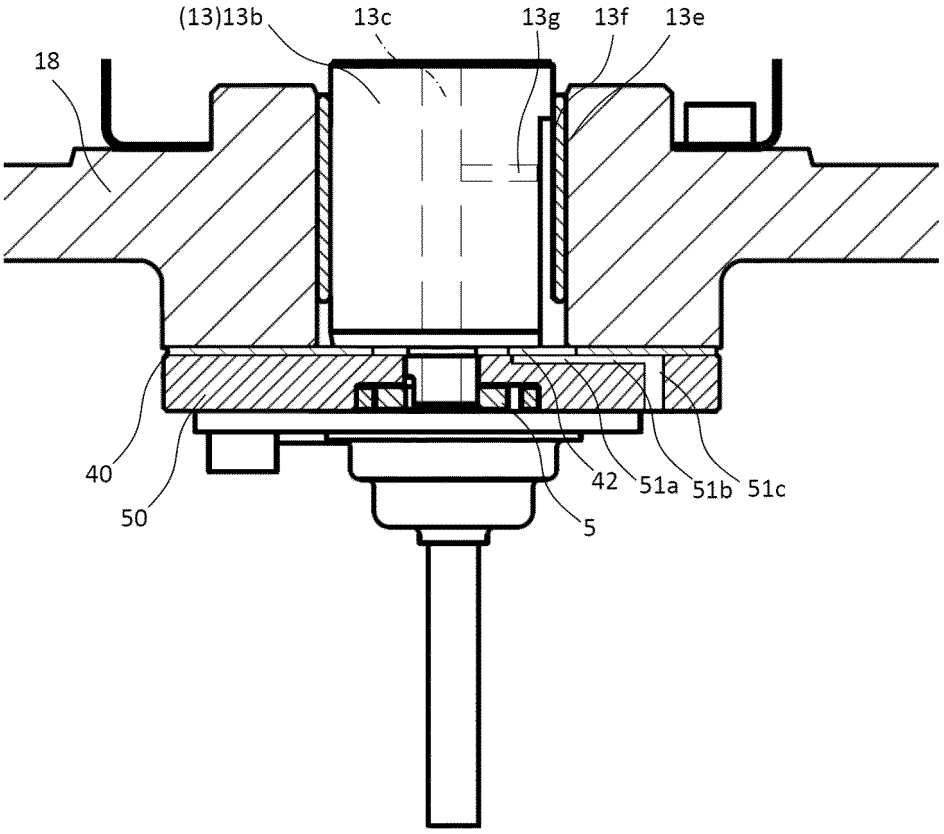
4. The hermetic compressor according to claim 3, wherein
the outer groove covered with the thrust-receiving plate has a cross-section area which is equal to or smaller than the lateral hole.

5. The hermetic compressor according to claim 3 or 4, wherein
the discharge hole is formed such that it penetrates the upper and lower surfaces of the oil pump housing.

[Fig. 1]

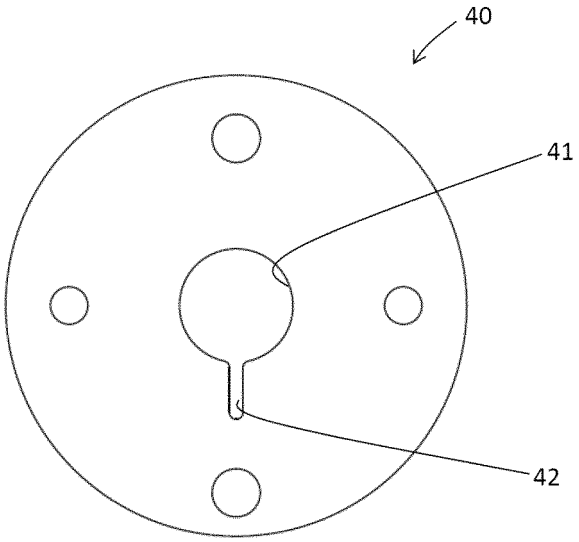

2
15
6
14
(1)1c
11a
16
11b
15a
17
11c
3
12b
12a
12c
32
30
10
11
12
13
31
21
20
22
13a
13b
18
13c
(1)1a
5
(1)1b
4

[Fig. 2]

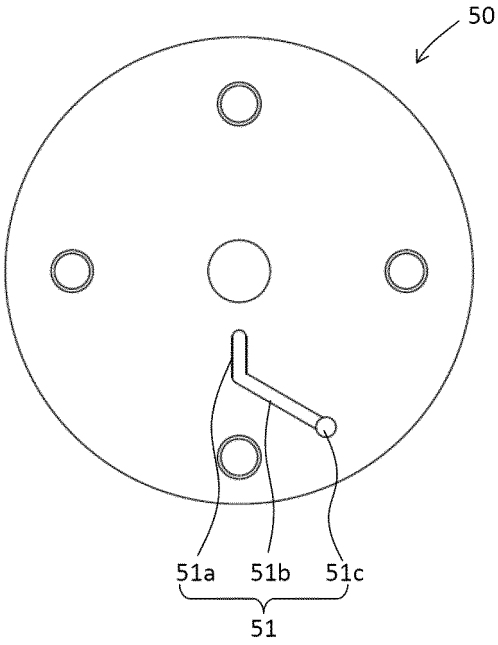


[Fig. 3]

(a)



(b)



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/001200

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F04C29/02(2006.01)i, F04C18/02(2006.01)i, F04C29/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. F04C29/02, F04C18/02, F04C29/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2015-34473 A (DAIKIN INDUSTRIES, LTD.) 19 February 2015, paragraphs [0034]-[0077], fig. 1-4, (Family: none)	1 2-5
Y A	JP 5-231357 A (MITSUBISHI ELECTRIC CORP.) 07 September 1993, fig. 1, (Family: none)	1 2-5
Y A	JP 11-182473 A (SANYO ELECTRIC CO., LTD.) 06 July 1999, fig. 1-4, (Family: none)	1 2-5

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23.02.2018	06.03.2018
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/001200

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 5-149285 A (DAIKIN INDUSTRIES, LTD.) 15 June 1993, fig. 3, (Family: none)	2-5
A	JP 11-22669 A (DAIKIN INDUSTRIES, LTD.) 26 January 1999, fig. 6, (Family: none)	2-5

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H5231357 B **[0007]**
- JP H11182473 B **[0007]**