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(71) Applicant: **Panasonic Corporation**
Osaka 571-8501 (JP)
(72) Inventor: **IIDA, Noboru**
Osaka-shi, Osaka 540-6207 (JP)
(74) Representative: **Eisenführ Speiser**
Patentanwälte Rechtsanwälte PartGmbB
Postfach 31 02 60
80102 München (DE)

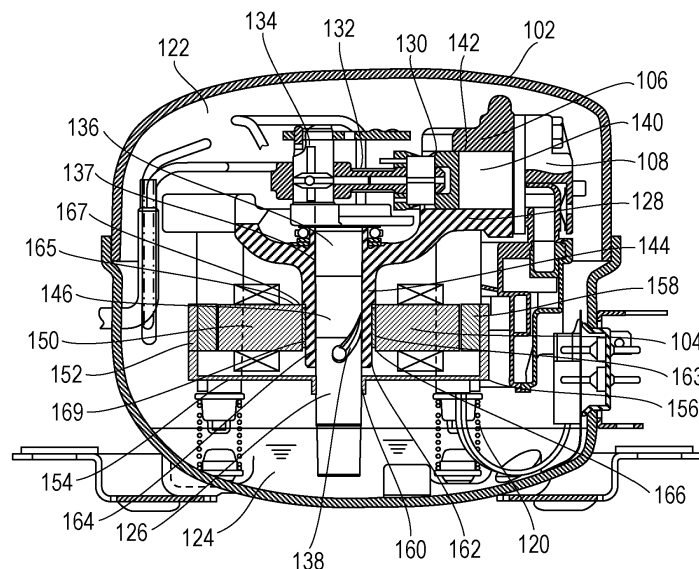
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(54) **SEALED COMPRESSOR AND REFRIGERATION DEVICE USING THE SAME**

(57) In a sealed compressor, electrically-operated element (104) and compressive element (106) driven by electrically-operated element (104) are housed in the inside of sealed container (102). Compressive element (106) includes shaft (126) formed of main shaft (136) and eccentric shaft (134), and cylinder block (128) having: bearing (144) which pivotally supports main shaft (136) of shaft (126); and cylinder (142). Further, the sealed compressor includes piston (130) which is movable in

the cylinder in a reciprocating manner, and connecting portion (132) which connects eccentric shaft (134) and piston (130) to each other. Electrically-operated element (104) is an outer-rotor-type motor which includes stator (150), and rotor (152) which surrounds an outer periphery of stator (150) and is disposed coaxially with stator (150). Further, stator (150) is fixed to outer peripheral surface (162) of bearing (144) by adhesive agent (163).

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a sealed compressor and a refrigeration device such as a household-use electric freezer refrigerator or a show case using the sealed compressor.

BACKGROUND ART

[0002] Recently, along with diversification of food materials, a demand for the increase of capacity of an indoor volume of the household-use electric freezer refrigerator is increasing. As one of methods for increasing the indoor volume while maintaining a size of an external appearance of the household-use electric freezer refrigerator, the reduction in size of a machine compartment which houses a sealed compressor has been in progress. In the sealed compressor used in the household-use electric freezer refrigerator, other refrigeration cycle devices and the like, the miniaturization and the reduction in height of the sealed compressor have been strongly required.

[0003] Conventionally, with respect to this type of sealed compressor, to achieve the miniaturization and the reduction in height of the sealed compressor, there has been known a sealed compressor which uses an outer-rotor-type motor suitable for the miniaturization and the reduction in thickness of the sealed compressor in place of an inner-rotor-type motor (see Patent Literature 1, for example). A rotor rotates inside a stator as an electrically-operated element in the inner-rotor-type motor, while a rotor rotates outside a stator in the outer-rotor-type motor.

[0004] Fig. 7 is a side view showing a bearing mechanism and an electrically-operated element of a conventional sealed compressor (see Patent Literature 1).

[0005] As shown in Fig. 7, the conventional sealed compressor includes: shaft 8 having main shaft 4 and eccentric shaft 6; and bearing 10 which pivotally supports main shaft 4. Sliding portions 12, 14 are formed on an outer peripheral surface of main shaft 4 and an inner peripheral surface of bearing 10, respectively.

[0006] Electrically-operated element 18 is an outer-rotor-type motor which is formed of: stator 20; and rotor 22 which surrounds stator 20 and is disposed coaxially with stator 20.

[0007] Stator 20 is fixed to outer peripheral surface 23 of bearing 10 by welding, shrinkage fitting, press-fitting or the like. Sliding portion 14 is mounted on an inner periphery of bearing 10 to which stator 20 is fixed.

[0008] Further, in rotor 22, permanent magnet 28 is disposed on outer peripheral end portion 26 of disc-like frame 24. Rotor 22 is fixed to an outer periphery of a lower end of shaft 8 by circular cylindrical rotor shaft hole 30 formed on a center of frame 24 by shrinkage fitting or the like.

[0009] However, in the conventional configuration described in Patent Literature 1, stator 20 is fixed to outer peripheral portion 23 of bearing 10 by welding, shrinkage fitting, press-fitting or the like. Accordingly, in the conventional configuration, the inner peripheral surface of bearing 10 to which stator 20 is fixed is deformed so that the conventional configuration has a drawback that a solid contact occurs between the inner peripheral surface of bearing 10 and sliding portion 12 of main shaft 4 and hence, wear is liable to occur between the inner peripheral surface of bearing 10 and sliding portion 12 of main shaft 4.

Citation List

Patent Literature

[0010] PTL 1: Unexamined German Patent Publication 102010051266 Specification

SUMMARY OF THE INVENTION

[0011] The present invention has been made to overcome the above-mentioned drawbacks, and it is an object of the present invention to provide a sealed compressor having high durability in such a manner that when a stator is fixed to an outer peripheral surface of a bearing, the deformation of an inner peripheral surface of the fixed bearing is reduced so that a solid contact which occurs between the bearing and a main shaft is avoided whereby the occurrence of wear can be prevented.

[0012] In a sealed compressor of the present invention, an electrically-operated element and a compressive element driven by the electrically-operated element are housed in the inside of a sealed container. The compressive element includes: a shaft formed of a main shaft and an eccentric shaft; a cylinder block having: a bearing which pivotally supports the main shaft of the shaft; and a cylinder; a piston which is movable in the cylinder in a reciprocating manner; and a connecting portion which connects the eccentric shaft and the piston to each other. The electrically-operated element is an outer-rotor-type motor which includes: a stator; and a rotor which surrounds an outer periphery of the stator and is disposed coaxially with the stator. The stator is fixed to an outer peripheral surface of the bearing by an adhesive agent.

[0013] With such a configuration, it is possible to reduce the deformation of an inner peripheral surface of the bearing which occurs when the stator is fixed to the outer peripheral surface of the bearing. Accordingly, a solid contact which occurs between the bearing and the main shaft is avoided so that the occurrence of wear can be prevented.

[0014] In the sealed compressor of the present invention, the stator is fixed to the outer peripheral surface of the bearing by an adhesive agent and hence, compared to the case where the stator is fixed to the outer peripheral surface of the bearing by welding, shrinkage fitting,

press-fitting or the like, the deformation of the inner peripheral surface of the bearing can be reduced. Therefore, a solid contact which occurs between the bearing and the main shaft is avoided and hence, the occurrence of wear can be prevented. Accordingly, the durability of the sealed compressor can be enhanced.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 is a cross-sectional view of a sealed compressor according to a first exemplary embodiment of the present invention.

FIG. 2 is an enlarged cross-sectional view showing a fixing portion between a stator and a bearing of the sealed compressor according to the first exemplary embodiment of the present invention.

FIG. 3 is a bottom view as viewed from below of the stator and the bearing of the sealed compressor according to the first exemplary embodiment of the present invention.

FIG. 4 is another enlarged cross-sectional view showing the fixing portion between the stator and the bearing of the sealed compressor according to the first exemplary embodiment of the present invention.

FIG. 5 is still another enlarged cross-sectional view showing the fixing portion between the stator and the bearing of the sealed compressor according to the first exemplary embodiment of the present invention.

FIG. 6 is a schematic view showing a refrigeration device according to a second exemplary embodiment of the present invention.

FIG. 7 is a side view showing a bearing mechanism and an electrically-operated element of a conventional sealed compressor.

DESCRIPTION OF EMBODIMENTS

[0016] Hereinafter, exemplary embodiments of the present invention are described with reference to drawings. The present invention is not limited by the exemplary embodiments.

(FIRST EXEMPLARY EMBODIMENT)

[0017] FIG. 1 is a cross-sectional view of a sealed compressor according to the first exemplary embodiment of the present invention. FIG. 2 is an enlarged cross-sectional view showing a fixing portion between a stator and a bearing of the sealed compressor. FIG. 3 is a bottom view as viewed from below of the stator and the bearing of the sealed compressor.

[0018] In FIG. 1, the sealed compressor according to this exemplary embodiment is configured such that compressor body 108 which includes electrically-operated el-

ement 104 and compressive element 106 is housed in sealed container 102 formed by drawing a steel plate. Compressive element 106 is driven by electrically-operated element 104.

5 [0019] Compressor body 108 is resiliently supported by suspension springs 120.

10 [0020] Sealed container 102 is filled with refrigerant gas 122 which is at a pressure substantially equal to a pressure on a low-pressure side of a refrigeration device (not shown) and in a relatively low temperature state. For example, refrigerant gas 122 is R600a or the like which is a hydrocarbon refrigerant having a low global warming potential. A bottom portion in sealed container 102 is filled with lubrication oil 124.

15 [0021] Compressive element 106 is formed of: shaft 126; cylinder block 128; piston 130; connecting portion 132 and the like.

20 [0022] Shaft 126 includes: eccentric shaft 134; main shaft 136; and oil supply mechanism 138 which supplies oil 124 from a lower end of main shaft 136 which is immersed in oil 124 to an upper end of eccentric shaft 134.

25 [0023] Cylinder block 128 is an integral body formed of cylinder 142 which forms compression chamber 140 and bearing 144 which rotatably and pivotally supports main shaft 136.

30 [0024] Main shaft 136 has non-sliding portion 146 at a portion of sliding portion 137 which is in slide contact with inner peripheral surface 164 of bearing 144. Non-sliding portion 146 is formed by reduction of diameter which narrows an outer diameter of main shaft 136. Non-sliding portion 146 of main shaft 136 is disposed between an upper end and a lower end of bearing 144.

35 [0025] Electrically-operated element 104 is an outer-rotor-type motor formed of: a stator 150; and rotor 152 which surrounds the periphery of stator 150 and is disposed coaxially with stator 150.

40 [0026] In rotor 152, permanent magnet 158 is disposed on outer peripheral end portion 156 of disc-like frame 154. Circular cylindrical rotor shaft hole 160 is formed in the center of frame 154, and an outer periphery of the lower end of main shaft 136 is fixedly engaged with rotor shaft hole 160 by press-fitting, welding, shrinkage fitting or the like.

45 [0027] As can be clearly understood from an enlarged cross-sectional view shown in FIG. 2, fit-on portion 167 and fit-on portion 169 are formed on upper end surface 165 and lower end surface 166 of stator 150, respectively. Further, an inner diameter of an inner peripheral surface of a portion of stator 150 except for fit-on portion 167 and fit-on portion 169 of stator 150 is set larger than an inner diameter of fit-on portion 167 and an inner diameter of fit-on portion 169 so that a predetermined gap is formed between the inner peripheral surface of stator 150 and outer peripheral surface 162 of bearing 144.

55 [0028] As shown in FIG. 3, opening portion 170 which opens in the gap formed between the inner peripheral surface of the portion of stator 150 except for fit-on portion 167 and fit-on portion 169 and outer peripheral surface

162 of bearing 144 is formed in fit-on portion 169 of stator 150. Further, stator 150 is fixed by adhesive agent 163 having excellent heat resistance, such as an epoxy-based adhesive agent, which is injected into the gap formed between outer peripheral surface 162 of bearing 144 and the inner peripheral surface of stator 150 through opening portion 170.

[0029] Bearing 144 is made of an iron-based material which contains carbon.

[0030] To enhance slidability of bearing 144 with respect to main shaft 136 and seizure resistance of bearing 144 against main shaft 136 and to ensure strength of bearing 144, bearing 144 is made of an iron-based material where a carbon content is not less than 1% and not more than 10%.

[0031] When a material for forming bearing 144 is an iron-based material and a carbon content of the material is not less than 1%, fixing stator 150 to bearing 144 by welding is difficult because bearing 144 becomes brittle at the time of welding. On the other hand, with the use of a method where stator 150 is fixed to bearing 144 by an adhesive agent 163, stator 150 can be fixed to bearing 144 in a stable manner. When a carbon content is increased, bearing 144 becomes brittle and hence, usually, it is preferable to set the carbon content to 7% at maximum.

[0032] In a case where stator 150 is fixed to bearing 144 by welding, bearing 144 is made of an iron-based material having a carbon content of not less than 1% and hence, bearing 144 becomes brittle at the time of welding so that stator 150 cannot be easily fixed to bearing 144. On the other hand, in this exemplary embodiment, stator 150 is fixed to bearing 144 by adhesive agent 163 and hence, even when bearing 144 is made of an iron-based material having a carbon content of not less than 1%, stator 150 can be fixed to bearing 144 in a stable manner.

[0033] The manner of operation and advantageous effects of the sealed compressor having the above-mentioned configuration is described hereinafter.

[0034] When electricity is supplied to electrically-operated element 104, an electric current flows through stator 150 so that a magnetic field is generated, and rotor 152 fixed to main shaft 136 rotates. Due to rotation of rotor 152, shaft 126 rotates. Then, piston 130 moves in a reciprocating manner in cylinder 142 by way of connecting portion 132 mounted on eccentric shaft 134 in a rotatable manner. In this manner, compressive element 106 performs a predetermined compression operation.

[0035] Next, the manner of operation and advantageous effect acquired by fixing stator 150 to outer peripheral surface 162 of bearing 144 by an adhesive agent 163 are described.

[0036] A stator of an outer-rotor-type motor such as stator 150 of the outer-rotor-type motor according to this exemplary embodiment is usually fixed to outer peripheral surface 162 of bearing 144 by press-fitting, welding, shrinkage fitting or the like. Accordingly, inner peripheral surface 164 of bearing 144 at the position where stator

150 is fixed is deformed and hence, a solid contact occurs between sliding portion 137 of main shaft 136 and stator 150 whereby wear is liable to occur between sliding portion 137 of main shaft 136 and stator 150.

[0037] However, stator 150 of the sealed compressor according to this exemplary embodiment is fixed to outer peripheral surface 162 of bearing 144 by adhesive agent 163. Accordingly, unlike the case where stator 150 is fixed to outer peripheral surface 162 of bearing 144 by press-fitting, welding, shrinkage fitting or the like, there is no possibility that an excessively large force is applied to bearing 144. Accordingly, it is possible to suppress the generation of distortion on inner peripheral surface 164 of bearing 144.

[0038] Therefore, a solid contact between inner peripheral surface 164 of bearing 144 and sliding portion 137 of main shaft 136 is avoided and hence, the occurrence of wear can be prevented. Accordingly, the durability of the sealed compressor can be enhanced.

[0039] Even when adhesive agent 163 is interposed between the inner peripheral surface of stator 150 and outer peripheral surface 162 of bearing 144, with the formation of fit-on portion 167 and fit-on portion 169 on stator 150, deterioration of concentricity between inner peripheral surface 164 of the bearing and the outer peripheral surface of stator 150 can be suppressed. Therefore, the gap formed between stator 150 and rotor 152 can be maintained uniformly. Accordingly, efficiency of the operation of the sealed compressor can be enhanced.

[0040] A predetermined gap is ensured between the inner peripheral surface of the portion of stator 150 except for fit-on portion 167 and fit-on portion 169 and outer peripheral surface 162 of bearing 144. Opening portion 170 which opens in the gap formed between the inner peripheral surface of stator 150 and outer peripheral surface 162 of bearing 144 is formed in fit-on portion 169. With such a configuration, the gap formed between the inner peripheral surface of stator 150 and outer peripheral surface 162 of bearing 144 can be easily filled with adhesive agent 163 through opening portion 170. Accordingly, productivity of the sealed compressor is enhanced. Further, stator 150 and bearing 144 can be fixed to each other with certainty.

[0041] In this exemplary embodiment, opening portion 170 is formed in fit-on portion 169 of stator 150. However, opening portion 170 may be formed in fit-on portion 167. Also in this case, substantially the same advantageous effect can be obtained.

[0042] In this exemplary embodiment, a plurality of opening portions 170 may be formed. With such a configuration, the gap can be filled with adhesive agent 163 more easily.

[0043] FIG. 4 is another enlarged cross-sectional view showing a fixing portion between stator 150 and bearing 144 of the sealed compressor according to the first exemplary embodiment of the present invention. In FIG. 4, a gap into which adhesive agent 163 is filled is disposed on a bearing 144 side. With such a configuration, an elec-

tromagnetic steel plate of stator 150 can be formed into the same shape over the entire fixing portion.

[0044] FIG. 5 is still another enlarged cross-sectional view showing a fixing portion between stator 150 and bearing 144 of the sealed compressor according to the first exemplary embodiment of the present invention. In FIG. 5, an upper side of a paper on which Fig. 5 is drawn corresponds to an upper side of stator 150. In FIG. 5, fit-on portion 167 is formed on an upper half of stator 150. With such a configuration, the gap can be easily filled with adhesive agent 163.

[0045] As has been described heretofore, in the sealed compressor of this exemplary embodiment, electrically-operated element 104 and compressive element 106 which is driven by electrically-operated element 104 are housed in the inside of sealed container 102. Compressive element 106 includes: shaft 126 formed of main shaft 136 and eccentric shaft 134; and cylinder block 128 having: bearing 144 which pivotally supports main shaft 136 of shaft 126; and cylinder 142. Compressive element 106 includes: piston 130 which is movable in cylinder 142 in a reciprocating manner, and connecting portion 132 which connects eccentric shaft 134 and piston 130 to each other. Electrically-operated element 104 is an outer-rotor-type motor which includes: stator 150; and rotor 152 which surrounds the outer periphery of stator 150 and is disposed coaxially with stator 150. Stator 150 is fixed to outer peripheral surface 162 of bearing 144 by adhesive agent 163.

[0046] With such a configuration, the deformation of inner peripheral surface 164 of bearing 144 to which stator 150 is fixed can be reduced. Therefore, a solid contact which occurs between bearing 144 and main shaft 136 is avoided so that the occurrence of wear can be prevented. Accordingly, the durability of the sealed compressor can be enhanced.

[0047] Fit-on portions 167, 169 which are fitted on outer peripheral surface 162 of bearing 144 may be provided to portions of the inner peripheral portion of stator 150. With such a configuration, even when adhesive agent 163 is interposed between the inner peripheral portion of stator 150 and outer peripheral surface 162 of bearing 144, deterioration of concentricity between the inner peripheral portion of bearing 144 and the outer peripheral surface of stator 150 can be suppressed and hence, a gap formed between stator 150 and rotor 152 can be maintained uniformly. Accordingly, efficiency of the operation of the sealed compressor can be enhanced.

[0048] Fit-on portions 167, 169 may be formed on upper end surface 165 and lower end surface 166 of stator 150, respectively, and a gap may be formed between a portion of the inner peripheral portion of stator 150 except for fit-on portions 167, 169 and outer peripheral surface 162 of bearing 144. With such a configuration, the gap formed between the inner peripheral portion of stator 150 and outer peripheral surface 162 of bearing 144 can be easily filled with adhesive agent 163. Accordingly, outer peripheral surface 162 of bearing 144 and stator 150 can

be fixed to each other with certainty.

[0049] Adhesive agent 163 and oil 124 are insulated from each other by fit-on portions 167, 169. With such a configuration, it is possible to suppress oil 124 from attacking adhesive agent 163 thus suppressing the deterioration of adhesive agent 163 itself. It is also possible to suppress the generation of a substance which adversely influences oil 124 and refrigerant gas 122 from adhesive agent 163. As a result, reliability of the sealed compressor can be enhanced.

[0050] Opening portion 170 which opens in the gap formed between the inner peripheral portion of stator 150 and outer peripheral surface 162 of bearing 144 may be formed in fit-on portions 167, 169. With such a configuration, adhesive agent 163 can be easily injected into the gap formed between the inner peripheral portion of stator 150 and outer peripheral surface 162 of bearing 144. Accordingly, productivity of the sealed compressor can be enhanced.

[0051] A plurality of opening portions 170 may be formed. With such a configuration, the gap can be more easily filled with adhesive agent 163.

[0052] The gap may be formed on a bearing 144 side. With such a configuration, an electromagnetic steel plate of stator 15 can be formed into the same shape over the entire fixing portion.

[0053] Fit-on portion 167 may be formed on an upper half of stator 150 on an eccentric shaft side. With such a configuration, adhesive agent 163 can be easily filled in the gap.

[0054] Bearing 144 may be made of an iron-based material which contains carbon. With such a configuration, slidability of bearing 144 with respect to main shaft 136 and seizure resistance of bearing 144 against main shaft 136 can be enhanced, and strength of bearing 144 is ensured.

[0055] Bearing 144 may contain not less than 1% and not more than 7% of carbon. With such a configuration, stator 150 can be fixed to bearing 144 in a stable manner.

(SECOND EXEMPLARY EMBODIMENT)

[0056] FIG. 6 is a schematic view showing a refrigeration device according to a second exemplary embodiment of the present invention. In the refrigeration device of this exemplary embodiment, the sealed compressor described in the first exemplary embodiment is mounted in refrigerant circuit 310. The basic configuration of the refrigeration device is schematically described.

[0057] In FIG. 6, the refrigeration device includes: body 302 which is formed of a heat insulating box having an opening equipped with a door; partition wall 308 which partitions the inside of body 302 into article accommodating space 304 and machine compartment 306, and refrigerant circuit 310 which cools the inside of accommodating space 304.

[0058] Refrigerant circuit 310 is configured such that compressor 312 which is the sealed compressor de-

scribed in the first exemplary embodiment, heat-radiator 314, pressure reduction device 316, and heat absorbing device 318 are annularly connected to each other by pipes. Heat absorbing device 318 is disposed in the inside of accommodating space 304 equipped with a blower (not shown). Cooling heat of heat absorbing device 318 is stirred by the blower so that cooling heat circulates the inside of accommodating space 304 as indicated by an arrow in FIG. 6 whereby accommodating space 304 is cooled.

[0059] The refrigeration device which has been described heretofore includes compressor 312 which is the sealed compressor described in the first exemplary embodiment. That is, in compressor 312, distortion generated on inner peripheral surface 164 of bearing 144 can be suppressed by fixing stator 150 to outer peripheral surface 162 of bearing 144 by adhesive agent 163. Further, a solid contact between inner peripheral surface 164 of bearing 144 and main shaft 136 is avoided. Therefore, it is possible to provide a sealed compressor having high durability which can prevent the occurrence of wear. Accordingly, durability of the refrigeration device can be enhanced.

[0060] As has been described heretofore, the refrigeration device of this exemplary embodiment includes refrigerant circuit 310 which is formed by annularly connecting compressor 312, heat-radiator 314, pressure reduction device 316, and heat absorbing device 318 to each other by pipes. It is sufficient that compressor 312 is the sealed compressor described in the first exemplary embodiment. With such a configuration, performance and durability of the refrigeration device can be enhanced.

INDUSTRIAL APPLICABILITY

[0061] As has been described heretofore, the present invention can provide a sealed compressor and a refrigeration device having high durability. Accordingly, the present invention is not limited to household-use electric appliances such as an electric refrigerator or an air conditioner, and is broadly applicable to a refrigeration device for a business-use showcase, a vending machine and the like.

REFERENCE MARKS IN THE DRAWINGS

[0062]

102	sealed container
104	electrically-operated element
106	compressive element
108	compressor body
120	suspension spring
122	refrigerant gas
124	oil
126	shaft
128	cylinder block

130	piston
132	connecting portion
134	eccentric shaft
136	main shaft
5 137	sliding portion
138	oil supply mechanism
140	compression chamber
142	cylinder
144	bearing
10 146	non-sliding portion
150	stator
152	rotor
154	frame
156	outer peripheral end portion
15 158	permanent magnet
160	rotor shaft hole
162	outer peripheral surface
163	adhesive agent
164	inner peripheral surface
20 165	upper end surface
166	lower end surface
167, 169	fit-on portion
170	opening portion
302	body
25 304	accommodating space
306	machine compartment
308	partition wall
310	refrigerant circuit
312	compressor
30 314	heat-radiator
316	pressure reduction device
318	heat absorbing device

35 Claims

1. A sealed compressor wherein, an electrically-operated element and a compressive element driven by the electrically-operated element are housed in a sealed container,

the compressive element includes:

a shaft formed of a main shaft and an eccentric shaft;

a cylinder block having: a bearing which pivotally supports the main shaft of the shaft; and a cylinder;

a piston which is movable in the cylinder in a reciprocating manner; and

a connecting portion which connects the eccentric shaft and the piston to each other, the electrically-operated element is an outer-rotor-type motor which includes: a stator; and a rotor which surrounds an outer periphery of the stator and is disposed coaxially with the stator, and

the stator is fixed to an outer peripheral surface of the bearing by an adhesive agent.

2. The sealed compressor according to claim 1, wherein a fit-on portion which fits on the outer peripheral surface of the bearing is formed on a portion of an inner peripheral portion of the stator. 5
3. The sealed compressor according to claim 2, wherein the fit-on portion is formed on an upper end surface and a lower end surface of the stator, and a gap is formed between an inner peripheral portion of the stator and the outer peripheral surface of the bearing at portions except for the fit-on portion. 10
4. The sealed compressor according to claim 3, wherein an opening portion which opens in the gap formed between the inner peripheral portion of the stator and the outer peripheral surface of the bearing is formed in the fit-on portion. 15
5. The sealed compressor according to claim 4, wherein a plurality of the opening portions is formed. 20
6. The sealed compressor according to claim 3, wherein the gap is formed on the bearing side.
7. The sealed compressor according to claim 2, wherein the fit-on portion is formed on an upper half of the stator on the eccentric shaft side. 25
8. The sealed compressor according to claim 1, wherein the bearing is made of an iron-based material which contains carbon. 30
9. The sealed compressor according to claim 8, wherein the bearing is made of the iron-based material which contains not less than 1% and not more than 7% of carbon. 35
10. A refrigeration device comprising a refrigerant circuit formed by annularly connecting a compressor, a heat-radiator, a pressure reduction device and a heat absorbing device to each other by pipes, wherein the compressor is the sealed compressor according to any one of claims 1 to 9. 40

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FIG. 1

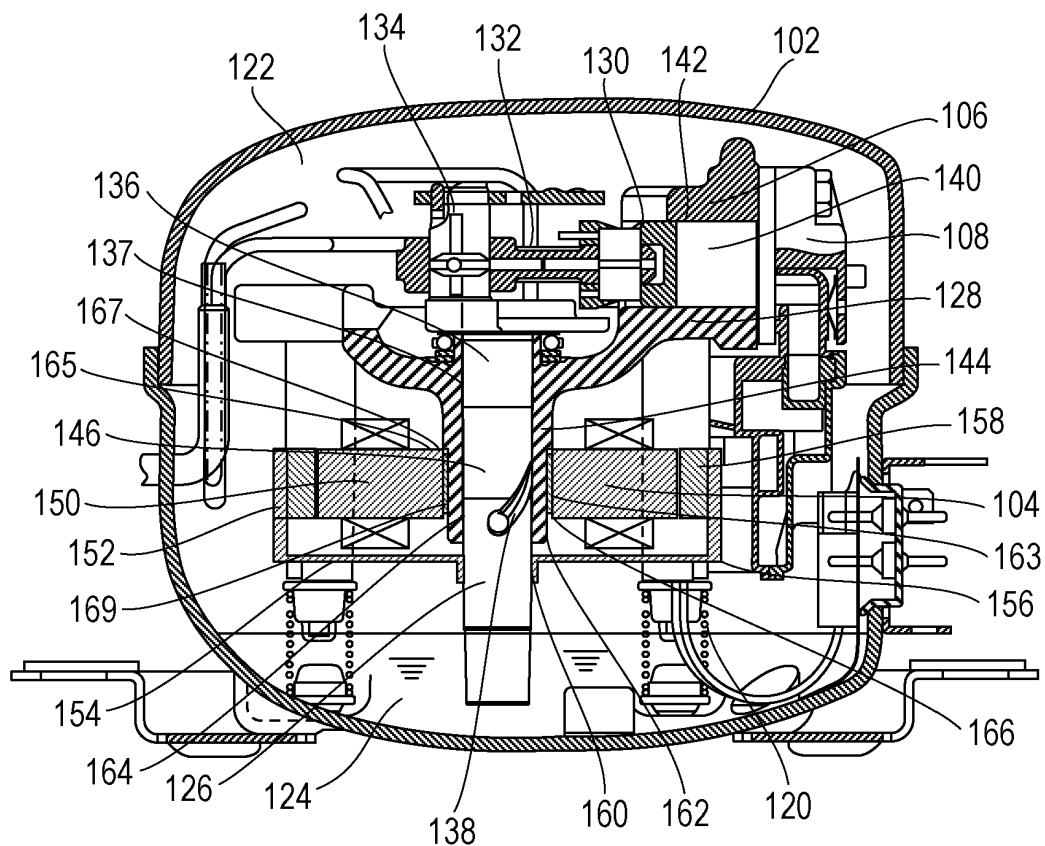


FIG. 2

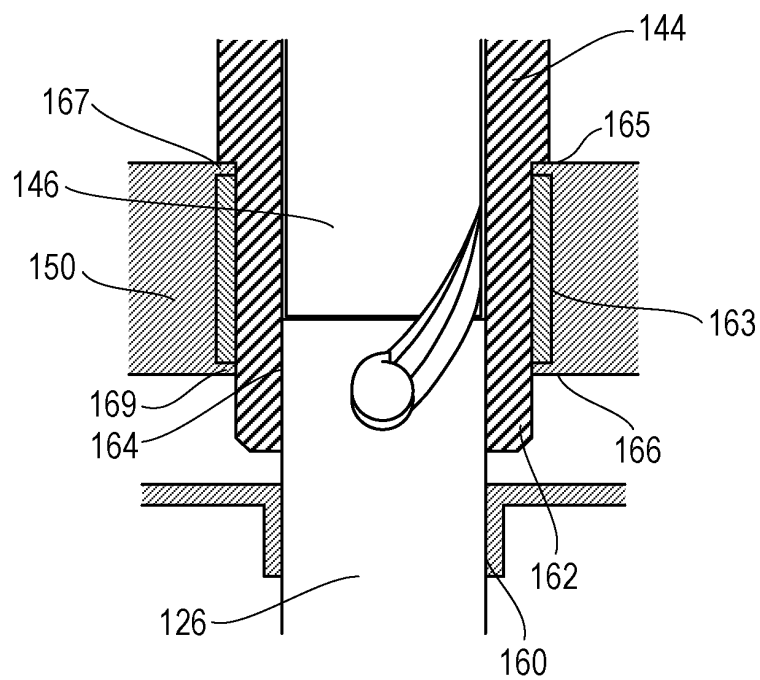


FIG. 3

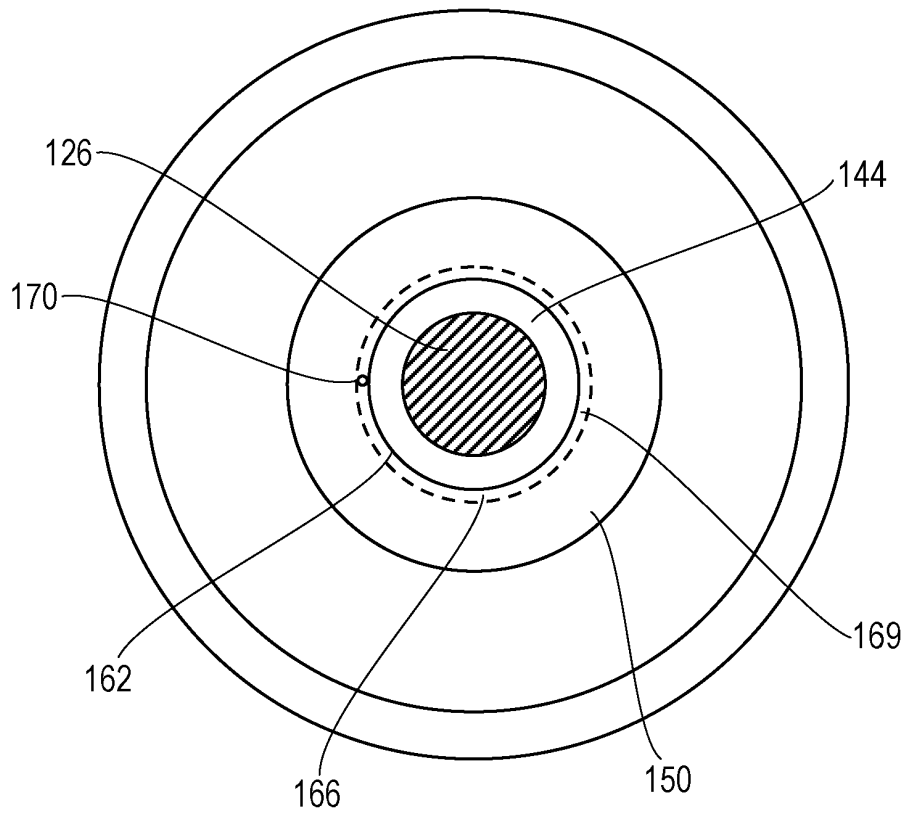


FIG. 4

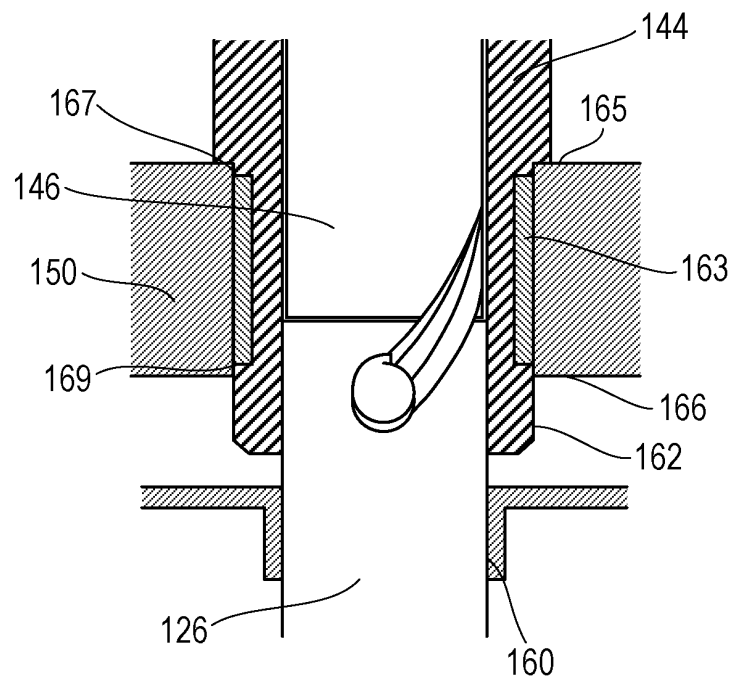


FIG. 5

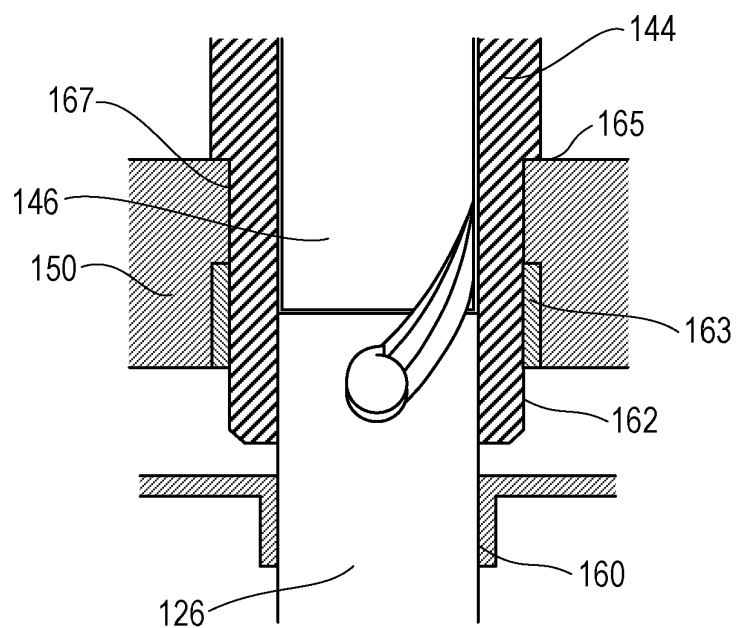


FIG. 6

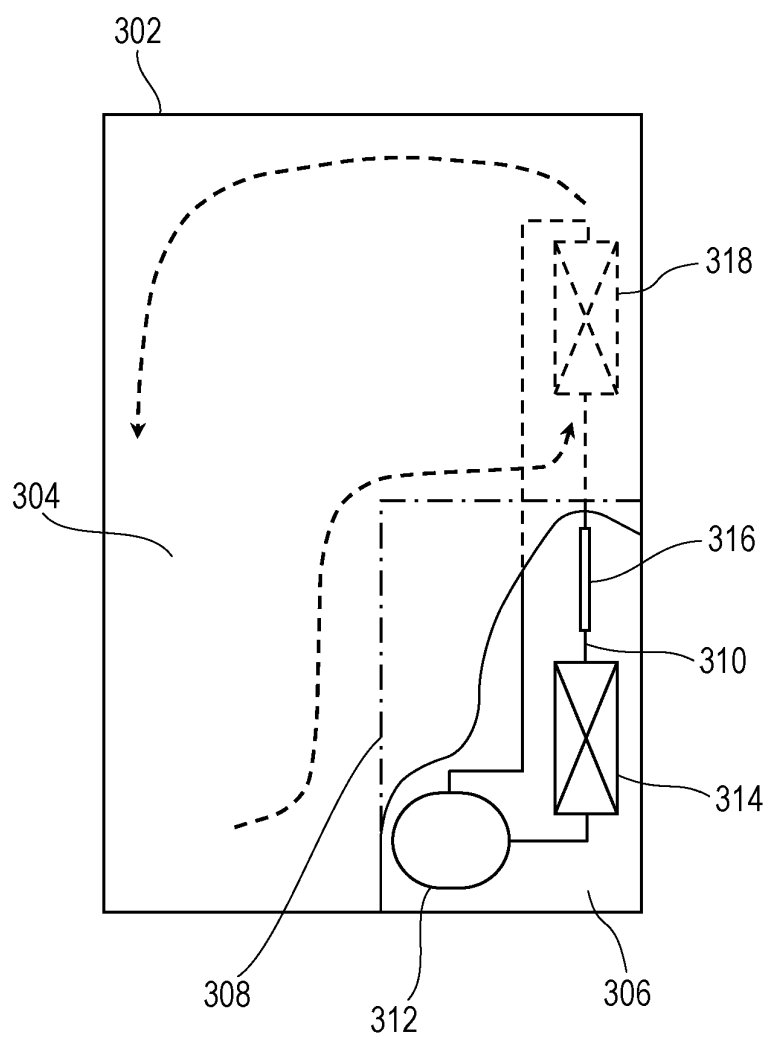
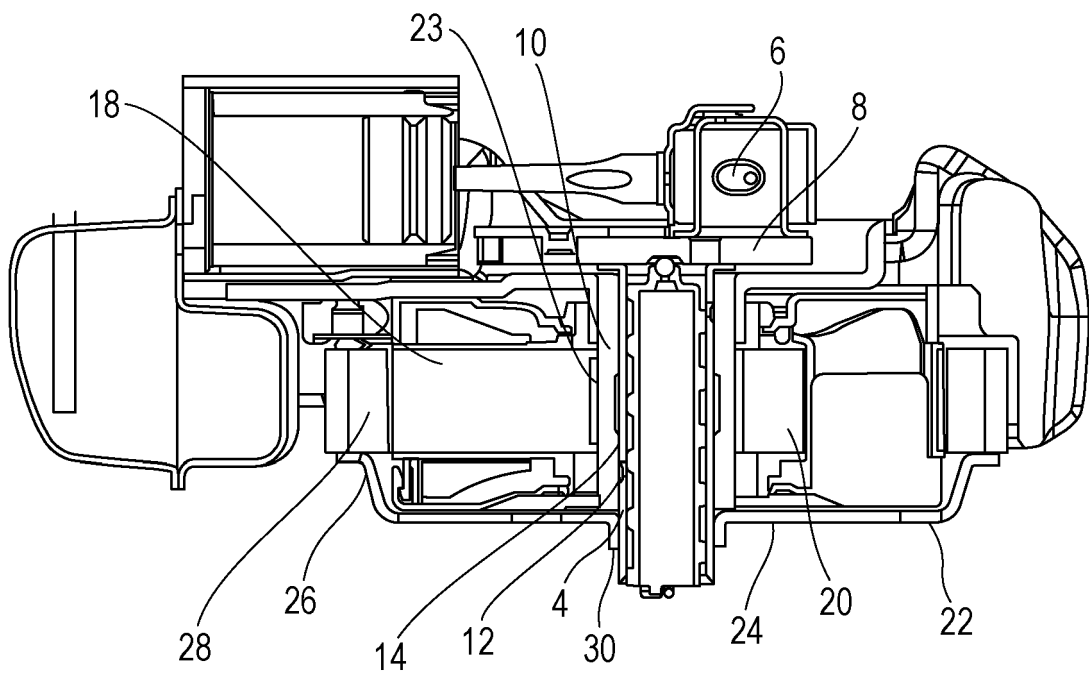


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/003400

A. CLASSIFICATION OF SUBJECT MATTER

F04B39/00(2006.01) i, F04B35/04(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)

F04B39/00, F04B35/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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.
A	JP 2000-297744 A (ERC Inc.), 24 October 2000 (24.10.2000), entire text; all drawings (Family: none)	1-10
A	JP 2013-201823 A (Shinano Kenshi Co., Ltd.), 03 October 2013 (03.10.2013), entire text; all drawings & US 2013/0251564 A1 entire text; all drawings & CN 103321872 A	1-10
A	JP 2002-21733 A (Funai Electric Co., Ltd.), 23 January 2002 (23.01.2002), entire text; all drawings (Family: none)	1-10

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

* Special categories of cited documents:

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Date of the actual completion of the international search
05 October 2015 (05.10.15)Date of mailing of the international search report
13 October 2015 (13.10.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/003400

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 2005-344600 A (Toshiba Carrier Corp.), 15 December 2005 (15.12.2005), entire text; all drawings (Family: none)	1-10
A	JP 8-312594 A (Akaishi Kinzoku Kogyo Kabushiki Kaisha), 26 November 1996 (26.11.1996), paragraph [0014]; fig. 2 & KR 10-0389948 B	1-10
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 102010051266 [0010]