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(54) **SCROLL COMPRESSOR**

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(57) **ABSTRACT**

A scroll compressor includes a hermetic container in which a refrigeration machine oil is stored in a bottom area, a compression mechanism that compresses a refrigerant which is suctioned into the hermetic container, an electric motor which has a motor rotor and a motor stator and is configured to drive the compression mechanism which is connected thereto via a shaft, a sub-frame that is fixed to the hermetic container and supports the shaft in a rotatable manner from a lower side of the electric motor, a balance weight that is disposed on a lower end face of the motor rotor, and a fixed cup that is disposed on an upper end of the sub-frame and surrounds the balance weight.

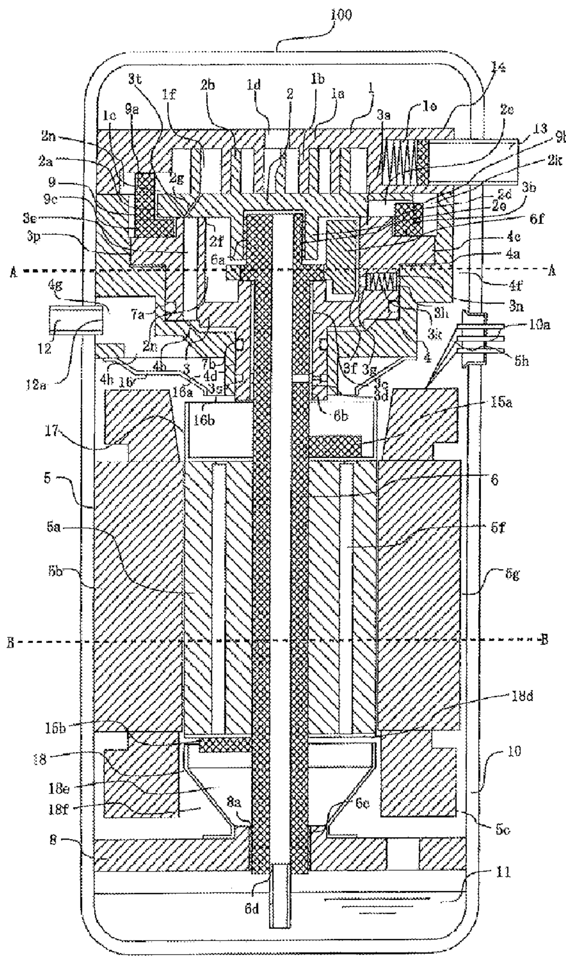
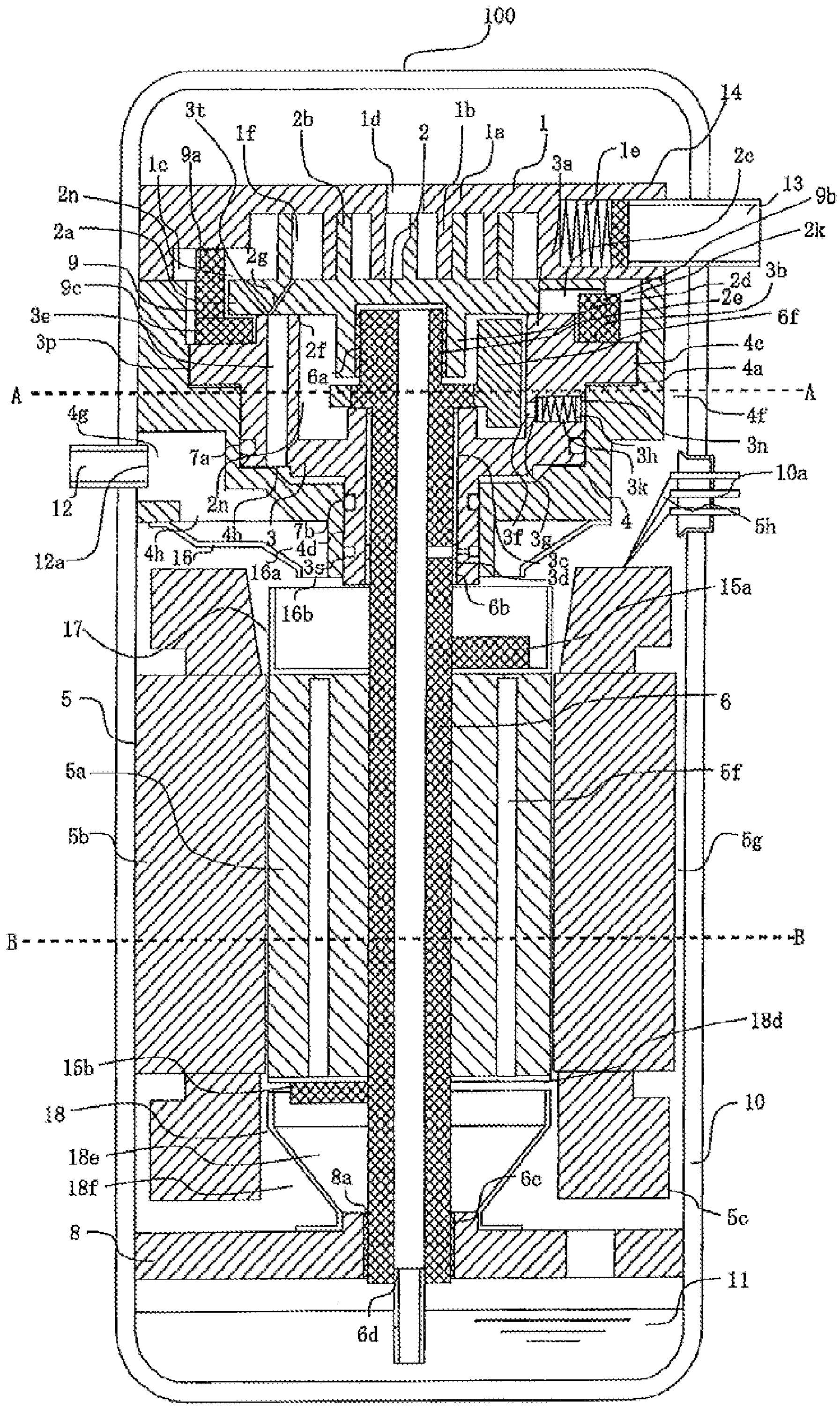


FIG. 1


100
14
1e
3a
1
1a
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11
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FIG. 2

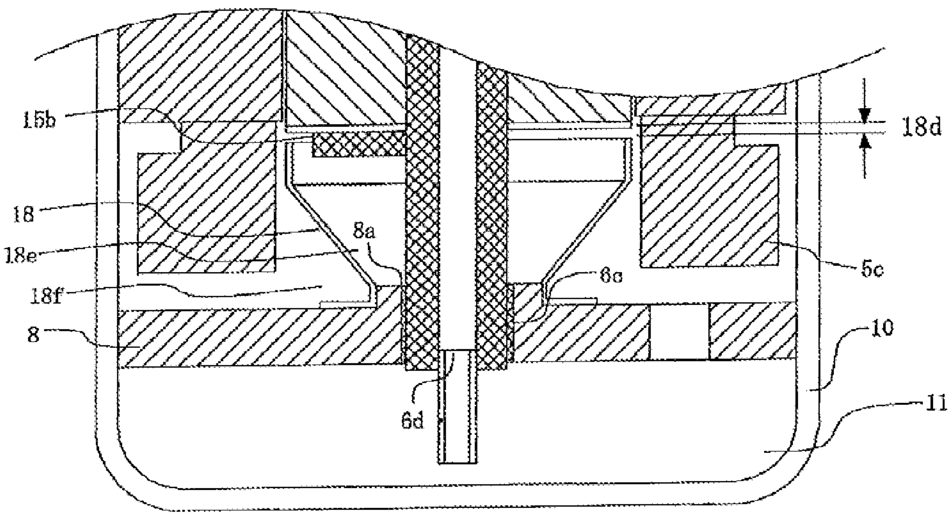
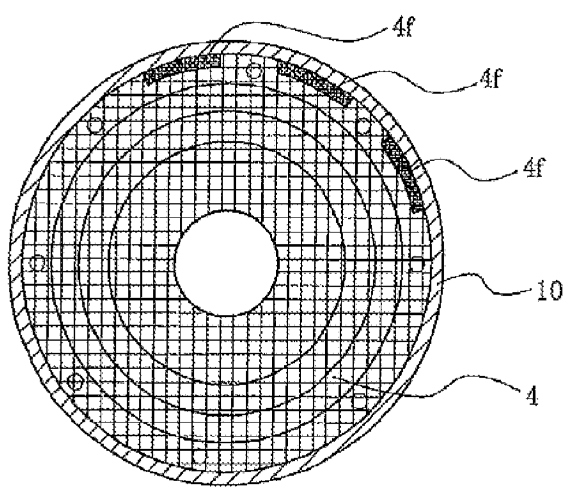
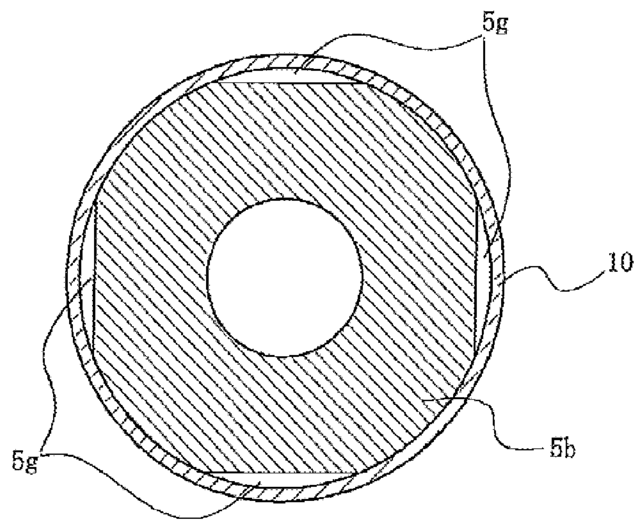


FIG. 3



F I G. 4



F I G. 5

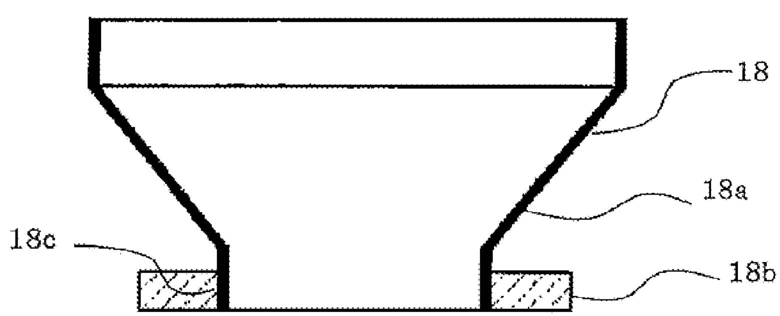


FIG. 6A

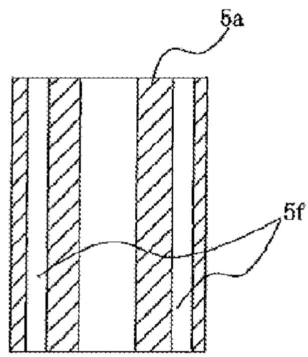


FIG. 6B

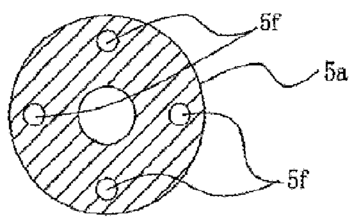
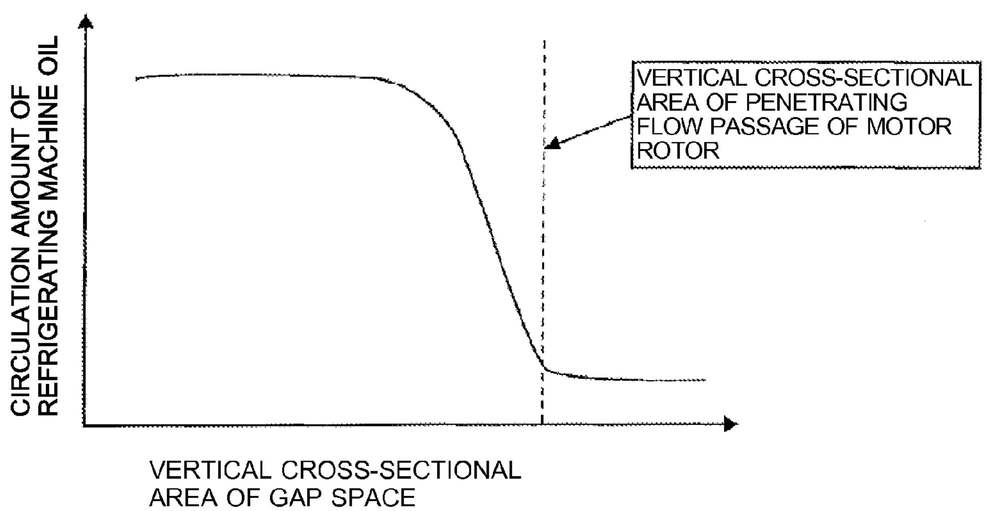


FIG. 7



SCROLL COMPRESSOR

TECHNICAL FIELD

[0001] The present invention relates to scroll compressors that reduce the amount of refrigerating machine oil discharged to the outside of a hermetic container.

BACKGROUND ART

[0002] In scroll compressors that use a compression mechanism which is driven by an electric motor element to compress a refrigerant which is introduced in a hermetic container, some scroll compressors reduce the amount of refrigerating machine oil discharged to the outside of the hermetic container (for example, see Patent Literatures 1 and 2).

[0003] In the scroll compressor described in Patent Literature 1, a compression element (**2**) is positioned on the lower part in a vertical hermetic casing (**1**) and a motor (**3**) with a drive shaft (**4**) is positioned on the upper side of the compression element (**2**). A bearing (**15**) of the drive shaft (**4**) is disposed on the upper side of the motor and an oil supply pump (**8**) is disposed on the lower side of the drive shaft (**4**). A forced oil supply passage (**18**) which communicates with the oil supply pump (**8**) is disposed to supply oil to the bearing (**15**) and a spiral groove (**19**) is formed on the outer peripheral surface of a rotor (**31**) of the motor (**3**) to downwardly return the oil supplied to the bearing (**15**) in a forcible manner such that the oil after lubrication can be returned to the oil supply pump without using a special oil separator while the oil is forcibly supplied to the bearing (**15**) disposed on the upper side.

[0004] Further, the scroll compressor described in Patent Literature 2 includes a scroll compression mechanism (**11**) that compresses a refrigerant and a drive motor (**13**) that is connected to the scroll compression mechanism (**11**) via a drive shaft (**15**) to drive the scroll compression mechanism (**11**), which are housed in a casing (**3**), and the scroll compression mechanism (**11**) is supported by a main frame (**21**) in the casing (**3**), the drive shaft (**15**) of the drive motor (**13**) is supported by a bearing plate (**8**) in the casing (**3**), the bearing plate (**8**) has an opening (**8**E) that communicates upper and lower spaces of the bearing plate (**8**) and includes a cover (**80**) that covers the surrounding of the drive shaft (**15**) between the drive motor (**13**) and the bearing plate (**8**), and the cover (**80**) includes a plurality of cover members (**80**A, **80**B) which are separated into such sizes that are allowed to pass through the opening (**8**E).

CITATION LIST

Patent Literature

[0005] [Patent Literature 1] Japanese Unexamined Patent Application Publication No. 5-302581 (for example, see FIG. 1)

[0006] [Patent Literature 2] Japanese Unexamined Patent Application Publication No. 2013-47481 (for example, see FIG. 1)

SUMMARY OF INVENTION

Technical Problem

[0007] However, in conventional scroll compressors shown in Patent Literatures 1 and 2, a balance weight disposed on the lower end of the rotor of the electric motor may be rotated due to driving of the electric motor during start of operation. Then, when the liquid level of the refrigerating machine oil or the mixed liquid of the refrigerating machine oil and the refrigerant is around or above the lower end of the electric motor element, the refrigerating machine oil or the mixed liquid of the refrigerating machine oil and the refrigerant may be mixed by the balance weight. This causes a problem that the refrigerating machine oil is discharged to the outside of the hermetic container, which results in decreased reliability of the bearing, and the amount of oil in the refrigeration cycle increases, which results in decreased cycle efficiency.

[0008] The present invention has been made to solve the above problem and an object of the invention is to provide a scroll compressor that prevents a refrigerating machine oil or a mixed liquid of refrigerating machine oil and refrigerant from being mixed during driving period of an electric motor and reduces the amount of refrigerating machine oil discharged to the outside of a hermetic container.

Solution to Problem

[0009] A scroll compressor according to the present invention includes a hermetic container in which a refrigeration machine oil is stored in a bottom area, a compression mechanism that compresses a refrigerant which is suctioned into the hermetic container, an electric motor which has a motor rotor and a motor stator and is configured to drive the compression mechanism which is connected thereto via a shaft, a subframe that is fixed to the hermetic container and supports the shaft in a rotatable manner from a lower side of the electric motor, a balance weight that is disposed on a lower end face of the motor rotor, and a fixed cup that is disposed on an upper end of the sub-frame and surrounds the balance weight.

Advantageous Effects of Invention

[0010] According to the scroll compressor of the present invention, the fixed cup is not rotated even during driving period of the electric motor since the fixed cup is disposed on the upper end of the sub-frame which is fixed to the hermetic container. Further, the balance weight is surrounded by the fixed cup.

[0011] Accordingly, the refrigerating machine oil or the mixed liquid of the refrigerating machine oil and the refrigerant can be prevented from being mixed by rotation of the balance weight, the amount of the refrigerating machine oil discharged to the outside of the hermetic container can be reduced, the reliability of the bearings is improved, and the cycle efficiency of the refrigeration cycle is improved.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. **1** is a vertical cross-sectional view of a scroll compressor according to Embodiment 1 of the present invention.

[0013] FIG. **2** is an enlarged view of an essential part of FIG. **1**.

[0014] FIG. **3** is a transverse cross-sectional view of a guide frame taken along the line A-A of FIG. **1**.

[0015] FIG. **4** is a transverse cross-sectional view of a motor stator taken along the line B-B of FIG. **1**.

[0016] FIG. **5** is a vertical cross-sectional view of a fixed cup according to Embodiment 3 of the present invention.

[0017] FIG. **6**A is a vertical cross-sectional view which shows a penetrating flow passage of a motor rotor according to Embodiment 5 of the present invention.

[0018] FIG. **6**B is a transverse cross-sectional view which shows a penetrating flow passage of a motor rotor according to Embodiment 5 of the present invention.

[0019] FIG. **7** is a view which shows a relationship of a vertical cross-sectional area of a gap space of the scroll compressor and a circulation amount of a refrigerating machine oil according to Embodiment 5 of the present invention.

DESCRIPTION OF EMBODIMENTS

[0020] Embodiments of the invention will be described below with reference to the drawings. It should be noted that the present invention is not limited by the following Embodiments. In the accompanying drawings, the size relationship between components may be different from the actual relationship.

Embodiment 1

[0021] FIG. **1** is a vertical cross-sectional view of a scroll compressor **100** according to Embodiment 1 of the present invention, and FIG. **2** is an enlarged view of an essential part of FIG. **1**.

[0022] The scroll compressor **100** according to Embodiment 1 of the present invention includes a compression mechanism **14** which has a fixed scroll **1** and a rocking scroll **2** in a hermetic container **10** which is in the shape of a hermetic dome and is configured to compress a refrigerant, and an electric motor **5** which has a motor rotor **5***a* and a motor stator **5***b* and is configured to drive the compression mechanism **14** which is connected to the electric motor **5** via a main shaft **6**.

[0023] The fixed scroll **1** is composed of a base plate **1***a* and a scroll lap **1***b*, and an outer periphery of the fixed scroll **1** is fastened to a guide frame **4** by using a bolt (not shown in the figure). The scroll lap **1***b* is disposed on one side (the lower side in FIG. **1**) of the base plate **1***a*, and oldham guiding grooves **1***c* are formed on the outer periphery of the fixed scroll **1** at two positions which are substantially on a straight line. Further, a fixed key **9***a* of an oldham mechanism **9** engages the oldham guiding groove **1***c* in a reciprocatingly slidable manner. Still further, a discharge port **1***d* is formed at the center of the base plate **1***a* through which a refrigerant is discharged. In addition, a suction pipe **13** is press fit into the fixed scroll **1** through the hermetic container **10** with a suction port **1***e* being located inside the fixed scroll **1**.

[0024] The rocking scroll **2** is composed of a base plate **2***a* and a scroll lap **2***b*. The scroll lap **2***b* which has a shape substantially the same as that of the scroll lap **1***b* of the fixed scroll **1** is disposed on one side (the upper side in FIG. **1**) of the base plate **2***a*. The scroll lap **1***b* of the fixed scroll **1** and the scroll lap **2***b* of the rocking scroll **2** geometrically form a compression chamber **1***f*. The refrigerant suctioned into the hermetic container **10** is compressed in response to change in volume of the compression chamber **1***f*. Further, a boss **2***d* in a hollow cylindrical shape is formed at the center of a surface (the lower side in FIG. **1**, which is hereinafter referred to as the lower surface) of the base plate **2***a* opposite to a surface on which the scroll lap **2***b* is disposed. The boss **2***d* rotatably supports a rocking shaft section **6***a* on the upper end of the main shaft **6**. In addition, a thrust surface **2***f* is formed around the circumference of the boss **2***d* to be in sliding contact with the thrust bearing **3***a* of a compliant frame **3**.

[0025] Oldham guiding grooves **2***c* which has a phase difference of 90 degrees from the oldham guiding grooves **1***c* of the fixed scroll **1** are formed on the outer periphery of the base plate **2***a* of the rocking scroll **2** at two positions which are substantially on a straight line. Further, a rocking key **9***b* of the oldham mechanism **9** engages the oldham guiding groove **2***c* in a reciprocatingly slidable manner. In addition, a rocking scroll bleeding hole **2***g* which penetrates the compression chamber **1***f* and the thrust surface **2***f* is formed on the base plate **2***a* so that a refrigerant gas is extracted during compression through the bleeding hole **2***g* and is guided to the thrust surface **2***f*.

[0026] The compliant frame **3** is provided with upper and lower cylindrical surfaces **3***p*, **3***s* formed on the outer periphery of the compliant frame **3** which are radially supported by cylindrical surfaces **4***c*, **4***d* formed on the inner periphery of the guide frame **4**. The compliant frame **3** is also provided with a main shaft bearing **3***c* and an auxiliary main shaft bearing **3***d* at the center of the compliant frame **3** such that the main shaft bearing **3***c* and the auxiliary main shaft bearing **3***d* radially support the main shaft **6** which is rotated by the electric motor **5**. Further, a communication hole **3***e* is formed to penetrate the thrust bearing **3***a* in the axis direction, and the opening **3***t* of the thrust bearing **3***a* is located at a position which faces the rocking scroll bleeding hole **2***g*.

[0027] A slide surface **3***b* on which an oldham mechanism annular section **9***c* reciprocatingly slides is formed outside the thrust bearing **3***a* of the compliant frame **3**, and a communication hole **3***f* that communicates a base plate circumferential space **2***k* and a frame upper space **4***a* is provided so as to communicate with the inside of the oldham mechanism annular section **9***c*. Further, the compliant frame **3** is provided with an intermediate pressure regulating valve **3***g* that adjusts a pressure of a boss outer diameter space **2***n* and an intermediate pressure regulating valve guard **3**h. Further, an intermediate pressure regulating valve space **3***n* is formed to house an intermediate pressure regulating valve spring **3***k*. The intermediate pressure regulating valve spring **3***k* is housed in a collapsed state which is shorter than its natural length.

[0028] FIG. **3** is a transverse cross-sectional view of the guide frame **4** taken along the line A-A of FIG. **1**.

[0029] As shown in FIG. **3**, the outer peripheral surface of the guide frame **4** is fixed to the hermetic container **10** by shrink-fitting, welding or the like, and first notches **4***f* are formed on the outer periphery to serve as passages for a mixed gas of the refrigerant and the refrigerating machine oil. Further, as shown in FIG. **1**, the first notches **4***f* are formed at positions on the opposite side of the discharge pipe **12**. A first discharge passage **4***g* is formed to extend from the center on the lower end of the guide frame **4** to the side face, and the discharge pipe **12** is disposed to penetrate the hermetic container **10** with the end portion **12***a* being housed in the first discharge passage **4***g*. A cover **16** which has an opening **4***h* and forms a second discharge passage **16***a* and an opening **16***b* is disposed on one side (the lower side in FIG. **1**) of the guide frame **4**.

[0030] A frame lower space **4***b* is formed by the inner surface of the guide frame **4** and the outer surface of the compliant frame **3**, and the upper side and the lower side of the frame lower space **4***b* are partitioned by an upper ring seal member **7***a* and a lower ring seal member **7***b*, respectively. Although ring-shaped seal grooves are formed at two positions on the inner peripheral surface of the guide frame **4** to house the upper ring seal member **7***a* and the lower ring seal member **7***b*, the seal groove may be formed on the outer peripheral surface of the compliant frame **3**. The frame lower space **4***b* communicates only with the communication hole **3***e* of the compliant frame **3** and is configured to seal the refrigerant gas during compression which is supplied through the rocking scroll bleeding hole **2***g*. Further, a space around the circumference of the thrust bearing **3***a*, which is surrounded by the base plate **2***a* of the rocking scroll **2** and the compliant frame **3** on its upper and lower sides, that is, a base plate circumferential space **2***k* is a lower pressure space of a suction gas atmosphere (suction pressure).

[0031] The motor rotor **5***a* is disposed inside the motor stator **5***b*, and the penetrating flow passage **5***f* is formed in the motor rotor **5***a* in the axis direction. The motor stator **5***b* is disposed outside the motor rotor **5***a*, and a motor stator coil **5***c* is wound around the motor stator **5***b*. A main shaft portion **6***b* of the main shaft **6** is fixedly provided inside the motor rotor **5***a*. The motor rotor **5***a* rotates to cause the main shaft **6** to rotate and transmits a drive force to the compression mechanism **14** which is connected via the main shaft **6**. Further, second notches **5***g* are formed between the outer periphery of the motor stator **5***b* and the hermetic container **10** to serve as passages for a mixed gas of the refrigerant and the refrigerating machine oil.

[0032] A rocking shaft portion **6***a* which is rotatably supported by the rocking bearing **2***e* of the rocking scroll **2** is formed on the upper end of the main shaft **6**, and a main shaft balance weight **6***f* is shrink-fitted under the rocking shaft portion **6***a*. Further, the main shaft portion **6***b* which is rotatably supported by the main shaft bearing **3***d* and the auxiliary main shaft bearing **3***d* of the compliant frame **3** is formed under the main shaft balance weight **6***f*. Still further, a sub-shaft portion **6***c* which is rotatably supported by a sub-shaft bearing **8***e* of the sub-frame **8** is formed on the lower end of the main shaft **6**, and the outer peripheral surface of the sub-frame **8** is fixed to the hermetic container **10** by shrink-fitting, welding or the like. The motor rotor **5***a* is shrink-fitted between the sub-shaft portion **6***c* and the main shaft portion **6***b*. The refrigerating machine oil is stored in an oil sump **11** at the bottom of the hermetic container **10**, and the refrigerating machine oil is suctioned through an oil supply port **6***d* which is formed on the lower end face of the main shaft **6** by using an oil supply mechanism disposed in the main shaft **6**.

[0033] An upper balance weight **15***a* and a lower balance weight **15***b* is fixed to the upper end face and the lower end face of the motor rotor **5***a*, respectively, and in addition to the main shaft balance weight **6***f*, those balance weights disposed at three positions keep the static balance and the dynamic balance. That is, those balance weights keep balance during shut down period of the electric motor **5** and offset the imbalance between the centrifugal force and the moment generated at the compression mechanism **14** during driving period of the electric motor **5** to keep balance. Further, an upper cup **17** is disposed to surround the upper balance weight **15***a* at the upper end of the motor rotor **5***a*, and a fixed cup **18** is disposed to surround the lower balance weight **15***b* at the upper end of the sub-frame **8**. The fixed cup **18** is formed to separate a cup inside space **18***e* which contains the lower balance weight **15***b* therein and a cup outside space **18***f* which does not contain the lower balance weight **15***b* therein (which is located outside the fixed cup **18**) in the space between the upper end of the sub-frame **8** and the lower balance weight **15***b*. Further, as shown in FIG. **2**, a gap space **18***d* is formed between the upper end of the fixed cup **18** and the lower end of the motor rotor **5***a*.

[0034] FIG. **4** is a transverse cross-sectional view of the motor stator **5***b* taken along the line B-B of FIG. **1**.

[0035] As shown in FIG. **4**, the outer peripheral surface of the motor stator **5***b* is fixed to the hermetic container **10** by shrink-fitting, welding or the like, and the second notches **5***g* are formed on the outer periphery to serve as passages for a mixed gas of the refrigerant and the refrigerating machine oil. Further, as shown in FIG. **1**, glass terminals **10***a* are disposed on the side face of the hermetic container **10**, and the lead wires **5***h* which extend from the motor stator **5***b* are connected to the glass terminals **10***a*.

[0036] Next, an operation of the scroll compressor **100** according to Embodiment 1 during operating period will be described.

[0037] The suction refrigerant is suctioned through the suction pipe **13** during starting and operating period of the scroll compressor **100** and enters the compression chamber **1***f* formed by the scroll lap **1***b* of the fixed scroll **1** and the scroll lap **2***b* of the rocking scroll **2**. The rocking scroll **2** which is driven by the electric motor **5** reduces the volume of the compression chamber **1***f* as the eccentric rotation movement. This compression stroke causes the suction refrigerant to be under high pressure. Further, in this compression stroke, the refrigerant gas of the intermediate pressure during compression is guided from the rocking scroll bleeding hole **2***g* of the rocking scroll **2** to the frame lower space **4***b* via the communication hole **3***e* of the compliant frame **3** so as to keep the intermediate pressure atmosphere of the frame lower space **4***b*.

[0038] After the compression stroke, the mixed gas of the refrigerant and the refrigerating machine oil which is suctioned from the suction hole **1** e and is discharged from the discharge port **1***d* of the fixed scroll **1** is guided to the bottom of the hermetic container **10** through the first notches **4***f* formed on the outer periphery of the guide frame **4** and the second notches **5***g* formed on the outer periphery of the motor stator **5***b*. The mixed gas of the refrigerant and the refrigerating machine oil are separated in the course of being guided to the bottom of the hermetic container **10**. The separated refrigerant gas flows through the gap space **18***d* between the upper end of the fixed cup **18** and the lower end of the motor rotor **5***a* and the penetrating flow passage **5***f* of the motor rotor **5***a* and is released to the outside of the hermetic container **10** through the discharge pipe **12**.

[0039] Next, a state of the scroll compressor **100** according to Embodiment 1 during shut down period will be described.

[0040] In the shut down period of the scroll compressor **100**, when the temperature of the scroll compressor **100** is low, the refrigerant in the refrigeration cycle is liquefied and flows into the scroll compressor **100** and is mixed with the refrigerating machine oil. The liquid level of the mixed liquid comes near the lower end of the motor stator coil **5***c* which is wound around the motor stator **5***b* or above the lower end of the motor stator coil **5***c*.

[0041] Next, an operation of the scroll compressor **100** according to Embodiment 1 during start of operation will be described.

[0042] Since the fixed cup **18** is disposed on the upper end of the sub-frame **8**, the fixed cup **18** does not rotate even during driving period of the electric motor **5**. Further, the lower balance weight **15***b* is surrounded by the fixed cup **18**.

Accordingly, the refrigerating machine oil or the mixed liquid of the refrigerating machine oil and the refrigerant can be prevented from being mixed by rotation of the lower balance weight **15**_b_, the amount of the refrigerating machine oil discharged to the outside of the hermetic container can be reduced, the reliability of all the bearings (rocking bearing **2**_e_, thrust bearing **3**_a_, main shaft bearing **3**_c_, auxiliary main shaft bearing **3**_d_, sub-shaft bearing **8**_a_) is improved, and the cycle efficiency of the refrigeration cycle is improved.

[0043] The refrigerating machine oil may be miscible or immiscible with the refrigerant. In the case of the refrigerating machine oil miscible with the refrigerant, the refrigerating machine oil released into the refrigeration cycle is returned to the scroll compressor **100** along with the refrigerant flowing from the refrigeration cycle during shut down period of the scroll compressor **100**. As a result, the liquid level of the mixed liquid becomes higher than that of the immiscible refrigerating machine oil. Accordingly, the fixed cup **18** is more effective when used for the miscible refrigerating machine oil.

Embodiment 2

[0044] Next, the scroll compressor according to Embodiment 2 will be described. In Embodiment 2, the refrigerating machine oil is sealed in the scroll compressor with the liquid level being above the lower end of the motor stator coil **5**_c_ which is wound around the motor stator **5**_b_.

[0045] In the following description, the configuration and operation which are the same as those of Embodiment 1 will not be described.

[0046] When the scroll compressor is installed in air conditioning apparatuses or refrigerating machines which include a large refrigeration cycle, the amount of refrigerating machine oil sealed in the scroll compressor is increased in accordance with the increased amount of refrigerant in the refrigeration cycle so that the liquid level of the refrigerating machine oil is above the lower end of the electric motor **5**.

[0047] As described above, even when the refrigerating machine oil is sealed with the liquid level thereof being above the lower end of the electric motor **5**, the refrigerating machine oil or the mixed liquid of the refrigerating machine oil and the refrigerant can be prevented from being mixed by rotation of the lower balance weight **15**_b_, the amount of the refrigerating machine oil discharged to the outside of the hermetic container can be reduced, the reliability of all the bearings is improved, and the cycle efficiency of the refrigeration cycle is improved, since the lower balance weight **15**_b_ is surrounded by the fixed cup **18** disposed on the upper end of the sub-frame **8**.

Embodiment 3

[0048] Next, the scroll compressor according to Embodiment 3 will be described. In Embodiment 3, the fixed cup **18** is formed of two parts in the scroll compressor.

[0049] In the following description, the configuration and operation which are the same as those of Embodiment 1 or 2 will not be described.

[0050] FIG. **5** is a vertical cross-sectional view of the fixed cup **18** according to Embodiment 3 of the present invention.

[0051] As shown in FIG. **5**, the fixed cup **18** is composed of a seat member **18**_b_ for fixing to the sub-frame **8** and a cup member **18**_a_ that surrounds the lower balance weight **15**_b_, and the cup member **18**_a_ is connected to the seat member **18**_b_ via a connection section **18**_c_.

[0052] As described above, since the fixed cup **18** is composed of two members of the seat member **18**_b_ and the cup member **18**_a_, the seat member **18**_b_ can be formed thick to retain the fixture strength and the cup member **18**_a_ can be formed thin to save material cost.

Embodiment 4

[0053] Next, the scroll compressor according to Embodiment 4 will be described. In Embodiment 4, the seat member **18**_b_ and the cup member **18**_a_ are welded in the scroll compressor.

[0054] In the following description, the configuration and operation which are the same as those of any of Embodiments 1 to 3 will not be described.

[0055] In FIG. **5**, the cup member **18**_a_ is connected to the seat member **18**_b_ by welding at a connection section **18**_c_.

[0056] As described above, since the seat member **18**_b_ and the cup member **18**_a_ are connected by welding in the fixed cup **18**, it is possible to prevent the cup member **18**_a_ from being detached from the seat member **18**_b_ due to pressure difference between the sup inside space **18**_e_ and the cup outside space **18**_f_.

Embodiment 5

[0057] Next, the scroll compressor according to Embodiment 5 will be described. In Embodiment 5, dimensions between the motor rotor **5**_a_ and the fixed cup **18** in the scroll compressor are defined.

[0058] In the following description, the configuration and operation which are the same as those of any of Embodiments 1 to 4 will not be described.

[0059] FIG. **6**A is a vertical cross-sectional view which shows the penetrating flow passage **5**_f_ of the motor rotor **5**_a_ according to Embodiment 5 of the present invention. FIG. **6**B is a transverse cross-sectional view which shows the penetrating flow passage **5**_f_ of the motor rotor **5**_a_ according to Embodiment **5** of the present invention.

[0060] In the scroll compressor according to Embodiment 5 of the present invention, dimensions of the fixed cup **18** are defined such that the vertical cross-sectional area of the gap space **18**_d_ between the upper end of the fixed cup **18** shown in FIG. **2** and the lower end of the motor rotor **5**_a_ is larger than the vertical cross-sectional area of the penetrating flow passage **5**_f_ of the motor rotor **5**_a_ shown in FIGS. **6**A, **6**B and **7**.

[0061] FIG. **7** is a view which shows a relationship of a vertical cross-sectional area of the gap space of the scroll compressor and a circulation amount of the refrigerating machine oil according to Embodiment 5 of the present invention. In FIG. **7**, the horizontal axis represents the vertical cross-sectional area of the gap space **18**_d_, and the vertical axis represents the circulation amount of the refrigerating machine oil in the refrigeration cycle during operating period of the scroll compressor. The dotted line represents the position of the vertical cross-sectional area of the penetrating flow passage **5**_f_ of the motor rotor **5**_a_ in FIG. **7**.

[0062] As shown in FIG. **7**, when the vertical cross-sectional area of the gap space **18**_d_ becomes larger than the the vertical cross-sectional area of the penetrating flow passage **5**_f_ of the motor rotor **5**_a_, the circulation amount of the refrigerating machine oil during operating period of the scroll compressor decreases. Based on this relationship, the amount of the refrigerating machine oil released from the scroll compressor into the refrigeration cycle during operating period can be reduced by defining a height dimension or a diameter dimension of the fixed cup **18** such that the vertical cross-sectional area of the gap space **18***d* is larger than the the vertical cross-sectional area of the penetrating flow passage **5***f* of the motor rotor **5***a*. Accordingly, the reliability of all the bearings is improved, and the cycle efficiency of the refrigeration cycle is improved.

[Reference Signs List]

[0063] **1** fixed scroll; **1***a* base plate (of the fixed scroll); **1***b* scroll lap (of the fixed scroll); **1***c* oldham guiding groove (of the fixed scroll); **1***d* discharge port; **1***e* suction port; **1***f* compression chamber **2** rocking scroll; **2***a* base plate (of the rocking scroll); **2***b* scroll lap (of the rocking scroll); **2***c* oldham guiding groove (of the rocking scroll); **2***d* boss; **2***e* rocking bearing; **2***f* thrust surface; **2***g* rocking scroll air bleed hole; **2***k* base plate circumferential space; **2***n* boss outer diameter space; **3** compliant frame; **3***a* thrust bearing; **3***b* slide surface; **3***c* main shaft bearing; **3***d* auxiliary main shaft bearing; **3***e* communication hole; **3***f* communication hole; **3***g* intermediate pressure regulating valve; **3***h* intermediate pressure regulating valve guard; **3***k* intermediate pressure regulating spring; **3**n intermediate pressure regulating valve space; **3***p* cylindrical surface (of the compliant frame); **3***t* thrust bearing opening; **4** guide frame; **4***a* frame upper space; **4***b* frame lower space; **4***c* cylindrical surface (of the guide frame); **4***f* first notch; **4***g* first discharge passage; **4***h* opening; **5** electric motor; **5***a* motor rotor; **5***b* motor stator; **5***c* motor stator coil; **5***f* penetrating flow passage; **5***g* second notch; **5***h* lead wire; **6** main shaft; **6***a* rocking shaft portion; **6***b* main shaft portion; **6***c* sub-shaft portion; **6***d* oil supply port; **6***f* main shaft balance weight; **7***a* upper ring seal member; **7***b* upper ring seal member; **8** sub-frame; **8***a* sub-shaft bearing; **9** oldham mechanism; **9***a* fixed key of the oldham mechanism; **9***b* rocking key of the oldham mechanism; **9***c* oldham mechanism annular section; **10** hermetic container; **10***a* glass terminal; **11** oil sump; **12** discharge pipe; **12***a* end portion (of the discharge pipe); **13** suction pipe; **14** compression mechanism; **15** balance weight; **15***a* upper balance weight; **15***b* lower balance weight; **16** cover; **16***a* second discharge passage; **16***b* opening; **17** upper cup; **18** fixed cup; **18***a* cup member; **18***b* seat member; **18***c* connection section; **18***d* gap space; **18***e* cup inside space; **18***f* cup outside space; 100 scroll compressor

1. A scroll compressor comprising:

a hermetic container in which a refrigeration machine oil is stored in a bottom area of the hermetic container;

a compression mechanism that compresses a refrigerant which is suctioned into the hermetic container;

an electric motor which has a motor rotor and a motor stator and is configured to drive the compression mechanism which is connected to the electric motor via a shaft;

a sub-frame that is fixed to the hermetic container and supports the shaft in a rotatable manner from a lower side of the electric motor;

a balance weight that is disposed on a lower end face of the motor rotor; and

a fixed cup that is disposed on an upper end of the sub-frame and surrounds the balance weight.

2. The scroll compressor of claim **1**, wherein the fixed cup separates an inside space which contains the balance weight therein and an outside space which does not contain the balance weight therein in a space between the upper end of the sub-frame and the balance weight.

3. The scroll compressor of claim **1**, wherein the refrigerating machine oil is sealed with the liquid level thereof being above the lower end of the electric motor.

4. The scroll compressor of claim **2**, wherein the refrigerating machine oil is sealed with the liquid level thereof being above the lower end of the electric motor.

5. The scroll compressor of claim **1**, wherein the fixed cup is formed by connecting a seat member for fixing to the sub-frame and a cup member that surrounds the balance weight.

6. The scroll compressor of claim **2**, wherein the fixed cup is formed by connecting a seat member for fixing to the sub-frame and a cup member that surrounds the balance weight.

7. The scroll compressor of claim **3**, wherein the fixed cup is formed by connecting a seat member for fixing to the sub-frame and a cup member that surrounds the balance weight.

8. The scroll compressor of claim **4**, wherein the fixed cup is formed by connecting a seat member for fixing to the sub-frame and a cup member that surrounds the balance weight.

9. The scroll compressor of claim **5**, wherein the seat member for fixing to the sub-frame and the cup member that surrounds the balance weight are connected by welding.

10. The scroll compressor of claim **6**, wherein the seat member for fixing to the sub-frame and the cup member that surrounds the balance weight are connected by welding.

11. The scroll compressor of claim **7**, wherein the seat member for fixing to the sub-frame and the cup member that surrounds the balance weight are connected by welding.

12. The scroll compressor of claim **8**, wherein the seat member for fixing to the sub-frame and the cup member that surrounds the balance weight are connected by welding.

13. The scroll compressor of claim **1**, wherein a penetrating flow passage is formed in the motor rotor in an axis direction, and a vertical cross-sectional area of a gap space between an upper end of the fixed cup and a lower end of the motor rotor is larger than the vertical cross-sectional area of the penetrating flow passage.

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