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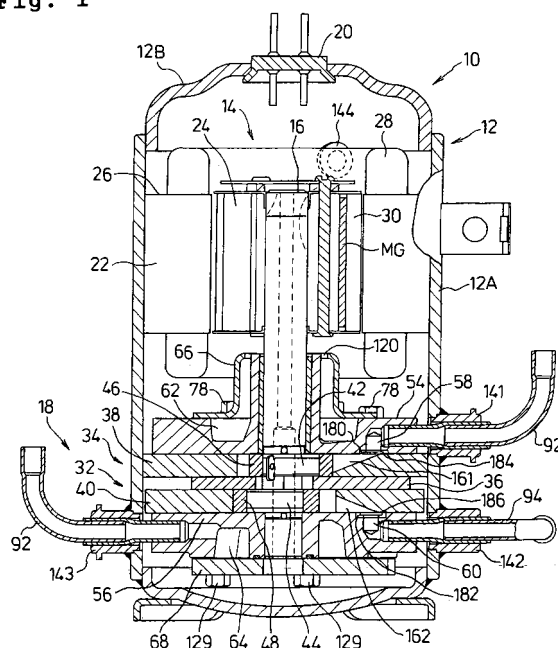
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(54) Sealed type compressor with suction filter

(57) A compressor is provided which enables easy installation of the filter even when any refrigerant suction passage cannot be provided on a cylinder side of a compression element or even when any long suction passage cannot be provided. The compressor comprises, in a sealed container 12, a drive element 14, a rotary compression mechanism 18 including first and second rotary compression elements 32 and 34, an upper support member 54 and a lower support member 56 for journaling a rotary shaft 16. The upper support member 54 and the lower support member 56 are provided with suction passages 58 and 60 for communicating with the interior of upper and lower cylinders 38 and 40 at suction ports 161 and 162, respectively, and recessed noise eliminating chambers 62 and 64. Filter installation portions 180 and 182 which are recessed are provided to surround and enclose open ends of the suction passages 58 and 60. Filters 184 and 186 are inserted into and installed on the filter installation portions 180 and 182, respectively, and the filter 184 is pressed against and stopped by the upper surface of the upper cylinder 38, while the filter 186 is pressed against and stopped by the lower surface of the lower cylinder 40.

Fig. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a compressor for compressing a refrigerant suitable for use in, for example, an air conditioning system, a water heater, a car air conditioner, a showcase, a freezer and refrigerator, or a refrigeration unit such as an automatic dispenser.

2. Description of the Related Art

[0002] In such a conventional compressor, for example, in a multistage compression type rotary compressor of an inside high-pressure type as disclosed in, for example, JP-A-2004-19599, refrigerant gas is drawn into a low pressure chamber side of a cylinder from a refrigerant introduction pipe via a suction port of a first rotary compression element. The refrigerant gas is then compressed by operations of a roller and a vane to become intermediate pressure. The intermediate pressure refrigerant gas is discharged from a high pressure chamber side of the cylinder through a discharge port, a noise eliminating chamber, and a refrigerant introduction pipe provided outside a sealed container. The intermediate pressure refrigerant gas is then drawn into the lower pressure chamber side of the cylinder through a suction port of a second rotary compression element, where it is subjected to a second stage compression by the operations of the roller and the vane to become high-temperature and high-pressure refrigerant gas.

[0003] The high-temperature and high-pressure refrigerant gas compressed by the second rotary compression element flows from the high pressure chamber side of the cylinder into the sealed container through the discharge port and the noise eliminating chamber. Then, the high-temperature and high-pressure refrigerant gas discharged into the sealed container is discharged from a refrigerant discharge pipe to the outside of the sealed container to be supplied to a refrigerating cycle, such as an air conditioning system, where the refrigerant gas radiates heat and is condensed to enter an evaporator, in which heat of the refrigerant is absorbed and the refrigerant gas is evaporated. Thereafter it is drawn again into the first rotary compression element through the refrigerant introduction pipe. This cycle is repeated.

[0004] As a sealed-type electric compressor with such an arrangement, a rotary compressor 10X is well known, as shown in Figs. 6 and 7, which includes a filter 185 press fitted into an inlet side of a suction passage 59 for the refrigerant provided in a cylinder 39 constituting the rotary compression element, so as to prevent foreign material from flowing into a compression chamber not shown of the cylinder 39, and to avoid inconveniences, including wear or locking of sliding parts of the rotary compression element.

[0005] That is, in the conventional sealed-type electric compressor, the filter 185 is installed over a tip end of a refrigerant introduction pipe 93 which is inserted into and connected to the refrigerant suction passage 59 provided in the cylinder 39, and then is press fitted into the inlet side of the suction passage 59, thereby removing foreign material which intends to be drawn into the compression chamber of the cylinder 39 together with the refrigerant gas.

[0006] This method of installation of the filter suffers from the problem that the filter cannot be often installed when the refrigerant suction passage cannot be provided in the cylinder constituting the compression element, or when a long refrigerant suction passage cannot be provided.

SUMMARY OF THE INVENTION

[0007] Accordingly, the invention has an object to provide a compressor which enables easy installation of a filter even when any refrigerant suction passage cannot be provided on a cylinder side of a compression element or even when any long suction passage cannot be provided.

[0008] According to a first aspect of the invention, there is provided a compressor which comprises, in a sealed container, a drive element, a compression element, a drive shaft for transferring a driving force of the drive element to the compression element to drive the compression element, and a bearing member for journaling the drive shaft. Refrigerant gas introduced from an outside of the sealed container is drawn into the compression element via the bearing member, and then the refrigerant gas is compressed by the compression element to be discharged to the outside of the sealed container. A filter is fitted into a recess provided at an outlet of a refrigerant passage of the bearing member, the refrigerant passage leading to a suction port of a cylinder constituting the compression element, and the filter is pressed against and stopped by the cylinder.

[0009] According to a second aspect of the invention, there is provided a compressor which comprises, in a sealed container, a drive element, a compression element, a drive shaft for transferring a driving force of the drive element to the compression element to drive the compression element, and a bearing member for journaling the drive shaft. Refrigerant gas introduced from an outside of the sealed container is drawn into the compression element via a refrigerant introduction pipe, and then the refrigerant gas is compressed by the compression element to be discharged to the outside of the sealed container. A plate-like filter is held and fixed between the compression element and the refrigerant introduction pipe on an outlet side of the refrigerant introduction pipe.

[0010] In the first aspect of the invention, the filter is fitted into the recess provided at the outlet of the refrigerant passage of the bearing member, which passage leads to the suction port of the cylinder constituting the

compression element, and the filter is pressed against and stopped by the cylinder. This enables easy installation of the filter even when any refrigerant suction passage cannot be provided on the cylinder side or even when any long suction passage cannot be provided. Accordingly, this can surely avoid the occurrence of inconveniences, including wear or locking of sliding parts of the rotary compression element.

[0011] In the second aspect of the invention, since the plate-like filter is held and fixed between the compression element and the refrigerant introduction pipe on the outlet side of the refrigerant introduction pipe, the filter can be easily installed on the compressor even when any suction passage cannot be provided on the cylinder side or even when any long suction passage cannot be provided. This can surely avoid the occurrence of inconveniences, including the wear or locking of sliding parts of the rotary compression element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a schematic longitudinal sectional view showing an inside high-pressure type two-stage rotary compressor according to a first preferred embodiment of the invention;

Fig. 2 is a plan view of a filter used in the compressor of the embodiment;

Fig. 3 is a side sectional view of the filter used in the compressor of the embodiment;

Fig. 4 is a schematic longitudinal sectional view showing an inside high-pressure type two stage rotary compressor according to a second preferred embodiment of the invention;

Fig. 5 is an enlarged view of a principal part on which the filter of the second embodiment is installed;

Fig. 6 is a diagram explaining a part of a conventional compressor with a filter installed thereon; and

Fig. 7 is a diagram explaining the filter which is installed over a refrigerant introduction pipe of the conventional compressor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] A compressor according to a first preferred embodiment of the invention comprises, in a sealed container, a drive element, a compression element, a drive shaft for transferring a driving force of the drive element to the compression element to drive the compression element, and a bearing member for journaling the drive shaft. Refrigerant gas introduced from an outside of the sealed container is drawn into the compression element via the bearing member, and then is compressed by the compression element to be discharged to the outside of the sealed container. A filter installation portion is formed as a recess for surrounding and enclosing an outlet of a refrigerant passage of the bearing member leading to a

suction port of a cylinder constituting the compression element. A filter which includes a wire-mesh filtration part supported by a metallic doughnut-shaped support member is fitted into the filter installation portion, and then is pressed against and stopped by the cylinder.

[0014] A compressor according to a second preferred embodiment of the invention comprises, in a sealed container, a drive element, a compression element, a drive shaft for transferring a driving force of the drive element to the compression element to drive the compression element, and a bearing member for journaling the drive shaft. Refrigerant gas introduced from an outside of the sealed container is drawn into the compression element via a refrigerant introduction pipe, and then is compressed by the compression element to be discharged to the outside of the sealed container. A plate-like filter which includes a wire mesh filtration part supported by a metallic doughnut-shaped support member is held and fixed between the compression element and the refrigerant introduction pipe on an outlet side of the refrigerant introduction pipe.

First Preferred Embodiment

[0015] The first preferred embodiment of the invention will be described below in detail with reference to Figs. 1 to 3.

[0016] Fig. 1 is a longitudinal sectional view showing a multistage (two-stage) compression type rotary compressor of an inside high-pressure type 10 which includes first and second rotary compression elements 32 and 34 according to the first embodiment. Fig. 2 is a plain view of a filter of the embodiment, and Fig. 3 is a sectional view of the filter of the embodiment. For simple understanding, in Figs. 1 to 3, elements that have the same functions as those explained in Figs. 6 and 7 are given the same reference numerals.

[0017] Referring to Fig. 1, the multistage (two-stage) compression type rotary compressor of the inside high-pressure type 10 is designed to compress a carbon dioxide (CO₂) which is to be used as a refrigerant for an air conditioning system. The rotary compressor 10 comprises a cylindrical sealed container 12 made of a steel plate, a drive element 14 disposed at and accommodated in an upper side of an inner space of the sealed container 12, and a rotary compression mechanism 18 composed of the first rotary compression element 32 (first stage) and the second rotary compression element 34 (second stage) which are respectively disposed under the drive element 14 and driven by a rotary shaft 16 of the drive element 14.

[0018] The sealed container 12 has its bottom serving as an oil reservoir, and includes a container body 12A for accommodating therein the drive element 14 and the rotary compression mechanism 18, and an end cap (cover) 12B with a substantially bowl shape for closing an opening positioned at an upper part of the container body 12A. A terminal 20 (wiring of which is omitted in descrip-

tion) for supplying power to the drive element 14 is attached to the center of the end cap 12B.

[0019] The drive element 14 includes a stator 22 which is annularly attached to the inner peripheral surface of the sealed container 12 in the upper space thereof, and a rotor 24 inserted into and installed inside the stator 22 with a slight clearance. The rotary shaft 16 extending vertically through the center of the stator 22 is fixed to the rotor 24.

[0020] The stator 22 includes a laminated body 26 formed by laminating doughnut-shaped electromagnetic steel plates and a stator coil 28 which is wound around the teeth of the laminated body 26 by direct winding (concentrating winding). The rotor 24 is formed by inserting a permanent magnet MG in a laminated body 30 made of electromagnetic steel plates like the stator 22.

[0021] An intermediate partition plate 36 is held between the first rotary compression element 32 and the second rotary compression element 34. That is, both the first rotary compression element 32 and the second rotary compression element 34 comprise the intermediate partition plate 36, upper and lower cylinders 38, 40 disposed over and under the intermediate partition plate 36, upper and lower eccentric portions 42, 44 provided on the rotary shaft 16, upper and lower rollers 46, 48 which are eccentrically rotated inside the upper and lower cylinders 38, 40 while fitted into the upper and lower eccentric portions 42, 44 with a 180-degree phase difference therebetween, upper and lower vanes (not shown) abutting against the upper and lower rollers 46, 48 and partitioning each of the upper and lower cylinders 38, 40 into a lower pressure chamber side and a high pressure chamber side, and an upper support member 54 and a lower support member 56 serving both as supporting means by closing an upper opening face of the upper cylinder 38 and the lower opening face of the lower cylinder 40, and as bearing means of the rotary shaft 16.

[0022] There are provided in the upper support member 54 and lower support member 56, suction passages 58, 60 which communicate with the inside of the upper and lower cylinders 38 and 40 through suction ports 161, 162, and noise eliminating chambers 62, 64 which are recessed. Filter installation portions 180, 182 are formed as recesses for surrounding and enclosing open ends of the suction passages 58 and 60, into which portions filters 184, 186 are inserted, respectively. The filter 184 as used herein is a plate-like filter composed of a wire-mesh filtration part 184A supported by a metallic doughnut shaped frame 184B, as shown in, for example, Figs. 2 and 3 (filter 186 has the same structure). The frame 184B of the filter 184 is pressed against and stopped by the upper surface of the upper cylinder 38, while a frame 186B of the filter 186 is pressed against and stopped by the lower surface of the lower cylinder 40 such that the filters 184, 186 are not disconnected from the filter installation portions 180, 182. Thus, the filter 184 is held between the upper support member 54 and the upper cylinder 38, and the filter 186 is held between the lower

support member 56 and the lower cylinder 40, so that the filters are prevented from dropping off.

[0023] The noise eliminating chambers 62, 64 of the upper support member 54 and the lower support member 56 have openings thereof opposite to the upper and lower cylinders 38, 40 closed with respective covers. That is, the noise eliminating chamber 62 is blocked by an upper cover 66, and the noise eliminating chamber 64 is blocked by a lower cover 68.

[0024] The upper cover 66 has its periphery fixed to the upper support member 54 from above by four main bolts 78. Two of the main bolts 78 have tip ends thereof screw-engaged with the upper cylinder, and the other two have tip ends thereof screw-engaged with the lower support member 56. Above the upper cover 66 is positioned the drive element 14.

[0025] The noise eliminating chamber 62 of the upper support member 54 and the interior of the sealed container 12 communicate with each other through a discharge hole 120 which is open towards the drive element 14 in the sealed container 12, penetrating the upper cover 66. Thus, refrigerant gas compressed by the second rotary compression element 34 is discharged into the sealed container 12 through the discharge hole 120.

[0026] The lower cover 68 is made of a doughnut-shaped circular steel plate, and it is fixed to the lower support member 56 from below by screwing four main bolts 129 at four spots on the periphery thereof to block an opening disposed on the lower surface of the noise eliminating chamber 64. The tip end of each main bolt 129 is screw-engaged with the upper support member 54.

[0027] Sleeves 141, 142, 143, and 144 are respectively fixed to the side surface of the container body 12A of the sealed container 12 by performing projection welding at open positions corresponding to the suction passages 58, 60 of the upper and lower support members 54, 56, the noise eliminating chamber 64, and the portion above the rotor 24 (portion directly above the drive element 14).

[0028] The sleeve 141 is vertically adjacent to the sleeve 142. The sleeve 142 is positioned substantially opposite to the sleeve 143 with respect to the rotary shaft 16. The sleeve 141 is displaced from the sleeve 144 by about 90 degrees with respect to the rotary shaft 16.

[0029] One end of a refrigerant introduction pipe 92 is inserted into and connected to the sleeve 141 to communicate with the suction passage 58 of the upper support member 54. The other end of the refrigerant introduction pipe 92 passes through the upper part of the sealed container 12, and is inserted into and connected to the sleeve 143 to communicate with the noise eliminating chamber 64 of the lower support member 56. A refrigerant introduction pipe 94 is inserted into and connected to the sleeve 142 to communicate with the suction passage 60 of the lower support member 56. A refrigerant discharge pipe not shown is inserted into and connected to the sleeve 144.

[0030] In the rotary compressor 10, carbon dioxide

(CO₂) which is natural refrigerant is used as a refrigerant considering earth consciousness, inflammability, toxicity or the like, and an existing oil such as mineral oil, polyalkyleneglycol (PAG); alkylbenzene oil, ether oil, ester oil, or the like is used as the oil of the lubricant.

[0031] In the rotary compressor 10 of the embodiments described above, when a stator coil 28 of the drive element 14 is energized via the terminal 20 and the wiring not shown, the drive element 14 is operated to rotate the rotor 24. Once the rotor 24 is rotated, the upper and lower rollers 46, 48 engaged with the upper and lower eccentric portions 42, 44 which are integrally provided with the rotary shaft 16 are caused to rotate eccentrically in the upper and lower cylinders 38, 40, as described above.

[0032] As a result, a lower pressure (about 4 MPaG) refrigerant gas supplied via a refrigerant introduction pipe 94 is drawn into the low pressure chamber side of the lower cylinder 40 from a suction port 162 via the suction passage 60 provided in the lower support member 56. Then, the refrigerant gas is compressed by the operations of the roller 48 and the vane not shown of the first rotary compression element 32 to be changed into intermediate pressure (about 8MPaG). Consequently, the intermediate pressure refrigerant is discharged into the noise eliminating chamber 64 from the high pressure chamber side of the cylinder 40 via the discharge port not shown.

[0033] At this time, since the filter 186 is disposed in the filter installation portion 182, the low pressure refrigerant gas introduced via the refrigerant introduction pipe 94 is drawn into the low pressure chamber side of the lower cylinder 40, and then filtered by the filter 186 to remove the foreign material. This can avoid the occurrence of inconveniences, including wear or locking of the sliding parts of the first rotary compression element 32.

[0034] The intermediate-pressure refrigerant discharged into the noise eliminating chamber 64 is drawn into the refrigerant introduction pipe 92, passes over the suction passage 58 of the upper support member 54 via the outside of the sealed container 12, and then is drawn into the low pressure chamber side of the upper cylinder 38 from the suction port 161. Also, at this time, the refrigerant is filtered by the filter 184, thereby removing the foreign material in the refrigerant drawn into the low pressure chamber side of the upper cylinder 38. This can avoid the occurrence of inconveniences, including the wear or locking of the sliding parts of the second rotary compression element 34. In addition, the refrigerant gas is cooled when it passes through the refrigerant introduction pipe 92 provided outside the sealed container 12.

[0035] The intermediate-pressure refrigerant gas drawn into the low pressure chamber side of the upper cylinder 38 is compressed by the operations of the roller 46 and the vane not shown of the second rotary compression element 34 into high-temperature and high-pressure (about 10 to 12 MPaG) refrigerant gas, which is then discharged from the high pressure chamber side of the cylinder 38 into the noise eliminating chamber

62 via the discharge port not shown.

[0036] The high-temperature and high-pressure refrigerant gas discharged into the noise eliminating chamber 62 is discharged from the discharge hole 120 of the upper cover 66 into an area inside the sealed container 12 under the drive element 14, and then passes through a clearance between the members to reach the upper side of the drive element 14, so that the refrigerant gas is discharged to the outside of the sealed container via the sleeve 144.

[0037] When the rotary compressor 10 is incorporated as, for example, a compressor for an air conditioner, the high-temperature and high-pressure refrigerant gas fed through the refrigerant discharge pipe connected to the sleeve 144 is introduced into a heat exchanger, so that the heat is radiated and the refrigerant gas is condensed. The condensed low-temperature and high-pressure refrigerant liquid is subjected to reduced pressure using an expansion valve to flow into an evaporator, where it is evaporated, and then flows back into the compressor through the refrigerant introduction pipe 94. This cycle is repeated. The latent heat caused by evaporating the refrigerant in the evaporator produces the cooling effect.

25 Second Preferred Embodiment

[0038] Now, the second preferred embodiment of the invention will be described below in detail with reference to Figs. 2 to 5. Elements of the second embodiment that are in common to those in the first embodiment will be given the same reference numerals, and explanation thereof will be omitted below.

[0039] In the second embodiment, on the outlet sides of the refrigerant introduction pipes 92 and 94, the plate-like filter 184 is held and fixed between the first rotary compression element 32 and the refrigerant introduction pipe 92, and the plate-like filter 186 between the second rotary compression element 34 and the refrigerant introduction pipe 94.

[0040] Fig. 5 is an enlarged view of the principal part of the first rotary compression element 32. The second rotary compression element 34 has the same construction as that of the first rotary compression element 32, and thus explanation of the second rotary compression element will also be given simultaneously below.

[0041] In more detail, among the lower support member 56 and the lower cylinder 40 constituting the first rotary compression element 32, the lower support member 56 is provided with the suction passage 60 communicating with the interior of the lower cylinder 40 at the suction port 162, and an insertion portion 196 into which a copper pipe 192 is inserted as an extended pipe of the refrigerant introduction pipe 94 so as to cause the refrigerant introduction pipe 94 to communicate with the suction passage 60. Just like the first rotary compression element 32, in the second rotary compression element 34, among the upper support member 54 and the upper cylinder 38, the upper support member 54 is provided with the suction

passage 58 communicating with the interior of the upper cylinder 38 at the suction port 161, and an insertion portion 194 into which a copper pipe 190 is inserted as an extended pipe of the refrigerant introduction pipe 92 so as to cause the refrigerant introduction pipe 92 to communicate with the suction passage 58. The refrigerant introduction pipes 92, 94 are welded and fixed to the copper pipes 190, 192, respectively, which are welded and fixed to the sleeves 141, 142, respectively. A collar 197 is formed of an iron pipe.

[0042] A filter installation portion 198 formed of a step is provided between the tip end of each of the copper pipes 190 and 192 and the refrigerant introduction side of each of the suction passages 58 and 60. The filter installation portion 198, when insertion portions 194, 196 are formed in the upper and lower support members 54, 56, is formed by making a lower hole with substantially the same diameter as that of the filters 184, 186, and then by making a slightly larger hole with substantially the same diameter as that of the copper pipes 190, 192. That is, the filter installation portion 198 is the step formed of a difference in the diameter between the lower hole and each of the holes for the upper and lower copper pipes 190, 192. As can be seen from the above, when the filters 184, 186 are installed on the filter installation portions 198, the filters 184, 186 are fixed thereto by pressing the frame 184B, 186B against the copper pipes 190, 192 of the refrigerant introduction pipes 92, 94, respectively.

[0043] It should be noted that although in the embodiments the insertion portions 194, 196 and the filter installation portion 198 are formed in the upper and lower support members 54, 56, the invention is not limited thereto. Depending on the construction of the rotary compressor 10, on the upper and lower cylinders 38, 40 may be formed the filter installation portions 198, in which the respective filters 184, 186 may be installed to be held between the refrigerant introduction pipes 92 and 94.

[0044] Although in the embodiments 1 and 2 as described in detail, the multistage compression type rotary compressor of the inside high-pressure type is exemplified as the compressor of the invention, the invention is not limited thereto. The compressor of the invention may be useful as a multistage compression type rotary compressor of an inside intermediate-pressure type, a one-stage compression type rotary compressor, or a one-stage or multistage compression type rotary compressor of a scroll type or a reciprocating type.

Claims

1. A compressor comprising, in a sealed container:

a drive element;
a compression element;
a drive shaft for transferring a driving force of the drive element to the compression element

to drive said compression element; and
a bearing member for journaling the drive shaft, wherein refrigerant gas introduced from an outside of the sealed container is drawn into the compression element via the bearing member, and then is compressed by the compression element to be discharged to the outside of the sealed container, and
wherein a filter is fitted into a recess provided at an outlet of a suction passage of the bearing member, the suction passage leading to a suction port of a cylinder constituting the compression element, said filter being pressed against and stopped by the cylinder.

2. A compressor comprising, in a sealed container:

a drive element;
a compression element;
a drive shaft for transferring a driving force of the drive element to the compression element to drive said compression element; and
a bearing member for journaling the drive shaft, wherein refrigerant gas introduced from an outside of the sealed container is drawn into the compression element via a refrigerant introduction pipe, and then is compressed by the compression element to be discharged to the outside of the sealed container, and
wherein a plate-like filter is held and fixed between the compression element and the refrigerant introduction pipe on an outlet side of the refrigerant introduction pipe.

3. A refrigerating cycle using the compressor according to claim 1 or 2.

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Fig. 1

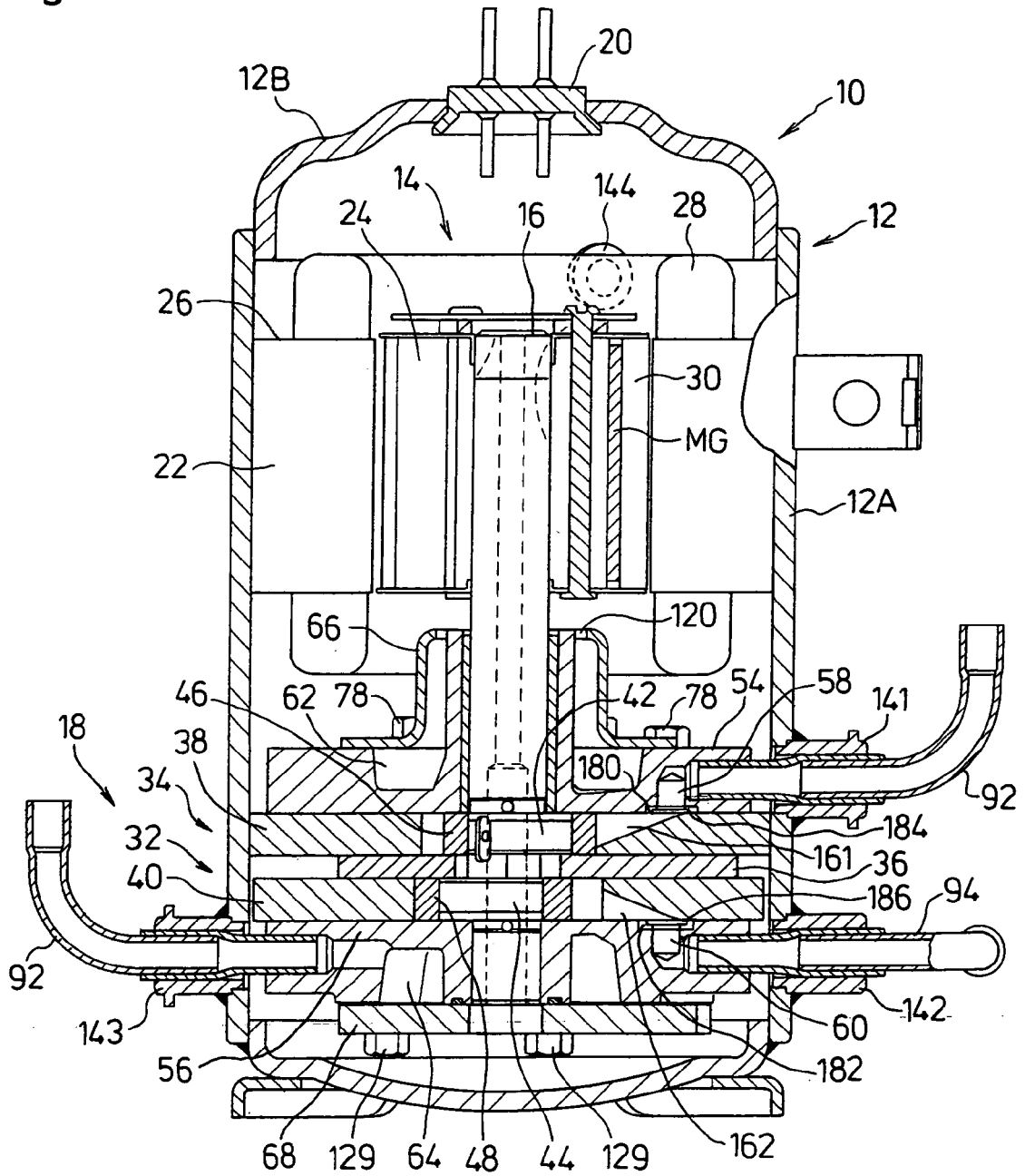


Fig. 2

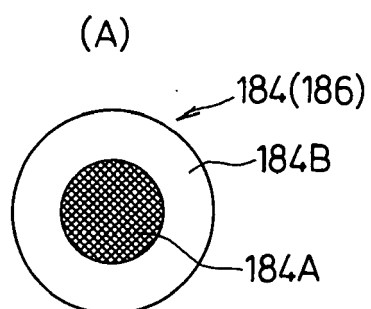


Fig. 3

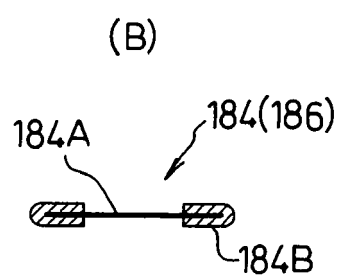


Fig. 4

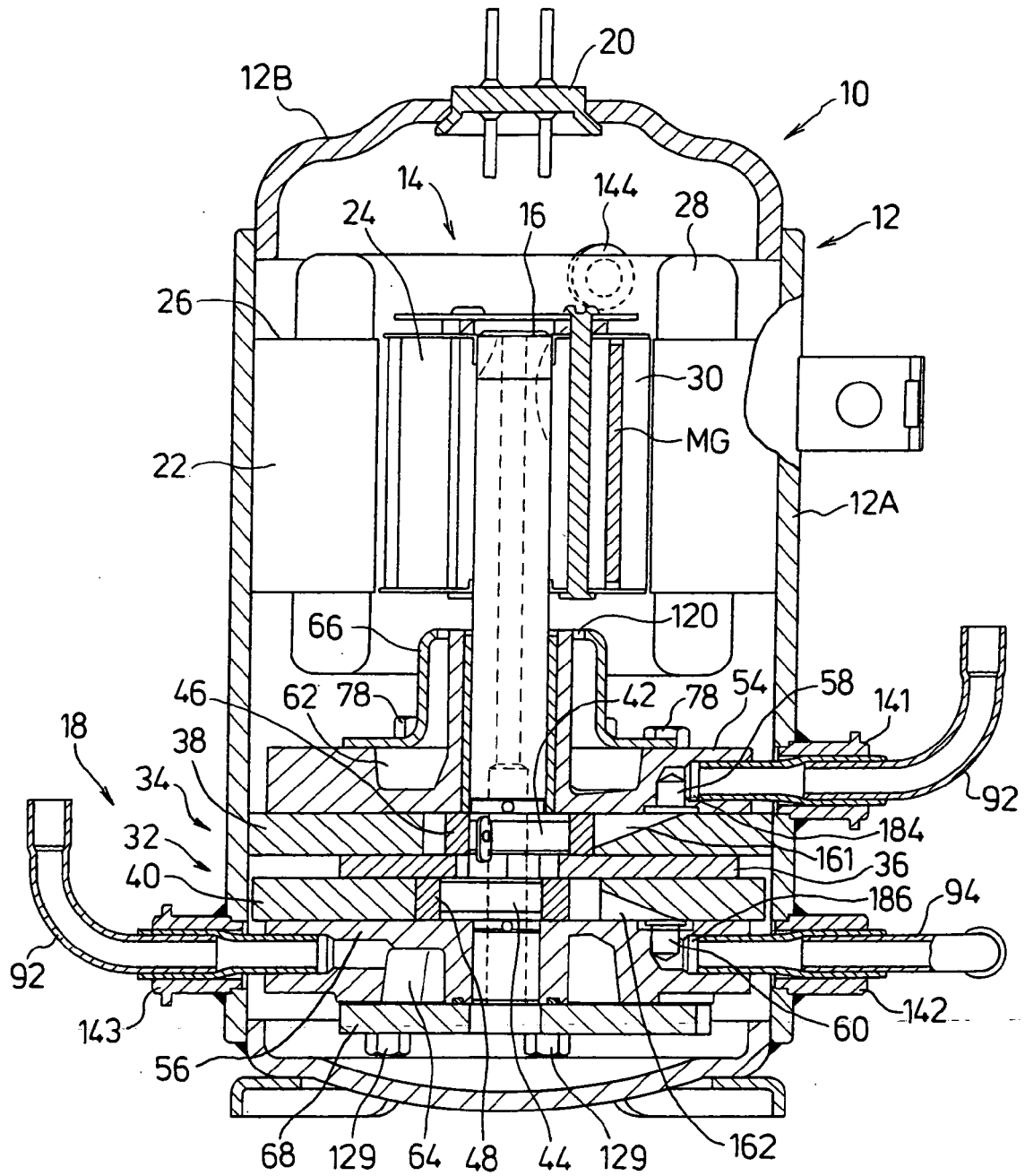


Fig. 5

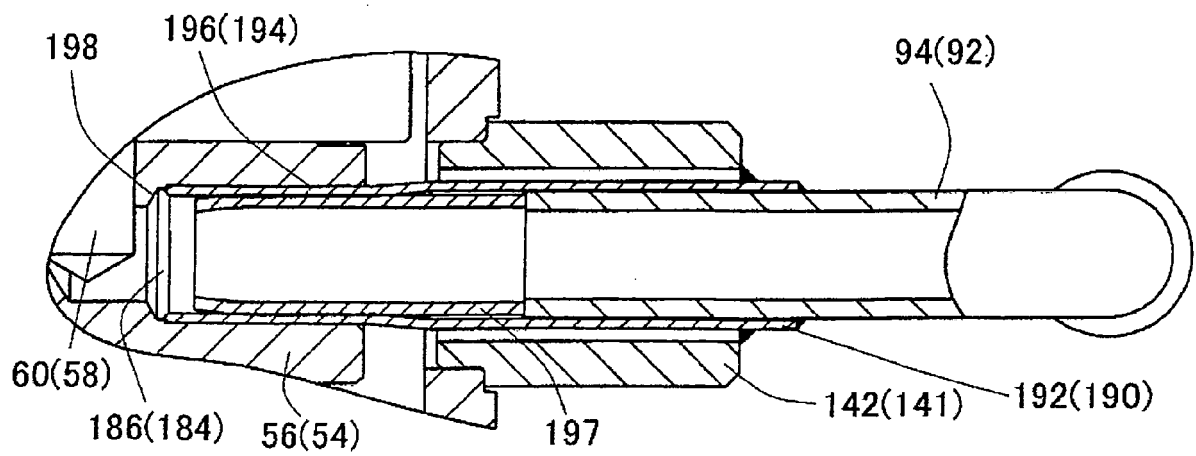


Fig. 6

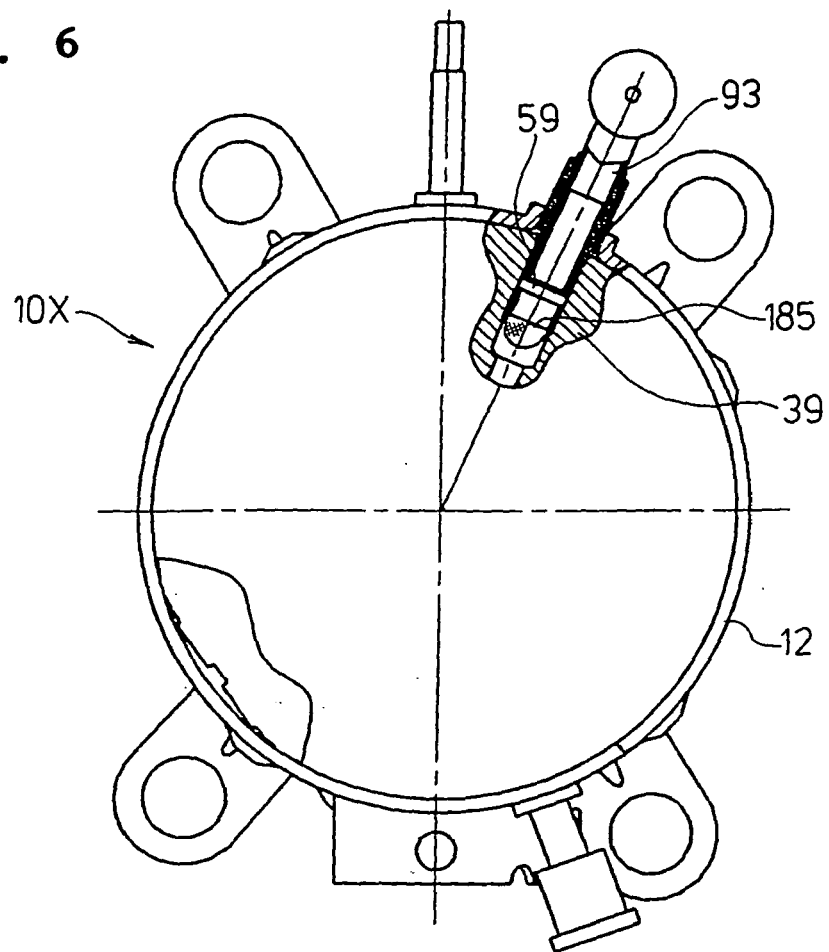
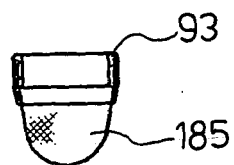


Fig. 7





European Patent
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Application Number
EP 05 02 0757

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 December 2005	Examiner Lequeux, F
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EPO FORM 1503 (03.82 (P04C01))

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 05 02 0757

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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