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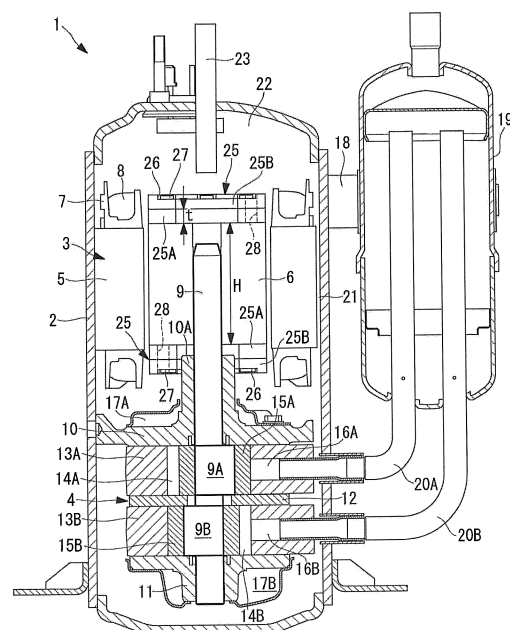
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(54) **ELECTRIC COMPRESSOR**

(57) An electric compressor 1 includes an electric motor 3, a rotary drive shaft 9 joined to a rotor 6 of the electric motor 3, a compression mechanism 4 including, at least on one end side of the rotary drive shaft 9, bearing members 10, 11 configured to support the rotary drive shaft 9 and driven through the rotary drive shaft 9, and a weight member 25 as a rotary inertia body provided at least on the end surface of the rotor 6 close to the compression mechanism 4 or each end surface of the rotor 6. The weight member 25 provided on the end surface of the rotor 6 close to the compression mechanism 4 is a ring-shaped weight member 25 hung over the outer periphery of a boss portion 10A of the bearing member 10 forming the compression mechanism 4 and having a flat outer end surface.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The present invention relates to an electric compressor configured such that a compression mechanism is driven through a rotary drive shaft by an electric motor.

2. DESCRIPTION OF RELATED ART

[0002] For an electric compressor applied to a refrigerator, an air conditioner, etc., a magnetic motor configured such that a permanent magnet is embedded in a rotor is used as an electric motor. It has been known that in the case of using a rare-earth magnet as the above-described magnet to increase magnetic force to obtain the same output, the axial thickness dimension of the rotor can be reduced for reduction in the weight and size of the electric motor and also of the electric compressor. However, in the case of using the rare-earth magnet, the weight of the rotor itself is reduced, and inertia force in rotation is decreased. For this reason, a change in the angular velocity of the motor rotor due to a change in a gas compression torque in a compression stroke becomes greater. This leads to a lower efficiency of the electric compressor and an increase in vibration and noise in the electric compressor.

[0003] For the above-described reasons, in order to reduce the change in the angular velocity of the motor rotor and to realize performance improvement of the electric compressor and reduction in vibration and noise in the electric compressor, the following has been proposed as described in, e.g., Japanese Unexamined Patent Application, Publication No. 2005-248843 and Japanese Unexamined Patent Application, Publication No. 2007-146736: a mass body (a weight member) as a rotary inertia body is provided at least on one or both of end surfaces of a motor rotor, and the inertia force of the mass body is used to reduce a change in the angular velocity of the motor rotor.

{PTL 1}

Japanese Unexamined Patent Application, Publication No. 2005-248843

{PTL 2}

Japanese Unexamined Patent Application, Publication No. 2007-146736

BRIEF SUMMARY OF THE INVENTION

[0004] However, a compression mechanism is, through a bearing member, provided at least at one end portion of a rotary drive shaft joined to the motor rotor. With the weight member provided on the rotor, whirling is caused in proportional to the weight of the weight member and the distance between the compression mecha-

nism and the electric motor. This might provide an adverse effect on balancing in a rotation system. Depending on the shape and fixing structure of the weight member, the weight member also serves as, e.g., a balance weight for balancing in the rotation system. Thus, in the configuration in which part of an outer peripheral surface or an outer end surface of the weight member is provided with a protrusion or in which a swaging portion of each rivet fixing the weight member protrudes, such a protrusion mixes lubricant oil and refrigerant gas in the electric compressor, leading to promotion of a power loss and an oil loss. Thus, the shape and fixing structure of the weight member need to be devised.

[0005] The present invention has been made in view of the above-described situation, and is intended to provide an electric compressor configured such that a weight member(s) as a rotary inertia body is provided on a rotor to reduce a change in the angular velocity of the rotor in order to realize performance improvement of the electric compressor and reduction in noise and vibration in the electric compressor and to reduce whirling due to the weight member(s) and an oil loss due to mixing of lubricant oil and refrigerant gas.

[0006] In order to solve the above-described problems, the electric compressor of the present invention employs the following techniques.

[0007] That is, the electric compressor of the present invention includes an electric motor including a stator and a rotor, a rotary drive shaft joined to the rotor of the electric motor, a compression mechanism including, at least on one end side of the rotary drive shaft, a bearing member configured to support the rotary drive shaft and driven through the rotary drive shaft, and a weight member as a rotary inertia body provided at least on a compression mechanism side end surface or each end surface of the rotor of the electric motor. The weight member provided on the compression mechanism side end surface of the rotor is a ring-shaped weight member hung over the outer periphery of a boss portion of the bearing member forming the compression mechanism and having a flat outer end surface.

[0008] According to the present invention, the weight member as the rotary inertia body provided at least on the compression mechanism side end surface of the rotor is hung over the outer periphery of the boss portion of the bearing member forming the compression mechanism, and is in the ring shape with the flat outer end surface. Thus, the weight member as the rotary inertia body increases inertia force to reduce a change in the angular velocity of the motor rotor due to a change in a gas compression torque in a compression stroke, leading to performance improvement of the electric compressor and reduction in noise and vibration in the electric compressor. Since the weight member is placed close to the compression mechanism as much as possible, whirling due to the weight member can be reduced. In addition, an oil loss caused due to the following reason can be reduced: lubricant oil is mixed by rotation of the weight member in

the electric compressor, and accordingly, the lubricant oil scatters to cause the oil loss. Thus, the efficiency of the electric compressor can be further increased, and performance improvement and reduction in vibration and noise can be realized. Moreover, because of reduction in the oil loss, reliability in lubrication and heat exchange performance on a refrigeration cycle size can be improved.

[0009] In the above-described aspect of the electric compressor of the present invention, the weight member provided on each end surface of the rotor is a ring-shaped weight member having a flat outer end surface.

[0010] According to the present invention, the weight member provided on each end surface of the rotor is the ring-shaped weight member with the flat outer end surface. Thus, mixing due to contact among an outer peripheral surface or an outer end surface of the rotating weight member, lubricant oil, and refrigerant gas in the electric compressor is reduced. This reduces a power loss, scatter of lubricant oil, and contact between such oil and refrigerant gas due to the above-described mixing, as well as reducing the oil loss due to mixing promotion. Thus, the efficiency of the electric compressor can be further increased. Moreover, because of reduction in the oil loss, reliability in lubrication and heat exchange performance on the refrigeration cycle size can be improved.

[0011] In any of the above-described aspects of the electric compressor of the present invention, the weight member is, with a rivet or a bolt/nut, integrally joined to the rotor at a plurality of countersunk portions provided at the outer end surface of the weight member, and a swaging portion of the rivet or a head portion of the bolt/nut is housed in a corresponding one of the countersunk portions.

[0012] According to the present invention, the weight member is, with the rivet or the bolt/nut, integrally joined to the rotor at the countersunk portions provided at the outer end surface of the weight member, and the swaging portion of the rivet or the head portion of the bolt/nut can be housed in a corresponding one of the countersunk portions. This can prevent the swaging portion or the head portion of the bolt/nut from protruding outward from the outer end surface of the weight member because the weight member is, with the rivet or the bolt/nut, integrally joined to the rotor at the countersunk portions and the swaging portion or the head portion of the bolt/nut is housed in a corresponding one of the countersunk portions. Thus, mixing of lubricant oil and refrigerant gas by the swaging portion of the rivet or the head portion of the bolt/nut can be prevented, and the oil loss can be further reduced.

[0013] In any of the above-described aspects of the electric compressor of the present invention, the weight member is in such an asymmetrical shape that a hole is provided at a predetermined eccentric position, and serves as both a rotary inertia body and a balance weight.

[0014] According to the present invention, the weight member is in such an asymmetrical shape that the hole

is provided at the predetermined eccentric position, and serves as both the rotary inertia body and the balance weight. Thus, the weight member can function not only as the rotary inertia body but also as the balance weight for balancing in the rotation system because the hole is provided at the predetermined eccentric position of the weight member as the rotary inertia body to reduce a hole-side weight. Consequently, only providing the hole can offer two functions of the rotary inertia body and the balance weight without providing a protrusion etc. at one weight member. As a result, each of the above-described advantageous effects can be provided while configuration simplification and cost reduction can be realized.

[0015] In any of the above-described aspects of the electric compressor of the present invention, an end portion of the weight member close to the rotor is formed of a nonmagnetic body, and an outer end portion of the weight member is formed of a magnetic body.

[0016] According to the present invention, the end portion of the weight member close to the rotor is formed of the nonmagnetic body, and the outer end portion of the weight member is formed of the magnetic body. Thus, magnetic flux leakage from the rotor end surface can be prevented by the nonmagnetic body while part of the weight member can be formed of the magnetic body as an inexpensive material such as an iron-based material. That is, a nonmagnetic body such as a brass material (brass) and a stainless steel material as high specific gravity metal materials has been typically used for the weight member of this type to prevent magnetic flux leakage. However, the end portion of the weight member close to the rotor is formed of the nonmagnetic body such as a brass material, a stainless steel material, and high manganese steel, and the outer end portion of the weight member is formed of the magnetic body. Thus, magnetic flux leakage from the rotor end surface can be prevented while part of the weight member can be made of an inexpensive iron-based material such as cast iron. Consequently, the weight member can fulfill the functions thereof while cost reduction can be realized.

[0017] In the above-described aspect of the electric compressor of the present invention, the nonmagnetic body of the weight member has a thickness dimension t at least exceeding 5% of the axial thickness H of the rotor.

[0018] According to the present invention, the nonmagnetic body of the weight member has the thickness dimension t at least exceeding 5% of the axial thickness H of the rotor. Since the nonmagnetic body of the weight member has the thickness dimension t equal to or greater than 5% of the axial thickness H of the rotor, the outer end portion of the weight member can be formed of the inexpensive magnetic body such as cast iron while magnetic flux leakage can be sufficiently prevented. Thus, the weight member can fulfill the functions thereof, and cost reduction can be realized.

[0019] In any of the above-described aspects of the electric compressor of the present invention, the weight of the weight member at least exceeds 10% of the total

weight of the rotor.

[0020] According to the present invention, the weight of the weight member at least exceeds 10% of the total weight of the rotor. Thus, the total of the weight of the rotor and the weight of the weight member at least exceeding 10% of the total weight of the rotor ensures a weight required for reducing the change in the angular velocity of the motor rotor due to the change in the gas compression torque, and therefore, required inertia force is obtained. Accordingly, the change in the angular velocity of the rotor can be reduced. Consequently, efficiency lowering, vibration, and noise due to the change in the angular velocity of the rotor can be eliminated. As a result, performance improvement of the electric compressor and reduction in vibration and noise in the electric compressor can be realized.

[0021] According to the present invention, the weight member as the rotary inertia body increases inertia force to reduce the change in the angular velocity of the motor rotor due to the change in the gas compression torque in the compression stroke, leading to performance improvement of the electric compressor and reduction in noise and vibration in the electric compressor. In addition, since the weight member is placed close to the compression mechanism as much as possible, whirling due to the weight member can be reduced. In addition, the oil loss caused due to the following reason can be reduced: lubricant oil is mixed by rotation of the weight member in the electric compressor, and accordingly, the lubricant oil scatters to cause the oil loss. Thus, the efficiency of the electric compressor can be further increased, and performance improvement and reduction in vibration and noise can be realized. Moreover, because of reduction in the oil loss, reliability in lubrication and heat exchange performance on the refrigeration cycle size can be improved.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0022]

FIG. 1 is a longitudinal sectional view of an electric compressor of an embodiment of the present invention.

FIG. 2 is a plan view of a rotor of an electric motor incorporated into the electric compressor, and illustrates the rotor from an end surface side.

DETAILED DESCRIPTION OF THE INVENTION

[0023] An embodiment of the present invention will be described below with reference to FIGS. 1 and 2.

[0024] FIG. 1 is a longitudinal sectional view of an electric compressor of the embodiment of the present invention, and FIG. 2 is a plan view of a rotor of an electric motor of the electric compressor illustrated from an end surface side.

[0025] An electric compressor 1 of the present embodiment is a two-cylinder rotary electric compressor 1 configured such that an electric motor 3 and a two-cylinder rotary compression mechanism 4 are built in a closed housing 2. Needless to say, the present invention is not limited to such a two-cylinder rotary electric compressor 1.

[0026] The electric motor 3 including a stator 5 and a rotor 6 is fixed in an upper portion in the closed housing 2. The stator 5 is configured as follows: many annular magnetic steel plates provided with a plurality of punched-out tooth portions on an inner peripheral side are stacked on each other, and a stator wire 8 such as an aluminum wire is concentratedly wound around the tooth portions through an insulating bobbin 7. On the other hand, the rotor 6 is configured as follows: many annular magnetic steel plates provided with a plurality of punched-out magnet insertion holes are stacked on each other, and a permanent magnet (not shown) such as a ferrite magnet, a neodymium magnet as a rare-earth magnet, or a dysprosium magnet is inserted into each magnet insertion hole such that the magnet steel plates are integrally joined in a cylindrical shape with rivets or bolts/nuts. The rotor 6 is attached to an inner peripheral portion of the stator 5 with an air gap being formed therebetween.

[0027] The electric motor 3 is fixed in the closed housing 2 in such a manner that the stator 5 is shrink-fitted into the closed housing 2. The two-cylinder rotary compression mechanism 4 is fixed below the electric motor 3. The rotor 6 of the electric motor 3 is integrally joined to a rotary drive shaft 9 at one end portion thereof, and the compression mechanism 4 is coupled to the other end portion of the rotary drive shaft 9. With this configuration, the compression mechanism 4 is driven. At a lower portion of the rotary drive shaft 9, two eccentric shaft portions 9A, 9B are, with a predetermined spacing in an upper-lower direction, arranged facing each other such that the phases thereof shift from each other by 180 degrees.

[0028] The compression mechanism 4 includes, for example, a pair of upper and lower bearing members 10, 11; a pair of upper and lower cylinder bodies 13A, 13B provided between the upper and lower bearing members 10, 11 with a separator plate 12 being sandwiched between the upper and lower cylinder bodies 13A, 13B; cylinder chambers 14A, 14B each formed in a corresponding one of the cylinder bodies 13A, 13B and closed by the upper or lower bearing member 10, 11 and the separator plate 12 on the upper and lower sides; rotors 15A, 15B each rotatably fitted onto a corresponding one of the eccentric shaft portions 9A, 9B of the rotary drive shaft 9 in a corresponding one of the cylinder chambers 14A, 14B and each rotating on an inner peripheral surface of a corresponding one of the cylinder chambers 14A, 14B; and vanes slidably fitted into a radial groove provided in each cylinder body 13A, 13B and dividing the inside of each cylinder chamber 14A, 14B into a suction

side and a discharge side, and vane pressing springs of the vanes (any of them are not shown).

[0029] Note that the upper and lower bearing members 10, 11 are configured as follows: the upper bearing member 10 as a main bearing and the lower bearing member 11 as a sub bearing rotatably support the rotary drive shaft 9, a lower surface of the upper bearing member 10 closes one end of the cylinder chamber 14A formed in the cylinder body 13A, and an upper surface of the lower bearing member 11 closes one end of the cylinder chamber 14B formed in the cylinder body 13B. Such a two-cylinder rotary compression mechanism 4 has been widely known.

[0030] In the compression mechanism 4, the cylinder bodies 13A, 13B, the separator plate 12, and the upper and lower bearing members 10, 11 are, as illustrated in FIG. 1, integrally joined with, e.g., bolts in the following state: the cylinder bodies 13A, 13B are stacked respectively on both sides of the separator plate 12 to sandwich the separator plate 12, and the upper and lower bearing members 10, 11 are further stacked respectively on both upper and lower end surfaces of the cylinder bodies 13A, 13B. Such a compression mechanism 4 is fixed in the closed housing 2 in such a manner that the upper bearing member 10 is welded (plug-welded) to plural points of the closed housing 2. Note that instead of the upper bearing member 10, any of the cylinder bodies 13A, 13B may be fixed in the closed housing 2.

[0031] Low-pressure refrigerant gas having circulated in a refrigeration cycle is, by way of an accumulator 19 integrally assembled with the outer periphery of the closed housing 2 with a bracket 18, sucked into the pair of upper and lower cylinder chambers 14A, 14B of the compression mechanism 4 through suction pipes 20A, 20B and suction ports 16A, 16B provided respectively at the cylinder bodies 13A, 13B. The low-pressure refrigerant gas having sucked into the cylinder chambers 14A, 14B is compressed to a predetermined pressure in such a manner that each rotor 15A, 15B rotates, by the electric motor 3, through a corresponding one of the eccentric shaft portions 9A, 9B of the rotary drive shaft 9 in a corresponding one of the cylinder chambers 14A, 14B. Then, the resultant is discharged into discharge chambers 17A, 17B through discharge valves (not shown).

[0032] The high-pressure refrigerant gas having discharged into the discharge chambers 17A, 17B is discharged from the discharge chambers 17A, 17B into the closed housing 2, and then, is guided to an upper space 22 of the electric motor 3 through, e.g., a refrigerant flow path 21 formed between an outer peripheral surface of the stator 5 and an inner peripheral surface of the closed housing 2. Subsequently, the refrigerant gas circulates toward the refrigeration cycle through a discharge pipe 23. Note that a bottom portion in the closed housing 2 serves as an oil sump, and is filled with a predetermined amount of lubricant oil for the purpose of lubricating a sliding portion of the compression mechanism 4.

[0033] The electric motor 3 of the electric compressor

1 configured as described above is, at least on a lower end surface of the cylindrical rotor 6 close to the compression mechanism 4 or on both upper and lower end surfaces of the cylindrical rotor 6, provided with a weight member(s) 25 having both a balance weight function for balancing in a rotation system and a rotary inertia body function for reducing a change in the angular velocity of the rotor 6 due to a change in a gas compression torque in a compression stroke. Note that in the present embodiment, the weight member 25 is provided on each of the upper and lower end surfaces of the rotor 6, but the weight member 25 may be provided only on the lower end surface of the rotor 6 close to the compression mechanism 4.

[0034] Each weight member 25 is a ring-shaped mass body having a circular outer peripheral shape with the substantially same diameter as the outer diameter of the rotor 6 and having both end surfaces in a flat shape. Moreover, an upper end portion of a boss portion 10A of the upper bearing member 10 is inserted into the ring-shaped inner peripheral portion of the weight member 25 provided on the lower end surface of the rotor 6, and such a weight member 25 is hung over the outer periphery of the boss portion 10A. Thus, the electric motor 3 and the compression mechanism 4 are placed close to each other, and the distance between these two components is shortened as much as possible.

[0035] As illustrated in FIG. 2, four countersunk portions 26 having a predetermined depth are provided at equal intervals in a circumferential direction on an outer end side of the weight member 25. Each countersunk portion 26 is for preventing a swaging portion of each rivet 27 or a head portion of each bolt/nut (not shown) from protruding outward beyond the flat outer end surface of the weight member 25 when the weight member 25 is integrally fixed to each end surface of the rotor 6 with the rivets 27 or the bolts/nuts.

[0036] Moreover, the weight of the weight members 25 at least exceeds 10% of the total weight of the rotor 6 in order for each weight member 25 to function as a rotary inertia body for reducing the change in the angular velocity of the rotor 6. The total of the weight of the rotor 6 and the weight of the weight members 25 at least exceeding 10% of the total weight of the rotor 6 ensures a weight required for reducing the change in the angular velocity of the rotor 6 due to the change in the gas compression torque, and therefore, required inertia force is obtained. Thus, the change in the angular velocity of the rotor 6 can be reduced.

[0037] Further, the weight member 25 provided on a lower end side of the rotor 6 is provided with two holes 28 punched out at the positions eccentric in the direction facing 180 degrees the eccentric shaft portion 9A of the rotary drive shaft 9, and on the other hand, the weight member 25 provided on an upper end side of the rotor 6 is provided with two holes 28 punched out at the positions eccentric in the same direction as that of the eccentric shaft portion 9A of the rotary drive shaft 9. Thus, each weight member 25 is in an asymmetrical shape. A weight

on the side provided with the holes 28 is reduced, and therefore, each weight member 25 also has the balance weight function for balancing in the rotation system.

[0038] Moreover, each weight member 25 is formed of two different metal material layers stacked in the thickness direction thereof. That is, an end portion of the weight member 25 contacting the end surfaces of the rotor 6 is a nonmagnetic body 25A, and an outer end portion of the weight member 25 is a magnetic body 25B. In order to prevent magnetic flux leakage from the end surfaces of the rotor 6, e.g., a brass material (brass), a stainless steel material, or high manganese steel as a high specific gravity metal material can be used as the nonmagnetic body 25A, and an inexpensive iron-based material such as cast iron can be used as the magnetic body 25B. Thus, the weight member 25 is configured so that magnetic flux leakage can be prevented while the use amount of the relatively-expensive nonmagnetic body 25A such as the brass material (brass), the stainless steel material, and the high manganese steel is reduced as much as possible and that a required weight of the weight member 25 can be ensured.

[0039] In the case of using the above-described high specific gravity metal material, the thickness t of the nonmagnetic body 25A for preventing magnetic flux leakage is a thickness dimension t at least exceeding 5% of the axial thickness dimension H of the rotor 6. Note that the axial thickness dimension H of the rotor 6 of the electric motor 3 is about 80 mm to 100 mm, and the thickness t of the nonmagnetic body 25A is about 4 mm to 5 mm.

[0040] With the configuration described above, the following features and advantageous effects are provided according to the present embodiment.

[0041] In the electric compressor 1 described above, current with a required frequency is applied to the stator wire 8 of the electric motor 3 through an inverter to rotatably drive the rotor 6. Then, each rotor 15A, 15B of the two-cylinder rotary compression mechanism 4 rotates through the rotary drive shaft 9 joined to the rotor 6. Accordingly, low-pressure refrigerant gas having sucked into the cylinder chambers 14A, 14B through the suction pipes 20A, 20B and the suction ports 16A, 16B is compressed, and then, is discharged into the closed housing 2 through the discharge chambers 17A, 17B. Such high-pressure refrigerant gas is guided to the upper space 22 of the electric motor 3 through the refrigerant flow path 21 etc., and then, circulates to the refrigeration cycle through the discharge pipe 23.

[0042] Meanwhile, for the unbalance moment of the rotation system generated by rotation of the rotary drive shaft 9, the weight member 25 provided on each end surface of the rotor 6 of the electric motor 3 functions as a counter weight to provide a static unbalance amount or a dynamic unbalance amount, thereby reducing a rotation system unbalance amount. Thus, vibration and noise due to such an unbalance amount can be reduced. Consequently, the rotation system can be balanced in the electric compressor 1, and vibration and noise in the

electric compressor 1 can be reduced.

[0043] Reduction in the weight and size of the rotor 6 reduces the weight of the rotor itself, leading to smaller inertia force in rotation. For this reason, the change in the angular velocity of the rotor due to the change in the gas compression torque in the compression stroke tends to be greater. This leads to a lower efficiency of the electric compressor and greater vibration and noise in the electric compressor. However, since the weight member(s) 25 functioning as the rotary inertia body is provided at least on one or both of the end surfaces of the rotor 6, such inertia force reduces the change in the angular velocity of the rotor 6, and therefore, lowering of the efficiency and an increase in vibration and noise can be suppressed. Thus, the efficiency of the electric compressor 1 can be enhanced, and performance improvement and reduction in vibration and noise can be realized.

[0044] In particular, the weight member 25 as the rotary inertia body provided at least on the end surface of the rotor 6 close to the compression mechanism 4 is hung over the outer periphery of the boss portion 10A of the upper bearing member 10 forming the compression mechanism 4, and is in the ring shape with the flat outer end surfaces. Thus, the weight member 25 as the rotary inertia body increases inertia force to reduce the change in the angular velocity of the rotor 6 due to the change in the gas compression torque in the compression stroke, leading to performance improvement of the electric compressor 1 and reduction in noise and vibration in the electric compressor 1. Since the weight member 25 is placed close to the compression mechanism 4 as much as possible, whirling due to the weight member 25 can be reduced. In addition, an oil loss caused due to the following reason can be reduced: lubricant oil is mixed by rotation of the weight member 25 in the electric compressor 1, and accordingly, the lubricant oil scatters to cause the oil loss.

[0045] Thus, the efficiency of the electric compressor 1 can be further increased, and performance improvement and reduction in vibration and noise can be realized. Moreover, because of reduction in the oil loss, reliability in lubrication and heat exchange performance on a refrigeration cycle size can be improved.

[0046] In the present embodiment, the weight member 25 provided on each end surface of the rotor 6 is the ring-shaped weight member 25 with the flat outer end surfaces. Thus, mixing due to contact among the outer peripheral surface or outer end surfaces of the rotating weight member 25, lubricant oil, and refrigerant gas in the electric compressor 1 is reduced. This reduces a power loss, scatter of the lubricant oil, and contact between the lubricant oil and refrigerant gas due to the above-described mixing, as well as reducing the oil loss due to mixing promotion, for example. Thus, the efficiency of the electric compressor 1 can be further increased. Moreover, because of reduction in the oil loss, reliability in lubrication and heat exchange performance on the refrigeration cycle size can be improved.

[0047] Each weight member 25 is, with the rivets 27 or the bolts/nuts, integrally joined to the rotor 6 at the countersunk portions 26 provided at the outer end surface of the weight member 25, and each swaging portion of the rivets 27 or each head portion of the bolts/nuts can be housed in a corresponding one of the countersunk portions 26. This can prevent each swaging portion or each head portion of the bolts/nuts from protruding outward from the outer end surface of the weight member 25 because the weight member 25 is, with the rivets 27 or the bolts/nuts, integrally joined to the rotor 6 at the countersunk portions 26 and each swaging portion or each head portion of the bolts/nuts is housed in a corresponding one of the countersunk portions 26. Thus, mixing of lubricant oil and refrigerant gas by the swaging portions of the rivets 27 or the head portions of the bolts/nuts can be prevented, and the oil loss can be further reduced.

[0048] In the present embodiment, each weight member 25 is in such an asymmetrical shape that the holes 28 are provided at the predetermined eccentric positions, and serves as both the rotary inertia body and the balance weight. Thus, the weight member 25 can function not only as the rotary inertia body but also as the balance weight for balancing in the rotation system because the holes 28 are provided at the predetermined eccentric positions of the weight member 25 as the rotary inertia body to reduce the weight on the side close to the holes 28. Consequently, only providing the holes 28 can offer two functions of the rotary inertia body and the balance weight without providing a protrusion etc. at one weight member 25. As a result, each of the above-described advantageous effects can be provided while configuration simplification and cost reduction can be realized.

[0049] Further, the end portion of each weight member 25 close to the rotor 6 is formed of the nonmagnetic body 25A, and the outer end portion of the weight member 25 is formed of the magnetic body 25B. Thus, magnetic flux leakage from the end surface of the rotor 6 can be prevented by the nonmagnetic body 25A while part of the weight member 25 can be formed of the magnetic body 25B as an inexpensive material such as an iron-based material.

[0050] That is, a nonmagnetic body such as a brass material (brass) and a stainless steel material as high specific gravity metal materials has been typically used for the weight member 25 of this type to prevent magnetic flux leakage. However, the end portion of the weight member 25 close to the rotor 6 is formed of the nonmagnetic body 25A such as the brass material, the stainless steel material, and the high manganese steel, and the outer end portion of the weight member 25 is formed of the magnetic body 25B. Thus, magnetic flux leakage from the end surface of the rotor 6 can be prevented while part of the weight member 25 can be made of the inexpensive iron-based material such as cast iron. Consequently, the weight member 25 can fulfill the functions thereof while cost reduction can be realized.

[0051] At this point, the nonmagnetic body 25A of each

weight member 25 has the thickness dimension t at least exceeding 5% of the axial thickness H of the rotor 6. Since the nonmagnetic body 25A of the weight member 25 has the thickness dimension t equal to or greater than 5% of the axial thickness H of the rotor 6, the outer end portion of the weight member 25 can be formed of the inexpensive magnetic body 25B such as cast iron while magnetic flux leakage can be sufficiently prevented. Thus, the weight member 25 can fulfill the functions thereof, and cost reduction can be realized.

[0052] In the present embodiment, the weight of the weight members 25 at least exceeds 10% of the total weight of the rotor 6. Thus, the total of the weight of the rotor 6 and the weight of the weight members 25 at least exceeding 10% of the total weight of the rotor 6 ensures a weight required for reducing the change in the angular velocity of the rotor 6 due to the change in the gas compression torque, and therefore, required inertia force is obtained. Accordingly, the change in the angular velocity of the rotor 6 can be reduced. Consequently, efficiency lowering, vibration, and noise due to the change in the angular velocity of the rotor 6 can be eliminated. As a result, performance improvement of the electric compressor 1 and reduction in vibration and noise in the electric compressor 1 can be realized.

[0053] Note that the present invention is not limited to the aspect of the above-described embodiment, and modification can be optionally made without departing from the scope of the present invention. For example, in the above-described embodiment, the example where the present invention is applied to the two-cylinder rotary electric compressor 1 has been described. However, the present invention is, needless to say, applicable to the following compressors: a single-cylinder rotary electric compressor; a scroll electric compressor; various types of electric compressors each configured such that an electric motor 3 is placed in a lower portion in a closed housing 2 and that a compression mechanism 4 is placed in an upper portion in the closed housing 2; and an electric compressor configured such that two pairs of compression mechanisms 4 are placed respectively on upper and lower sides with the compression mechanisms 4 sandwiching an electric motor 3.

[0054] Moreover, the electric compressor 1 of the present invention is similarly applicable not only to a compressor for a refrigeration cycle using refrigerant such as R407C, R410A, R32, and R1234yf, but also to a compressor using, as lubricant oil, refrigerating machine oil applicable to the above-described refrigerant.

REFERENCE SIGN LIST

[0055]

1	electric compressor
3	electric motor
4	compression mechanism
5	stator

6 rotor
 9 rotary drive shaft
 10 upper bearing member
 10A boss portion
 11 lower bearing member
 25 weight member
 25A nonmagnetic body
 25B magnetic body
 26 countersunk portion
 27 rivet
 28 hole

Claims

1. An electric compressor (1) **characterised in that** it comprises:

an electric motor (3) including a stator (5) and a rotor (6) ;
 a rotary drive shaft (9) joined to the rotor (6) of the electric motor (3);
 a compression mechanism (4)

including, at least on one end side of the rotary drive shaft (9), a bearing member (10, 11) configured to support the rotary drive shaft and driven through the rotary drive shaft (9); and

a weight member (25) as a rotary inertia body provided at least on a compression mechanism (4) side end surface or each end surface of the rotor (6) of the electric motor (3),

wherein the weight member (25) provided on the compression mechanism side end surface of the rotor (6) is a ring-shaped weight member hung over an outer periphery of a boss portion (10A) of the bearing member (10, 11) forming the compression mechanism and having a flat outer end surface.

2. The electric compressor of claim 1, wherein the weight member (25) provided on each end surface of the rotor (6) is a ring-shaped weight member having a flat outer end surface.
3. The electric compressor of claim 1 or 2, wherein the weight member (25) is, with a rivet (27) or a bolt/nut, integrally joined to the rotor (6) at a plurality of countersunk portions (26) provided at the outer end surface of the weight member (25), and a swaging portion of the rivet (27) or a head portion of the bolt/nut is housed in a corresponding one of the countersunk portions (26).
4. The electric compressor of any one of claims 1 to 3, wherein

the weight member (25) is in such an asymmetrical shape that a hole (28) is provided at a predetermined eccentric position, and serves as both a rotary inertia body and a balance weight.

5. The electric compressor of any one of claims 1 to 4, wherein an end portion of the weight member (25) close to the rotor is formed of a nonmagnetic body (25A), and an outer end portion of the weight member is formed of a magnetic body (25B).
6. The electric compressor of claim 5, wherein the nonmagnetic body (25A) of the weight member (25) has a thickness dimension t at least exceeding 5% of an axial thickness H of the rotor (6).
7. The electric compressor of any one of claims 1 to 6, wherein a weight of the weight member (25) at least exceeds 10% of a total weight of the rotor (6).

FIG. 1

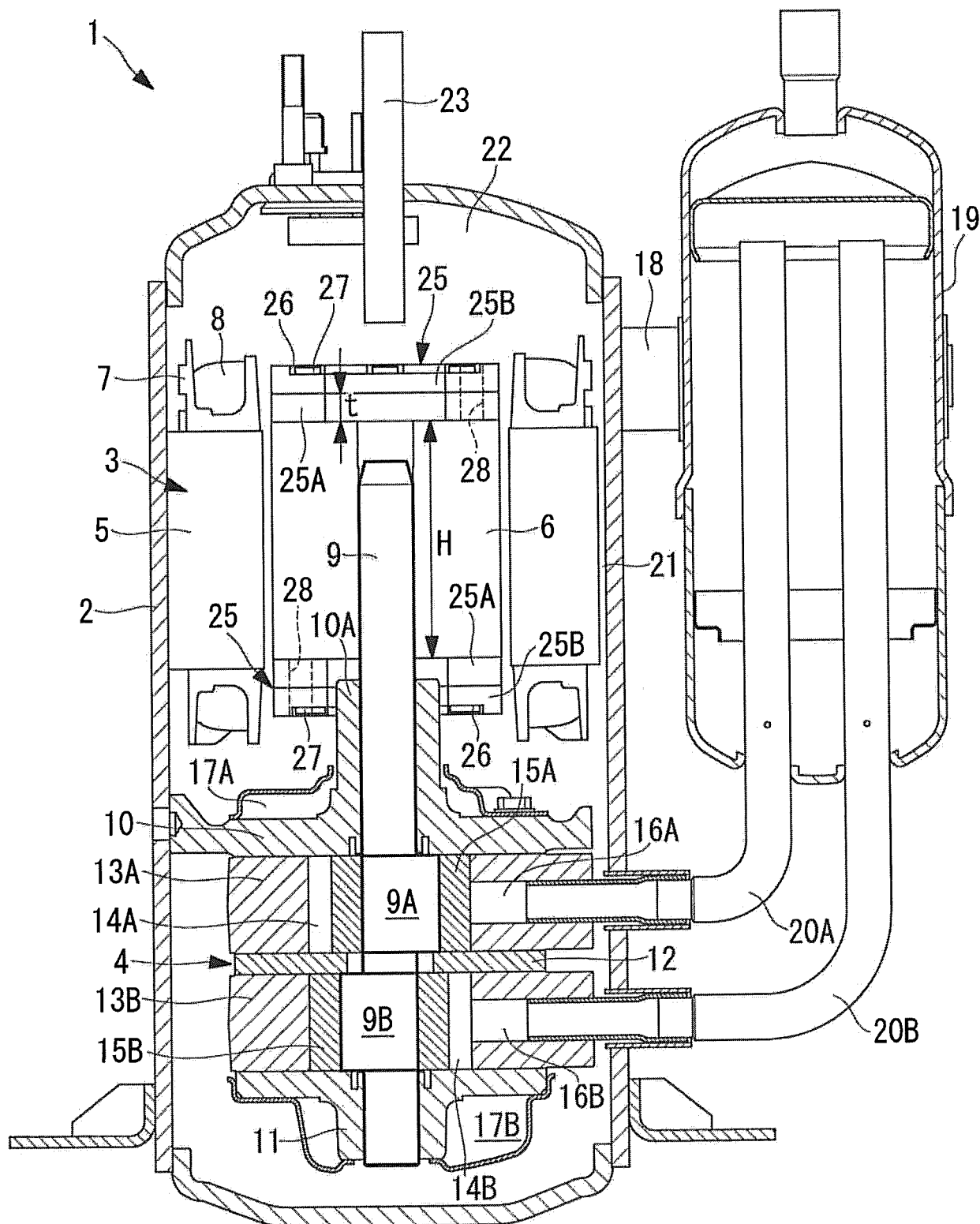
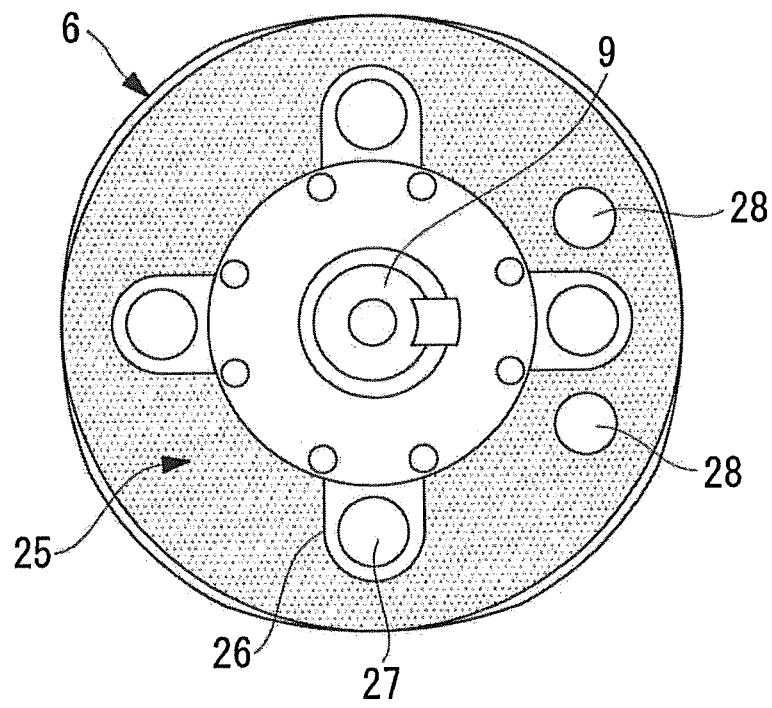


FIG. 2





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Application Number
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