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(54) SCROLL TYPE COMPRESSOR

(57) While using an Oldham mechanism as a spin prevention unit mechanism, an Oldham ring is positively lubricated by keeping a medium mixe with oil on a back surface of a turning scroll, and a compression mechanism is kept compact. In a scroll type compressor in which an Oldham ring (18) is provided between a turning scroll member (11) and a block member (5) that axially supports a drive shaft, a fixed scroll member (10) and the block members (5) hold an annular thrust race (16) that receives a load in an axial direction from the turning scroll member (11) with the thrust race sandwiched therebetween, an end of the turning scroll member (11) is slidably brought into close contact with the thrust race (16) on an entire circumference thereof, the thrust race (16) is brought into close contact with the end surface of the block member (5) to the outer side in a radial direction beyond key groove portions (25b, 25c) which are paired and formed on the block member (5), the turning scroll member (11), the thrust race (16), and the block member (5) define a retention space, and the medium with oil is retained in the retention space.

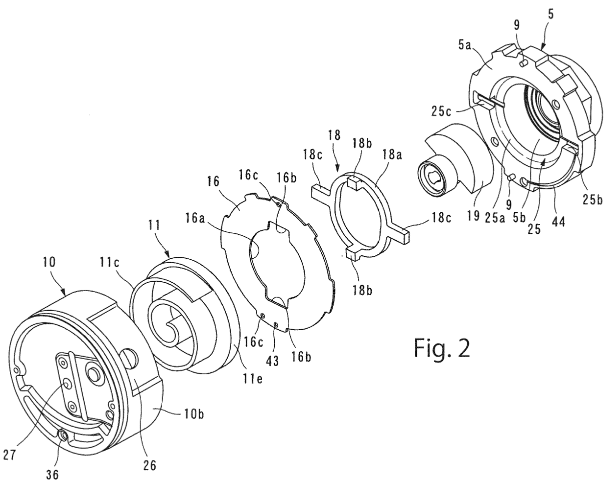

Fig. 2

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Description

Technical Field

[0001] The present invention relates to a scroll-type compressor which is used in a refrigerating cycle of a vehicle-use air conditioner or the like, and more particularly to a scroll-type compressor capable of ensuring reliability of a rotation prevention mechanism using an Oldham ring.

Background Art

[0002] The scroll-type compressor includes: a fixed scroll member which is fixed to the inside of a housing and has an end plate and a spiral wall which is raised from the end plate; and an orbiting scroll member which is arranged to face the fixed scroll member in an opposed manner, and has an end plate and a spiral wall raised from the end plate. Due to the orbiting movement of the orbiting scroll member, a compression chamber formed between the spiral walls of both scroll members is moved toward the center while decreasing a volume thereof thus compressing a working fluid.

[0003] In such a compressor, a block member (pivotally supporting member) which pivotally supports a drive shaft on a side opposite to a side where the orbiting scroll member faces the fixed scroll member in an opposed manner is fixed to the housing. In JP-A-8-219061 and JP-A-2006-266123 described below, an Oldham ring which prevents the rotation of the orbiting scroll member is arranged between the block member and the orbiting scroll member.

The Oldham ring includes: key portions which are slidably accommodated in key grooves formed on the block member and the orbiting scroll member respectively. Since the key portions are always brought into slide contact with the block member and the orbiting scroll member, it is necessary to ensure favorable lubrication.

[0004] Accordingly, in JP-A-8-219061, the following are provided: in the block member, a through hole in which a main bearing for rotatably holding the drive shaft; a support portion which is arranged in an end portion of the through hole and extends toward the center in the radial direction; a bearing swing space where a swing bearing on which a swing shaft mounted on the drive shaft with eccentricity is mounted swings; a body swing space where an orbiting scroll member (swing scroll body) swings are formed; a thrust bearing portion which extends outwardly in the radial direction and is brought into contact with the swing scroll body on a plane which spreads in the radial direction from the bearing swing space to the body swing space; an Oldham ring accommodating groove which is formed on an outer side of the thrust bearing portion in the radial direction; and a block-side key groove which is formed in the radial direction ranging from the Oldham ring accommodating portion to a peripheral wall portion of the body swing space. Further, a scroll-side key groove is formed in the orbiting scroll member such that the scroll-side key groove is formed in the radial direction perpendicular to the block-side key groove. The Oldham ring is arranged in the Oldham ring accommodating groove, and is configured to include a block-side pawl which is slidably inserted into the block-side key groove formed in the block member, and a scroll-side pawl which is slidably inserted into the scroll-side key groove formed in the orbiting scroll member.

[0005] An oil space which is arranged between the drive shaft and the support portion, is defined by the drive shaft and the block and is communicated with an oil reservoir, a bearing space which is defined by inserting the swing shaft into the swing bearing, and an oil introducing hole which makes the oil space and the bearing space communicate with each other are provided. By interrupting the oil space and the bearing swing space by sealing, a lubrication oil passage is formed such that lubrication oil is made to flow from the oil space to the body swing space through the oil introducing hole, the bearing space, the swing bearing, a slide contact portion between the swing shaft and the swing bearing, the bearing swing space and the trust bearing portion. Further, by providing oil guides which spread outwardly in the radial direction from the body swing space where the orbiting scroll member is accommodated to the block-side key grooves where the block-side pawls of the Oldham ring are slidably inserted along the swing direction of the orbiting scroll member, lubrication oil in the body swing space is pushed out outwardly in the radial direction along the oil guides due to swing operation of the orbiting scroll member so that oil can be positively supplied to the block-side key grooves.

[0006] Further, JP-A-2006-266123 discloses the constitution where, for suppressing a drawback where lubrication oil is not sufficiently filled in a back surface side of an orbiting scroll member so that a wear is generated on a slide portion of the Oldham ring or the Oldham ring generates vibrations or an impact sound, a back pressure chamber is formed on a back surface of the orbiting scroll member, the orbiting scroll member is pressed to a fixed scroll side by regulating a pressure in the back pressure chamber by a valve device arranged between the back pressure chamber and an intake chamber, and lubrication oil is filled in the back pressure chamber so as to prevent wear on the Oldham ring arranged in the back pressure chamber.

[0007] However, the scroll compressor disclosed in JP-A-8-219061 is constituted such that oil supplied from a gap formed in a bearing of the orbiting scroll passes through a thrust slide surface and, thereafter, oil passes through key grooves formed in the Oldham ring of the swing scroll, and is introduced to an intake region outside the orbiting scroll. In this manner, the scroll compressor disclosed in JP-A-8-219061 has no particular structure for holding oil and hence, oil which flows into a body swing space does not retain in the body swing space and is sucked directly into a compression mechanism. Accordingly, there is a possibility of a drawback where the lubrication of block-side pawls and the block-side key grooves of the Oldham ring is not sufficiently performed. Particularly, in a vehicle-use compressor which is placed laterally (horizontally), there may be a case where an intake passage of the compression mechanism is provided on a lower portion of the compressor. Accordingly, there is a possibility that oil will not be sufficiently supplied to a slide portion (the pawls, the key grooves and the like arranged above the Oldham ring) which is disposed above the compressor thus giving rise to a possibility of insufficient lubrication.

[0008] In this respect, JP-A-2006-266123 discloses the constitution where the orbiting scroll member completely floats because of the pressure in the back pressure chamber so that the orbiting scroll member is brought into close contact with the fixed scroll member. Accordingly, even when a back pressure leaks to the outside of an end plate of the orbiting scroll member in the radial direction through the gap formed between the block member (main bearing member) and the orbiting scroll or the key grooves of the Oldham ring, oil in the back pressure chamber can be held. However, in such a type of configuration where the orbiting scroll member is pressed to the fixed scroll member by a back pressure of the orbiting scroll member, the pressure on the back surface of the orbiting scroll member is increased with respect to an intake pressure region of the compression mechanism and hence, it is necessary to cover the compression space including the intake pressure region of the fixed scroll member with the end plate of the orbiting scroll member. Accordingly, the end plate becomes extremely large in relation to a wrap of the orbiting scroll member thus giving rise to a drawback that an outer diameter of the orbiting scroll member becomes inevitably large whereby an outer diameter of the compressor also becomes large eventually.

[0009] The invention has been made in view of the above-mentioned circumstances, and it is a main object of the invention to provide a scroll-type compressor which can form a space where oil or a working fluid mixed with oil is retained to some extent on a back surface of an orbiting scroll member even when an Oldham mechanism is used as a rotation prevention mechanism thus surely performing the lubrication of an Oldham ring and also maintaining a compression mechanism in a compact shape.

Further, it is also an object of the invention to provide a scroll-type compressor which can suppress fluttering of the Oldham ring arranged between an orbiting scroll member and a block member.

[0010] To overcome the above-mentioned drawbacks, a scroll-type compressor according to the invention includes: a fixed scroll member whose movement in the rotational direction and the axial direction with respect to the inside of a housing is limited; a drive shaft which transmits a rotational force; an orbiting scroll member which is arranged to face the fixed scroll member in an opposed manner, and is connected to the drive shaft by way of an eccentric shaft which is eccentric with respect to a shaft center of the drive shaft so that the orbiting scroll member performs an orbiting movement about the shaft center of the drive shaft; a block member which is provided on a side of the orbiting scroll member opposite to a side to which the fixed scroll member faces in an opposed manner (while being integrally formed with the housing or being fixed to the housing), and pivotally supports the drive shaft; and a rotation prevention member which is arranged between the orbiting scroll member and the block member, includes a plurality of key portions which are slidably engaged with a plurality of key groove portions formed on a back surface of the orbiting scroll member and a plurality of key portions which are slidably engaged with a plurality of key groove portions formed on an end surface of the block member which faces the orbiting scroll member in an opposed manner, and prevents the rotation of the orbiting scroll member by making the key portions engaged with the key groove portions corresponding to the key portions respectively, wherein a medium is compressed by moving a compression chamber formed by the fixed scroll member and the orbiting scroll member toward a center side while reducing a volume thereof due to the orbiting movement of the orbiting scroll member, characterized in that an annular thrust race which receives the orbiting scroll member in the axial direction is sandwiched between the fixed scroll member and the block member, the thrust race is slidably brought into close contact with the whole circumference of an end surface of the orbiting scroll member which faces the thrust race in an opposed manner, and the thrust race is brought into close contact with the end surface of the block member to an area outside the key groove portions formed on the block member in the radial direction, and a retention space is defined by the orbiting scroll member, the thrust race and the block member, and the medium (oil or a working fluid mixed with oil) compressed in the compression chamber is supplied to and is retained in the retention space.

[0011] In this manner, the thrust race is sandwiched between the fixed scroll member and the block member, and the thrust race is slidably brought into close contact with the whole circumference of the end surface of the orbiting scroll member. Accordingly, there is no possibility that the medium which is introduced into the retention space will leak through between the orbiting scroll member and the thrust race. Further, the thrust race is brought into close contact with the end surface of the block member to an area outside the key groove portions formed on the block member in the radial direction. Accordingly, there is no possibility that the medium which is introduced into the retention space through the key groove portions formed on the block member will leak. Accordingly, it is possible to retain the medium (oil or a working fluid mixed with oil) compressed in the compression chamber in the retention space defined by the orbiting scroll member, the thrust race and the block member and hence, the favorable lubrication of the Oldham ring can be maintained. Further, the thrust race is provided between the fixed scroll member and the block member and hence, it is unnecessary to cover the compression space including an intake pressure region of the fixed scroll member with an end plate of the orbiting scroll member whereby an outer diameter of the orbiting scroll member can be made small.

[0012] As the constitution which slidably brings the thrust race into close contact with the whole circumference of the end surface of the orbiting scroll member which faces the thrust race in an opposed manner, an annular slide surface with which the thrust race is brought into close contact may be formed by forming a recessed portion on a back surface of the end plate of the orbiting scroll which faces the thrust race in an opposed manner, and the slide surface may be formed such that the slide surface does not project from the thrust race.

As the constitution by which the medium (oil or a working fluid mixed with oil) compressed in the compression chamber is supplied to the retention space defined by the orbiting scroll member, the thrust race and the block member, a discharge region where the working fluid which is compressed in the compression chamber is discharged may be formed behind the fixed scroll member in the inside of the housing, and the discharge region and the retention space may be communicated with each other through a pressure supply passage having a throttle formed in a middle portion thereof.

[0013] The retention space and an intake passage through which the working fluid is introduced into the compression chamber may be communicated with each other through a pressure release passage, and a pressure regulating valve may be arranged in the middle portion of the pressure release passage so that a retention state of the medium in the retention space may be regulated, and a pressure in the retention space may be maintained at a predetermined pressure set in advance.

[0014] As a specific example of the above-mentioned constitution, the scroll compressor may be configured such that the rotation prevention member is arranged in an Oldham accommodating portion which is formed in the block portion, and is constituted of: a ring portion; a pair of key portions which is formed on the ring portion in a projecting manner, passes through the thrust race, and is slidably engaged with the pair of key groove portions formed on the back surface of the orbiting scroll member; and a pair of key portions which is formed on both sides of the ring portion in the radial direction in a projecting manner, and is slidably engaged with the pair of key groove portions formed on the block member, the Oldham accommodating portion is constituted of a ring portion accommodating portion which accommodates the ring portion therein, and a pair of key groove portions which is communicated with the ring portion accommodating portion and with which the pair of key portions formed on both sides of the ring portion in the radial direction in a projecting manner is slidably engaged, and the pressure supply passage is communicated with one of the pair of key groove portions formed on the block member, and the pressure release passage is communicated with the other of the pair of key groove portions formed on the block member.

[0015] Due to such a constitution, although oil is separated from a working fluid which is discharged into the discharge chamber to some extent in the scroll-type compressor, the separated oil or the working fluid mixed with oil is introduced into one of the pair of key groove portions from the discharge chamber through the pressure supply passage and, thereafter, is introduced into the other key groove portion through the ring portion accommodating portion and, thereafter, is discharged into the intake passage through the pressure release passage. Accordingly, it is possible to supply an abundant amount of oil to the slide part such as the Oldham ring.

[0016] As has been explained above, according to the invention, the annular thrust race which receives the orbiting scroll member in the axial direction is sandwiched between the fixed scroll member and the block member, the thrust race is slidably brought into close contact with the whole circumference of the end surface of the orbiting scroll member, and the thrust race is brought into close contact with the end surface of the block member to an area outside the key groove portions formed on the block member in the radial direction and hence, the retention space is defined by the orbiting scroll member, the thrust race and the block member, and the medium compressed in the compression chamber is retained in the retention space. Accordingly, while adopting the Oldham mechanism as the rotation prevention mechanism, it is possible to retain a certain amount of oil or a working fluid mixed with oil on a back surface of the orbiting scroll member so that regardless of the installation state of the compressor, the lubrication of the Oldham ring can be surely performed, and the compression mechanism can be maintained in a compact shape.

[0017] Further, to retain the medium compressed in the compression chamber in the retention space defined by the orbiting scroll member, the thrust race and the block member, the discharge region where the working fluid which is compressed in the compression chamber is discharged and the retention space are communicated with each other through the pressure supply passage having the throttle formed in the middle portion thereof, and the retention space and the intake passage through which the working fluid is introduced into the compression chamber are communicated with each other through the pressure release passage where the pressure regulating valve is arranged in the middle portion of the pressure release passage. By adopting such a constitution, a retention state of the medium retaining in the retention space can be regulated by the pressure regulating valve, and also a pressure in the retention space can be regulated to a desired intermediate pressure.

[0018] Further, the rotation prevention member is accommodated in the Oldham accommodating portion which is formed in the block portion. The rotation prevention member is formed as the Oldham ring which includes the ring portion, the pair of key portions which is formed on the ring portion in a projecting manner, passes through the thrust race, and is slidably engaged with the pair of key groove portions formed on the back surface of the orbiting scroll member, and the pair of key portions which is formed on both sides of the ring portion in the radial direction in a projecting manner, and is slidably engaged with the pair of key groove portions formed on the block member. The Oldham accommodating portion is constituted of the ring portion accommodating portion which accommodates the ring portion therein, and the pair of key groove portions which is communicated with the ring portion accommodating portion and with which the pair of key portions formed on both sides of the ring portion in the radial direction in a projecting manner is slidably engaged. In the above-mentioned constitution, by making the pressure supply passage communicated with one of the pair of key groove portions formed on the block member, and by making the pressure release passage communicated with the other of the pair of key groove portions formed on the block member, the passage which allows the medium (oil or working fluid mixed with oil) compressed in the compression chamber to pass through the slide portion of the Oldham ring is formed. Accordingly, regardless of the installation state of the compressor, it is possible to supply an abundant amount of oil to the slide portion of the rotation prevention member or the like thus ensuring a favorable lubrication state of the rotation prevention member or the like.

[0019]

[Fig. 1] Fig. 1 is a cross-sectional view showing an example of the whole constitution of a scroll-type compressor according to the invention including a cross section taken along a line C-C in Fig. 5 and Fig. 6B.

[Fig. 2] Fig. 2 is an exploded perspective view showing respective parts used in an area ranging from a block member to a fixed scroll member of the scroll-type compressor according to the invention.

[Fig. 3] Fig. 3A is a cross-sectional view showing the constitution ranging from the fixed scroll member to the block member which is housed in a housing of the scroll-type compressor taken along a line B-B in Fig. 5 and Fig. 6B. Fig. 3B is a view of the fixed scroll member shown in Fig. 3A as viewed in the axial direction.

[Fig. 4] Fig. 4A and Fig. 4B are views showing an orbiting scroll member, wherein Fig. 4A is a cross-sectional view taken along a line B-B in Fig. 4B and Fig. 5, and Fig. 4B is a view of a side of the orbiting scroll member which faces a thrust race in an opposed manner as viewed in the axis direction.

[Fig. 5] Fig. 5 is a view showing a side of the block member which faces the thrust race in an opposed manner as viewed in the axial direction.

[Fig. 6] Fig. 6A is a cross-sectional view showing the constitution ranging from the orbiting scroll member to the block member shown in Fig. 3A taken along a line B-B in Fig. 5 and Fig. 6B. Fig. 6B is a view as viewed from a line A-A in Fig. 6A.

Description of Embodiments

[0020] Hereinafter, a scroll-type compressor of the invention is explained in conjunction with an embodiment where an electric compressor which is formed of an integral body consisting of a compression mechanism and a motor is used as the scroll-type compressor by reference with attached drawings.

[0021] Fig. 1 shows an electric compressor 1 suitable for a refrigerating cycle which uses a refrigerant as a working fluid. In the electric compressor 1, a compression mechanism 3 and a motor 4 which drives the compression mechanism 3 are arranged in the inside of a housing 2 made of an aluminum alloy, wherein the compression mechanism 3 is arranged on a left side in the drawing, and the motor 4 is arranged on a right side in the drawing. In Fig. 1, a front side of the compressor is arranged on a right side in the drawing, and a rear side of the compressor is arranged on a left side in the drawing.

[0022] A drive shaft 8 is arranged in the housing 2 in such a manner that the drive shaft 8 is rotatably supported on a block member (shaft support member) 5 which is fixed to a middle portion of an inner side of the housing 2 and a front wall portion 2a by way of bearings 6, 7.

[0023] The compression mechanism 3 is of a scroll type which includes a fixed scroll member 10 and an orbiting scroll member 11 arranged to face the fixed scroll member 10 in an opposed manner. The fixed scroll member 10 is constituted of: a disc-shaped end plate 10a which is fixed to an inner side of a rear portion of the housing 2; a cylindrical outer peripheral wall 10b which is formed over the whole circumference of the end plate 10a along an outer periphery of the end plate 10a and is raised from the end plate 10a in the frontward direction; and a whirlpool-like spiral wall 10c which extends frontwardly from the end plate 10a inside the outer peripheral wall.

[0024] The orbiting scroll member 11 is constituted of a disc-shaped end plate 11 a and a whirlpool-like spiral wall 11c which is raised from the end plate 11a in the rearward direction. An eccentric shaft 8a which is formed on a rear end portion of the drive shaft 8 and is eccentrically arranged from a shaft center of the drive shaft is connected to a boss portion 11b formed on a back surface of the end plate 11a by way of a bushing 12 and a bearing 13. Accordingly, the orbiting scroll member 11 is supported in an orbiting manner about the shaft center of the drive shaft 8.

[0025] The fixed scroll member 10 and the orbiting scroll member 11 have respective spiral walls 10c, 11c thereof meshed with each other, and a distal end of each one scroll member is brought into contact with the end plate 10a, 11a of the counterpart scroll member. Accordingly, a compression chamber 15 is defined in a space surrounded by the end plate 10a and the spiral wall 10c of the fixed scroll member 10 and the end plate 11a and the spiral wall 11c of the orbiting scroll member 11.

[0026] As shown in Fig. 2 and Fig. 3, a thin-plate-shaped annular thrust race 16 is sandwiched between the outer peripheral wall 10b of the fixed scroll member 10 and an end surface 5a of the block member 5, and the fixed scroll member 10 and the block member 5 are made to abut each other by way of the thrust race 16.

[0027] The thrust race 16 is made of a material possessing excellent wear resistance. The thrust race 16 is formed into a size such that an outer peripheral shape conforms to an outer peripheral shape of the end surface 5a of the block member 5 which the thrust race 16 faces in an opposed manner. A center hole 16a which allows the boss portion 11b of the orbiting scroll member 11 to pass there through is formed in a center portion of the thrust race 16. The fixed scroll member 10, the thrust race 16 and the block member 5 are positioned and fixed by positioning pins 9 which are inserted into pin insertion holes 16c formed in the thrust race 16.

As also shown in Fig. 4, a recessed portion 11d is formed on a back surface of the orbiting scroll member 11 in such a manner that a portion ranging from a periphery to the boss portion 11b is slightly (by approximately 0.5mm, for example) indented (decreasing a thickness of the end plate) while leaving the periphery having a predetermined width (for example, approximately 2mm). The thrust race 16 allows the boss portion 11b of the orbiting scroll member 11 to pass through the center hole 16a thereof, and is brought into close contact with the whole circumference of a back surface of the orbiting scroll member 11. Accordingly, on the back surface of the end plate 11a of the orbiting scroll member 11, an annular slide surface 11f having a predetermined width is formed on the periphery of the end plate 11a in such a manner that the annular slide surface 11f surrounds the recessed portion 11d.

The slide surface 11f of the orbiting scroll member 11 is formed such that the slide surface 11f does not cross the center hole 16a and cutaway portions 16b formed in the thrust race 16 during the orbiting movement of the orbiting scroll member 11 (such that the center hole 16a and the cutaway portions 16b are always arranged inside the slide surface 11f), and the slide surface 11f is brought into slide contact with the thrust race 16 such that the slide surface 11f does not go beyond or project from the thrust race 16.

Further, key groove portions 11e which extend in the radial direction are formed on the recessed portion 11d. The key groove portions 11e formed on the recessed portion 11d are formed so as not to go beyond (penetrate the slide surface 11f) the periphery of the end plate 11a, and are formed inside the annular slide surface 11f.

[0028] The block member 5 has a through hole 5b at the center thereof, and is formed into a cylindrical shape such that a diameter of an inner surface of the block member 5 is stepwisely increased. In the block member 5, from a front side remotest from the thrust race 16, a sealing member accommodating portion 22 which accommodates a sealing member 21 for sealing a gap between the block member 5 and the drive shaft 8 therein, a bearing accommodating portion 23 which accommodates the bearing 6 therein, a weight accommodating portion 24 which accommodates a balance weight 19 which is integrally formed with the bushing 12 and is rotated along with the rotation of the drive shaft 8 therein, and an Oldham accommodating portion 25 which is formed from the end surface 5a of the block member 5 and accommodates an Oldham ring 18 described later between the Oldham accommodating portion 25 and the thrust race 16 are formed.

[0029] A rotation prevention mechanism of the orbiting scroll member 11 is constituted of the Oldham ring (rotation prevention member) 18, and the orbiting scroll member 11 and the block member 5 with which the Oldham ring 18 is engaged. The Oldham ring 18 is an integral body formed of a ring portion 18a which is formed into an annular shape so as to allow the boss portion of the orbiting scroll member to pass there through, a pair of key portions 18b which is formed on the ring portion 18a in a projecting manner in the normal direction from an orbiting scroll member 11 side, and a pair of key portions 18c which is formed on the ring portion 18a in an extending manner in an arm shape in the radial direction. The key portions 18b are formed at two positions displaced from each other by 180 degrees in phase, while the key portions 18c are formed at two positions displaced from each other by 180 degrees in phase and are also formed in a displaced manner from the key portions 18b by 90 degrees (the key portions 18b and the key portions 18c being formed such that a line which connects the pair of key portions 18b and a line which connects the pair of key portions 18c become orthogonal to each other).

[0030] The key portions 18b are configured such that the key portions 18b pass through the cutaway portions 16b which extend upwardly and downwardly in the drawing from the center hole 16a formed in the thrust race 16 respectively, are slidably engaged with the key groove portions 11e which are formed on the recessed portion 11d of the orbiting scroll member 11 in a radially extending manner with a minute clearance there between, and are movable only in the extending direction of the key groove portions 11e (in this embodiment, in the vertical direction).

[0031] As also shown in Fig. 5, the Oldham accommodating portion 25 which is formed on the block member 5 so as to accommodate the Oldham ring 18 is constituted of a circular ring portion accommodating portion 25a which is formed on a thrust-race-side opening end of the block member 5, and key groove portions 25b, 25c which extend in the radial direction from the ring portion accommodating portion 25a. The ring portion 18a of the Oldham ring 18 is accommodated in the ring portion accommodating portion 25a in a state where the movement of the ring portion 18a in the extending direction of the key portions 18c is allowed. The pair of key portions 18c is slidably engaged with the key groove portions 25b, 25c with a minute clearance there between in a state where the key portions 18c are movable only in the extending direction of the key groove portions 25b, 25c (in this embodiment, in the horizontal direction).

[0032] Accordingly, although a rotational force is generated in the orbiting scroll member 11 due to the rotation of the drive shaft 8, since the pair of key portions 18b of the Oldham ring 18 slides in the pair of key groove portions 11e formed on the orbiting scroll member 11 in a reciprocating manner, and the pair of key portions 18c slides in the pair of key groove portions 25b, 25c formed on the block member 5 in a reciprocating manner, the orbiting scroll member 11 performs an orbiting movement with respect to the shaft center of the drive shaft 8 in a state where the rotation of the orbiting scroll member 11 is prevented.

[0033] The center hole 16a formed in the thrust race 16 is formed with a size such that the center hole 16a allows the boss portion 11b of the orbiting scroll member to pass there through but does not allow the ring portion 18a of the Oldham ring 18 to pass there through, and the ring portion 18a of the Oldham ring 18 can be brought into slide contact with the periphery of a block-side end surface of the thrust race 16 around the center hole. The cutaway portions 16b which allow the key portions 18b to pass there through are formed within a movable range of the key portions 18b by taking into account the movement of the Oldham ring 18.

[0034] The thrust race 16 is brought into close contact with the end surface of the block member 5 so as to close the key groove portions 25b, 25c of the Oldham accommodating portion 25. That is, the thrust race 16 is brought into close contact with the end surface of the block member 5 to areas outside the key groove portions 25b, 25c formed on the block member 5 in the radial direction, and the Oldham accommodating portion 25 of the block member 5 is formed inside the close contact portion between the thrust race 16 and the block member 5. In this embodiment, the thrust race 16 is formed with a size where an outer edge of the thrust race 16 conforms with a shape of the end surface of the block member 5 and hence, the thrust race is brought into close contact with the whole surface of the end surface of the block member 5 whereby an introducing groove 38 of a pressure supply passage 45 described later is also closed simultaneously.

While the drive shaft 8 is allowed to pass through the block member 5 by way of the bearing 6, the sealing member 21 is arranged in the sealing member accommodating portion 22 of the block member 5 so that a gap defined between the drive shaft 8 and the block member 5 is hermetically sealed by the sealing member 21.

[0035] Accordingly, a front side of the thrust race 16 is brought into close contact with the end surface of the block member 5, a back side of the thrust race 16 is brought into close contact with the whole circumference of the slide surface 11f of the orbiting scroll member 11 and hence, a retention space 50 is formed of a region surrounded by the orbiting scroll member 11, the thrust race 16 and the block member 5.

[0036] An intake chamber 26 which sucks a refrigerant introduced from an intake port 40 described later through an intake passage 41 is formed between the outer peripheral wall 10b of the above-mentioned fixed scroll member 10 and the outermost peripheral portion of the spiral wall 11c of the orbiting scroll member 11. In the inside of the housing, on a back side of the fixed scroll member 10, a discharge chamber 28 is formed between the fixed scroll member 10 and the rear side wall 2b of the housing 2. A refrigerant gas compressed in the compression chamber 15 is discharged into the discharge chamber 28 through a discharge hole 27 formed in an approximately center portion of the fixed scroll member 10. Oil contained in the refrigerant gas discharged into the discharge chamber 28 is separated from the gas to some extent in the discharge chamber 28, and is supplied under pressure to an external refrigerant circuit from a discharge port not shown in the drawing. Separated oil and a refrigerant mixed with oil are also accumulated in a reservoir chamber 31 which is arranged below the discharge chamber 28. A high pressure region is formed of the discharge chamber 28 and the reservoir chamber 31.

[0037] On the other hand, in the inside of the housing 2, a motor accommodating space 32 which accommodates the motor 4 therein is formed in front of the block member 5, and a stator 33 which constitutes the motor 4 is fixedly mounted in the motor accommodating space 32. The stator 33 is constituted of an iron core 34 having a cylindrical shape and a coil 35 which is wound around the iron core 34, and is fixed to an inner surface of the housing 2. A rotor 36 which is rotatably accommodated in the inside of the stator 33 and is formed of a magnet is fixedly mounted on the drive shaft 8. The rotor 36 is configured to be rotated by a rotary magnetic force generated by the stator 33 along with the rotation of the drive shaft 8. The motor 4 formed of a brushless DC motor is constituted of the stator 33 and the rotor 36.

[0038] The intake port 40 through which a refrigerant gas is sucked is formed in a side surface of the housing 2 which faces the motor accommodating space 32 in an opposed manner. An intake passage 41 is formed in such a manner that a refrigerant which flows into the motor accommodating space 32 from the intake port 40 is introduced into the intake chamber 26 through a gap which is formed between the stator 33 and the housing 2, a gap not shown in the drawing which is formed between the block member 5 and the housing 2, and a gap which is formed between the fixed scroll member 10 and the housing 2.

[0039] A passage 42 is formed in a lower portion of the fixed scroll member 10. That is, the passage 42 which has one end thereof opened in the reservoir chamber 31 constituting a portion of the discharge region and has the other end thereof opened on an end surface of the fixed scroll member 10 which faces the thrust race 16 in an opposed manner is formed in the end plate 10a and the outer peripheral wall 10b of the fixed scroll member 10. A through hole 43 is formed in the thrust race 16 at a position which faces an opening portion of the passage 42. Further, an introducing groove 44 is formed on an end surface of the block member 5 which faces the thrust race 16 in an opposed manner in such a manner that the introducing groove 44 is formed along an outer periphery of the block member 5 ranging from a position which faces the through hole 43 formed in the thrust race 16 to one key groove portion 25b.

[0040] Due to such a constitution, the discharge region is communicated with one key groove portion 25b through the passage 42, the through hole 43 and the introducing groove 44, and a pressure supply passage 45 which makes the discharge region and the Oldham accommodating portion 25 communicate with each other is constituted of the passage 42, the through hole 43 and the introducing groove 44. Further, an orifice 46 is formed in a middle portion of the pressure supply passage 45, in this embodiment, in the vicinity of an end portion of the pressure supply passage 45 which opens in the reservoir chamber 31, and a filter 47 is arranged upstream of the orifice 46.

[0041] A pressure release passage 48 is formed in the block member 5, wherein the pressure release passage 48 has one end thereof opened in the other key groove portion 25c and has the other end thereof opened on a back surface of the block member 5 at a position which faces the motor accommodating space 32 (intake passage). Further, a pressure regulating valve 49 which releases a pressure to the intake passage 41 when a pressure in the retention space 50 becomes a predetermined pressure or more is mounted in a middle portion of the pressure release passage 48, for example, on an open end portion of the intake passage 41. Accordingly, in this embodiment, a pressure in the retention space 50 is set to an intermediate pressure between a pressure of a working fluid which is introduced into the compression chamber 15 and a pressure of the working fluid discharged from the compression chamber 15. It is desirable that such an intermediate pressure is set to be large within a range where a compression reaction force which the thrust race 16 receives from the orbiting scroll member 11 can be reduced. However, when the intermediate pressure is excessively large, a so-called turnover phenomenon where the orbiting scroll member 11 is inclined occurs and hence, the intermediate pressure is set to a value which falls within a range where such a turnover phenomenon does not occur, for example, a range from 0.02 to 0.05MPa.

[0042] Symbol 51 indicates an inverter drive circuit which is mounted on an inverter circuit end plate 53 accommodated in an inverter accommodating chamber 52 formed on an upper portion of the housing 2. The inverter drive circuit is provided for controlling the supply of electric power to the motor 4. An inverter-side cluster 55 is connected to the inverter drive circuit 51 via a cable 54, a motor-side cluster 58 is connected to the stator 33 via a cable 57, the inverter-side cluster 55 is mounted on a relay terminal (air-tight terminal) 56 which is mounted on a rear portion of the inverter accommodating chamber 52 of the housing 2 from above, and the motor-side cluster 58 is mounted on the relay terminal 56 from below. Due to such a constitution, the inverter drive circuit 51 and the stator 33 are electrically connected to each other via the relay terminal 56 thus supplying electric power to the motor 4 from the inverter drive circuit 51.

[0043] Due to such a constitution, when the motor 4 is rotated so that the drive shaft 8 is rotated, in the compression mechanism 3, the orbiting scroll member 11 is rotated about the eccentric shaft 8a and hence, the orbiting scroll member 11 orbits about the shaft center of the fixed scroll member 10. In such an operation, the rotation of the orbiting scroll member 11 is prevented by the rotation prevention mechanism constituted of the Oldham ring 18 and hence, only the orbiting movement is allowed.

[0044] Due to the orbiting movement of the orbiting scroll member 11, the compression chamber 15 moves from an outer peripheral side to a center side of the spiral walls 10c, 11c of both scroll members while gradually decreasing a volume thereof. Accordingly, a refrigerant gas sucked into the compression chamber 15 from the intake chamber 26 is compressed, and the compressed refrigerant gas is discharged into the discharge chamber 28 through the discharge hole 27 formed in the end plate 10a of the fixed scroll member 10. Then, the refrigerant gas is fed to an external refrigerant circuit through the discharge port not shown in the drawing.

[0045] Lubrication oil which is mixed to the refrigerant gas discharged into the discharge chamber 28 is separated from the refrigerant gas to some extent in the discharge chamber 28, the separated lubrication oil is supplied to the key groove portion 25b formed on the Oldham accommodating portion 25 of the block member 5 together with the refrigerant through the pressure supply passage 45 on which the orifice 46 is mounted, and is introduced into the retention space 50 arranged on a back side of the orbiting scroll member 11. Thereafter, the lubrication oil traverses the retention space 50 from one key groove portion 25b to the other key groove portion 25c, and is released into the intake passage 41 from the pressure release passage 48 formed in the other key groove portion 25c through the pressure regulating valve 49.

[0046] Due to such a constitution, the retention space 50 is formed by bringing the periphery of the orbiting scroll member 11 and the end surface of the block member 5 into close contact with the thrust race 16. Accordingly, it is possible to retain oil or a working fluid (refrigerant) mixed with oil supplied from the compression chamber 15 in the retention space 50 and hence, it is possible to supply an abundant amount of oil to the slide portions of the Oldham ring 18. Accordingly, the lubrication of the Oldham ring can be surely performed thus ensuring the reliability of the rotation prevention mechanism.

[0047] The pressure regulating valve 49 which is mounted in the pressure release passage 48 opens when the pressure becomes a predetermined pressure or more and releases a medium accumulated in the retention space 50 into the intake passage 41 (motor accommodating space 32). Accordingly, a retention state of a medium in the retention space 50 can be regulated by the pressure regulating valve 49, and a pressure in the retention space 50 can be set to an intermediate pressure. Accordingly, an amount of oil to be retained in the retention space can be regulated by the pressure regulating valve 49, and an intermediate pressure is applied to the orbiting scroll member 11 from a back side of the orbiting scroll member 11 and hence, a compression reaction force which acts on the orbiting scroll member 11 can be decreased with the use of the intermediate pressure of the retention space 50.

[0048] That is, by regulating a valve opening pressure of the pressure regulating valve 49, the smooth movement of the Oldham ring can be ensured, and a load applied to the thrust race 16 can be reduced within a range where the turnover of the orbiting scroll member 11 does not occur (a biasing force by which the orbiting scroll member 11 is pushed to the thrust race 16 can be attenuated). Accordingly, wear on a slide contact portion between the orbiting scroll member 11 and the thrust race 16 can be reduced.

[0049] Further, according to the above-mentioned constitution, the thrust race 16 is interposed between the fixed scroll member 10 and the block member 5, and the orbiting scroll member 11 is brought into contact with the thrust race 16. Accordingly, it is no more necessary to cover a compression space in the fixed scroll member 10 with the end plate 11 a of the orbiting scroll member 11 for increasing a back pressure of the orbiting scroll member 11, so that an outer diameter of the orbiting scroll member 11 can be decreased thus eventually decreasing an outer diameter of the compressor. Still further, the Oldham ring 18 is held between the block member 5 and the thrust race 16 thus covering the Oldham accommodating portion 25 with the block member 5 and the thrust race 16 and hence, it is possible to suppress fluttering of the Oldham ring 18.

[0050] According to the above-mentioned constitution, oil or a refrigerant mixed with oil which is separated in the compression chamber is supplied to one key groove portion 25b of the Oldham accommodating portion 25 which accommodates the Oldham ring 18 through the pressure supply passage 45 and, thereafter, is fed to the other key groove portion 25c through the ring portion accommodating portion 25a and, thereafter, is discharged to the intake passage 41 through the pressure release passage 48. Accordingly, the passage which can supply an abundant amount of oil to the slide contact portion between the Oldham ring 18 and the thrust race 16, the slide contact portion between the orbiting scroll member 11 and the thrust race 16, the bearing 13 and the like can be positively formed and hence, a favorable lubrication state can be acquired irrespective of an installed state of the compressor.

[0051] In the above-mentioned constitution, oil is naturally separated from a refrigerant which is discharged to the discharge chamber 28, and the separated oil or the refrigerant mixed with oil is supplied to the retention space 50. However, it may be possible to adopt the constitution where an oil separator which separates oil in a refrigerant discharged to the discharge chamber is further provided, oil separated by the oil separator is accumulated in the reservoir chamber 31, and only oil is supplied to the retention space 50.

Further, with respect to the above-mentioned constitution, the case where the pressure in the retention space is set to an intermediate pressure is exemplified. However, any constitution is adopted provided that a medium compressed in the compression chamber can be temporarily retained in the retention space 50. That is, it is possible to adopt the constitution where the pressure regulating valve 49 is removed from the pressure release passage 48 and a medium is temporarily retained in the retention space by making use of passage resistance of the pressure release passage per se. Alternatively, it may be possible to adopt the constitution where a pressure is discharged to the intake passage 41 through the bearing 6 by eliminating the pressure release passage 48 and the sealing member 21, and a medium is temporarily retained by making use of passage resistance when the medium passes through an area in the vicinity of the bearing 6.

Further, with respect to the above-mentioned constitution, the case where the block member 5 is constituted as the member fixed to the housing is exemplified. However, the block member 5 may be integrally formed with the housing by molding.

Reference Signs List

[0052]

1:	electric compressor
2:	housing
4:	motor
5:	block member
8:	drive shaft
10:	fixed scroll member
11:	orbiting scroll member
11a:	end plate
11d:	recessed portion
11f:	slide surface
15:	compression chamber
16:	thrust race
18:	Oldham ring
18a:	ring portion
18b, 18c:	key portion

11d, 25b: key groove portion
25: Oldham accommodating portion
50: retention space
41: intake passage
28: discharge chamber
45: pressure supply passage
48: pressure release passage
49: pressure regulating valve

Claims

1. 1. Scroll-type compressor comprising:

a fixed scroll member whose movement in the rotational direction and the axial direction with respect to the inside of a housing is limited;
a drive shaft which transmits a rotational force;
an orbiting scroll member which is arranged to face the fixed scroll member in an opposed manner, and is connected to the drive shaft by way of an eccentric shaft which is eccentric with respect to the shaft center of the drive shaft so that the orbiting scroll member performs an orbiting movement about the shaft center of the drive shaft;
a block member which is provided on a side of the orbiting scroll member opposite to a side to which the fixed scroll member faces in an opposed manner, and pivotally supports the drive shaft; and
a rotation prevention member which is arranged between the orbiting scroll member and the block member, includes a plurality of key portions which are slidably engaged with a plurality of key groove portions formed on a back surface of the orbiting scroll member and a plurality of key portions which are slidably engaged with a plurality of key groove portions formed on an end surface of the block member which faces the orbiting scroll member in an opposed manner, and prevents the rotation of the orbiting scroll member by making the key portions engaged with the key groove portions corresponding to the key portions respectively,
wherein a medium is compressed by moving a compression chamber formed by the fixed scroll member and the orbiting scroll member toward a center side while reducing a volume of the compression chamber due to the orbiting movement of the orbiting scroll member, **characterized in that**
an annular thrust race which receives the orbiting scroll member in the axial direction is sandwiched between the fixed scroll member and the block member,
the thrust race is slidably brought into close contact with the whole circumference of an end surface of the orbiting scroll member which faces the thrust race in an opposed manner, and the thrust race is brought into close contact with the end surface of the block member to an area outside the key groove portions formed on the block member in the radial direction, and
a retention space is defined by the orbiting scroll member, the thrust race and the block member, and the medium compressed in the compression chamber is supplied to and is retained in the retention space.

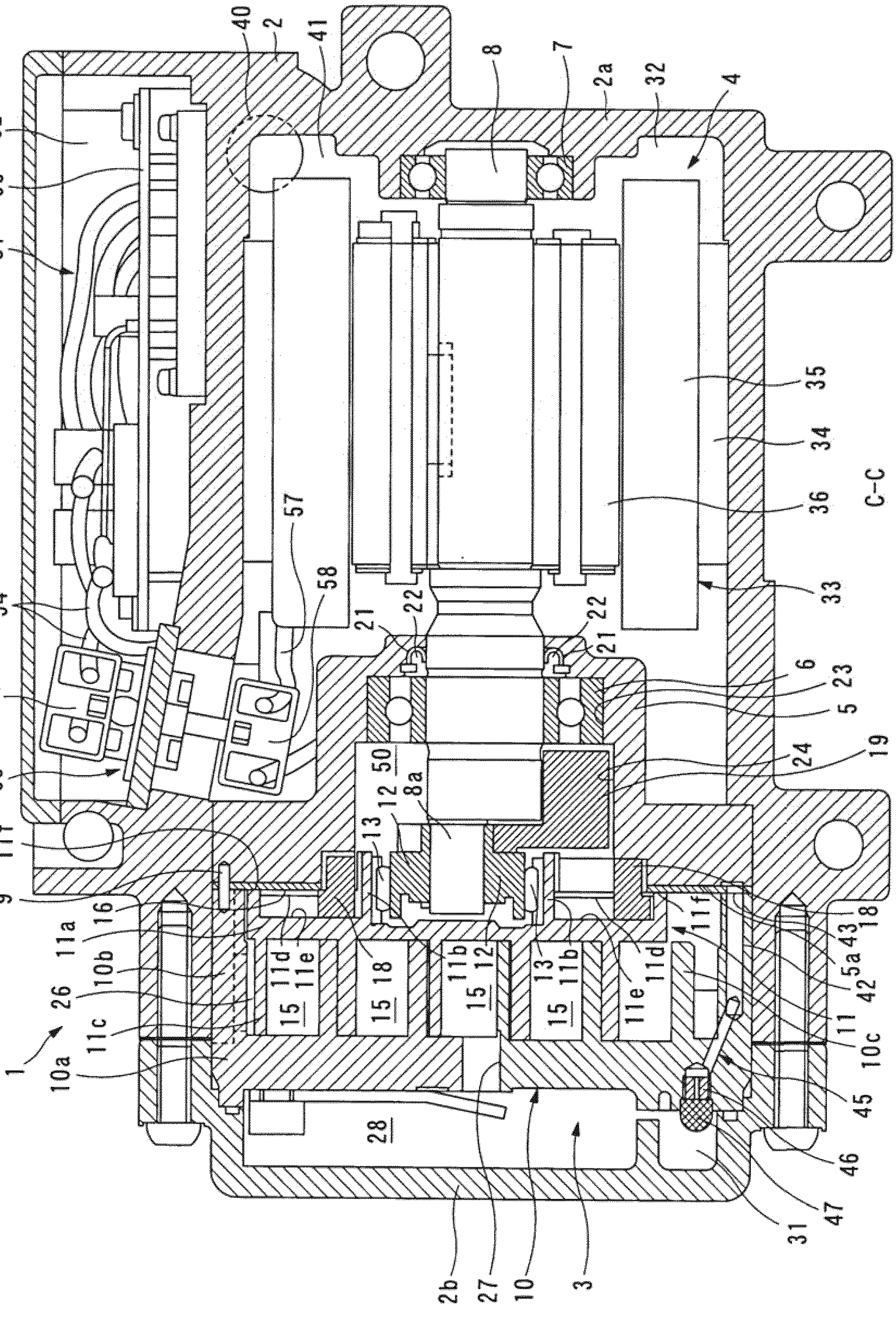
2. 2. Scroll-type compressor according to claim 1, **characterized in that** an annular slide surface with which the thrust race is brought into close contact is formed by forming a recessed portion on a back surface of an end plate of the orbiting scroll, and the slide surface is formed such that the slide surface does not project from the thrust race.

3. 3. Scroll-type compressor according to claim 1 or 2, **characterized in that** a discharge region where the medium which is retained in the retention space is discharged is formed behind the fixed scroll member in the inside of the housing, and
the discharge region and the retention space are communicated with each other through a pressure supply passage having a throttle formed in a middle portion thereof.

4. 4. Scroll-type compressor according to claim 3, **characterized in that** the retention space and an intake passage through which the medium is introduced into the compression chamber are communicated with each other through a pressure release passage, and a pressure regulating valve is arranged in the middle portion of the pressure release passage.

5. 5. Scroll-type compressor according to claim 4, **characterized in that** the rotation prevention member is arranged in an Oldham accommodating portion which is formed in the block portion, and is constituted of: a ring portion; a pair of key portions which is formed on the ring portion in a projecting manner, passes through the thrust race, and is slidably engaged with the pair of key groove portions formed on the back surface of the orbiting scroll member; and a pair of key portions which is formed on both sides of the ring portion in the radial direction in a pro-

jecting manner, and is slidably engaged with the pair of key groove portions formed on the block member,
the Oldham accommodating portion is constituted of a ring portion accommodating portion which accommodates the ring portion therein, and a pair of key groove portions which is communicated with the ring portion accommodating portion and with which the pair of key portions formed on both sides of the ring portion in the radial direction in a projecting manner is slidably engaged, and
the pressure supply passage is communicated with one of the pair of key groove portions formed on the block member, and the pressure release passage is communicated with the other of the pair of key groove portions formed on the block member.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2
2a
2b
3
4
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5a
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7
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8a
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11b
11c
11d
11e
11f
12
13
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16
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24
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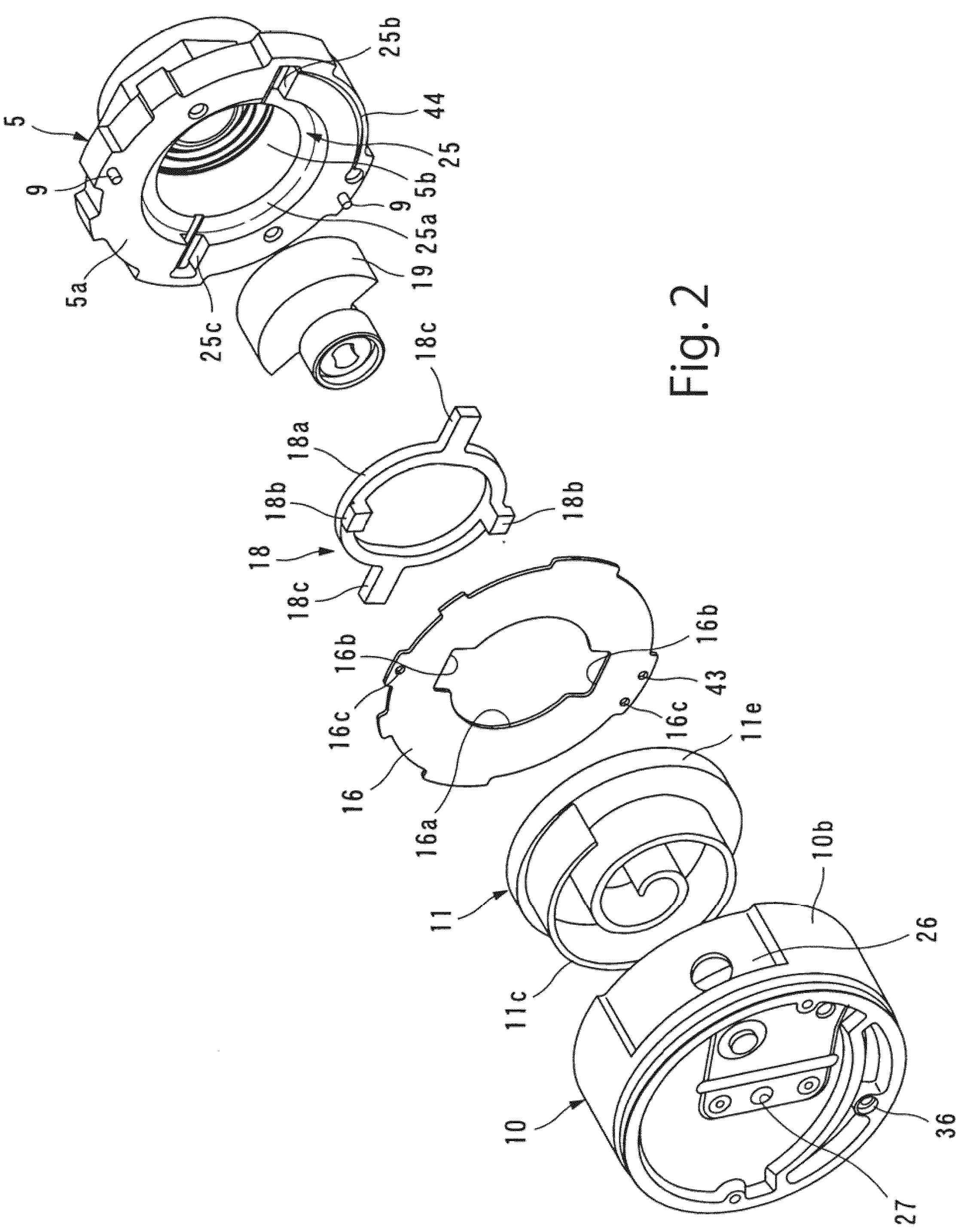
58
C-C

Fig. 1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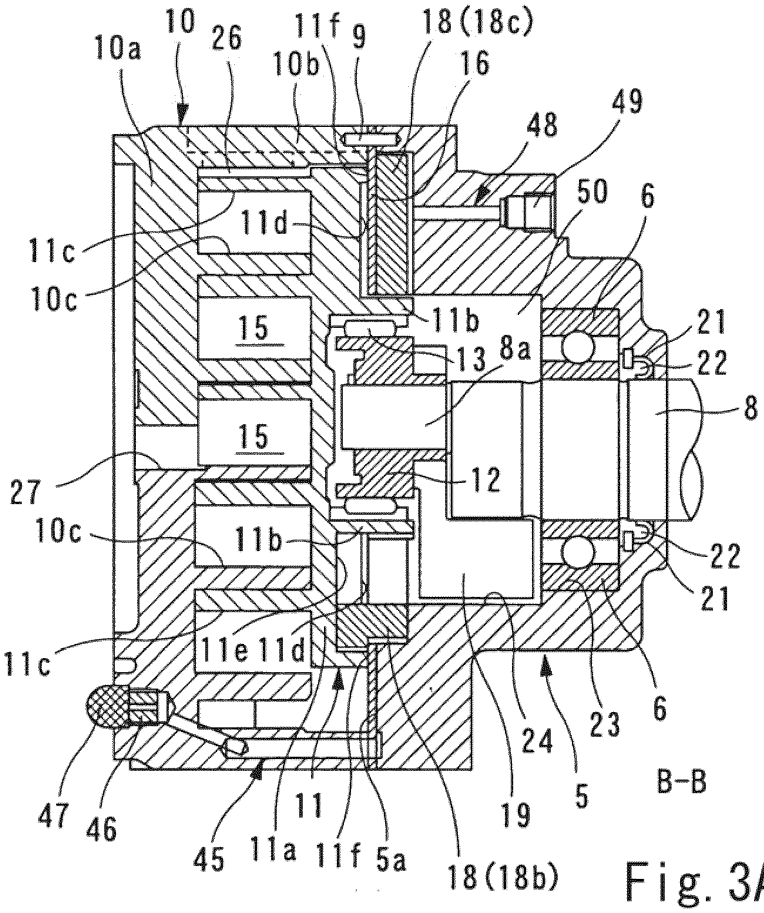
16c
16
16a
16c
43
16b
11e
11
11c
10b
26
10
36
27

Fig. 2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10
26
10b
11f
9
18(18c)
16
48
49
50
6
11d
11c
10c
11b
15
13
8a
21
22
15
8
27
12
10c
11b
22
21
11c
11e
11d
24
23
6
47
46
45
11
11a
11f
5a
18(18b)
19
5
B-B

Fig. 3A

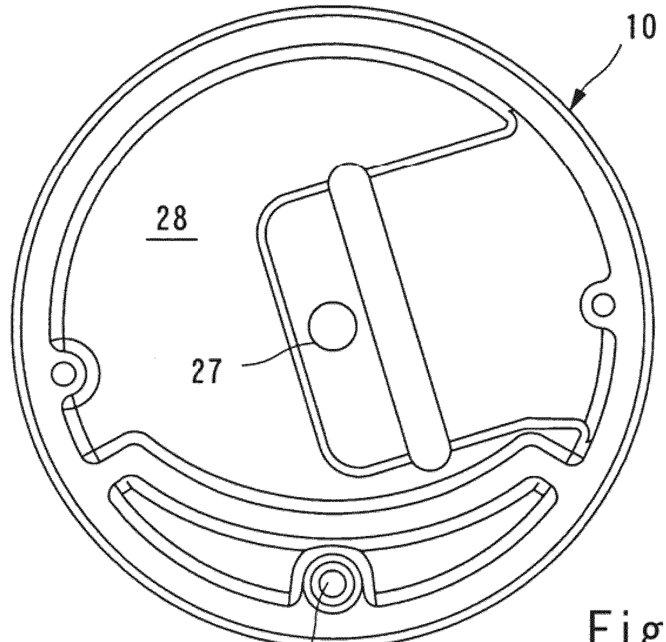

10
28
27
45

Fig. 3B

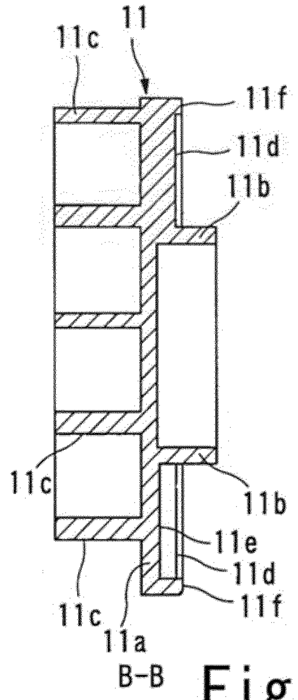


Fig. 4A

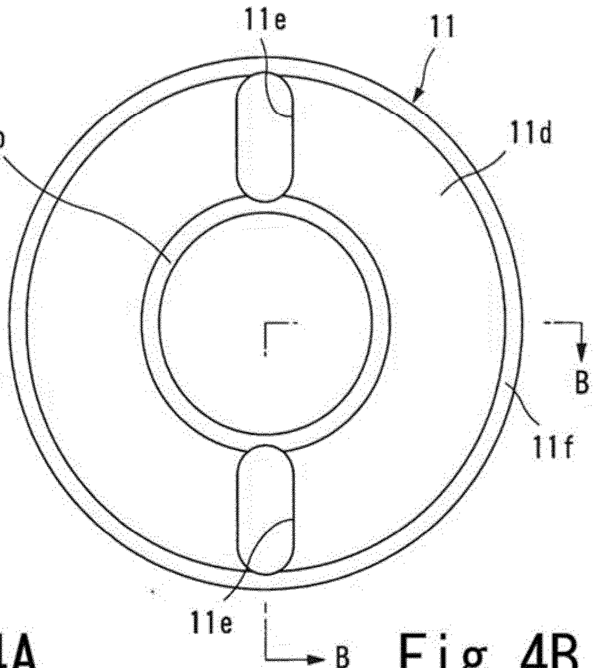


Fig. 4B

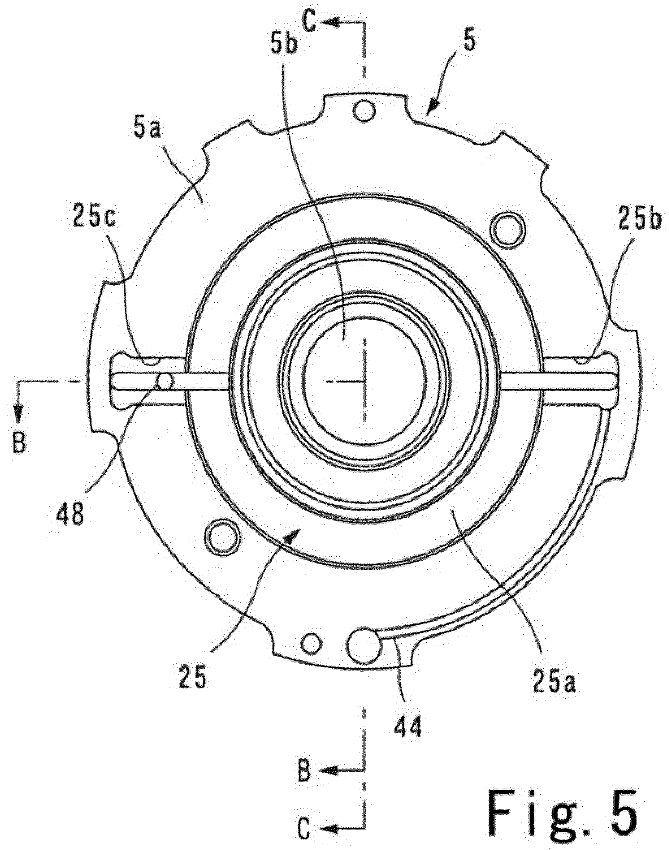
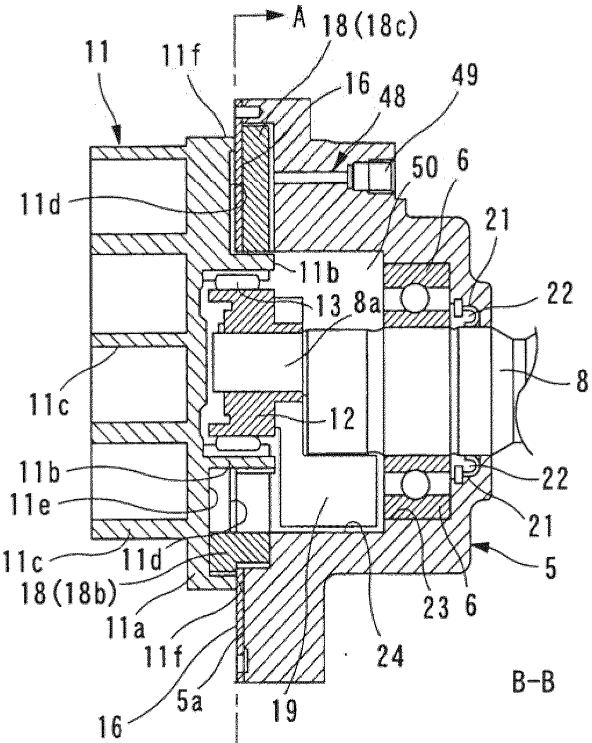


Fig. 5


A
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11
11f
16
48
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50
6
11d
21
11b
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11b
22
11e
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18 (18b)
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11a
11f
24
5a
19
16
A
B-B

Fig. 6A

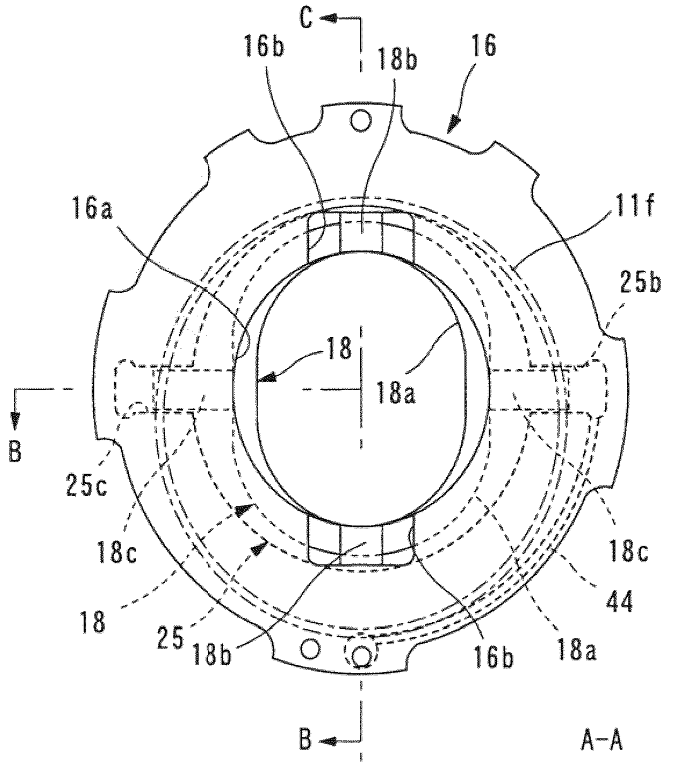
C
16b
18b
16
16a
11f
25b
18
18a
B
25c
18c
18c
44
18
25
18b
16b
18a
B
C
A-A

Fig. 6B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/005156

A. CLASSIFICATION OF SUBJECT MATTER
F04C18/02(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04C18/02

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 61-118580 A (Matsushita Electric Industrial Co., Ltd.), 05 June 1986 (05.06.1986), page 2, lower right column, line 3 to page 3, upper right column, line 20; fig. 1 (Family: none)	1-4 5
Y	JP 7-19185 A (Sanyo Electric Co., Ltd.), 20 January 1995 (20.01.1995), paragraph [0020]; fig. 1 to 2 (Family: none)	1-4
Y	JP 8-193581 A (Hitachi, Ltd.), 30 July 1996 (30.07.1996), paragraphs [0032], [0062]; fig. 19 & US 5829959 A & US 6174150 B1 & KR 10-0148879 B & CN 1144885 A	2-4

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 December, 2011 (08.12.11)	20 December, 2011 (20.12.11)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/005156

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 8-303365 A (Matsushita Electric Industrial Co., Ltd.), 19 November 1996 (19.11.1996), fig. 1 to 2 (Family: none)	1,3

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 8219061 A **[0003] [0004] [0007]**
- JP 2006266123 A **[0003] [0006] [0008]**