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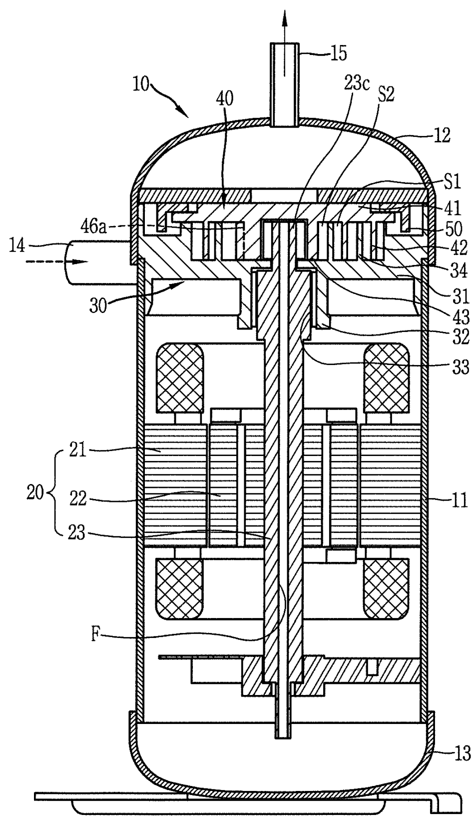
(54) **Scroll compressor**

(57) Disclosed is a scroll compressor. An interference prevention portion is formed on a side wall surface of at least one of a fixed wrap and an orbiting wrap. Under such configuration, the end of the fixed wrap does not interfere with the orbiting wrap at an arc compression surface of the orbiting wrap, but is inserted into the interference prevention portion. Accordingly, occurrence of a gap between the fixed wrap and the orbiting wrap can be prevented, and thus compression efficiency can be enhanced.

FIG. 4



EP 2 806 166 A2

Description

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

[0001] The present disclosure relates to a scroll compressor, and particularly, to a scroll compressor having a structure that a rotation shaft is overlapped with a wrap of an orbiting scroll.

2. Background of the Disclosure

[0002] Generally, a scroll compressor indicates a compressor configured to suck and compress a refrigerant under a structure that an orbiting scroll performs an orbital motion with respect to a fixed scroll, in a state where a fixed wrap of the fixed scroll has been engaged with an orbiting wrap of the orbiting scroll. In this case, a compression chamber composed of a suction chamber, an intermediate pressure chamber and a discharge chamber is consecutively moved between the fixed wrap and the orbiting wrap.

[0003] Such scroll compressor is more advantageous than other types of compressors in the aspect of vibration and noise, since it performs a suction process, a compression process and a discharge process consecutively.

[0004] Behavior characteristics of the scroll compressor may be determined by a type of the fixed wrap and the orbiting wrap. The fixed wrap and the orbiting wrap may have any shape. However, it is general that the fixed wrap and the orbiting wrap have a form of an involute curve which can be easily processed. The involute curve has a path formed by the end of a string when the string wound on a basic circle having an arbitrary radius is unwound. In case of using such involute curve, a capacity change rate is constant because the thickness of the wrap is constant. For a high compression ratio, the number of turns of the wrap should be increased. However, in this case, the size of the scroll compressor may be also increased.

[0005] In the orbiting scroll, an orbiting wrap is formed at one side surface of a plate formed in a disc shape. A boss portion is formed on a rear surface of the plate where the orbiting wrap has not been formed, thereby being connected to a rotation shaft which drives the orbiting scroll to perform an orbital motion. Such structure is advantageous in that a diameter of the plate can be reduced, because the orbiting wrap is formed on an almost entire area of the plate. However, in such structure, a point of application to which a repulsive force of a refrigerant is applied during a compression operation, and a point of application to which a reaction force to attenuate the repulsive force is applied are spaced from each other in a vertical direction. This may cause an unstable behavior of the orbiting scroll during the operation, resulting in severe vibration or noise.

[0006] In order to solve such problems, a scroll compressor shown in FIG. 1 has been proposed. The scroll compressor has a structure that a coupling point between a rotation shaft 1 and an orbiting scroll 2 is formed on the same surface as an orbiting wrap 2a. In such scroll compressor, since a point of application to which a repulsive force of a refrigerant is applied, and a point of application to which a reaction force to attenuate the repulsive force is applied are same, a phenomenon that the orbiting scroll 2 is tilted can be solved.

[0007] An Oldham ring 4, configured to prevent rotation of the orbiting scroll 2, is installed between the orbiting scroll 2 and a fixed scroll 3. The orbiting scroll 2 and the Oldham ring 4 perform a relative motion with respect to each other in a state where key recesses 2b and keys 4a are coupled to each other. The Oldham ring 4 induces the orbiting scroll 2 to perform an orbital motion. The key recesses 2b of the orbiting scroll 2 and the keys 4a of the Oldham ring 4 are coupled to each other with a tolerance gap ($\delta 1$) of about 10~30μm, so that the orbiting scroll 2 can perform a sliding motion with respect to the Oldham ring 4.

[0008] However, the conventional scroll compressor may have the following problems. As shown in FIG. 2, due to the tolerance gap ($\delta 1$) between the key recesses 2b of the orbiting scroll 2 and the keys 41 of the Oldham ring 4, a rotation moment occurs when the orbiting scroll 2 performs an orbital motion. Due to such rotation moment, offset is generated at a specific part between the orbiting wrap 2a of the orbiting scroll 2 and the fixed wrap 3a of the fixed scroll, i.e., at both sides of an arc compression surface based on contact points formed by a tangent line and the arc compression surface, the tangent line drawn at a center of a rotation shaft coupling portion of the orbiting scroll 2 toward the arc compression surface. Due to offset of the orbiting scroll 2 in such offset section (β), interference (A) occurs between the orbiting wrap 2a and the fixed wrap 3a as shown in FIG. 3. Due to such interference (A), a leakage gap (B) between the orbiting wrap 2a and the fixed wrap 3a occurs at other parts. This may cause compression loss.

SUMMARY OF THE DISCLOSURE

[0009] Therefore, an aspect of the detailed description is to provide scroll compressor capable of preventing occurrence of a leakage gap between an orbiting wrap of an orbiting scroll and a fixed wrap of a fixed scroll, by preventing interference between the orbiting wrap and the fixed wrap.

[0010] To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, there is provided a scroll compressor, comprising: a hermetic container; a fixed scroll having a fixed wrap; an orbiting scroll having an orbiting wrap which forms a compression chamber by being engaged with the fixed wrap, having a rotation shaft coupling portion at a center portion thereof, having an arc compression surface which forms the compression chamber around the rotation shaft coupling portion, and performing an orbital motion with respect to the fixed scroll; and a rotation shaft having an eccentric portion which is coupled to the orbiting scroll, the eccentric portion overlapped with the orbiting wrap in a radial direction, wherein an interference prevention portion is formed at the fixed wrap or the orbiting wrap such that an interval between the fixed wrap and the orbiting wrap is larger than an orbiting radius of the orbiting wrap.

[0011] The interference prevention portion may be formed at the arc compression surface.

[0012] The interference prevention portion may be formed such that a starting point and an ending point thereof are included in the arc compression surface.

[0013] The scroll compressor may further include an Oldham ring coupled to the orbiting scroll and configured to prevent rotation of the orbiting scroll. tolerance gap may be formed between the orbiting scroll and the Oldham ring, and a maximum depth of the interference prevention portion may be equal to or smaller than the tolerance gap.

[0014] A plurality of key recesses may be formed at the orbiting scroll in a radial direction, such that keys of the Oldham ring are coupled thereto. An equation of $\delta 2 = (\delta 1 \times (L2/L1)) \pm 5\ \mu m$ may be obtained, where L1 is a shortest distance between the key recess and a center of the rotation shaft coupling portion, L2 is a shortest distance between a center line between the orbiting wraps and the center of the rotation shaft coupling portion, $\delta 1$ is a tolerance gap between the Oldham ring and the key recess, $\delta 2$ is a depth (offset amount) of the interference prevention portion, and α is an rotation angle of the rotation shaft.

[0015] The rotation shaft may be coupled to the rotation shaft coupling portion of the orbiting scroll by passing through the fixed scroll.

[0016] According to another aspect of the present invention, there is provided a scroll compressor, including: a fixed scroll having a fixed wrap; an orbiting scroll having an orbiting wrap which forms a first compression chamber and a second compression chamber on an outer side surface and an inner side surface thereof by being engaged with the fixed wrap, having a rotation shaft coupling portion at a center portion thereof, having an arc compression surface which forms the first compression chamber around the rotation shaft coupling portion, and performing an orbital motion with respect to the fixed scroll; and a rotation shaft having an eccentric portion which is coupled to the rotation shaft coupling portion of the orbiting scroll, the eccentric portion overlapped with the orbiting wrap in a radial direction, wherein the arc compression surface is spaced from a side wall surface of the fixed wrap by an orbiting radius, and wherein a distance between the fixed wrap and the orbiting wrap is equal to the orbiting radius at a first curved surface of the arc compression surface from a first point where the arc compression surface starts to an arbitrary second point, the distance is longer than the orbiting radius at a second curved surface of the arc compression surface from the second point to a third point where arc compression is performed, and the distance is equal to the orbiting radius at a third curved surface of the arc compression surface from the third point to a fourth point where the arc compression is ended.

[0017] A curvature of the second curved surface may be larger than that of the first curved surface or the third curved surface.

[0018] The scroll compressor may further include an Oldham ring coupled to the orbiting scroll and configured to prevent rotation of the orbiting scroll. tolerance gap may be formed between the orbiting scroll and the Oldham ring, and a maximum depth of the second curved surface may be equal to or smaller than the tolerance gap.

[0019] A plurality of key recesses may be formed at the orbiting scroll in a radial direction, such that keys of the Oldham ring are coupled thereto. An equation of $\delta 2 = (\delta 1 \times (L2/L1)) \pm 5\ \mu m$ may be obtained, where L1 is a shortest distance between the key recess and a center of the rotation shaft coupling portion, L2 is a shortest distance between a center line of the orbiting wraps and the center of the rotation shaft coupling portion, $\delta 1$ is a tolerance gap between the Oldham ring and the key recess, $\delta 2$ is a depth (offset amount) of the second curved surface, and α is an rotation angle of the rotation shaft.

[0020] The rotation shaft may be coupled to the rotation shaft coupling portion of the orbiting scroll by passing through the fixed scroll.

[0021] According to another aspect of the present invention, there may be provided a scroll compressor, including: a fixed scroll having a fixed wrap; an orbiting scroll having an orbiting wrap which forms a first compression chamber and a second compression chamber on its outer side surface and inner side surface by being engaged with the fixed wrap, and performing an orbital motion with respect to the fixed scroll; a rotation shaft having an eccentric portion overlapped with the orbiting wrap in a radial direction; and a driving unit configured to drive the rotation shaft, wherein a rotation shaft coupling portion, to which the eccentric portion is coupled, is formed in a central portion of the orbiting scroll, wherein a protruded portion is formed on an inner circumferential surface of an inner end portion of the fixed wrap, wherein a recess portion, which forms a compression chamber by contacting the protruded portion, is formed on an outer circumferential surface of the rotation shaft coupling portion, and wherein an interference prevention portion is formed at the fixed wrap or the orbiting wrap such that an interval between the fixed wrap and the orbiting wrap is larger than an orbiting radius of the orbiting wrap.

[0022] The interference prevention portion may be formed at the arc compression surface.

[0023] The interference prevention portion may be formed such that a starting point and an ending point thereof are included in the arc compression surface.

[0024] The scroll compressor may further include an Oldham ring coupled to the orbiting scroll and configured to prevent rotation of the orbiting scroll. tolerance gap may be formed between the orbiting scroll and the Oldham ring, and a maximum depth of the interference prevention portion may be equal to or smaller than the tolerance gap.

[0025] A plurality of key recesses may be formed at the orbiting scroll in a radial direction, such that keys of the Oldham ring are coupled thereto. An equation of $\delta 2 = (\delta 1 \times (L2/L1)) \pm 5\ \mu m$ may be obtained, where L1 is a shortest distance between the key recess and a center of the rotation shaft coupling portion, L2 is a shortest distance between a center line of the orbiting wraps and the center of the rotation shaft coupling portion, $\delta 1$ is a tolerance gap between the Oldham ring and the key recess, $\delta 2$ is a depth (offset amount) of the second curved surface, and α is an rotation angle of the rotation shaft.

[0026] A thickness of the rotation shaft coupling portion may be increased within a predetermined section, toward an opposite direction to a moving direction of the compression chamber at the recess portion. A thickness of the fixed wrap may be decreased within a predetermined section, toward an opposite direction to a moving direction of the compression chamber at the protruded portion.

[0027] In the scroll compressor according to the present invention, the interference prevention portion may be formed on a side wall surface of at least one of a fixed wrap and an orbiting wrap. Under such configuration, the end of the fixed wrap does not interfere with the orbiting wrap at an arc compression surface of the orbiting wrap, but is inserted into the interference prevention portion. Accordingly, occurrence of a gap between the fixed wrap and the orbiting wrap can be prevented, and thus compression efficiency can be enhanced.

[0028] Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the disclosure, are given by way of illustration only, since various changes and modifications within the spirit and scope of the disclosure will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The accompanying drawings, which are included to provide a further understanding of the disclosure and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the disclosure.

[0030] In the drawings:

FIG. 1 is a longitudinal section view of a scroll compressor in accordance with the conventional art;

FIG. 2 is a planar view illustrating a coupled state between an orbiting scroll and an Oldham ring in the scroll compressor of FIG. 1;

FIG. 3 is a planar view illustrating a relation between a fixed scroll and an orbiting scroll in the scroll compressor of FIG. 2;

FIG. 4 is a longitudinal section view of a scroll compressor according to the present invention;

FIG. 5 is an exploded perspective view of a compression part in the scroll compressor of FIG. 4;

FIG. 6 is a planar view illustrating a coupled state between an orbiting scroll and an Oldham ring in the scroll compressor of FIG. 5;

FIG. 7 is a planar view illustrating a compression part in the scroll compressor of FIG. 4;

FIG. 8 is a perspective view of an orbiting scroll in the scroll compressor of FIG. 4;

FIG. 9 is an enlarged view for explaining an interference prevention portion of FIG. 8;

FIG. 10 is a planar view illustrating a relation between a fixed scroll and an orbiting scroll in the scroll compressor of FIG. 4; and

FIG. 11 is a planar view illustrating another embodiment of an interference prevention portion in the scroll compressor of FIG. 4.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0031] Description will now be given in detail of the exemplary embodiments, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numbers, and description thereof will not be repeated.

[0032] Hereinafter, a scroll compressor according to the present invention will be explained in more detail with reference to the attached drawings.

[0033] Referring to FIGS. 4 to 9, in a scroll compressor according to the present invention, a driving motor 20 may be installed in a hermetic container 10, and a fixed scroll 30 integrally formed with a main frame may be fixedly installed above the driving motor 20. An orbiting scroll 40, which is engaged with the fixed scroll 30 and configured to compress a refrigerant while performing an orbit motion by being coupled to a rotation shaft 23 of the driving motor 20, may be installed above the fixed scroll 30.

[0034] The hermetic container 10 may include a cylindrical casing 11, and an upper shell 12 and a lower shell 13 coupled to an upper part and a lower part of the casing 11 by welding so as to cover the upper part and the lower part of the casing 11. A suction pipe 14 may be installed on a side surface of the casing 10, and a discharge pipe 15 may be installed above the upper shell 12. The lower shell 13 may also serve as an oil chamber for storing therein oil to be supplied to the compressor for a smooth operation of the compressor.

[0035] The driving motor 20 may include a stator fixed to an inner surface of the casing 10, and a rotor 22 positioned in the stator 22 and rotating by a reciprocal operation with the stator 22. A rotation shaft 23, which rotates together with the rotor 22, may be coupled to a central part of the rotor 22.

[0036] An oil passage (F) may be penetratingly-formed at a central region of the rotation shaft 23, in a lengthwise direction. An oil pump 24, configured to supply oil stored in the lower shell 13 to the upper side, may be installed at a lower end of the rotation shaft 23. A pin portion 23c may be formed at an upper end of the rotation shaft 23, in an eccentric manner from the center of the rotation shaft.

[0037] The fixed scroll 30 may be fixed as its outer circumferential surface is forcibly-inserted between the casing 11 and the upper shell 12 by shrinkage fitting. Alternatively, the fixed scroll 30 may be coupled to the casing 11 and the upper shell 12 by welding.

[0038] A boss portion 32 may be formed at a central region of a plate portion 31 of the fixed scroll 30. A shaft accommodating hole 33, configured to accommodate the rotation shaft 23 in a penetrating manner, may be formed at the boss portion 32. A fixed wrap 34 may be formed on an upper surface of the plate portion 31 of the fixed scroll. The fixed wrap 34 is engaged with an orbiting wrap to be explained later, and forms a first compression chamber (S1) on an outer side surface of the orbiting wrap 42 and a second compression chamber (S2) on an inner side surface of the orbiting wrap 42.

[0039] The orbiting scroll 40 may be supported at an upper surface of the fixed scroll 30. The orbiting scroll 40 may include the plate portion 41 formed in an approximately circle shape, and the orbiting wrap 42 formed on an upper surface of the plate portion 41. The orbiting wrap 42 forms a pair of compression chambers S1 and S2 which move consecutively, by being engaged with the fixed wrap 34. Each of the compression chambers S1 and S2 may be composed of a suction chamber, an intermediate pressure chamber and a discharge chamber. A rotation shaft coupling portion 43, which has an approximately circle shape and to which the pin portion 23c of the rotation shaft 23 is rotatably insertion-coupled, may be formed at a central region of the plate portion 41.

[0040] The pin portion 23c of the rotation shaft 23 may be insertion-coupled to the rotation shaft coupling portion 43. The pin portion 23c may be coupled to the rotation shaft coupling portion 43 of the orbiting scroll 30, through the plate portion 31 of the fixed scroll 30.

[0041] The orbiting wrap 42, the fixed wrap 34 and the pin portion 23c may be formed to overlap one another, in a radius direction of the scroll compressor. During a compression operation of the scroll compressor, a repulsive force of a refrigerant is applied to the fixed wrap 34 and the orbiting wrap 42. As a reaction force of the repulsive force, a compressive force is applied between the rotation shaft coupling portion 43 and the pin portion 23c. In the case where the pin portion 23c of the rotation shaft 23 overlaps the wrap in a radius direction through the plate portion 41 of the orbiting scroll 40, a repulsive force of a refrigerant and a compressive force are applied to the same side surface based on the plate portion 41 of the orbiting scroll. Therefore, the repulsive force and the compressive force may be attenuated from each other.

[0042] An Oldham ring 50, configured to prevent rotation of the orbiting scroll 40, may be coupled to an upper side of the orbiting scroll 40. The Oldham ring 50 may include a ring portion 51 having an approximately circle shape and fitted into a rear surface of the plate portion 41 of the orbiting scroll 40, and a pair of first keys 52 and a pair of second keys 53 protruding from one side surface of the ring portion 51.

[0043] The first keys 52 may be protruded with a length greater than a thickness of an outer circumferential surface of the plate portion 41 of the orbiting scroll 40, and may be inserted into first key recesses 31 a of the fixed scroll 30.

[0044] The second keys 53 may be fitted into second key recesses 41 a formed on an outer circumference of the plate portion 41 of the orbiting scroll 40.

[0045] The first key recess 31 a and the first key 52 are preferably formed so that both side surfaces of the first key 52 slidably-contact both side surfaces of the first key recess 31 a. Likewise, the second key recess 41a and the second key 53 are preferably formed so that both side surfaces of the second key 53 slidably-contact both side surfaces of the second key recess 41a. In this case, if the keys 52, 53 contact the key recesses 31 a, 41 a too closely, frictional resistance is increased between the keys 52, 53 and the key recess 31a, 41a. As a result, the orbiting scroll 40 may not smoothly perform an orbital motion. In order to solve such problem, as shown in FIG. 6, a tolerance gap (δ1) may be formed between the key recess 31 a and the key 52, and between the key recess 41 a and the key 53. In this case, the tolerance gap (δ1) is large enough for the orbiting scroll 40 can perform an orbital motion as the keys 52, 53 are smoothly slid on the key recesses 31 a, 41 a.

[0046] Each of the fixed wrap 34 and the orbiting wrap 42 may be formed in an involute curve. However, in some cases, the fixed wrap 34 and the orbiting wrap 42 may be formed in other curve rather than an involute curve. Referring to FIG. 4, under an assumption that the center of the rotation shaft coupling portion 43 is 'O' and two contact points are 'P1' and 'P2', an angle (α) defined by two straight lines is smaller than 360°, the straight lines formed by connecting the center 'O' of the rotation shaft coupling portion 43 to the two contact points 'P1' and 'P2', respectively. Also, a distance (ℓ) between a normal vector of the contact point 'P1' and a normal vector of the contact point 'P2 is larger than 0. Under such configuration, the scroll compressor can have an increased compression ratio, because it has a smaller volume than in a case where the first compression chamber (S1) prior to discharge has the fixed wrap 34 and the orbiting wrap 42 of an involute curve. The orbiting wrap 42 and the fixed wrap 34 have a shape that a plurality of arcs having different diameters and origins are connected. In this case, the outermost curve may have an approximately oval shape with a major axis and a minor axis.

[0047] A protruded portion 35, which protrudes toward the rotation shaft coupling portion 43, may be formed near an inner end portion of the fixed wrap 34. A contact portion 35a may be further formed at the protruded portion 35, in a protruding manner from the protruding portion 35. Accordingly, the inner end portion of the fixed wrap may have a larger thickness than other parts.

[0048] The thickness of the fixed wrap 34 is gradually decreased, starting from the inner contact point P1 of the two contact points (P1, P2) defining the first compression chamber (S1) upon initiating the discharge operation. More specifically, a first decrease part 35b is formed adjacent to the contact point (P1) and a second decrease part 35c is connected to the first decrease part 31 b. A thickness reduction rate at the first decrease part is higher than that at the second decrease part. After the second decrease part, the fixed wrap may be increased in thickness within a predetermined interval.

[0049] A recess portion 44, which is engaged with the protruded portion 35, may be formed at the rotation shaft coupling portion 43. One side wall of the recess portion 44 may contact the contact portion 35a of the protruded portion 35, thereby forming the contact point 'P1' of the first compression chamber (S1).

[0050] One side wall of the recess portion 44 may include a first increase part 45a where a thickness is relatively greatly increased, and a second increase part 45b connected to the first increase part 45a and having a thickness increased at a relatively low rate. These correspond to the first decrease part 35b and the second decrease part 35c of the fixed wrap 34. The first increase part 45a, the first decrease part 35b, the second increase part 45b and the second decrease part 35c may be obtained by turning a generating curve toward the rotation shaft coupling portion. Accordingly, the inner contact point (P1) of the first compression chamber (S1) may be positioned at the first increase part and the second increase part, and the length of the first compression chamber right before a discharge operation may be shortened so as to enhance a compression ratio.

[0051] Another side wall of the recess portion 44 may be formed to have an arc compression surface 46 having a circular shape and formed by connecting lines to one another, the lines formed as the orbiting wrap contacts the end of the fixed wrap 34 while the orbiting scroll 40 performs an orbital motion. A diameter of the arc of the arc compression surface 46 is determined by the wrap thickness of the end of the fixed wrap, and an orbiting radius of the orbiting wrap. If the wrap thickness of the end of the fixed wrap is increased, the diameter of the arc is increased. As a result, the thickness of the orbiting wrap near the arc is increased, and thus durability of the scroll compressor is enhanced. Further, a compression path is increased, and thus a compression ratio of the second compression chamber (S2) is increased.

[0052] An operation of the scroll compressor according to the present invention is as follows. Once the rotation shaft 43 rotates as power is supplied to the driving motor 40, the orbiting scroll 60 eccentrically-coupled to the rotation shaft 43 performs an orbital motion along a predetermined path. And the compression chamber (P) formed between the orbiting scroll 60 and the fixed scroll 30 moves to the center of the orbital motion consecutively, to thus have a decreased volume. In the compression chamber (P), a refrigerant is sucked, compressed and discharged consecutively. Such processes are repeatedly performed.

[0053] The orbiting scroll 40 performs an orbital motion while its rotation is prevented by the Oldham ring 50. A tolerance gap ($\delta 1$) of approximately 10~30 μm is required between the key recess 41 a of the orbiting scroll 40 and the key 52, and between the key recess 31 a of the fixed scroll 30 and the key 53, so that the orbiting scroll 40 and the Oldham ring 50 can perform a sliding motion with respect to each other. In this case, the orbiting scroll 40 generates a rotation moment due to the tolerance gap ($\delta 1$). As a result, when the scroll compressor is substantially operated, wrap interference (A) may occur between the fixed wrap 34 and the orbiting wrap 42 as shown in FIG. 3.

[0054] In this embodiment, as shown in FIGS. 6 to 9, an interference prevention portion 46a having a predetermined depth in a thickness direction of the orbiting wrap 42 may be formed at the arc compression surface 46 of the recess portion 44 of the orbiting scroll 40.

[0055] The interference prevention portion 46a may be formed to have a depth $\delta 2$ from an orbiting radius (r) which is obtained in a state where the fixed wrap 34 and the orbiting wrap 42 have been aligned to be concentric with each other.

[0056] For instance, as shown in FIG. 9, a starting point of a second curved surface (P12 - P13) which forms the interference prevention portion 46a may be positioned at a first curved surface (P11 ~ P12) between a first point (P11) where arc compression starts and an arbitrary second point (P12). And an ending point of the second curved surface (P12 - P13) which forms the interference prevention portion 46a may be positioned at a third curved surface (P13 - P14) between an arbitrary third point (P13) closer to a discharge opening than the second point (P12) and a fourth point (P14) where compression is ended.

[0057] A depth of the interference prevention portion 46a may be equal to or smaller than tolerance gap ($\delta 1$). If the depth of the interference prevention portion 46a is larger than the tolerance gap ($\delta 1$), a gap is generated between the fixed wrap 34 and the orbiting wrap 42. This may cause compression performance to be significantly lowered.

[0058] Referring to FIG. 6, it is assumed that an rotation angle (radian) of the rotation shaft 23 is α, tolerance gap is $\delta 1$, a shortest distance between the second key recess and a center of the rotation shaft coupling portion is L1, a shortest distance between a center line of the orbiting wraps and the center of the rotation shaft coupling portion is L2, a depth (offset amount) of the interference prevention portion is δ2. Under such assumption, δ2 may be calculated as follows.

$$\alpha \times L1 = \delta 1 \quad \text{--------- Formula 1.}$$

$$\alpha \times L2 = \delta 2 \quad \text{--------- Formula 2.}$$

[0059] When the formula 1 is applied to the formula 2, $\delta 2 = \delta 1 \times (L2/L1)$.

[0060] For instance, δ2 = 30x23/53 = 13.0μm, in a case where the tolerance gap (δ1) is 30μm, the shortest distance (L1) between the second key recess 41 a and a center of the rotation shaft coupling portion 43 is 53 mm, and the shortest distance (L2) between a center line of the orbiting wraps and the center of the rotation shaft coupling portion is 23 mm. Accordingly, an equation of $\delta 2 = (\delta 1 \times (L2/L1)) \pm 5\mu m$ may be obtained.

[0061] As shown in FIG. 10, the end of the fixed wrap 34 does not interference with the orbiting wrap 42 at the arc compression surface 46 of the orbiting wrap 42, but is inserted into the interference prevention portion 46a. Accordingly, occurrence of a gap between the fixed wrap 34 and the orbiting wrap 42 can be prevented, and thus compression efficiency can be enhanced.

[0062] In the aforementioned embodiment, the interference prevention portion 46a is formed at the arc compression surface 46 of the orbiting scroll 42. However, in this embodiment, as shown in FIG. 11, the interference prevention portion 46a may be formed at a starting end of the fixed wrap 34 of the fixed scroll 30, the fixed wrap which corresponds to the arc compression surface 46 of the orbiting scroll 40.

[0063] In this case, an interference prevention portion 32a may be formed to have a predetermined depth in a thickness direction of the fixed wrap 34, on an outer circumferential surface of the fixed wrap 34 which contacts the arc compression surface 46, within a section where arc compression is performed based on the orbiting scroll 40.

[0064] Like in the aforementioned embodiment, it is preferable that the depth of the interference prevention portion 32a is equal to or smaller than the tolerance gap (δ1) formed between the key recess 41 a of the orbiting scroll 40 and the key 53 of the Oldham ring 50. The effects in this embodiment are almost the same as those in the aforementioned embodiment, and thus detailed explanations thereof will be omitted.

[0065] The foregoing embodiments and advantages are merely exemplary and are not to be considered as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

[0066] As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be considered broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. A scroll compressor, comprising:

a hermetic container (10);
a fixed scroll (30) fixedly-coupled to the hermetic container (10), and having a fixed wrap (34);
an orbiting scroll (40) having an orbiting wrap (42) which forms a compression chamber (P) by being engaged with the fixed wrap (34), having a rotation shaft coupling portion (43) at a center portion thereof, having an arc compression surface (46) which forms the compression chamber (P) around the rotation shaft coupling portion (43), and configured to perform an orbital motion with respect to the fixed scroll (30); and
a rotation shaft (23) having an eccentric portion which is coupled to the orbiting scroll (40) by passing through the fixed scroll (30), the eccentric portion overlapped with the orbiting wrap (42) in a radial direction,
wherein an interference prevention portion (46a) is formed at the fixed wrap (34) or the orbiting wrap (42) such that an interval between the fixed wrap (34) and the orbiting wrap (42) is larger than an orbiting radius (r) of the orbiting wrap (42).

2. The scroll compressor of claim 1, wherein the interference prevention portion (46a) is formed at the arc compression surface (46).

3. The scroll compressor of claim 2, wherein the interference prevention portion (46a) is formed such that a starting point and an ending point thereof are included in the arc compression surface (46).

4. The scroll compressor of one of claims 1 to 3, further comprising an Oldham ring (50) coupled to the orbiting scroll (40) and configured to prevent rotation of the orbiting scroll (40), and
wherein a tolerance gap (δ1) is formed between the orbiting scroll (40) and the Oldham ring (50), and
wherein a maximum depth (δ2) of the interference prevention portion (46a) is equal to or smaller than the tolerance gap (δ1).

5. The scroll compressor of claim 4, wherein a plurality of key recesses (41 a) are formed at the orbiting scroll (40) in a radial direction, such that keys (53) of the Oldham ring (50) are coupled thereto, and
wherein $\delta 2 = (\delta 1 \times (L2/L1)) \pm 5\ \mu m$, where L1 is a shortest distance between the key recess (41 a) and a center of the rotation shaft coupling portion (43), L2 is a shortest distance between a center line of the orbiting wraps (42) and the center of the rotation shaft coupling portion (43), δ1 is a tolerance gap between the Oldham ring (50) and the key recess (41 a), and δ2 is a depth (offset amount) of the second curved surface.

6. The scroll compressor of one of claims 1 to 5, wherein the arc compression surface (46) is spaced from a side wall surface of the fixed wrap (34) by an orbiting radius, and
wherein a distance between the fixed wrap (34) and the orbiting wrap (42) is equal to the orbiting radius at a first curved surface (P11 ~ P12) of the arc compression surface (46) from a first point (P11) where the arc compression surface (46) starts to an arbitrary second point (P12),
wherein the distance between the fixed wrap (34) and the orbiting wrap (42) is longer than the orbiting radius at a second curved surface (P12 - P13) of the arc compression surface (46) from the second point (P12) to a third point (P13) where arc compression is performed, wherein the interference prevention portion (46a) is formed at the second curved surface (P12 - P13), and
wherein the distance between the fixed wrap (34) and the orbiting wrap (42) is equal to the orbiting radius at a third curved surface (P13 - P14) of the arc compression surface from the third point (P13) to a fourth point (P14) where the arc compression is ended.

7. The scroll compressor of claim 6, wherein a curvature of the second curved surface (P12 - P13) is larger than that of the first curved surface (P11 ~ P12) or the third curved surface (P13 ~ P14).

8. The scroll compressor of one of claims 1 to 7, wherein a protruded portion (35) is formed on an inner circumferential surface of an inner end portion of the fixed wrap (34),
wherein a recess portion (44), which forms a compression chamber by contacting the protruded portion (35), is formed on an outer circumferential surface of the rotation shaft coupling portion (43), and
wherein a thickness of the rotation shaft coupling portion (43) is increased within a predetermined section, toward an opposite direction to a moving direction of the compression chamber (P) at the recess portion (44), and
wherein a thickness of the fixed wrap (34) is decreased within a predetermined section, toward an opposite direction to a moving direction of the compression chamber (P) at the protruded portion (35).

9. The scroll compressor of one of claims 1 to 8, wherein the rotation shaft (23) is coupled to the rotation shaft coupling portion (43) of the orbiting scroll (40) by passing through the fixed scroll (30).

FIG. 1

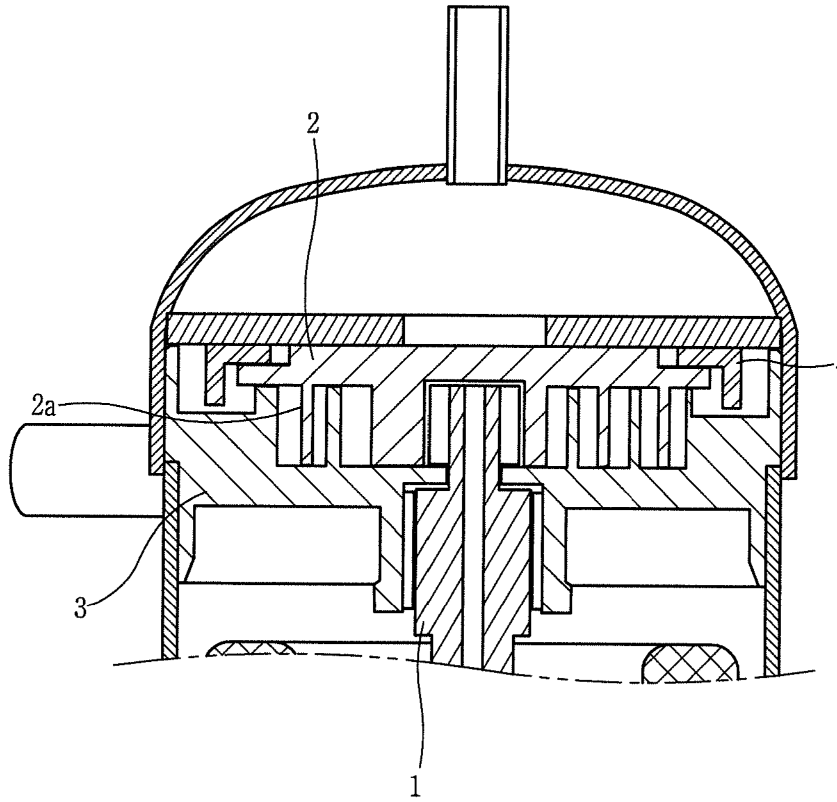


FIG. 2

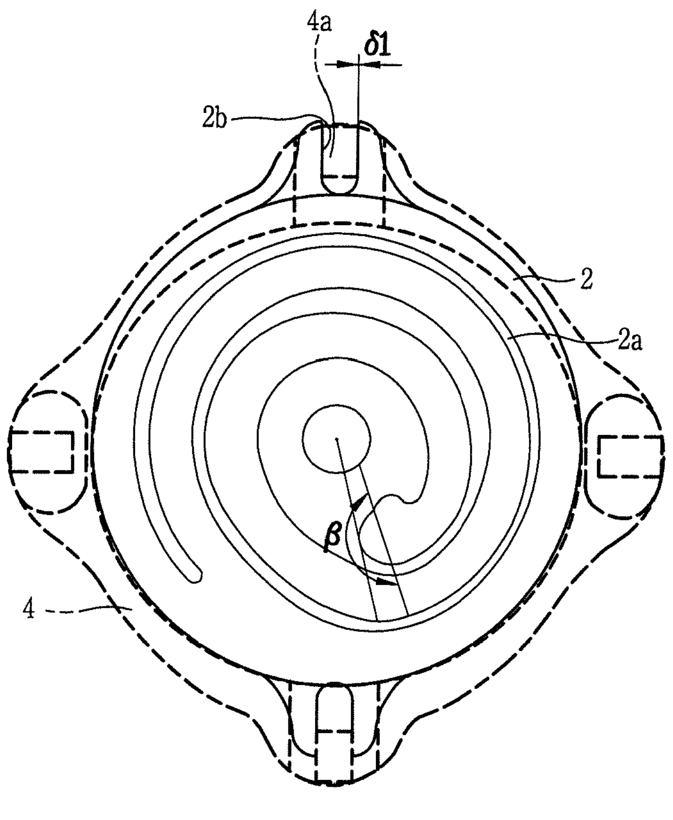


FIG. 3

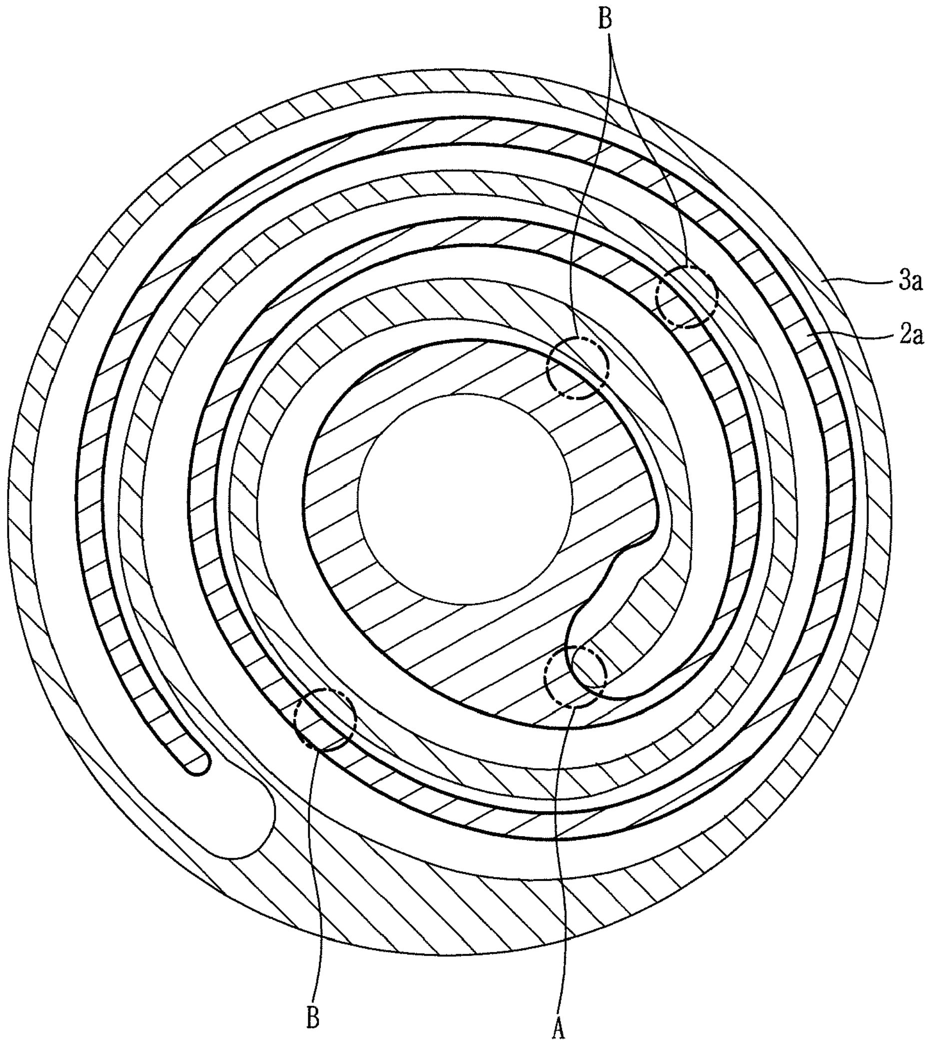


FIG. 4

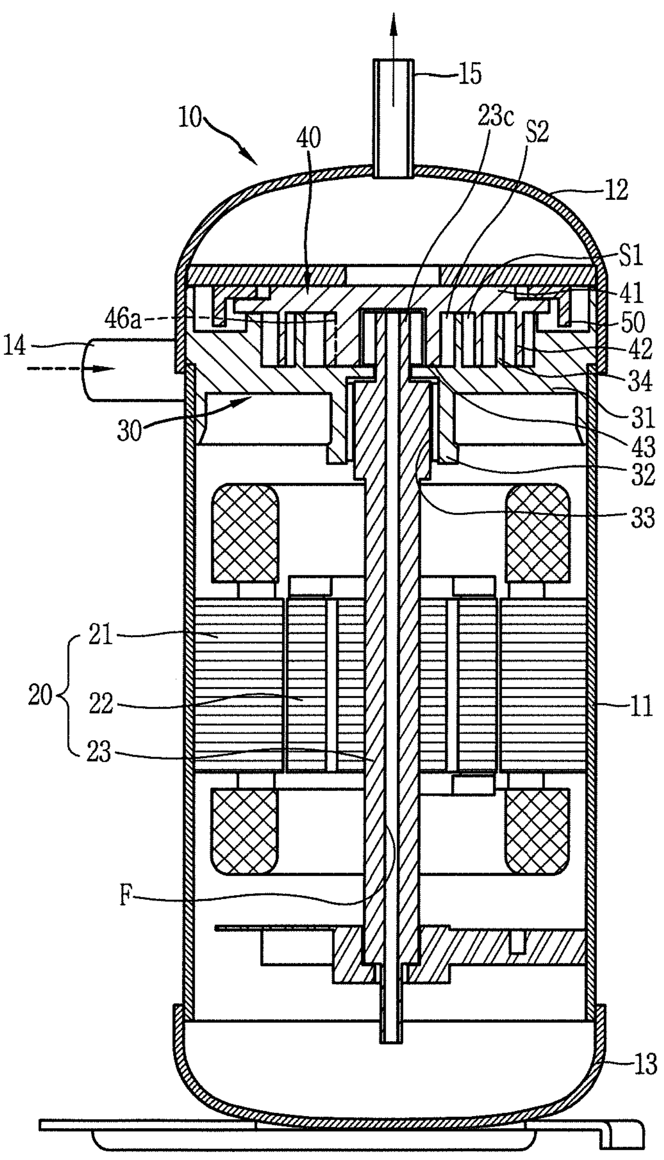

15
10
40
23c
S2
12
S1
41
46a
50
14
42
34
31
30
43
32
33
21
20
22
11
23
F
13

FIG. 5

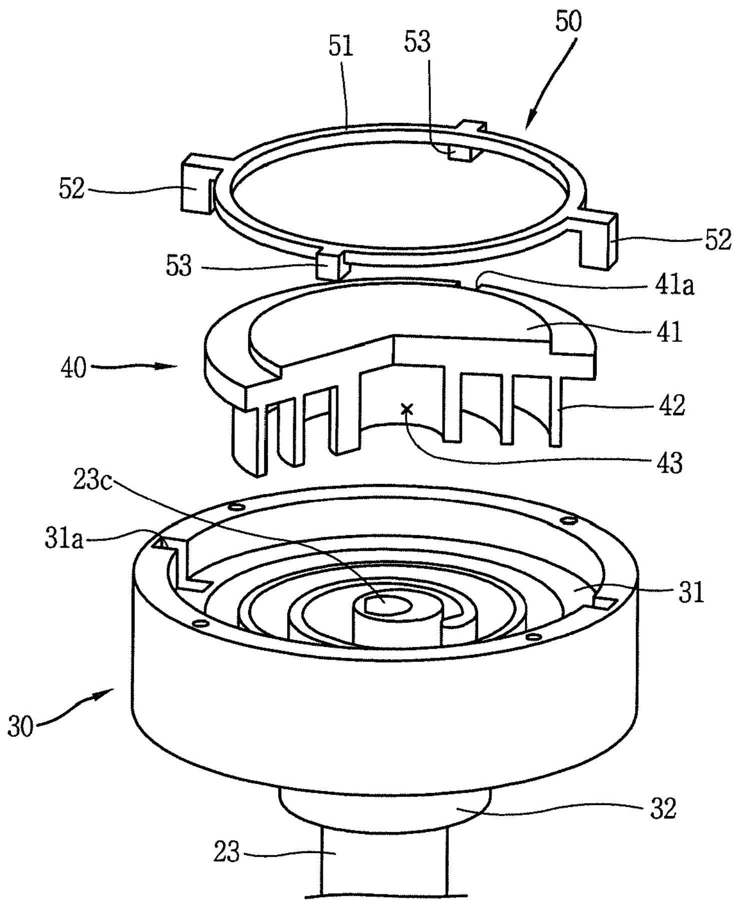


FIG. 6

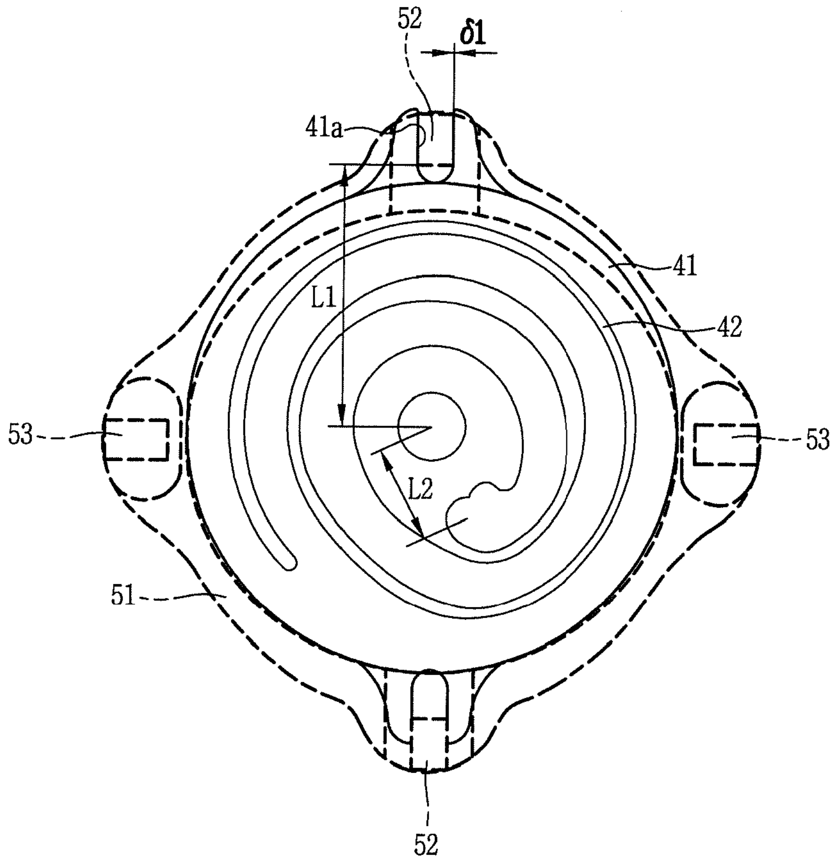


FIG. 7

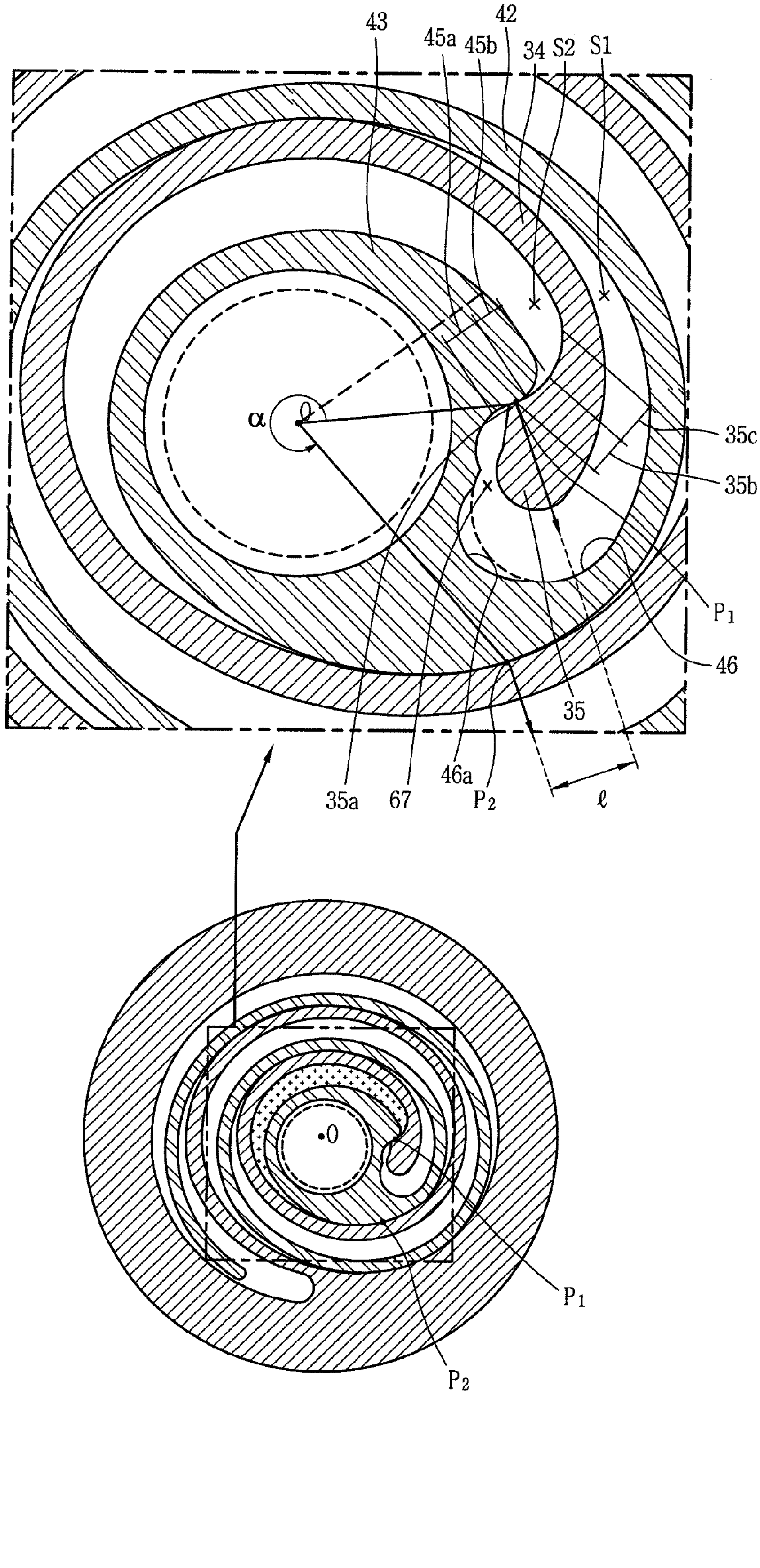


FIG. 8

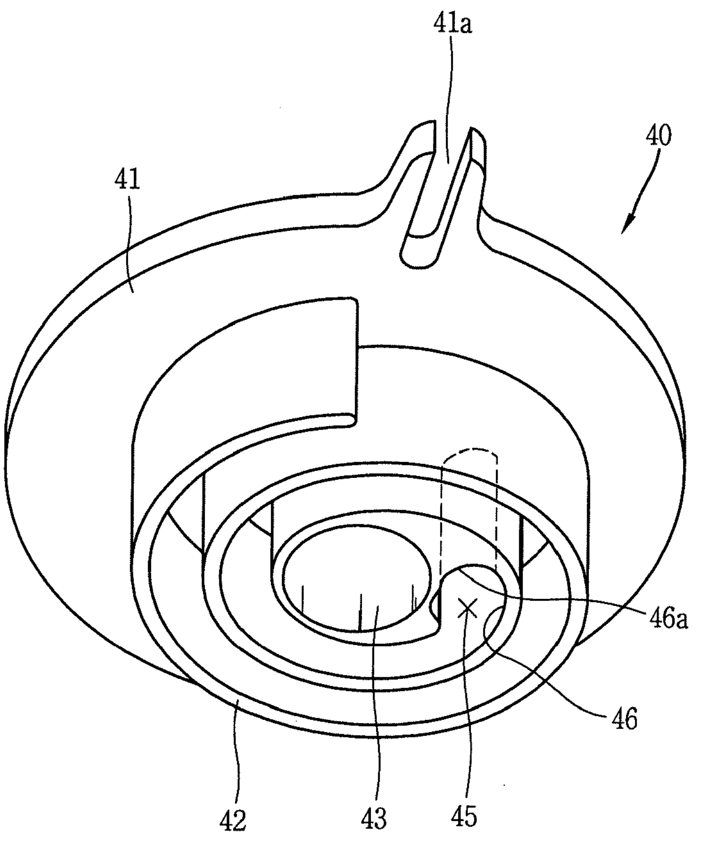


FIG. 9

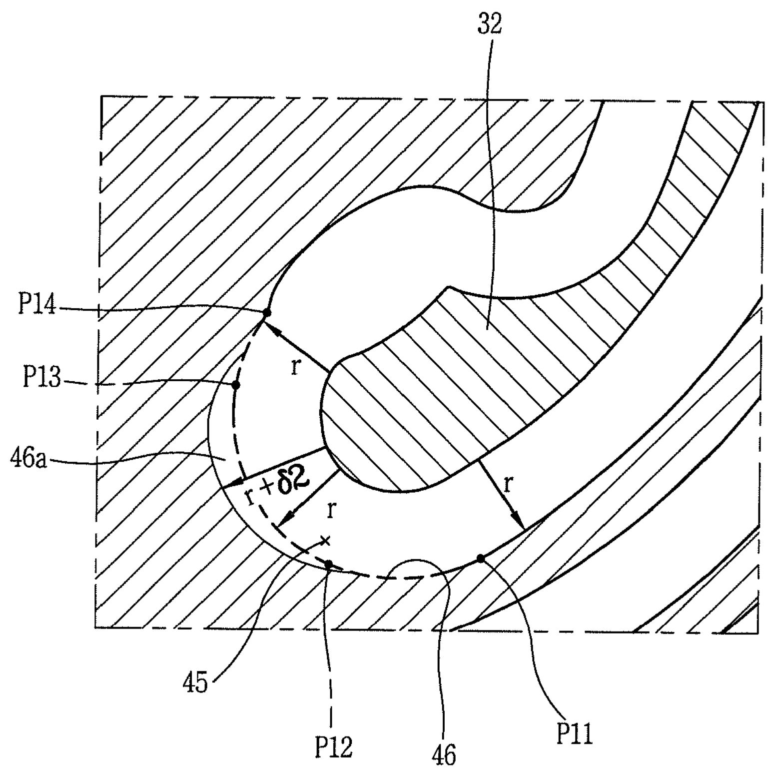


FIG. 10

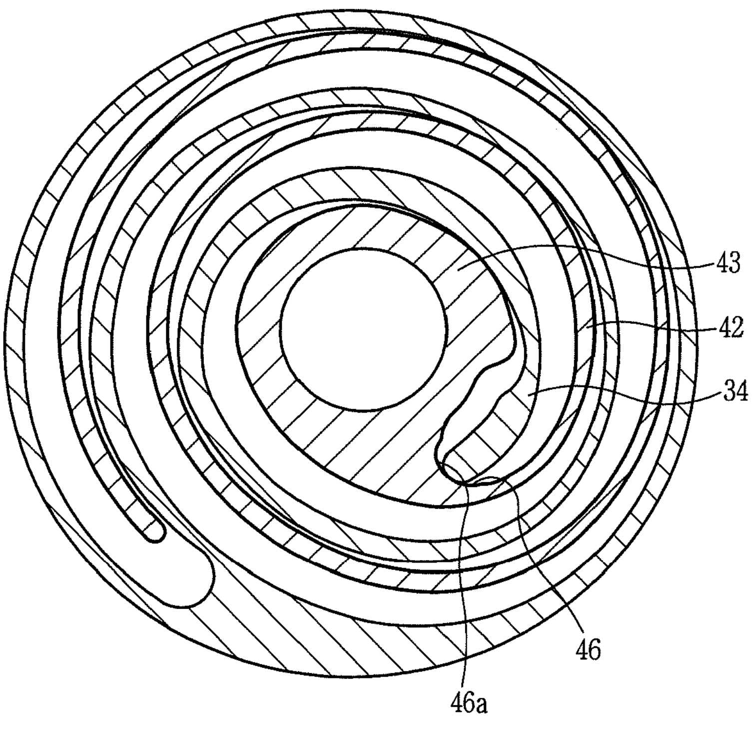


FIG. 11