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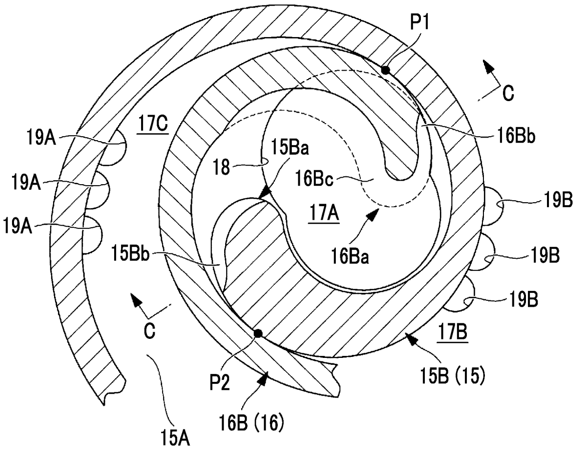
(54) SCROLL COMPRESSOR

(57) Provided is a scroll compressor in which: a discharge port (18) through which a compressed fluid is discharged is formed in an end plate (15A) of a fixed scroll (15); a center side compression chamber (17A) communicating with the discharge port (18) is formed between an inside end portion (15Ba) of a spiral wrap (15B) and an inside end portion (16Ba) of a spiral wrap (16B); a dorsal side compression chamber (17B) is formed between a dorsal side of the spiral wrap (15B) and a ventral side of the spiral wrap (16B); a ventral side compression chamber (17C) is formed between a ventral side of the spiral wrap (15B) and a dorsal side of the spiral wrap (16B); a cut-out portion (15Bb) providing communication between the center side compression chamber (17A) and the dorsal side compression chamber (17B) is formed on a dorsal side of a tooth tip surface facing the end plate; and a cut-out portion (16Bb) providing communication between the center side compression chamber (17A) and the ventral side compression chamber (17C) is formed on a dorsal side of a tooth tip surface facing the end plate (15A).

FIG. 2



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Description

Technical Field

[0001] The present disclosure relates to a scroll compressor.

Background Art

[0002] A scroll compressor includes a pair of a fixed scroll and an orbiting scroll in which a spiral wrap is erected on an end plate, and is configured as follows. A compression chamber formed by causing both scrolls to mesh with each other is moved while a volume of the compression chamber is reduced from an outer peripheral position to a center side in response to a revolving/orbiting motion of the orbiting scroll. In this manner, a refrigerant gas is compressed, and a high-pressure gas thereof is discharged to a discharge chamber from a discharge port provided in a center portion of the fixed scroll (for example, refer to PTL 1).

[0003] The scroll compressor has a configuration in which the volume of the compression chamber is reduced while the compression chamber is sequentially moved to the center side in response to orbiting driving of the orbiting scroll. The scroll compressor has a design volume ratio (operation pressure ratio) defined as a ratio between a maximum compression chamber volume formed at an outermost peripheral position of both scrolls when suctioning ends and a minimum compression chamber volume immediately before meshing between the fixed scroll and the orbiting scroll is released.

[0004] In PTL 1, a protruding wall is provided on a suction side wall of an inner peripheral end portion of the spiral wrap of the orbiting scroll. Since the protruding wall is provided, the minimum compression chamber volume is reduced, and the design volume ratio is raised by delaying a timing at which a suction side wall crosses the discharge port provided in the fixed scroll and one outer compression chamber of the compression chambers on the center side communicates with the discharge port.

Citation List

Patent Literature

[0005] [PTL 1] Japanese Unexamined Patent Application Publication No. 2013-181487

Summary of Invention

Technical Problem

[0006] However, the scroll compressor in the related article has a design pressure ratio determined by a shape of the scroll. Therefore, when the operation pressure ratio is lower than the design pressure ratio, excessive compression occurs in a fluid inside the scroll compressor to have a pressure higher than a discharge pressure. Consequently, compression loss input power occurs and operation efficiency is lowered.

[0007] The present disclosure is made in view of the above-described circumstances, and an object of the present disclosure is to provide a scroll compressor which can prevent excessive compression.

Solution to Problem

[0008] In order to solve the above-described problems, the scroll compressor of the present disclosure adopts the following means.

[0009] According to an aspect of the present disclosure, there is provided a scroll compressor including a fixed scroll having a spiral first wall body erected on one side surface of a first end plate, and an orbiting scroll having a spiral second wall body erected on one side surface of a second end plate and supported to make a revolving/orbiting motion while being prevented from rotating by being meshed with the first wall body. A discharge port for discharging a fluid compressed by the fixed scroll and the orbiting scroll is formed in the first end plate of the fixed scroll. A center-side compression chamber communicating with the discharge port is formed between a first inner end portion of the first wall body and a second inner end portion of the second wall body. A suction-side compression chamber adjacent to the center-side compression chamber is formed between a suction side of the first wall body and a pressure side of the second wall body. A pressure-side compression chamber adjacent to the center-side compression chamber is formed between a pressure side of the first wall body and a suction side of the second wall body. In the first inner end portion of the first wall body, a first cutout portion through which the center-side compression chamber and the suction-side compression chamber communicate with each other is formed on a suction side of a first tip surface facing the second end plate. In the second inner end portion of the second wall body, a second cutout portion through which the center-side compression chamber and the pressure-side compression chamber communicate with each other is formed on a suction side of a second tip surface facing the first end plate.

Advantageous Effects of Invention

[0010] According to the present disclosure, it is possible to provide a scroll compressor which can prevent excessive compression.

Brief Description of Drawings

[0011]

Fig. 1 is a longitudinal sectional view of a scroll compressor according to an embodiment of the present disclosure.

Fig. 2 is a sectional view taken along line A-A of the scroll compressor illustrated in Fig. 1.

Fig. 3 is a sectional view taken along line B-B of the scroll compressor illustrated in Fig. 1.

Fig. 4 is a sectional view taken along line C-C of the scroll compressor illustrated in Fig. 2.

Fig. 5 is a sectional view taken along line A-A of the scroll compressor illustrated in Fig. 1, and illustrates a state where a predetermined time has elapsed from Fig. 2.

Fig. 6 is a sectional view taken along line B-B of the scroll compressor illustrated in Fig. 1, and illustrates a state where a predetermined time has elapsed from Fig. 3.

Fig. 7 is a sectional view taken along line A-A of the scroll compressor illustrated in Fig. 1, and illustrates a state where a predetermined time has elapsed from Fig. 5.

Fig. 8 is a sectional view taken along line B-B of the scroll compressor illustrated in Fig. 1, and illustrates a state where a predetermined time has elapsed from Fig. 6.

Description of Embodiments

[0012] Hereinafter, a scroll compressor 1 according to an embodiment of the present disclosure will be described with reference to the drawings. For example, the scroll compressor 1 of the present embodiment is used as a refrigerating cycle (not illustrated) including a plurality of scroll compressors 1 connected in series. In the refrigerating cycle, the following steps are repeatedly performed. A low-temperature and low-pressure gas-phase refrigerant (fluid) evaporated by an evaporator (not illustrated) is compressed in a stepwise manner by the plurality of scroll compressors 1 to obtain a high-temperature and high-pressure gas-phase refrigerant. Heat is dissipated in a condenser (not illustrated) to obtain a high-temperature and high-pressure liquid-phase refrigerant. A pressure is reduced through an expansion valve (not illustrated) to obtain a low-temperature and low-pressure liquid-phase refrigerant.

[0013] In the refrigerating cycle, the refrigerant is compressed by the plurality of scroll compressors 1 (for example, two units). Therefore, an operation pressure ratio of each of the scroll compressors 1 is lower than a desired operation pressure ratio required for the refrigerating cycle. Therefore, in a case where the operation pressure ratio of each of the scroll compressors 1 is lower than a design pressure ratio, when excessive compression occurs in the refrigerant inside the scroll compressor 1 to have a pressure higher than a discharge pressure, compression loss input power occurs, and operation efficiency is lowered. Therefore, the scroll compressor 1 of the present embodiment adopts a configuration for preventing the excessive compression.

[0014] Hereinafter, the scroll compressor 1 of the present embodiment will be described in detail.

[0015] As illustrated in Fig. 1, the scroll compressor 1 includes a housing 2A and a housing 2B which form an outer shell. The housings 2A and 2B have an enclosed cylindrical shape, and internally form an enclosed space. A scroll compression mechanism 5, a drive shaft 6, an electric motor 7, and a bearing 8 are incorporated in the enclosed space.

[0016] The enclosed space corresponding to the housing 2A is referred to as a discharge chamber CB1, and the enclosed space corresponding to the housing 2B is referred to as a suction chamber CB2. A discharge pipe 31 for discharging the refrigerant is provided on an upper wall of the housing 2A, and causes the discharge chamber CB1 and an outside of the housing 2A to communicate with each other. A suction pipe 32 for suctioning the refrigerant is provided on a side wall of the housing 2B, and causes the suction chamber CB2 and an outside of the housing 2B to communicate with each other.

[0017] The scroll compression mechanism 5 is a device that compresses and discharges the refrigerant, and is connected to the drive shaft 6 driven by the electric motor 7. The drive shaft 6 is supported to be rotatable by the housing 2B via the bearing 8. A rear end of the drive shaft 6 is integrally provided with a crank pin 13 that is eccentric by a predetermined dimension in a direction orthogonal to an axis X which is a central axis of the drive shaft 6 with respect to the axis X. The crank pin 13 is connected to the orbiting scroll 16 of the scroll compression mechanism 5 via a known driven crank mechanism 14 including a drive bush and a drive bearing which have a variable orbiting radius.

[0018] The scroll compression mechanism 5 causes a pair of a fixed scroll 15 and the orbiting scroll 16 to mesh with each other with a phase shift of 180°. In this manner, a pair of the compression chambers 17 facing each other across a center of the fixed scroll 15 are formed between the fixed scroll 15 and the orbiting scroll 16. The scroll compression mechanism 5 compresses a refrigerant gas by moving the compression chamber 17 from an outer peripheral position to a center position while gradually reducing a volume.

[0019] The fixed scroll 15 has a spiral wrap (first wall body) 15B which is a wall body erected on one side surface of an end plate (first end plate) 15A. A discharge port 18 from which the refrigerant gas compressed by the fixed scroll 15 and the orbiting scroll 16 is discharged is formed in the end plate 15A. The fixed scroll 15 is fixed to a discharge cover 3 pinched between the housings 2A and 2B.

[0020] The orbiting scroll 16 has a spiral wrap (second wall body) 16B which is a wall body erected on one side surface of an end plate (second end plate) 16A. The orbiting scroll 16 is connected to a crank pin 13 of the drive shaft 6 via the driven crank mechanism 14, and is supported and driven for revolving/orbiting by a thrust bearing surface of the housing 2B via a known rotation prevention mechanism (not illustrated). The orbiting scroll

16 meshes with the spiral wrap 15B of the fixed scroll 15, and is supported to be capable of a revolving/orbiting motion while being prevented from rotating.

[0021] A tooth tip surface (first tip surface) 15C of the fixed scroll 15 faces a tooth bottom surface (one side surface) 16D of the orbiting scroll 16, and a tooth tip surface (second tip surface) 16C of the orbiting scroll 16 faces a tooth bottom surface 15D of the fixed scroll 15. The discharge cover 3 is disposed above the fixed scroll 15 (on a back surface side of the end plate 15A), and defines a back pressure chamber CB3 together with a back surface of the end plate 15A.

[0022] A discharge port 18 through which the compression chamber 17 and the back pressure chamber CB3 communicate with each other is formed in the end plate 15A. A discharge port 3A through which the back pressure chamber CB3 and the discharge chamber CB1 communicate with each other is formed in the discharge cover 3. The compression chamber 17 and the discharge chamber CB1 communicate with each other via the discharge port 18, the back pressure chamber CB3, and the discharge port 3A.

[0023] In the discharge chamber CB1, a retainer 93 that regulates a reed valve 92 and a movable range of the reed valve 92 is provided in an outlet portion of the discharge port 3A. The refrigerant pressurized to a predetermined pressure in the compression chamber 17 flows into the back pressure chamber CB3 from the discharge port 18, is guided from the discharge port 3A to the discharge chamber CB1 via the reed valve 92, and is discharged outward from the discharge pipe 31.

[0024] Next, a cutout portion 15Bb formed on a tooth tip surface 15C of a spiral wrap 15B of the fixed scroll 15 and a cutout portion 16Bb formed on a tooth tip surface 16C of a spiral wrap 16B of the orbiting scroll 16 will be described to with reference to the drawings.

[0025] Figs. 2 and 3 are a sectional view taken along line A-A and a sectional view taken along line B-B of the scroll compressor illustrated in Fig. 1. Fig. 4 is a sectional view taken along line C-C of the scroll compressor illustrated in Fig. 2. Figs. 5 and 6 are a sectional view taken along line A-A and a sectional view taken along line B-B of the scroll compressor illustrated in Fig. 1, and illustrate a state where a predetermined time has elapsed from Figs. 2 and 3. Figs. 7 and 8 are a sectional view taken along line A-A and a sectional view taken along line B-B of the scroll compressor illustrated in Fig. 1, and illustrate a state where a predetermined time has elapsed from Figs. 5 and 6.

[0026] As illustrated in Figs. 2 to 7, the compression chamber 17 illustrated in Fig. 1 has a center-side compression chamber 17A, a suction-side compression chamber 17B, and a pressure-side compression chamber 17C. The center-side compression chamber 17A is a compression chamber formed between an inner end portion (first inner end portion) 15Ba of the spiral wrap 15B and an inner end portion (second inner end portion) 16Ba of the spiral wrap 16B, and communicates with the discharge port 18.

[0027] The suction-side compression chamber 17B is a compression chamber formed between a suction side of the spiral wrap 15B and a pressure side of the spiral wrap 16B, and is adjacent to the center-side compression chamber 17A. The pressure-side compression chamber 17C is a compression chamber formed between a pressure side of the spiral wrap 15B and a suction side of the spiral wrap 16B, and is adjacent to the center-side compression chamber 17A.

[0028] As illustrated in Figs. 2, 5, and 7, a plurality of bypass ports 19A provided with a valve that opens when the pressure of the refrigerant gas in the pressure-side compression chamber 17C is equal to or higher than a predetermined pressure are formed in the end plate 15A. The bypass port 19A prevents excessive compression by discharging the refrigerant gas whose pressure is equal to or higher than the predetermined pressure before the refrigerant gas is discharged from the discharge port 18.

[0029] As illustrated in Figs. 2, 5, and 7, a plurality of bypass ports 19B provided with a valve that opens when the pressure of the refrigerant gas in the suction-side compression chamber 17B is equal to or higher than a predetermined pressure are formed in the end plate 15A. The bypass port 19B prevents excessive compression by discharging the refrigerant gas whose pressure is equal to or higher than the predetermined pressure before the refrigerant gas is discharged from the discharge port 18.

[0030] In the inner end portion 15Ba of the spiral wrap 15B, the cutout portion (first cutout portion) 15Bb through which the center-side compression chamber 17A and the suction-side compression chamber 17B communicate with each other is formed on the suction side of the tooth tip surface 15C facing the end plate 16A. As illustrated in Fig. 4, the cutout portion 15Bb is a portion cut out so that a width W2 of the spiral wrap 15B close to the tooth tip surface 15C is narrower than a width W1 of the spiral wrap 15B close to the tooth bottom surface 15D of the fixed scroll 15 in a horizontal direction HD orthogonal to the axis X.

[0031] The cutout portion 15Bb has a constant width (W1-W2 in Fig. 4) along a vertical direction VD parallel to the axis X. A height H2 of the cutout portion 15Bb in the vertical direction VD is higher than a height H1 of the spiral wrap 15B in the vertical direction VD excluding a portion of the cutout portion 15Bb. For example, the height H2 is set to approximately twice the height H1.

[0032] The cutout portion 15Bb is provided to quicken a timing at which the suction-side compression chamber 17B and the center-side compression chamber 17A communicate with each other, compared to the spiral wrap 15B in which the cutout portion 15Bb is not formed (width in the horizontal direction HD is the same at each position in the vertical direction VD).

[0033] In the inner end portion 16Ba of the spiral wrap 16B, a cutout portion (second cutout portion) 16Bb through which the center-side compression chamber 17A and the pressure-side compression chamber 17C communicate with each other is formed on the suction side of the tooth tip surface 16C facing the end plate 15A. In addition, in the inner end portion 16Ba of the spiral wrap 16B, a cutout portion 16Bc is formed on the pressure side of the tooth tip surface 16C facing the end plate 15A.

[0034] As illustrated in Fig. 4, the cutout portion 16Bb and the cutout portion 16Bc are portions cut out so that a width W4 of the spiral wrap 16B close to the tooth tip surface 16C is narrower than a width W3 of the spiral wrap 16B close to the tooth bottom surface 16D of the orbiting scroll 16 in the horizontal direction HD orthogonal to the axis X.

[0035] The cutout portion 16Bb has a constant width along the vertical direction VD parallel to the axis X. A height H4 of the cutout portion 16Bb in the vertical direction VD is higher than a height H3 of the spiral wrap 16B in the vertical direction VD excluding portions of the cutout portion 16Bb and the cutout portion 16Bc. For example, the height H4 is set to approximately twice the height H3.

[0036] The cutout portion 16Bb is provided to quicken a timing at which the pressure-side compression chamber 17C and the center-side compression chamber 17A communicate with each other, compared to the spiral wrap 16B in which the cutout portion 16Bb is not formed.

[0037] Here, a timing at which the suction-side compression chamber 17B and the center-side compression chamber 17A communicate with each other via the cutout portion 15Bb and a timing at which the pressure-side compression chamber 17C and the center-side compression chamber 17A communicate with each other via the cutout portion 16Bb will be described.

[0038] Figs. 2 and 3 illustrate an operating state where the volume of the center-side compression chamber 17A is gradually reduced, and illustrate a state where the center-side compression chamber 17A does not communicate with the suction-side compression chamber 17B and the pressure-side compression chamber 17C. As illustrated in Figs. 2 and 3, the pressure side of the spiral wrap 15B and the suction side of the spiral wrap 16B are in contact with each other at a meshing point P1, and the suction side of the spiral wrap 15B and the pressure side of the spiral wrap 16B are in contact with each other at a meshing point P2. The meshing point P1 is located in a region where the cutout portion 16Bb of the spiral wrap 16B does not exist, and the meshing point P2 is located in a region where the cutout portion 15Bb of the spiral wrap 15B does not exist.

[0039] After a predetermined time has elapsed from a state illustrated in Figs. 2 and 3, the state is changed to a state illustrated in Figs. 5 and 6. Figs. 5 and 6 illustrate an operating state where the volume of the center-side compression chamber 17A is gradually reduced, and illustrate a state where the center-side compression chamber 17A starts to communicate with both the suction-side compression chamber 17B and the pressure-side compression chamber 17C. As illustrated in Figs. 5 and 6, the meshing point P1 is located in a region where the cutout portion 16Bb of the spiral wrap 16B exists, and the meshing point P2 is located in a region where the cutout portion 15Bb of the spiral wrap 15B exists.

[0040] Figs. 5 and 6 illustrate a timing immediately after the center-side compression chamber 17A and the suction-side compression chamber 17B start to communicate with each other, and the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other. As illustrated in Figs. 5 and 6, the cutout portion 15Bb and the cutout portion 16Bb are formed so that a timing at which the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other via the cutout portion 16Bb coincides with a timing at which the center-side compression chamber 17A and the suction-side compression chamber 17B start to communicate with each other via the cutout portion 15Bb.

[0041] As illustrated in Fig. 5, when the center-side compression chamber 17A and the suction-side compression chamber 17B start to communicate with each other, and the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other, the discharge port 18 and the pressure-side compression chamber 17C start to communicate with each other at a communication point P3. That is, the discharge port 18 is formed in the end plate 15A so that a timing at which the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other via the cutout portion 16Bb coincides with a timing at which the discharge port 18 and the pressure-side compression chamber 17C start to directly communicate with each other.

[0042] When the center-side compression chamber 17A and the suction-side compression chamber 17B start to communicate with each other, the refrigerant gas flows into the center-side compression chamber 17A from the suction-side compression chamber 17B via the cutout portion 15Bb, and the pressure in the suction-side compression chamber 17B is lowered. In addition, the refrigerant gas flows into the center-side compression chamber 17A from the pressure-side compression chamber 17C via the cutout portion 16Bb, and the pressure in the pressure-side compression chamber 17C is lowered.

[0043] After a predetermined time has elapsed from a state illustrated in Figs. 5 and 6, the state is changed to a state illustrated in Figs. 7 and 8. Figs. 7 and 8 illustrate an operating state where the volume of the center-side compression chamber 17A is gradually reduced, and illustrate a state where the center-side compression chamber 17A communicates with both the suction-side compression chamber 17B and the pressure-side compression chamber 17C.

[0044] As illustrated in Figs. 7 and 8, the meshing point

P1 is located in a region where the cutout portion 16Bb of the spiral wrap 16B exists, and the meshing point P2 is located in a region where the cutout portion 15Bb of the spiral wrap 15B exists. As illustrated in Fig. 7, the discharge port 18 is formed in the end plate 15A to directly communicate with the pressure-side compression chamber 17C in a state where the center-side compression chamber 17A and the pressure-side compression chamber 17C communicate with each other via the cutout portion 16Bb.

[0045] According to the scroll compressor 1 of the present embodiment described above, the following operational effects are achieved.

[0046] According to the scroll compressor 1 of the present embodiment, in the inner end portion 15Ba of the spiral wrap 15B of the fixed scroll 15, the cutout portion 15Bb through which the center-side compression chamber 17A and the suction-side compression chamber 17B communicate with each other is formed on the suction side of the tooth tip surface 15C facing the end plate 16A of the orbiting scroll 16. Therefore, in a process in which the volume of the center-side compression chamber 17A is gradually reduced, a timing at which the center-side compression chamber 17A and the suction-side compression chamber 17B start to communicate with each other is quickened, compared to when the cutout portion 15Bb is not formed. Therefore, excessive compression in the suction-side compression chamber 17B can be prevented.

[0047] In addition, according to the scroll compressor 1 of the present embodiment, in the inner end portion 16Ba of the spiral wrap 16B of the orbiting scroll 16, the cutout portion 16Bb through which the center-side compression chamber 17A and the pressure-side compression chamber 17C communicate with each other is formed on the suction side of the tooth tip surface 16C facing the end plate 15A of the fixed scroll 15. Therefore, in a process in which the volume of the center-side compression chamber 17A is gradually reduced, a timing at which the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other is quickened, compared to when the cutout portion 16Bb is not formed. Therefore, excessive compression in the pressure-side compression chamber 17C can be prevented.

[0048] In addition, according to the scroll compressor 1 of the present embodiment, the discharge port 18 directly communicates with the pressure-side compression chamber 17C in a state where the center-side compression chamber 17A and the pressure-side compression chamber 17C communicate with each other via the cutout portion 16Bb. Therefore, the refrigerant gas compressed in the pressure-side compression chamber 17C is directly guided to the discharge port 18, and is guided to the discharge port 18 from the cutout portion 16Bb via the center-side compression chamber 17A. Since the refrigerant gas compressed in the pressure-side compression chamber 17C is guided to the discharge port 18 from two paths, excessive compression in the pressure-side compression chamber 17C can be reliably prevented.

[0049] According to the scroll compressor 1 of the present embodiment, a timing at which the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other coincides with a timing at which the discharge port 18 and the pressure-side compression chamber 17C start to communicate with each other. Therefore, a pressure loss of the refrigerant gas can be prevented by sufficiently securing a flow path cross-sectional area of the refrigerant gas when the pressure-side compression chamber 17C and the discharge port 18 start to communicate with each other.

[0050] According to the scroll compressor 1 of the present embodiment, a timing at which the center-side compression chamber 17A and the pressure-side compression chamber 17C start to communicate with each other coincides with a timing at which the center-side compression chamber 17A and the suction-side compression chamber 17B start to communicate with each other. Therefore, it is possible to prevent torsion in a direction opposite to a rotation direction of the orbiting scroll 16 which is caused by a pressure difference between the suction-side compression chamber 17B and the pressure-side compression chamber 17C. In this manner, it is possible to prevent loss caused by a leakage of the refrigerant gas inside the scroll compression mechanism 5, and it is possible to prevent abnormal noise generated by the leakage of the refrigerant gas.

[0051] The scroll compressor according to the embodiment of the present disclosure as described above is understood as follows, for example.

[0052] The scroll compressor (1) according to an aspect of the present disclosure includes the fixed scroll (15) having the spiral first wall body (15B) erected on one side surface of the first end plate (15A), and the orbiting scroll (16) having the spiral second wall body (16B) erected on one side surface of the second end plate (16A) and supported to make a revolving/orbiting motion while being prevented from rotating by being meshed with the first wall body. The discharge port (18) for discharging the fluid compressed by the fixed scroll and the orbiting scroll is formed in the first end plate of the fixed scroll. The center-side compression chamber (17A) communicating with the discharge port is formed between the first inner end portion (15Ba) of the first wall body and the second inner end portion (16Ba) of the second wall body. The suction-side compression chamber (17B) adjacent to the center-side compression chamber is formed between the suction side of the first wall body and the pressure side of the second wall body. The pressure-side compression chamber (17C) adjacent to the center-side compression chamber is formed between the pressure side of the first wall body and the suction side of the second wall body. In the first inner end portion of the first wall body, the first cutout portion (15Bb) through which the center-side compression chamber and the suction-side compression chamber communicate with each other is formed on the suction side of the first tip surface (15C) facing the second end plate. In the second inner end portion of the second wall body, the second cutout portion (16Bb) through which the center-side compression chamber and the pressure-side compression chamber communicate with each other is formed on the suction side of the second tip surface (16C) facing the first end plate.

[0053] According to the scroll compressor according to an aspect of the present disclosure, in the first inner end portion of the first wall body of the fixed scroll, the first cutout portion through which the center-side compression chamber and the suction-side compression chamber communicate with each other is formed on the suction side of the first tip surface facing the second end plate of the orbiting scroll. Therefore, in a process in which the volume of the center-side compression chamber is gradually reduced, a timing at which the center-side compression chamber and the suction-side compression chamber start to communicate with each other is quickened, compared to when the first cutout portion is not formed. Therefore, excessive compression in the suction-side compression chamber can be prevented.

[0054] In addition, according to the scroll compressor according to an aspect of the present disclosure, in the second inner end portion of the second wall body of the orbiting scroll, on the suction side of the second tip surface facing the first end plate of the fixed scroll. A second cutout portion is formed to allow the center-side compression chamber and the pressure-side compression chamber to communicate with each other. Therefore, in a process in which the volume of the center-side compression chamber is gradually reduced, the timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other is earlier than in a case where the second cutout portion is not formed. Therefore, excessive compression in the pressure-side compression chamber can be prevented.

[0055] In the scroll compressor according to an aspect of the present disclosure, a configuration may be adopted as follows. The discharge port may be formed in the first end plate to directly communicate with the pressure-side compression chamber in a state where the center-side compression chamber and the pressure-side compression chamber communicate with each other via the second cutout portion.

[0056] According to the scroll compressor of the present configuration, the discharge port directly communicates with the pressure-side compression chamber in a state where the center-side compression chamber and the pressure-side compression chamber communicate with each other via the second cutout portion. Therefore, the fluid compressed in the pressure-side compression chamber is directly guided to the discharge port, and is guided to the discharge port from the second cutout portion via the center-side compression chamber. Since the fluid compressed in the pressure-side compression chamber is guided to the discharge port from two paths, excessive compression in the pressure-side compression chamber can be reliably prevented.

[0057] In the scroll compressor having the above-described configuration, an aspect may be adopted as follows. The discharge port may be formed in the first end plate so that a timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other via the second cutout portion coincides with a timing at which the discharge port and the pressure-side compression chamber start to communicate with each other.

[0058] According to the scroll compressor of the present aspect, a timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other coincides with a timing at which the discharge port and the pressure-side compression chamber start to communicate with each other. Therefore, a pressure loss of the fluid can be prevented by sufficiently securing a flow path cross-sectional area of the fluid when the pressure-side compression chamber and the discharge port start to communicate with each other.

[0059] In the scroll compressor according to an aspect of the present disclosure, a configuration may be adopted as follows. The first cutout portion and the second cutout portion may be formed so that a timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other via the second cutout portion coincides with a timing at which the center-side compression chamber and the suction-side compression chamber start to communicate with each other via the first cutout portion.

[0060] According to the scroll compressor of the present configuration, a timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other coincides with a timing at which the center-side compression chamber and the suction-side compression chamber start to communicate with each other. Therefore, it is possible to prevent a disadvantage caused by a pressure difference between the suction-side compression chamber and the pressure-side compression chamber.

Reference Signs List

[0061]

1: Scroll compressor
2A, 2B: Housing
3A: Discharge port
5: Scroll compression mechanism
6: Drive shaft
7: Electric motor
15: Fixed scroll
15A: End plate (first end plate)
15B: Spiral wrap (first wall body)

15Ba: Inner end portion(first inner end portion)
15Bb: Cutout portion (first cutout portion)
15C: Tooth tip surface (first tip surface)
15D: Tooth bottom surface
16: Orbiting scroll
16A: End plate (second end plate)
16B: Spiral wrap (second wall body)
16Ba: Inner end portion (second inner end portion)
16Bb: Cutout portion (second cutout portion)
16Bc: Cutout portion
16C: Tooth tip surface (second tip surface)
16D: Tooth bottom surface
17: Compression chamber
17A: Center-side compression chamber
17B: Suction-side compression chamber
17C: Pressure-side compression chamber
18: Discharge port
HD: Horizontal direction
P1: Meshing point
P2: Meshing point
P3: Communication point
VD: Vertical direction
X: Axis

Claims

1. A scroll compressor comprising:

    a fixed scroll having a spiral first wall body erected on one side surface of a first end plate; and
    an orbiting scroll having a spiral second wall body erected on one side surface of a second end plate and supported to make a revolving/orbiting motion while being prevented from rotating by being meshed with the first wall body,
    wherein a discharge port for discharging a fluid compressed by the fixed scroll and the orbiting scroll is formed in the first end plate of the fixed scroll,
    a center-side compression chamber communicating with the discharge port is formed between a first inner end portion of the first wall body and a second inner end portion of the second wall body,
    a suction-side compression chamber adjacent to the center-side compression chamber is formed between a suction side of the first wall body and a pressure side of the second wall body,
    a pressure-side compression chamber adjacent to the center-side compression chamber is formed between a pressure side of the first wall body and a suction side of the second wall body,
    in the first inner end portion of the first wall body, a first cutout portion through which the center-side compression chamber and the suction-side compression chamber communicate with each other is formed on a suction side of a first tip surface facing the second end plate, and
    in the second inner end portion of the second wall body, a second cutout portion through which the center-side compression chamber and the pressure-side compression chamber communicate with each other is formed on a suction side of a second tip surface facing the first end plate.

2. The scroll compressor according to Claim 1, wherein the discharge port is formed in the first end plate to directly communicate with the pressure-side compression chamber in a state where the center-side compression chamber and the pressure-side compression chamber communicate with each other via the second cutout portion.

3. The scroll compressor according to Claim 2, wherein the discharge port is formed in the first end plate so that a timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other via the second cutout portion coincides with a timing at which the discharge port and the pressure-side compression chamber start to communicate with each other.

4. The scroll compressor according to any one of Claims 1 to 3, wherein the first cutout portion and the second cutout portion are formed so that a timing at which the center-side compression chamber and the pressure-side compression chamber start to communicate with each other via the second cutout portion coincides with a timing at which the center-side compression chamber and the suction-side compression chamber start to communicate with each other via the first cutout portion.

FIG. 1

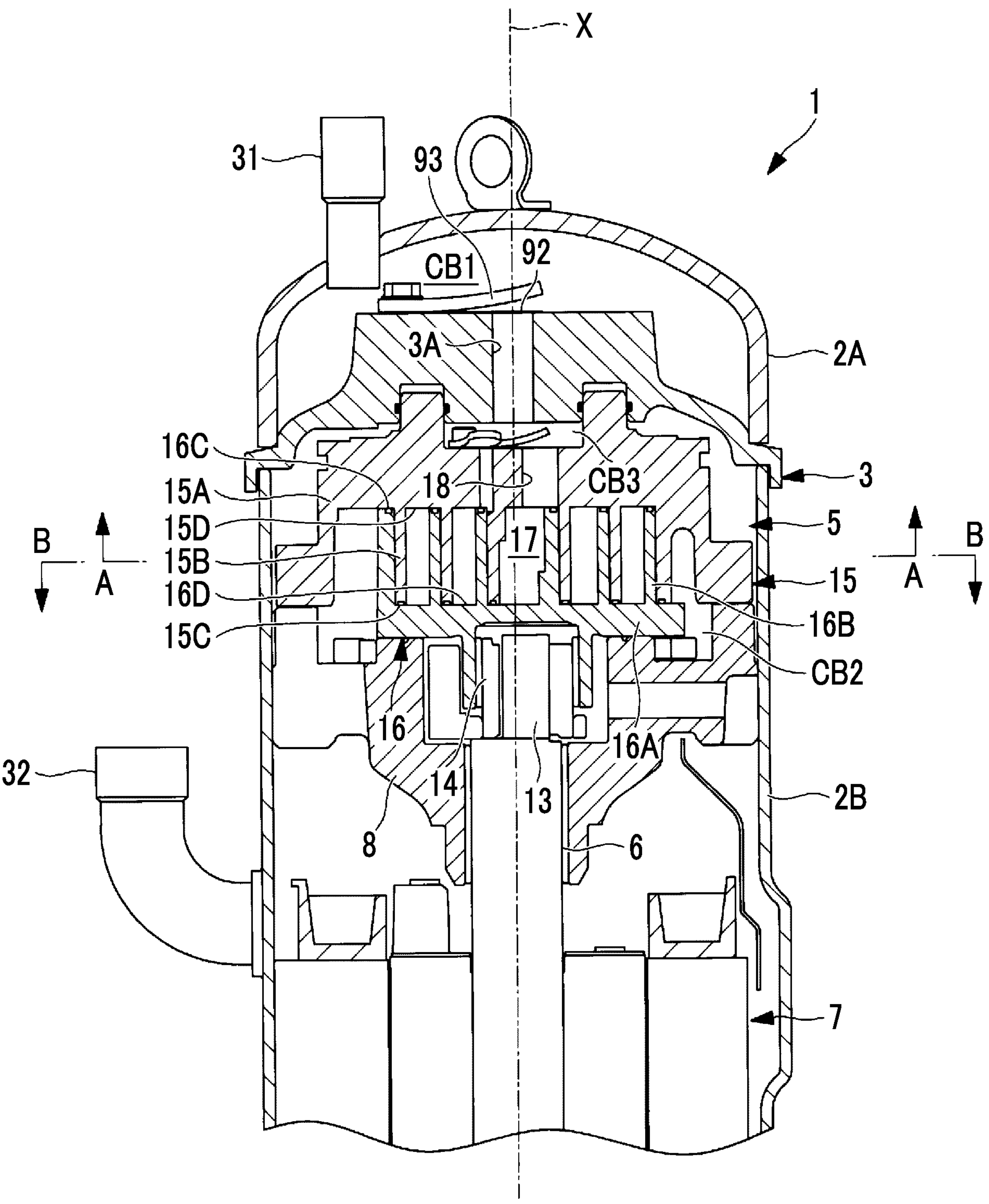

X
1
31
93
92
CB1
3A
2A
16C
CB3
3
18
15A
5
15D
B
B
17
15B
A
A
15
16D
16B
15C
CB2
16
16A
32
14
13
2B
8
6
7

FIG. 2

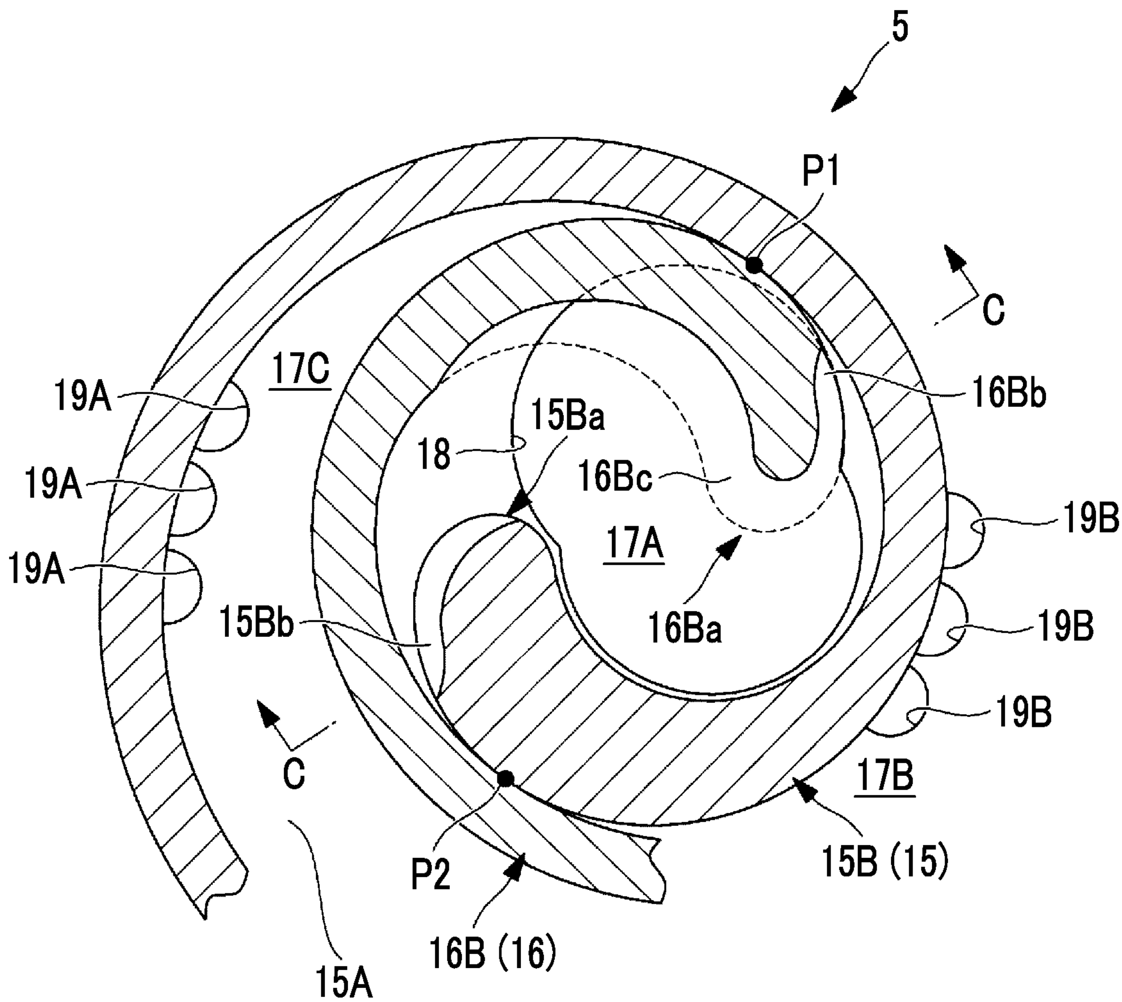

5
P1
C
17C
16Bb
19A
15Ba
19A
18
16Bc
19B
17A
19A
19B
15Bb
16Ba
19B
C
17B
P2
15B (15)
16B (16)
15A

FIG. 3

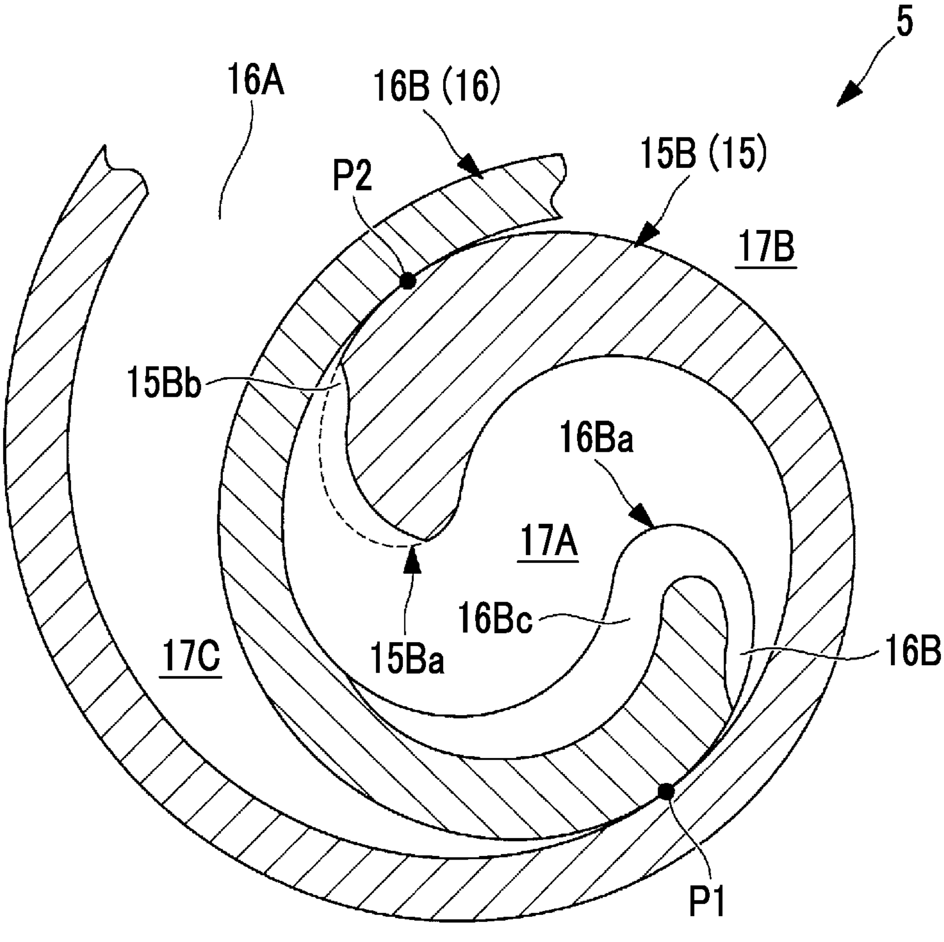


FIG. 4

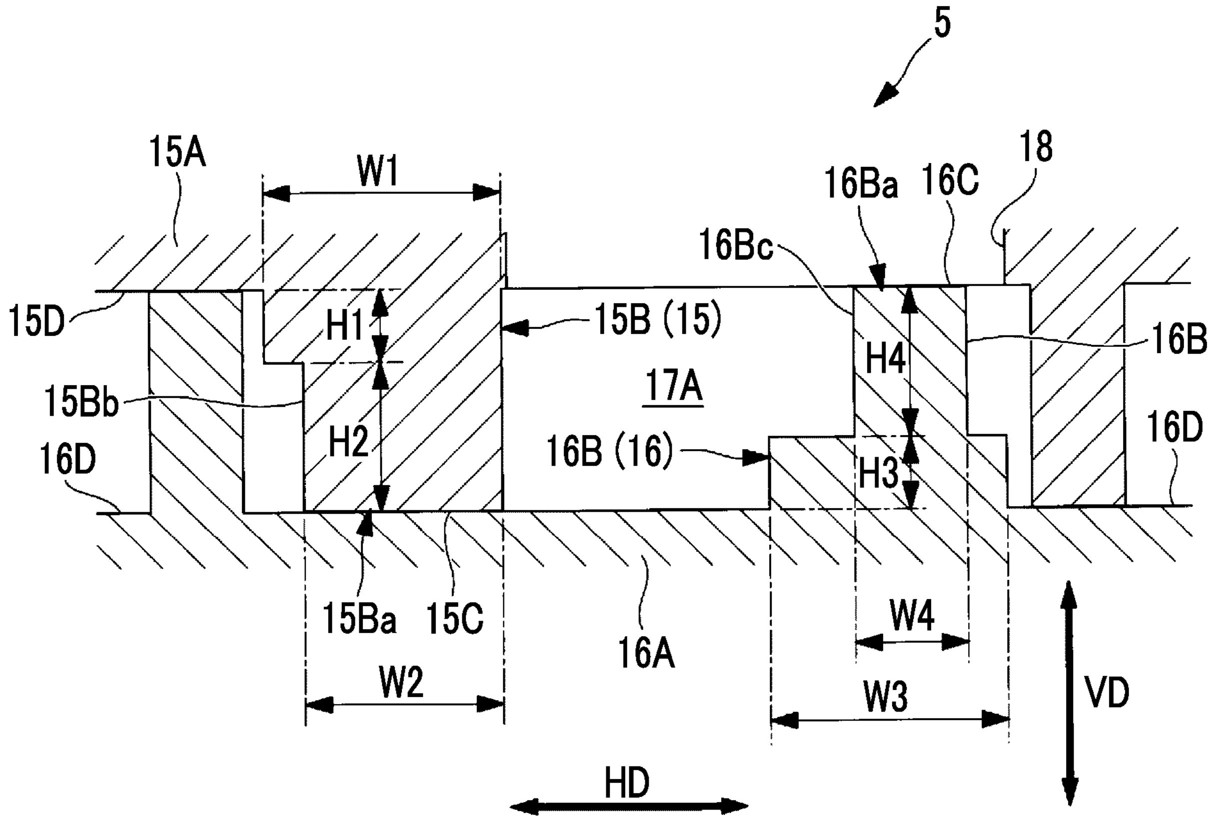

5
15A
W1
18
16Ba
16C
16Bc
15D
H1
15B (15)
16Bb
15Bb
17A
H4
16D
H2
16B (16)
H3
16D
15Ba
15C
16A
W4
W2
W3
VD
HD

FIG. 5

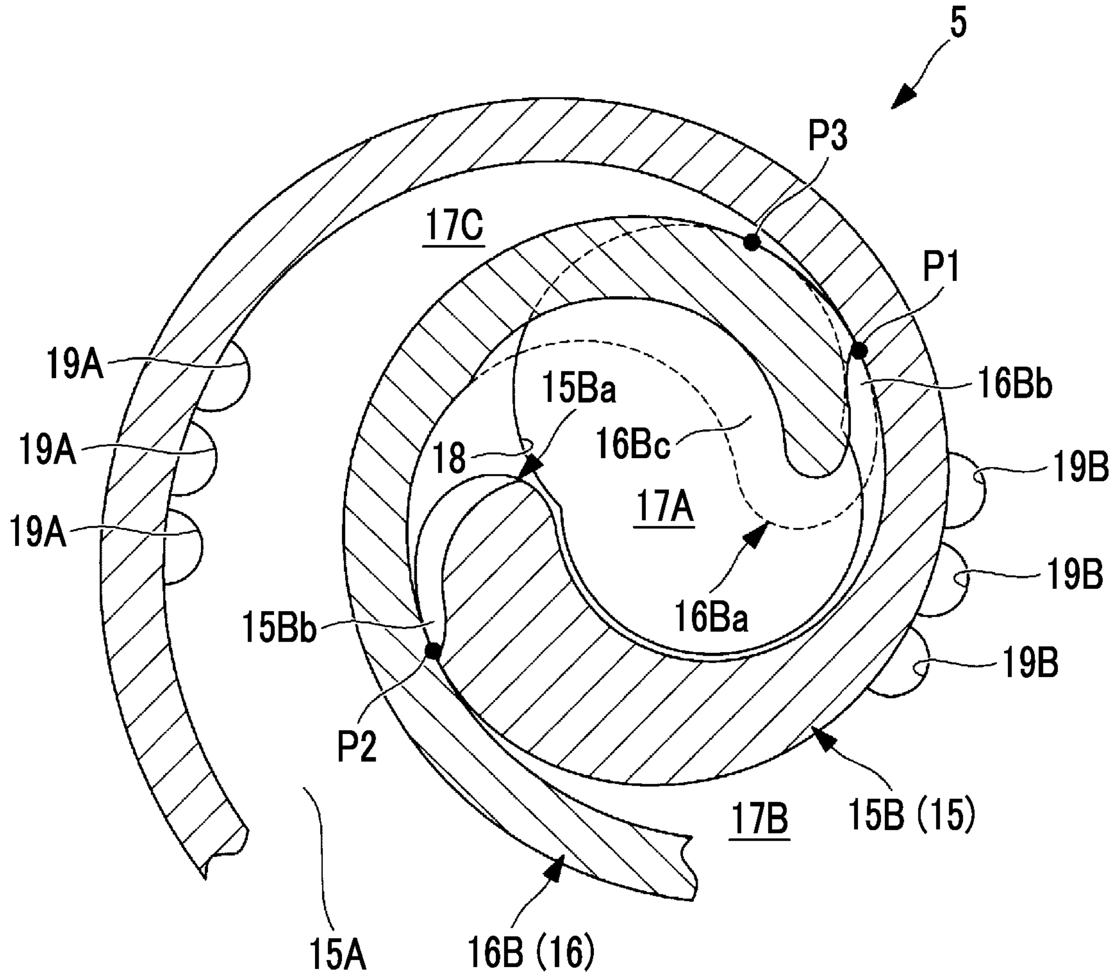

5
P3
17C
P1
19A
16Bb
15Ba
19A
16Bc
19B
18
17A
19A
19B
16Ba
15Bb
19B
P2
17B
15B (15)
15A
16B (16)

FIG. 6

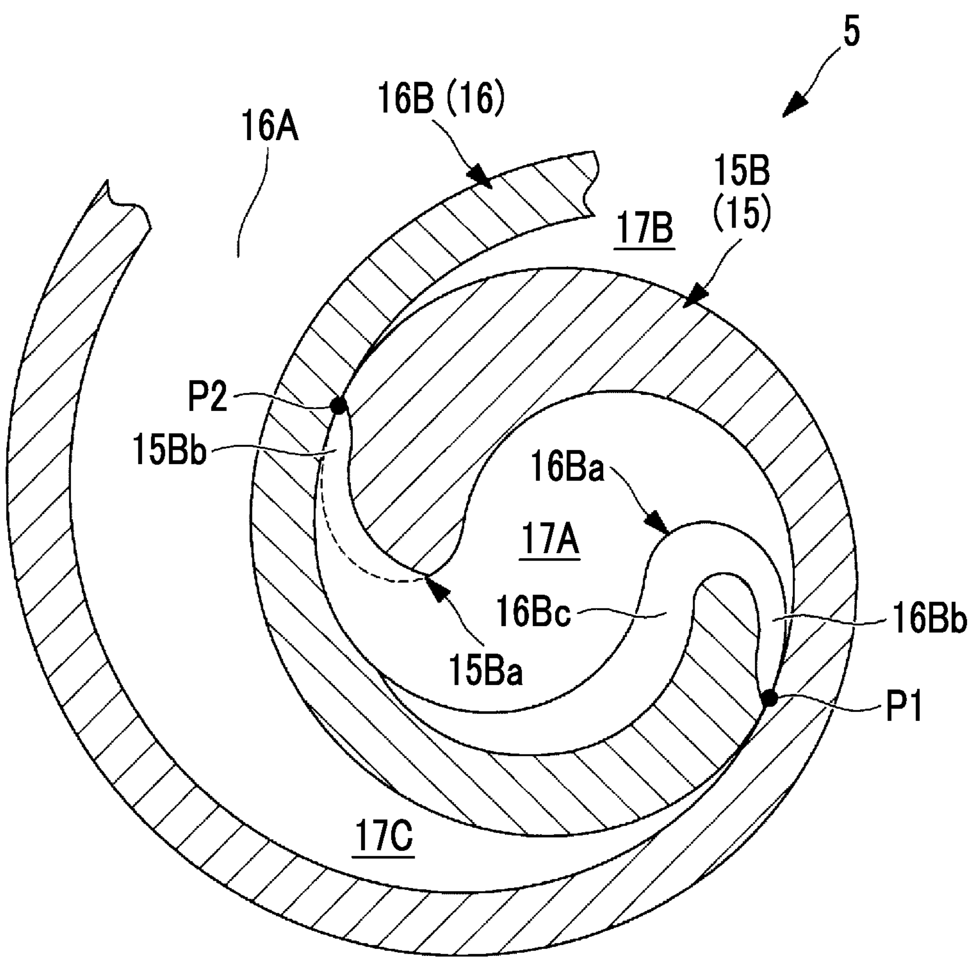


FIG. 7

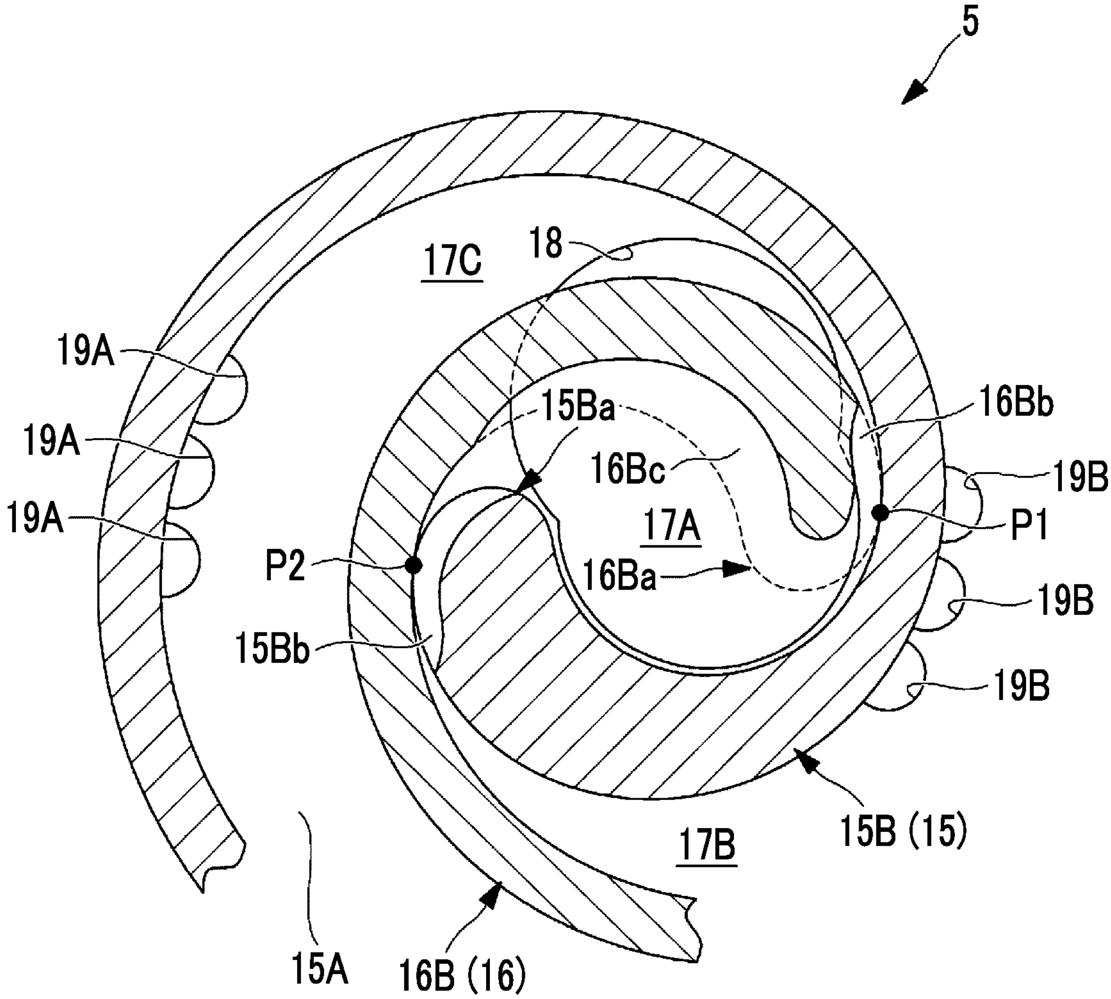
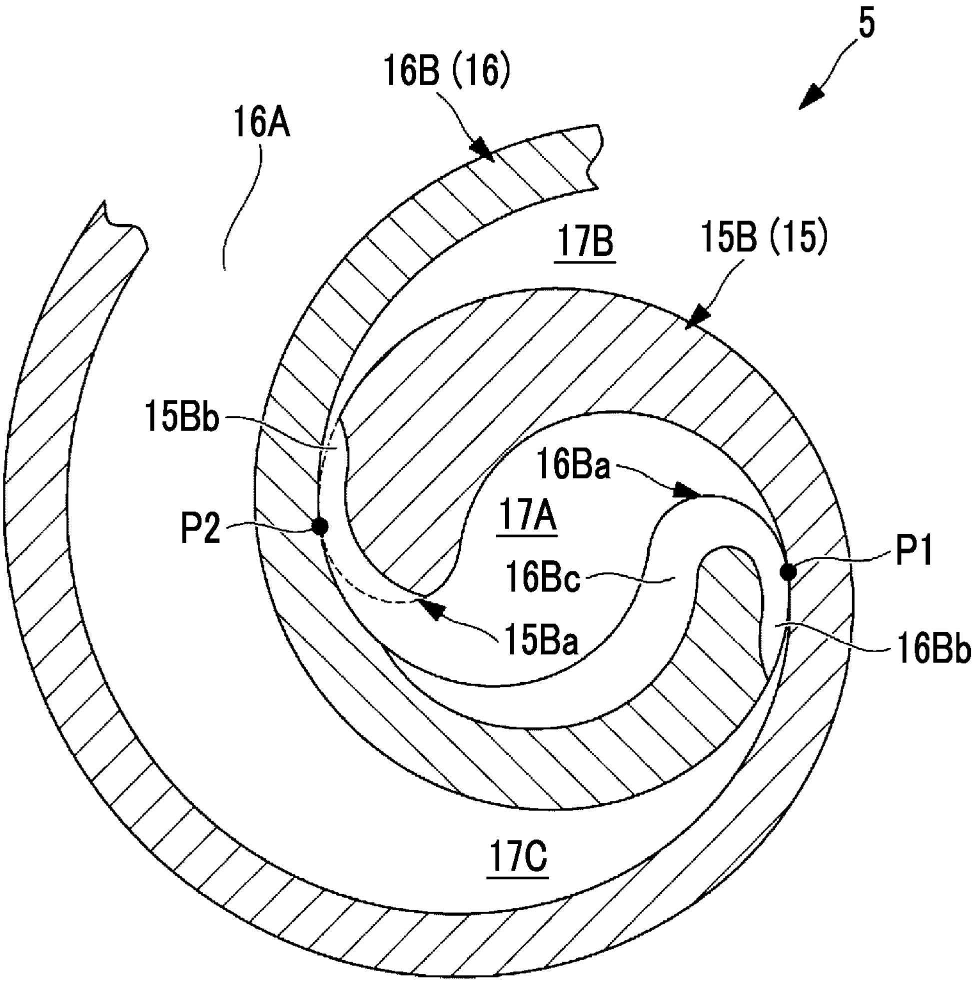

5
17C
18
19A
19A
19A
15Ba
16Bb
16Bc
19B
P1
17A
P2
16Ba
19B
15Bb
19B
17B
15B (15)
15A
16B (16)

FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/006233

A. CLASSIFICATION OF SUBJECT MATTER

F04C 18/02(2006.01)i
FI: F04C18/02 311V

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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.
X Y	JP 7-77178 A (SANDEN CORP) 20 March 1995 (1995-03-20) paragraphs [0017]-[0020], fig. 1-3	1 2-4
X Y	JP 2000-110749 A (FUJITSU GENERAL LTD) 18 April 2000 (2000-04-18) paragraphs [0015]-[0020], fig. 4	1 2-4
Y	JP 3-88986 A (DAIKIN IND LTD) 15 April 1991 (1991-04-15) publication gazette, p. 1, lower right column, line 13 to p. 2, upper left column, line 10, fig. 4	2-4
A	JP 2009-52428 A (PANASONIC CORP) 12 March 2009 (2009-03-12) paragraph [0023]	1-4
A	JP 1-294982 A (MITSUBISHI ELECTRIC CORP) 28 November 1989 (1989-11-28) publication gazette, p. 3, lower right column, the last line to p. 4, upper right column, line 7, fig. 5	1-4

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

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Date of the actual completion of the international search	Date of mailing of the international search report
12 April 2022	**26 April 2022**

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office (ISA/JP) **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/006233

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 9-264273 A (SANYO ELECTRIC CO LTD) 07 October 1997 (1997-10-07) paragraph [0029], fig. 6	2-4
A	JP 63-306291 A (TOSHIBA CORP) 14 December 1988 (1988-12-14) publication gazette, p. 2, upper left column, lines 6-10	2-4
A	JP 11-236888 A (FUJITSU GENERAL LTD) 31 August 1999 (1999-08-31) paragraph [0022], fig. 1-3	2-4

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/006233

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 7-77178 A	20 March 1995	(Family: none)	
JP 2000-110749 A	18 April 2000	(Family: none)	
JP 3-88986 A	15 April 1991	(Family: none)	
JP 2009-52428 A	12 March 2009	(Family: none)	
JP 1-294982 A	28 November 1989	(Family: none)	
JP 9-264273 A	07 October 1997	(Family: none)	
JP 63-306291 A	14 December 1988	(Family: none)	
JP 11-236888 A	31 August 1999	(Family: none)	

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Patent documents cited in the description

- JP 2013181487 A **[0005]**