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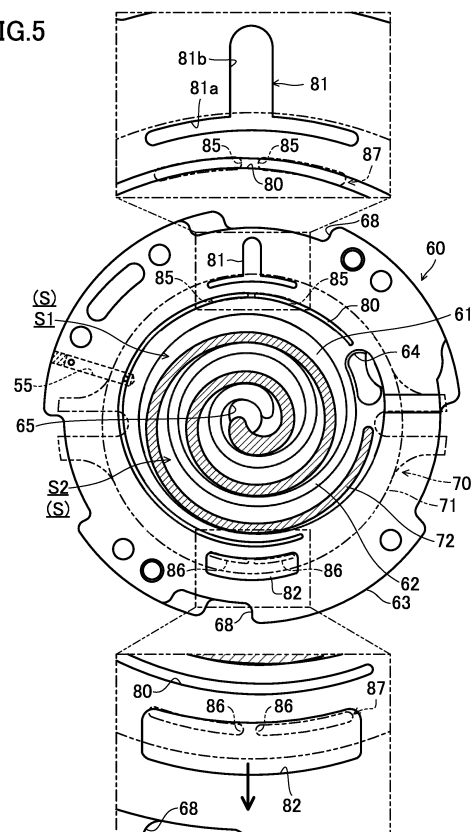
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(54) **SCROLL COMPRESSOR**

(57) First and second oil discharge grooves (81, 82) are formed in a facing surface of a fixed scroll (60). Part of first and second oil discharge grooves (81, 82) is open at a position radially outward of a sliding range of a movable scroll (70). The first and second oil discharge grooves (81, 82) and a suction port (64) of a compression chamber (S) communicate with each other through an oil collection path (90).

FIG.5



Description

TECHNICAL FIELD

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

BACKGROUND ART

[0002] Patent Document 1 discloses a scroll compressor configured to perform a first operation in which among a fixed-side oil groove, a movable-side oil groove, and a compression chamber (or a fluid chamber), only the fixed-side oil groove and the movable-side oil groove communicate with each other, and a second operation in which the movable-side oil groove simultaneously communicates with both of the fixed-side oil groove and the compression chamber after the first operation.

CITATION LIST

PATENT DOCUMENT

[0003] Patent Document 1: Japanese Unexamined Patent Publication No. 2016-160816

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] In the disclosure of Patent Document 1, the movable-side oil groove communicates with the space in the compression chamber, radially outward of a movable scroll. Less oil is thus supplied to the space in the compression chamber, radially inward of the movable scroll.

[0005] It is an objective of the present disclosure to supply oil to the spaces in a compression chamber which are located radially inward and outward of a movable scroll.

SOLUTION TO THE PROBLEM

[0006] A first aspect of the present disclosure is directed to a scroll compressor including a casing (20), a first scroll (60) housed in the casing (20), and a second scroll (70) defining a compression chamber (S) together with the first scroll (60). The scroll compressor includes: an oil discharger (81, 82) formed in a facing surface of the first scroll (60) facing the second scroll (70); and an oil collection path (90) through which the oil discharger (81, 82) communicates with a suction port (64) of the compression chamber (S).

[0007] In the first aspect, the first scroll (60) has the oil discharger (81, 82) in its facing surface. The oil discharger (81, 82) and the suction port (64) of the compression chamber (S) communicate with each other through the oil collection path (90).

[0008] Accordingly, oil can be supplied to the spaces in the compression chamber (S) which are located radially inward and outward of the movable scroll.

[0009] A second aspect of the present disclosure is an embodiment of the first aspect. In the second aspect, part of the oil discharger (81, 82) is open at a position radially outward of a relative sliding range of the second scroll (70) on the facing surface of the first scroll (60).

[0010] In the second aspect, part of the oil discharger (81, 82) is open at a position radially outward of the relative sliding range of the second scroll (70), which prevents the oil discharger (81, 82) from being closed entirely by the second scroll (70).

[0011] A third aspect of the present disclosure is an embodiment of the first or second aspect. In the third aspect, the scroll compressor includes: an oil supplier (80) formed radially inward of the oil discharger (81, 82) in the facing surface of the first scroll (60); and an intermittent communication mechanism (87) configured to allow the oil supplier (80) to intermittently communicate with the oil discharger (81, 82).

[0012] In the third aspect, the intermittent communication mechanism (87) allows the oil supplier (80) and the oil discharger (81, 82) to intermittently communicate with each other, which intermittently suspends the discharge of the oil from the oil supplier (80) to the oil discharger (81, 82). This configuration can reduce excessive oil discharged to the oil discharger (81, 82).

[0013] A fourth aspect of the present disclosure is an embodiment of the third aspect. In the fourth aspect, the intermittent communication mechanism (87) includes an oil conveyor (85, 86) formed in a facing surface of the second scroll (70) facing the first scroll (60).

[0014] In the fourth aspect, the oil conveyor (85, 86) formed in the facing surface of the second scroll (70) constitutes the intermittent communication mechanism (87). Accordingly, by simply forming a groove-like oil conveyor (85, 86) in the facing surface of the second scroll (70), it is possible to make the oil supplier (80) and the oil discharger (81, 82) communicate with each other intermittently when the second scroll (70) is rotated relative to the first scroll (60).

[0015] A fifth aspect of the present disclosure is an embodiment of the fourth aspect. In the fifth aspect, the oil conveyor (85, 86) includes a plurality of oil conveyors provided circumferentially at a distance.

[0016] In the fifth aspect, the plurality of oil conveyors (85, 86) are provided circumferentially at a distance. The plurality of oil conveyors (85, 86) formed in this manner, that is, formed into a shape in which a single oil conveyor (85, 86) is made discontinuous in a middle, avoids continuous connection between the oil supplier (80) and the oil discharger (81, 82) through the oil conveyor (85, 86). This configuration can reduce excessive oil discharged to the oil discharger (81, 82).

[0017] A sixth aspect of the present disclosure is an embodiment of any one of the first to fifth aspects. In the sixth aspect, an inside of the casing (20) includes a par-

tioned space (23) that is partitioned by the casing (20) and a housing (50) and communicates with the oil discharger (81, 82), a suction pipe (12) is provided on an upstream side of the suction port (64) with a predetermined gap interposed between the suction pipe (12) and the suction port (64), the suction port (64) therefore having an opening (67) that communicates with the partitioned space (23), and the oil collection path (90) includes the partitioned space (23) and the opening (67).

[0018] In the sixth aspect, the inside of the casing (20) includes the partitioned space (23) that communicates with the oil discharger (81, 82). The opening (67) that communicates with the partitioned space (23) is formed between the suction port (64) and the suction pipe (12). The oil collection path (90) includes the partitioned space (23) and the opening (67).

[0019] Accordingly, the high-temperature oil collected into the oil discharger (81, 82) dissipates heat and cools while passing through the partitioned space (23). Thus, the oil with a high temperature is less likely to be supplied to the suction port (64).

[0020] A seventh aspect of the present disclosure is an embodiment of any one of the first to sixth aspects. In the seventh aspect, the oil discharger (81, 82) includes a plurality of oil dischargers (81, 82) formed in the facing surface of the first scroll (60).

[0021] In the seventh aspect, the plurality of oil dischargers (81, 82) are formed in the facing surface of the first scroll (60), which allows collection of the oil from the plurality of portions in the circumferential direction of the first scroll (60).

[0022] An eighth aspect of the present disclosure is an embodiment of the seventh aspect. In the eighth aspect, the plurality of oil dischargers (81, 82) are opposed to each other across an axis of the first scroll (60).

[0023] In the eighth aspect, the plurality of oil dischargers (81, 82) are opposed to each other across the axis of the first scroll (60). This configuration allows the collection of the oil from the separate positions in the circumferential direction of the first scroll (60).

[0024] A ninth aspect of the present disclosure is an embodiment of any one of the first to eighth aspects. In the ninth aspect, the first scroll (60) is a fixed scroll (60), and the second scroll (70) is a movable scroll (70).

[0025] In the ninth aspect, the fixed scroll (60) constitutes the first scroll (60). The movable scroll (70) constitutes the second scroll (70).

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a diagram illustrating a longitudinal sectional view of a configuration of a scroll compressor according to this embodiment.

FIG. 2 is a diagram illustrating a bottom view of a configuration of a fixed scroll.

FIG. 3 is a diagram illustrating a top view of a con-

figuration of a movable scroll.

FIG. 4 is a diagram illustrating a longitudinal sectional view of an enlarged main part of the scroll compressor.

FIG. 5 is a diagram illustrating a positional relationship among an oil supply groove, oil discharge grooves, and oil conveyance grooves during a first operation.

FIG. 6 is a diagram illustrating a positional relationship among the oil supply groove, the oil discharge grooves, and the oil conveyance grooves during a second operation.

FIG. 7 is a diagram illustrating a positional relationship among the oil supply groove, the oil discharge grooves, and the oil conveyance grooves during a third operation.

FIG. 8 is a diagram illustrating a positional relationship among the oil supply groove, the oil discharge grooves, and the oil conveyance grooves during a fourth operation.

DESCRIPTION OF EMBODIMENT

«Embodiment»

[0027] An embodiment will be described.

[0028] As shown in FIG. 1, a scroll compressor (10) is placed in a refrigerant circuit of a vapor compression refrigeration cycle. In the refrigerant circuit, the refrigerant compressed by the scroll compressor (10) is condensed by a condenser, decompressed by a decompression mechanism, evaporated by an evaporator, and sucked into the scroll compressor (10).

[0029] The scroll compressor (10) includes a casing (20), and an electric motor (30) and a compression mechanism (40) housed in the casing (20). The casing (20) is in the shape of a vertically long cylinder like a sealed dome.

[0030] The electric motor (30) includes a stator (31) fixed to the casing (20) and a rotor (32) inside the stator (31). The rotor (32) is fixed to a drive shaft (11).

[0031] The casing (20) has, at its bottom, an oil reservoir (21) for storing oil. A suction pipe (12) is connected to an upper portion of the casing (20). A discharge pipe (13) is connected to a central portion of the casing (20).

[0032] A housing (50) is fixed to the casing (20). The housing (50) is located above the electric motor (30). The compression mechanism (40) is located above the housing (50). The discharge pipe (13) has an inflow end between the electric motor (30) and the housing (50).

[0033] The drive shaft (11) extends vertically along the center axis of the casing (20). The drive shaft (11) includes a main shaft portion (14) and an eccentric portion (15) connected to the upper end of the main shaft portion (14).

[0034] The main shaft portion (14) has a lower portion rotatably supported by a lower bearing (22) of the casing (20). The lower bearing (22) is fixed to the inner circum-

ferential surface of the casing (20). The main shaft portion (14) has an upper portion extending so as to pass through the housing (50) and rotatably supported by an upper bearing (51) of the housing (50).

[0035] The compression mechanism (40) includes a fixed scroll (60) (first scroll) and a movable scroll (70) (second scroll). The fixed scroll (60) is fixed to the upper surface of the housing (50). The movable scroll (70) is interposed between the fixed scroll (60) and the housing (50).

[0036] The housing (50) includes an annular portion (52) and a concave portion (53). The annular portion (52) forms the outer circumference of the housing (50). The concave portion (53) is provided in an upper central portion of the housing (50) and formed in a dish-like shape with a concave center. The upper bearing (51) is located below the concave portion (53).

[0037] The housing (50) is fixed to the inside of the casing (20) by press fitting. The inner circumferential surface of the casing (20) and the outer circumferential surface of the annular portion (52) of the housing (50) are in airtight contact with each other throughout the entire circumference. The housing (50) divides the inside of the casing (20) into an upper space (23) (partitioned space) for housing the compression mechanism (40) and a lower space (24) for housing the electric motor (30).

[0038] The fixed scroll (60) includes a fixed-side end plate (61), an outer circumferential wall (63) in a substantially cylindrical shape which stands on the outer edge of the lower surface of the fixed-side end plate (61), and a spiral fixed-side wrap (62) which stands inside the outer circumferential wall (63) of the fixed-side end plate (61) (see FIG. 2).

[0039] The fixed-side end plate (61) is located on the outer circumference and continuous with the fixed-side wrap (62). The end surface of the fixed-side wrap (62) and the end surface of the outer circumferential wall (63) are substantially flush with each other. The fixed scroll (60) is fixed to the housing (50).

[0040] The movable scroll (70) includes a movable-side end plate (71), a spiral movable-side wrap (72) located on the upper surface of the movable-side end plate (71), and a boss (73) located at a central portion of the lower surface of the movable-side end plate (71) (see FIG. 3).

[0041] The eccentric portion (15) of the drive shaft (11) is inserted into the boss (73), whereby the boss (73) is connected to the drive shaft (11). An Oldham coupling (46) is provided at an upper portion of the housing (50). The Oldham coupling (46) blocks the rotation of the movable scroll (70) on its axis.

[0042] The compression mechanism (40) includes, between the fixed scroll (60) and the movable scroll (70), a compression chamber (S) into which a refrigerant flows. The movable scroll (70) is placed so that the movable-side wrap (72) meshes with the fixed-side wrap (62) of the fixed scroll (60). Here, the lower surface of the outer circumferential wall (63) of the fixed scroll (60) serves as

a facing surface that faces the movable scroll (70). On the other hand, the upper surface of the movable-side end plate (71) of the movable scroll (70) serves as a facing surface that faces the fixed scroll (60).

[0043] A suction port (64) that communicates with the compression chamber (S) is formed in the outer circumferential wall (63) of the fixed scroll (60). The suction pipe (12) is located upstream of the suction port (64), with a predetermined gap interposed therebetween. Accordingly, the suction port (64) has, at its upstream side, an opening (67) that communicates with the upper space (23).

[0044] The compression chamber (S) is divided into outer chambers (S1) radially outward of the movable scroll (70), and inner chambers (S2) radially inward of the movable scroll (70). Specifically, when the inner circumferential surface of the outer circumferential wall (63) of the fixed scroll (60) and the outer circumferential surface of the movable-side wrap (72) of the movable scroll (70) substantially come into contact with each other, the outer chamber (S1) and the inner chambers (S2) become separate sections with the contact portion serving as a boundary (see, e.g., FIG. 5).

[0045] The fixed-side end plate (61) of the fixed scroll (60) has, at its center, an outlet (65). A high-pressure chamber (66) to which the outlet (65) is open is provided in the upper surface of the fixed-side end plate (61) of the fixed scroll (60). The high-pressure chamber (66) communicates with the lower space (24) via a path (not shown) formed through the fixed-side end plate (61) of the fixed scroll (60) and the housing (50). The high-pressure refrigerant compressed by the compression mechanism (40) flows out to the lower space (24).

[0046] An oil supply hole (16) is provided inside the drive shaft (11) so as to extend vertically from the lower end to the upper end of the drive shaft (11). A lower end portion of the drive shaft (11) is immersed in the oil reservoir (21). The oil supply hole (16) supplies the oil in the oil reservoir (21) to the lower bearing (22) and the upper bearing (51), and to the gap between the boss (73) and the drive shaft (11). The oil supply hole (16) is open to the upper end surface of the drive shaft (11) and supplies oil to above the drive shaft (11).

[0047] The concave portion (53) of the housing (50) communicates with the oil supply hole (16) of the drive shaft (11) via the inside of the boss (73) of the movable scroll (70). The high-pressure oil is supplied to the concave portion (53), so that a high pressure equivalent to the discharge pressure of the compression mechanism (40) acts on the concave portion (53). The movable scroll (70) is pressed onto the fixed scroll (60) by the high pressure that acts on the concave portion (53).

[0048] An oil path (55) is provided in the housing (50) and the fixed scroll (60). The oil path (55) has an inflow end that communicates with the concave portion (53) of the housing (50). The oil path (55) has an outflow end open to the facing surface of the fixed scroll (60). Through the oil path (55), the high-pressure oil in the concave

portion (53) is supplied to the facing surfaces of the movable-side end plate (71) of the movable scroll (70) and the outer circumferential wall (63) of the fixed scroll (60).

<Configurations of Oil Supply Groove, Oil Discharge Grooves, and Oil Conveyance Grooves>

[0049] As shown in FIG. 2, an oil supply groove (80) (oil supplier) and first and second oil discharge grooves (81, 82) (oil dischargers) are formed in the facing surface of the outer circumferential wall (63) of the fixed scroll (60).

[0050] The oil supply groove (80) is formed in the facing surface, of the outer circumferential wall (63) of the fixed scroll (60), which faces the movable-side end plate (71) of the movable scroll (70). The oil supply groove (80) extends substantially in an arc shape along the inner circumferential surface of the outer circumferential wall (63) of the fixed scroll (60). The oil path (55) communicates with the oil supply groove (80), and oil is supplied to the oil supply groove (80) from the oil path (55).

[0051] The first oil discharge groove (81) is located radially outward of the oil supply groove (80). The first oil discharge groove (81) is located on the upper side in FIG. 2. The first oil discharge groove (81) includes a first groove (81a) extending circumferentially and a second groove (81b) extending radially outward from the circumferential center of the first groove (81a). The second groove (81b) is open at a position radially outward of the sliding range of the movable scroll (70). This configuration prevents the movable scroll (70) from closing the second groove (81b) of the first oil discharge groove (81).

[0052] The second oil discharge groove (82) is located radially outward of the oil supply groove (80). The second oil discharge groove (82) is located at a position (lower side in FIG. 2) opposite to the first oil discharge groove (81) across the axis of the fixed scroll (60).

[0053] The second oil discharge groove (82) is a curved groove extending circumferentially. Part of the second oil discharge groove (82) is open at a position radially outward of the sliding range of the movable scroll (70).

[0054] As shown in FIG. 3, a first oil conveyance groove (85) and a second oil conveyance groove (86) (oil conveyors) are formed in the facing surface of the movable-side end plate (71) of the movable scroll (70).

[0055] The first oil conveyance groove (85) is located closer to the first oil discharge groove (81) on the facing surface of the movable scroll (70). Two first oil conveyance grooves (85) are provided circumferentially at a distance.

[0056] The second oil conveyance groove (86) is opposed to the first oil conveyance grooves (85) across the axis of the fixed scroll (60) and located closer to the second oil discharge groove (82). Two second oil conveyance grooves (86) are provided circumferentially at a distance.

[0057] The state of communication of the first oil con-

veyance grooves (85) with the oil supply groove (80) and the first oil discharge groove (81) changes in accordance with the eccentric rotation of the movable scroll (70). The state of communication of the second oil conveyance grooves (86) with the oil supply groove (80) and the second oil discharge groove (82) changes in accordance with the eccentric rotation of the movable scroll (70). In this manner, the first and second oil conveyance grooves (85, 86) constitute an intermittent communication mechanism (87) that allows the oil supply groove (80) to intermittently communicate with the first and second oil discharge grooves (81, 82).

[0058] The first oil discharge groove (81) communicates with the upper space (23) via a cutout (68) (located on the upper side in FIG. 2) of the fixed scroll (60). The second oil discharge groove (82) communicates with the upper space (23) via a cutout (68) (located on the lower side in FIG. 2) of the fixed scroll (60). The suction port (64) of the compression chamber (S) communicates with the upper space (23) via the opening (67).

[0059] The oil collected by the first and second oil discharge grooves (81, 82) is thus supplied through the upper space (23) and the opening (67) to the suction port (64) as indicated by the arrows in FIG. 4. Accordingly, the upper space (23) and the opening (67) constitute an oil collection path (90) through which the first and second oil discharge grooves (81, 82) communicate with the suction port (64) of the compression chamber (S).

[0060] The compression mechanism (40) performs four operations for supplying the high-pressure oil in the oil supply groove (80) to predetermined portions. Specifically, the compression mechanism (40) sequentially and repeatedly performs the operations, e.g., first operation, second operation, third operation, fourth operation, first operation, second operation, ... , and so on, during the eccentric rotation of the movable scroll (70).

-Operation-

[0061] A basic operation of the scroll compressor (10) will be described. When activated, the electric motor (30) rotatably drives the movable scroll (70) of the compression mechanism (40). Since the rotation of the movable scroll (70) is blocked by the Oldham coupling (46), the movable scroll (70) performs only the eccentric rotation about the axis of the drive shaft (11).

[0062] As shown in FIGS. 5 to 8, when the movable scroll (70) rotates eccentrically, the compression chamber (S) is sectioned into the outer chamber (S1) and the inner chambers (S2). The plurality of inner chambers (S2) are formed between the fixed-side wrap (62) of the fixed scroll (60) and the movable-side wrap (72) of the movable scroll (70). As the movable scroll (70) rotates eccentrically, these inner chambers (S2) gradually come closer to the center (i.e., the outlet (65)) and the volumes of these inner chambers (S2) gradually decrease. The refrigerant is gradually compressed in the inner chambers (S2) in this manner.

[0063] When the inner chamber (S2) with the minimum volume communicates with the outlet (65), the high-pressure gas refrigerant in the inner chamber (S2) is discharged to the high-pressure chamber (66) via the outlet (65). The high-pressure gas refrigerant in the high-pressure chamber (66) flows out to the lower space (24) via the path formed in the fixed scroll (60) and the housing (50). The high-pressure gas refrigerant in the lower space (24) is discharged outside the casing (20) via the discharge pipe (13).

-Oil Supply Operation-

[0064] Next, an oil supply operation of the scroll compressor (10) will be described in detail with reference to FIGS. 4 to 8.

[0065] Once the high-pressure gas refrigerant flows out to the lower space (24) of the scroll compressor (10), the lower space (24) becomes a high-pressure atmosphere, and the pressure of the oil in the oil reservoir (21) increases. The high-pressure oil in the oil reservoir (21) flows upward through the oil supply hole (16) of the drive shaft (11) and flows out from the opening at the upper end of the eccentric portion (15) of the drive shaft (11) to the inside of the boss (73) of the movable scroll (70).

[0066] The oil supplied to the boss (73) is supplied to the gap between the eccentric portion (15) of the drive shaft (11) and the boss (73). Accordingly, the concave portion (53) of the housing (50) becomes a high-pressure atmosphere equivalent to the discharge pressure of the compression mechanism (40). The high pressure of the concave portion (53) presses the movable scroll (70) onto the fixed scroll (60).

[0067] The high-pressure oil accumulated in the concave portion (53) flows out through the oil path (55) to the oil supply groove (80). Accordingly, the high-pressure oil corresponding to the discharge pressure of the compression mechanism (40) is supplied to the oil supply groove (80). The first, second, third, and fourth operations are sequentially performed as the movable scroll (70) rotates eccentrically in this state. In all these operations, the oil in the oil supply groove (80) is utilized for lubrication of the facing surfaces around the oil supply groove (80).

<First Operation>

[0068] The first operation is performed when the movable scroll (70) is located, for example, at the eccentric angle position shown in FIG. 5. In the first operation, the oil supply groove (80) and the first oil conveyance grooves (85) communicate with each other to fill the first oil conveyance grooves (85) with the high-pressure oil. In addition, the second oil discharge groove (82) and the second oil conveyance grooves (86) communicate with each other to pass the oil stored in the second oil conveyance grooves (86) to the second oil discharge groove (82). The oil received by the second oil discharge groove

(82) is supplied through the oil collection path (90) to the suction port (64). The oil supplied to the suction port (64) is distributed to the outer chamber (S1) located radially outward of the movable-side wrap (72) of the movable scroll (70) and to the inner chambers (S2) located radially inward. As a result, the oil sealing performances of the outer chamber (S1) and the inner chamber (S2) can improve.

10 <Second Operation>

[0069] The second operation is performed when the movable scroll (70) at the eccentric angle position in FIG. 5 further rotates eccentrically and is located at the eccentric angle position shown in FIG. 6, for example. In the second operation, the first oil conveyance grooves (85) move apart from the oil supply groove (80) toward the first oil discharge groove (81). In addition, the second oil conveyance grooves (86) move apart from the second oil discharge groove (82) toward the oil supply groove (80).

[0070] The two first oil conveyance grooves (85) are provided circumferentially in an intermittent manner. It is therefore possible to reduce oil that leaks out of the oil supply groove (80) into the first oil conveyance grooves (85) even when, for example, the movable scroll (70) shifts and the first oil conveyance grooves (85) communicate with the oil supply groove (80) and the first oil discharge groove (81). The two second oil conveyance grooves (86), too, are provided circumferentially, which provides the same advantage.

<Third Operation>

[0071] The third operation is performed when the movable scroll (70) at the eccentric angle position in FIG. 6 further rotates eccentrically and is located at the eccentric angle position shown in FIG. 7, for example. In the third operation, the oil supply groove (80) and the second oil conveyance grooves (86) communicate with each other to fill the second oil conveyance grooves (86) with the high-pressure oil.

[0072] In addition, the first oil discharge groove (81) and the first oil conveyance grooves (85) communicate with each other to pass the oil stored in the first oil conveyance grooves (85) to the first oil discharge groove (81). The oil received by the first oil discharge groove (81) is supplied through the oil collection path (90) to the suction port (64). The oil supplied to the suction port (64) is distributed to the outer chamber (S1) located radially outward of the movable-side wrap (72) of the movable scroll (70) and to the inner chambers (S2) located radially inward.

55 <Fourth Operation>

[0073] The fourth operation is performed when the movable scroll (70) at the eccentric angle position in FIG.

7 further rotates eccentrically and is located at the eccentric angle position shown in FIG. 8, for example. In the fourth operation, the first oil conveyance grooves (85) move apart from the first oil discharge groove (81) toward the oil supply groove (80). In addition, the second oil conveyance grooves (86) move apart from the oil supply groove (80) toward the second oil discharge groove (82).

[0074] The fourth operation is followed by the first operation again. After that, the second, third, and fourth operations are repeated sequentially.

-Advantages of Embodiment-

[0075] The scroll compressor (10) according to this embodiment includes: the casing (20), the fixed scroll (60) (first scroll) housed in the casing (20), and the movable scroll (70) (second scroll) defining the compression chamber (S) together with the fixed scroll (60). The scroll compressor includes: the first oil discharge groove (81) and the second oil discharge groove (82) (oil dischargers) formed in the facing surface of the fixed scroll (60) facing the movable scroll (70); and the oil collection path (90) through which the first and second oil discharge grooves (81, 82) communicate with the suction port (64) of the compression chamber (S).

[0076] In this embodiment, the first and second oil discharge grooves (81, 82) are formed in the facing surface of the fixed scroll (60). The first and second oil discharge grooves (81, 82) and the suction port (64) of the compression chamber (S) communicate with each other through the oil collection path (90).

[0077] Accordingly, oil can be supplied to the spaces in the compression chamber (S) which are located radially inward and outward of the movable scroll (70).

[0078] Specifically, the oil supplied to the facing surface of the fixed scroll (60) flows radially outward when the movable scroll (70) rotates relative to the fixed scroll (60), and is collected by the first and second oil discharge grooves (81, 82). The oil collected by the first and second oil discharge grooves (81, 82) is supplied through the oil collection path (90) to the suction port (64), and is thus distributed to the spaces in the compression chamber (S) which are located radially inward and outward of the movable scroll (70). As a result, the oil sealing performances of the inner and outer chambers can improve.

[0079] In the scroll compressor (10) according to this embodiment, part of each of the first and second oil discharge grooves (81, 82) is open at a position radially outward of the relative sliding range of the movable scroll (70) on the facing surface of the fixed scroll (60).

[0080] In this embodiment, part of each of the first and second oil discharge grooves (81, 82) is open at a position radially outward of the relative sliding range of the movable scroll (70), which prevents the first and second oil discharge grooves (81, 82) from being closed entirely by the movable scroll (70). This configuration can reduce the suspension of the oil supply to the suction port (64).

[0081] The scroll compressor (10) according to this

embodiment further includes: the oil supply groove (80) (oil supplier) formed radially inward of the first and second oil discharge grooves (81, 82) in the facing surface of the fixed scroll (60); and the intermittent communication mechanism (87) configured to allow the oil supply groove (80) to intermittently communicate with the first and second oil discharge grooves (81, 82).

[0082] In this embodiment, the intermittent communication mechanism (87) allows the oil supplier (80) and the first and second oil discharge grooves (81, 82) to intermittently communicate with each other, which intermittently suspends the discharge of the oil from the oil supplier (80) to the first and second oil discharge grooves (81, 82). This configuration can reduce excessive oil discharged to the first and second oil discharge grooves (81, 82).

[0083] In the scroll compressor (10) according to this embodiment, the intermittent communication mechanism (87) is configured as the first and second oil conveyance grooves (85, 86) (oil conveyors) formed in the facing surface of the movable scroll (70) facing the fixed scroll (60).

[0084] In this embodiment, the first and second oil conveyance grooves (85, 86) formed in the facing surface of the movable scroll (70) constitute the intermittent communication mechanism (87). Accordingly, by simply forming the first and second groove-like oil conveyance grooves (85, 86) in the facing surface of the movable scroll (70), it is possible to make the oil supplier (80) and the first and second oil discharge grooves (81, 82) communicate with each other intermittently when the movable scroll (70) is rotated relative to the fixed scroll (60).

[0085] In the scroll compressor (10) according to this embodiment, each of the first and second oil conveyance grooves (85, 86) includes the plurality of oil conveyance grooves (85, 86) provided circumferentially at the distance.

[0086] In this embodiment, the plurality of first and second oil conveyance grooves (85, 86) are provided circumferentially at a distance. The plurality of first and second oil conveyance grooves (85, 86) formed in this manner, that is, formed into a shape in which a single first or second oil conveyance groove (85, 86) is made discontinuous in a middle, avoids continuous connection between the oil supplier (80) and the first and second oil discharge grooves (81, 82) through the first and second oil conveyance grooves (85, 86), respectively. This configuration can reduce excessive oil discharged to the first and second oil discharge grooves (81, 82).

[0087] In the scroll compressor (10) according to this embodiment, the inside of the casing (20) includes an upper space (23) (partitioned space) that is partitioned by the casing (20) and a housing (50) and communicates with the first and second oil discharge grooves (81, 82). A suction pipe (12) is provided on an upstream side of the suction port (64) with a predetermined gap interposed between the suction pipe (12) and the suction port (64); the suction port (64) therefore has an opening (67) that

communicates with the upper space (23). The oil collection path (90) includes the upper space (23) and the opening (67).

[0088] In this embodiment, the inside of the casing (20) includes the upper space (23) that communicates with the first and second oil discharge grooves (81, 82). The opening (67) that communicates with the upper space (23) is formed between the suction port (64) and the suction pipe (12). The oil collection path (90) includes the upper space (23) and the opening (67).

[0089] Accordingly, the high-temperature oil collected into the first and second oil discharge grooves (81, 82) dissipates heat and cools while passing through the upper space (23). Thus, the oil with a high temperature is less likely to be supplied to the suction port (64).

[0090] In the scroll compressor (10) according to this embodiment, the plurality of oil discharge grooves (81, 82) are formed in the facing surface of the fixed scroll (60).

[0091] In this embodiment, the plurality of oil discharge grooves (81, 82) are formed in the facing surface of the fixed scroll (60), which allows collection of the oil from the plurality of portions in the circumferential direction of the fixed scroll (60).

[0092] In the scroll compressor (10) according to this embodiment, the plurality of oil discharge grooves (81, 82) are opposed to each other across the axis of the fixed scroll (60).

[0093] In this embodiment, the plurality of oil discharge grooves (81, 82) are opposed to each other across the axis of the fixed scroll (60). This configuration allows the collection of the oil from the separate positions in the circumferential direction of the fixed scroll (60).

[0094] In the scroll compressor (10) according to this embodiment, the first scroll (60) is the fixed scroll (60), and the second scroll (70) is the movable scroll (70).

[0095] In this embodiment, the fixed scroll (60) constitutes the first scroll (60). The movable scroll (70) constitutes the second scroll (70).

«Other Embodiments»

[0096] The embodiment described above may be modified as follows.

[0097] An example has been described in this embodiment where the oil supply groove (80) and the first and second oil discharge grooves (81, 82) are formed in the facing surface of the fixed scroll (60), whereas the first and second oil conveyance grooves (85, 86) are formed in the facing surface of the movable scroll (70). The embodiment is not limited thereto. For example, the oil supply groove (80) and the first and second oil discharge grooves (81, 82) may be formed in the facing surface of the movable scroll (70), whereas the first and second oil conveyance grooves (85, 86) may be formed in the facing surface of the fixed scroll (60).

[0098] While the embodiment and variations have been described above, it will be understood that various changes in form and details can be made without depart-

ing from the spirit and scope of the claims. The above embodiment and variations may be appropriately combined or replaced as long as the functions of the target of the present disclosure are not impaired.

INDUSTRIAL APPLICABILITY

[0099] As described above, the present disclosure is useful for a scroll compressor.

DESCRIPTION OF REFERENCE CHARACTERS

[0100]

10	Scroll Compressor
12	Suction Pipe
20	Casing
23	Upper Space (Partitioned Space)
50	Housing
60	Fixed Scroll (First Scroll)
64	Suction Port
67	Opening
70	Movable Scroll (Second Scroll)
80	Oil Supply Groove (Oil Supplier)
81	First Oil Discharge Groove (Oil Discharger)
82	Second Oil Discharge Groove (Oil Discharger)
85	First Oil Conveyance Groove (Oil Conveyor)
86	Second Oil Conveyance Groove (Oil Conveyor)
87	Intermittent Communication Mechanism
90	Oil Collection Path
S	Compression Chamber

Claims

1. A scroll compressor including a casing (20), a first scroll (60) housed in the casing (20), and a second scroll (70) defining a compression chamber (S) together with the first scroll (60), the scroll compressor comprising:

an oil discharger (81, 82) formed in a facing surface of the first scroll (60) facing the second scroll (70); and

an oil collection path (90) through which the oil discharger (81, 82) communicates with a suction port (64) of the compression chamber (S).

2. The scroll compressor of claim 1, wherein part of the oil discharger (81, 82) is open at a position radially outward of a relative sliding range of the second scroll (70) on the facing surface of the first scroll (60).

3. The scroll compressor of claim 1 or 2, further comprising:

an oil supplier (80) formed radially inward of the

oil discharger (81, 82) in the facing surface of the first scroll (60); and
 an intermittent communication mechanism (87) configured to allow the oil supplier (80) to intermittently communicate with the oil discharger (81, 82). 5

4. The scroll compressor of claim 3, wherein the intermittent communication mechanism (87) includes an oil conveyor (85, 86) formed in a facing surface of the second scroll (70) facing the first scroll (60). 10

5. The scroll compressor of claim 4, wherein the oil conveyor (85, 86) includes a plurality of oil conveyors provided circumferentially at a distance. 15

6. The scroll compressor of any one of claims 1 to 5, wherein 20

an inside of the casing (20) includes a partitioned space (23) that is partitioned by the casing (20) and a housing (50) and communicates with the oil discharger (81, 82),
 a suction pipe (12) is provided on an upstream side of the suction port (64) with a predetermined gap interposed between the suction pipe (12) and the suction port (64), the suction port (64) therefore having an opening (67) that communicates with the partitioned space (23), and 25
 the oil collection path (90) includes the partitioned space (23) and the opening (67). 30

7. The scroll compressor of any one of claims 1 to 6, wherein 35
 the oil discharger (81, 82) includes a plurality of oil dischargers (81, 82) formed in the facing surface of the first scroll (60).

8. The scroll compressor of claim 7, wherein 40
 the plurality of oil dischargers (81, 82) are opposed to each other across an axis of the first scroll (60).

9. The scroll compressor of any one of claims 1 to 8, wherein 45

the first scroll (60) is a fixed scroll (60), and
 the second scroll (70) is a movable scroll (70). 50

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FIG.1

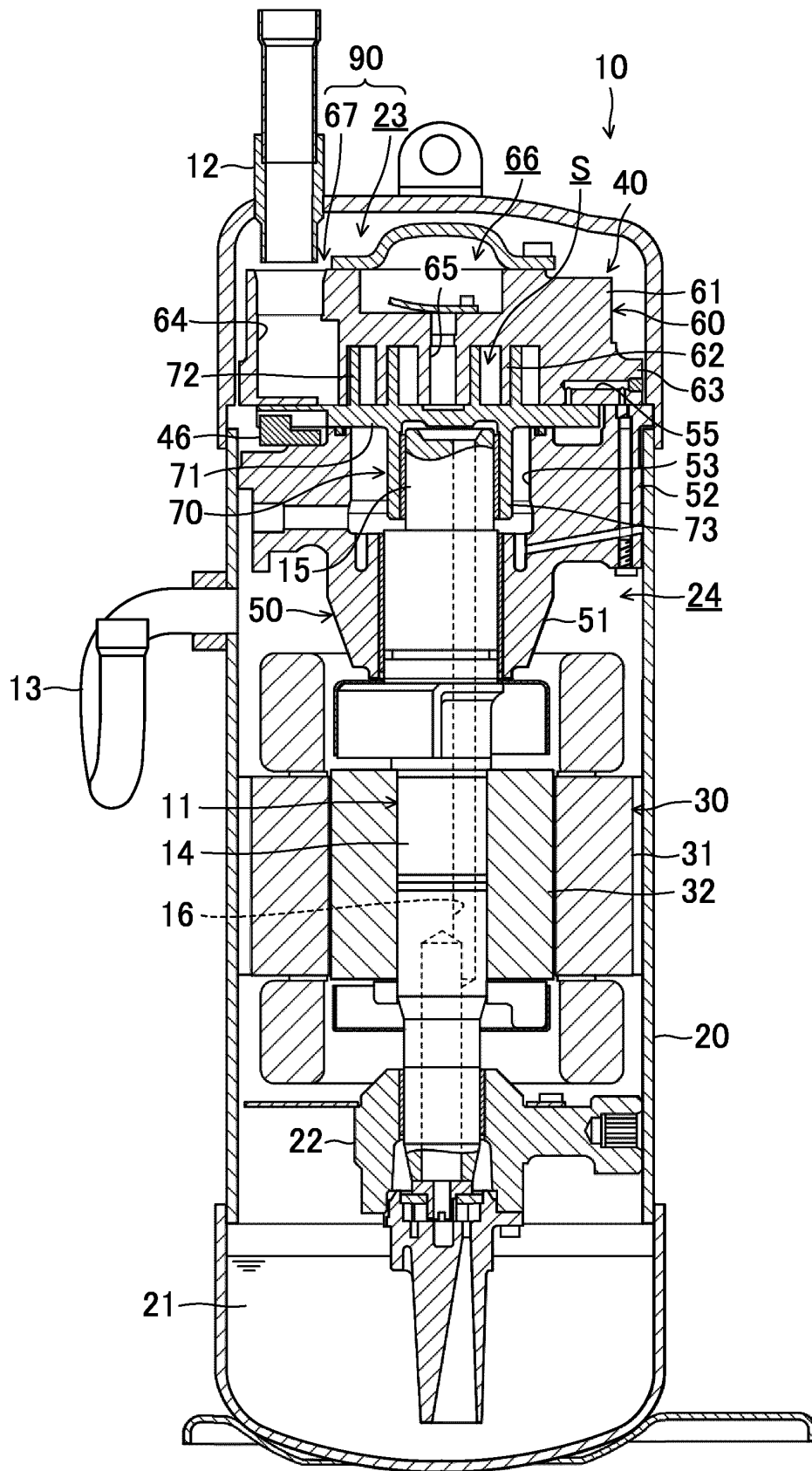


FIG.2

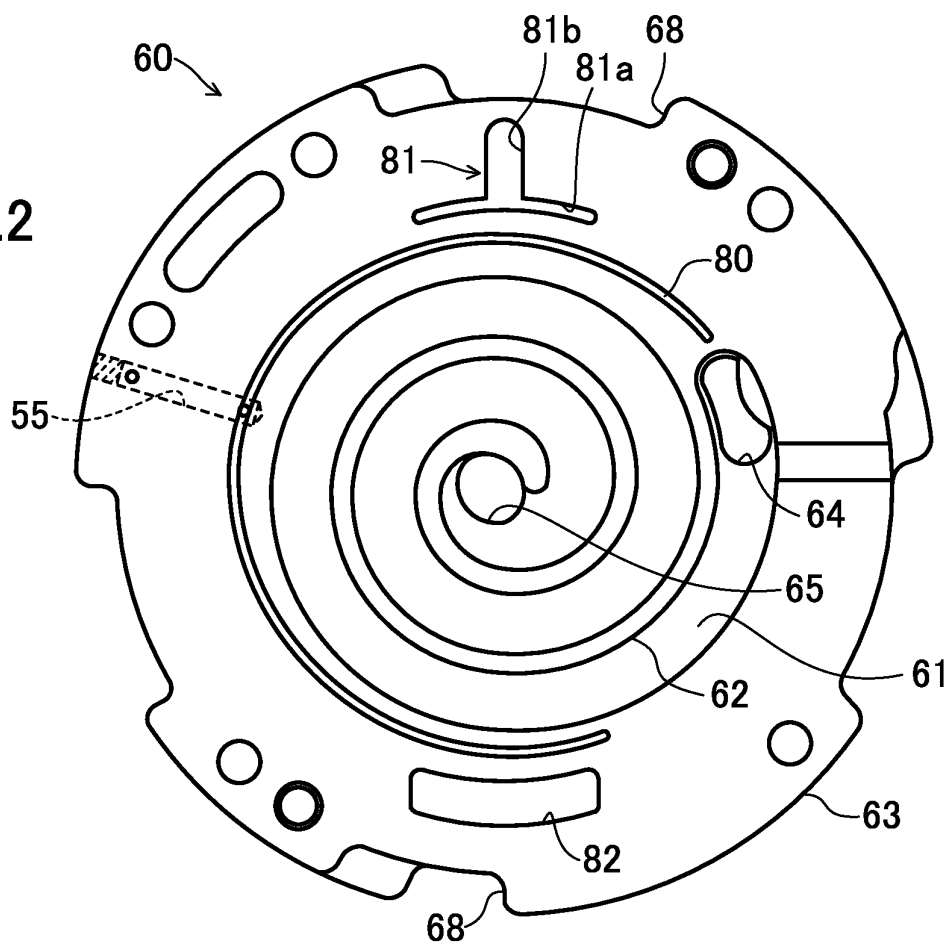


FIG.3

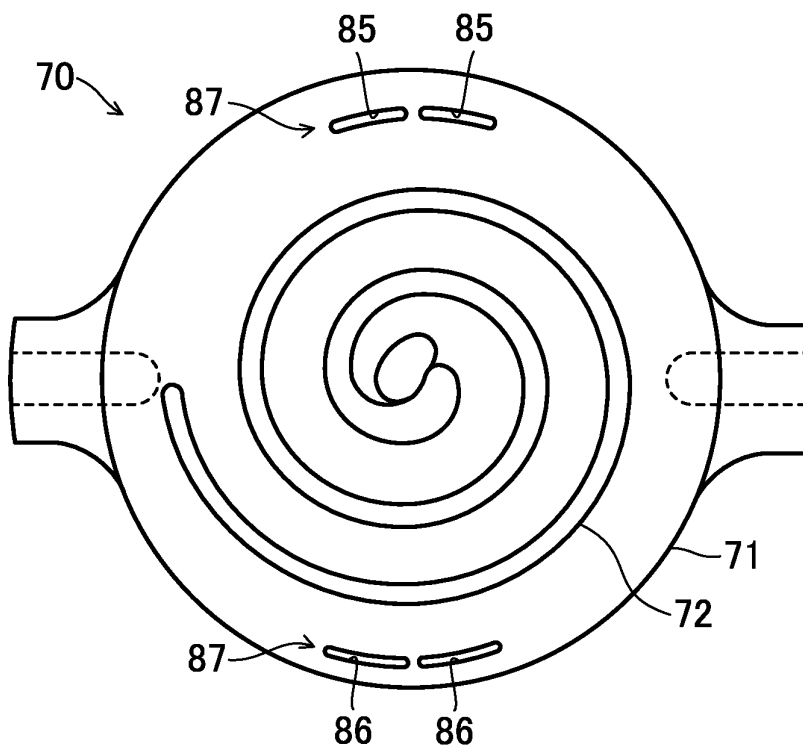


FIG.4

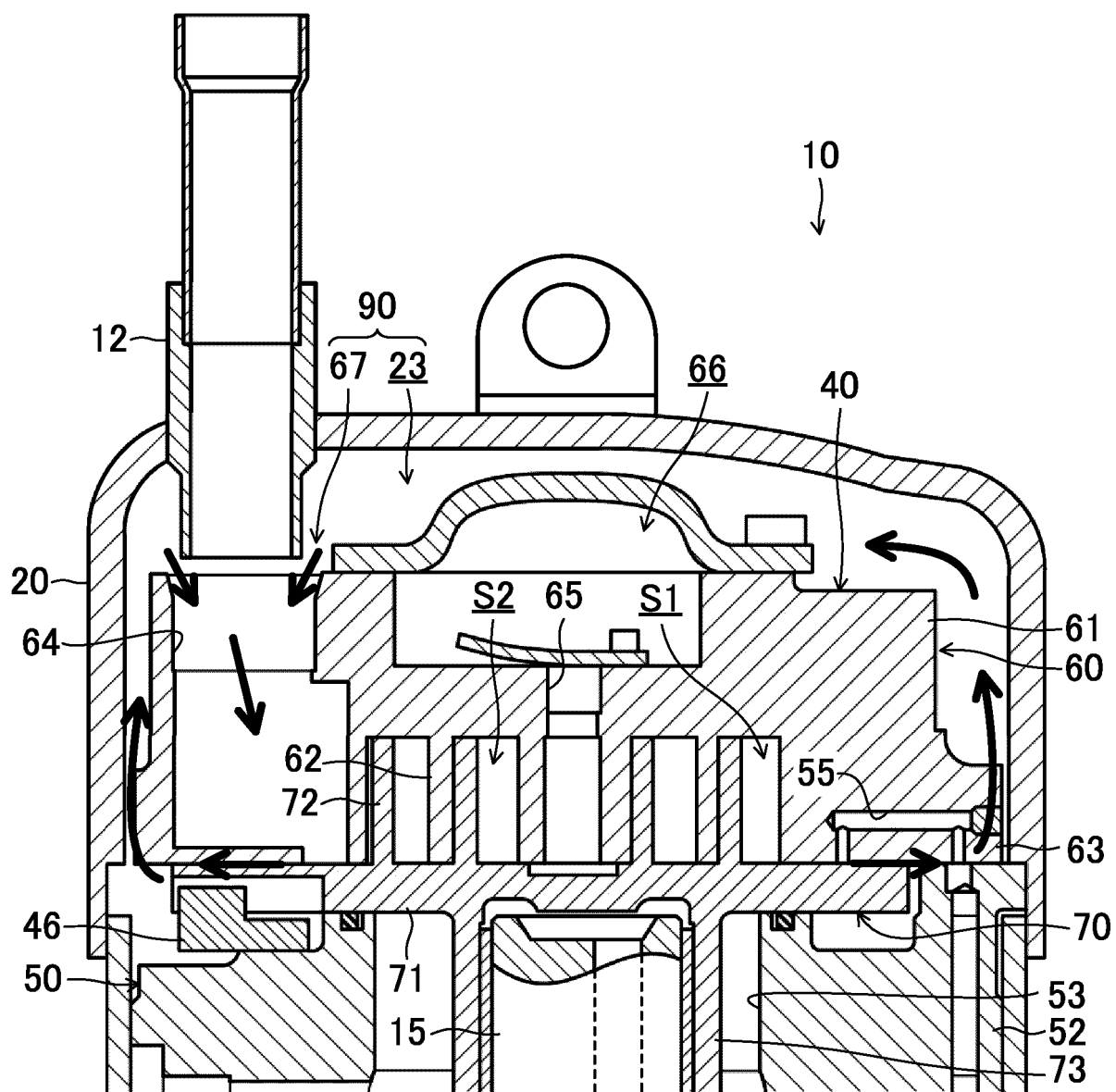


FIG.5

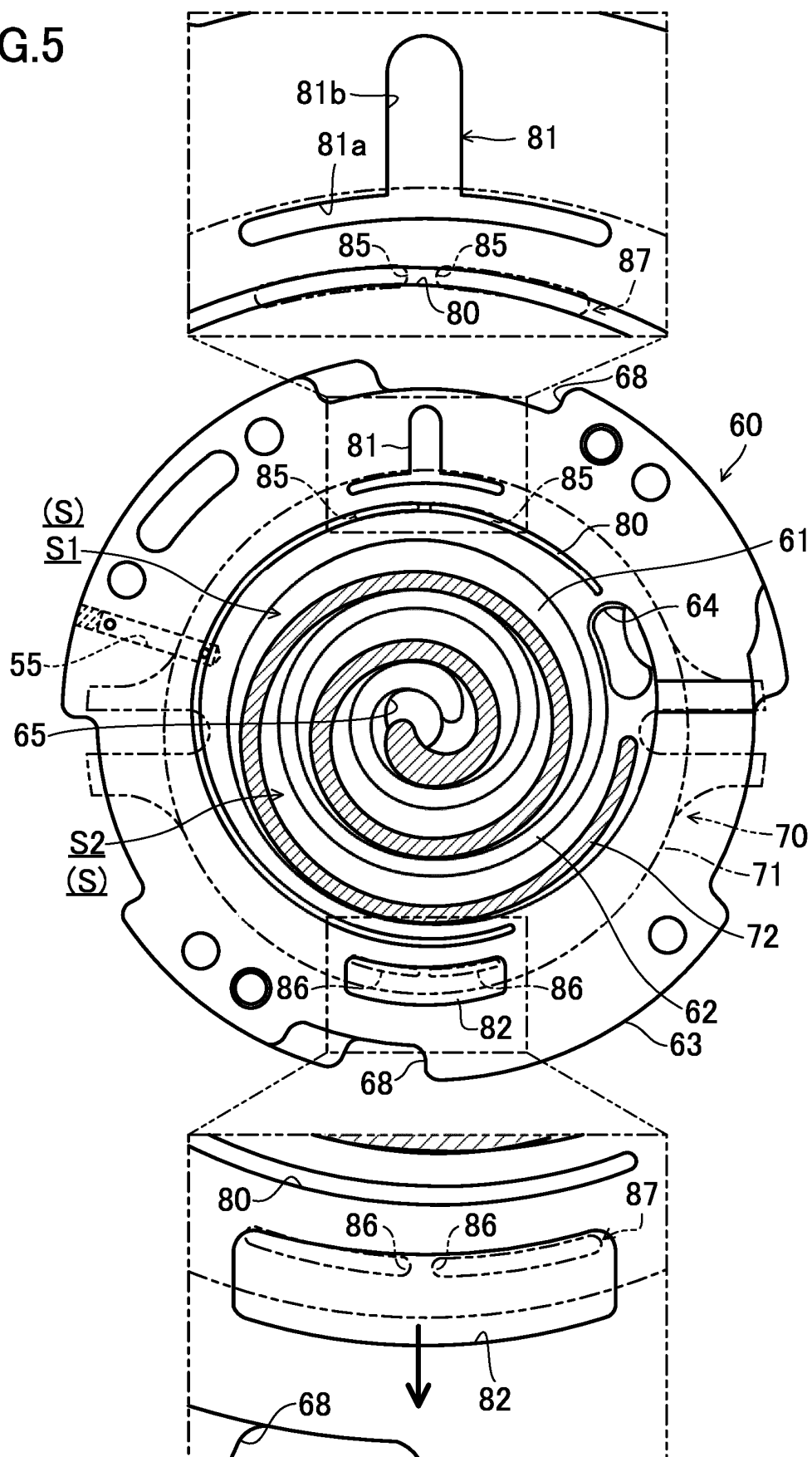


FIG.6

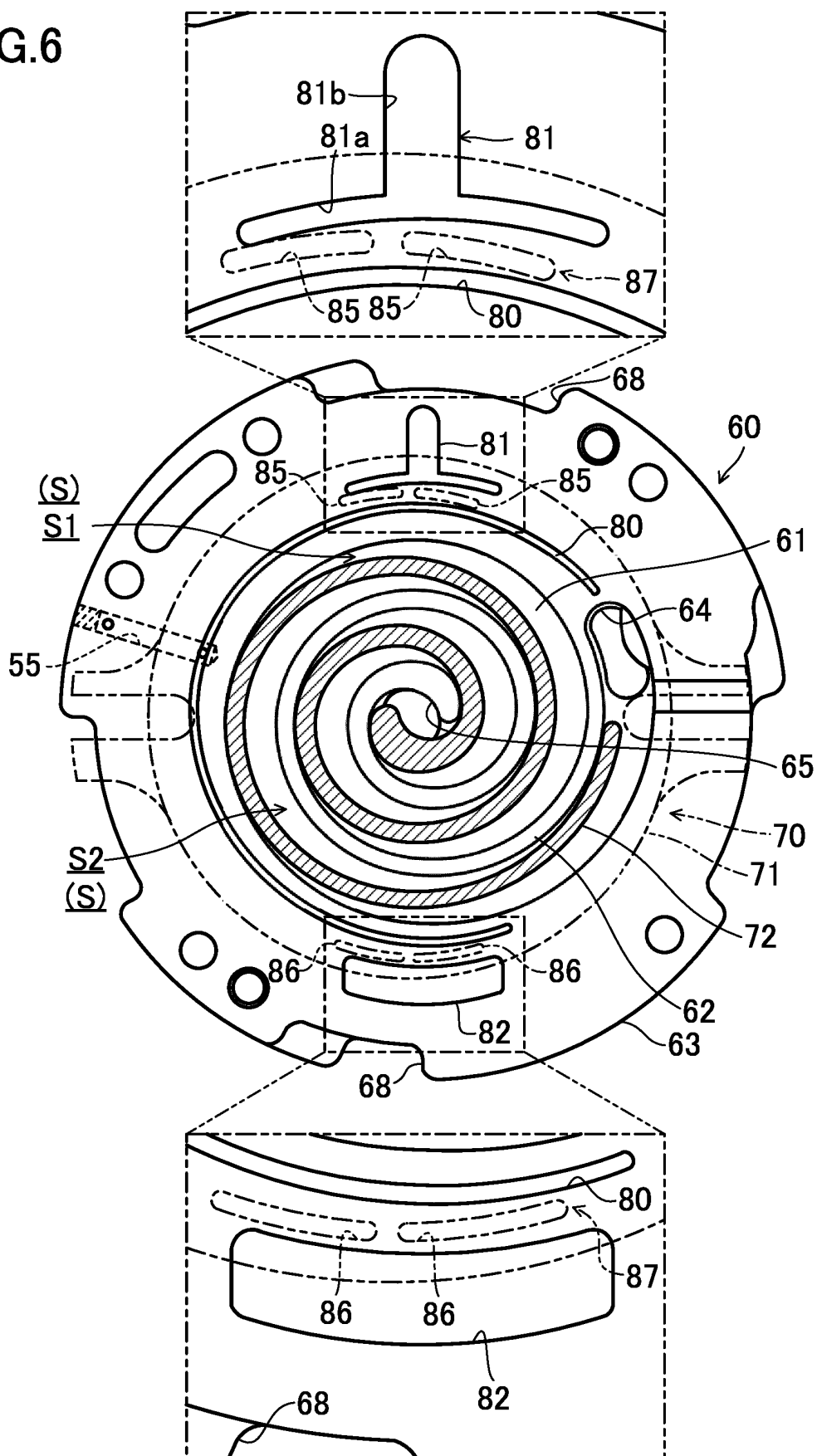


FIG.7

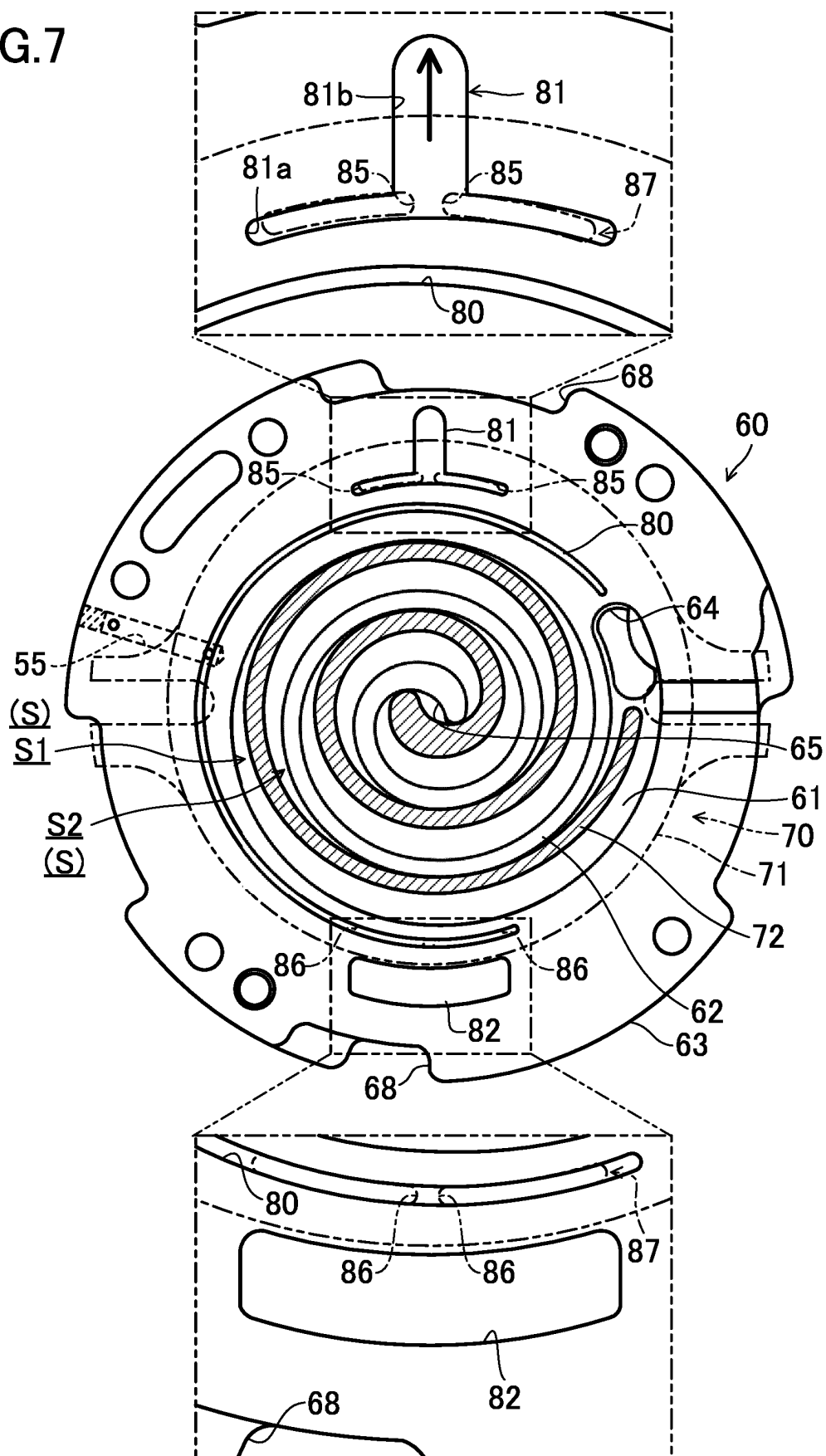
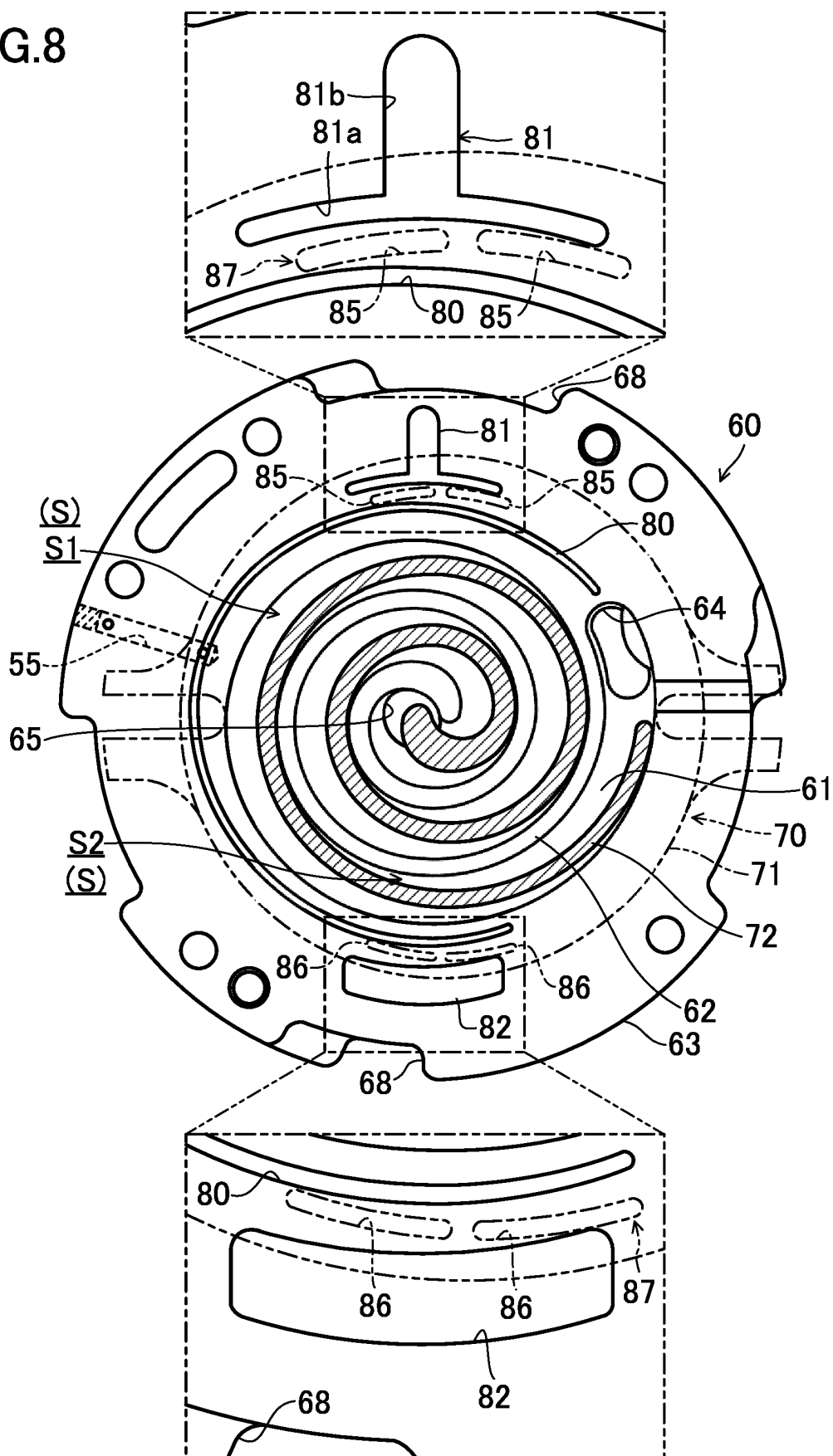


FIG.8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/000399

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. F04C18/02 (2006.01) i

FI: F04C18/02311U, F04C18/02311W

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)

Int.Cl. F04C2/00-2/077, F04C18/00-18/077

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 1971-2020

Registered utility model specifications of Japan 1996-2020

Published registered utility model applications of Japan 1994-2020

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	JP 2008-31920 A (DAIKIN INDUSTRIES, LTD.) 14.02.2008 (2008-02-14), paragraphs [0036]-[0039], [0045], [0047], [0048], [0080], [0083], [0089], fig. 1, 2	1-9
Y	JP 2013-87678 A (DAIKIN INDUSTRIES, LTD.) 13.05.2013 (2013-05-13), paragraphs [0055], [0056], [0062]-[0064], fig. 2, 4-6	1-9

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search
28.02.2020Date of mailing of the international search report
10.03.2020Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No. PCT/JP2020/000399
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JP 2008-31920 A	14.02.2008	(Family: none)
JP 2013-87678 A	13.05.2013	(Family: none)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2016160816 A [0003]