



(51) International Patent Classification:

F04C 29/12 (2006.01) F25B 31/02 (2006.01)

F04C 18/02 (2006.01) F25B 1/047 (2006.01)

(21) International Application Number:

PCT/US2020/022030

(22) International Filing Date:

11 March 2020 (11.03.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/816,626 11 March 2019 (11.03.2019) US

16/814,487 10 March 2020 (10.03.2020) US

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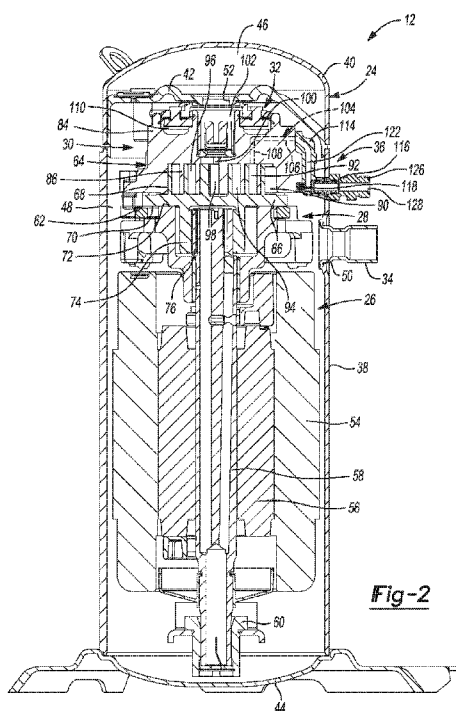
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: CLIMATE-CONTROL SYSTEM HAVING VALVE ASSEMBLY



(57) Abstract: A compressor includes a shell, first and second scroll members, a fitting assembly and a valve assembly. The first scroll member includes a first end plate having a first spiral wrap extending therefrom. The second scroll member includes a second end plate having a second spiral wrap extending therefrom and an injection passage formed in the second end plate. The second spiral wrap is meshingly engaged with the first spiral wrap to form compression pockets. The injection passage is in fluid communication with the compression pockets. The fitting assembly is in fluid communication with the injection passage. The valve assembly coupled to one of the second scroll member and the fitting assembly and movable between a closed position in which fluid communication between the compression pockets and the suction chamber is prevented and an open position in which fluid communication between the compression pockets and the suction chamber is allowed.

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

CLIMATE-CONTROL SYSTEM HAVING VALVE ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Patent Application No. 16/814,487, filed on March 10, 2020 and also claims the benefit of U.S. Provisional Application No. 62/816,626, filed on March 11, 2019. The entire disclosure of the above application is incorporated herein by reference.

FIELD

[0002] The present disclosure relates to a climate-control system having a valve assembly.

BACKGROUND

[0003] This section provides background information related to the present disclosure and is not necessarily prior art.

[0004] A climate-control system such as, for example, a heat-pump system, a refrigeration system, or an air conditioning system, may include a fluid circuit having an outdoor heat exchanger, one or more indoor heat exchangers, one or more expansion devices, and one or more compressors circulating a working fluid (e.g., refrigerant or carbon dioxide) through the fluid circuit. Efficient and reliable operation of the climate-control system is desirable to ensure that the climate-control system is capable of effectively and efficiently providing a cooling and/or heating effect on demand.

SUMMARY

[0005] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0006] In one form, the present disclosure discloses a compressor includes a shell, first and second scroll members, a fluid-injection fitting assembly and a valve assembly.

The shell defines a suction chamber. The first scroll member is disposed within the shell and includes a first end plate having a first spiral wrap extending therefrom. The second scroll member is disposed within the shell and includes a second end plate having a second spiral wrap extending therefrom and an injection passage formed in the second end plate. The second spiral wrap is meshingly engaged with the first spiral wrap to form compression pockets. The injection passage being in fluid communication with a radially

intermediate one of the compression pockets. The fluid-injection fitting assembly is at least partially disposed within the shell and in fluid communication with the injection passage. The fluid-injection fitting assembly is configured to provide working fluid to the radially intermediate one of the compression pockets. The valve assembly is coupled to one of the second scroll member and the fluid-injection fitting assembly and movable between a closed position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is prevented and an open position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is allowed. The valve assembly is movable from the closed position to the open position when a fluid pressure in the radially intermediate one of the compression pockets exceeds a predetermined threshold value.

[0007] In some configurations of the compressor of the above paragraph, the fluid-injection fitting assembly includes a scroll fitting and a transfer conduit attached to the scroll fitting. The valve assembly is coupled to the scroll fitting.

[0008] In some configurations of the compressor of any one or more of the above paragraphs, the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position. The valve body is movable relative to the valve housing from the closed position to the open position when fluid pressure in the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

[0009] In some configurations of the compressor of any one or more of the above paragraphs, working fluid in the radially intermediate one of the compression pockets flows to a passage formed in the scroll fitting and out an aperture formed in the valve housing into the suction chamber when the valve body is movable from the closed position to the open position.

[0010] In some configurations of the compressor of any one or more of the above paragraphs, the predetermined threshold value is greater than or equal to 500psi.

[0011] In some configurations of the compressor of any one or more of the above paragraphs, the valve assembly is coupled to the second end plate of the second scroll member.

[0012] In some configurations of the compressor of any one or more of the above paragraphs, the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position. The valve body is movable relative to the valve housing from the closed position to the open position when a fluid pressure in

the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

[0013] In some configurations of the compressor of any one or more of the above paragraphs, working fluid in the radially intermediate one of the compression pockets flows to the injection passage and out an aperture formed in an end cap of the valve assembly into the suction chamber when the valve body is movable from the closed position to the open position.

[0014] In some configurations of the compressor of any one or more of the above paragraphs, the predetermined threshold value is greater than or equal to 500psi.

[0015] In some configurations of the compressor of any one or more of the above paragraphs, a passage is formed in the second end plate of the second scroll member and is in fluid communication with the radially intermediate one of the compression pockets.

[0016] In some configurations of the compressor of any one or more of the above paragraphs, the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position. The valve body is movable relative to the valve housing from the closed position to the open position when a fluid pressure in the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

[0017] In some configurations of the compressor of any one or more of the above paragraphs, working fluid in the radially intermediate one of the compression pockets flows to the passage and out an aperture formed in an end cap of the valve assembly into the suction chamber when the valve body is movable from the closed position to the open position.

[0018] In some configurations of the compressor of any one or more of the above paragraphs, the injection passage and the fluid-injection fitting assembly cooperate to define a fluid circuit. Fluid communication between the radially intermediate one of the compression pockets and the suction chamber via the fluid circuit is allowed when the valve assembly is in the open position.

[0019] In another form, the present disclosure discloses a compressor including a shell, first and second scroll members, a fluid-injection fitting assembly and a valve assembly. The shell defines a suction chamber. The first scroll member is disposed within the shell and includes a first end plate having a first spiral wrap extending therefrom. The second scroll member is disposed within the shell and includes a second end plate having

a second spiral wrap extending therefrom and an injection passage formed in the second end plate. The second spiral wrap is meshingly engaged with the first spiral wrap to form compression pockets. The injection passage is in fluid communication with a radially intermediate one of the compression pockets. The fluid-injection fitting assembly is at least partially disposed within the shell and in fluid communication with the injection passage. The fluid-injection fitting assembly is configured to provide working fluid to the radially intermediate one of the compression pockets. The valve assembly is coupled to the fluid-injection fitting assembly and movable between a closed position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is prevented and an open position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is allowed. The valve assembly is movable from the closed position to the open position when a pressure difference of working fluid in the radially intermediate one of the compression pockets and working fluid in the suction chamber exceeds a predetermined threshold value.

[0020] In some configurations of the compressor of the above paragraph, the fluid-injection fitting assembly includes a scroll fitting and a transfer conduit attached to the scroll fitting. The valve assembly is coupled to the scroll fitting.

[0021] In some configurations of the compressor of any one or more of the above paragraphs, the valve assembly includes a valve flap that is movable relative to the scroll fitting from the closed position to the open position when the pressure difference of working fluid in the radially intermediate one of the compression pockets and working fluid in the suction chamber exceeds the predetermined threshold value.

[0022] In some configurations of the compressor of any one or more of the above paragraphs, working fluid in the radially intermediate one of the compression pockets flows to a first passage formed in the scroll fitting and out a second passage formed in the scroll fitting into the suction chamber when the valve flap is movable from the closed position to the open position.

[0023] In some configurations of the compressor of any one or more of the above paragraphs, the second passage extends perpendicular to the first passage.

[0024] In some configurations of the compressor of any one or more of the above paragraphs, the fluid-injection fitting assembly includes a scroll fitting and a transfer conduit attached to the scroll fitting. The valve assembly is coupled to the transfer conduit.

[0025] In some configurations of the compressor of any one or more of the above paragraphs, the valve assembly includes a valve flap that is movable relative to the transfer conduit from the closed position to the open position when the pressure difference of working fluid in the radially intermediate one of the compression pockets and working fluid in the suction chamber exceeds the predetermined threshold value.

[0026] In some configurations of the compressor of any one or more of the above paragraphs, working fluid in the radially intermediate one of the compression pockets flows through a first passage formed in the scroll fitting and out an aperture formed in the transfer conduit into the suction chamber when the valve flap is movable from the closed position to the open position.

[0027] In some configurations of the compressor of any one or more of the above paragraphs, the injection passage and the fluid-injection fitting assembly cooperate to define a fluid circuit. Fluid communication between the radially intermediate one of the compression pockets and the suction chamber via the fluid circuit is allowed when the valve assembly is in the open position.

[0028] In yet another form, the present disclosure discloses a compressor including a shell, first and second scroll members, a fluid-injection fitting assembly and a valve assembly. The shell defines a suction chamber. The first scroll member is disposed within the shell and includes a first end plate having a first spiral wrap extending therefrom and a venting passage formed in the first end plate. The second scroll member is disposed within the shell and includes a second end plate having a second spiral wrap extending therefrom and an injection passage formed in the second end plate. The second spiral wrap is meshingly engaged with the first spiral wrap to form compression pockets. The injection passage and the venting passage is in fluid communication with a radially intermediate one of the compression pockets. The fluid-injection fitting assembly is at least partially disposed within the shell and in fluid communication with the injection passage. The fluid-injection fitting assembly is configured to provide working fluid to the radially intermediate one of the compression pockets. The valve assembly is coupled to the first end plate and movable between a closed position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is prevented and an open position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is allowed. The valve assembly is movable from the closed position to the open position when a fluid

pressure within the radially intermediate one of the compression pockets exceeds a predetermined threshold value.

[0029] In some configurations of the compressor of the above paragraph, the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position. The valve body is movable relative to the valve housing from the closed position to the open position when the fluid pressure in the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

[0030] In some configurations of the compressor of any one or more of the above paragraphs, working fluid in the radially intermediate one of the compression pockets flows to the venting passage and out an aperture formed in an end cap of the valve assembly into the suction chamber when the valve body is movable from the closed position to the open position.

[0031] In some configurations of the compressor of any one or more of the above paragraphs, the predetermined threshold value is greater than or equal to 500psi.

[0032] In yet another form, the present disclosure discloses a climate-control system including a compressor, a first fluid passageway, a second fluid passageway, a conduit and a valve. The compressor defines a suction chamber and includes a first inlet, a second inlet and a compression mechanism forming a compression pocket. The first inlet is in fluid communication with the suction chamber. The second inlet is in fluid communication with the compression pocket. The first fluid passageway includes a first heat exchanger. The first fluid passageway provides working fluid from the first heat exchanger to the first inlet. The second fluid passageway extends between a second heat exchanger and the second inlet. The second fluid passageway provides working fluid from the second heat exchanger to the second inlet. The conduit extends from the first fluid passageway to the second fluid passageway. The valve is disposed along the conduit and movable between a closed position in which fluid communication between the compression pocket and the suction chamber via the conduit is prevented and an open position in which fluid communication between the compression pocket and the suction chamber via the conduit is allowed. The valve is movable from the closed position to the open position when a fluid pressure in the compression pocket exceeds a predetermined threshold value.

[0033] In some configurations of the climate-control system of the above paragraph, the predetermined threshold value is greater than or equal to 500psi.

[0034] In some configurations of the climate-control system of any one or more of the above paragraphs, the conduit extends from the first fluid passageway at a location between the first inlet and the first heat exchanger to the second fluid passageway at a location between the second heat exchanger and the second inlet.

5 **[0035]** In some configurations of the climate-control system of any one or more of the above paragraphs, the first heat exchanger is an evaporator and the second heat exchanger is a condenser.

[0036] In some configurations of the climate-control system of any one or more of the above paragraphs, working fluid in the compression pocket flows through the conduit,
10 the first inlet and into the suction chamber when the valve is moved from the closed position to the open position.

[0037] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present
15 disclosure.

DRAWINGS

[0038] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

20 **[0039]** Figure 1 is a schematic representation of a climate-control system according to the principles of the present disclosure;

[0040] Figure 2 is a cross-sectional view of a compressor of the climate-control system of Figure 1;

[0041] Figure 3 is a perspective view of a non-orbiting scroll of the compression
25 mechanism and a fluid-injection fitting assembly;

[0042] Figure 4 is a partial cross-sectional view of the fluid-injection fitting assembly of Figure 3 having a valve assembly in an open position;

[0043] Figure 5 is a cross-sectional view of the valve assembly in the closed position;

30 **[0044]** Figure 6 is a cross-sectional view of the valve assembly in the open position;

[0045] Figure 7 is a partial cross-sectional view of an alternate fluid-injection fitting assembly having a valve assembly in a closed position;

[0046] Figure 8 is a partial cross-sectional view of the fluid-injection fitting assembly of Figure 7 with the valve assembly in an open position;

[0047] Figure 9 is a partial cross-sectional view of yet another alternate fluid-injection fitting assembly;

5 [0048] Figure 10 is a perspective view of a transfer conduit of the fluid-injection fitting assembly of Figure 9 having a valve assembly in a closed position;

[0049] Figure 11 is a perspective view of the transfer conduit of the fluid-injection fitting assembly of Figure 9 having the valve assembly in an open position;

10 [0050] Figure 12 is a partial perspective view of an alternate non-orbiting scroll and an alternate fluid-injection fitting assembly;

[0051] Figure 13 is a partial cross-sectional view of the non-orbiting scroll and fluid-injection fitting assembly of Figure 12;

[0052] Figure 14 is a schematic representation of an alternate climate-control system according to the principles of the present disclosure;

15 [0053] Figure 15 is a perspective view of another alternate non-orbiting scroll and an alternate fluid-injection fitting assembly;

[0054] Figure 16 is a cross-sectional view of the non-orbiting scroll and fluid-injection fitting assembly of Figure 15; and

20 [0055] Figure 17 is a cross-sectional view of an alternate orbiting scroll according to the principles of the present disclosure.

[0056] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

25 [0057] Example embodiments will now be described more fully with reference to the accompanying drawings.

[0058] Example embodiments are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art. Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of embodiments of the present disclosure. It will be
30 apparent to those skilled in the art that specific details need not be employed, that example embodiments may be embodied in many different forms and that neither should be construed to limit the scope of the disclosure. In some example embodiments, well-

known processes, well-known device structures, and well-known technologies are not described in detail.

[0059] The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms "a," "an," and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "comprising," "including," and "having," are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

[0060] When an element or layer is referred to as being "on," "engaged to," "connected to," or "coupled to" another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly engaged to," "directly connected to," or "directly coupled to" another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.). As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0061] Although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as "first," "second," and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the example embodiments.

[0062] Spatially relative terms, such as "inner," "outer," "beneath," "below," "lower," "above," "upper," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the example term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0063] With reference to Figure 1, a climate-control system 10 is provided that may include a fluid-circuit having a compressor 12, a first heat exchanger 14 (an outdoor heat exchanger such as a condenser or gas cooler, for example), first and second expansion devices 16, 18, a second heat exchanger 20 and a third heat exchanger 22 (an indoor heat exchanger such as an evaporator). The compressor 12 may pump working fluid (e.g., refrigerant, carbon dioxide, etc.) through the circuit.

[0064] As shown in Figure 2, the compressor 12 may be a low-side compressor (i.e., a compressor in which the motor assembly is disposed within a suction chamber or suction-pressure region of the compressor), for example. The compressor 12 may include a hermetic shell assembly 24, a motor assembly 26, a main bearing housing 28, a compression mechanism 30, a seal assembly 32, a suction gas inlet fitting 34 (e.g., a first inlet of the compressor 12) and a fluid-injection fitting assembly 36 (e.g., a second inlet of the compressor 12).

[0065] The shell assembly 24 may generally form a compressor housing and may include a cylindrical shell 38, an end cap 40 at an upper end thereof, a transversely extending muffler plate 42 and a base 44 at a lower end thereof. The end cap 40 and the muffler plate 42 may generally define a discharge chamber 46, while the cylindrical shell 38, the muffler plate 42 and the base 44 may generally define a suction chamber 48. A discharge fitting (not shown) may be attached to the shell assembly 24 at an opening (not shown) in the end cap 40 and may be in fluid communication with the first heat exchanger 14. The suction gas inlet fitting 34 may be attached to the shell assembly 24 at an opening 50 such that the suction gas inlet fitting 34 is in fluid communication with the third heat exchanger 22. The muffler plate 42 may include a discharge passage 52

extending therethrough that provides communication between the compression mechanism 30 and the discharge chamber 46.

5 **[0066]** The motor assembly 26 may generally include a motor stator 54, a rotor 56 and a driveshaft 58. The motor stator 54 may be fixedly coupled with shell 38 (e.g., press-fit into the shell 38). The driveshaft 58 may be rotatably driven by the rotor 56. The rotor 56 may be press-fit onto the driveshaft 58.

10 **[0067]** The main bearing housing 28 may be affixed to the shell 38 at a plurality of points in any desirable manner, such as staking, for example, and may axially support the compression mechanism 30. The main bearing housing 28 may include a bearing that rotatably supports one end of the driveshaft 58. The other end of the driveshaft 58 may be supported by a lower bearing housing 60.

15 **[0068]** As shown in Figure 2, the compression mechanism 30 may generally include an orbiting scroll or first scroll member 62 and a non-orbiting scroll or second scroll member 64. The orbiting scroll 62 may include an endplate 66 having a spiral vane or wrap 68 on the upper surface thereof and an annular flat thrust surface 70 on the lower surface. The thrust surface 70 may interface with the annular flat thrust bearing surface 72 on the main bearing housing 28. A cylindrical hub 74 may project downwardly from the thrust surface 70 and may have a drive bushing 76 rotatably disposed therein. The drive bushing 76 may include an inner bore in which the driveshaft 58 is drivingly disposed. An
20 Oldham coupling may be engaged with the orbiting and non-orbiting scrolls 62, 64 to prevent relative rotation therebetween.

25 **[0069]** The non-orbiting scroll 64 may include an endplate 84 having a spiral wrap 86 on a lower surface thereof. The spiral wrap 86 may form a meshing engagement with the wrap 68 of the orbiting scroll 62, thereby creating compression pockets, including an inlet pocket 90 (i.e., a radially outer pocket), intermediate pockets 92, 94, 96 (i.e., radially intermediate pockets), and an outlet pocket 98 (i.e., a radially inner pocket). The non-orbiting scroll 64 may include a discharge passage 100 in communication with the outlet pocket 98 and an upwardly open recess 102. The upwardly open recess 102 may be in fluid communication with the discharge chamber 46 via the discharge passage 52 in the
30 muffler plate 42.

[0070] The endplate 84 may include a fluid-injection passage 104 formed therein. The fluid-injection passage 104 may be in fluid communication with the fluid-injection fitting assembly 36 and with one or more of the intermediate pockets 92, 94, 96, and may include a radially extending portion 106 and an axially extending portion 108. The fluid-

injection passage 104 may allow working fluid from the fluid-injection fitting assembly 36 to flow into the one or more of the intermediate pockets 92, 94, 96. The non-orbiting scroll 64 may include an annular recess 110 in the upper surface thereof.

[0071] As shown in Figure 2, the seal assembly 32 may be located within the annular recess 110. In this way, the seal assembly 32 may be axially displaceable within the annular recess 110 relative to the shell assembly 24 and/or the non-orbiting scroll 64 to provide for axial displacement of the non-orbiting scroll 64 while maintaining a sealed engagement with the muffler plate 42 to isolate the discharge chamber 46 from the suction chamber 48. More specifically, in some configurations, pressure within the annular recess 110 may urge the seal assembly 32 into engagement with the muffler plate 42, and the spiral wrap 86 of the non-orbiting scroll 64 into engagement with the endplate 66 of the orbiting scroll 62, during normal compressor operation.

[0072] With reference to Figures 2-6, the fluid-injection fitting assembly 36 may include a scroll fitting 114, a transfer conduit 116, a valve assembly 118 (Figures 2 and 4-6), and a shell fitting 126. The scroll fitting 114 may be at least partially disposed in the shell 38 and may be attached to the non-orbiting scroll 64 via bolts 120. The scroll fitting 114 may include a passage 122 that is in fluid communication with the injection passage 104 at a first end and in fluid communication with the transfer conduit 116 and the valve assembly 118 at a second end. A sealing member 124 (e.g., a gasket) is disposed between the non-orbiting scroll 64 and the scroll fitting 114 to prevent leakage from or into the injection passage 104 and/or the scroll fitting 114.

[0073] As shown in Figure 2, the shell fitting 126 (i.e., a second inlet) is attached to the shell 38 at an opening thereof. The transfer conduit 116 may be at least partially disposed in the shell 38 and may be attached to the scroll fitting 114 at a first end and to the shell fitting 126 at a second end. The transfer conduit 116 may be in fluid communication with the passage 122 of the scroll fitting 114 at the first end and may be in fluid communication with a passage 128 of the shell fitting 126 at the second end. With reference to Figures 4-6, a first sealing member 130 (e.g., an O-ring) may be disposed in a groove 132 formed in the transfer conduit 116 at or near the first end and a second sealing member 134 (e.g., an O-ring) may be disposed in a groove 136 formed in the transfer conduit 116 at or near the second end. In this way, the first and second sealing members 130, 134 prevent leakage from or into the transfer conduit 116, the scroll fitting 114 and/or the shell fitting 126. In some configurations, the transfer conduit 116 could be integrally formed with or a part of the scroll fitting 114 or the shell fitting 126.

[0074] As shown in Figures 2 and 4-6, the valve assembly 118 may include a valve housing 138, an end cap 140 a valve body 142 and a coiled spring 144. The valve housing 138 may be fixedly coupled to the scroll fitting 114 and may include an end wall 145 and a sidewall 146 that cooperate to define a valve-housing passage 147. The end wall 145 may define a first opening 148 and the sidewall 146 may define second openings 149. The first opening 148 is in fluid communication with the passage 122 of the scroll fitting 114 and also selectively in fluid communication with the second openings 149 via the valve-housing passage 147. The second openings 149 may be in fluid communication with the suction chamber 48 and selectively in fluid communication with the valve-housing passage 147. The end cap 140 is attached to the valve housing 138 at an end opposite the end wall 145.

[0075] The valve body 142 and the coiled spring 144 are disposed in the valve-housing passage 147 of the valve housing 138. The valve body 142 may be disposed within the valve-housing passage 147 and movable relative to the valve housing 138 between a closed position and an open position. In the closed position (Figure 5), the valve body 142 may sealingly engage the end wall 145 to prevent fluid communication between the first opening 148 and the valve-housing passage 147. In the open position (Figure 6), the valve body 142 may be spaced apart from the end wall 145, thereby allowing fluid communication between the first opening 148 and the valve-housing passage 147. The coiled spring 144 is connected to the end cap 140 and the valve body 142, and biases the valve body 142 into the closed position.

[0076] While the compressor 12 is described above as a low-side scroll compressor (i.e., a compressor in which the motor assembly is disposed within a suction-pressure chamber within the shell), in some configurations, the compressor 12 could be a high-side compressor (i.e., a compressor in which the motor assembly is disposed within a discharge-pressure chamber within the shell). For example, the compressor 12 could be a high-side or low-side compressor and could be a rotary, reciprocating, or screw compressor, or any other suitable type of compressor.

[0077] With reference back to Figure 1, the first heat exchanger 14 may be in fluid communication with the compressor 12 and may receive compressed working fluid from the compressor 12 via a discharge line 150 that is connected to the discharge fitting (not shown) of the compressor 12. The first heat exchanger 14 may transfer heat from the compressed working fluid to ambient air that may be forced over the first heat exchanger

14. In some configurations, the first heat exchanger 14 may transfer heat from the compressed working fluid to a stream of liquid such as water, for example.

[0078] From the first heat exchanger 14, a first portion of the working fluid may flow to a first fluid passageway 152. The first fluid passageway 152 may include the first
5 expansion device 16 (e.g., an expansion valve or capillary tube), a first conduit 154 of the second heat exchanger 20, and the third heat exchanger 22. The working fluid in the first fluid passageway 152 flows through the conduit 154 of the second heat exchanger 20 and the first expansion device 16 where its temperature and pressure are lowered. The working fluid then flows to the third heat exchanger 22 where the working fluid may
10 absorb heat from a space to be cooled. From the third heat exchanger 22, the working fluid flows to the suction gas inlet fitting 34 (via a suction line 156) to be compressed by the compression mechanism 30.

[0079] A second portion of the working fluid from the first heat exchanger 14 may flow to a second fluid passageway 158 (e.g., a fluid-injection passageway). The second
15 fluid passageway 158 may include the second expansion device 18 (e.g., an expansion valve or capillary tube) and a conduit 160 of the second heat exchanger 20. The working fluid in the second fluid passageway 158 may flow through the second expansion device 18 where its pressure is lowered. The working fluid then flows through the conduit 160 of the second heat exchanger 20 where it absorbs heat from the working fluid flowing
20 through the conduit 154. The working fluid then flows to the fluid-injection fitting assembly 36 and into the intermediate pocket 92 of the compression mechanism 30 (via the injection passage 104). In this manner, the second fluid passageway 158, the fluid-injection fitting assembly 36, and the injection passage 104 may define a fluid-injection circuit. In some configurations, the second heat exchanger 20 may be a counter-flow heat
25 exchanger as oppose to a parallel-flow heat exchanger. In some configurations, the system 10 may not include the second heat exchanger 20, e.g., if liquid injection (as opposed to vapor injection) is desired.

[0080] When the compressor 12 is in an OFF-mode, the compressor 12 may experience a flooded start condition. A flooded start condition is a condition where
30 working fluid in a liquid phase (i.e., a mixture of gaseous and liquid working fluid or entirely liquid working fluid) may migrate into or otherwise be present in the compression pockets 90, 92, 94, 96, 98 of the compression mechanism 30 when the compressor 12 is switched from the OFF-mode to an ON-mode. During a flooded start condition, high fluid pressure (e.g., fluid pressures greater than or equal to 500 pounds per square inch (psi)) may be

generated in the compression pockets 90, 92, 94, 96, 98 when the compression mechanism 30 compresses working fluid in the compression pockets 90, 92, 94, 96, 98 that is at least partially in liquid phase.

[0081] During normal operation of the system 10, intermediate-pressure working fluid may flow through the fluid-injection circuit from the second fluid passageway 158, through the fluid-injection fitting assembly 36, through the injection passage 104 and into the intermediate compression pocket 92). If the high pressure working fluid in the compression pocket 92 and/or the fluid-injection circuit exceeds a predetermined threshold value (e.g., during a flooded start condition), the coiled spring 144 of the valve assembly 118 will compress, thereby moving the valve body 142 from the closed position (Figure 5) to the open position (Figure 6). Once the valve body 142 is moved from the closed position to the open position, high pressure working fluid in the compression pocket 92 and/or the fluid-injection circuit (e.g., the passage 122) flows through the first opening 148, the valve-housing passage 147, and out the second openings 149 into the suction chamber 48.

[0082] It should be understood that the coiled spring 144 may compress in response to high pressure working fluid in the compression pocket 92 being above a predetermined threshold value due to the compressor 12 experiencing a flooded start condition and not during normal operation of the system 10. Stated another way, fluid pressures in the compression pocket 92 and in the fluid-injection circuit during normal operation of the system 10 are below the predetermined threshold value that causes the spring 144 to compress and the valve body 142 to move from the closed position to the open position.

[0083] One of the benefits of the climate-control system 10 of the present disclosure is the reduction of pressure of the high pressure working fluid generated during a flooded start condition, which increases the reliability of the compressor 12. That is, a flooded start condition may be detrimental to the reliability of the compressor 12 and, in turn, the efficient operation of the climate-control system 10. By reducing the pressure of the high pressure working fluid generated during a flooded start condition, the compressor 12 is more reliable, which allows for efficient operation of the climate-control system 10.

[0084] Another benefit of the climate-control system 10 of the present disclosure is the prevention of damage to the gasket 124 and the reduction of moment on the fitting 114 due to venting excessively high pressure working fluid to the suction chamber 48.

This allows the gasket 124 to maintain a proper seal between the scroll 64 and the fitting 114.

[0085] With reference to Figures 7-8, another fluid-injection fitting assembly 236 is provided. The fluid-injection fitting assembly 236 may be incorporated into the
5 compressor 12 instead of the fluid-injection fitting assembly 36. The structure and function of the fluid-injection fitting assembly 236 may be similar or identical to that of the fluid-injection fitting assembly 36 described above, apart from any exception noted below.

[0086] The fluid-injection fitting assembly 236 may include a scroll fitting 238, a valve flap 240 and a transfer conduit (not shown). The scroll fitting 238 may be at least
10 partially disposed in the shell 38 and may be attached to the non-orbiting scroll 64 via bolts (not shown). The scroll fitting 238 may include a first passage 242 and a second passage 243. The first passage 242 may be in fluid communication with the injection passage 104 at a first end and in fluid communication the transfer conduit at a second end. The second passage 243 may be in fluid communication with the first passage 242
15 and in selective fluid communication with the suction chamber 48.

[0087] The valve flap 240 may be movably mounted to the scroll fitting 238 (via fasteners 246; only one shown in Figures 7 and 8) between a closed position (Figure 7) and an open position (Figure 8). In the closed position, the valve flap 240 may be sealingly engaged with the scroll fitting 238 to prevent fluid communication between the
20 first passage 242 and the suction chamber 48. In the open position, the valve flap 240 may be spaced apart from the scroll fitting 238, thereby allowing fluid communication between the first passage 242 and the suction chamber 48 (via the second passage 243).

[0088] High pressure working fluid in the compression pocket 92 may flow at least partially through a fluid-injection circuit (the fluid-injection circuit may be defined by the
25 injection passage 104, the passages 242, 243 of the scroll fitting 238, the transfer conduit (not shown), the shell fitting 126 and the second fluid passageway 158). If a pressure difference between high pressure working fluid in the compression pockets 90, 92, 94, 96, 98 (and/or the fluid-injection circuit) and working fluid in the suction chamber 48 exceeds a predetermined threshold, the valve flap 240 moves from the closed position
30 to the open position. Once the valve flap 240 is moved from the closed position to the open position, high pressure working fluid in the compression pocket 92 and/or the fluid-injection circuit (e.g., the passages 242, 243) is vented out into the suction chamber 48. The valve flap 240 moves from the open position back to the closed position once the pressure difference between the high pressure working fluid in the compression pockets

90, 92, 94, 96, 98 (and/or the fluid-injection circuit) and the working fluid in the suction chamber 48 is below the predetermined threshold.

[0089] The structure and function of the transfer conduit (not shown) may be similar or identical to that of the transfer conduit 116 described above, and therefore, will not be described again in detail.

[0090] It should be understood that the valve flap 240 may move from the closed position to the open position in response to a pressure difference between high pressure working fluid in the compression pockets 90, 92, 94, 96, 98 (and/or the fluid-injection circuit) and working fluid in the suction chamber 48 exceeding a predetermined threshold value due to the compressor 12 experiencing a flooded start condition and not during normal operation of the system 10. Stated another way, the pressure difference between high pressure working fluid in the compression pockets 90, 92, 94, 96, 98 (and/or the fluid-injection circuit) and working fluid in the suction chamber 48 during normal operation of the compressor 12 is below the predetermined threshold value and would not cause the valve flap 240 to move from the closed position to the open position.

[0091] With reference to Figures 9-11, another fluid-injection fitting assembly 336 is provided. The fluid-injection fitting assembly 336 may be incorporated into the compressor 12 instead of the fluid-injection fitting assemblies 36, 236. The structure and function of the fluid-injection fitting assembly 336 may be similar or identical to that of the fluid-injection fitting assemblies 36, 236 described above, apart from any exception noted below.

[0092] The fluid-injection fitting assembly 336 may include a scroll fitting 338 and a transfer conduit 340. The scroll fitting 338 may be at least partially disposed in the shell 38 and may be attached to the non-orbiting scroll 64 via bolts 339. The scroll fitting 338 may include a fluid passage 342 that may be in fluid communication with the injection passage 104 at a first end and in fluid communication with the transfer conduit 340 at a second end.

[0093] The transfer conduit 340 may be at least partially disposed in the shell 38 and may be attached to the scroll fitting 338 at a first end and to the shell fitting 126 at a second end. A passage 345 of the transfer conduit 340 may be in fluid communication with the fluid passage 342 of the scroll fitting 338 at the first end and may be in fluid communication with the passage 128 of the shell fitting 126 at the second end. A first sealing member 346 (e.g., an O-ring) may be disposed in a groove 348 formed in the transfer conduit 340 at or near the first end and a second sealing member 350 (e.g., an

O-ring) may be disposed in a groove 352 formed in the transfer conduit 340 at or near the second end. In this way, the first and second sealing members 346, 350 prevent leakage from or into the transfer conduit 340, the scroll fitting 338 and/or the shell fitting 126.

5 **[0094]** The fluid-injection fitting assembly 336 also includes a valve flap 354 that may be movably mounted to the transfer conduit 340 (via a fastener 355) between a closed position (Figure 10) and an open position (Figure 11). In the closed position, the valve flap 354 may be sealingly engaged with the transfer conduit 340 to prevent fluid communication between the passage 345 and the suction chamber 48. In the open position, the valve flap 354 may be spaced apart from the transfer conduit 340, thereby allowing fluid communication between the passage 345 and the suction chamber 48 via an aperture 347 in the transfer conduit 340.

10 **[0095]** As shown in Figure 9, high pressure working fluid in the compression pocket 92 may flow at least partially through a fluid-injection circuit (the fluid-injection circuit may be defined by the injection passage 104, the passage 342 of the scroll fitting 338, the passage 345 of the transfer conduit 340, the passage 128 of the shell fitting 126 and the second fluid passageway 158). If a pressure difference between high pressure working fluid in the compression pockets 90, 92, 94, 96, 98 (and/or the fluid-injection circuit) and working fluid in the suction chamber 48 exceeds a predetermined threshold, the valve flap 354 moves from the closed position to the open position. Once the valve flap 354 is moved from the closed position to the open position, high pressure working fluid in the compression pocket 92 and/or the fluid-injection circuit (e.g., the passage 345) is vented out into the suction chamber 48. The valve flap 354 moves from the open position back to the closed position once the pressure difference between high pressure working fluid in the compression pockets 90, 92, 94, 96, 98 (and/or the fluid-injection circuit) and working fluid in the suction chamber 48 is below the predetermined threshold.

20 **[0096]** With reference to Figures 12-13, another compression mechanism 430 and fluid-injection fitting assembly 436 are provided. The compression mechanism 430 may be incorporated into the compressor 12 instead of the compression mechanism 30 described above. The structure and function of the compression mechanism 430 may be similar or identical to that of the compression mechanism 30 described above, apart from any exception noted below.

30 **[0097]** The compression mechanism 430 may generally include an orbiting scroll or first scroll member (not shown), a non-orbiting scroll or second scroll member 440 and

a valve assembly 442. The structure and function of the orbiting scroll may be similar or identical to that of the orbiting scroll 62 described above, and therefore, will not be described again in detail.

[0098] The non-orbiting scroll 440 may include an endplate 444 having a spiral wrap (not shown) projecting downwardly from the endplate 444. The spiral wrap may form a meshing engagement with the wrap (not shown) of the orbiting scroll, thereby creating compression pockets (not shown). The endplate 444 may include an injection passage 446 formed therein. The injection passage 446 may be in fluid communication with the fluid-injection fitting assembly 436 and one or more of the intermediate pockets of the compression pockets. The injection passage 446 may also be in selective fluid communication with the suction chamber 48 via the valve assembly 442. The injection passage 446 may allow working fluid from fluid-injection fitting assembly 436 to flow into the one or more of the intermediate pockets.

[0099] The valve assembly 442 may include a valve housing 448, a valve body 450, a coiled spring 452 and an end cap 454. The valve housing 448 may be coupled to the end plate 444 of the non-orbiting scroll 440. The valve body 450 may be disposed within the valve housing 448 and may be translatable between a closed position and an open position. In the closed position, the valve body 450 may prevent fluid communication between the injection passage 446 and the suction chamber 48. In the open position, the valve body 450 may allow fluid communication between the injection passage 446 and the suction chamber 48 (via openings 455, 456 in the valve housing 448 and the end cap 454, respectively). The coiled spring 452 is connected to the end cap 454 and the valve body 450, and biases the valve body 450 into the closed position. The end cap 454 is coupled to an end of the valve housing 448.

[0100] The fluid-injection fitting assembly 436 may be incorporated into the compressor 12 instead of the fluid-injection fitting assemblies 36, 236, 336 described above. The structure and function of the fluid-injection fitting assembly 436 may be similar or identical to that of the fluid-injection fitting assemblies 36, 236, 336 described above, apart from any exception noted below.

[0101] The fluid-injection fitting assembly 436 may include a scroll fitting 460 and a transfer conduit 462. The scroll fitting 460 may be at least partially disposed in the shell 38 and may be attached to the non-orbiting scroll 440 via bolts 463. The scroll fitting 460 may include a passage 464 that is in fluid communication with the injection passage 446 at a first end and in fluid communication with the transfer conduit 462 at a second end. A

sealing member 466 (e.g., a gasket) is disposed between the non-orbiting scroll 440 and the scroll fitting 460 to prevent leakage from or into the injection passage 446 and/or the scroll fitting 460.

5 **[0102]** The structure and function of the transfer conduit 462 may be similar or identical to the transfer conduit 116 described above, and therefore, will not be described again in detail.

10 **[0103]** High pressure working fluid in an intermediate compression pocket may flow at least partially through a fluid-injection circuit (the fluid-injection circuit may be defined by the injection passage 446, the passage 464 of the scroll fitting 460, the transfer conduit 462, the shell fitting 126 and the second fluid passageway 158). If fluid pressures in the compression pockets and the fluid-injection circuit exceeds a predetermined threshold value, the coiled spring 452 of the valve assembly 442 will compress, thereby moving the valve body 450 from the closed position to the open position. Once the valve body 450 is moved from the closed position to the open position, high pressure working
15 fluid in the intermediate compression pocket and/or the fluid-injection circuit (e.g., the passage 446) flows through the valve housing 448 and into the suction chamber 48.

20 **[0104]** With reference to Figure 14, another climate-control system 510 is provided. The structure and function of the climate control system 510 may be similar or identical to that of climate-control system 10 described above, apart from any exception noted below.

25 **[0105]** The climate-control system 510 may include a fluid-circuit having a compressor 512, a first heat exchanger 514 (an outdoor heat exchanger such as a condenser or gas cooler, for example), first and second expansion devices 516, 518, a second heat exchanger 520 and a third heat exchanger 522 (an indoor heat exchanger such as an evaporator). The structure and the function of the compressor 512, the first heat exchanger 514, the first and second expansion devices 516, 518, the second heat exchanger 520 and the third heat exchanger 522 may be similar or identical to that of the compressor 12, the first heat exchanger 14, the first and second expansion devices 16, 18, the second heat exchanger 20 and the third heat exchanger 22,
30 respectively, described above, and therefore, will not be described again in detail.

[0106] The climate-control system 510 may also include a conduit 554 extending between a first fluid passageway 556 and a second fluid passageway 558. The first fluid passageway 556 may include the first expansion device 516 and the third heat exchanger

522, and the second fluid passageway 558 may include the second expansion device 518.

[0107] A valve 562 (e.g., a pressure-relief valve) may be disposed along the conduit 554 and may vent high pressure working fluid generated in an intermediate compression pocket (not shown) of the compression mechanism (not shown) of the compressor 512 to a suction chamber (not shown) of the compressor 512. That is, if fluid pressures in the compression pockets due to the compressor 512 experiencing a flooded start condition exceeds a predetermined threshold value, the valve 562 will open and the high pressure working fluid may flow through a second inlet 564 (i.e., a fluid-injection fitting assembly), through the conduit 554 and into the suction chamber (via a suction line 566 and first inlet 568 (i.e., suction inlet gas fitting)). It should be understood that during normal operation of the system 510, fluid pressures are below the predetermined threshold value, and thus, the valve 562 is in the closed position.

[0108] With reference to Figures 15-16, another compression mechanism 630 and fluid-injection fitting assembly 636 is provided. The compression mechanism 630 may be incorporated into the compressor 12 instead of the compression mechanisms 30, 430 described above. The structure and function of the compression mechanism 630 may be similar or identical to that of the compression mechanisms 30, 430 described above, apart from any exception noted below.

[0109] The compression mechanism 630 may generally include an orbiting scroll or first scroll member (not shown), a non-orbiting scroll or second scroll member 640 and a valve assembly 642. The structure and function of the orbiting scroll may be similar or identical to that of the orbiting scroll 62 described above, and therefore, will not be described again in detail.

[0110] The non-orbiting scroll 640 may include an endplate 644 having a spiral wrap 645 projecting downwardly from the endplate 644. The spiral wrap 645 may form a meshing engagement with the wrap (not shown) of the orbiting scroll, thereby creating compression pockets (not shown). The endplate 644 may include an injection passage 646 and a venting passage 647 formed therein. The injection passage 646 may be in fluid communication with the fluid-injection fitting assembly 636 and one or more of the compression pockets. The injection passage 646 may allow working fluid from the fluid-injection fitting assembly 636 to flow into the one or more of the compression pockets. The venting passage 647 may be in fluid communication with the compression pockets and with the suction chamber 48 (via the valve assembly 642).

[0111] The function and structure of the valve assembly 642 may be similar or identical to that of the valve assembly 442, described above, and therefore, will not be described again in detail. The valve assembly 642 may be coupled to the endplate 644 and may allow fluid communication between the compression pockets and the suction chamber 48.

[0112] The fluid-injection fitting assembly 636 may include a scroll fitting 660 and a transfer conduit 662. The scroll fitting 660 may be at least partially disposed in the shell 38 and may be attached to the non-orbiting scroll 640 via bolts 663. The scroll fitting 660 may include a passage 664 that is in fluid communication with the injection passage 646 at a first end and in fluid communication with the transfer conduit 662 at a second end. A sealing member 666 (e.g., a gasket) is disposed between the non-orbiting scroll 640 and the scroll fitting 660 to prevent leakage from or into the injection passage 646 and/or the scroll fitting 660.

[0113] The structure and function of the transfer conduit 662 may be similar or identical to the transfer conduit 116, 462 described above, and therefore, will not be described again in detail.

[0114] If fluid pressures in the compression pockets due to the compressor 12 experiencing a flooded start condition exceeds a predetermined threshold value, the high pressure working fluid may flow through the venting passage 647 and into the suction chamber 48 (via the valve assembly 642). It should be understood that during normal operation of the system, fluid pressures are below the predetermined threshold value, and thus, the valve assembly 642 is in the closed position.

[0115] With reference to Figure 17, another compression mechanism 730 is provided. The compression mechanism 730 may be incorporated into the compressor 12 instead of the compression mechanism 30, 430, 630 described above. The structure and function of the compression mechanism 730 may be similar or identical to that of the compression mechanism 30, 430, 630 described above, apart from any exception noted below.

[0116] The compression mechanism 730 may generally include a non-orbiting scroll (not shown), an orbiting scroll 762 and a valve assembly 742. The structure and function of the non-orbiting scroll may be similar or identical to that of the non-orbiting scroll 64 described above, and therefore, will not be described again in detail.

[0117] The orbiting scroll 762 may include an endplate 766 having a spiral vane or wrap 768 on the upper surface thereof and an annular flat thrust surface 770 on the

lower surface. The wrap 768 may form a meshing engagement with the wrap (not shown) of the non-orbiting scroll, thereby creating compression pockets. The endplate 766 may include a venting passage 779 that may be in fluid communication with the compression pockets and with the suction chamber 48 (via the valve assembly 742). The venting
5 passage 779 may have an axial extending portion 780 and a radial extending portion 782. The thrust surface 770 may interface with the annular flat thrust bearing surface 72 on the main bearing housing 28. A cylindrical hub 774 may project downwardly from the thrust surface 770 and may have a drive bushing (not shown) rotatably disposed therein.

[0118] The function and structure of the valve assembly 742 may be similar or
10 identical to that of the valve assembly 442, 642 described above, and therefore, will not be described again in detail. The valve assembly 742 may be coupled to the endplate 766 and may allow fluid communication between the compression pockets and the suction chamber 48.

[0119] If fluid pressures in the compression pockets due to the compressor 12
15 experiencing a flooded start condition exceed a predetermined threshold value, the high pressure working fluid may flow through the venting passage 779 and into the suction chamber 48 (via the valve assembly 742). It should be understood that during normal operation of the system, fluid pressures are below the predetermined threshold value, and thus, the valve assembly 742 is in the closed position.

[0120] The foregoing description of the embodiments has been provided for
20 purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same
25 may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

CLAIMS

What is claimed is:

1. A compressor comprising:

a shell defining a suction chamber;

5 a first scroll member disposed within the shell and including a first end plate having a first spiral wrap extending therefrom;

a second scroll member disposed within the shell and including a second end plate having a second spiral wrap extending therefrom and an injection passage formed in the second end plate, the second spiral wrap meshingly engaged with the first spiral wrap to form compression pockets, the injection passage being in fluid communication with a radially intermediate one of the compression pockets;

10 a fluid-injection fitting assembly at least partially disposed within the shell and in fluid communication with the injection passage, the fluid-injection fitting assembly configured to provide working fluid to the radially intermediate one of the compression pockets; and

15 a valve assembly coupled to one of the second scroll member and the fluid-injection fitting assembly and movable between a closed position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is prevented and an open position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is allowed, wherein the valve assembly is movable from the closed position to the open position when a fluid pressure within the radially intermediate one of the compression pockets exceeds a predetermined threshold value.

20 2. The compressor of Claim 1, wherein the fluid-injection fitting assembly includes a scroll fitting and a transfer conduit attached to the scroll fitting, and wherein the valve assembly is coupled to the scroll fitting of the fluid-injection fitting assembly.

30 3. The compressor of Claim 2, wherein the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position, and wherein the valve body is movable relative to the valve housing from the closed position to the open position when fluid pressure in the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

4. The compressor of Claim 3, wherein high pressure working fluid in the radially intermediate one of the compression pockets flows to a passage formed in the scroll fitting and out an aperture formed in the valve housing into the suction chamber when the valve body is movable from the closed position to the open position.

5 5. The compressor of Claim 3, wherein the predetermined threshold value is greater than or equal to 500psi.

6. The compressor of Claim 1, wherein the valve assembly is coupled to the second end plate of the second scroll member.

10 7. The compressor of Claim 6, wherein the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position, and wherein the valve body is movable relative to the valve housing from the closed position to the open position when fluid pressure within the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

15 8. The compressor of Claim 7, wherein working fluid in the radially intermediate one of the compression pockets flows to the injection passage and out an aperture formed in an end cap of the valve assembly into the suction chamber when the valve body is movable from the closed position to the open position.

9. The compressor of Claim 8, wherein the predetermined threshold value is greater than or equal to 500psi.

20 10. The compressor of Claim 6, wherein a passage is formed in the second end plate of the second scroll member and is in fluid communication with the radially intermediate one of the compression pockets.

25 11. The compressor of Claim 10, wherein the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position, and wherein the valve body is movable relative to the valve housing from the closed position to the open position when fluid pressure within the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

12. The compressor of Claim 11, wherein working fluid in the compression pockets flows to the passage and out an aperture formed in an end cap of the valve

assembly into the suction chamber when the valve body is movable from the closed position to the open position.

13. The compressor of Claim 1, wherein the injection passage and the fluid-injection fitting assembly cooperate to define a fluid circuit, and wherein fluid communication between the radially intermediate one of the compression pockets and the suction chamber via the fluid circuit is allowed when the valve assembly is in the open position.

14. A compressor comprising:

a shell defining a suction chamber;

a first scroll member disposed within the shell and including a first end plate having a first spiral wrap extending therefrom;

a second scroll member disposed within the shell and including a second end plate having a second spiral wrap extending therefrom and an injection passage formed in the second end plate, the second spiral wrap meshingly engaged with the first spiral wrap to form compression pockets, the injection passage being in fluid communication with a radially intermediate one of the compression pockets;

a fluid-injection fitting assembly at least partially disposed within the shell and in fluid communication with the injection passage, the fluid-injection fitting assembly configured to provide working fluid to the radially intermediate one of the compression pockets; and

a valve assembly coupled to the fluid-injection fitting assembly and movable between a closed position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is prevented and an open position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber is allowed, wherein the valve assembly is movable from the closed position to the open position when a pressure difference of working fluid within the radially intermediate one of the compression pockets and working fluid in the suction chamber exceeds a predetermined threshold value.

15. The compressor of Claim 14, wherein the fluid-injection fitting assembly includes a scroll fitting and a transfer conduit attached to the scroll fitting, and wherein the valve assembly is coupled to the scroll fitting of the fluid-injection fitting assembly.

16. The compressor of Claim 15, wherein the valve assembly includes a valve flap that is movable relative to the scroll fitting from the closed position to the open position when the pressure difference of working fluid in the radially intermediate one of the compression pockets and working fluid in the suction chamber exceeds the predetermined threshold value.

17. The compressor of Claim 16, wherein working fluid in the radially intermediate one of the compression pockets flows to a first passage formed in the scroll fitting and out a second passage formed in the scroll fitting into the suction chamber when the valve flap is movable from the closed position to the open position.

18. The compressor of Claim 17, wherein the second passage extends perpendicular to the first passage.

19. The compressor of Claim 14, wherein the fluid-injection fitting assembly includes a scroll fitting and a transfer conduit attached to the scroll fitting, and wherein the valve assembly is coupled to the transfer conduit.

20. The compressor of Claim 19, wherein the valve assembly includes a valve flap that is movable relative to the transfer conduit from the closed position to the open position when the pressure difference of working fluid in the radially intermediate one of the compression pockets and working fluid in the suction chamber exceeds the predetermined threshold value.

21. The compressor of Claim 20, wherein working fluid in the radially intermediate one of the compression pockets flows through a first passage formed in the scroll fitting and out an aperture formed in the transfer conduit into the suction chamber when the valve flap is movable from the closed position to the open position.

22. The compressor of Claim 14, wherein the injection passage and the fluid-injection fitting assembly cooperate to define a fluid circuit, and wherein fluid communication between the radially intermediate one of the compression pockets and the suction chamber via the fluid circuit is allowed when the valve assembly is in the open position.

23. A compressor comprising:
a shell defining a suction chamber;

a first scroll member disposed within the shell and including a first end plate having a first spiral wrap extending therefrom and a venting passage formed in the first end plate;

a second scroll member disposed within the shell and including a second end plate having a second spiral wrap extending therefrom and an injection passage formed in the second end plate, the second spiral wrap meshingly engaged with the first spiral wrap to form compression pockets, the injection passage and the venting passage being in fluid communication with a radially intermediate one of the compression pockets;

a fluid-injection fitting assembly at least partially disposed within the shell and in fluid communication with the injection passage, the fluid-injection fitting assembly configured to provide working fluid to the radially intermediate one of the compression pockets; and

a valve assembly coupled to the first end plate and movable between a closed position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber via the venting passage is prevented and an open position in which fluid communication between the radially intermediate one of the compression pockets and the suction chamber via the venting passage is allowed, wherein the valve assembly is movable from the closed position to the open position when fluid pressure in the radially intermediate one of the compression pockets exceeds a predetermined threshold value.

24. The compressor of Claim 23, wherein the valve assembly includes a valve housing, a valve body, and a spring that biases the valve body toward the closed position, and wherein the valve body is movable relative to the valve housing from the closed position to the open position when fluid pressure in the radially intermediate one of the compression pockets exceeds the predetermined threshold value.

25. The compressor of Claim 24, wherein working fluid in the radially intermediate one of the compression pockets flows to the venting passage and out an aperture formed in an end cap of the valve assembly into the suction chamber when the valve body is movable from the closed position to the open position.

26. The compressor of Claim 25, wherein the predetermined threshold value is greater than or equal to 500psi.

27. A climate-control system comprising:

a compressor defining a suction chamber and including a first inlet, a second inlet and a compression mechanism forming a compression pocket, the first inlet in fluid communication with the suction chamber, the second inlet in fluid communication with
5 the compression pocket;

a first fluid passageway including a first heat exchanger, the first fluid passageway providing working fluid from the first heat exchanger to the first inlet;

a second fluid passageway extending between a second heat exchanger and the second inlet, the second fluid passageway providing working fluid from the second heat
10 exchanger to the second inlet;

a conduit extending from the first fluid passageway to the second fluid passageway; and

a valve disposed along the conduit and movable between a closed position in which fluid communication between the compression pocket and the suction chamber via
15 the conduit is prevented and an open position in which fluid communication between the compression pocket and the suction chamber via the conduit is allowed, wherein the valve is movable from the closed position to the open position when a fluid pressure in the compression pocket exceeds a predetermined threshold value.

28. The climate-control system of Claim 27, wherein the predetermined
20 threshold value is greater than or equal to 500psi.

29. The climate-control system of Claim 27, wherein the conduit extends from the first fluid passageway at a location between the first inlet and the first heat exchanger to the second fluid passageway at a location between the second heat exchanger and the second inlet.

30. The climate-control system of Claim 27, wherein the first heat exchanger is
25 an evaporator and the second heat exchanger is a condenser.

31. The climate-control system of Claim 27, wherein working fluid in the compression pocket flows through the conduit, the first inlet and into the suction chamber when the valve is movable from the closed position to the open position.

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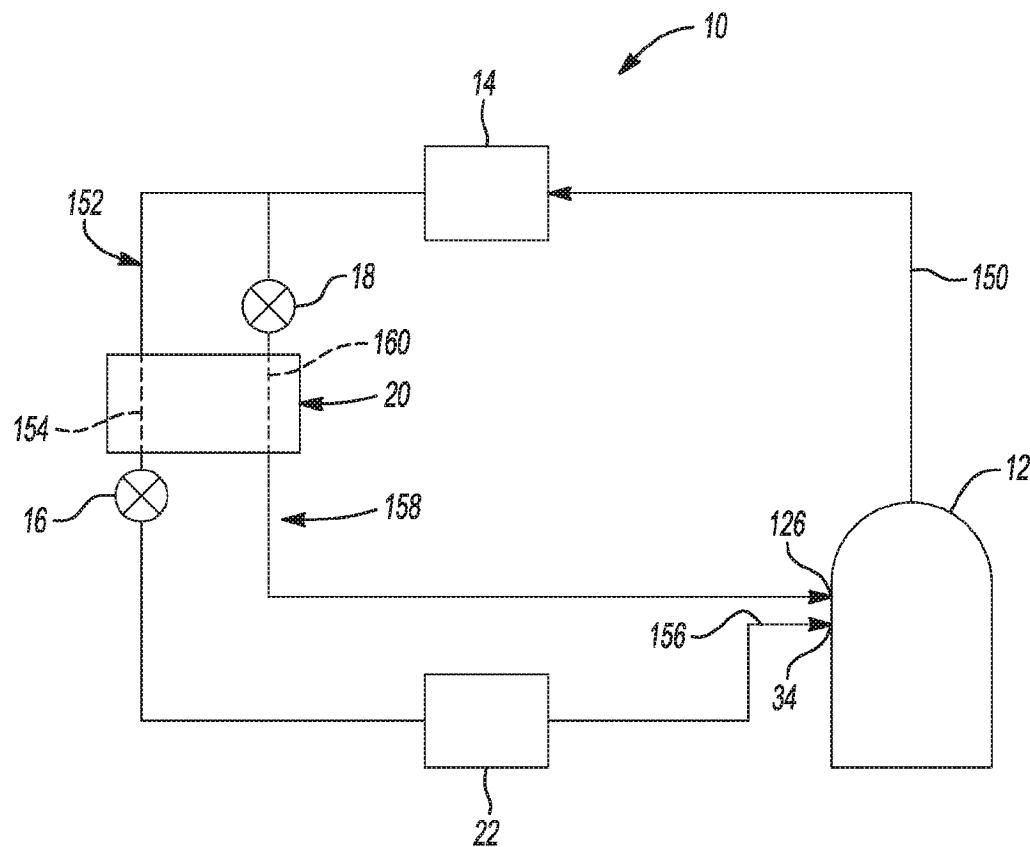
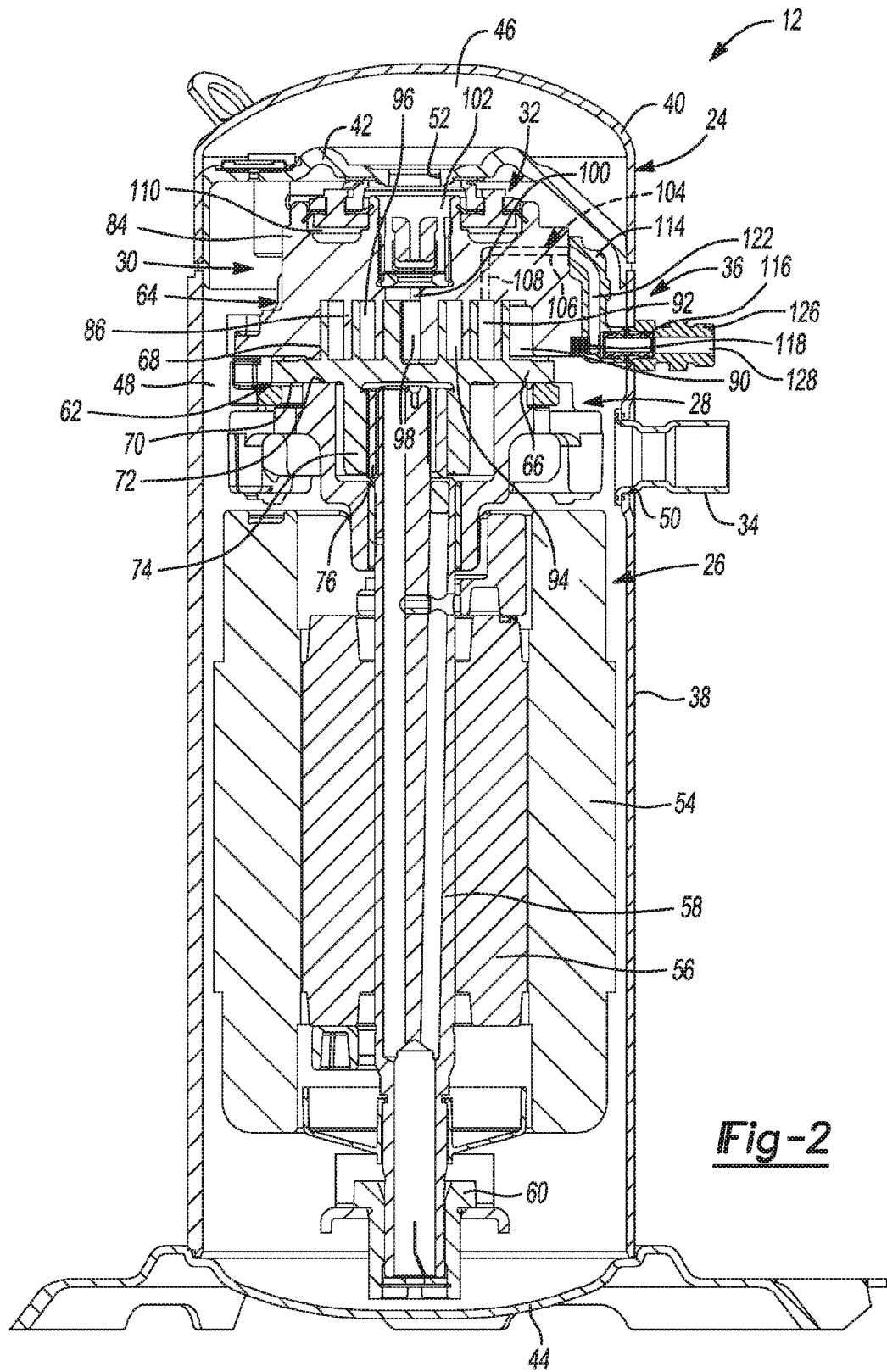


Fig-1



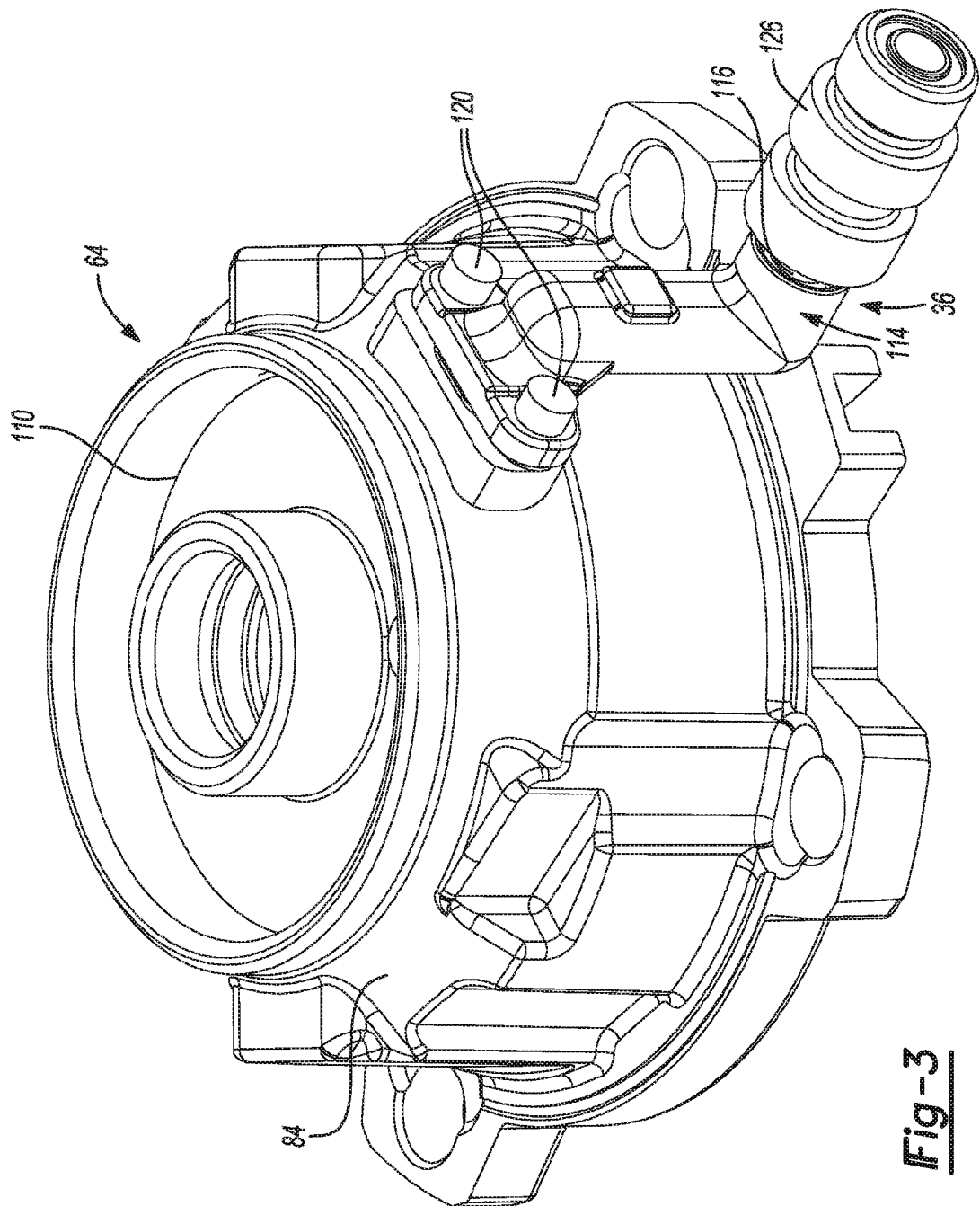
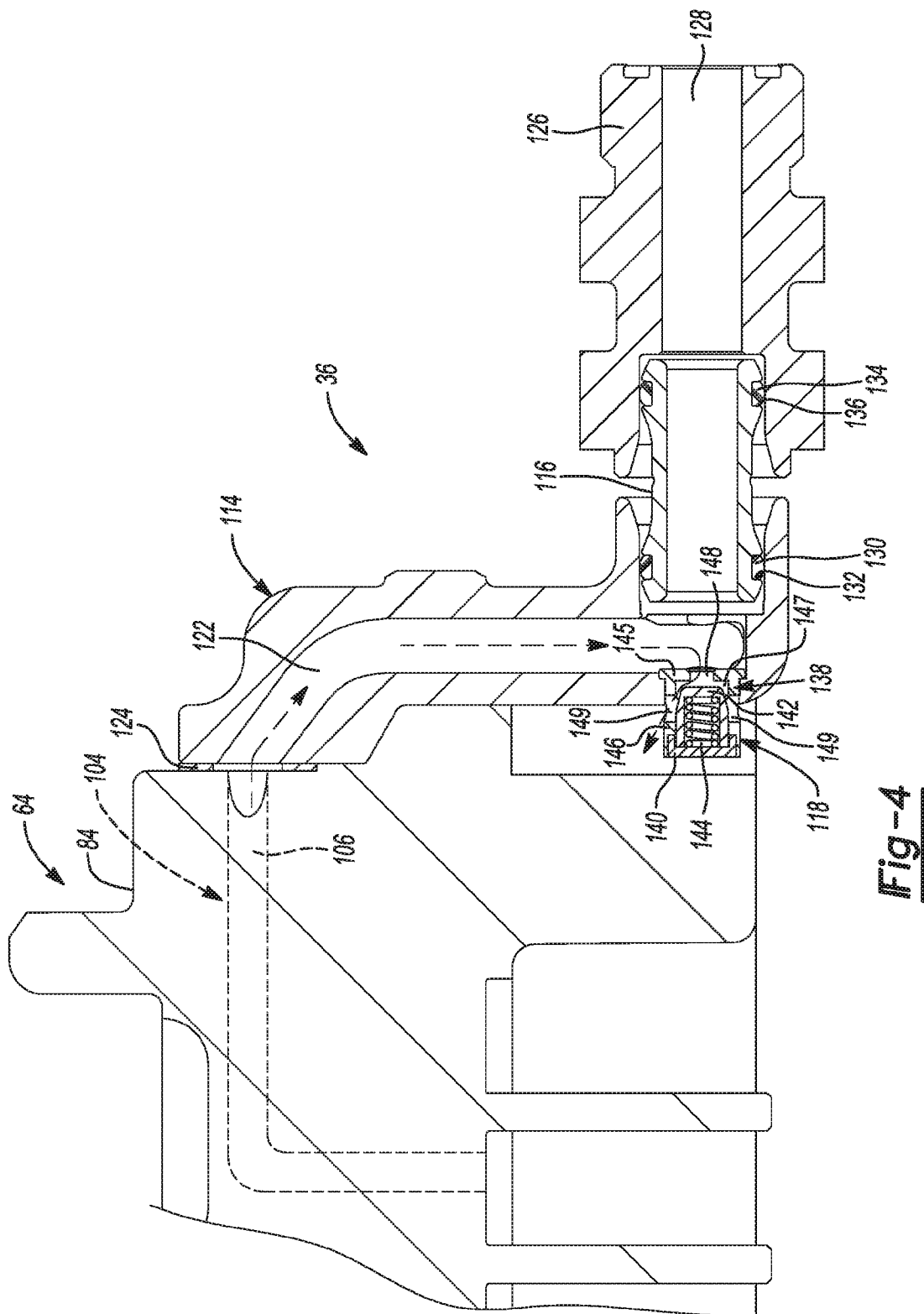


Fig-3



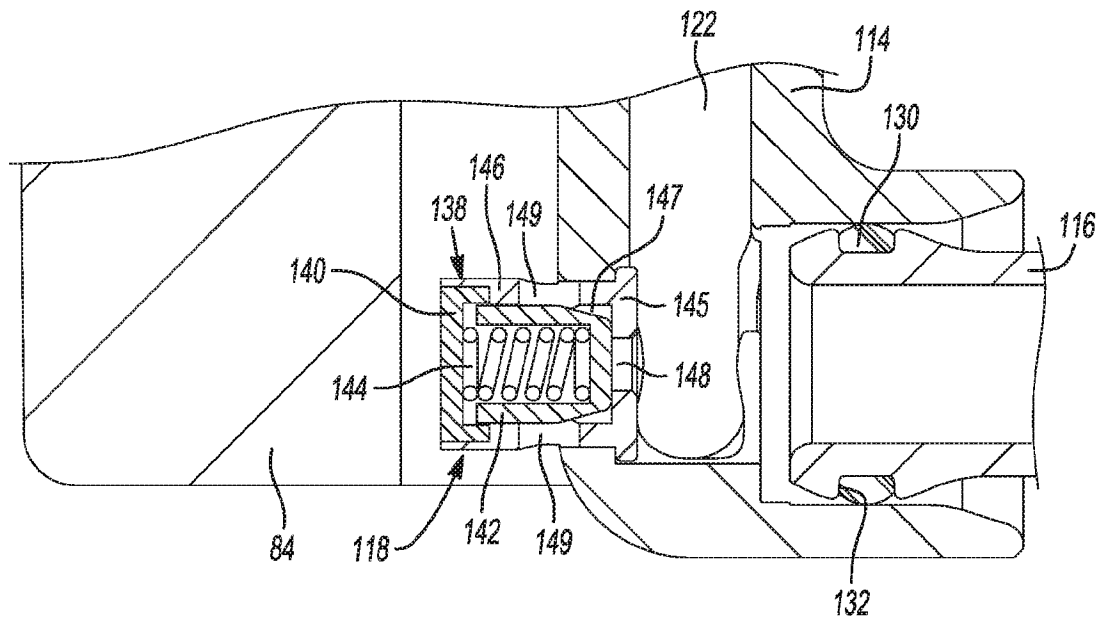


Fig-5

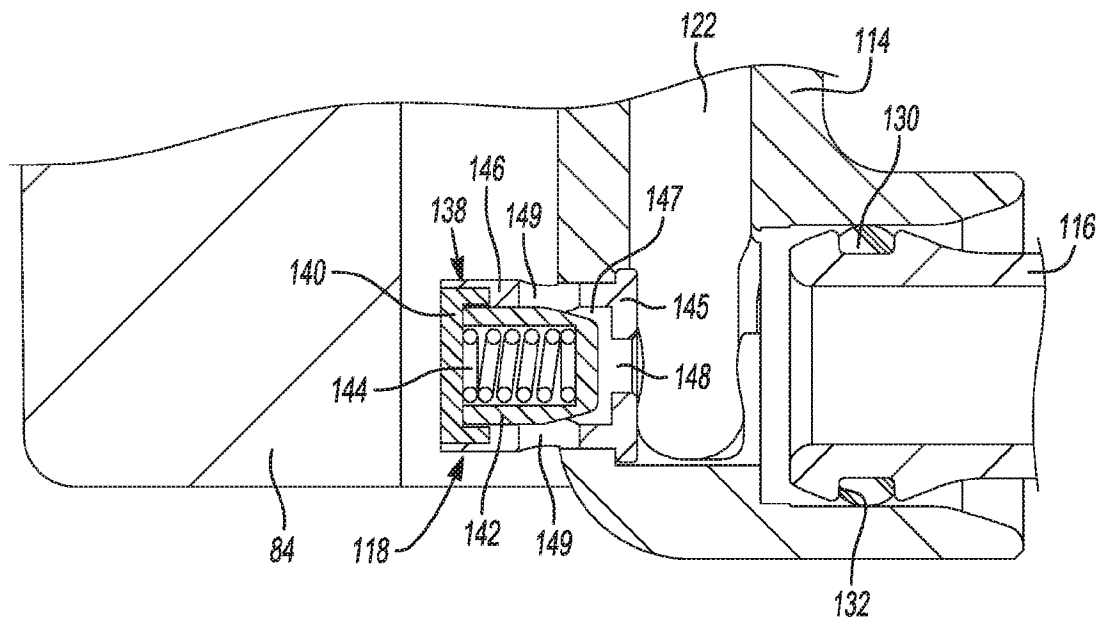


Fig-6

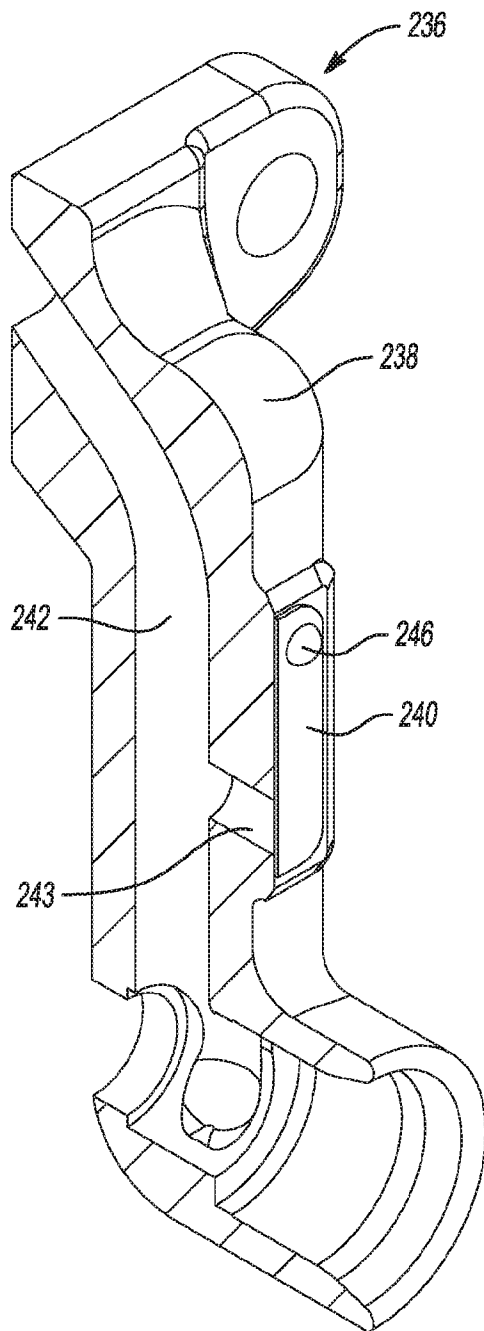


Fig-7

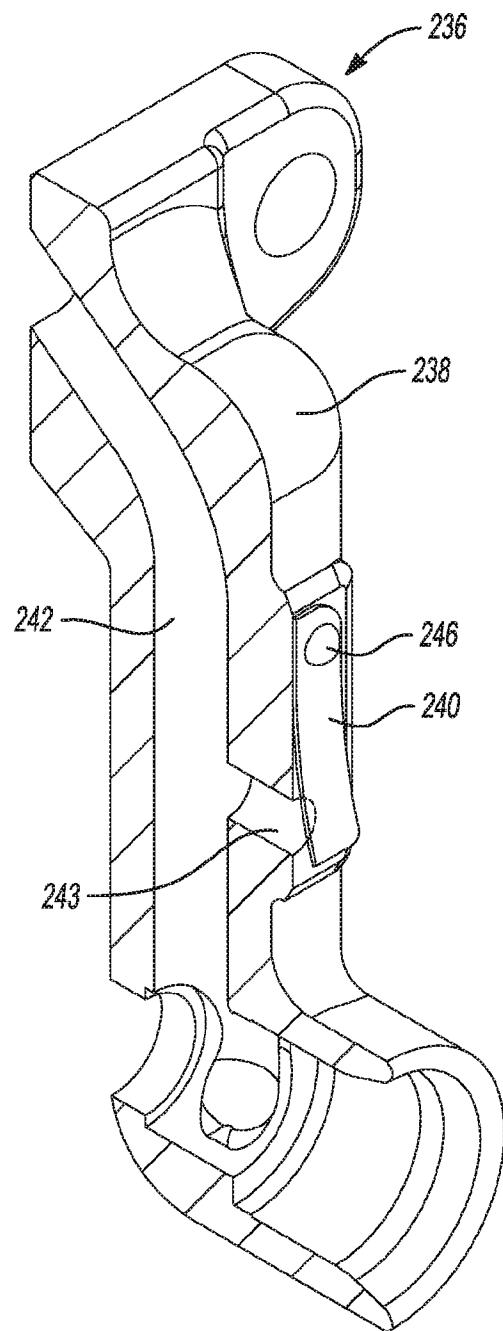
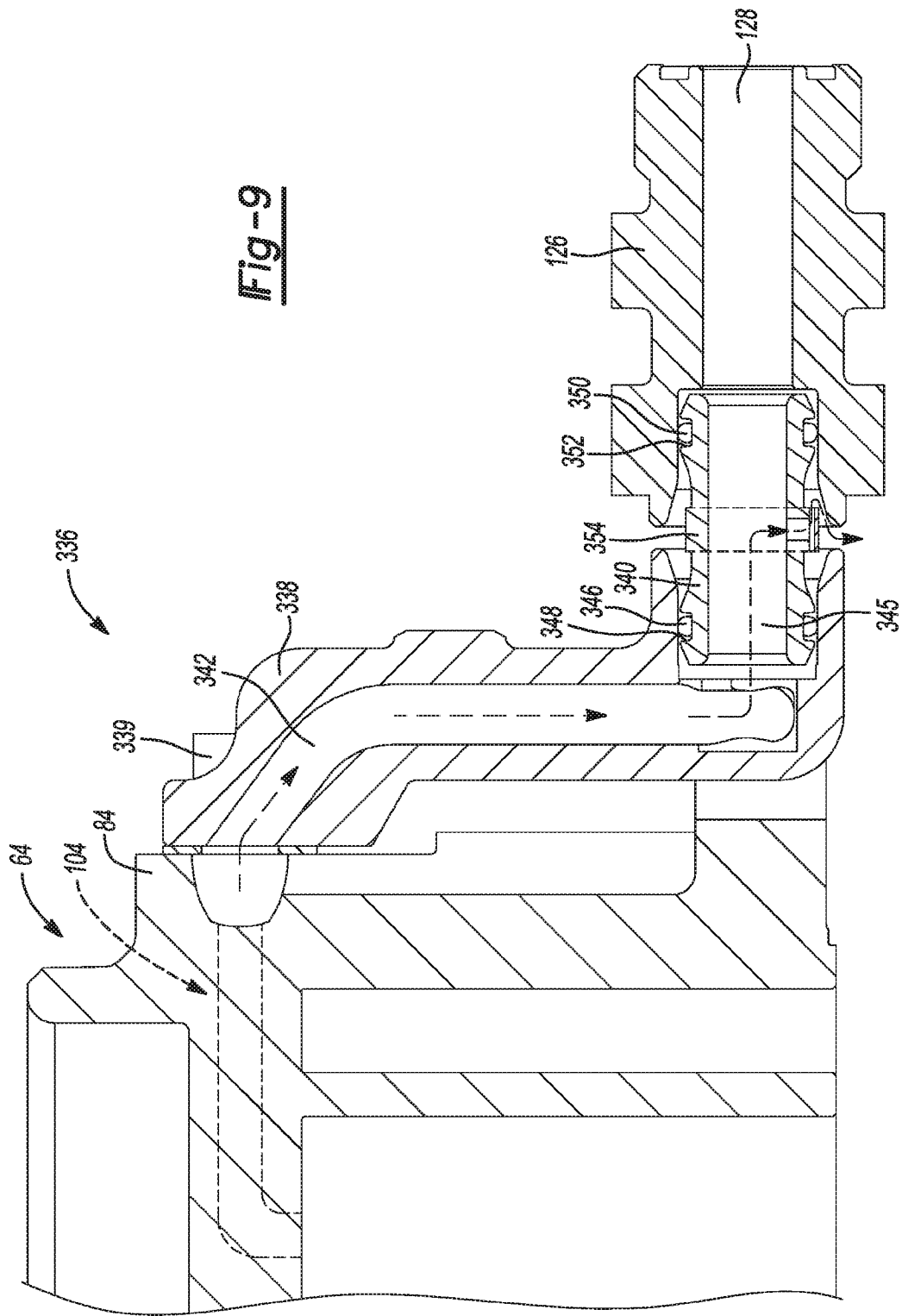
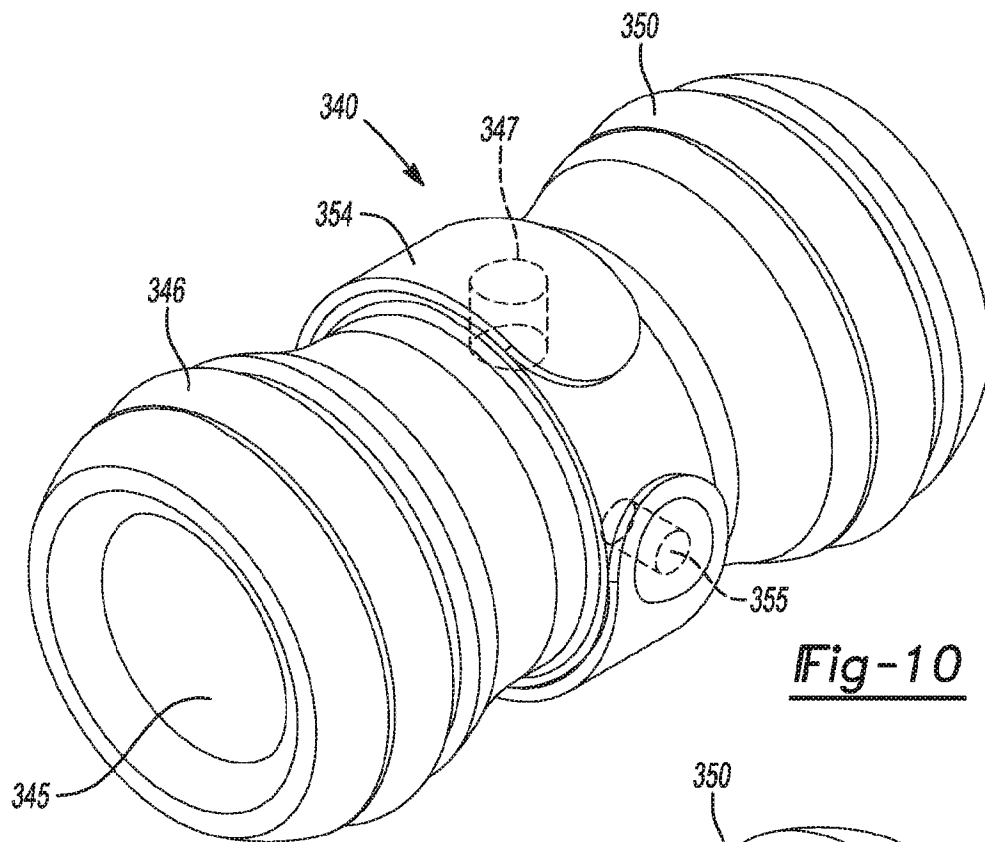
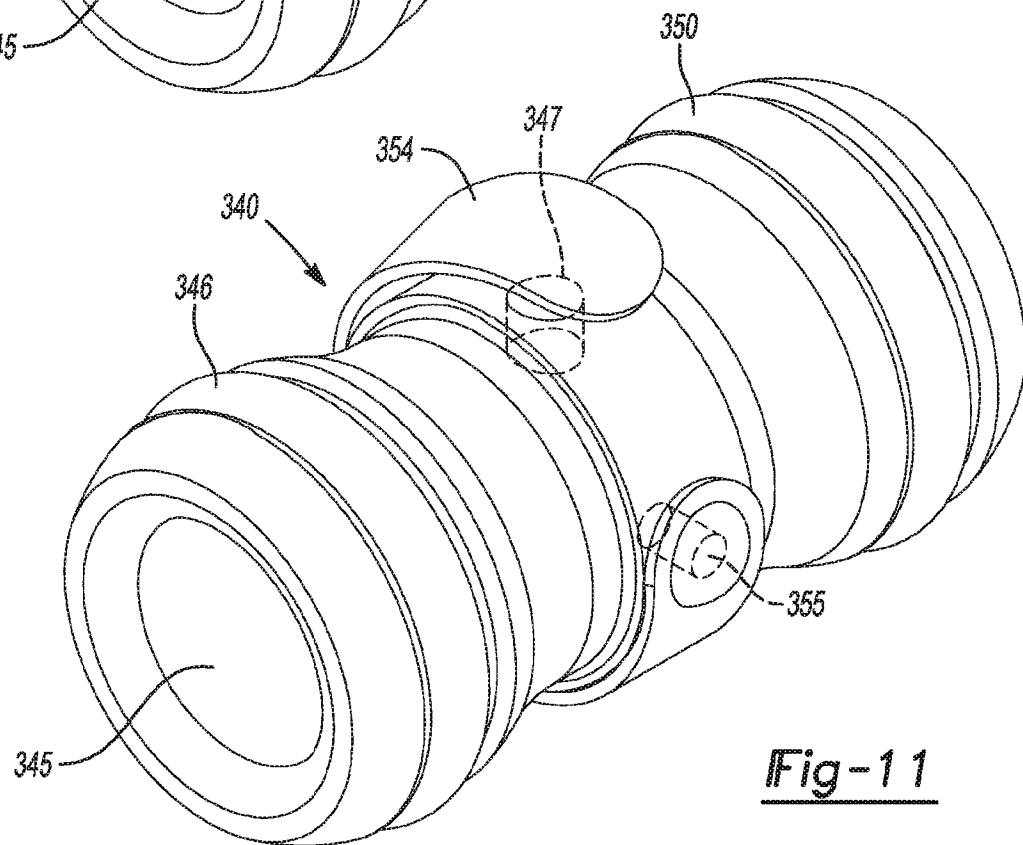
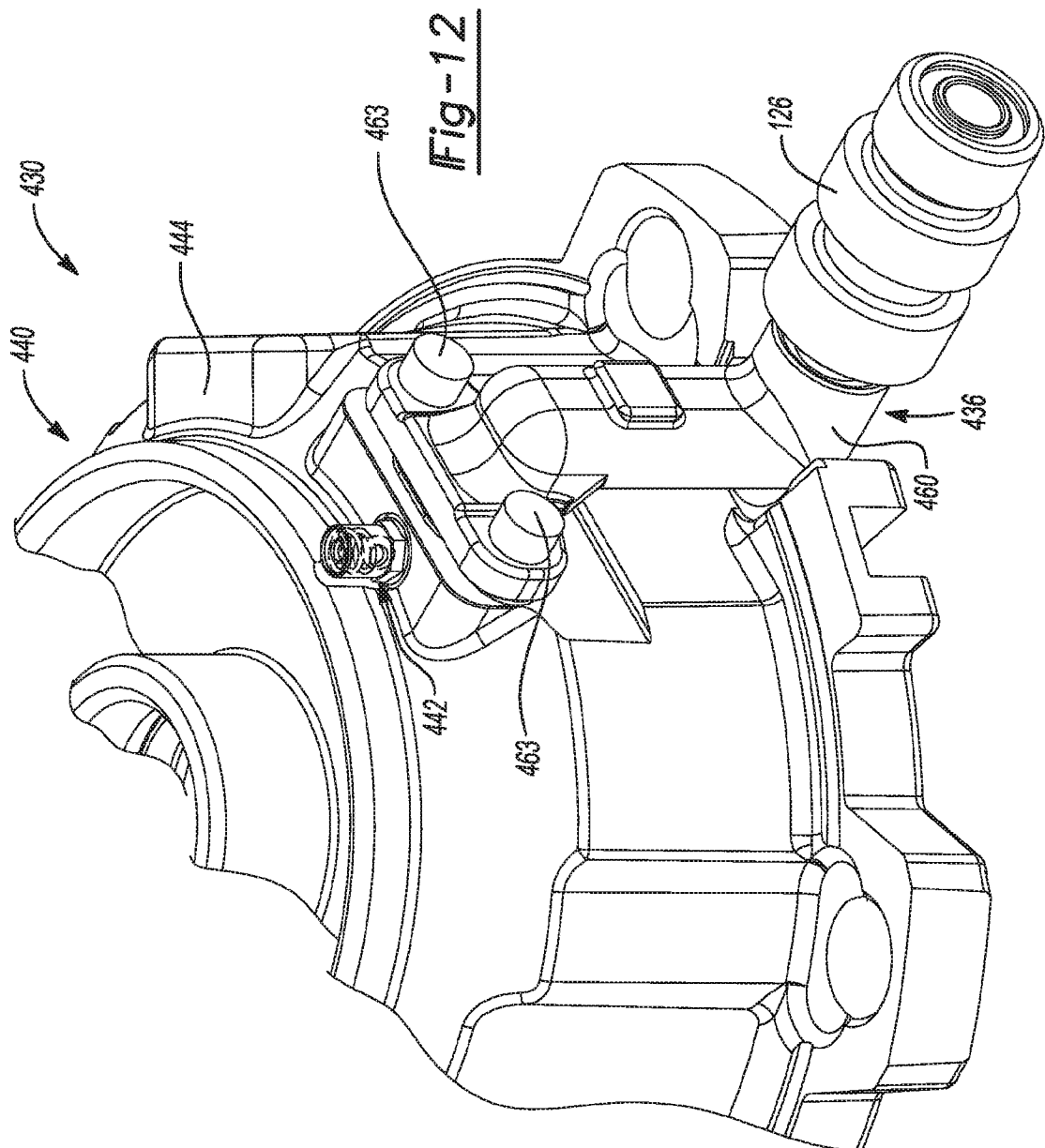
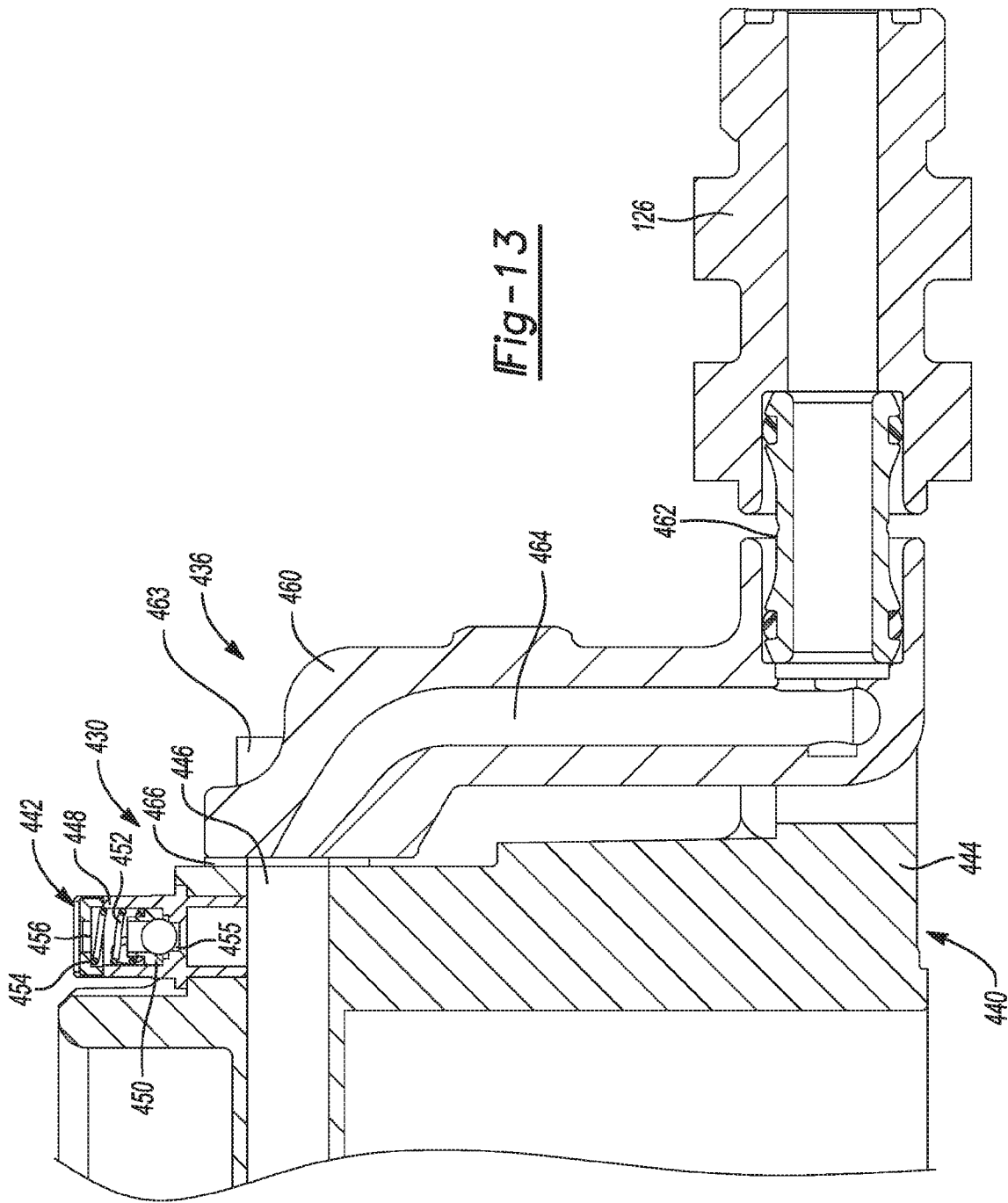


Fig-8



Fig-10Fig-11





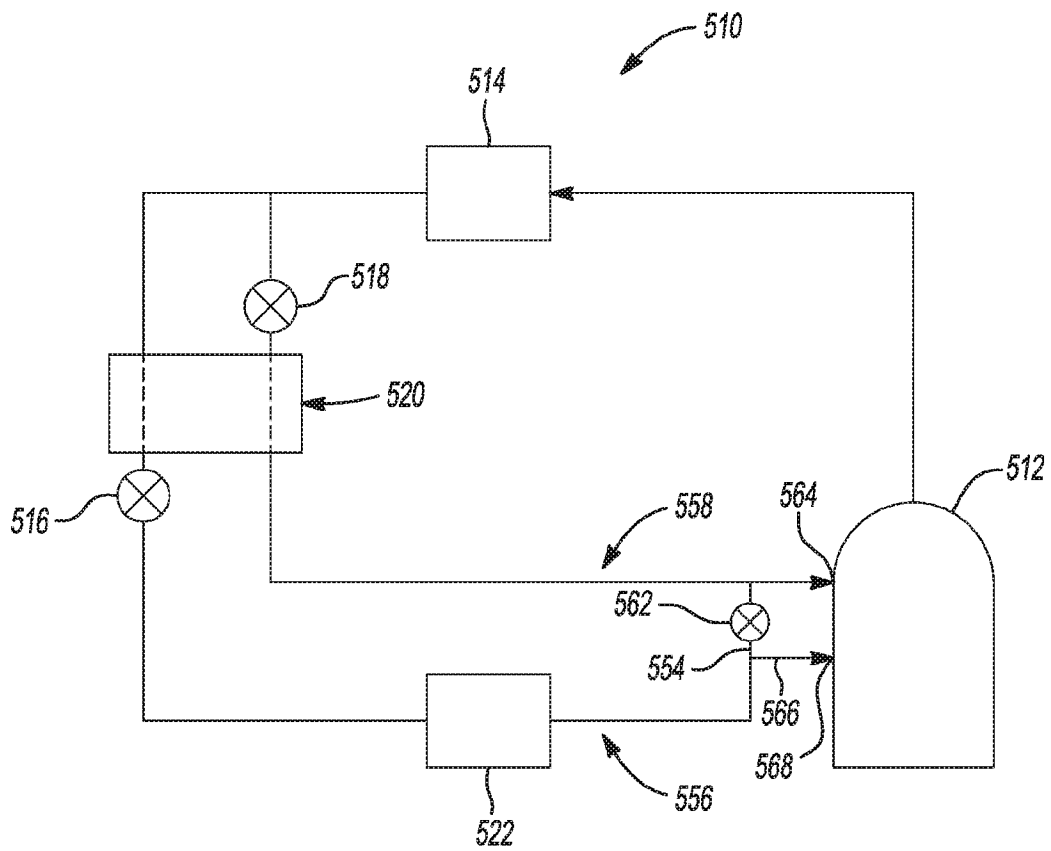


Fig-14

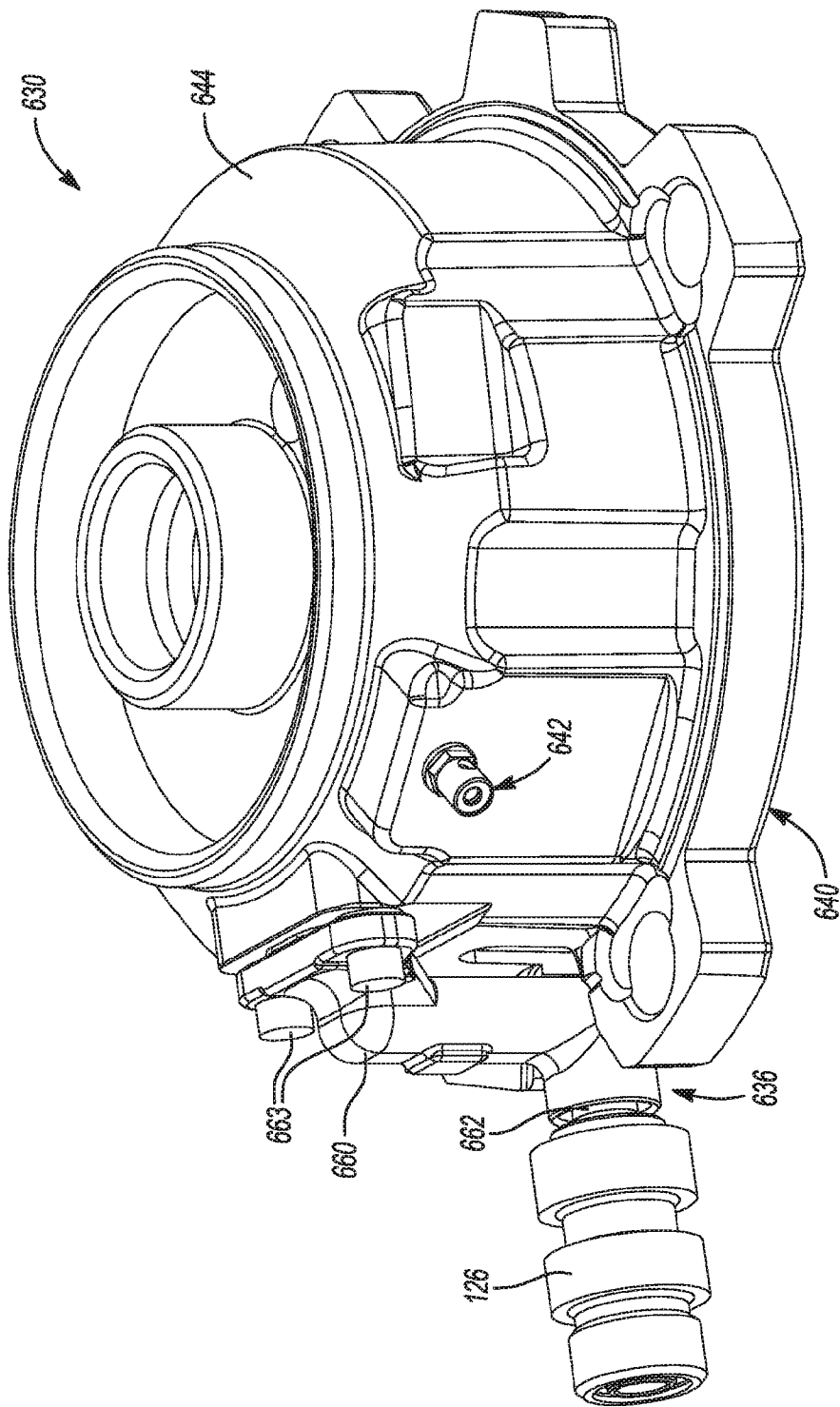


Fig-15

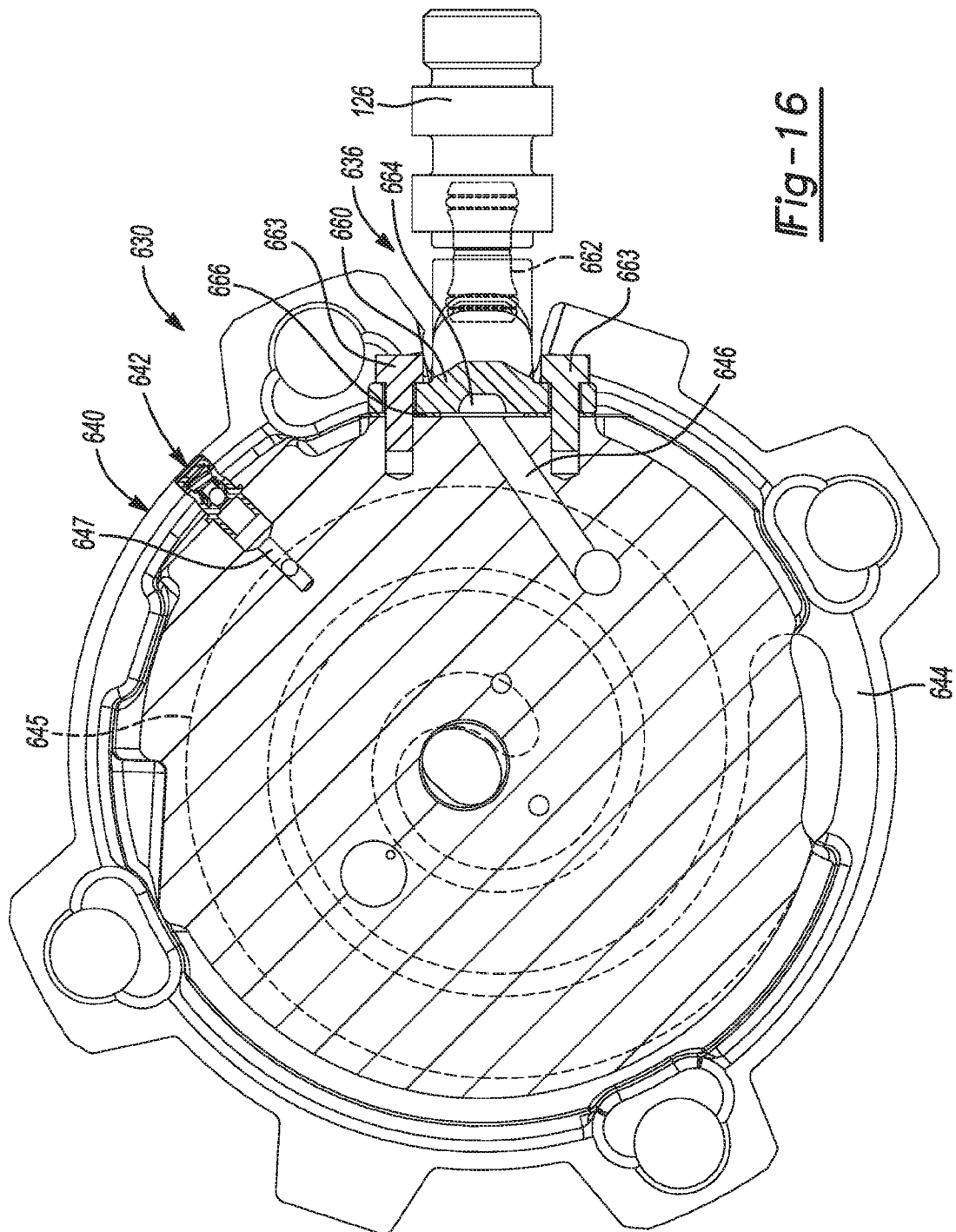
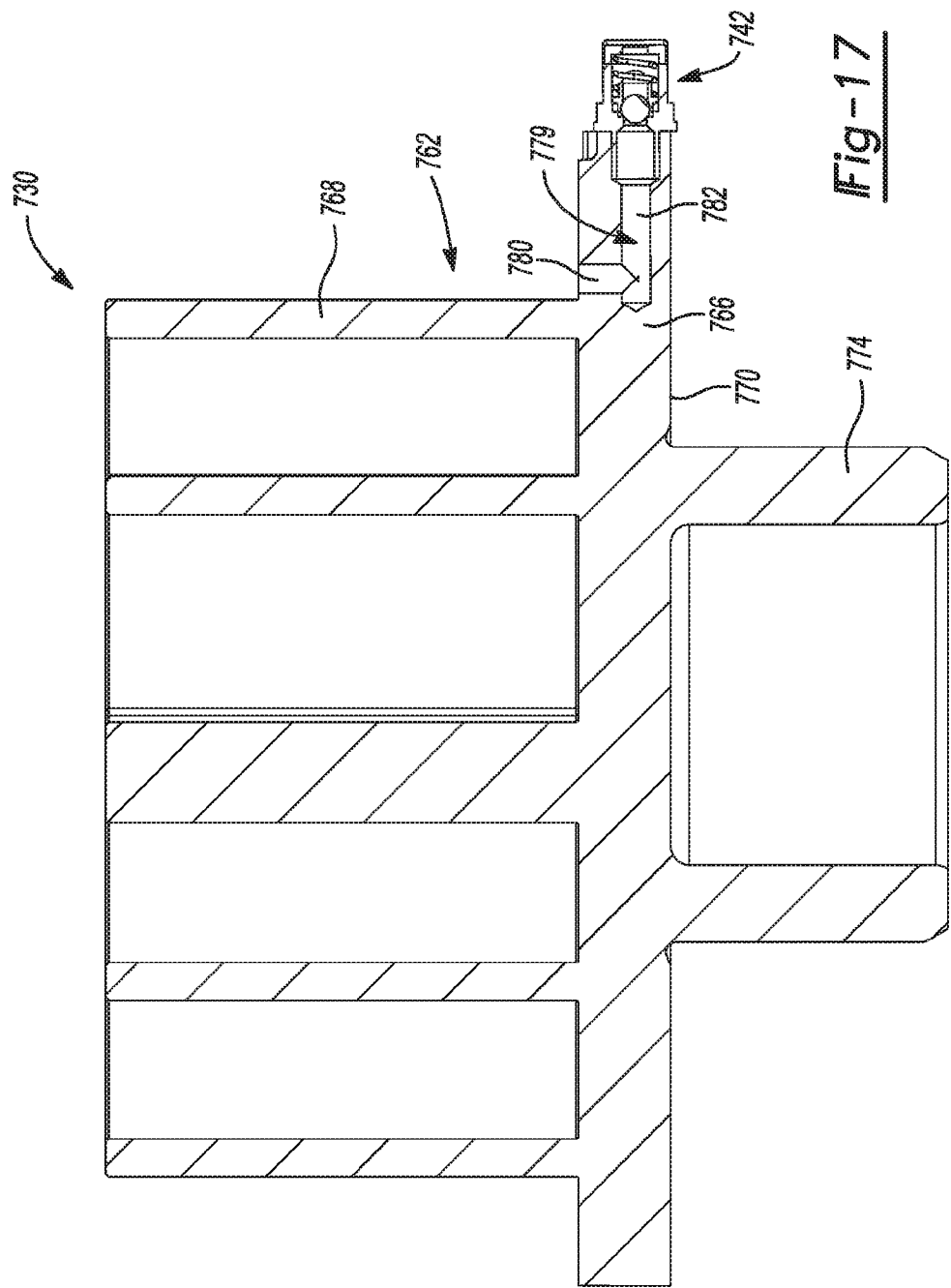


Fig-16



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2020/022030**A. CLASSIFICATION OF SUBJECT MATTER****F04C 29/12(2006.01)i, F04C 18/02(2006.01)i, F25B 31/02(2006.01)i, F25B 1/047(2006.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F04C 29/12; F01C 1/02; F01C 1/04; F04B 49/02; F04B 49/20; F04C 18/02; F25B 1/00; F25B 45/00; F25B 31/02; F25B 1/047

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: compressor, scroll member, fluid-injection fitting assembly, valve assembly, injection passage, venting passage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012-0107163 A1 (MONNIER et al.) 03 May 2012 paragraphs [0028]–[0034], [0049]–[0052] and figures 2, 6	1–31
Y	US 2008-0286118 A1 (GU et al.) 20 November 2008 paragraphs [0052], [0104] and figure 8	1–26
Y	JP 2008-267707 A (SCROLL TECHNOLOGIES) 06 November 2008 paragraph [0015] and figure 1A	2–5, 13–22
Y	US 2009-0013701 A1 (LIFSON et al.) 15 January 2009 paragraphs [0013]–[0015] and figure 1A	27–31
A	US 2011-0052437 A1 (IITSUKA et al.) 03 March 2011 paragraphs [0026]–[0046] and figures 1–2	1–31
A	US 6086335 A (BASS et al.) 11 July 2000 column 4, line 3 – column 7, line 27 and figures 1–6	1–31



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

02 July 2020 (02.07.2020)

Date of mailing of the international search report

02 July 2020 (02.07.2020)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

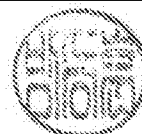
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BAHNG, Seung Hoon



Telephone No. +82-42-481-5560

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2020/022030

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012-0107163 A1	03/05/2012	BR 112013010135 A2 CN 103189654 A CN 103189654 B CN 106438352 A CN 106438352 B EP 2633196 A1 RU 2013124425 A RU 2550418 C2 US 8932036 B2 WO 2012-058455 A1	06/09/2016 03/07/2013 28/09/2016 22/02/2017 14/06/2019 04/09/2013 10/12/2014 10/05/2015 13/01/2015 03/05/2012
US 2008-0286118 A1	20/11/2008	CN 101755126 A CN 101755126 B EP 2150701 A1 EP 2150701 A4 EP 2150701 B1 US 8485789 B2 WO 2008-144037 A1	23/06/2010 20/11/2013 10/02/2010 11/03/2015 10/07/2019 16/07/2013 27/11/2008
JP 2008-267707 A	06/11/2008	None	
US 2009-0013701 A1	15/01/2009	CN 101400953 A CN 101400953 B DK 1996877 T3 EP 1996877 A1 EP 1996877 A4 EP 1996877 B1 HK 1130882 A1 US 9494352 B2 WO 2007-106116 A1	01/04/2009 09/05/2012 13/10/2014 03/12/2008 09/05/2012 27/08/2014 08/02/2013 15/11/2016 20/09/2007
US 2011-0052437 A1	03/03/2011	CN 102003389 A EP 2295804 A2 JP 2011-047368 A US 8475148 B2	06/04/2011 16/03/2011 10/03/2011 02/07/2013
US 6086335 A	11/07/2000	AU 1748946 B2 AU 9308798 A1 CN 100344923 C CN 100453814 C CN 100460683 C CN 1137614 A CN 1139727 C CN 1238674 C CN 1272171 A CN 1308633 C CN 1506584 A CN 1506584 C CN 1517553 A	13/06/2002 23/04/1999 24/10/2007 21/01/2009 11/02/2009 10/12/1996 25/02/2004 25/01/2006 01/11/2000 04/04/2007 23/06/2004 18/10/2006 04/08/2004

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2020/022030

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		CN 1517553 C	04/08/2004
		CN 1607478 A	20/04/2005
		CN 1607478 B	05/05/2010
		CN 1664372 A	07/09/2005
		CN 1664372 C	07/09/2005
		CN 1664373 A	07/09/2005
		CN 1664373 C	07/09/2005
		CN 1664473 A	07/09/2005
		CN 1664474 A	07/09/2005
		CN 1664474 C	12/11/2008
		CN 1664475 A	07/09/2005
		CN 1664476 A	07/09/2005
		CN 1664476 C	12/11/2008
		CN 1900526 A	24/01/2007
		CN 1900526 B	02/01/2013
		CN 1908437 A	07/02/2007
		CN 1908438 A	07/02/2007
		CN 1920305 A	28/02/2007
		CN 1920305 C	28/02/2007
		CN 1952813 A	25/04/2007
		CN 1952813 B	12/05/2010
		EP 0747597 A2	11/12/1996
		EP 0747597 A3	20/01/1999
		EP 0747597 B1	08/03/2006
		EP 1025403 A1	09/08/2000
		EP 1025403 B1	18/01/2006
		EP 1489368 A2	22/12/2004
		EP 1489368 A3	01/06/2005
		EP 1489368 B1	15/02/2012
		EP 1598611 A2	23/11/2005
		EP 1598611 A3	15/07/2009
		EP 1598611 B1	21/12/2016
		EP 1598612 A2	23/11/2005
		EP 1598612 A3	15/07/2009
		EP 1598613 A2	23/11/2005
		EP 1598614 A2	23/11/2005
		EP 1598615 A2	23/11/2005
		EP 1621771 A2	01/02/2006
		EP 1621771 A3	04/04/2007
		EP 1621771 B1	21/09/2011
		EP 1621772 A2	01/02/2006
		EP 1621772 A3	04/04/2007
		EP 1621772 B1	09/03/2011
		JP 08-334094 A	17/12/1996
		JP 2001-518601 A	16/10/2001
		JP 2006-300075 A	02/11/2006
		JP 2006-300076 A	02/11/2006
		JP 2006-300077 A	02/11/2006
		JP 3959437 B2	15/08/2007
		JP 4157275 B2	01/10/2008

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2020/022030Patent document
cited in search reportPublication
datePatent family
member(s)Publication
date

JP 4486624 B2	23/06/2010
JP 4621179 B2	26/01/2011
KR 10-0303943 B1	20/06/2002
KR 10-0517684 B1	28/09/2005
KR 10-0547984 B1	01/02/2006
KR 10-1997-0001976 A	24/01/1997
KR 10-2000-0017483 A	25/03/2000
KR 10-2001-0030754 A	16/04/2001
KR 10-2003-0079877 A	10/10/2003
US 2001-0002239 A1	31/05/2001
US 2001-0045097 A1	29/11/2001
US 2001-0049942 A1	13/12/2001
US 2002-0178737 A1	05/12/2002
US 2003-0084672 A1	08/05/2003
US 2003-0089119 A1	15/05/2003
US 2003-0094004 A1	22/05/2003
US 2004-0123612 A1	01/07/2004
US 2006-0288715 A1	28/12/2006
US 2007-0022771 A1	01/02/2007
US 5741120 A	21/04/1998
US 6047557 A	11/04/2000
US 6393852 B2	28/05/2002
US 6408635 B1	25/06/2002
US 6438974 B1	27/08/2002
US 6449972 B2	17/09/2002
US 6467280 B2	22/10/2002
US 6499305 B2	31/12/2002
US 6662578 B2	16/12/2003
US 6662583 B2	16/12/2003
US 6679072 B2	20/01/2004
US 7389649 B2	24/06/2008
US 7419365 B2	02/09/2008
US 7654098 B2	02/02/2010
US RE40400 E	24/06/2008
US RE40554 E	28/10/2008
US RE42006 E	28/12/2010
US RE44636 E	10/12/2013
WO 99-17066 A1	08/04/1999