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(54) **LUBRICANT SUPPLY PASSAGE FOR COMPRESSOR**

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(71) Applicant: **Carrier Corporation**, Palm Beach Gardens, FL (US)

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(72) Inventor: **Masao Akei**, Cicero, NY (US)

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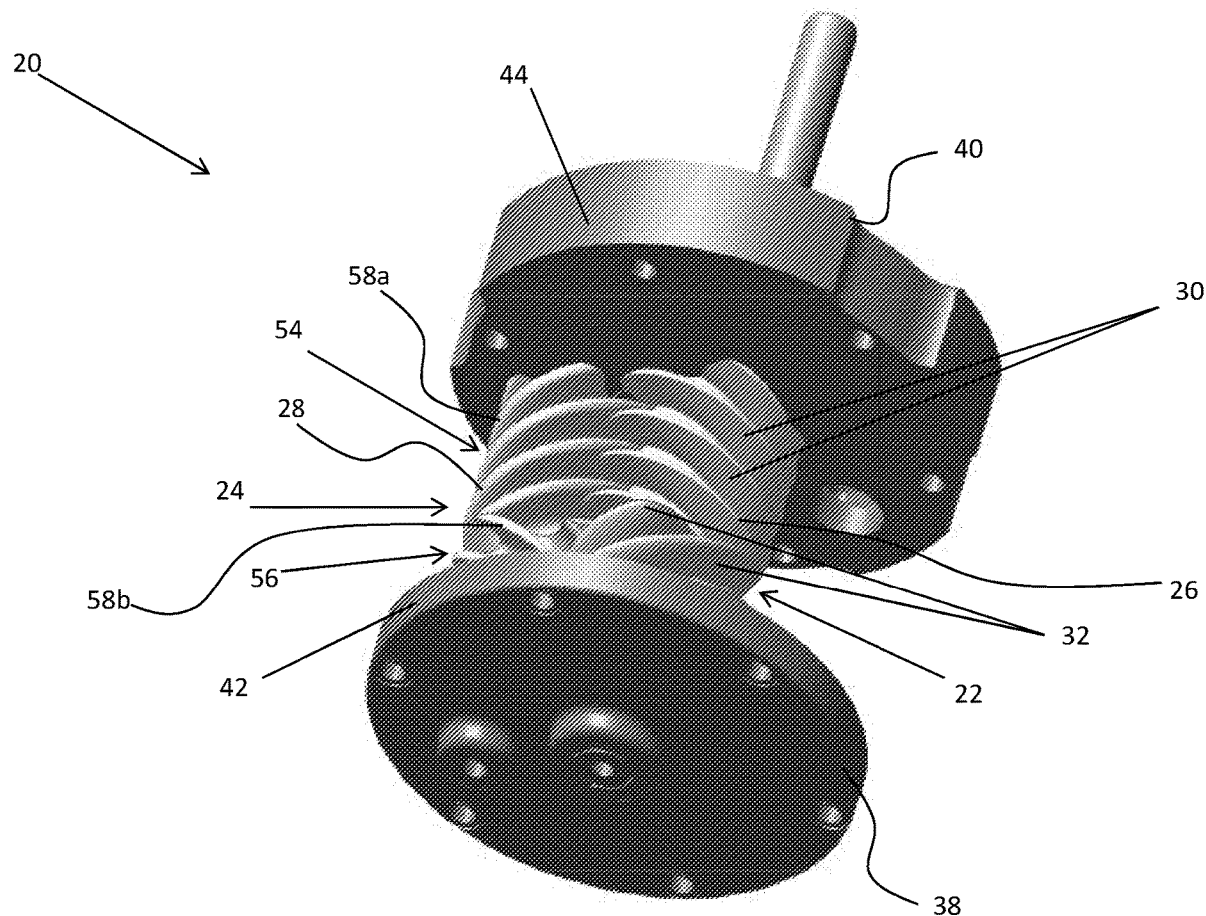
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(57) **ABSTRACT**

A fluid machine includes a first rotor rotatable about a first axis, a second rotor rotatable about a second axis, a casing for supporting said first rotor and said second rotor, a sump having a volume of lubricant contained therein, a first lubricant passage for supplying lubricant from the sump to a dynamic interface associated with the first rotor, and a second lubricant passage for supplying lubricant from the sump to a dynamic interface associated with the second rotor. A pressure differential created within the fluid machine supplies the lubricant from the sump to the first lubricant passage and the second lubricant passage.

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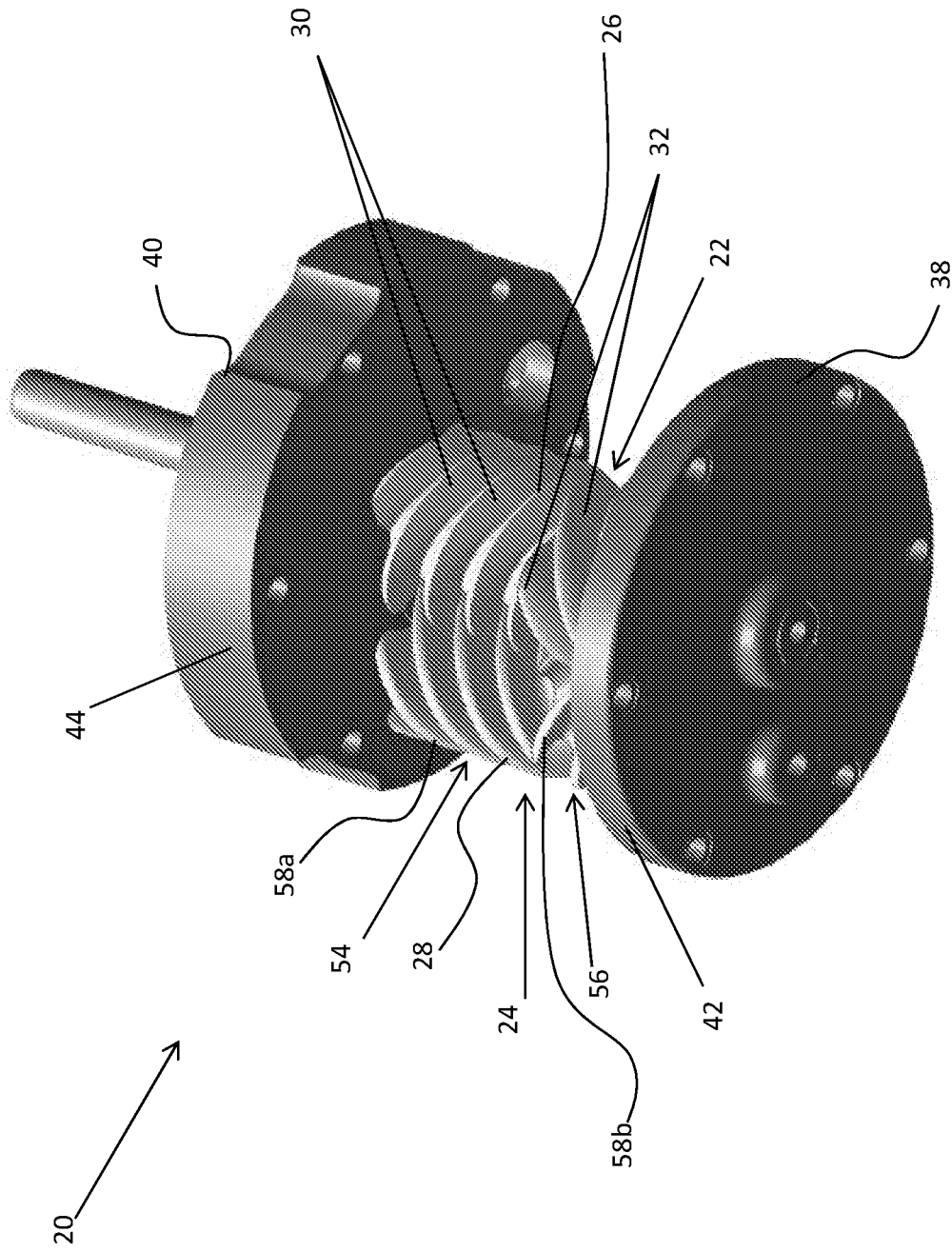


FIG. 2

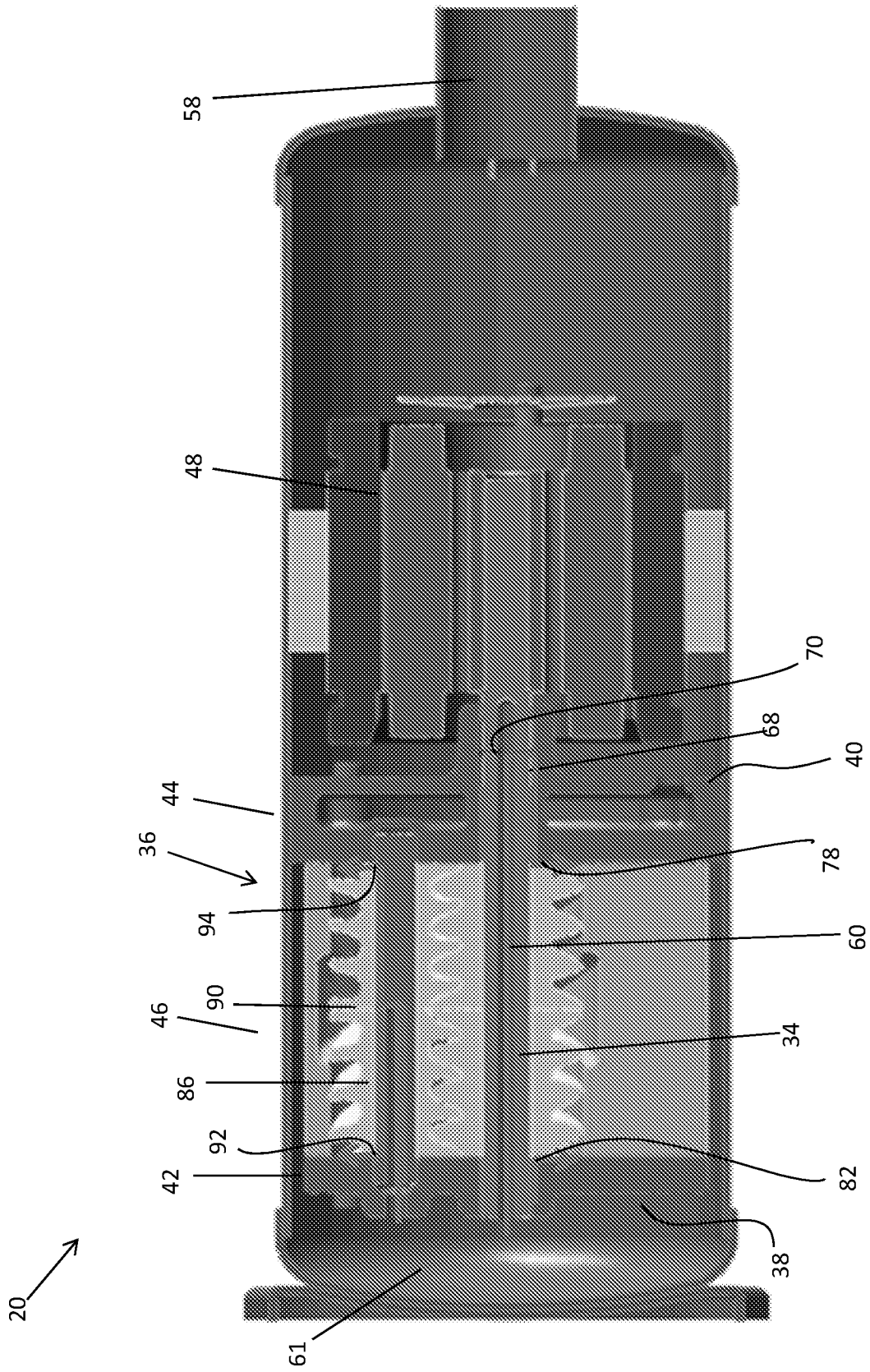


FIG. 3

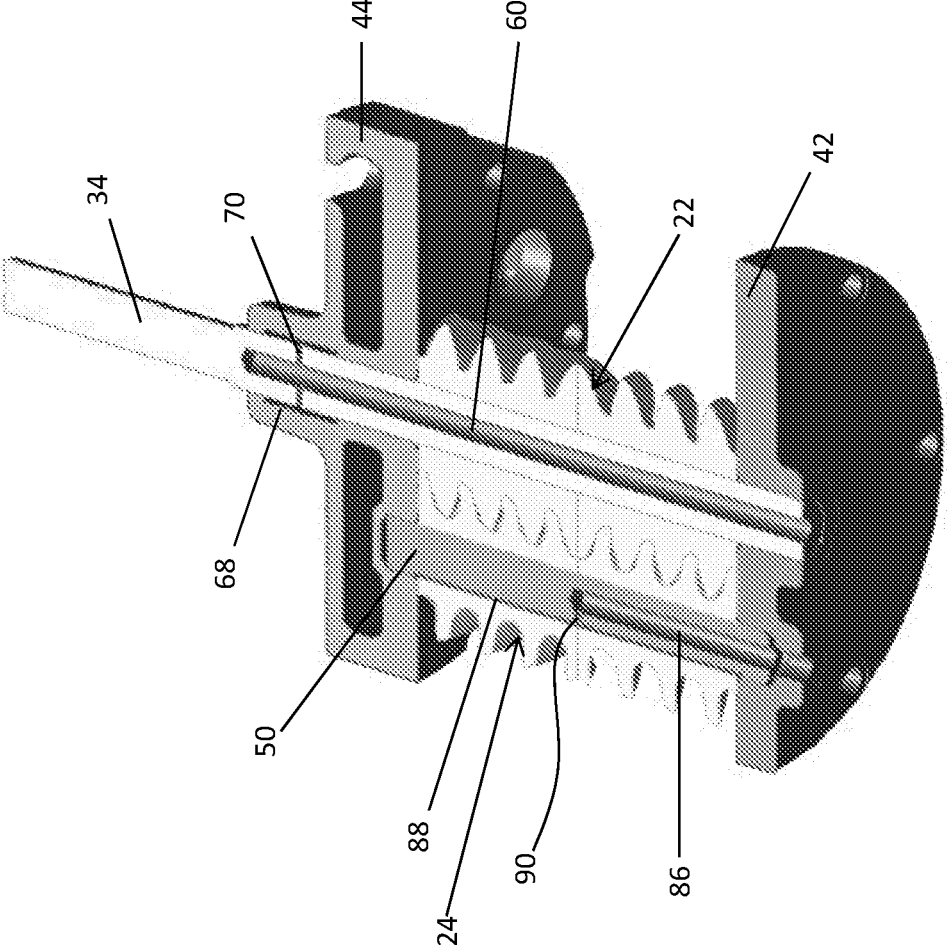


FIG. 4

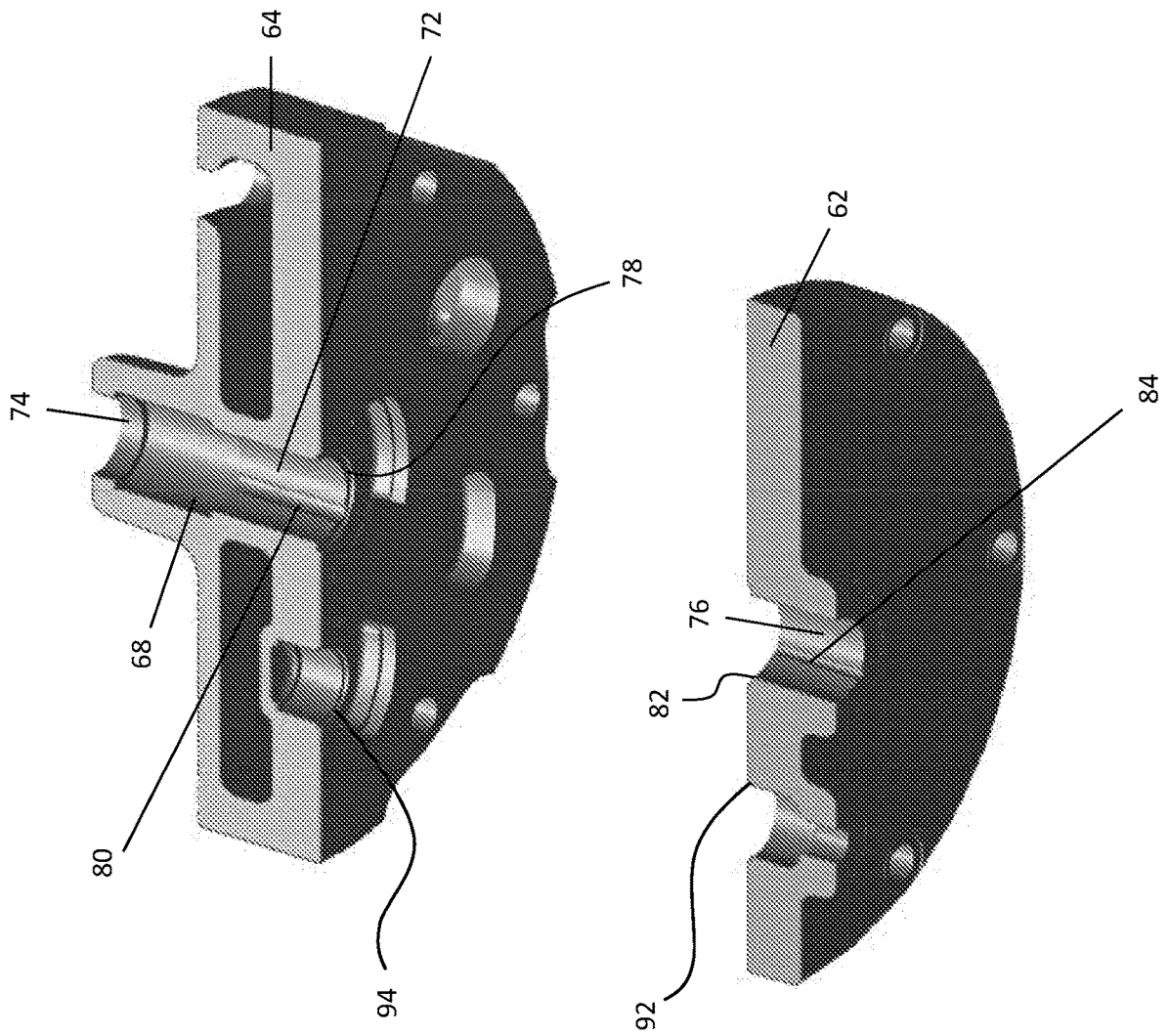


FIG. 5

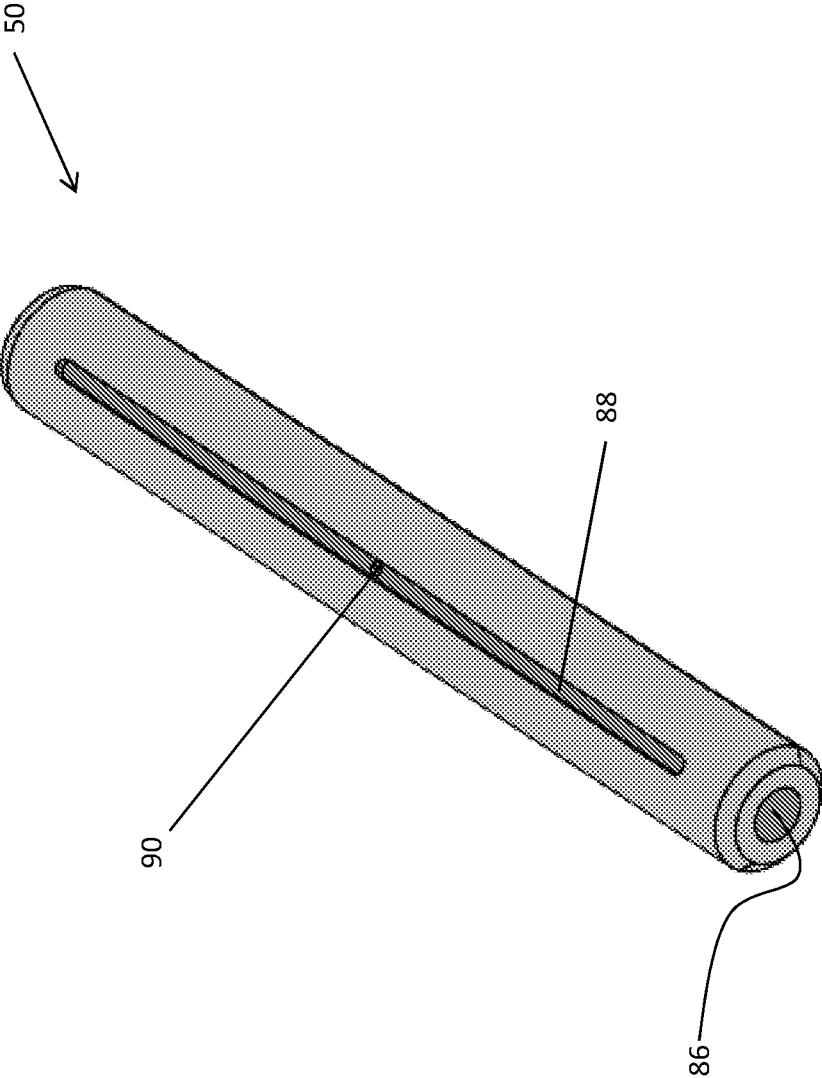


FIG. 6

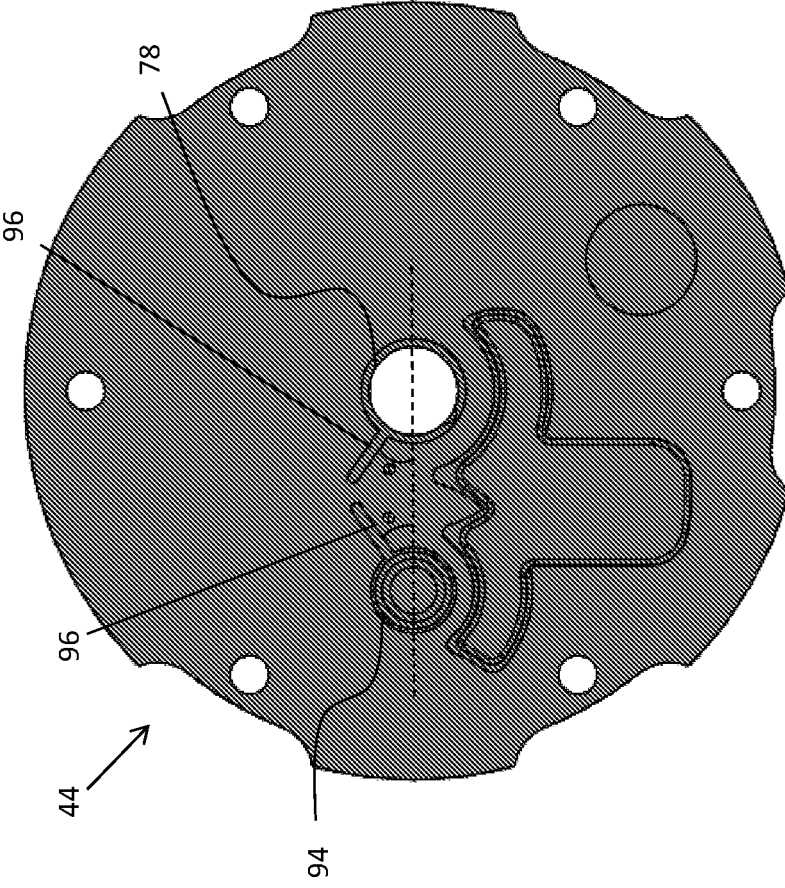


FIG. 7

LUBRICANT SUPPLY PASSAGE FOR COMPRESSOR

BACKGROUND

[0001] The subject matter disclosed herein relates generally to fluid machines, and more specifically, to fluid machines, such as compressors, having helically lobed rotors.

[0002] It has been determined that commonly used refrigerants, such as R-410A in one non-limiting example, have unacceptable global warming potential (GWP) such that their use will cease for many HVAC&R applications. Non-flammable, low GWP refrigerants are replacing existing refrigerants in many applications, but have lower density and do not possess the same cooling capacity as existing refrigerants. Replacement refrigerants require a compressor capable of providing a significantly greater displacement, such as a screw compressor.

[0003] Existing screw compressor typically utilized roller, ball, or other rolling element bearings to precisely position the rotors and minimize friction during high speed operation. However, for typical HVAC&R applications, existing screw compressors with roller element bearings result in an unacceptable large and costly fluid machine.

[0004] Therefore, there exists a need in the art for an appropriately sized and cost effective fluid machine that minimizes friction while allowing precise positioning and alignment of the rotors.

BRIEF DESCRIPTION

[0005] According to one embodiment, a fluid machine includes a first rotor rotatable about a first axis, a second rotor rotatable about a second axis, a casing for supporting said first rotor and said second rotor, a sump having a volume of lubricant contained therein, a first lubricant passage for supplying lubricant from the sump to a dynamic interface associated with the first rotor, and a second lubricant passage for supplying lubricant from the sump to a dynamic interface associated with the second rotor. A pressure differential created within the fluid machine supplies the lubricant from the sump to the first lubricant passage and the second lubricant passage.

[0006] In addition to one or more of the features described above, or as an alternative, in further embodiments during operation of the fluid machine, the pressure differential is formed between a high pressure adjacent at least one end of the casing and low pressure at a central location of the first rotor and the second rotor.

[0007] In addition to one or more of the features described above, or as an alternative, in further embodiments said lubricant is supplied from said sump to said first lubricant passage and said second lubricant passage simultaneously.

[0008] In addition to one or more of the features described above, or as an alternative, in further embodiments said first rotor is rotatably mounted to the casing without roller element bearings.

[0009] In addition to one or more of the features described above, or as an alternative, in further embodiments the first rotor includes a first shaft rotatably mounted to the casing, wherein at least one surface of the casing and the first shaft define the dynamic interface associated with the first rotor.

[0010] In addition to one or more of the features described above, or as an alternative, in further embodiments the at

least one surface of the casing arranged in direct contact with the first shaft functions as a bearing.

[0011] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one surface of the casing arranged in direct contact with the first shaft includes a first surface arranged in direct contact with a portion the first shaft adjacent a first end, and a second surface arranged in direct contact with a portion the first shaft adjacent a second end.

[0012] In addition to one or more of the features described above, or as an alternative, in further embodiments the first lubricant passage includes a first portion for supplying lubricant to the first surface and a second portion, distinct from the first portion, for supplying lubricant to the second surface, wherein lubricant is supplied to both the first portion and the second portion simultaneously.

[0013] In addition to one or more of the features described above, or as an alternative, in further embodiments the first lubricant passage further comprises: a cavity formed in a portion of the casing adjacent the first shaft, a passage extending axially through at least a portion of the first shaft, at least one radial hole coupling the cavity and the passage, and a groove extending from the cavity to an interior of a compression pocket formed between the first rotor and the second rotor and the casing.

[0014] In addition to one or more of the features described above, or as an alternative, in further embodiments the first lubricant passage further comprises: a counter bore formed at the interface between the casing and the compression pocket.

[0015] In addition to one or more of the features described above, or as an alternative, in further embodiments the first lubricant passage comprises: a groove extending from the sump to an interior of a compression pocket formed between the first rotor and the second rotor and the casing.

[0016] In addition to one or more of the features described above, or as an alternative, in further embodiments the second rotor further comprises: a second shaft supported by the casing, and a working portion rotatable relative to the second shaft. The second shaft and the working portion define the dynamic interface associated with the second rotor.

[0017] In addition to one or more of the features described above, or as an alternative, in further embodiments the second lubricant passage further comprises: a first passage extending axially through at least a portion of the second shaft, a second passage formed in an outer periphery of the second shaft, and at least one radial hole coupling the first passage and the second passage.

[0018] In addition to one or more of the features described above, or as an alternative, in further embodiments the second passage extends axially such that a first end of the second passage is fluidly coupled to a first portion of the casing and a second, opposite end of the second passage is fluidly coupled to a second portion of the casing.

[0019] In addition to one or more of the features described above, or as an alternative, in further embodiments a counter bore is formed in the casing where at least one of the first lubricant passage and the second lubricant passage enters a compression pocket formed between the first rotor and the second rotor.

[0020] In addition to one or more of the features described above, or as an alternative, in further embodiments comprising a recess is formed in the casing in fluid communi-

cation with the counter bore, the recess being arranged at an angle towards an interface between the first rotor and the second rotor.

[0021] In addition to one or more of the features described above, or as an alternative, in further embodiments at least one of an angle, length, width, and depth of the recess is optimized to control a flow of lubricant to the compression pocket.

[0022] According to another embodiment, a method of lubricating one or more dynamic interfaces of a fluid machine includes supplying lubricant from a sump to a dynamic interface associated with a first rotor of the fluid machine via a first lubricant passage, and supplying lubricant from a sump to a dynamic interface associated with a second rotor of the fluid machine via a second lubricant passage. The second lubricant passage is distinct from the first lubricant passage. Supplying lubricant to the dynamic interface associated with the first rotor and the dynamic interface associated with the second rotor occurs automatically in response to a pressure differential created within the fluid machine during operation of the fluid machine.

[0023] In addition to one or more of the features described above, or as an alternative, in further embodiments supplying lubricant from a sump to a dynamic interface associated with a first rotor and supplying lubricant from a sump to a dynamic interface associated with a second rotor occurs simultaneously.

[0024] In addition to one or more of the features described above, or as an alternative, in further embodiments supplying lubricant from a sump to a dynamic interface associated with a first rotor and supplying lubricant from a sump to a dynamic interface associated with a second rotor occurs without a pump or control valve.

[0025] In addition to one or more of the features described above, or as an alternative, in further embodiments supplying lubricant from a sump to a dynamic interface associated with a first rotor further comprises: supplying lubricant via a first passage to a first bearing surface, the first passage extending through an opening formed in a first shaft of the first rotor, and supplying lubricant via a second passage to a second bearing surface.

[0026] In addition to one or more of the features described above, or as an alternative, in further embodiments comprising supplying lubricant from the dynamic interface associated with a first rotor and the dynamic interface associated with a second rotor to a compression pocket formed between the first rotor and the second rotor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The subject matter, which is regarded as the disclosure, is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the disclosure are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

[0028] FIG. 1 is cross-sectional view of a fluid machine according to an embodiment;

[0029] FIG. 2 is a perspective view of a working portion of a fluid machine according to an embodiment;

[0030] FIG. 3 is cross-sectional view of a fluid machine including a lubricant supply passage according to an embodiment;

[0031] FIG. 4 is a cross-sectional view of a working portion of a fluid machine according to an embodiment;

[0032] FIG. 5 is a perspective cross-sectional view of a casing of a fluid machine according to an embodiment;

[0033] FIG. 6 is a perspective view of a second shaft of a fluid machine according to an embodiment; and

[0034] FIG. 7 is a front view of a surface of a bearing housing facing towards a compression pocket of the fluid machine according to an embodiment.

[0035] The detailed description explains embodiments of the disclosure, together with advantages and features, by way of example with reference to the drawings.

DETAILED DESCRIPTION

[0036] Referring now to the FIGS. 1 and 2, a fluid machine 20 is illustrated. In the illustrated, non-limiting embodiment, the fluid machine 20 is an opposed screw compressor. However, other suitable embodiments of a fluid machine, such as a pump, fluid motor, or engine for example, are also within the scope of the disclosure. The fluid machine 20 includes a first rotor 22 intermeshed with a second rotor 24. In an embodiment, the first rotor 22 is a male rotor having a male-lobed working portion 26 and the second rotor 24 is a female rotor including a female-lobed portion 28. Alternatively, the first rotor 22 may be a female rotor and the second rotor 24 may be a male rotor. The working portion 26 of the first rotor 22 includes at least one first helical lobe 30 and at least one second helical lobe 32. In the illustrated, non-limiting embodiment, the first rotor 22 includes two separate portions defining the first helical lobes 30 and the second helical lobes 32. In another embodiment, the first rotor 22, including the first and second helical lobes 30, 32, may be formed as a single integral piece.

[0037] The fluid machine 20 includes a first shaft 34 fixed for rotation with the first rotor 22. The fluid machine 20 further include a casing 36 rotatably supporting the first shaft 34 and at least partially enclosing the first rotor 22 and the second rotor 24. A first end 38 and a second end 40 of the casing 36 are configured to rotatably support the first shaft 34. In the illustrated, non-limiting embodiment, the first, lower end 38 of the casing 36 is formed by a lower bearing housing 42 and the second, upper end 40 of the casing 36 is formed by a distinct upper bearing housing 44. A rotor case 46 may extend between and couple the lower and upper bearing housings 42, 44. However, embodiments where the lower bearing housing 42 and/or the upper bearing housing 44 is integrally formed with the rotor case 46 are also contemplated herein.

[0038] The first shaft 34 of the illustrated embodiments is directly coupled to an electric motor 48 operable to drive rotation of the first shaft 34 about an axis X. Any suitable type of electric motor 48 is contemplated herein, including but not limited to an induction motor, permanent magnet (PM) motor, and switch reluctance motor for example. In an embodiment, the first rotor 22 is fixed to the first shaft 34 by a fastener, coupling, integral formation, interference fit, and/or any additional structures or methods known to a person having ordinary skill in the art (not shown), such that the first rotor 22 and the first shaft 34 rotate about axis X in unison.

[0039] The fluid machine 20 additionally includes a second shaft 50 operable to rotationally support the second rotor 24. The second rotor 24 includes an axially extending bore 52 within which the second shaft 50 is received. In an embodiment, the second shaft 50 is stationary or fixed relative to the casing 36 and the second rotor 24 is config-

ured to rotate about the second shaft 50. However, embodiments where the second shaft 50 is also rotatable relative to the casing 36 are also contemplated herein.

[0040] With specific reference to FIG. 2, the first rotor 22 is shown as including four first helical lobes 30 and at least four second helical lobes 32. The illustrated, non-limiting embodiment, is intended as an example only, and it should be understood by a person of ordinary skill in the art that any suitable number of first helical lobes 30 and second helical lobes 32 are within the scope of the disclosure. As shown, the first helical lobes 30 and the second helical lobes 32 have opposite helical configurations. In the illustrated, non-limited embodiment, the first helical lobes 30 are left-handed and the second helical lobes 32 are right-handed. Alternatively, the first helical lobes 30 may be right-handed and the second helical lobes 32 may be left-handed.

[0041] By including lobes 30, 32 with having opposite helical configurations, opposing axial flows are created between the first and second helical lobes 30, 32. Due to the symmetry of the axial flows, thrust forces resulting from the helical lobes 30, 32 are generally equal and opposite, such that the thrust forces substantially cancel one another. As a result, this configuration of the opposing helical lobes 30, 32 provides a design advantage since the need for thrust bearings in the fluid machine can be reduced or eliminated.

[0042] The second rotor 24 has a first portion 54 configured to mesh with the first helical lobes 30 and a second portion 56 configured to mesh with the second helical lobes 32. To achieve proper intermeshing engagement between the first rotor 22 and the second rotor 24, each portion 54, 56 of the second rotor 24 includes one or more lobes 58 having an opposite configuration to the corresponding helical lobes 30, 32 of the first rotor 22. In the illustrated, non-limiting embodiment, the first portion 54 of the second rotor 24 has at least one right-handed lobe 58a, and the second portion 56 of the second rotor 24 includes at least one left-handed lobe 58b.

[0043] In an embodiment, the first portion 54 of the second rotor 24 is configured to rotate independently from the second portion 56 of the second rotor 24. However, embodiments where the first and second portions 54, 56 are rotationally coupled are also contemplated herein. Each portion 54, 56 of the second rotor 24 may include any number of lobes 58. In an embodiment, the total number of lobes 58 formed in each portion 54, 56 of the second rotor 24 is generally larger than a corresponding portion of the first rotor 24. For example, if the first rotor 22 includes four first helical lobes 30, the first portion 54 of the second rotor 24 configured to intermesh with the first helical lobes 30 may include five helical lobes 58a. However, embodiments where the total number of lobes 58 in a portion 54, 56 of the second rotor 24 is equal to a corresponding group of helical lobes (i.e. the first helical lobes 30 or the second helical lobes 32) of the first rotor 22 are also within the scope of the disclosure.

[0044] Returning to FIG. 1, during operation of the fluid machine 20 of one embodiment, a gas or other fluid, such as a low GWP refrigerant for example, is drawn to a central location by a suction process generated by the fluid machine 20. Rotation of the first rotor 22 and the second rotor 24 compresses the refrigerant and forces the refrigerant toward the outer ends 38, 40 of the casing 36 due to the structure and function of the opposing helical rotors 22, 24. The compressed refrigerant is routed by an internal gas passage

within the casing 36 and discharged through the upper end 40 of the casing 36. The discharged refrigerant passes through the electric motor 48 and out of the discharge outlet 59.

[0045] With reference now to FIGS. 3-7, the fluid machine 20 includes one or more lubricant supply passages for providing a lubricant from a sump 61 to the dynamic interfaces of the machine 20. In an embodiment, the sump 61 containing a volume of lubricant, such as oil for example, is located adjacent and in communication with the lower bearing housing 42. A first shaft passage 60 extends axially through at least a portion of the first shaft 34. In the illustrated, non-limiting embodiment, the first shaft passage 60 extends from adjacent the lower end 38 of the casing 36 to adjacent the upper end 40 of the casing 36.

[0046] As best shown in FIGS. 4 and 5, in an embodiment, a cavity 68 formed in the upper bearing housing 64 is configured to surround a periphery of part of the first shaft 34. At least one radial hole 70 extends between the first shaft passage 60 to the outer surface of the shaft 34 to deliver lubricant to the cavity 68. In the illustrated, non-limiting embodiment, two radial holes 70 extending in opposite directions relative to one another from the first shaft passage 60 to the outer surface of the shaft 34. In addition, one or more surfaces of the bore formed in the upper bearing portion 44 and configured to contact the first shaft 34 may function as a bearing. For example, with reference for FIG. 5, a first surface 72 disposed adjacent a first side of the cavity 68 is operable as a main bearing and a second surface 74, disposed adjacent a second, opposite side of the cavity 68, is operable as a sub-bearing. Similarly, the bore formed in a lower bearing portion 62 for receiving a portion of the first shaft 34 includes a surface 76 operable as a bearing.

[0047] In an embodiment, a groove 80 extends over the axial length of the surface 72. This groove 80 is arranged in fluid communication with the cavity 68 and is configured to distribute lubricant from the cavity 68 over the axial length of the first surface 72. Alternatively, or in addition, a groove 84 extends over the axial length of the surface 76. The groove 84 is configured to distribute lubricant from the sump 61 located adjacent the lower bearing housing 42.

[0048] A second shaft passage 86 extends axially through the lower bearing housing 42 and at least a portion of the second shaft 50. In the illustrated, non-limiting embodiment, the second shaft passage 86 extends over about half of the axial length of the second shaft 50. However, a shaft passage 86 of any length is contemplated herein. With reference now to FIG. 6, an axially extending passage 88 is formed in an outer periphery of the second shaft 50 and at least one radial hole 90 fluidly couples the shaft passage 86 and the axial passage 88. In an embodiment, the radial hole is arranged generally centrally relative to the axial passage such that a portion of the lubricant is distributed in two directions relative to the radial hole 90. However, embodiments where the radial hole 90 is arranged adjacent an end of the passage 88 or at another location are also contemplated herein. The axial passage 88 is configured to distribute lubricant at the interface formed between the second shaft 50 and the bore 52 formed in the second rotor 24. In an embodiment, the axial passage 88 extends between the upper and lower bearing housings 44, 42.

[0049] During operation of the fluid machine 20, the relatively high pressure discharge at outer ends 38, 40 of the casing 36, and the relatively low pressure suction at a central

location of the first rotor 22 and the second rotor 24, urges or draws lubricant from the sump 61 through the lubricant supply passages associated with the first and second rotors 22, 24. More specifically, lubricant will flow from the sump 61 through the first shaft passage 60, the axial groove 84 formed in surface 76 of the lower bearing housing 42, and through the second shaft passage 86 simultaneously. The lubricant supply passages are intended to lubricate the surfaces 72, 74, and 76 of the upper and lower bearing housings 42, 44 that function as bearings for the first shaft 34, and the interface between the second shaft 50 and the second rotor 24 to reduce friction there between.

[0050] A counter bore 78, 82, 92, 94 may be formed in the surfaces of the lower bearing housing 42 and the upper bearing housing 44 facing the first and second rotors 22, 24, respectively. The counterbore 78 may be arranged in fluid communication with the groove 80. The counterbore 82 may be arranged in fluid communication with the groove 84. As a result, lubricant will flow to each of the counter bores 78, 82 after lubricating the respective surfaces 72, 74, and 76. Also, the counterbore 92, 94 may be arranged in fluid communication with the axial passage 88. As a result, lubricant will flow to the counter bores 92, 94 after lubricating the interface between the second shaft 50 and the second rotor 24. In an embodiment, a recess 96 may extend from one or more of the counter bores 78, 82, 92, 94 at an angle towards the interface between the first rotor 22 and the second rotor 24. Although the fluid machine illustrated and described herein includes a recess formed at each of the counter bores, embodiments where none or only some of the counter bores includes a recess are also within the scope of the disclosure.

[0051] The configuration of each recess 96, such as the angle, length, width, and depth for example, may be optimized to control the amount of lubricant flow to the compression pocket. In an embodiment, the recess 96 has a linear contour and is aligned with the interface between the lobes 30, 32 of the first rotor 22 and the corresponding lobes 58a, 58b of the second rotor 24. Accordingly, as shown FIG. 6, the angle of the recess 96 relative to the axis extending through the origin of both the first and second shafts 34, 50 is between 0 degrees and 60 degrees.

[0052] By positioning the recess 96 in alignment with the intermeshing engagement of the rotors 22, 24, the recess communicates with both the high pressure and low pressure areas adjacent the first rotor 22 and second rotor 24. As a result, lubricant may flow from the recess 96 into the compression pocket formed between the first and second rotors 22, 24. In an embodiment, the length of the recess 96, measured radially from the origin of the bore for receiving a corresponding shaft 34 or 50 is greater than a root radius of the rotor 22 or 24. Further, the length of the recess 96 may be greater than the root radius, but less than the tip radius of the rotor 22 or 24 associated therewith. In an embodiment, a width of the recess 96, measured perpendicular to the length, is between 1 mm and 10 mm, and a depth of the recess 96 extending into the lower or upper bearing housing 42, 44 is between 1-5 times the axial length of the clearance between the rotor 22 or 24 and the adjacent surface of the lower or upper bearing housing 42, 44. It should be understood that in embodiments including a plurality of recesses, the configuration of recesses may be the same, or alternatively, may be different.

[0053] The fluid machine 20 illustrated and described herein provides a simple and low cost configuration for a lubricant supply system. Because the pressure of the machine 20 is used to draw the fluid to the respective interfaces, costly devices, such as a pump or control valve for example, are not required. Further, because the lubricant is driven by the pressure differential created during operation of the machine 20, a stable supply of lubricant is provided over a wide range of shaft speeds.

[0054] While the disclosure has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the disclosure is not limited to such disclosed embodiments. Rather, the disclosure can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the disclosure. Additionally, while various embodiments of the disclosure have been described, it is to be understood that aspects of the disclosure may include only some of the described embodiments. Accordingly, the disclosure is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

1. A fluid machine comprising:
 - a first rotor rotatable about a first axis;
 - a second rotor rotatable about a second axis;
 - a casing for supporting said first rotor and said second rotor;
 - a sump having a volume of lubricant contained therein;
 - a first lubricant passage for supplying lubricant from the sump to a dynamic interface associated with the first rotor; and
 - a second lubricant passage for supplying lubricant from the sump to a dynamic interface associated with the second rotor, wherein a pressure differential created within the fluid machine supplies the lubricant from the sump to the first lubricant passage and the second lubricant passage.
2. The fluid machine of claim 1, wherein during operation of the fluid machine, the pressure differential is formed between a high pressure adjacent at least one end of the casing and low pressure at a central location of the first rotor and the second rotor.
3. The fluid machine of claim 1, wherein said lubricant is supplied from said sump to said first lubricant passage and said second lubricant passage simultaneously.
4. The fluid machine of claim 1, wherein said first rotor is rotatably mounted to the casing without roller element bearings.
5. The fluid machine of claim 1, wherein the first rotor includes a first shaft rotatably mounted to the casing, wherein at least one surface of the casing and the first shaft define the dynamic interface associated with the first rotor.
6. The fluid machine of claim 5, wherein the at least one surface of the casing arranged in direct contact with the first shaft functions as a bearing.
7. The fluid machine of claim 6, wherein the at least one surface of the casing arranged in direct contact with the first shaft includes a first surface arranged in direct contact with a portion the first shaft adjacent a first end, and a second surface arranged in direct contact with a portion the first shaft adjacent a second end.
8. The fluid machine of claim 7, wherein the first lubricant passage includes a first portion for supplying lubricant to the

first surface and a second portion, distinct from the first portion, for supplying lubricant to the second surface, wherein lubricant is supplied to both the first portion and the second portion simultaneously.

9. The fluid machine of claim **5**, wherein the first lubricant passage further comprises:

- a cavity formed in a portion of the casing adjacent the first shaft;
- a passage extending axially through at least a portion of the first shaft;
- at least one radial hole coupling the cavity and the passage; and
- a groove extending from the cavity to an interior of a compression pocket formed between the first rotor and the second rotor and the casing.

10. The fluid machine of claim **9**, wherein the first lubricant passage further comprises:

- a counter bore formed at the interface between the casing and the compression pocket.

11. The fluid machine of claim **5**, wherein the first lubricant passage comprises:

- a groove extending from the sump to an interior of a compression pocket formed between the first rotor and the second rotor and the casing.

12. The fluid machine of claim **5**, wherein the second rotor further comprises:

- a second shaft supported by the casing; and
- a working portion rotatable relative to the second shaft, wherein the second shaft and the working portion define the dynamic interface associated with the second rotor.

13. The fluid machine of claim **12**, wherein the second lubricant passage further comprises:

- a first passage extending axially through at least a portion of the second shaft;
- a second passage formed in an outer periphery of the second shaft; and
- at least one radial hole coupling the first passage and the second passage.

14. The fluid machine of claim **13**, wherein the second passage extends axially such that a first end of the second passage is fluidly coupled to a first portion of the casing and a second, opposite end of the second passage is fluidly coupled to a second portion of the casing.

15. The fluid machine of claim **1**, wherein a counter bore is formed in the casing where at least one of the first lubricant passage and the second lubricant passage enters a compression pocket formed between the first rotor and the second rotor.

16. The fluid machine of claim **15**, further comprising a recess is formed in the casing in fluid communication with the counter bore, the recess being arranged at an angle towards an interface between the first rotor and the second rotor.

17. The fluid machine of claim **16**, wherein at least one of an angle, length, width, and depth of the recess is optimized to control a flow of lubricant to the compression pocket.

18. A method of lubricating one or more dynamic interfaces of a fluid machine comprising:

supplying lubricant from a sump to a dynamic interface associated with a first rotor of the fluid machine via a first lubricant passage; and

supplying lubricant from a sump to a dynamic interface associated with a second rotor of the fluid machine via a second lubricant passage, the second lubricant passage being distinct from the first lubricant passage;

wherein supplying lubricant to the dynamic interface associated with the first rotor and the dynamic interface associated with the second rotor occurs automatically in response to a pressure differential created within the fluid machine during operation of the fluid machine.

19. The method of claim **18**, wherein supplying lubricant from a sump to a dynamic interface associated with a first rotor and supplying lubricant from a sump to a dynamic interface associated with a second rotor occurs simultaneously.

20. The method of claim **18**, wherein supplying lubricant from a sump to a dynamic interface associated with a first rotor and supplying lubricant from a sump to a dynamic interface associated with a second rotor occurs without a pump or control valve.

21. The method of claim **18**, wherein supplying lubricant from a sump to a dynamic interface associated with a first rotor further comprises:

supplying lubricant via a first passage to a first bearing surface, the first passage extending through an opening formed in a first shaft of the first rotor; and

supplying lubricant via a second passage to a second bearing surface.

22. The method of claim **18**, further comprising supplying lubricant from the dynamic interface associated with a first rotor and the dynamic interface associated with a second rotor to a compression pocket formed between the first rotor and the second rotor.

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