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# DESCRIPTION

Description

## BACKGROUND

**[0001]** Fluid pumps used in a variety of settings often utilize a packing seal system, which can comprise packing material and a packing gland, to mitigate loss of the transported fluid from the fluid transport system. These sealing systems are typically implemented along a rotating shaft used to drive the pumping component. For example, packing material can be compressed against a back seat, on a rotating shaft, by the packing gland and follower components. Often, a separate bushing component may be disposed on the shaft, between the packing gland and packing material. In this way, for example, the compressed packing material, along with a pressurized lubricant and bushing, can help mitigate fluid loss along the shaft.

US 4 478 423 A discloses an improved T-ring wiper seal and seal carrier assembly for use in the fluid end of a reciprocating pump.

US 3 013 826 A discloses a packing assembly used to preventing fluid leakage around a moving shaft.

## SUMMARY

**[0002]** This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key factors or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

**[0003]** One or more techniques and systems described herein can be utilized to help mitigate fluid loss or leakage from a fluid pump with a rotating shaft driving a pumping mechanism, such as in a gear pump, for example. In one implementation, a packing gland component and bushing component may be formed as a one-piece, packing gland-bushing component, instead of typical two-piece components. In this example, the packing gland-bushing component can have an internal seal that allows for use of lubricants at higher pressures. Further, in this implementation, a face of the packing gland portion may have removal components that allows for easier removal of the packing gland-bushing component from a pump shaft.

**[0004]** As another example, the one-piece packing gland-bushing may be configured to be

used without packing material, essentially comprising merely a bushing component. In this example, the packing gland-bushing component may have a slip-fit configuration with the shaft of the pump. For example, a plurality of O-rings may be used to provide a seal, and allow for pressurized lubricant to be introduced along the bushing portion, at higher pressures. In some configurations, this may allow for the elimination of packing material in the shaft seal.

**[0005]** The invention concerns a device for sealing a pump shaft of a pump, according to claim 1, and a pump comprising such a device, according to claim 9. Further preferred embodiments are defined in the dependent claims.

**[0006]** In one implementation of a system for sealing a pump shaft, a one-piece, combination packing gland and bushing component can be used to seat in a shaft casing along a rotating pump shaft. In this implementation, the packing gland and bushing component can comprise a proximal end that is situated on the shaft near a pump motor coupler portion of the shaft, and a distal end that is situated distally on the shaft from the pump motor coupler. The packing gland and bushing component can further comprise a packing gland portion at the proximal end to provide for compression of packing material in the shaft casing. Additionally, the packing gland and bushing component can comprise a bushing portion at the distal end in order to provide a bearing surface for the rotating shaft. In this implementation, the bushing portion can comprise an inner gasket channel that is disposed proximate a proximal end of the bushing portion. The inner gasket channel can be used hold a gasket between the inside of the bushing portion and the rotating shaft to mitigate leakage of a lubricant from the proximal end of the inside of the bushing portion. In this implementation, a packing material can be disposed proximate the distal end of the packing gland and bushing component to mitigate leakage of a fluid from a pumping chamber. The packing material can be subjected to compression force that is provided by the packing gland and bushing component.

**[0007]** To the accomplishment of the foregoing and related ends, the following description and annexed drawings set forth certain illustrative aspects and implementations. These are indicative of but a few of the various ways in which one or more aspects may be employed. Other aspects, advantages and novel features of the disclosure will become apparent from the following detailed description when considered in conjunction with the annexed drawings.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

### **[0008]**

FIGURE 1A is a component diagram illustrating a view of an example implementation of a pump where one or more portion of one or more systems described herein may be implemented.

FIGURES 1B and 1C are a component diagrams illustrating a cut-away view of an example implementation of a pump where an example system 100, described herein, may be

implemented.

FIGURES 2A and 2B are component diagrams illustrating various views of one or more portions of one or more systems described herein.

FIGURES 3A and 3B are component diagrams illustrating various views of one or more portions of one or more systems described herein.

FIGURE 4 is a component diagram illustrating a view of an example implementation of a pump where one or more portion of one or more systems described herein may be implemented.

FIGURE 5A is a component diagram illustrating a view of an example implementation of a pump where one or more portion of one or more systems described herein may be implemented.

FIGURES 5B and 5C are a component diagrams illustrating a cut-away view of an example implementation of a pump where an example system 100, described herein, may be implemented.

FIGURE 6 is a component diagram illustrating a perspective view of an example device 600 used to facilitate providing a seal in a pump.

FIGURE 7 is a component diagram illustrating a perspective cut-away view of an example device 600 used to facilitate providing a seal in a pump.

FIGURE 8 is a component diagram illustrating a view of an example implementation of a pump where one or more portion of one or more devices described herein may be implemented.

FIGURE 9 is a component diagram illustrating a cut-away view of an example implementation of a pump where one or more portion of one or more devices described herein may be implemented.

FIGURE 10 is a component diagram illustrating a cut-away view of an example implementation of a pump where one or more portion of one or more devices described herein may be implemented.

FIGURE 11 is a component diagram illustrating a close up of a cut-away view of an example implementation of a pump where one or more portion of one or more devices described herein may be implemented.

## DETAILED DESCRIPTION

**[0009]** The claimed subject matter is now described with reference to the drawings, wherein like reference numerals are generally used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to

provide a thorough understanding of the claimed subject matter. It may be evident, however, that the claimed subject matter may be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to facilitate describing the claimed subject matter.

**[0010]** As an example, pumps can be coupled to a motor by a rotating shaft. The motor typically rotates the shaft, which, in turn, rotates a pump rotor to move the fluids through coupled conduits. However, the location at which the rotating pump shaft enters the pumping chamber, comprising the pump rotor, offers a location for leakage of the pumped fluid from the pump chamber. A system can be devised for sealing a rotating pump shaft entrance to the pumping chamber. In one implementation, the pump can comprise a pump shaft casing, or pump shaft packing box, or the like, disposed proximally (e.g., proximally in relation to the connection of the shaft to the motor) from the entrance of the pump shaft to the pump chamber. In this implementation, the pump shaft is disposed inside the pump shaft casing, or pump shaft packing box, etc.

**[0011]** FIGURES 1-5 illustrate one implementation of an example system for sealing a rotating pump shaft in a pump. FIGURE 1A illustrates an example pump 50, in an elevation, rear view from the pump's motor toward the pump rotor. FIGURE 1B illustrates one implementation of a system 100, showing the example pump 50 in a top a cut-away view, along the A-A line of FIGURE 1A. FIGURE 1C illustrates one implementation of a system 100, showing the example pump 50 in a close up of a portion of the top a cut-away view of FIGURE 1B. In this implementation, a one-piece, combination packing gland and bushing component 102 can be used to seat in a shaft casing 150 along a rotating pump shaft 152. In this implementation, the packing gland and bushing component 102 can comprise a proximal end 104 that is proximate a pump motor coupling portion 162 of the shaft 152. Further, the packing gland and bushing component 102 can comprise a distal end 106 that is distal from the pump motor coupling portion 162 of the shaft 152.

**[0012]** Additionally, in this implementation, the packing gland and bushing component 102 can comprise a packing gland portion 108 disposed at the proximal end 104. The packing gland portion 108 can provide for compression of packing material in the shaft casing 150. The packing gland and bushing component 102 can also comprise a bushing portion 110 that is disposed at the distal end 106. The bushing portion 110 can provide a bearing surface 114 for the rotating shaft 152. In this implementation, the bushing portion can comprise an inner gasket channel 116 that is disposed proximate a proximal end of the bushing portion 110. The inner gasket channel 116 can be used to hold a gasket between the inside of the bushing portion 110 and the rotating shaft 152 to mitigate leakage of a lubricant from the proximal end 104, from the inside of the bushing portion 110.

**[0013]** As illustrated in FIGURES 1B and 1C, the example system 100 can comprise packing material 112 that is disposed proximate the distal end 106 of the packing gland and bushing component 102. The packing material 112 can be used to mitigate leakage of a fluid from a pumping chamber 154. Further, in this implementation, the packing material 112 can be

subjected to compression force provided by the packing gland and bushing component 102. As illustrated in FIGURES 3A and 3B, with continued reference to FIGURES 1B and 1C, in one implementation, the gland portion 104, of the packing gland and bushing component 102, can comprise two fastener couplers 302. In this implementation, the fastener couplers 302 can respectively be configured to receive a compression fastener 158 to facilitate compression of the packing material (e.g., against a packing retainer or rear seat of a packing chamber or shaft casing), such as by using the packing gland and bushing component 102. In one implementation, the pump can comprise a packing retainer, which may be removable from the pump rotor side of the shaft casing or packing chamber. In this way, for example, the packing material 112 may be removed (e.g., and replaced) without removal of the packing gland and bushing component 102.

**[0014]** As an example, the combination packing gland and bushing component 102 may be used to replace current two-piece bushing and packing gland systems in the shaft casing of a fluid pump. For example, two-piece packing gland systems, which are often made of two different materials, can be more difficult to remove from the shaft casing, for maintenance, and/or replacement of packing material. That is, using the example system 100, both the packing gland and bushing portions 108, 110 can be removed at the same time; and a one-piece, combination packing gland and bushing component 102 can be easier and less costly to manufacture in a single unit (e.g., machined, formed, etc.). Whereas current and prior two-piece systems have two separate pieces that are manufactured separately (e.g., and sometimes using different materials), and may need to be removed separately. Further, for example, the location of the inner gasket channel 116, with an accompanying gasket (e.g., O-ring), may allow for higher pressures of shaft lubricant pressure without causing typical lip seal failure of bushing found in current two-piece systems.

**[0015]** FIGURES 2A, 2B, 3A, 3B, 4, 5A, 5B, and 5C illustrate various views of one or more implementations of one or more portion of the example system 100, as may be utilized in an example pump 50. In one implementation, the packing gland and bushing component 102 can comprise an outer gasket channel 118 that is disposed proximate the proximal end 102 of the bushing portion 110. In this implementation, the outer gasket channel 118 can be used to hold an outer gasket 210 between the outside of the bushing portion 110 and a wall of the shaft casing 156. As an example, the outer gasket channel 118 with the outer gasket 210 can help mitigate leakage of lubricant (e.g., and/or pumped fluid) from the proximal end 104 of the packing gland and bushing component 102, around the external surface 204 of the bushing portion 110.

**[0016]** In one implementation, as illustrated in FIGURES 2A and 2B, the packing gland and bushing component can comprise a lubricant channel 202 that is disposed around the external surface 204 of the bushing portion 110, distally on the bushing portion 110 from the inner gasket channel 116. The lubricant channel 202 can be configured to operably receive bushing lubricant 160, such as provided by a lubricant source (e.g., injector). Further, in this implementation, the packing gland and bushing component 102 can comprise a lubricant port 206 that is disposed through a wall 306 of the bushing portion 110, between the lubricant

channel 202 and the interior of the bushing 308. The lubricant port 206 can be configured to operably transport lubricant 160 from the lubricant channel 202 to the interior of the bushing portion 308.

**[0017]** As one example, the pump (e.g., 50) may comprise a lubricant provider, such as lubrication pump, injector, or the like, that provides a lubricant source. In this example, the lubricant source can be fluidly coupled with a port located in the wall 156 of the shaft casing 150. Further, in this example, the port located in the wall 156 of the shaft casing 150 may be aligned with the lubrication channel 202, thereby providing a source of lubricant to the lubrication channel 202. Additionally, the lubrication port 206 can provide a fluid channel for the lubricant between the lubrication channel 202 and the interior of the bushing portion 308. In this way, for example, the bearing surface 114 of the bushing portion 110 can be provided with lubrication, at least while the shaft 152 is operably rotating during operation of the pump 50.

**[0018]** As one example, a location of the outer gasket channel 118, used with an accompanying gasket 210, can mitigate leakage of the lubricant to the proximal end 104 of the packing gland and bushing component 102, along its outer surface 204. Further, in this example, the location of the inner gasket channel 116, used with an accompanying inner gasket 208, can mitigate leakage of the lubricant to the proximal end 104 of the packing gland and bushing component 102, along its inner surface (e.g., the bearing surface 114). Additionally, the location of these gaskets 208, 218, in combination with the one-piece combination of the packing gland and bushing component 102 may allow for lubricant to be used at a higher pressure than prior. In this way, leakage of the pumped fluid from the pumping chamber 154 may also be mitigated by using higher lubricant pressures. As one example, the location of the gasket channel 116 and inner gasket 208 can provide a dynamic seal against the shaft 152. In this example, lubricant provided to the interior of the bushing portion 308 can help cool and lubricate the gasket 208. The gasket channel 116 and inner gasket 208 can also serve as a secondary containment to mitigate leakage from the pumping chamber 154, for example, if the packing material 112 would fail.

**[0019]** In one implementation, as illustrated in FIGURES 3A, 3B, and 4, the packing gland and bushing component 102 can comprise a packing gland and bushing removal component 304. In one implementation, the packing gland and bushing removal component 304 can be disposed on the packing gland portion 108 to facilitate removal of the packing gland and bushing component 102 from the pump shaft casing 150. As an example, the packing gland and bushing removal component 304 can comprise an access opening that allows a pulling tool to engage with the packing gland portion 108, to pull the packing gland and bushing component 102 from the pump shaft casing 150.

**[0020]** In one implementation, the packing gland and bushing removal component 304 can comprise a threaded portion to further facilitate removal of the packing gland and bushing component 102. For example, the access opening of the packing gland and bushing removal component 304 to facilitate in removal. As another example, a pulling tool can be coupled with the jack screws to provide for easy removal of the packing gland and bushing

component 102.

**[0021]** In one aspect, a device may be devised that can be used for sealing a pump shaft of a pump. FIGURES 6-11 illustrate one or more portions of an example device 600, in accordance with the invention, and one or more implementations of the example device 600 as used in an example pump 854. According to the invention, as illustrated in FIGURES 6-10, the example device 600 comprises a tubular portion 602. The tubular portion 602 comprises a distal end 604 that may be disposed adjacent a back seat 1052 of a pump shaft packing box 950. Further, according to the invention, the example device 600 comprises a proximal end 606 that may be disposed adjacent a proximal end 952 of the pump shaft packing box 950. That is, for example, the length of the tubular portion 602 can be configured to fit (e.g., and fill entirely) the length of the pump shaft packing box 950.

**[0022]** According to the invention, tubular portion 602 comprises an external diameter 702 that is sized to fit inside the pump shaft packing box 950, and an internal diameter 704 that is sized to receive a pump shaft 850. That is, the tubular portion 602 is configured to fit over the pump shaft 850, and to fit inside (e.g., and fill) the pump shaft packing box 950, such as in a slip-fit arrangement. In this way, for example, packing material may not be needed.

**[0023]** The example device 600 comprises a flange 608 that is disposed at the proximal end 606 of the tubular portion 602. According to the invention, the flange comprises two fastener couplers 610, that are respectively configured to receive a fastener 852 (e.g., a compression fastener, such as 158 of FIGURE 1). Further, the example device 600 comprises a first gasket channel 612 that is configured to receive a gasket. The first gasket channel 612 is disposed around the external surface 614 of tubular portion 602, proximate to the distal end 604. Additionally, the example device 600 comprises a second gasket channel 616 that is configured to receive a gasket. The second gasket channel 616 is disposed around the external surface 614 of tubular portion 602 proximate to the proximal end 606. The example device 600 also comprises a third gasket channel 706 that is configured to receive a gasket. The third gasket channel 706 is disposed around the internal surface 618 of tubular portion 602, between the first gasket channel 612 and the second gasket channel 616.

**[0024]** In one implementation, the example device 600 can comprise a fourth gasket channel 620 that is configured to receive a gasket. The fourth gasket channel 620 can be disposed around the internal surface 618 of tubular portion 602, proximate to the distal end 604. Further, in one implementation, the fourth gasket channel 620 can be disposed between the first gasket channel 612 and the distal end 604 of the tubular portion 602. In one implementation, a plurality of O-rings 902, 904, 906, 908 may be used as gaskets, to provide a slip-fit for the tubular portion on the pump shaft 850 in the pump shaft packing box 950. In this implementation, the plurality of O-rings can comprise a first O-ring 902 disposed in the first gasket channel 612; a second O-ring 904 disposed in the second gasket channel 616; and a third O-ring 906 disposed in the third gasket channel 706. Additionally, a fourth O-ring 908 can be disposed in the fourth gasket channel 620.

**[0025]** As an example, as illustrated in FIGURES 9-11, the plurality of O-rings 902, 904, 906, 908 disposed in their respective gasket channels 612, 616, 706, 620, can not only facilitate the slip-fit of the tubular portion 602 on the shaft 850 in the packing box 950, but can also mitigate leakage of fluid. For example, gaskets 906 and 908 may facilitate containment of lubricant 1050 between the shaft 850 and the inner surface 618 of the tubular portion 602 (e.g., the bearing surface); and may also mitigate leakage of pumped fluid along the inner surface 618 of the tubular portion 602 toward the proximal end 606. As another example, the gaskets 902 and 904 may facilitate containment of lubricant 1050 between the external surface 614 of the tubular portion 602 and the wall of the pump shaft packing box; and may further mitigate leakage of pumped fluid along the external surface 614 of the tubular portion 602 toward the proximal end 606. As another example, the proximal gasket 906 can provide a secondary containment of liquid from the pumping chamber (e.g., 154 of FIGURE 1) in the event that the distal gasket 908 were to fail.

**[0026]** The example device 600 can comprise a lubrication channel 622 that is configured to operably receive lubricant. In this implementation, the lubrication channel 622 can be disposed around the external surface 614 of the tubular portion 602, between the first gasket channel 612 and the second gasket channel 616. Further, the example device 600 can comprise a lubrication port 624 that is configured to operably transport lubricant 1050 between the lubrication channel 622 and the interior 618 of the tubular portion 602. In this implementation, the lubrication port 624 can be disposed through a wall 702 of the tubular portion 602, between the lubrication channel 622 and the interior 618 of the tubular portion 602. In this way, for example, an external lubrication supply can be fluidly provided to the lubrication channel 622, which, in turn, fluidly provides the lubricant 1050 to the interior 618 of the tubular portion 602, by way of the lubrication port 624. The lubricant 1050, for example, can be used to operably lubricate a bearing surface between the interior 618 of the tubular portion 602 and the pump shaft 850; and may also operably provide lubrication for the dynamic seals between the inner gaskets 906, 908 and the rotating pump shaft 850.

**[0027]** In one implementation, the example device 600 can comprise a seal removal component 626 that is disposed on the flange 608. The seal removal component 626 can be configured to facilitate removal of the device 600 from the pump shaft packing box 950. For example, the seal removal component 626 can comprise an access opening that allows a pulling tool to engage with the flange 608, to pull the example device 600 from the pump shaft packing box 950. As another example, the seal removal component 626 can comprise a threaded portion to further facilitate removal of the example device 600. For example, the access opening of the seal removal component 626 may comprise internal threads that allows for engagement with an external threaded component. In one example, jack screws may be threaded into the seal removal component 626 to facilitate removal of the example device 600. As another example, a pulling tool can be coupled with the jack screws to provide for easy removal of the example device 600.

**[0028]** In one aspect, a pump can be devised that provides for improved sealing of the pump shaft of the pump, and ease of maintenance of the pump seal. In this aspect, in one

implementation, as illustrated in FIGURES 1-5, the pump 50 can comprise a pump shaft 152 that rotates. For example, the rotation can be provided by a motor that is coupled to the shaft by way of a pump motor coupler 162. Further, the pump 50 can comprise a pump rotor that is disposed in a pump chamber 154. The pump rotor 164 can be operably coupled with the pump shaft 152, and can be configured to move fluid as a result of the rotation of the shaft 152. The pump 50 can also comprise a shaft casing 150 that is disposed around the pump shaft 152 to hold fluid seal system 100.

**[0029]** In this aspect, in one implementation, the pump 50 can comprise a fluid seal component 100 that is disposed between the pump shaft 152 and the shaft casing 150 to mitigate fluid leakage from the pump chamber 154. The fluid seal component 100 can comprise a one-piece, combination packing gland and bushing component 102 that comprises a proximal end 104 proximate the pump motor coupler 162, and a distal end 106 distal from the motor coupler 162. The packing gland and bushing component 102 can comprise a packing gland portion 108 at the proximal end 104. The gland portion 108 can comprise two fastener couplers 302, that are respectively configured to receive a compression fastener 158 to facilitate compression of packing material 112.

**[0030]** The packing gland and bushing component 102 can also comprise a bushing portion 110 disposed at the distal end 106 that provides a bearing surface 114 for the rotating shaft 152. Further, the packing gland and bushing component 102 can comprise an inner gasket channel 116 that is disposed at a proximal end 104 of the interior 308 of the bushing portion 110. Additionally, the packing gland and bushing component 102 can comprise an inner gasket 208 that is disposed in the inner gasket channel 116 between the inside 308 of the bushing portion 110 and the rotating shaft 152. The inner gasket 208 can be configured to mitigate leakage of a lubricant from the inside of the bushing portion 110. In one implementation, the pump 50 can comprise packing material 112 that is disposed in the shaft casing 150 at the distal end 106 of the packing gland and bushing component 102. The packing material 112 can be subjected to compression force provided by the packing gland and bushing component 102, to mitigate leakage of fluid from the pumping chamber 154.

**[0031]** In one implementation, in this aspect, the packing gland and bushing component 102 can comprise an outer gasket channel 118 that is disposed proximate the proximal end 104 of the bushing portion 110. The outer gasket channel 118 can be used to hold a gasket between the outside of the bushing portion 204 and a wall of the shaft casing 156. As an example, the outer gasket channel 118 can hold an outer gasket 210, such as an O-ring.

**[0032]** Further, the packing gland and bushing component 102 can comprise a lubricant channel 202 that is configured to operably receive bushing lubricant 160. In this implementation, the lubricant channel 202 can be disposed around the external surface 204 of the bushing portion 110 at a location that is distally from the inner gasket channel 116. Further, a lubricant port 206 can be configured to operably transport lubricant 160 from the lubricant channel 202 to the interior 308 of the bushing portion 110, such as to the bearing surface 114. The lubricant port 206 can be disposed through a wall 306 of the bushing portion 110 between

the lubricant channel 202 and the interior 308 of the bushing portion 110.

**[0033]** In one implementation, in this aspect, the example 50 can comprise a threaded packing gland and bushing removal component 304 that is disposed on the packing gland portion 108. The threaded packing gland and bushing removal component 304 can be configured to facilitate removal of the packing gland and bushing component removal component from the pump shaft casing. For example, a pulling tool or jack screws, may be coupled with the packing gland and bushing removal component 304 for easy removal of the packing gland and bushing component 102 from the shaft casing 150.

**[0034]** Moreover, the word "exemplary" is used herein to mean serving as an example, instance or illustration. Any aspect or design described herein as "exemplary" is not necessarily to be construed as advantageous over other aspects or designs. Rather, use of the word exemplary is intended to present concepts in a concrete fashion. As used in this application, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or." That is, unless specified otherwise, or clear from context, "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, if X employs A; X employs B; or X employs both A and B, then "X employs A or B" is satisfied under any of the foregoing instances. Further, At least one of A and B and/or the like generally means A or B or both A and B. In addition, the articles "a" and "an" as used in this application and the appended claims may generally be construed to mean "one or more" unless specified otherwise or clear from context to be directed to a singular form.

**[0035]** Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

**[0036]** Also, although the disclosure has been shown and described with respect to one or more implementations, equivalent alterations and modifications will occur to others skilled in the art based upon a reading and understanding of this specification and the annexed drawings. The disclosure includes all such modifications and alterations and is limited only by the scope of the following claims. In particular regard to the various functions performed by the above described components (e.g., elements, resources, etc.), the terms used to describe such components are intended to correspond, unless otherwise indicated, to any component which performs the specified function of the described component (e.g., that is functionally equivalent), even though not structurally equivalent to the disclosed structure which performs the function in the herein illustrated exemplary implementations of the disclosure. In addition, while a particular feature of the disclosure may have been disclosed with respect to only one of several implementations, such feature may be combined with one or more other features of the other implementations as may be desired and advantageous for any given or particular application. Furthermore, to the extent that the terms "includes," "having," "has," "with," or variants thereof are used in either the detailed description or the claims, such terms are

intended to be inclusive in a manner similar to the term "comprising."

**[0037]** The implementations have been described, hereinabove. It will be apparent to those skilled in the art that the above methods and apparatuses may incorporate changes and modifications without departing from the general scope of this invention. It is intended to include all such modifications and alterations in so far as they come within the scope of the appended claims.

## **REFERENCES CITED IN THE DESCRIPTION**

### **Cited references**

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

### **Patent documents cited in the description**

- US4478423A [0001]
- US3013826A [0001]

**Patentkrav**

**1.** Indretning til tætning af en pumpeaksel af en pumpe (50), omfattende:

en rørformet del (602) omfattende:

5 en distal ende (604), der skal anbringes ved siden af et bagsæde (1052) af en pumpeakselpakningsboks (950);

en proksimal ende (606), der skal anbringes ved siden af en proksimal ende (652) af pumpeakselpakningsboksen (950);

10 en udvendig diameter (702), der er dimensioneret til at passe inde i pumpeakselpakningsboksen (950); og

en indvendig diameter (704), der er dimensioneret til at modtage en roterende pumpeaksel (850);

15 en flange (608), der er anbragt ved den proksimale ende (606) af den rørformede del (602), hvor flangen omfatter to fastgørelseskoblinger (610), som hver især skal modtage en fastgørelsesanordning (852);

hvor den rørformede del (602) og flangen (608) er udformet som ét stykke;

en første pakningskanal (612) til at modtage en pakning, hvor den første pakningskanal er anbragt omkring den udvendige overflade (614) af den rørformede del (602) nær den distale ende (604);

20 en anden pakningskanal (616) til at modtage en pakning, hvor den anden pakningskanal er anbragt omkring den udvendige overflade (614) af den rørformede del (602) nær den proksimale ende (606); og

25 en tredje pakningskanal (706) til at modtage en pakning, hvor den tredje pakningskanal er anbragt rundt om den indvendige overflade (618) af den rørformede del (602) mellem den første pakningskanal (612) og den anden pakningskanal (616).

**2.** Indretning ifølge krav 1, omfattende en fjerde pakningskanal (620) til at modtage en pakning, hvor den fjerde pakningskanal er anbragt rundt om den indvendige overflade (618) af den rørformede del (602) nær den distale ende

30

(604).

5       **3.** Indretning ifølge krav 2, hvor den fjerde pakningskanal (618) er anbragt mellem den første pakningskanal (612) og den distale ende (604) af den rørformede del (602).

10       **4.** Indretning ifølge krav 1, omfattende en smørekanal (622) til operativt at modtage smøremiddel, hvor smørekanalen er anbragt rundt om den udvendige overflade (614) af den rørformede del mellem den første pakningskanal (612) og den anden pakningskanal (616).

15       **5.** Indretning ifølge krav 4, omfattende en smøreport (624) til operativt at transportere smøremiddel mellem smørekanalen (622) og det indre (618) af den rørformede del (602), hvor smøreporten er anbragt gennem en væg i den rørformede del mellem smørekanalen og det indre af den rørformede del.

20       **6.** Indretning ifølge krav 1, omfattende en flerhed af O-ringe for at tilvejebringe en glidepasning til den rørformede del på pumpeakslen i pumpeakselpakningsboksen, hvor flerheden af O-ringe omfatter:  
en første O-ring (902), som er anbragt i den første pakningskanal (612);  
en anden O-ring (904), som er anbragt i den anden pakningskanal (616); og  
en tredje O-ring (906), som er anbragt i den tredje pakningskanal (706).

25       **7.** Indretning ifølge krav 3, omfattende en fjerde O-ring (908), som er anbragt i den fjerde pakningskanal (620).

30       **8.** Indretning ifølge krav 1, omfattende en tætningsfjernelseskomponent (626), der er anbragt på flangen (608), for at lette fjernelse af indretningen fra pumpeakselpakningsboksen (950).

**9.** Pumpe (854), der omfatter:

- en pumpeaksel (850), der er konfigureret til at rotere;
- en pumpeakselpakningsboks (950) med et bagsæde (1052) og en proksimal ende (652);
- 5 en indretning til tætning af pumpens (854) pumpeaksel (850), hvilken indretning omfatter:
- en rørformet del (602) omfattende:
- en distal ende (604), som er anbragt i nærheden af bagsædet (1052) af pumpeakselpakningsboksen (950);
- 10 en proksimal ende (606), som er anbragt i nærheden af den proksimale ende (652) af pumpeakselpakningsboksen (950);
- hvor den rørformede del er monteret over pumpeakslen (850) og inde i pumpeakselpakningsboksen (950);
- en flange (608), som er anbragt ved den proksimale ende (606) af den rørformede del (602), hvor flangen omfatter to fastgørelseskoblinger (610), der hver
- 15 især skal modtage en fastgørelsesanordning (852);
- hvor den rørformede del (602) og flangen (608) er udformet som ét stykke;
- en første pakningskanal (612) til at modtage en pakning, hvor den første pakningskanal er anbragt omkring den udvendige overflade (614) af den rørformede del (602) nær den distale ende (604);
- 20 en første O-ring (902), der er anbragt i den første pakningskanal (612);
- en anden pakningskanal (616) til at modtage en pakning, hvor den anden pakningskanal er anbragt omkring den udvendige overflade (614) af den rørformede del (602) nær den proksimale ende (606);
- en anden O-ring (904), der er anbragt i den anden pakningskanal (616);
- 25 en tredje pakningskanal (706) til at modtage en pakning, hvor den tredje pakningskanal er anbragt rundt om den indvendige overflade (618) af den rørformede del (602) mellem den første pakningskanal (612) og den anden pakningskanal (616); og
- en tredje O-ring (906), der er anbragt i den tredje pakningskanal (706);
- 30 hvori flerheden af O-ringe (902, 904, 906) tilvejebringer en glidepasning til den rørformede del (602) på pumpeakslen i pumpeakselpakningsboksen (950).

5 **10.** Pumpe ifølge krav 9, hvor indretningen omfatter en fjerde pakningskanal (620) til at modtage en pakning, hvor den fjerde pakningskanal er anbragt omkring den indvendige overflade (618) af den rørformede del (602) nær den distale ende (604).

10 **11.** Pumpe ifølge krav 10, hvor den fjerde pakningskanal (618) er anbragt mellem den første pakningskanal (612) og den distale ende (604) af den rørformede del (602).

15 **12.** Pumpe ifølge et hvilket som helst af kravene 9 til 11, hvor indretningen omfatter en smørekanal (622) til operativt at modtage smøremiddel, hvor smørekanalen er anbragt rundt om den udvendige overflade (614) af den rørformede del mellem den første pakningskanal (612) og anden pakningskanal (616).

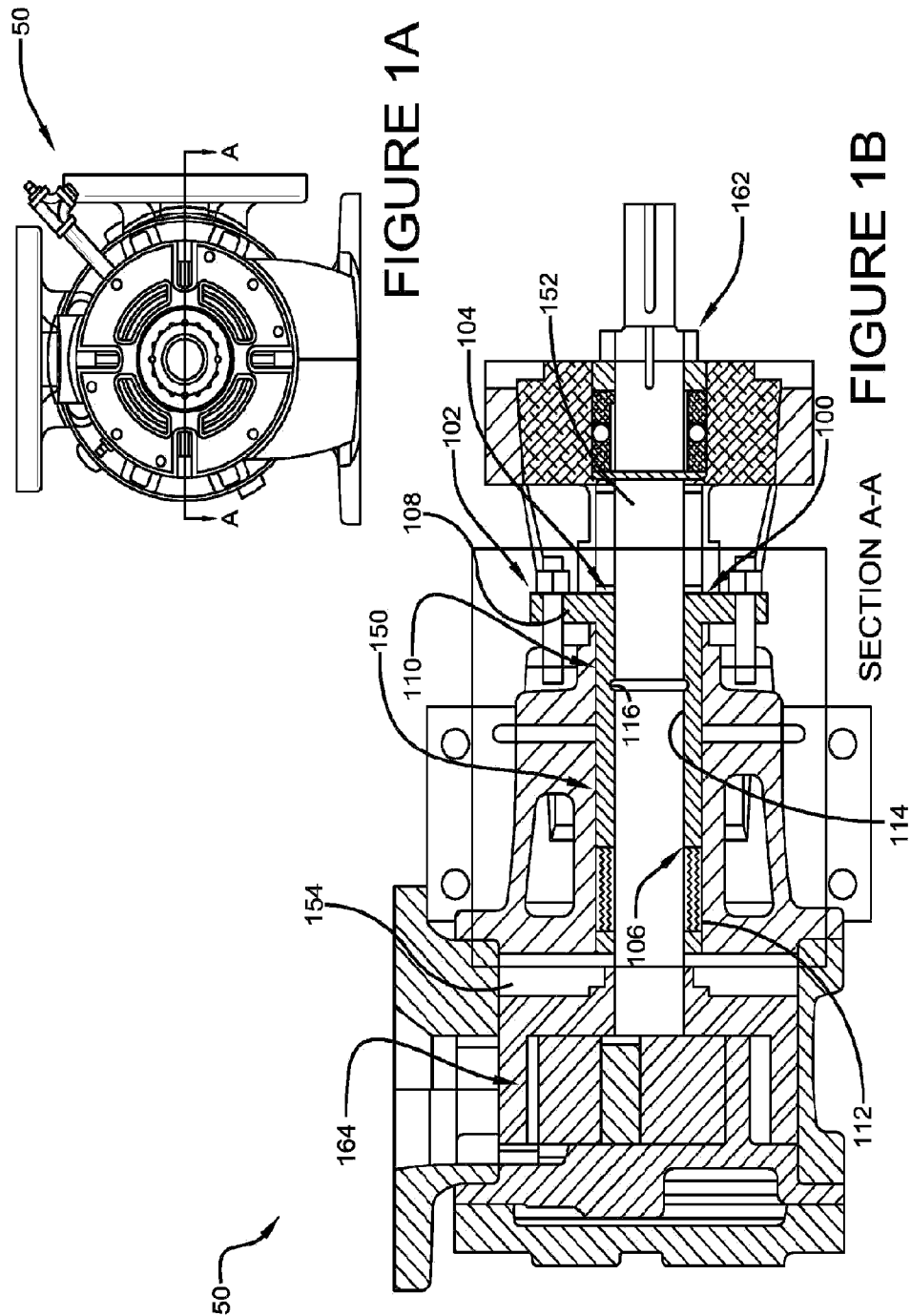
20 **13.** Pumpe ifølge krav 12, hvor indretningen omfatter en smøreport (624) til operativt at transportere smøremiddel mellem smørekanalen (622) og det indre (618) af den rørformede del (602), hvor smøreporten er anbragt gennem en væg i den rørformede del mellem smørekanalen og det indre af den rørformede del.

25 **14.** Pumpe ifølge krav 10 eller 11, hvor indretningen omfatter en fjerde O-ring (908), der er anbragt i den fjerde pakningskanal (620).

30 **15.** Pumpe ifølge et hvilket som helst af kravene 9 til 14, hvor indretningen omfatter en tætningsfjernelseskomponent (626), der er anbragt på flangen (608), for at lette fjernelse af indretningen fra pumpeakselpakningsboksen (950).

## DRAWINGS

Drawing



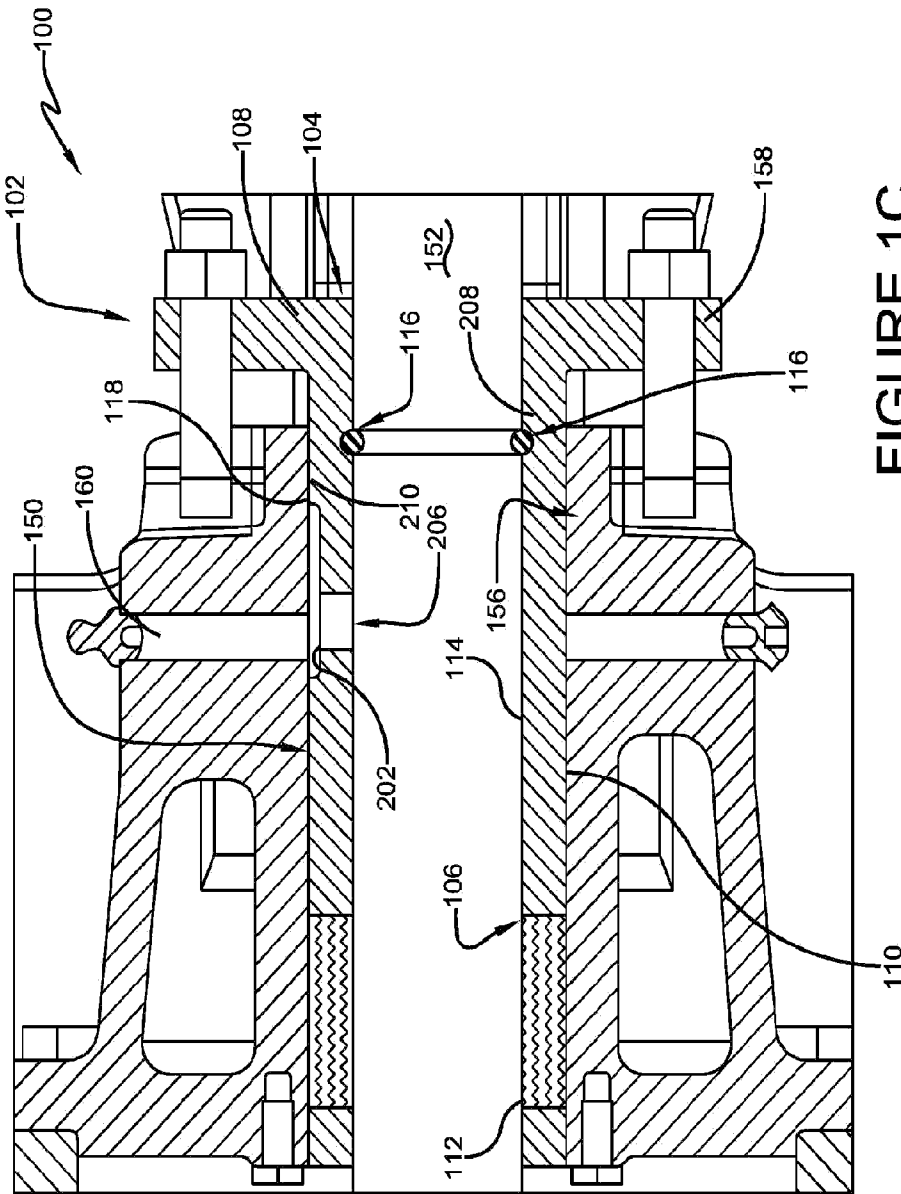


FIGURE 1C

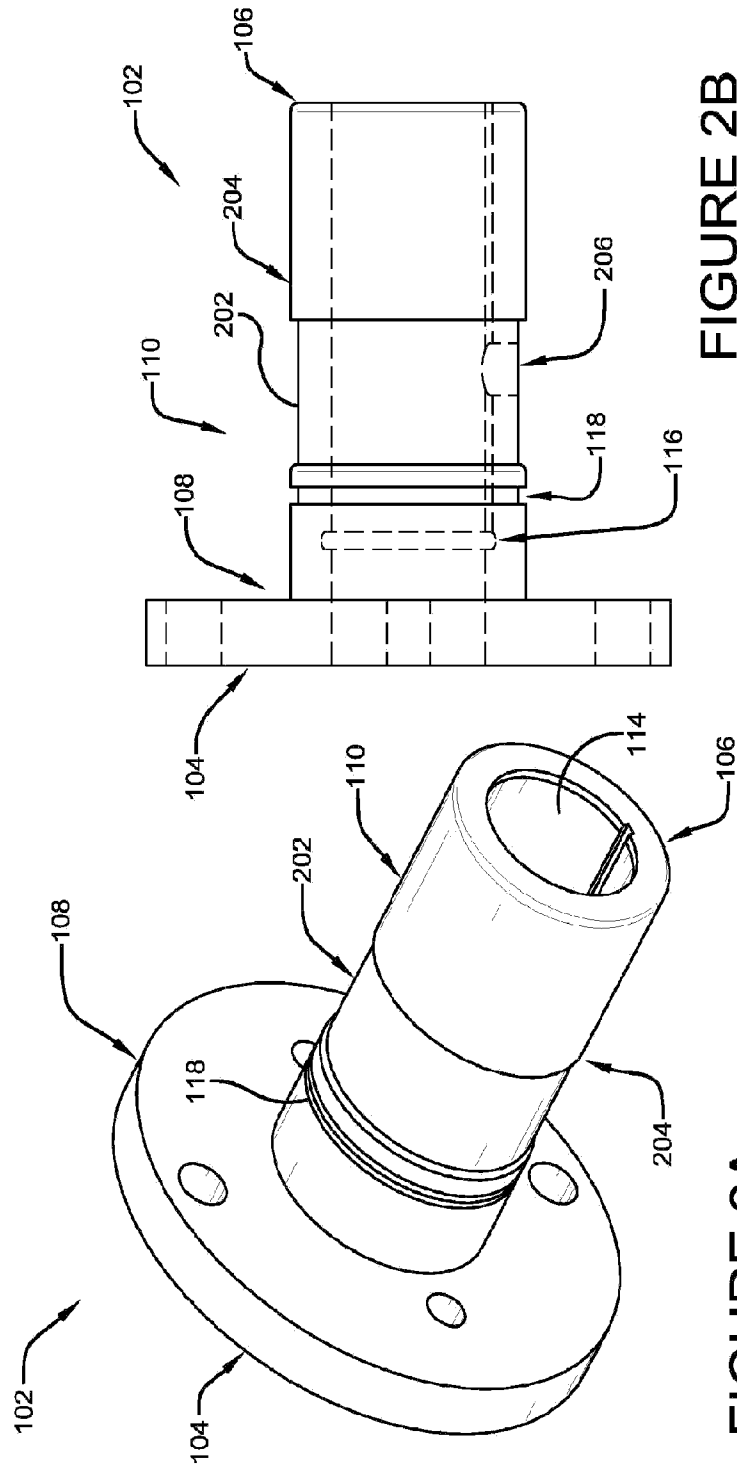


FIGURE 2A

FIGURE 2B

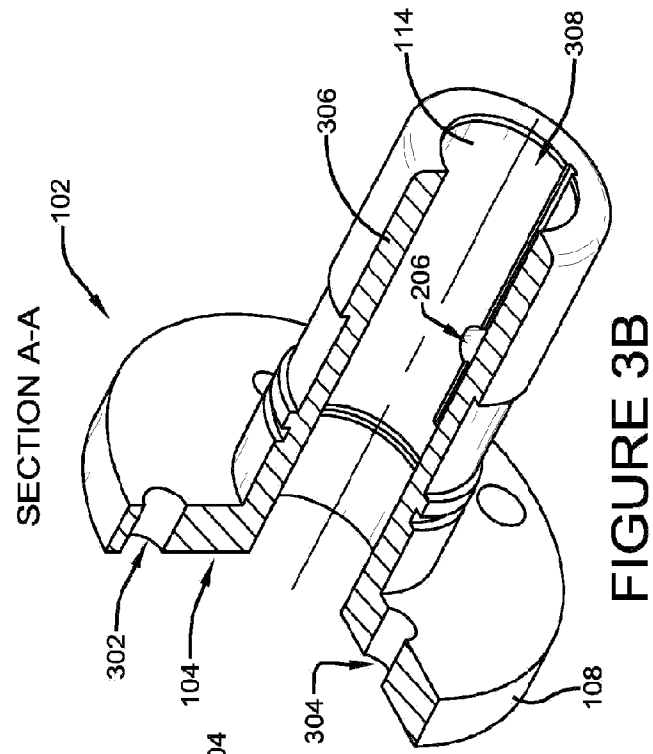
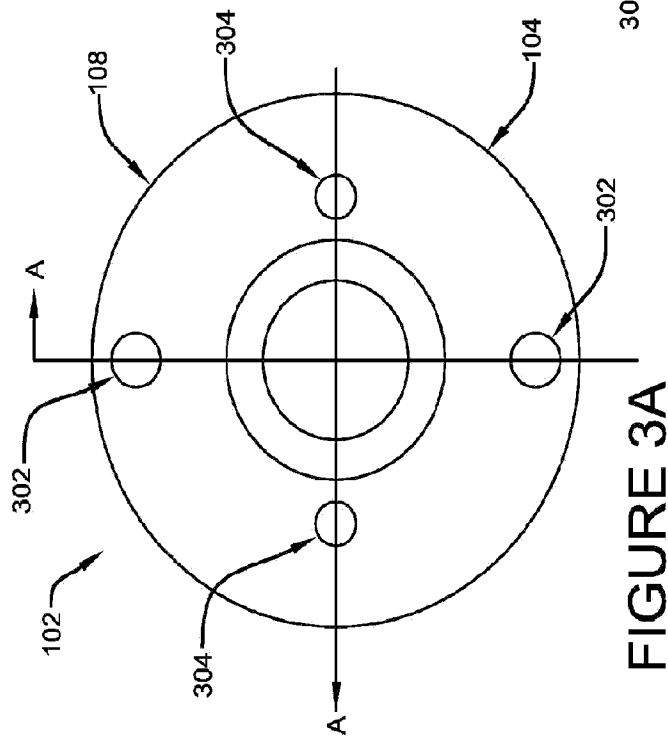


FIGURE 3B

FIGURE 3A

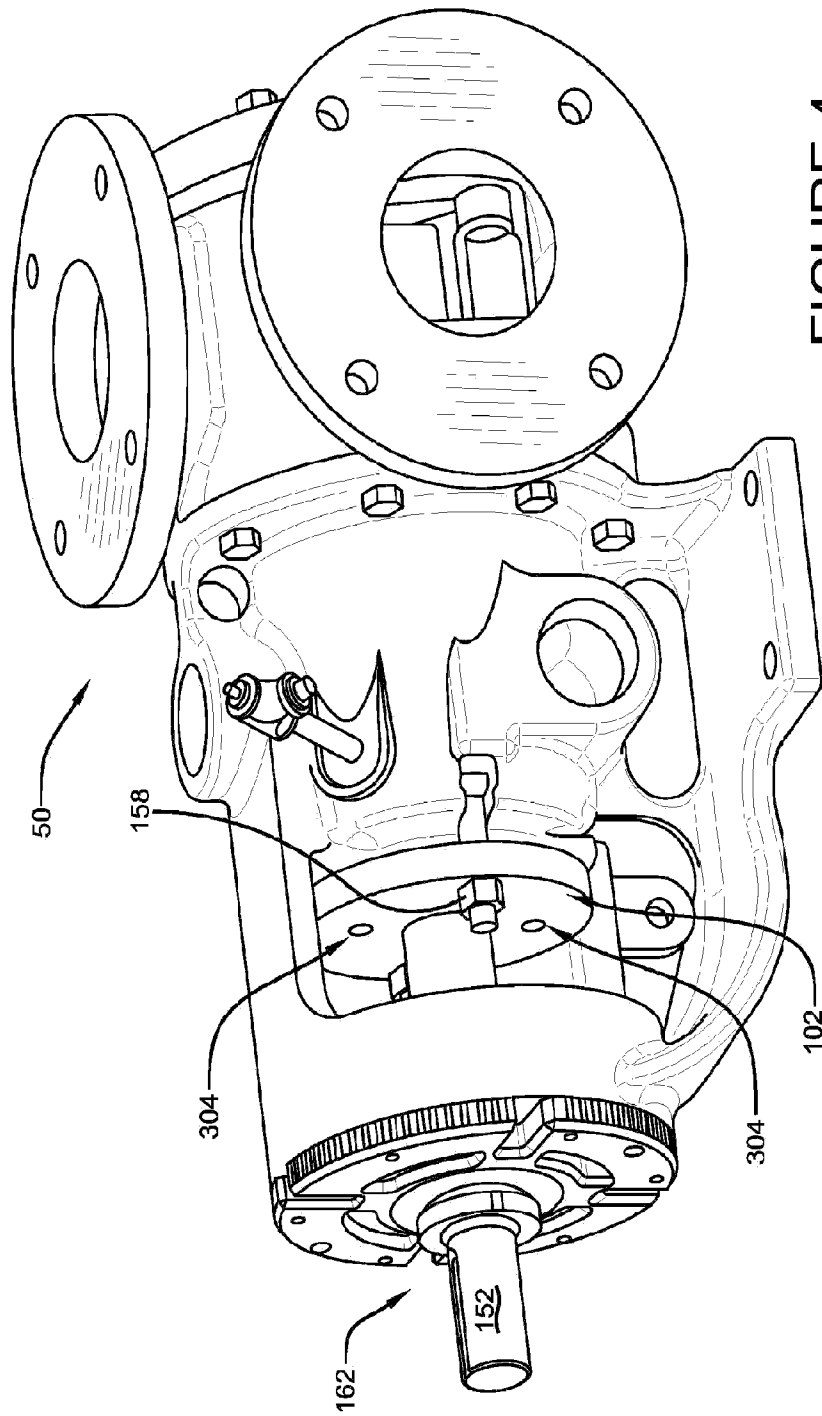


FIGURE 4

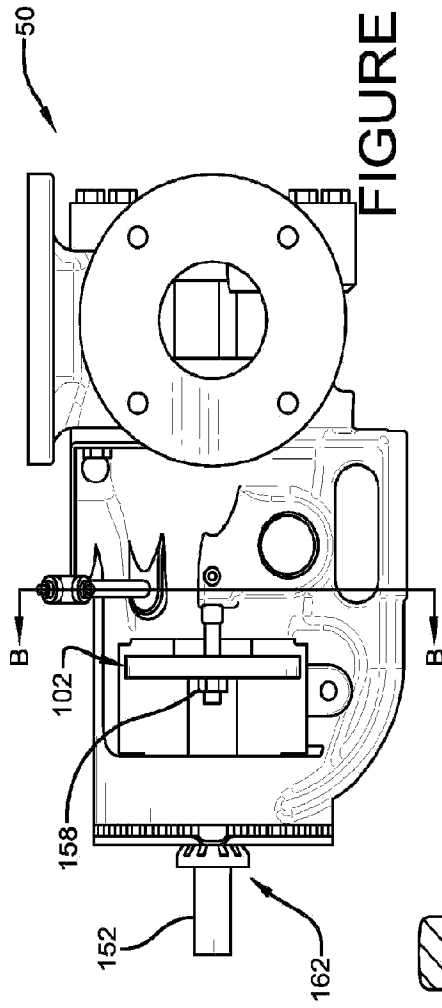


FIGURE 5A

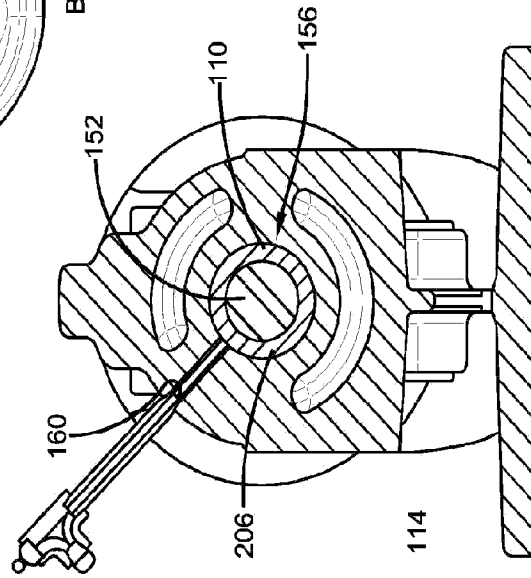


FIGURE 5B

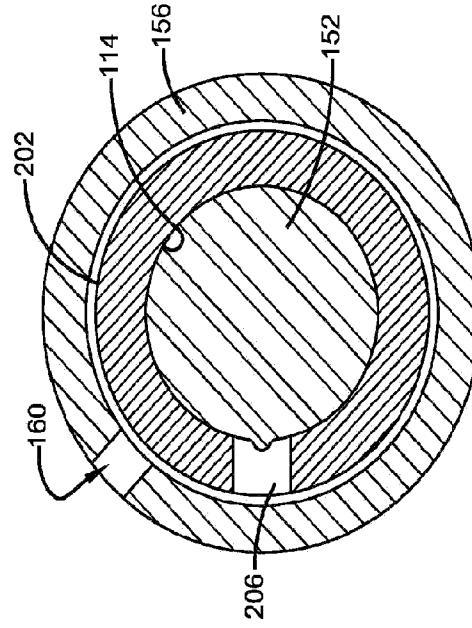


FIGURE 5C

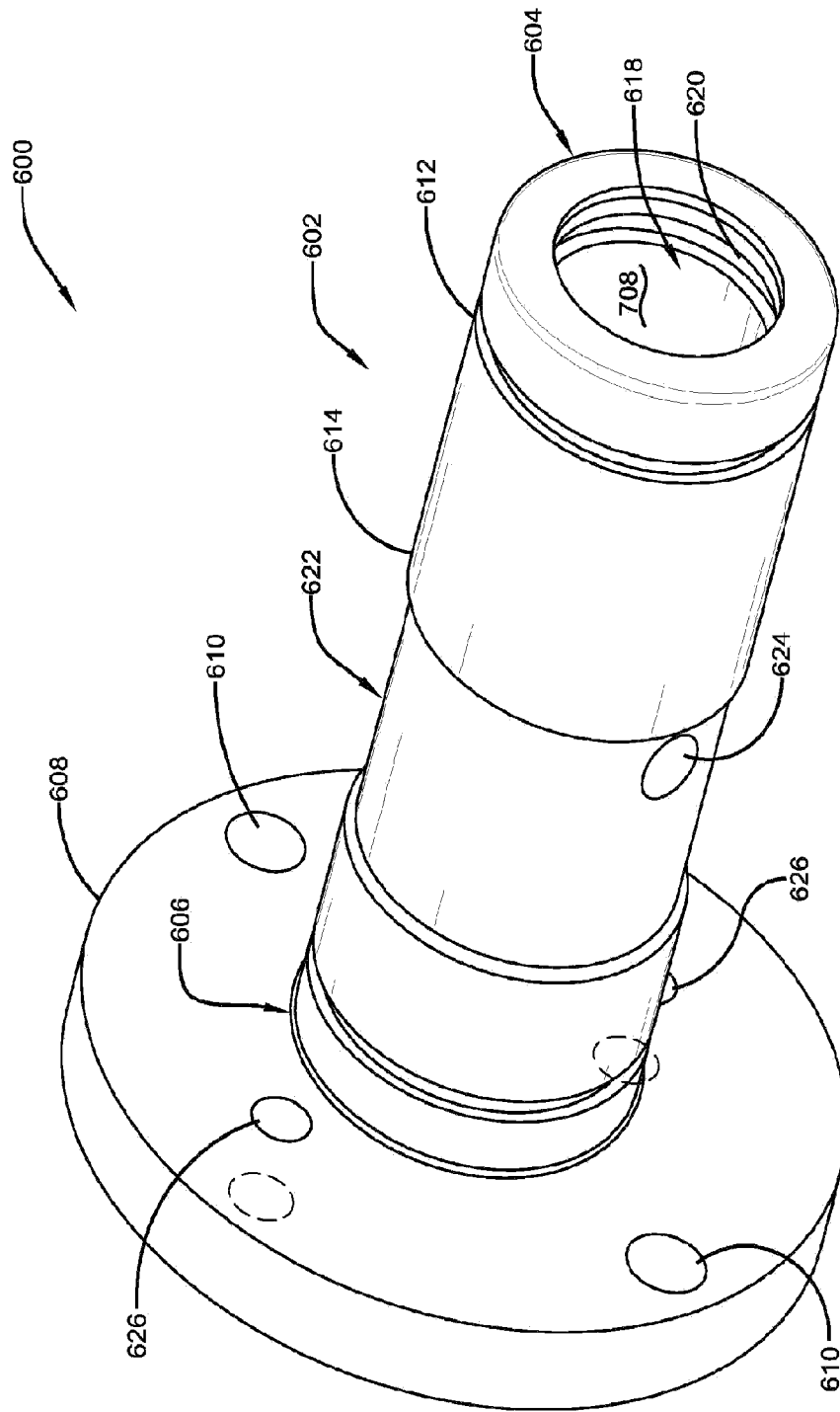
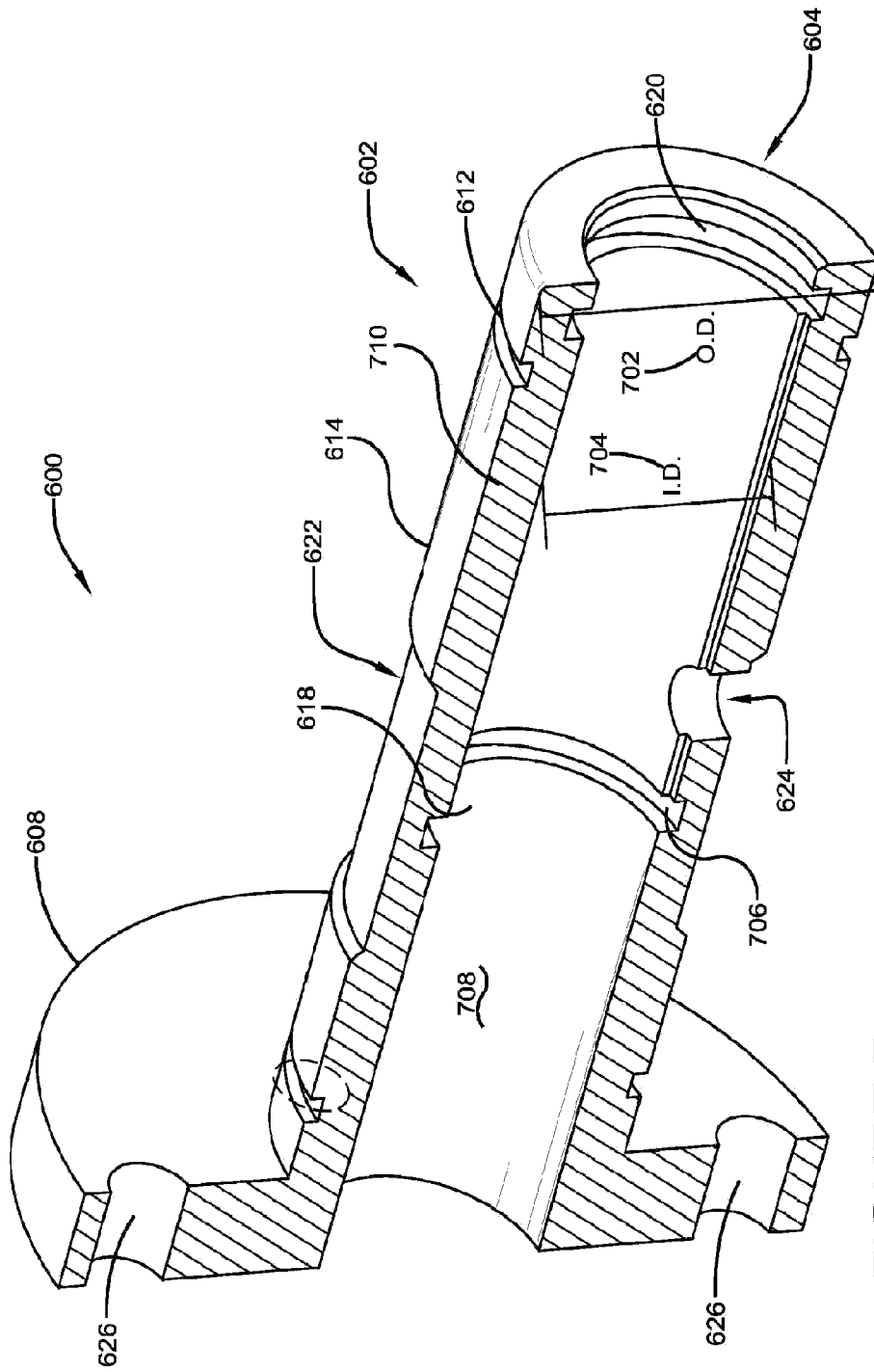


FIGURE 6



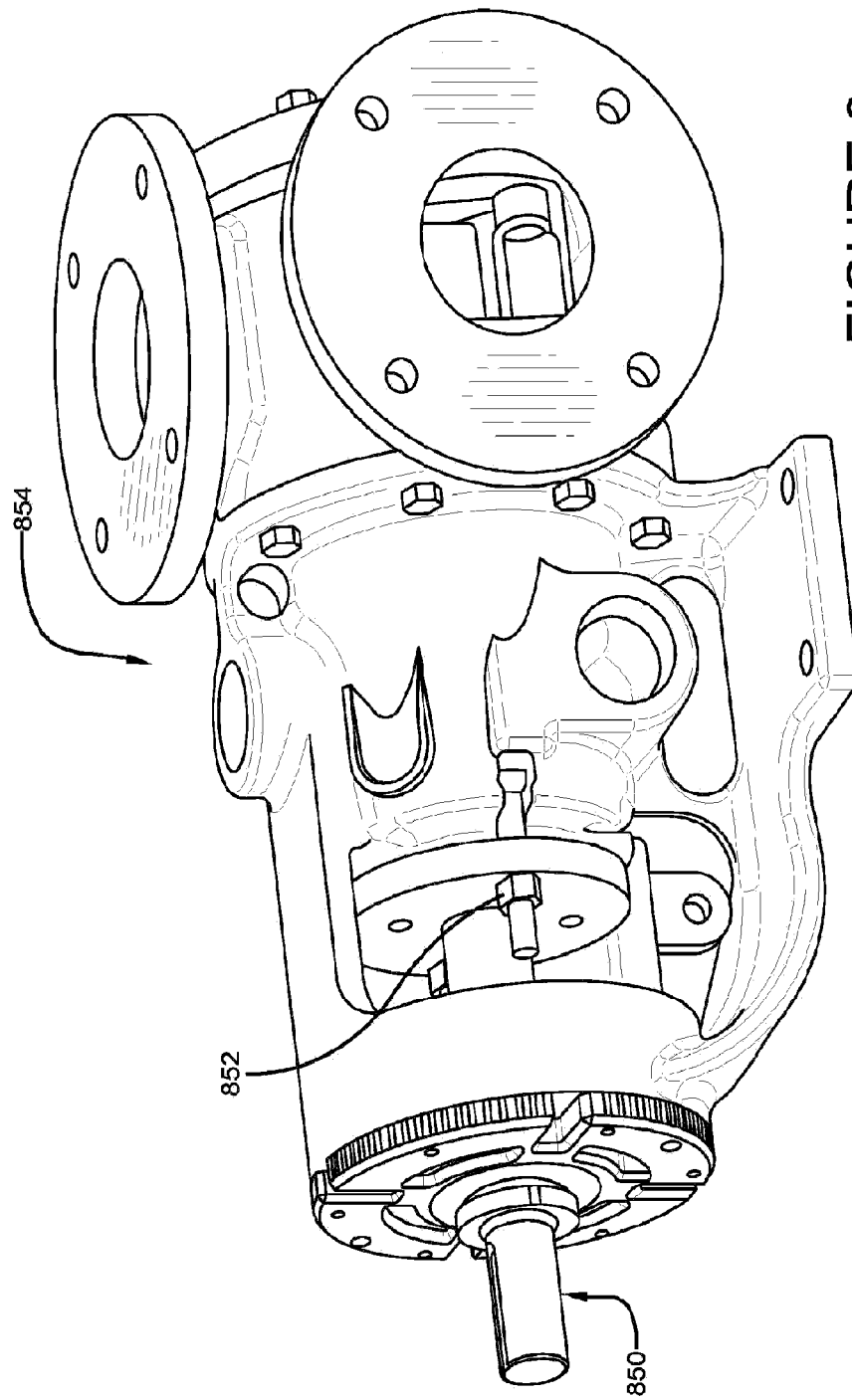
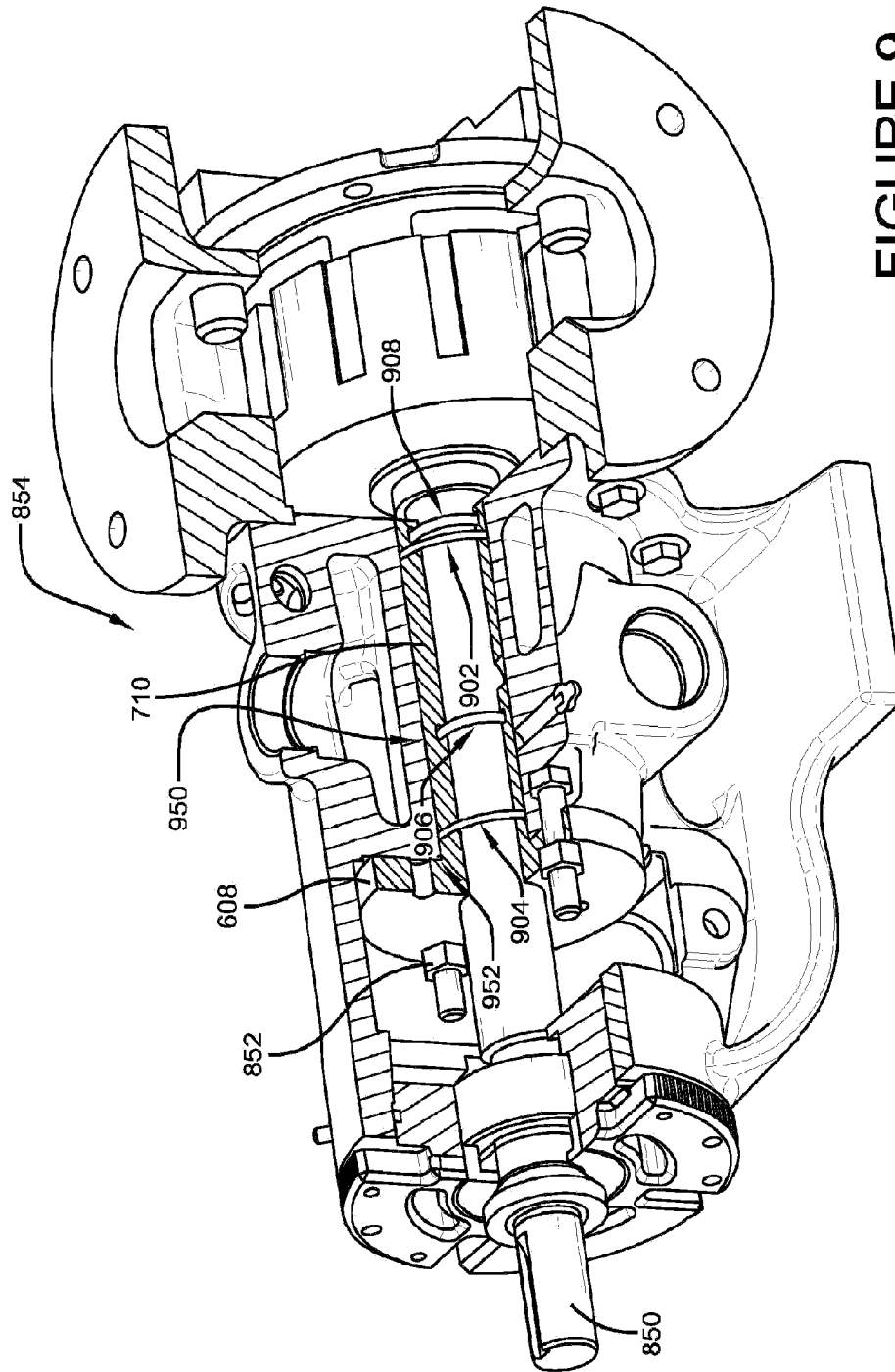


FIGURE 8



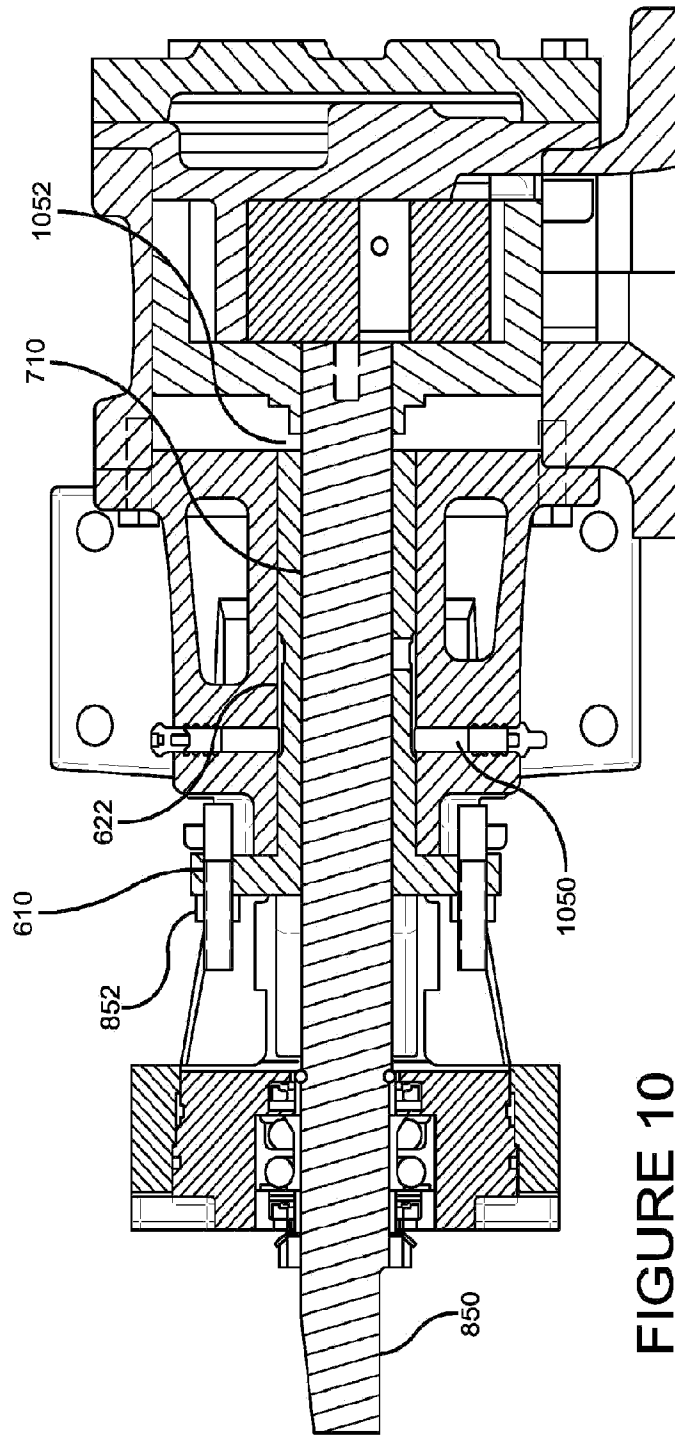


FIGURE 10

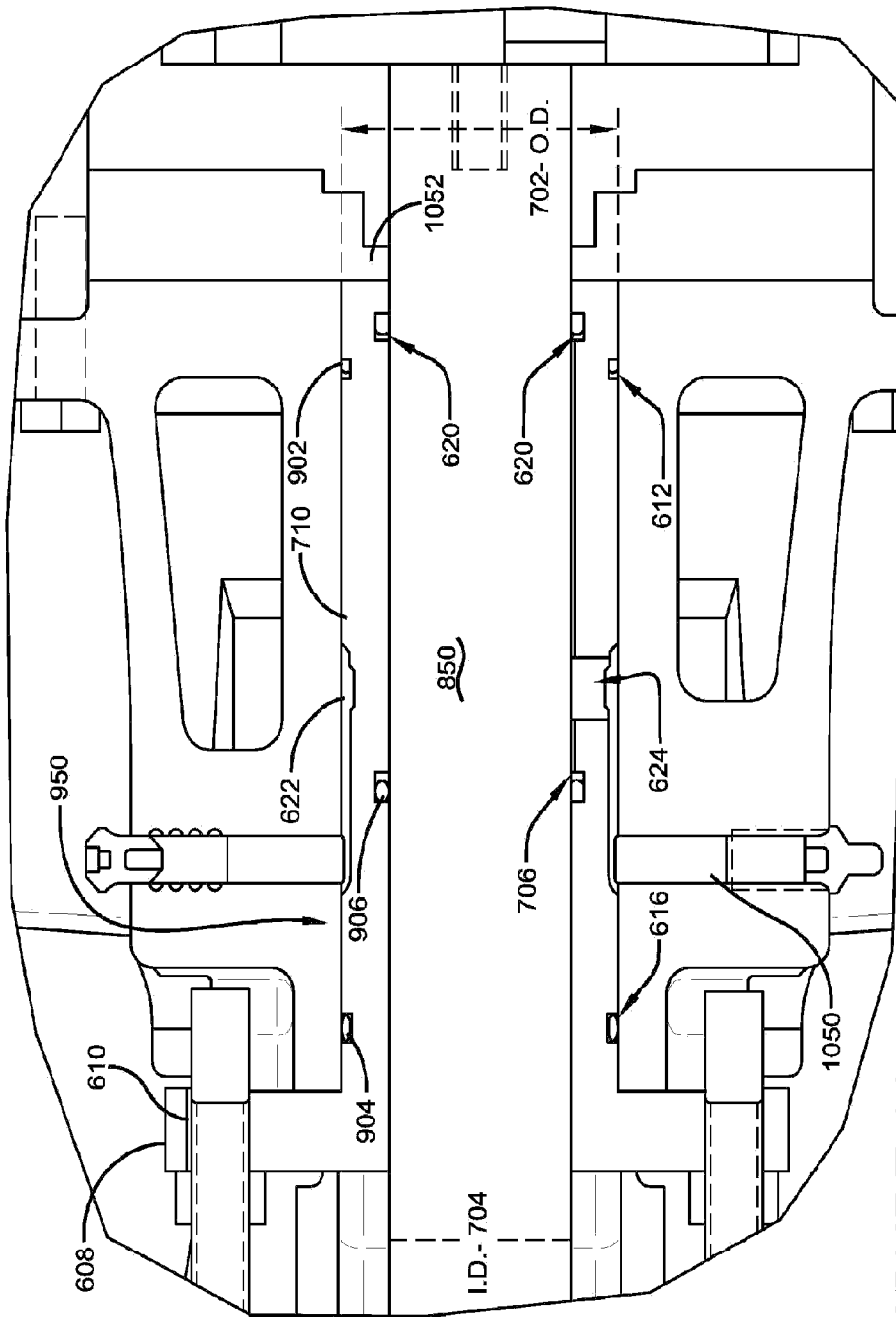


FIGURE 11