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(54) Title: CARRIER FOR PLUNGER DURING DISASSEMBLY

(57) Abstract: A carrier that holds a plunger for a reciprocating pump during maintenance. Maintenance of the pump typically includes repacking of the packing that surrounds the plunger and revalving of the pump's inlet and outlet valve. To allow repacking or revalving, the pump is disassembled and the plunger is removed. The carrier mates with the pump to hold and support weight of the plunger during disassembly, allowing one person to perform pump revalving and repacking.

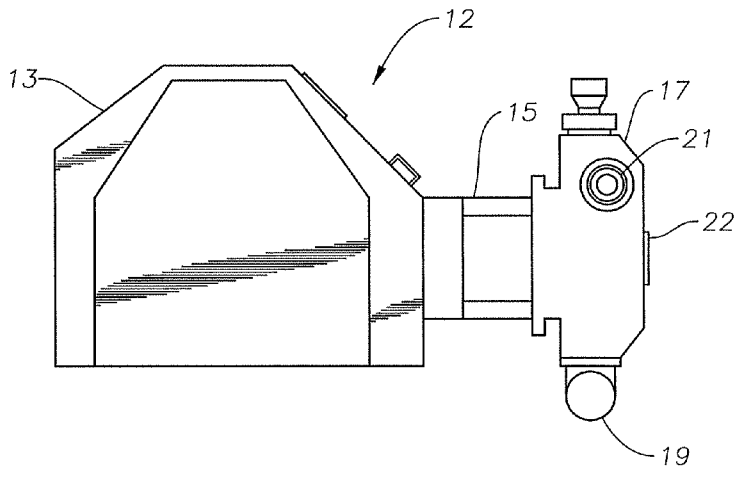

Fig. 1
(Prior Art)

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CARRIER FOR PLUNGER DURING DISASSEMBLY

INVENTORS: HAWES, John E.

Cross-Reference to Related Application

This application claims priority to provisional application 61/221,947, filed June 30, 2009, and is herein incorporated by reference in its entirety.

Field of the Invention

This invention relates in general to plungers used in reciprocating pumps, and, in particular, to a carrier that holds the plunger during maintenance.

Background of the Invention

[0001] Various kinds of pumps can be used in oilfield operations. One type of pump, for example, is a reciprocating pump. The reciprocating pump can be used to pump fluid such as chemicals, cement, or other media into a well. Reciprocating pumps typically increase the pressure within a cylinder by reciprocating a plunger longitudinally within the cylinder. Packing is generally used around the plunger and the plunger reciprocates as a crankshaft located within the pump rotates. As the plunger moves away from the cylinder, the pressure of the fluid inside chamber decreases creating a differential pressure across an inlet valve that allows the fluid to enter the cylinder. As plunger moves longitudinally towards the cylinder, the pressure of the fluid inside of the cylinder increases until the differential pressure across an outlet valve that allows fluid to exit cylinder.

[0002] Maintenance of the pump, typically includes repacking of the packing surrounding the plunger and revalving of the inlet and outlet valves mentioned above. To allow repacking or revalving, the pump is disassembled by removing a suction cover plate and removing the plunger. Additional pump components, such as connecting rods and pony rods may need to be stroked out to push out the plunger. However, the plunger is heavy and requires at least one person to be in position to pull and support the weight of the plunger. Another person would repack and revalve the pump in the meantime. Thus, two people are required to perform maintenance on the pump.

[0003] Thus, a technique would be desired that makes pump maintenance and disassembly safer, less time consuming, and less labor intensive.

Summary of the Invention

[0004] In an embodiment of the present invention, a carrier assembly is connected to a reciprocating pump for supporting a plunger removed from the pump during maintenance or disassembly. A semi-cylindrical mating end can engage a cylinder opening on the pump. The cylinder opening, previously covered by a suction cover plate, has threads on an interior surface. The mating end screws into the cylinder opening, with a semi-cylindrical flange on the mating end being in contact with the exterior of the pump along a periphery of the cylinder opening.

[0005] In an embodiment of the present invention, an upward facing concave surface or nest for receiving and supporting the plunger is connected at one end to the flange of the mating end. The nest is cantilevered and holds and supports the weight of the plunger during maintenance or disassembly of the pump. Further, the nest has approximately a length equal to that of the plunger it supports.

[0006] A hinge runs longitudinally down the middle of the carrier assembly to allow the assembly to fold or pivot about the hinge. Further, the nest may be adjustable to allow handling of varying sizes of plungers. The carrier assembly may be a single piece or fabricated from multiple pieces.

[0007] The carrier assembly thus advantageously provides a safer way to maintain and disassemble pumps because the carrier assembly, and not a person, supports the weight of the plunger. This also results in a less time consuming, and less labor intensive method of maintaining and disassembling the pumps as only one person, as opposed to two, is needed to perform maintenance procedures such as repacking and revalving of the pump.

Brief Description of the Drawings

[0008] Figure 1 is a schematic side view illustration of a prior art reciprocating pump;

[0009] Figure 2 is a sectional view of the pump of FIG. 1;

[0010] Figure 3 is an enlarged perspective view of one embodiment of a carrier connected to a cylinder opening to receive and hold the plunger, constructed in accordance with the invention.

[0011] Figure 4 is an enlarged frontal view of one embodiment of the carrier connected to a cylinder opening to receive and hold the plunger, constructed in accordance with the invention.

Detailed Description of the Invention

[0012] Referring to FIGS. 1 and 2, reciprocating pump assembly or pump 12 includes a crankshaft housing 13 that houses the power portion of reciprocating pump 12. Stay rods 15 connect crankshaft housing 13 to a fluid end 17 having a set of cylinders 37 (FIG. 2). Each cylinder 37 is in communication with a fluid inlet 19 and a fluid outlet 21. As shown in FIG. 2, a suction cover plate 22 connects to an end of each cylinder 37 opposite the crankshaft housing 13. Pump 12 can be free-standing on the ground, can be mounted to a trailer that can be towed between operational sites, or mounted to a skid such as for offshore operations.

[0013] Referring to FIG. 2, a portion of reciprocating pump 12 housed within crankshaft housing 13 is shown. Crankshaft housing 13 houses a crankshaft 25, which is typically mechanically connected to a motor (not shown). The motor rotates crankshaft 25 in order to drive reciprocating pump 12 (FIG. 1). In one embodiment, crankshaft 25 is cammed so that fluid is pumped from each cylinder 37 at alternating times. As is readily appreciable by those skilled in the art, alternating the cycles of pumping fluid from each of cylinders 37 helps minimize the primary, secondary, and tertiary (et al.) forces associated with reciprocating pump 12 (FIG. 1).

[0014] A bull gear 24 is mechanically connected to crankshaft 25 and is rotated by a motor through pinion gear 26. A connector rod 27 is connected to the crankshaft 25 at one end. The connector rod 27 connects to a crosshead 29 through a crosshead wrist pin 31, which holds connector rod 27 longitudinally relative to crosshead 29. The connector rod 27 pivots within the crosshead bushing 34 as crankshaft 25 rotates with the other end of connector rod 27. A pony rod 33 extends from crosshead 29 in a longitudinally opposite direction from crankshaft 25. Connector rod 27 and crosshead 29 convert rotational movement of crankshaft 25 into longitudinal movement of pony rod 33.

[0015] A plunger 35 is connected to pony rod 33 for pumping the fluid passing through cylinder 37. Packing 36 is mounted in the inner diameter of cylinder 37 and surrounds plunger 35. A packing nut 38 is threaded into the cylinder housing 17, and acts to maintain the packing 36 in the proper position within cylinder 37. Cylinder 37 includes an interior or cylinder chamber 39, which is where plunger 35 pressurizes the fluid being pumped by

reciprocating pump 12 (FIG. 1). Cylinder 17 also typically includes an inlet valve 41 and an outlet valve 43. Valves 41 and 43 are usually spring-loaded valves and are actuated by a predetermined differential pressure. Inlet valve 41 actuates to control fluid flow through fluid inlet 19 into cylinder chamber 39, and outlet valve 43 actuates to control fluid flow through fluid outlet 21 from cylinder chamber 39.

[0016] Plunger 35 reciprocates, or moves longitudinally toward and away from cylinder 17, as crankshaft 25 rotates. As plunger 35 moves longitudinally away from cylinder chamber 39, the pressure of the fluid inside chamber 39 decreases creating a differential pressure across inlet valve 41, which actuates valve 41 and allows the fluid to enter cylinder chamber 39 from fluid inlet 19. The fluid being pumped enters cylinder chamber 39 as plunger 35 continues to move longitudinally away from cylinder chamber 39 until the pressure difference between the fluid inside chamber 39 and the fluid in fluid inlet 19 is small enough for inlet valve 41 to actuate to its closed position. As plunger 35 begins to move longitudinally towards cylinder chamber 39, the pressure of the fluid inside of cylinder chamber 39 begins to increase. Fluid pressure inside cylinder chamber 39 continues to increase as plunger 35 approaches cylinder 17 until the differential pressure across outlet valve 43 is large enough to actuate valve 43 and allow the fluid to exit cylinder 17 through fluid outlet 21. In one embodiment, fluid is only pumped across one side of plunger 35, therefore reciprocating pump 12 is a single-acting reciprocating pump.

[0017] Maintenance of the pump 12, typically includes repacking of the packing 36 surrounding the plunger 35 and revalving of the inlet and outlet valves 41, 43. To allow repacking or revalving, the pump 12 is disassembled by removing the suction cover plate 22 and removing the plunger 35. The connector rod 27 and pony rod 33 can be stroked out to push the plunger 35 out the opening 53 (FIG. 3) previously closed by cover plate 22. Repacking and revalving, can thus require two people as the plunger 35 is heavy and someone needs to be in position to pull and support the weight of plunger 35..

[0018] Referring to FIGS. 3 and 4, an embodiment of a carrier assembly 50 is shown. The carrier assembly 50 includes a threaded semi-circular annular mating end 52 shown coaxially set within a correspondingly contoured opening 53. A semi-circular nest 54 is shown in the embodiment of FIG. 3 that is coaxial with and projecting from a side of the mating end 52 outside of the opening 53. The nest 54 is elongated and has an upper surface profiled so the plunger 35 can be set thereon during disassembly. The mating end 52 has a partial set of threads 57 on its outer surface and a semi-cylindrical flanged portion 58 on an end outside of the opening 53. The flanged portion 58 extends radially past the cylinder opening 53 and is

in contact with an exterior of the cylinder housing 17 adjacent the cylinder opening 53. Cylinder opening 53 has a threaded inner radius so the cover plate 22 can be set therein. The partial set of threads 57 on end 52 mate with the threads (not shown) in opening 53. A hinge 56 runs longitudinally along the carrier assembly 50 to allow the assembly 50 to fold longitudinally along the middle. Alternatively, a plurality of hinges can be utilized; optionally, the carrier assembly 50 can be a single piece. The threads 57 on the mating end 52 may engage the threads in the cylinder opening 53 after the suction cover plate 22 is removed. Once the assembly 50 is screwed in place, the nest 54 forms an upward facing, concave surface that can receive and hold the plunger 35 during disassembly. Carrier assembly 50 is thus cantilever supported and may be at least as long as the plunger 35. After maintenance is complete, the plunger 35 can be placed back into the cylinder opening 53 and the carrier assembly 50 can be removed. The suction cover plate 22 can then be placed back in the cylinder opening 53.

[0019] In an additional embodiment, the carrier assembly 50 is fabricated from multiple pieces, with the mating end 52 being separate from the nest 54.

[0020] In another embodiment (not shown), the mating end 52 is not threaded. Instead a hinge is located at the cylinder opening 53 to mate with a hinge on the mating end 52.

[0021] In another embodiment (not shown), a plurality of vertical ribs or protrusions are formed on either side of the cylinder opening 53. A plurality of slots formed on the mating end 52 can slidingly engage the ribs to support the carrier assembly 50.

[0022] In another embodiment (not shown), the concave and upward facing surface of the nest 54 may be adjusted to receive plungers 35 of varying size.

[0023] Reciprocating pumps 12 are large, and complex pieces of equipment with many parts that may have to be replaced as they wear out. Making the disassembly safer and less time consuming is thus desirable because it makes pump maintenance safer less labor intensive. By using a carrier assembly 50 that can mate with the cylinder opening 53 and that can hold the plunger 35 during disassembly, the need for two people to remove the plunger 35 is eliminated. Thus, revalving and repacking can be performed by one person.

[0024] This written description uses examples to disclose the invention, including the best mode, and also enable a person of ordinary skill in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. These embodiments are not intended to limit the scope of the invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have

structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

WHAT IS CLAIMED IS:

1. A carrier assembly for maintenance of a reciprocating pump, comprising:

a semi-circular mating end adapted to engage a cylinder opening on the pump,

a flange that projects radially outward from the mating end and past the cylinder opening; and

a semi-circular nest projecting axially from a portion of the flange and away from the cylinder opening having an upward facing concave surface for receiving and supporting a plunger removed from within the pump.

2. The carrier assembly of claim 1, further comprising a hinge that that runs longitudinally along the carrier assembly.

3. The carrier assembly of claim 2, wherein the hinge comprises a plurality of hinges that run longitudinally along the middle of the mating end, flange, and nest to allow the carrier assembly to pivot along the middle.

4. The carrier assembly of claim 1, wherein the mating end, flange, and nest are fabricated as a single piece.

5. The carrier assembly of claim 1, wherein the mating end, flange, and nest are fabricated as multiple pieces.

6. The carrier assembly of claim 1, wherein the mating end has threads on an exterior surface for threadingly engaging corresponding threads on an interior cylindrical surface of the cylinder opening.

7. The carrier assembly of claim 1, wherein the nest is adjustable to receive plungers of varying size.

8. The carrier assembly of claim 1, wherein the nest is cantilevered from the mating end.

9. The carrier assembly of claim 1, wherein the nest has a length approximately equal to a length of the plunger it supports.

10. The carrier assembly of claim 1, wherein the flange has an outer diameter that is larger than an outer diameter of the cylinder opening.

11. A carrier assembly for maintenance of a pump, comprising:

a semi-cylindrical mating end adapted to engage a cylinder opening on the pump, the mating end having a threaded outer diameter for threadingly engaging corresponding threads on an interior surface of the cylinder opening,

a semi-cylindrical flange on the mating end and in contact with the exterior of the pump, the flange having an outer diameter larger than an outer diameter of the cylinder opening;

an upward facing nest for receiving and supporting a plunger removed from within the pump, the nest being cantilevered from one end to the flange; and

a hinge that that runs longitudinally along the middle of the mating end, flange, and nest to allow the carrier assembly to pivot along the middle.

12. The carrier assembly of claim 11, wherein the mating end, flange, and nest are fabricated as a single piece.

13. The carrier assembly of claim 11, wherein the mating end, flange, and nest are fabricated as multiple pieces.

14. The carrier assembly of claim 11, wherein the nest is adjustable to receive plungers of varying size.

15. The carrier assembly of claim 1, wherein the nest has a length approximately equal a length of the plunger it supports.

16. A method for supporting a pump plunger during maintenance or disassembly of a pump, comprising:

removing a suction cover plate from a cylinder opening on the pump;

mating a semi-cylindrical mating end to the cylinder opening on the pump,

removing the plunger from within the pump through the cylinder opening; and

holding and supporting the plunger on an upward facing concave surface connected at one end to the mating end.

17. The method of claim 16, further comprising the steps of:
removing packing surrounding the pump plunger; and
repacking an area surrounding the plunger.

18. The method of claim 16, further comprising the step of revalving an inlet or an outlet valve within the pump;

19. The method of claim 16, wherein the step of mating a semi-cylindrical mating end to the cylinder opening comprises screwing the mating end into the cylinder opening.

20. The method of claim 16, wherein only one person is required to perform the steps of maintenance or disassembly.

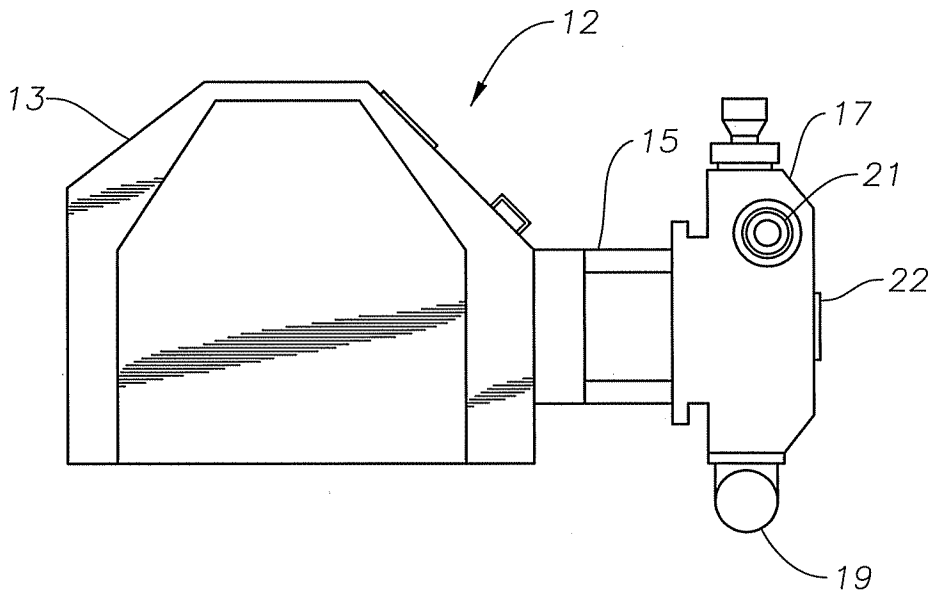

Fig. 1
(Prior Art)

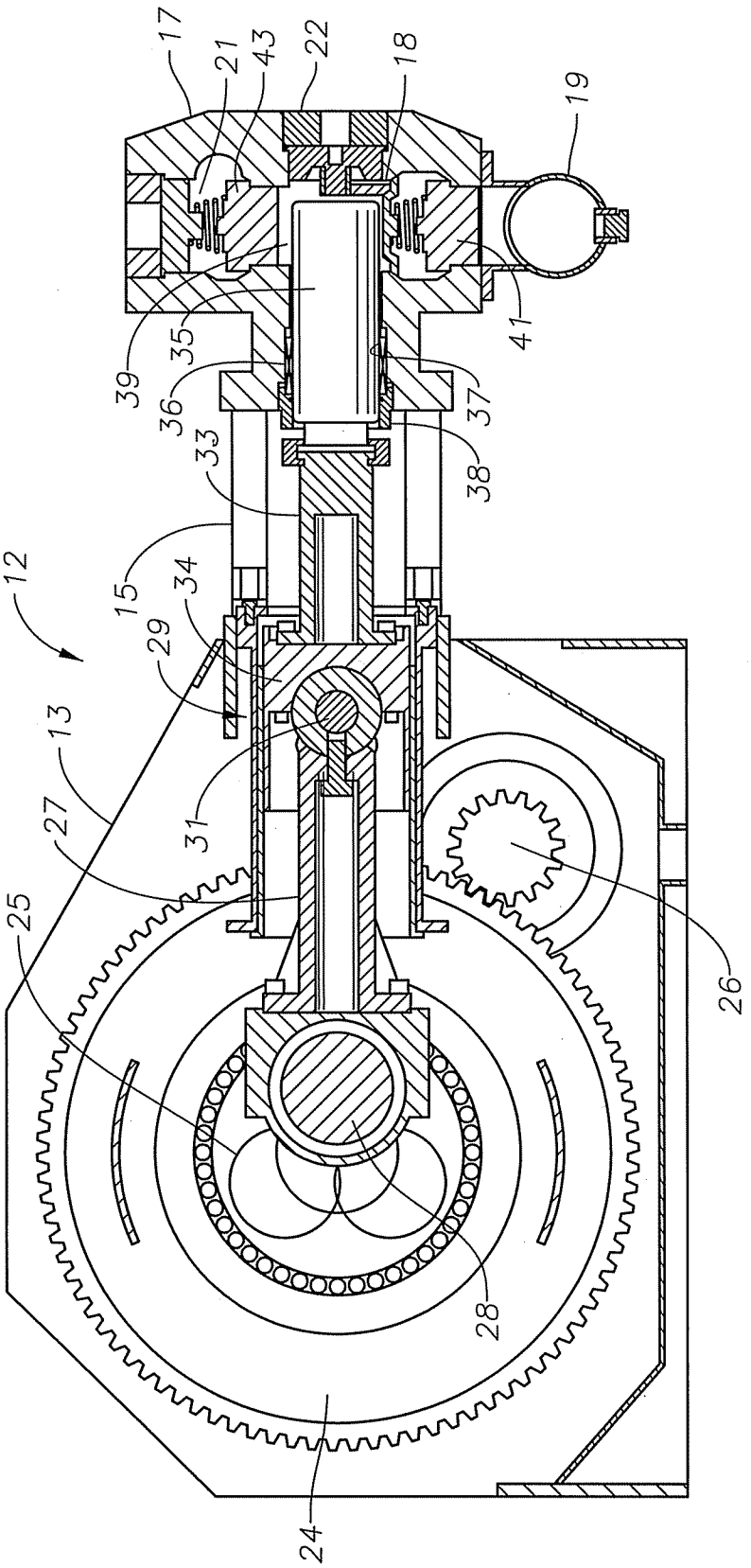

Fig. 2
(Prior Art)

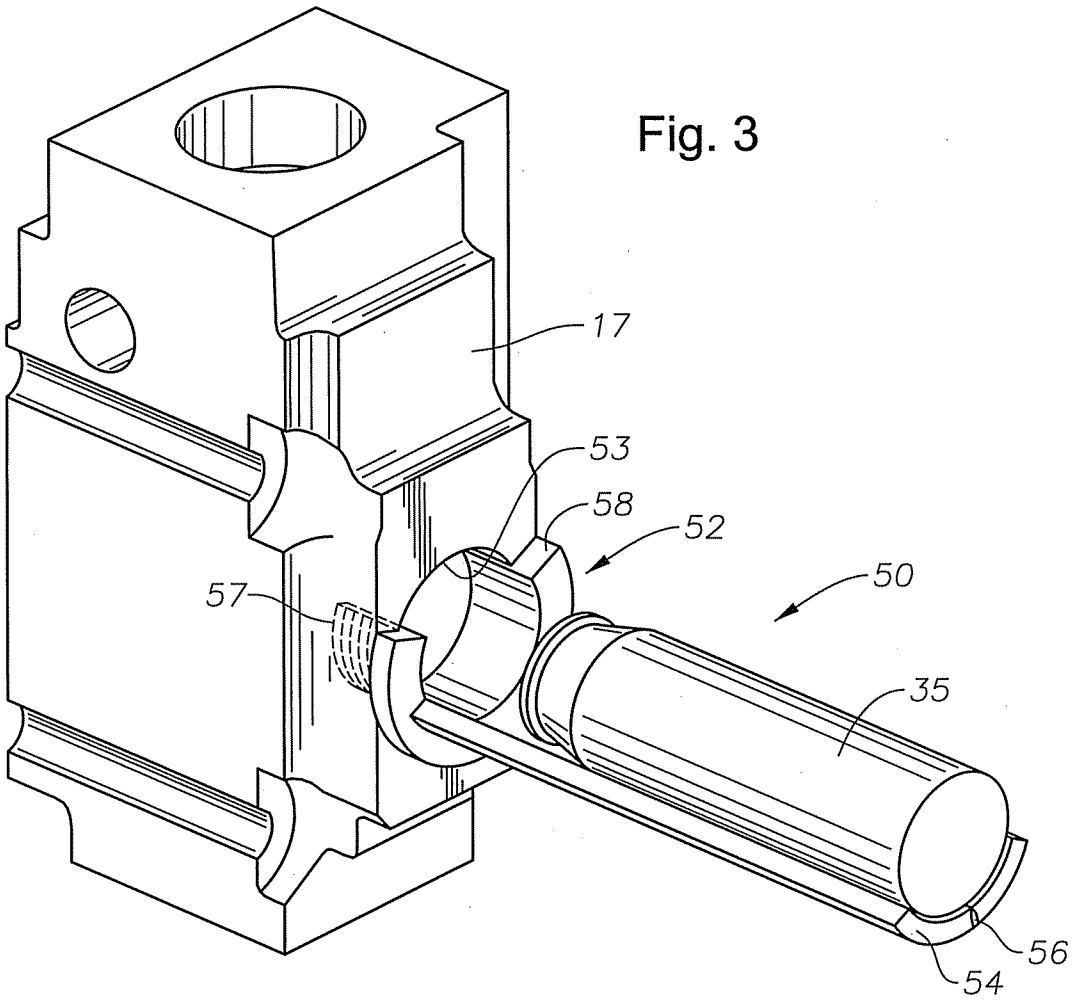

Fig. 3

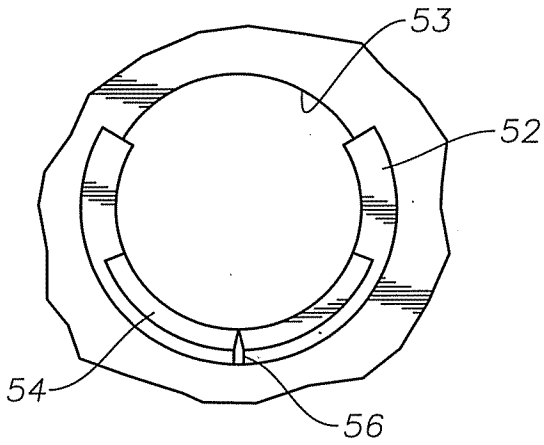

Fig. 4