2-27-2014

METHODS, SYSTEMS, AND DEVICES FOR SURGICAL ACCESS AND INSERTON

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US 20140058205A1

(19) **United States**

(12) **Patent Application Publication**

Frederick et al.

(10) **Pub. No.: US 2014/0058205 A1**

(43) **Pub. Date: Feb. 27, 2014**

(54) **METHODS, SYSTEMS, AND DEVICES FOR SURGICAL ACCESS AND INSERTION**

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(21) Appl. No.: **13/738,706**

(22) Filed: **Jan. 10, 2013**

Related U.S. Application Data

(60) Provisional application No. 61/584,947, filed on Jan. 10, 2012, provisional application No. 61/683,483, filed on Aug. 15, 2012.

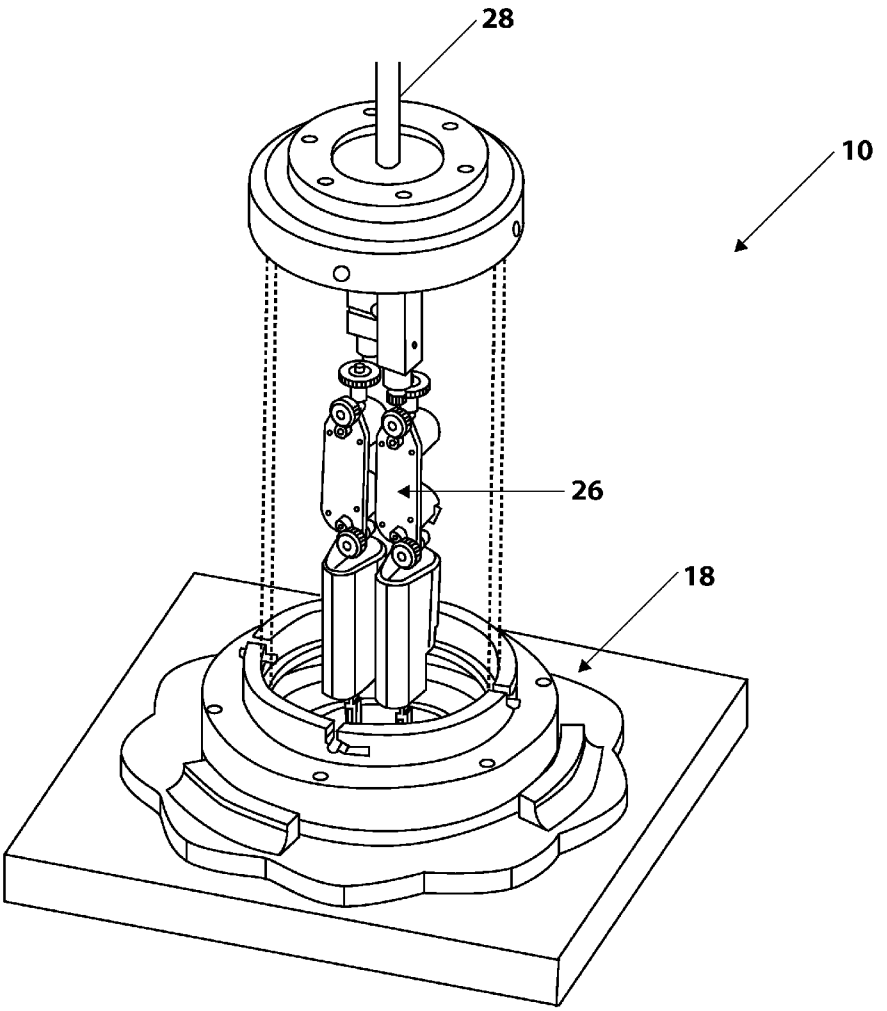
Publication Classification

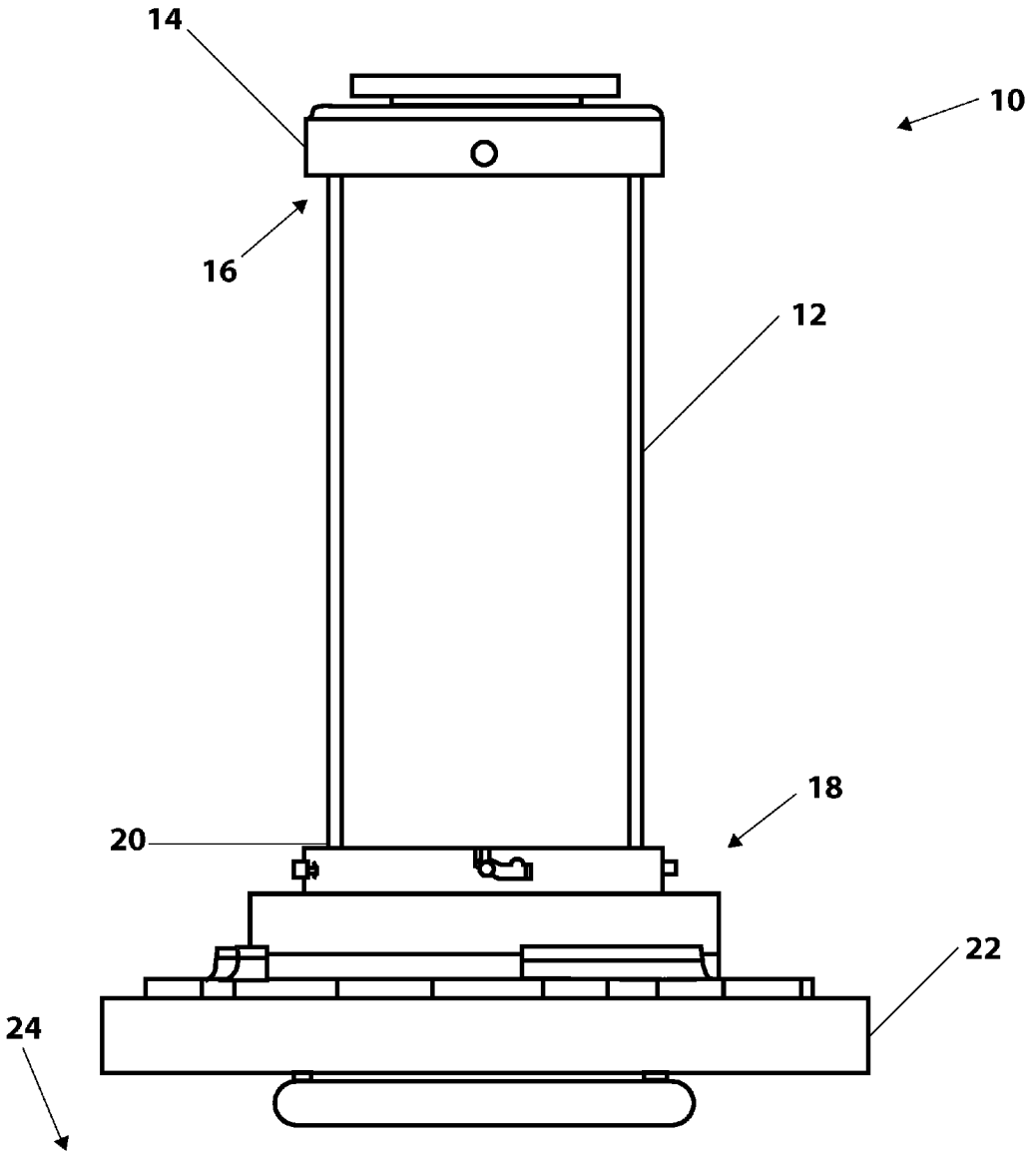
(51) **Int. Cl.**
A61B 17/02 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 17/0218*** (2013.01)
USPC **600/202**; 600/208

(57) **ABSTRACT**

The various embodiments herein relate to systems, devices, and/or methods relating to surgical procedures, and more specifically for accessing an insufflated cavity of a patient and/or positioning surgical systems or devices into the cavity.





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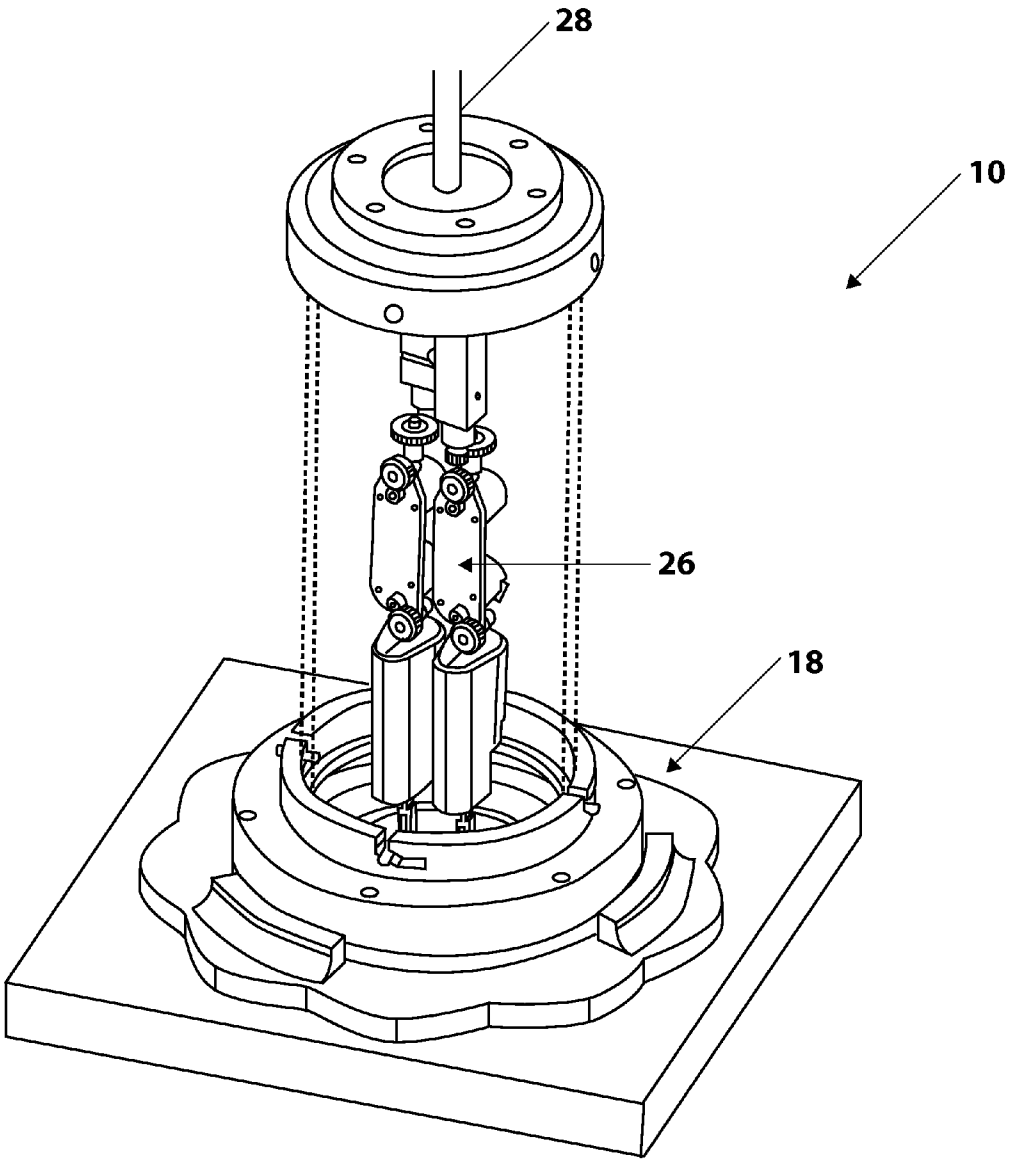
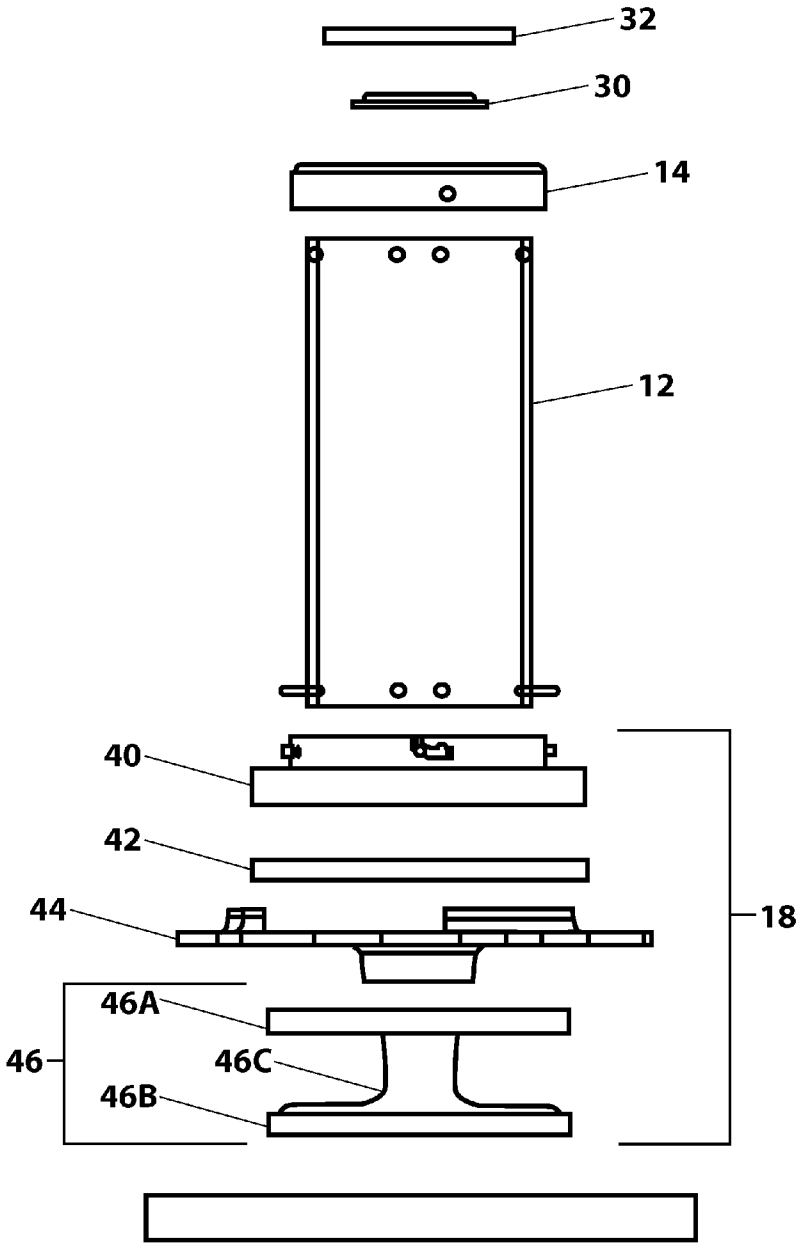


Figure 1B



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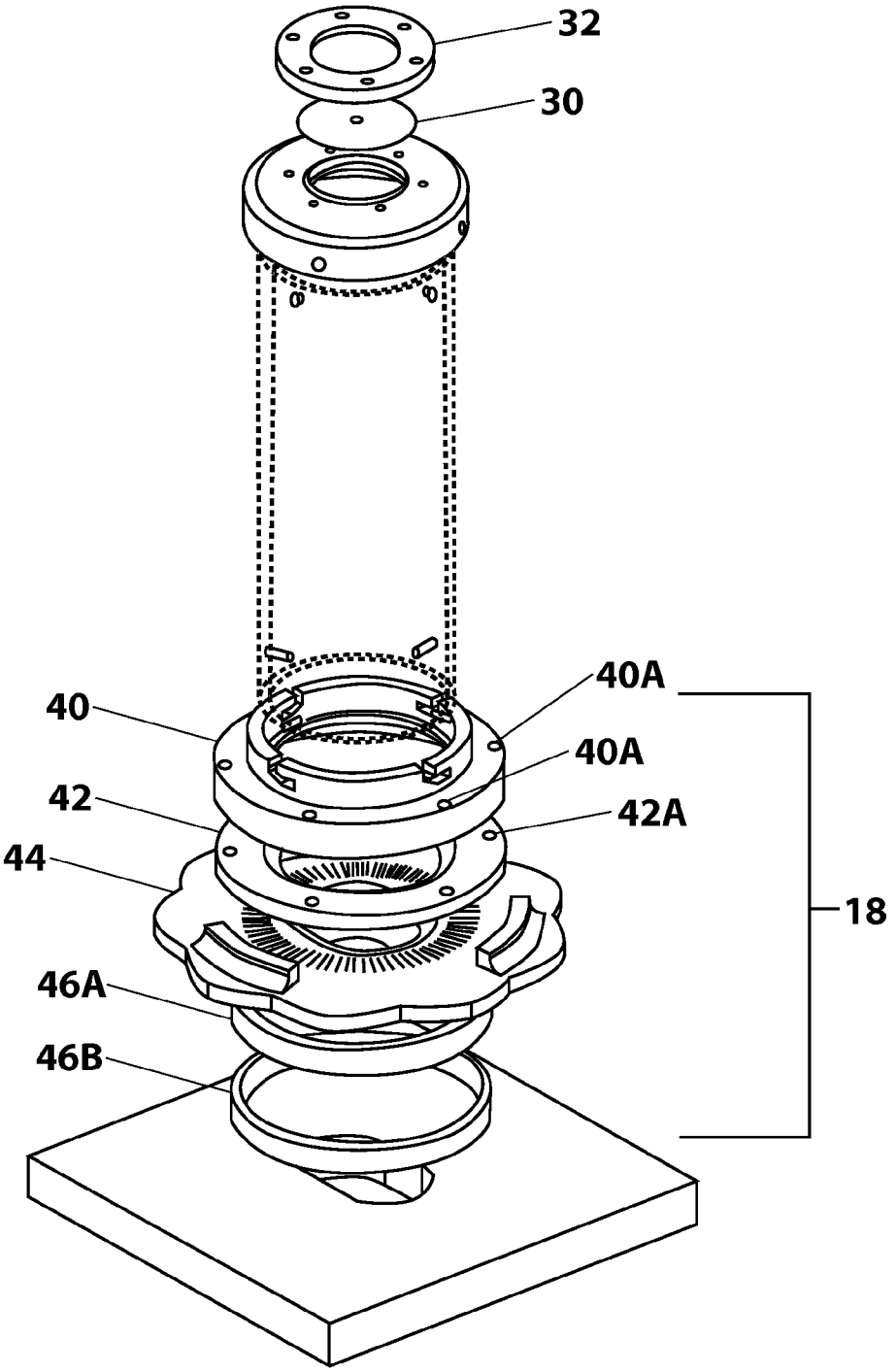

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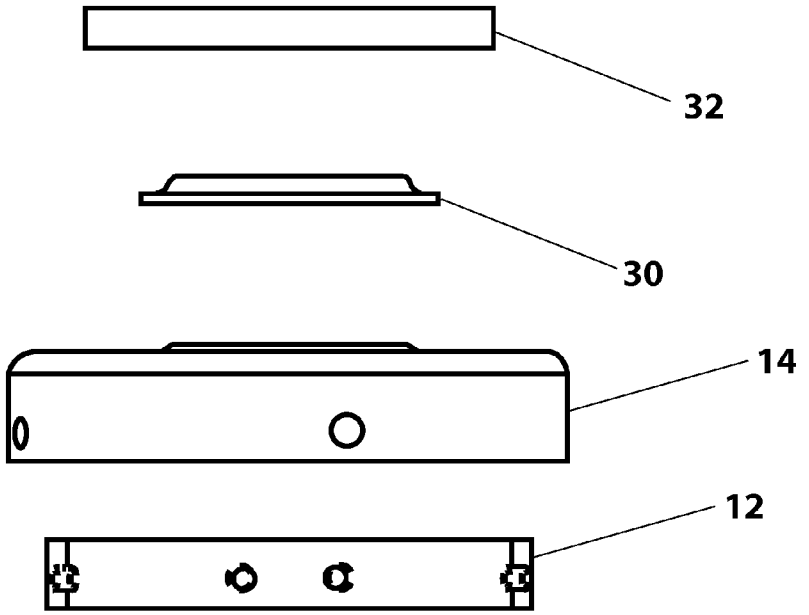

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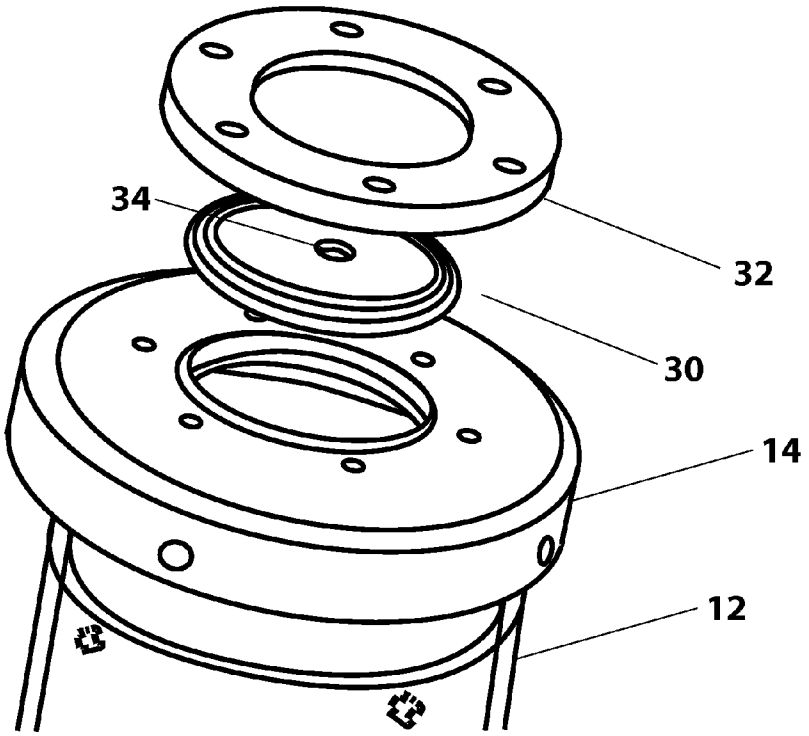

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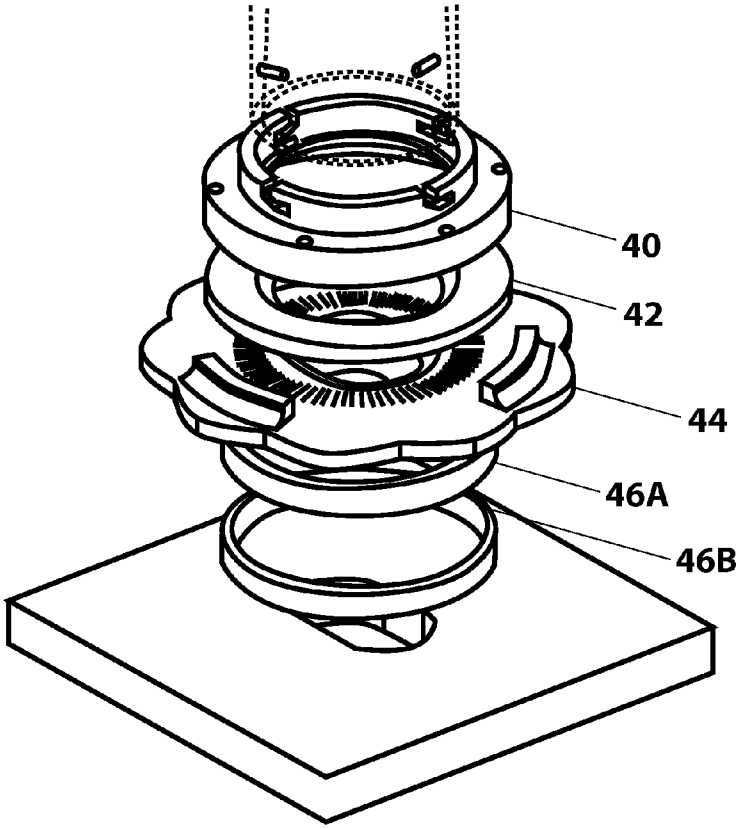

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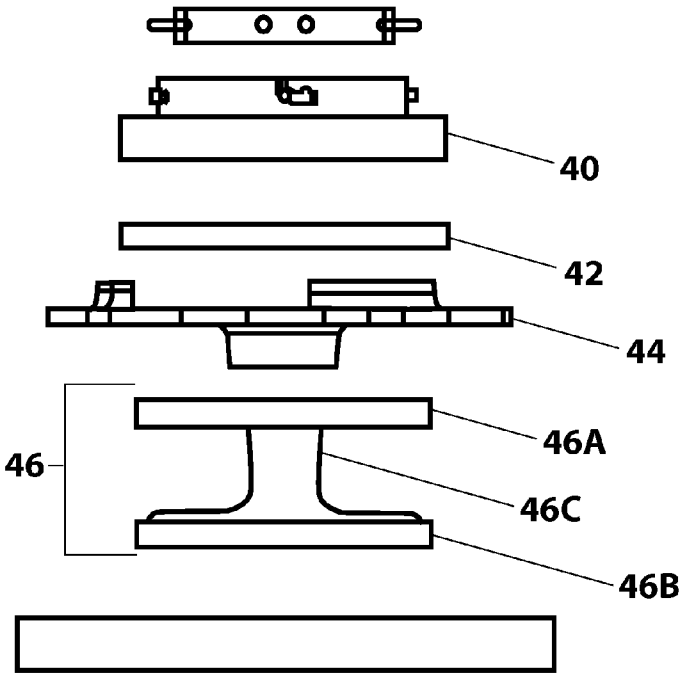

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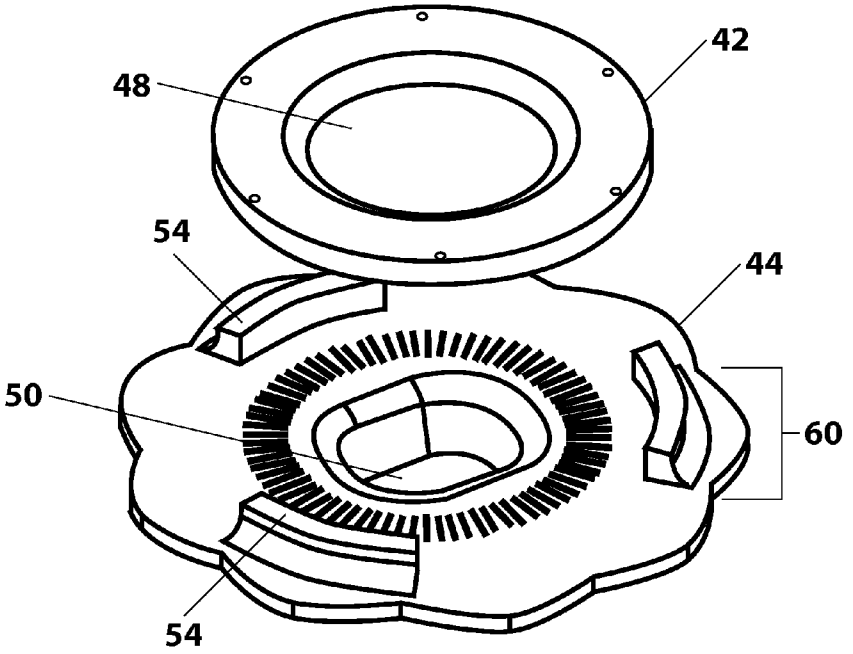

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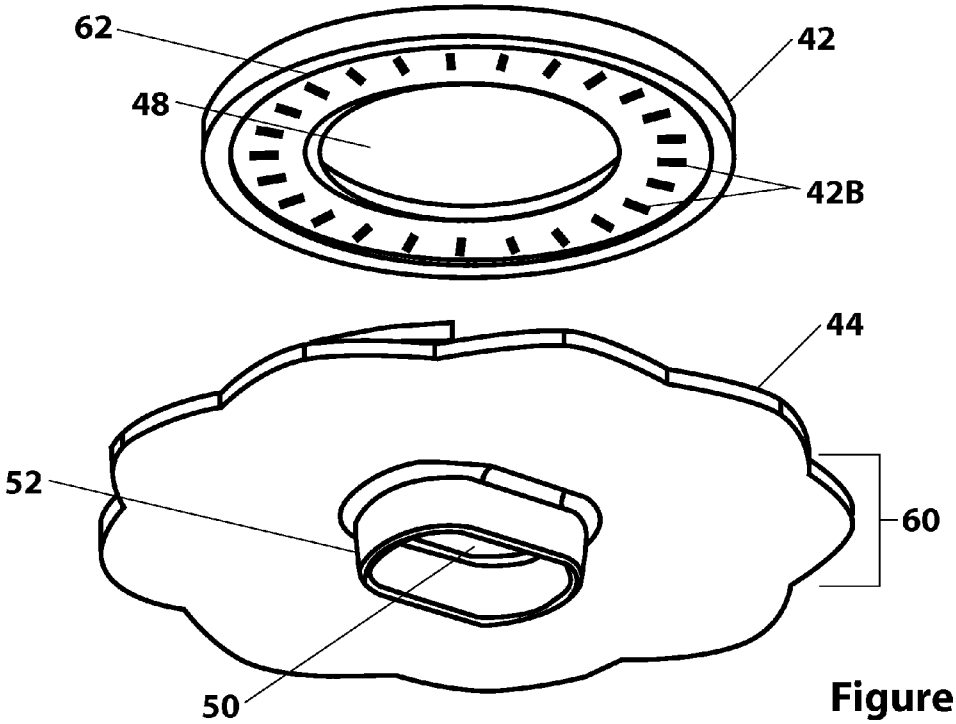

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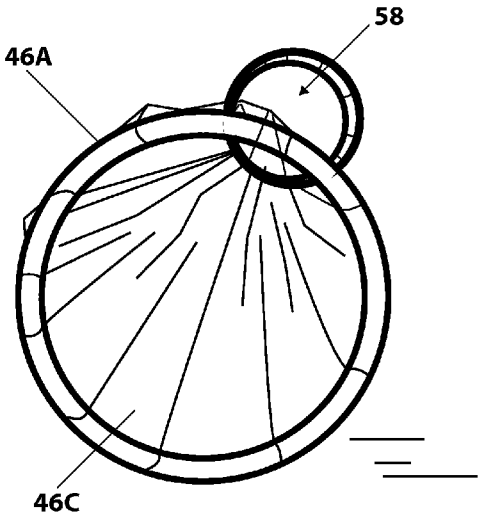

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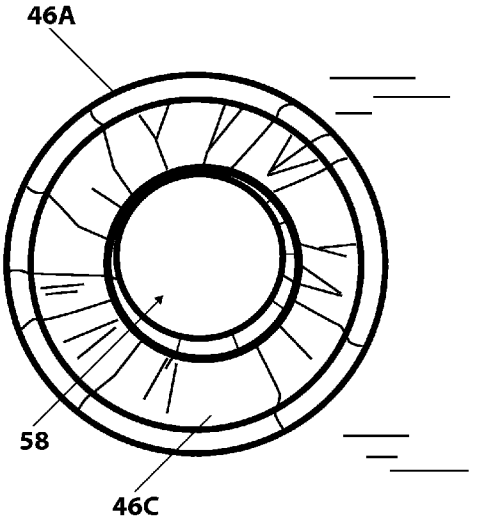

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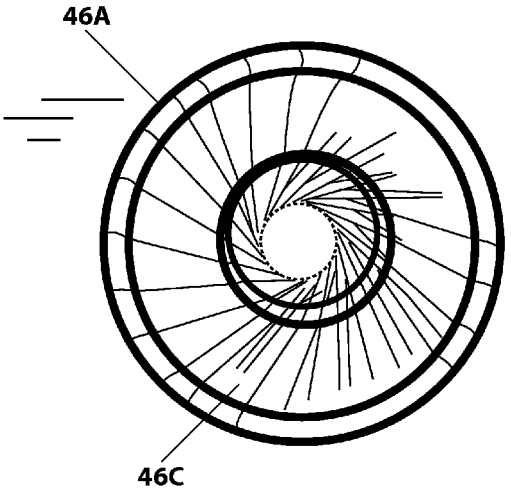

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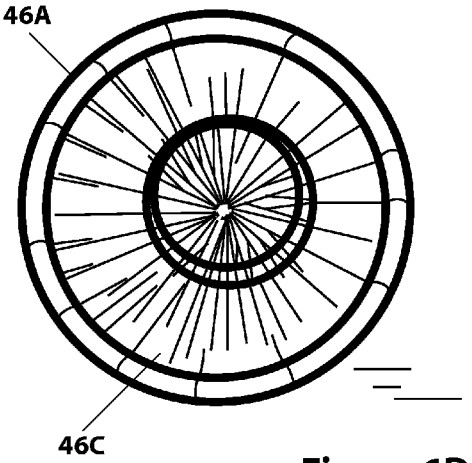

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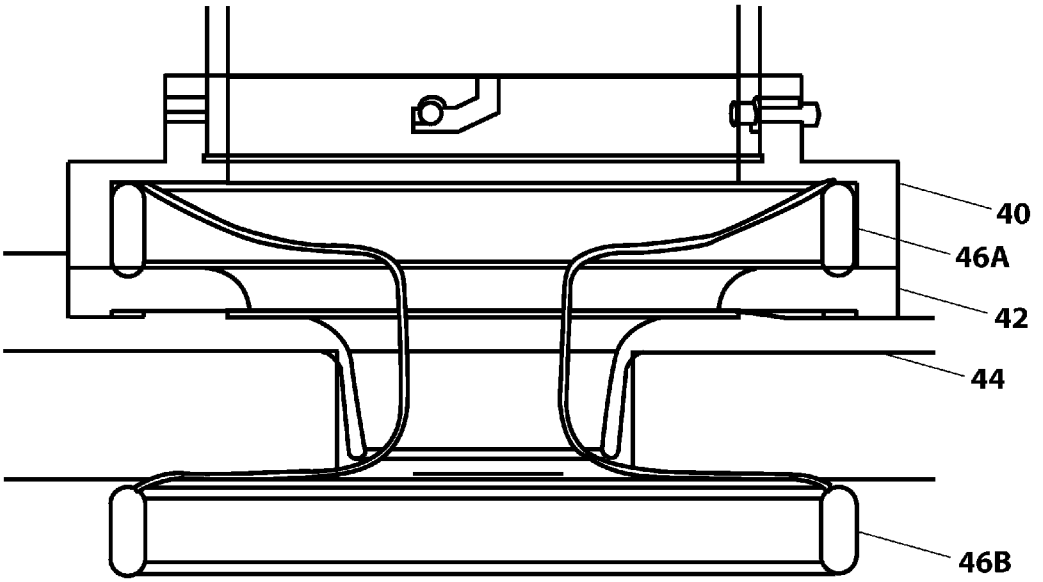

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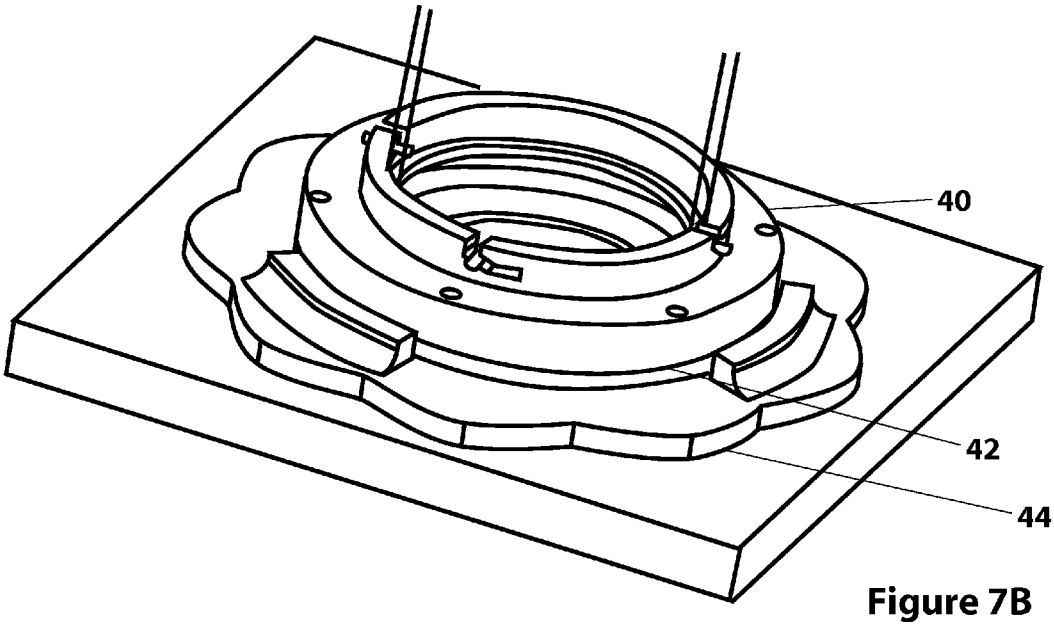

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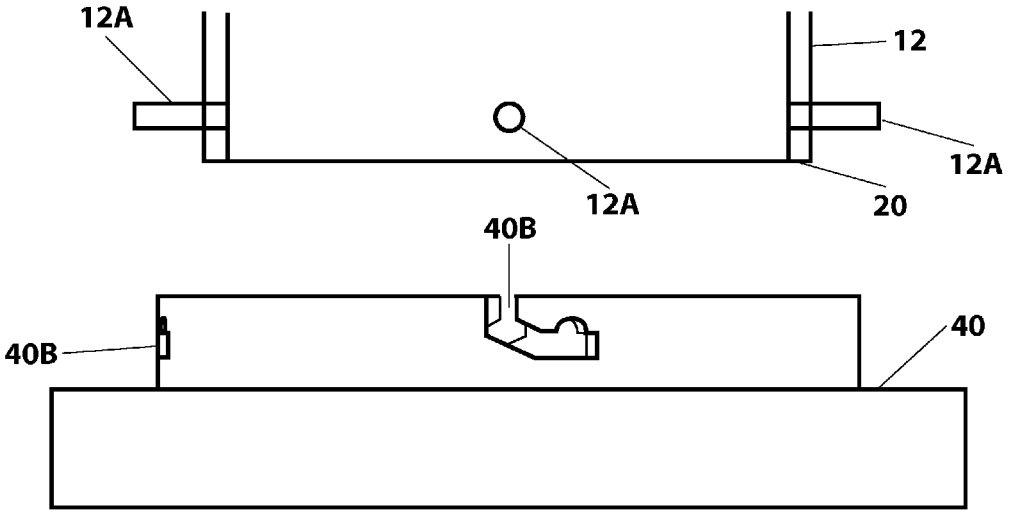

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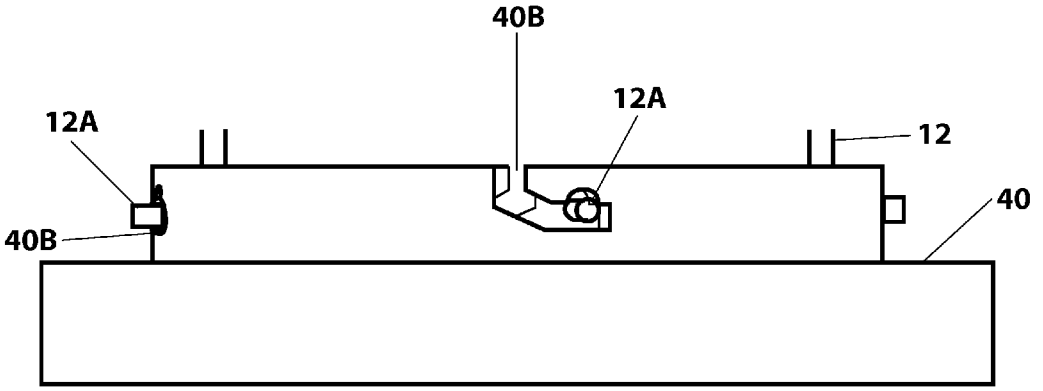

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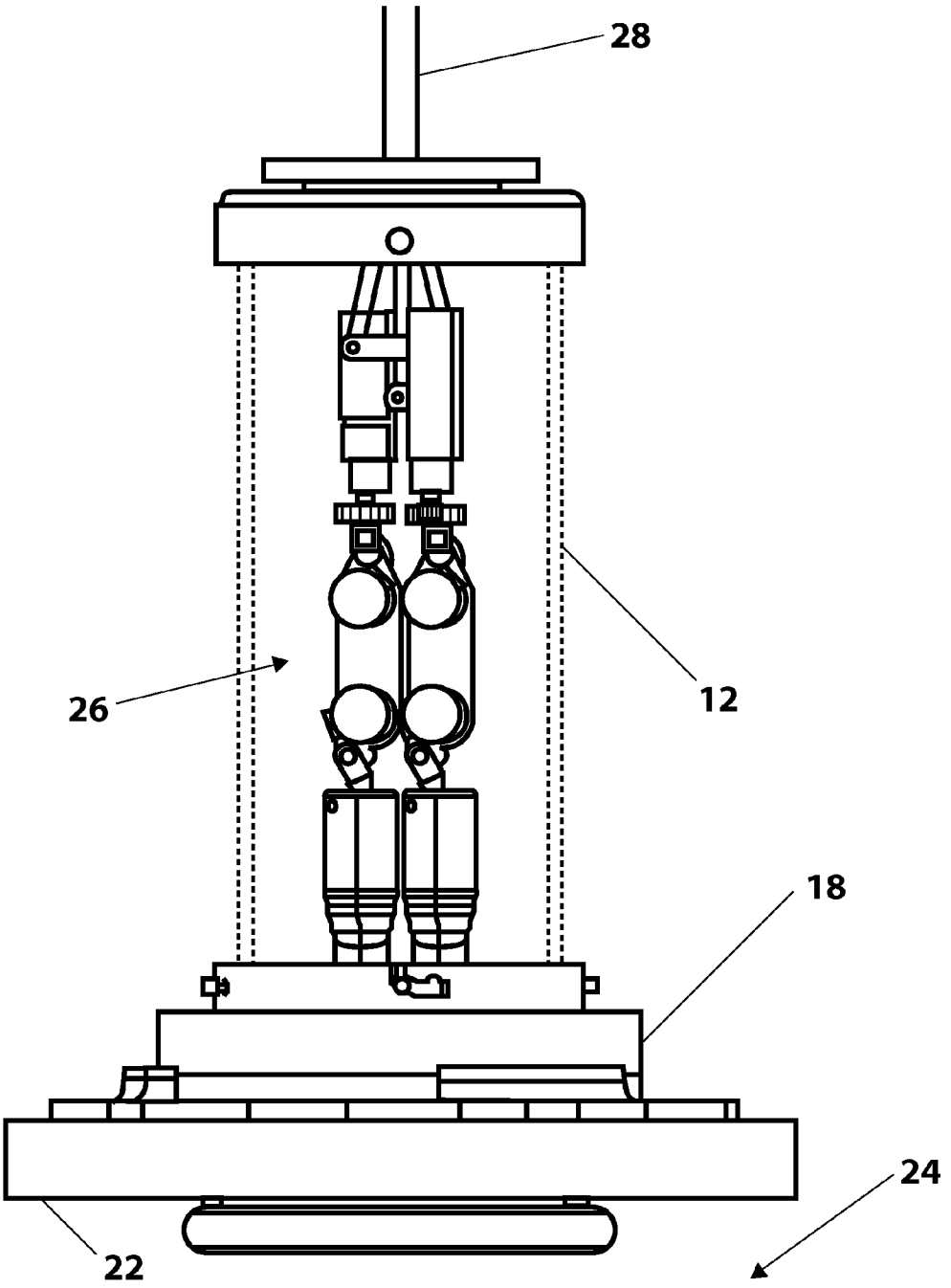

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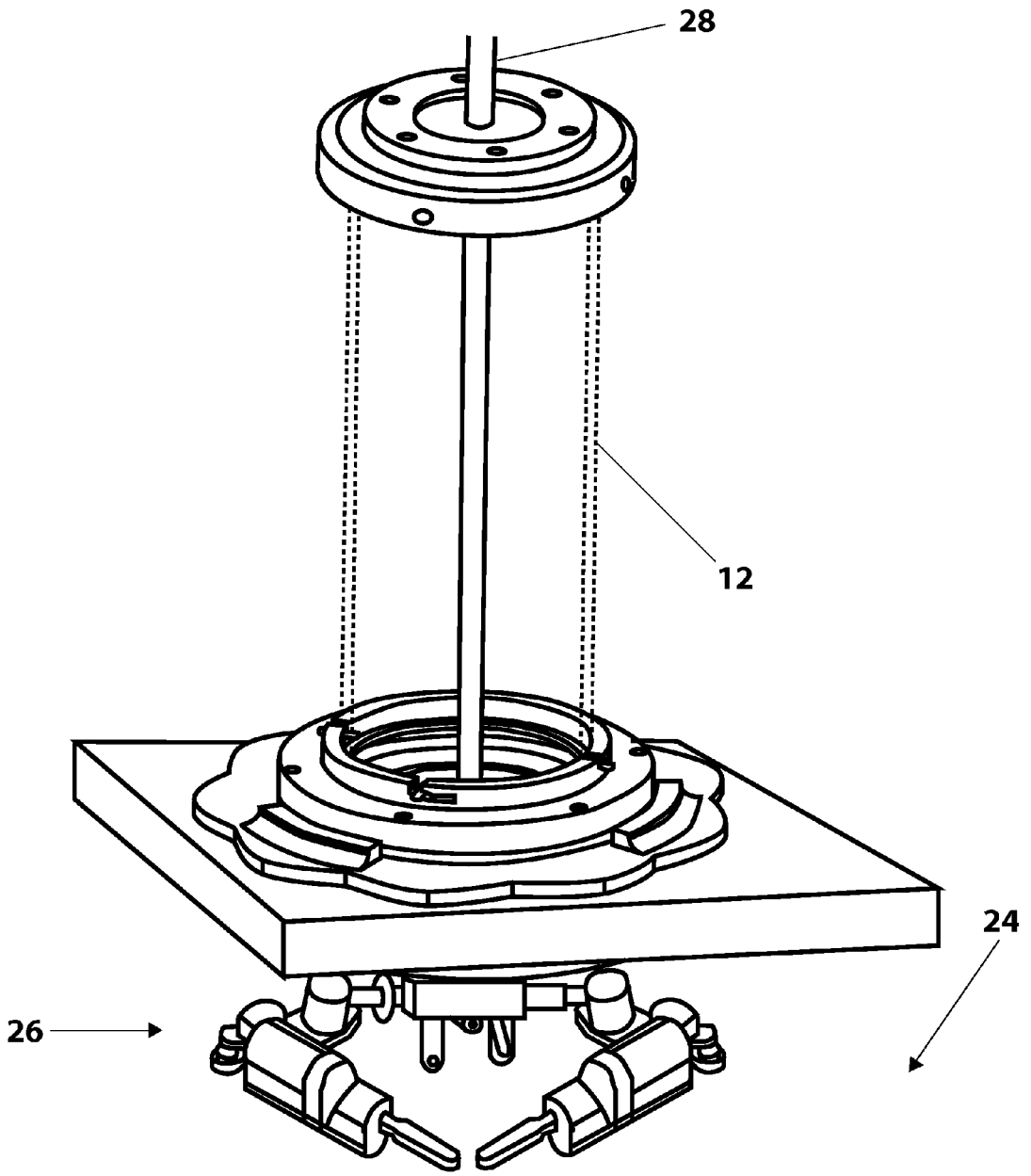

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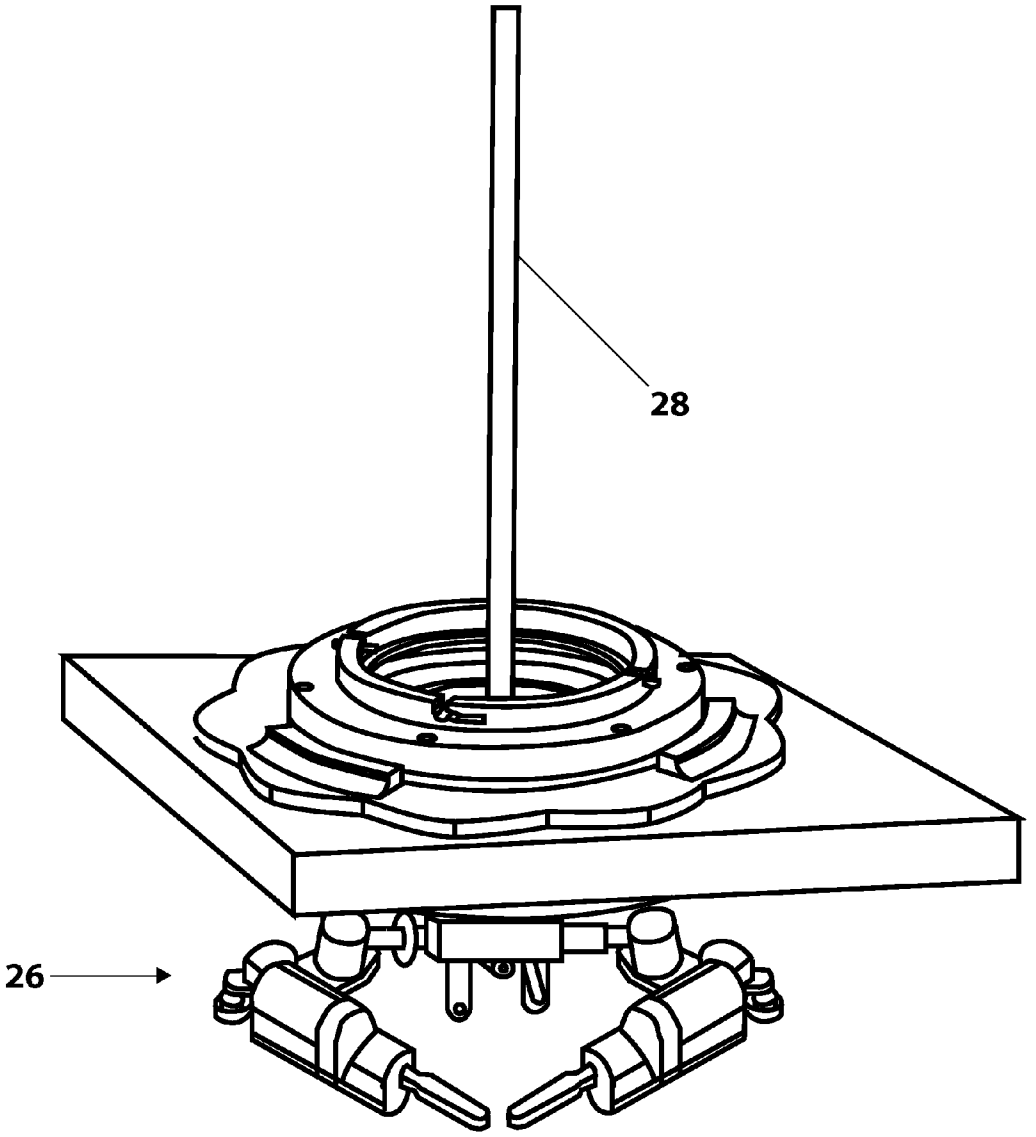

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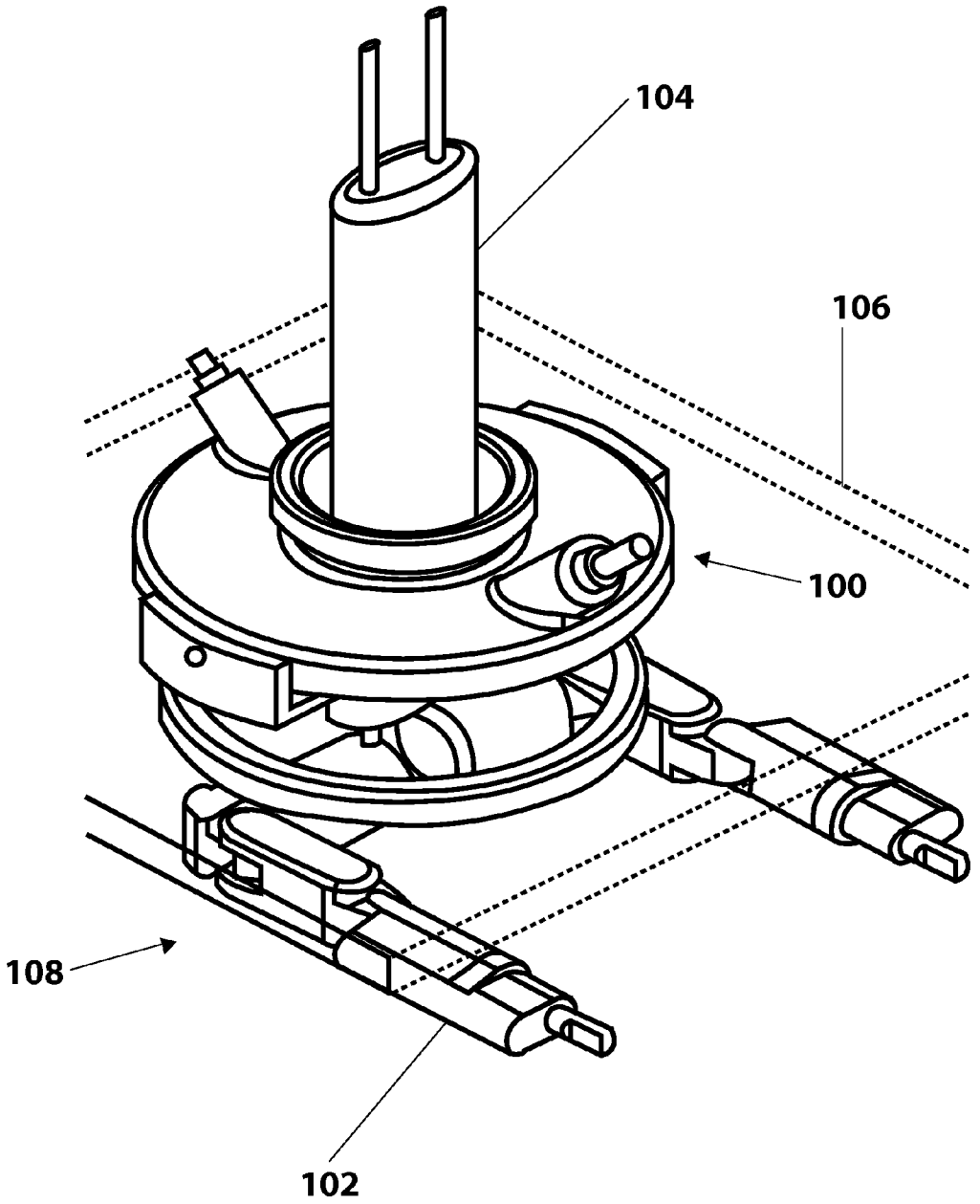

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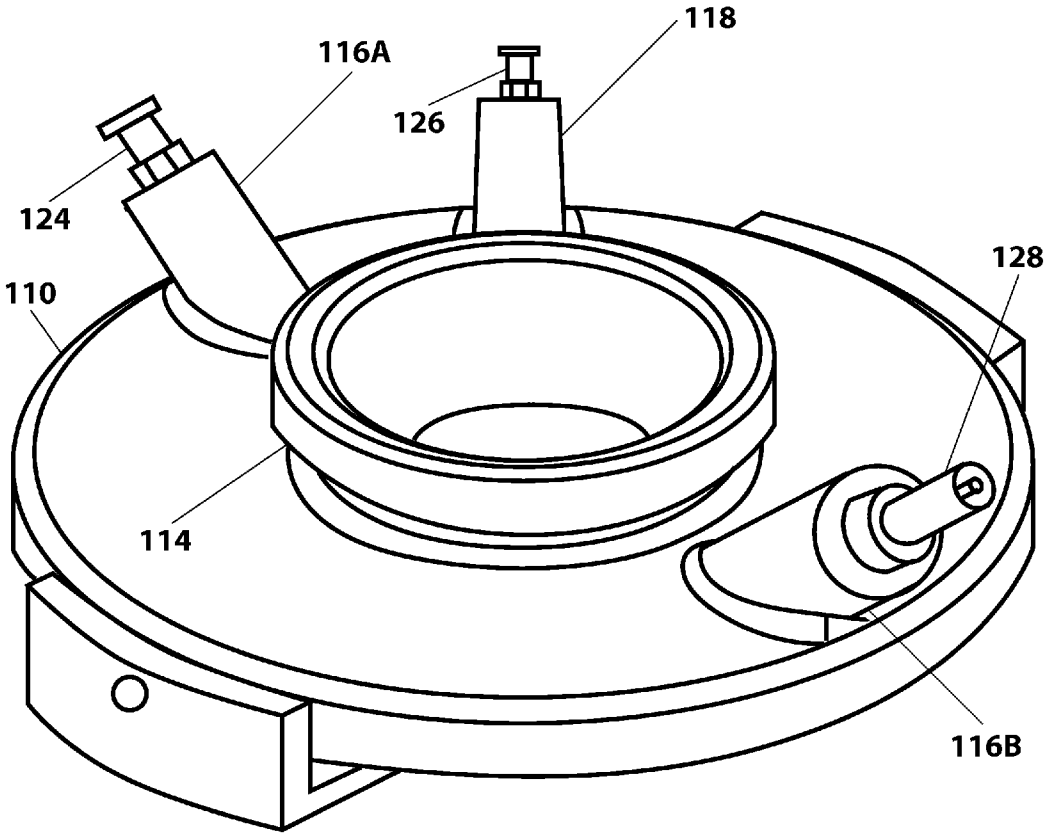

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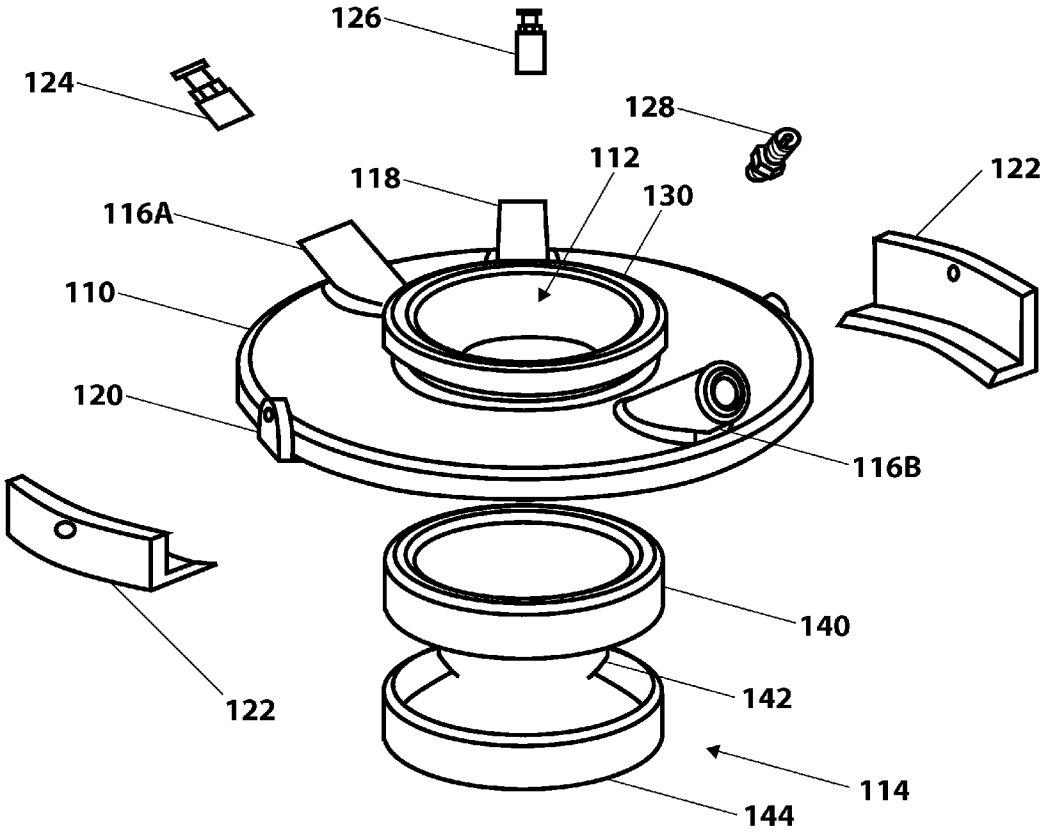
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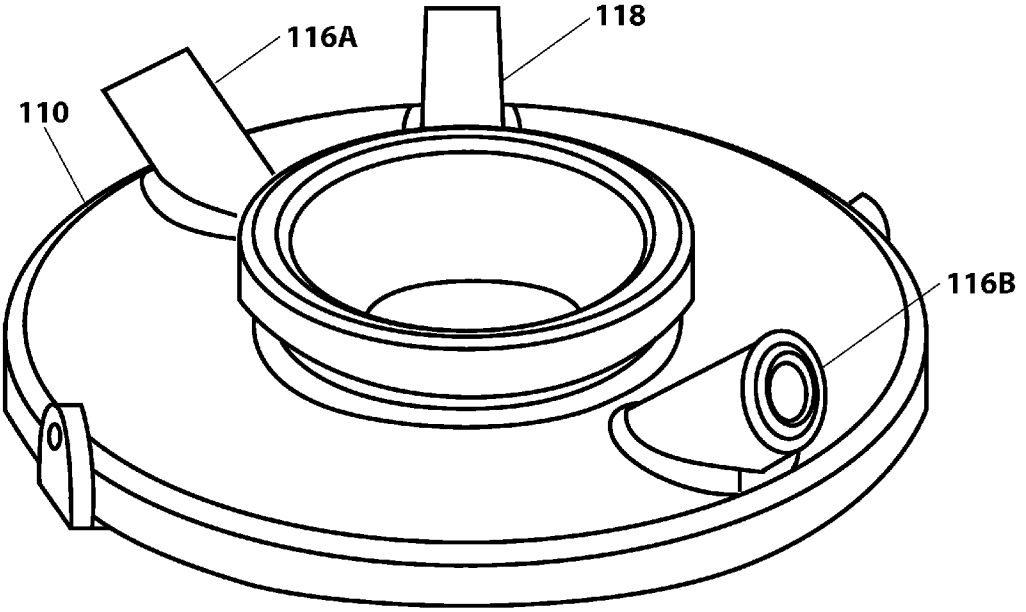
Figure 13B



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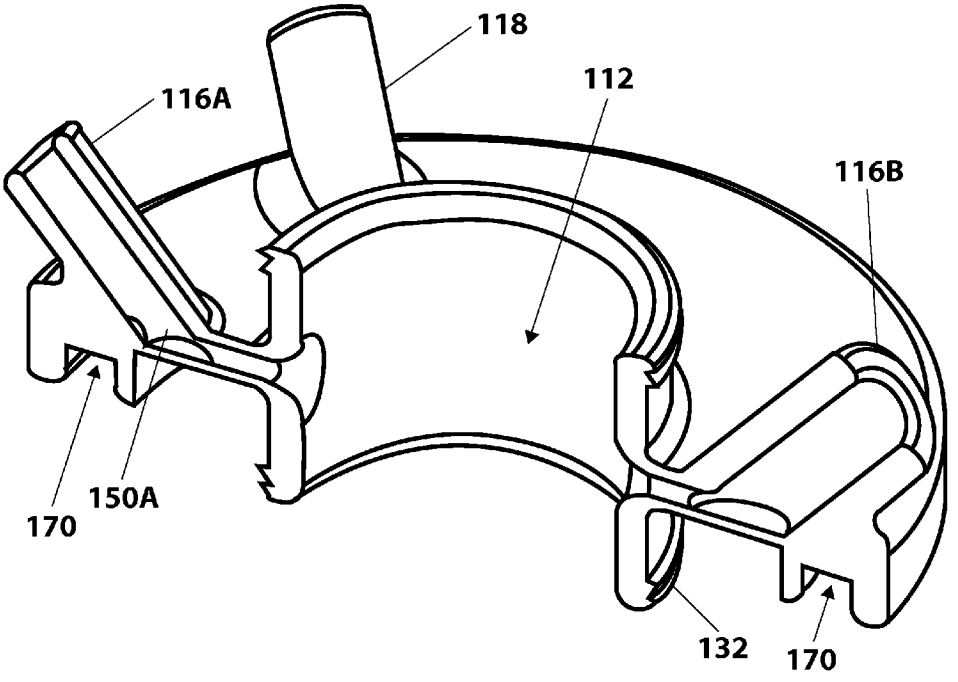

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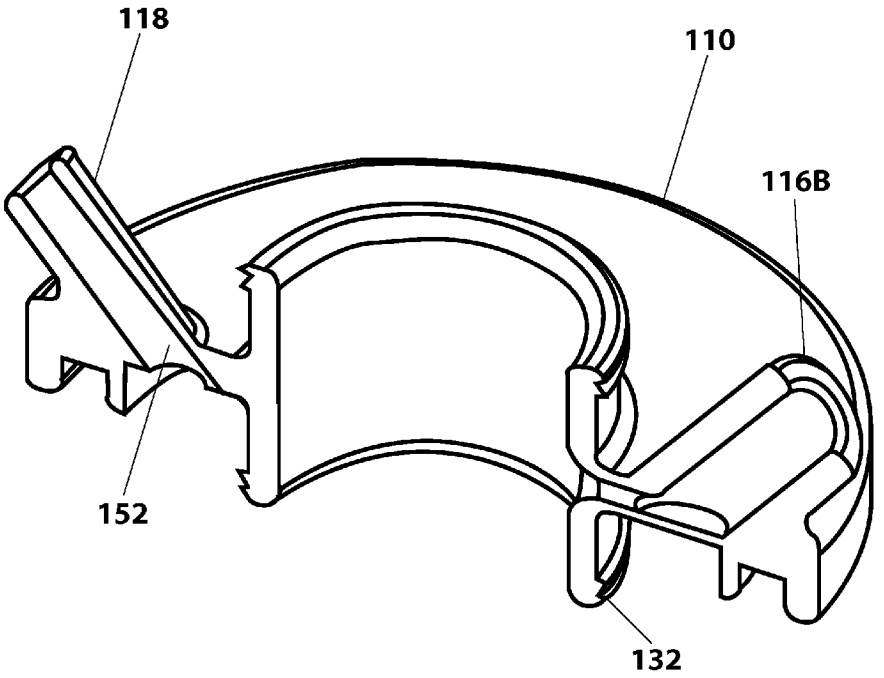

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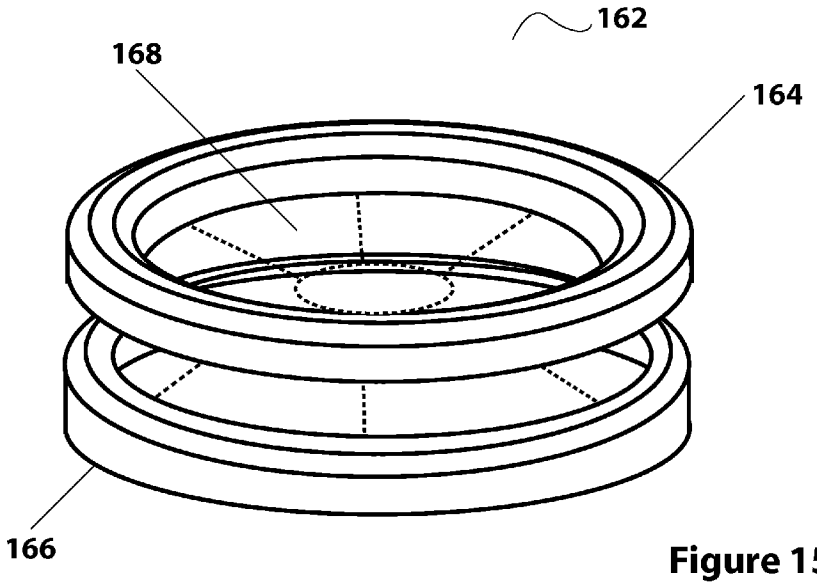

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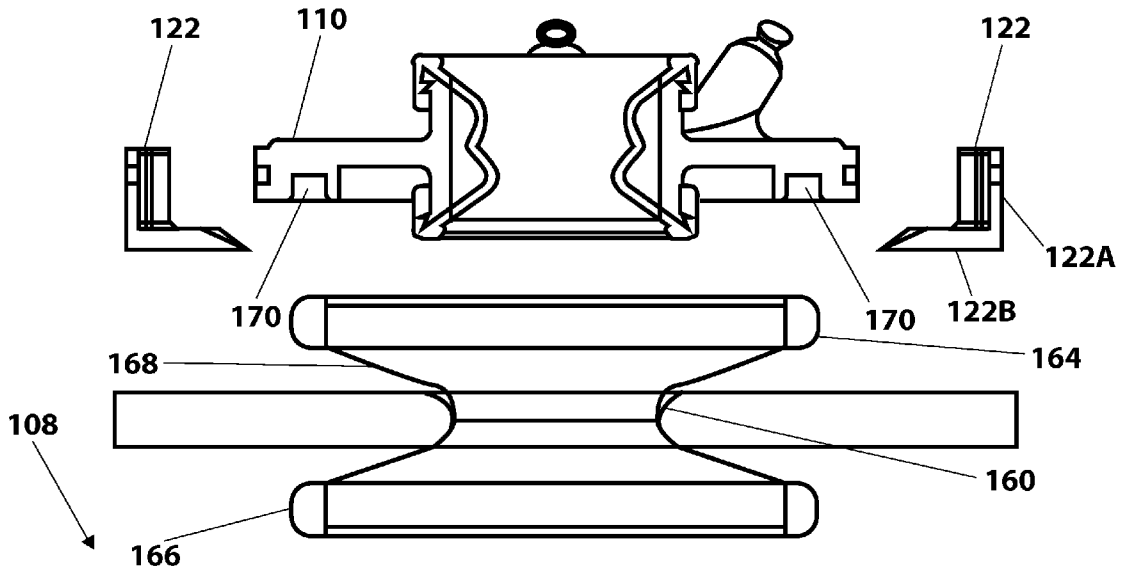

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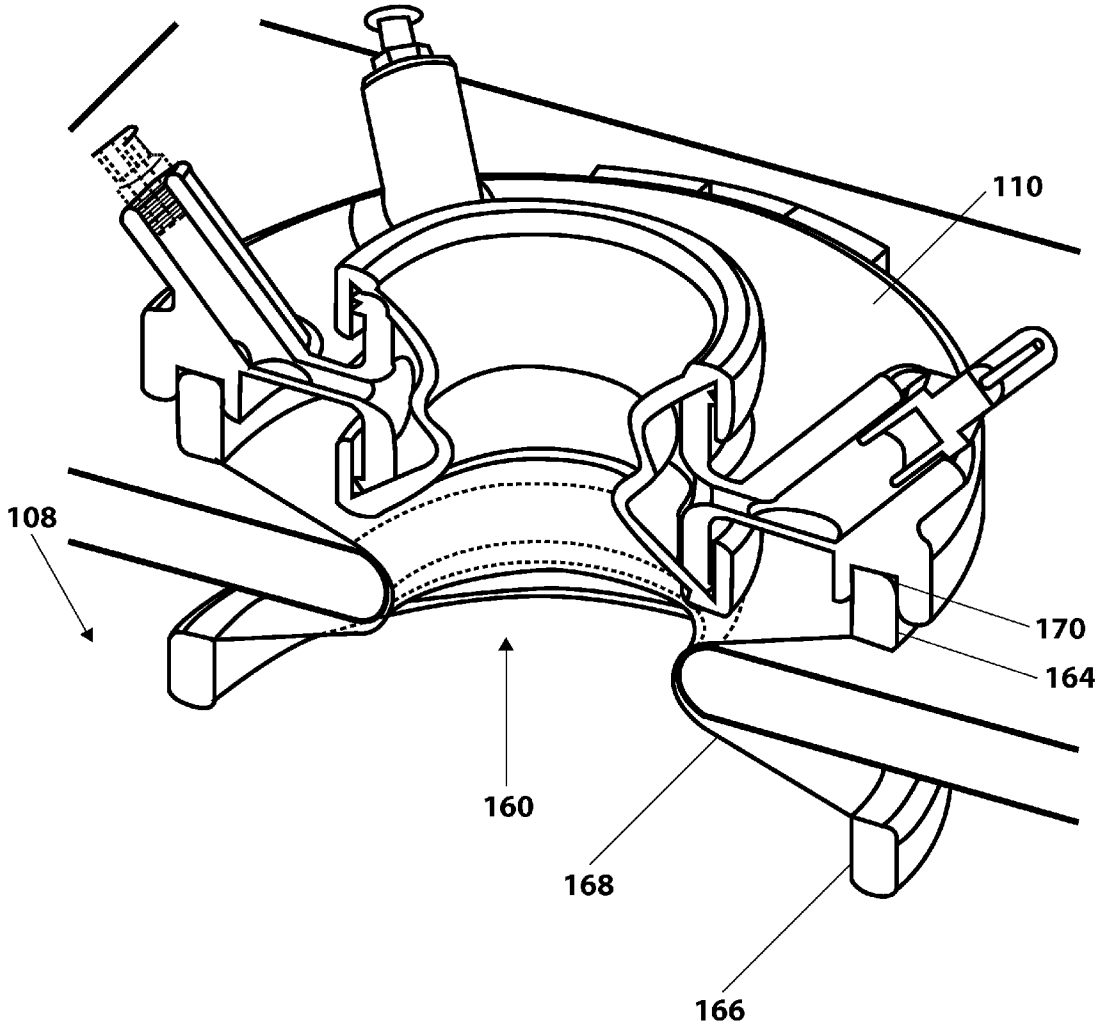

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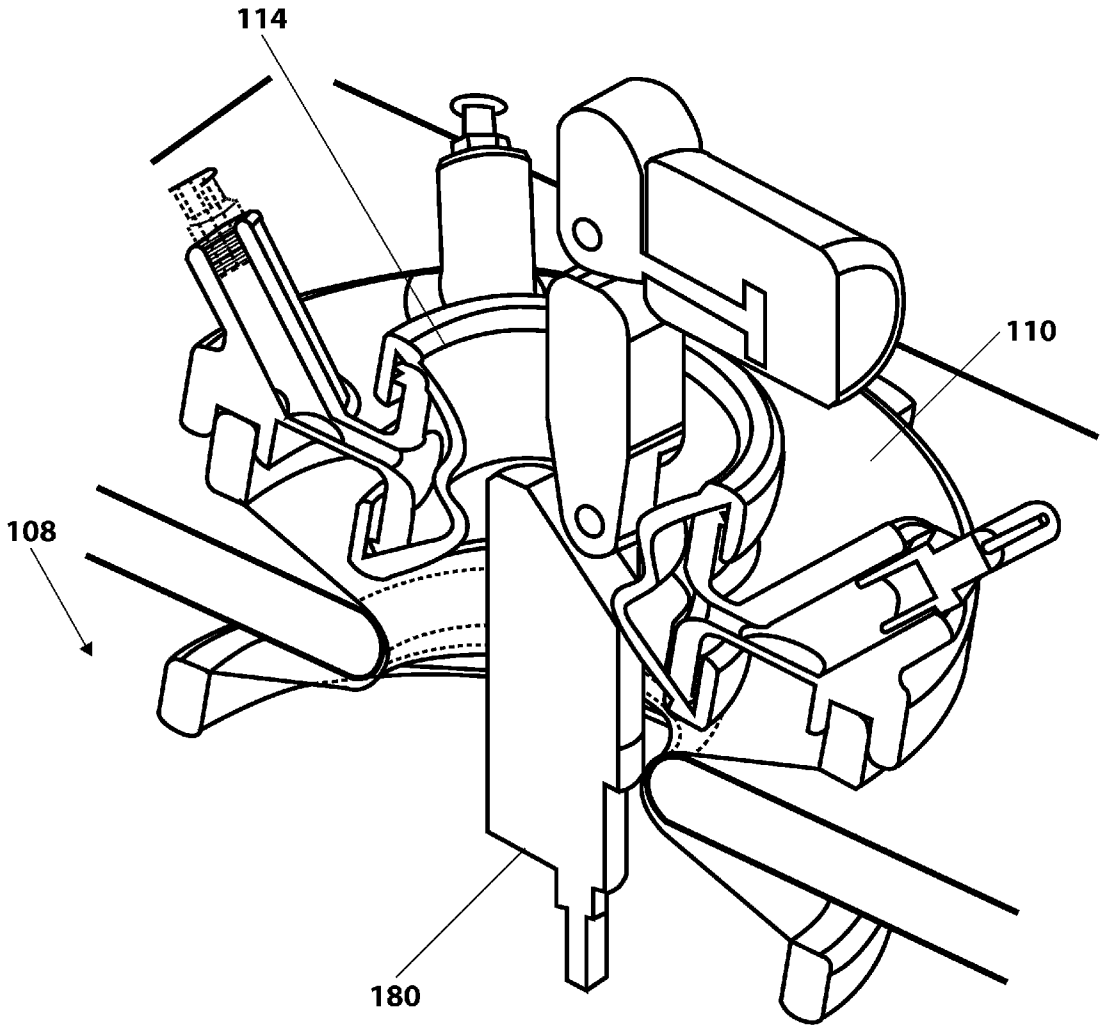

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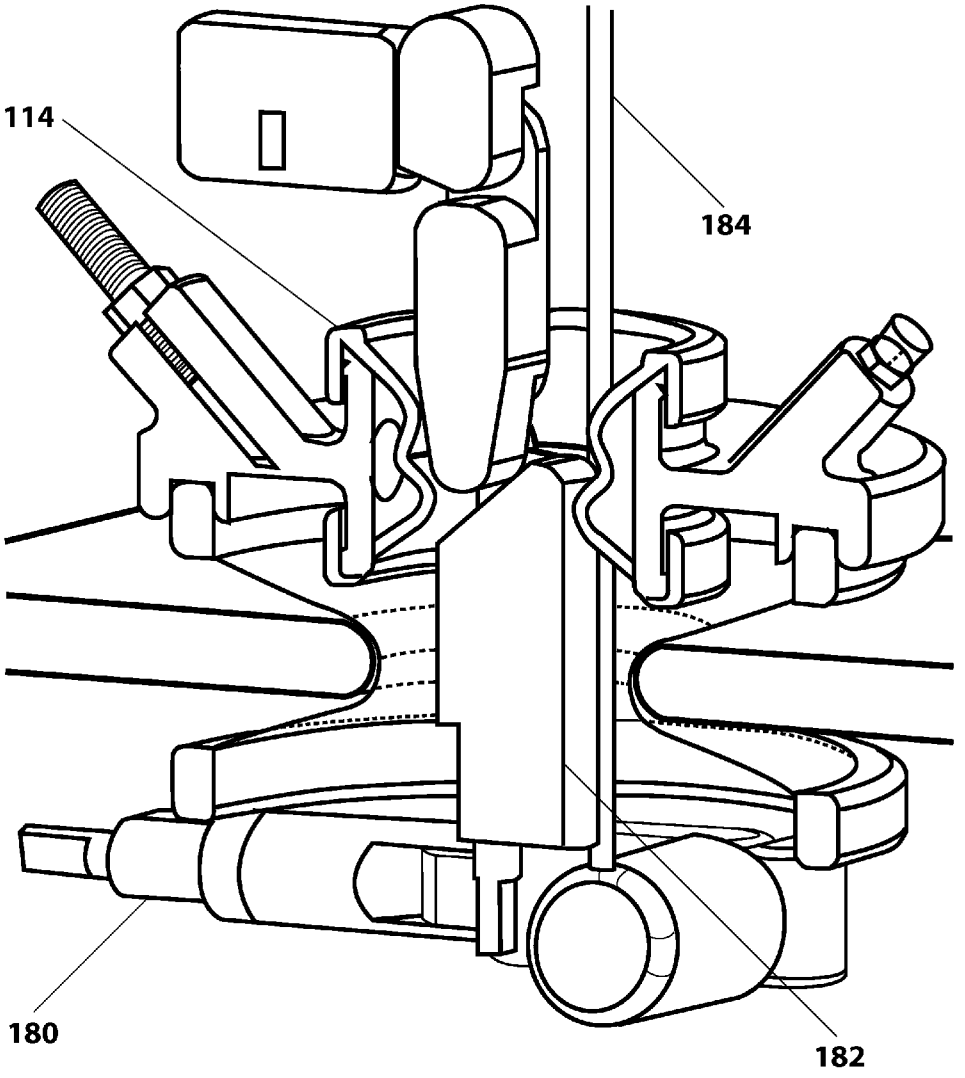

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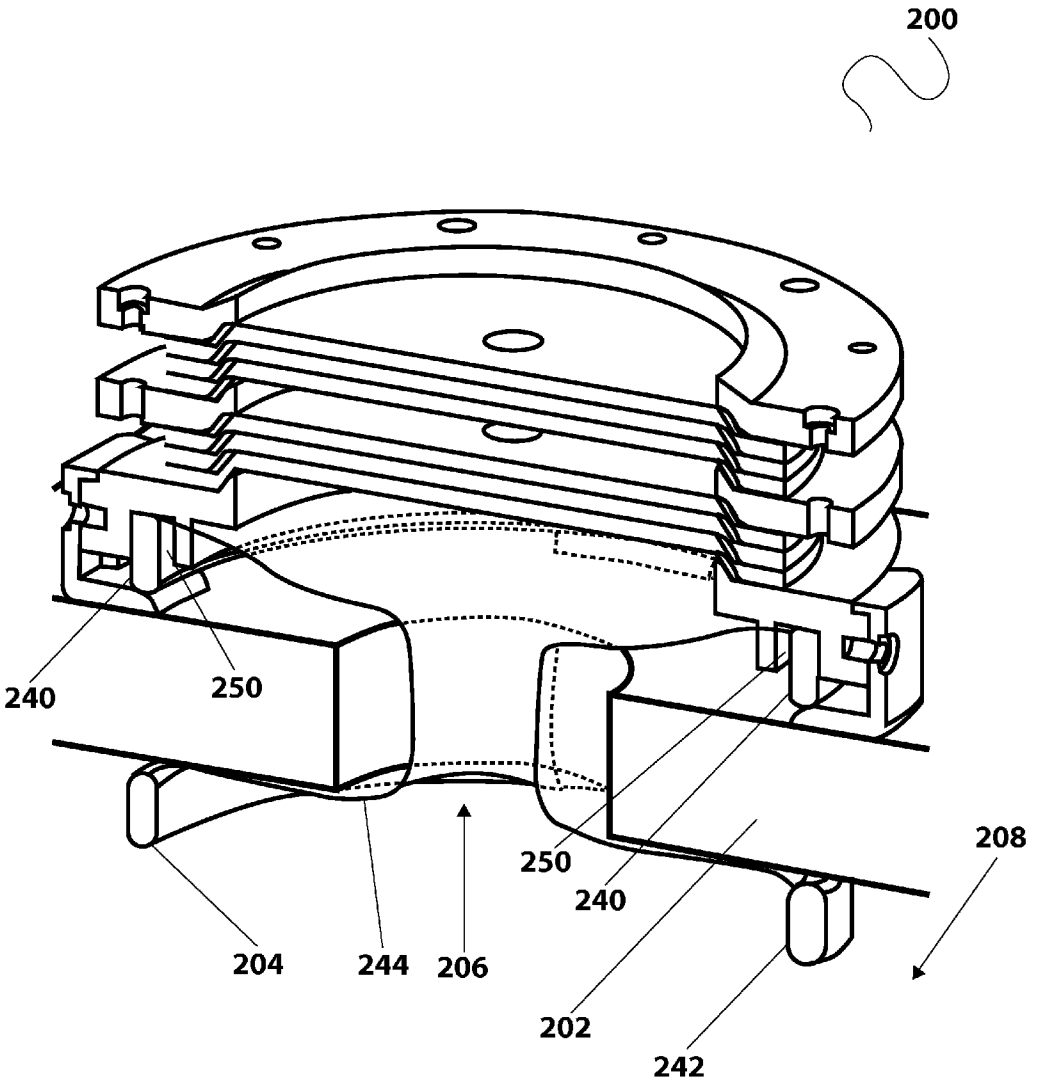

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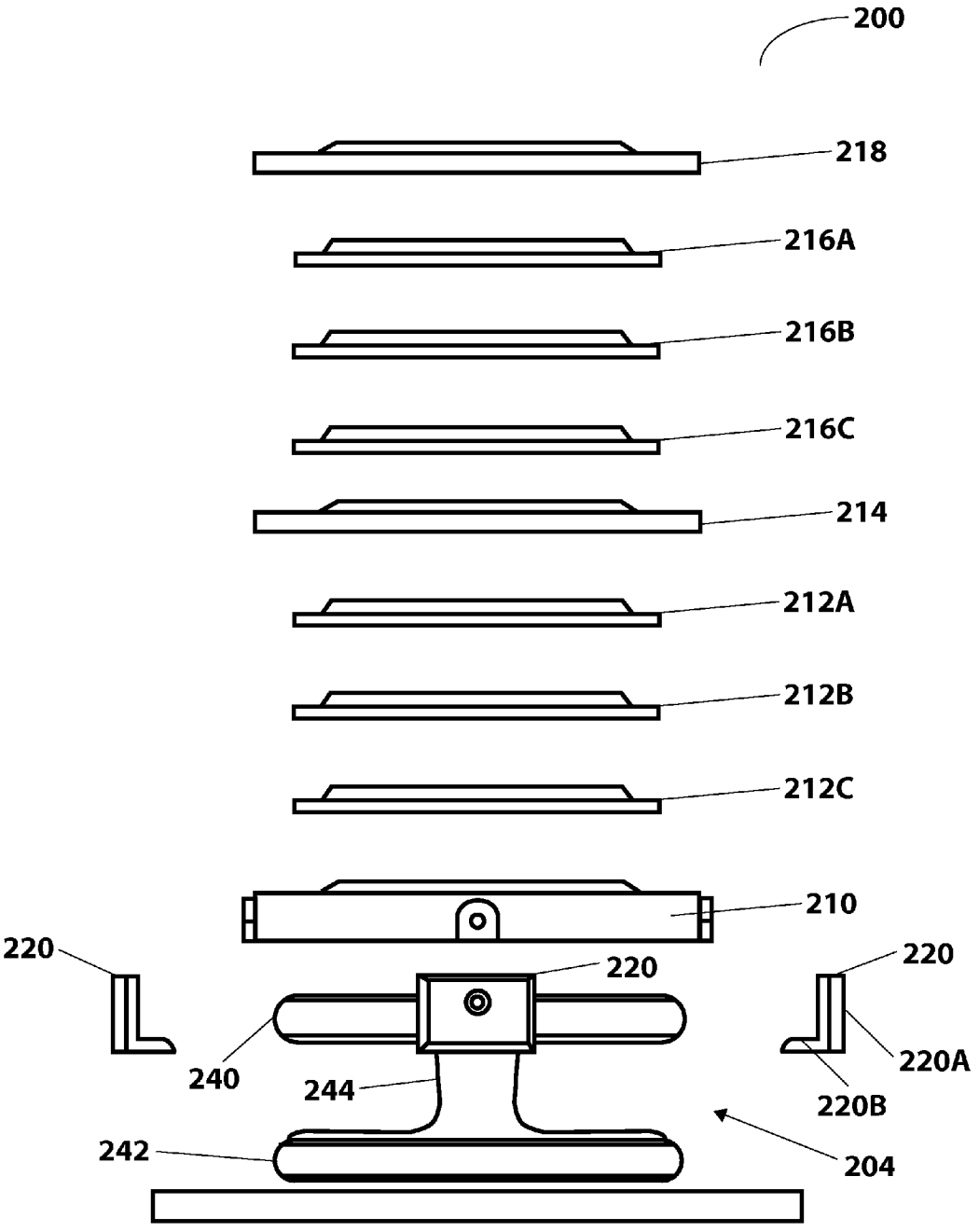
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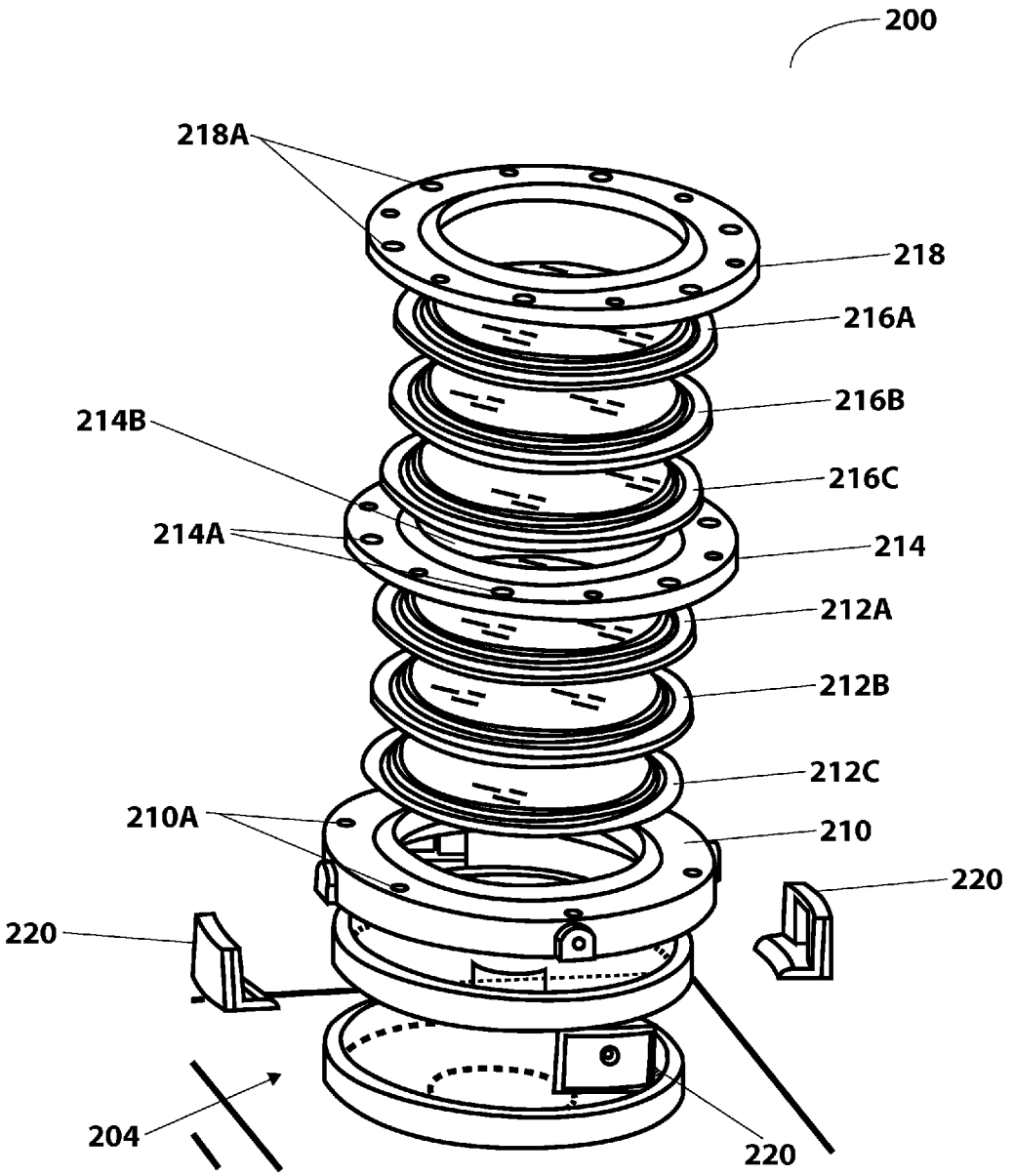
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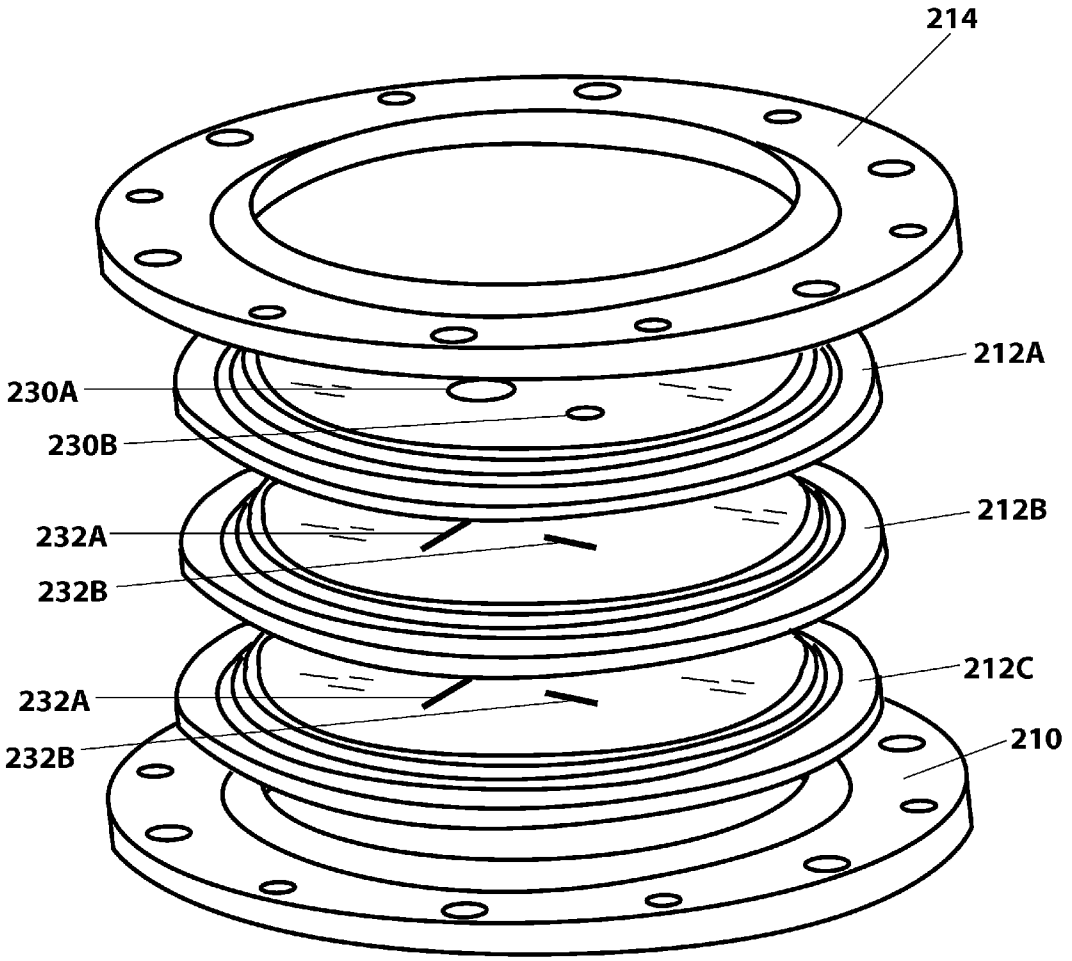
Figure 19B



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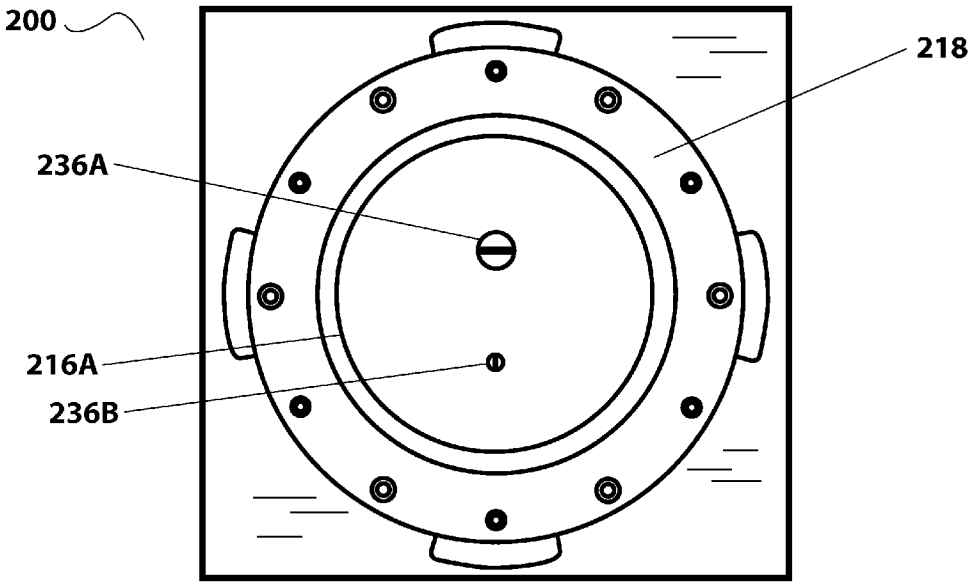

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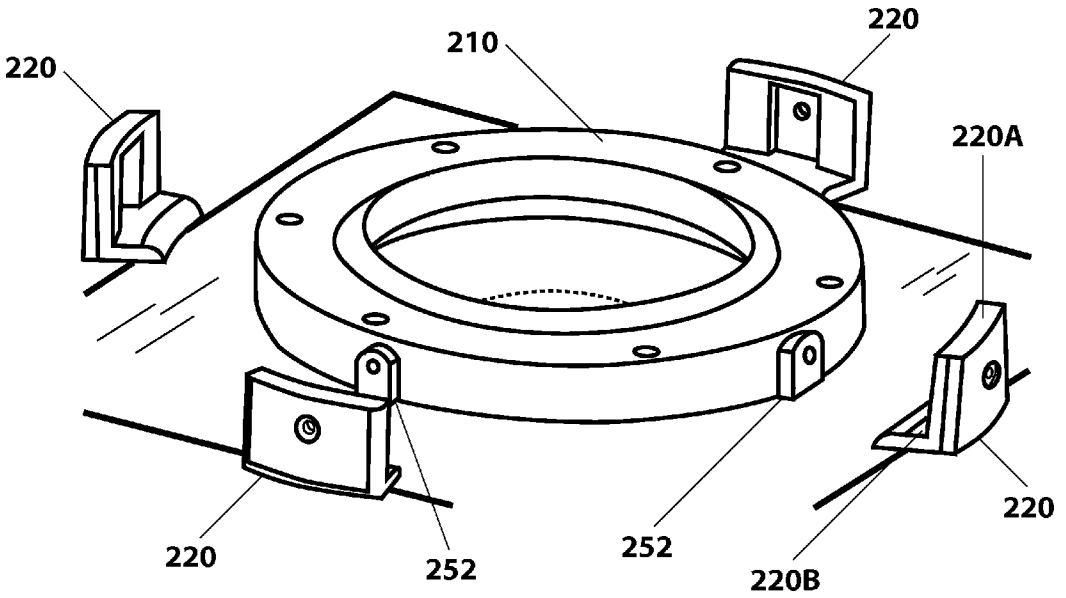

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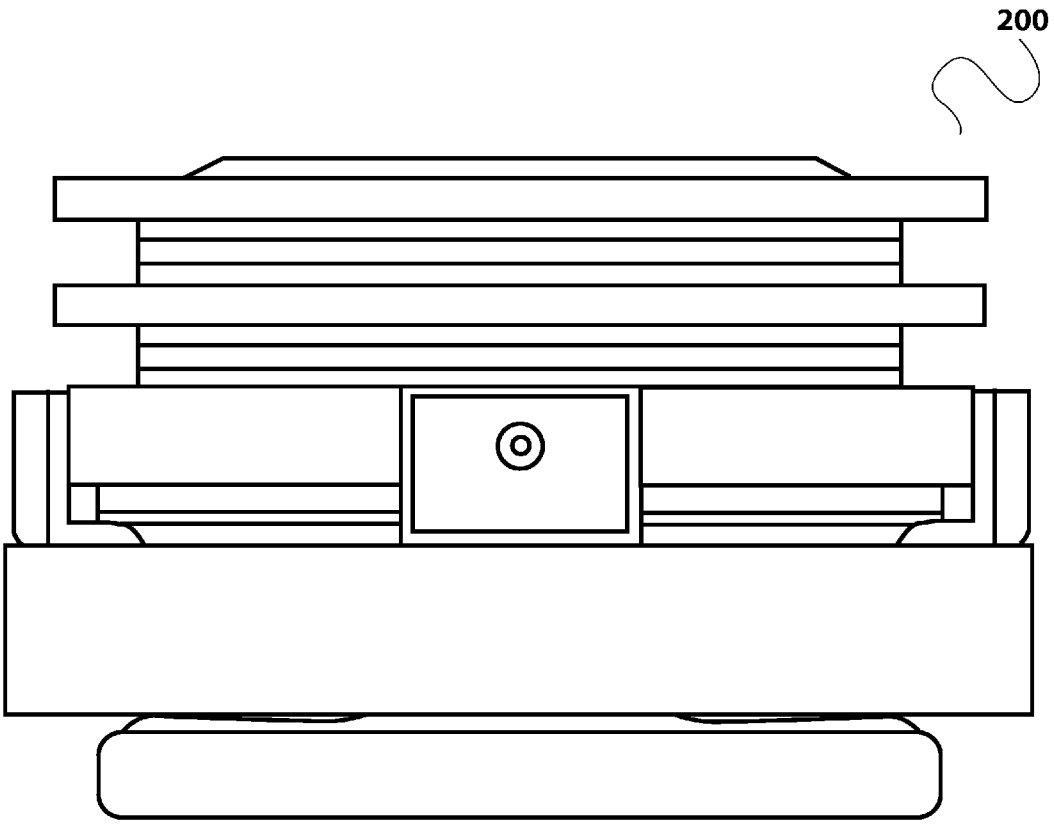

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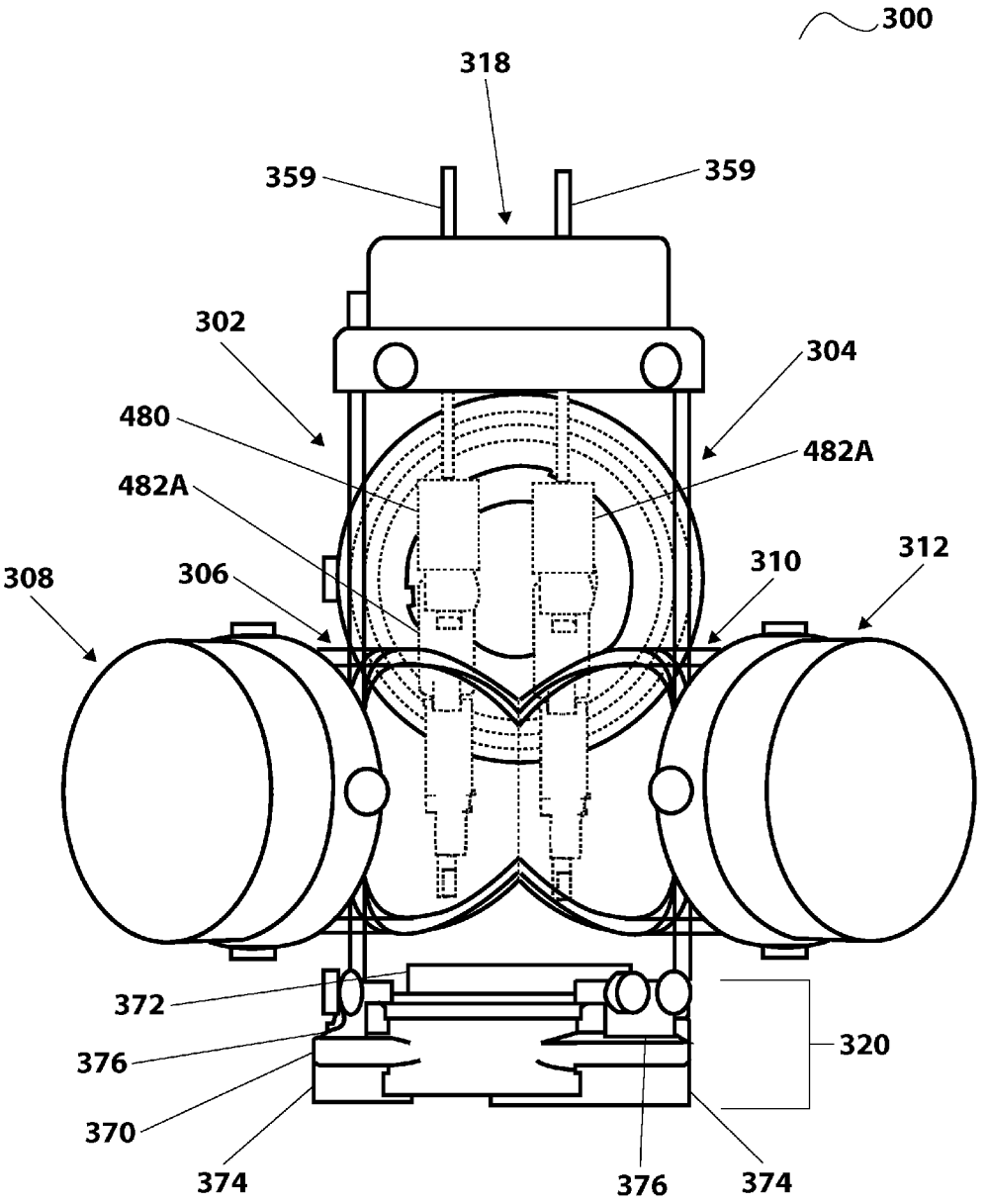
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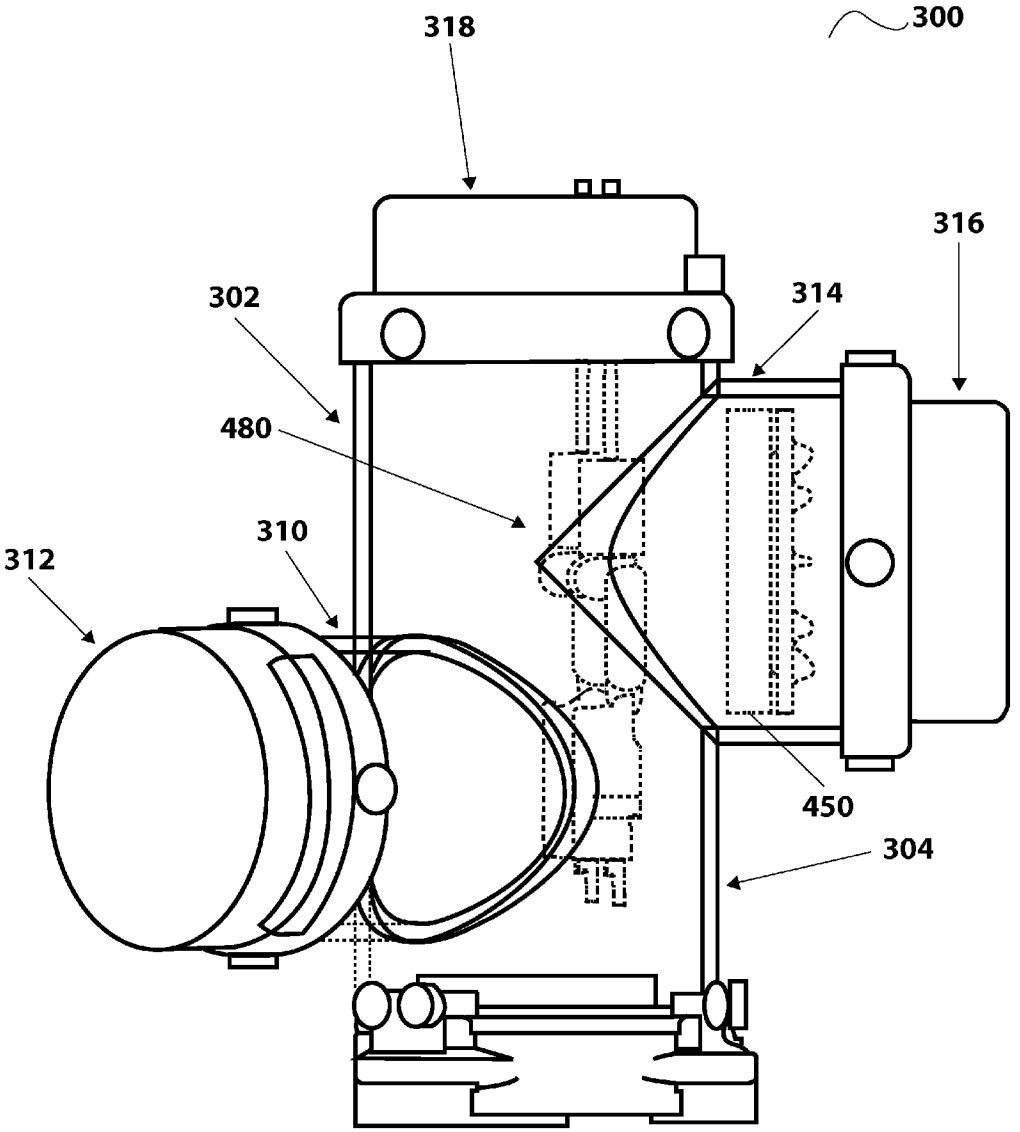
Figure 24A



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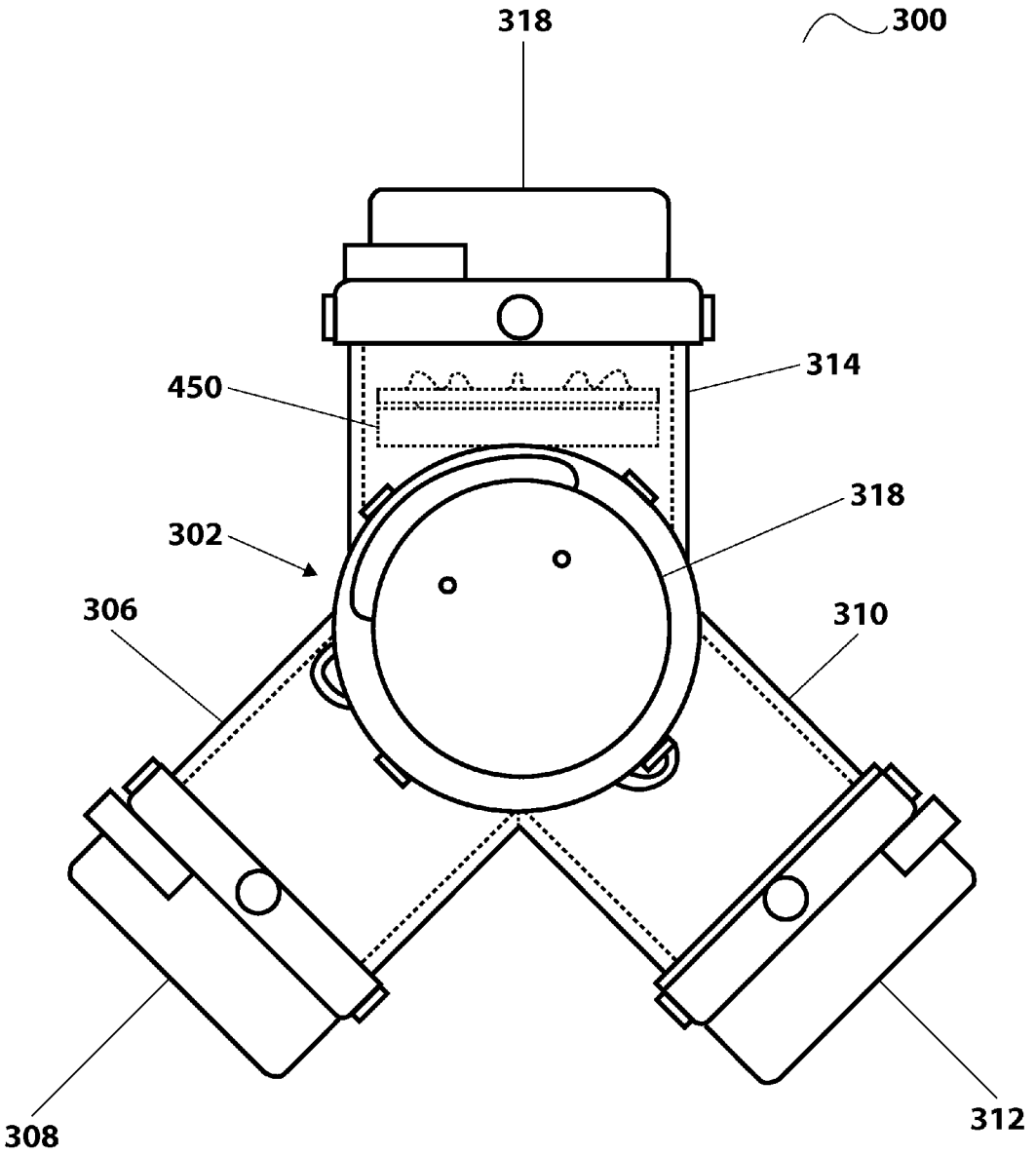

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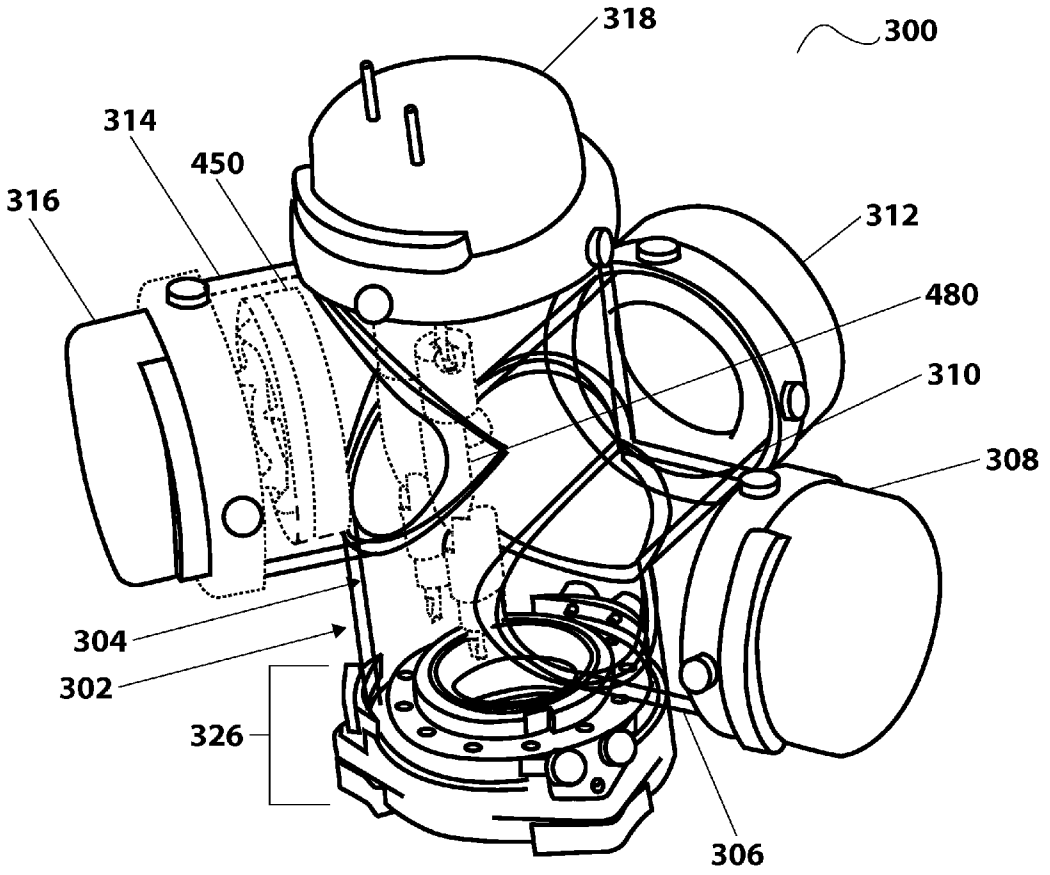

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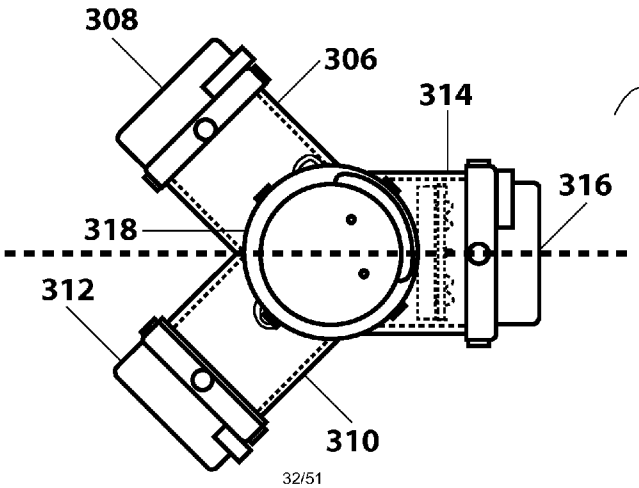

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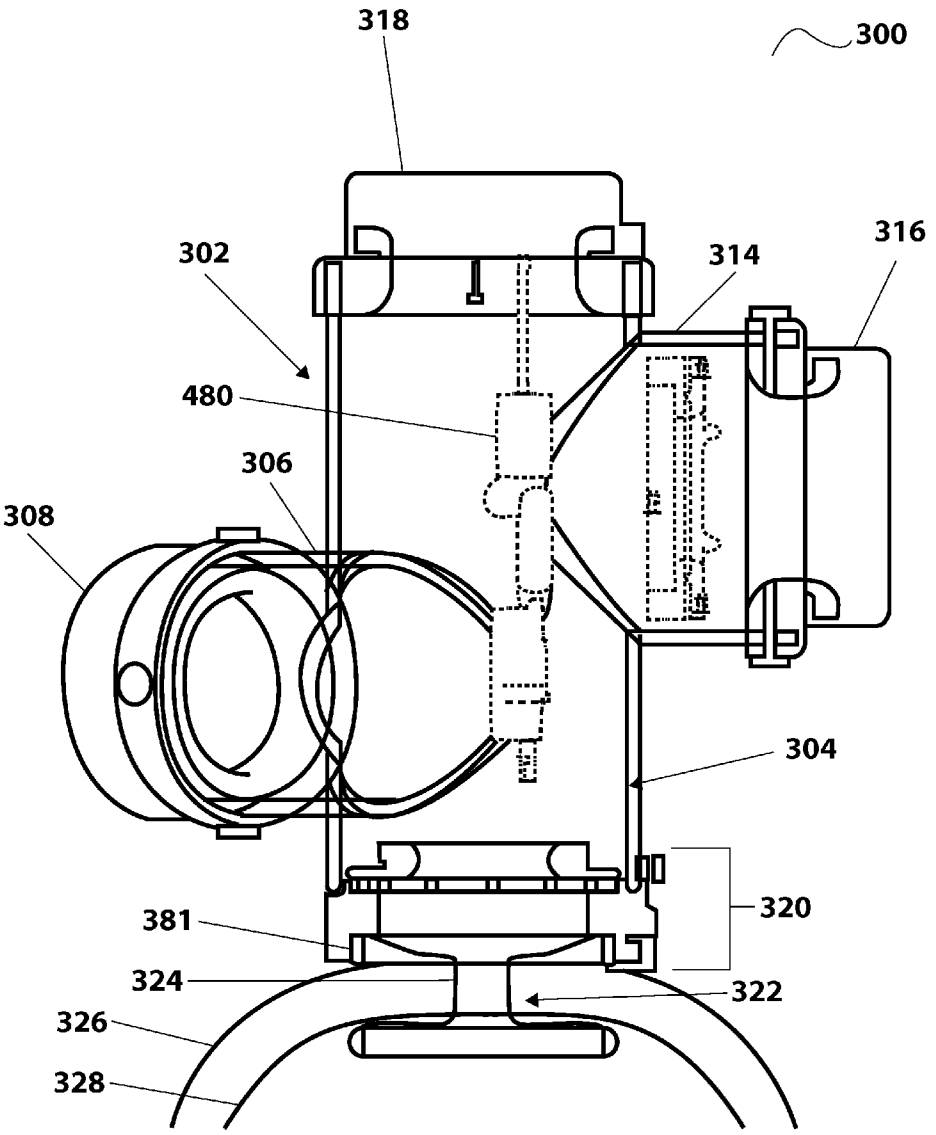

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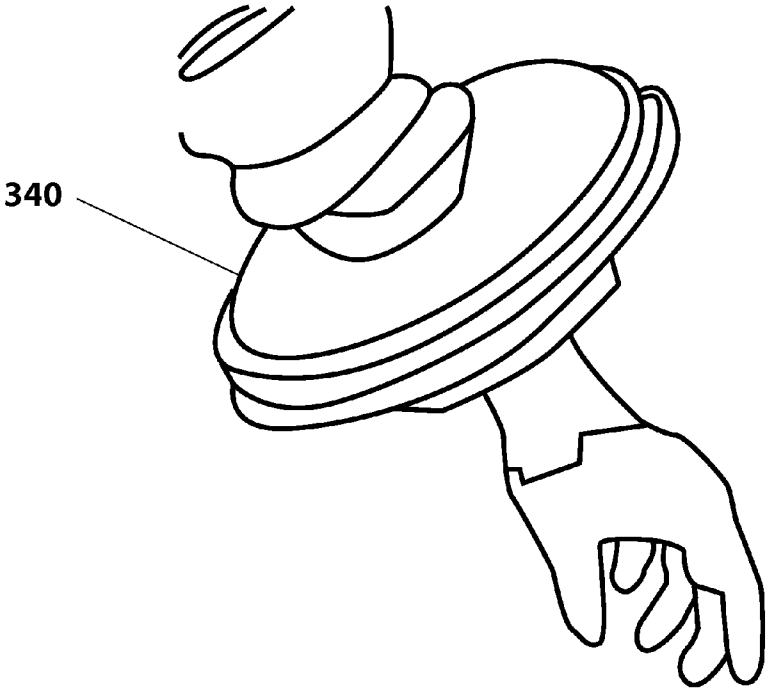

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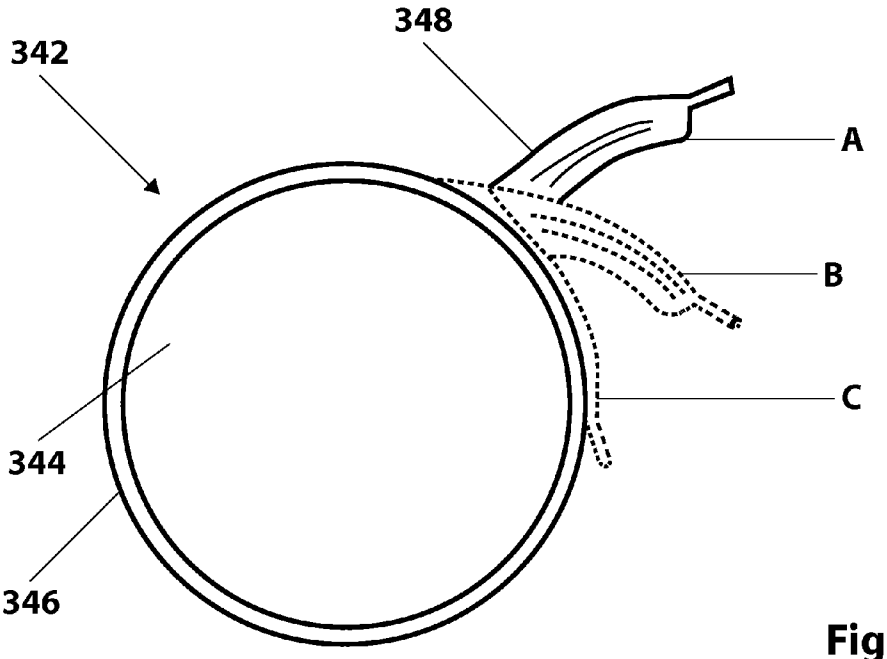

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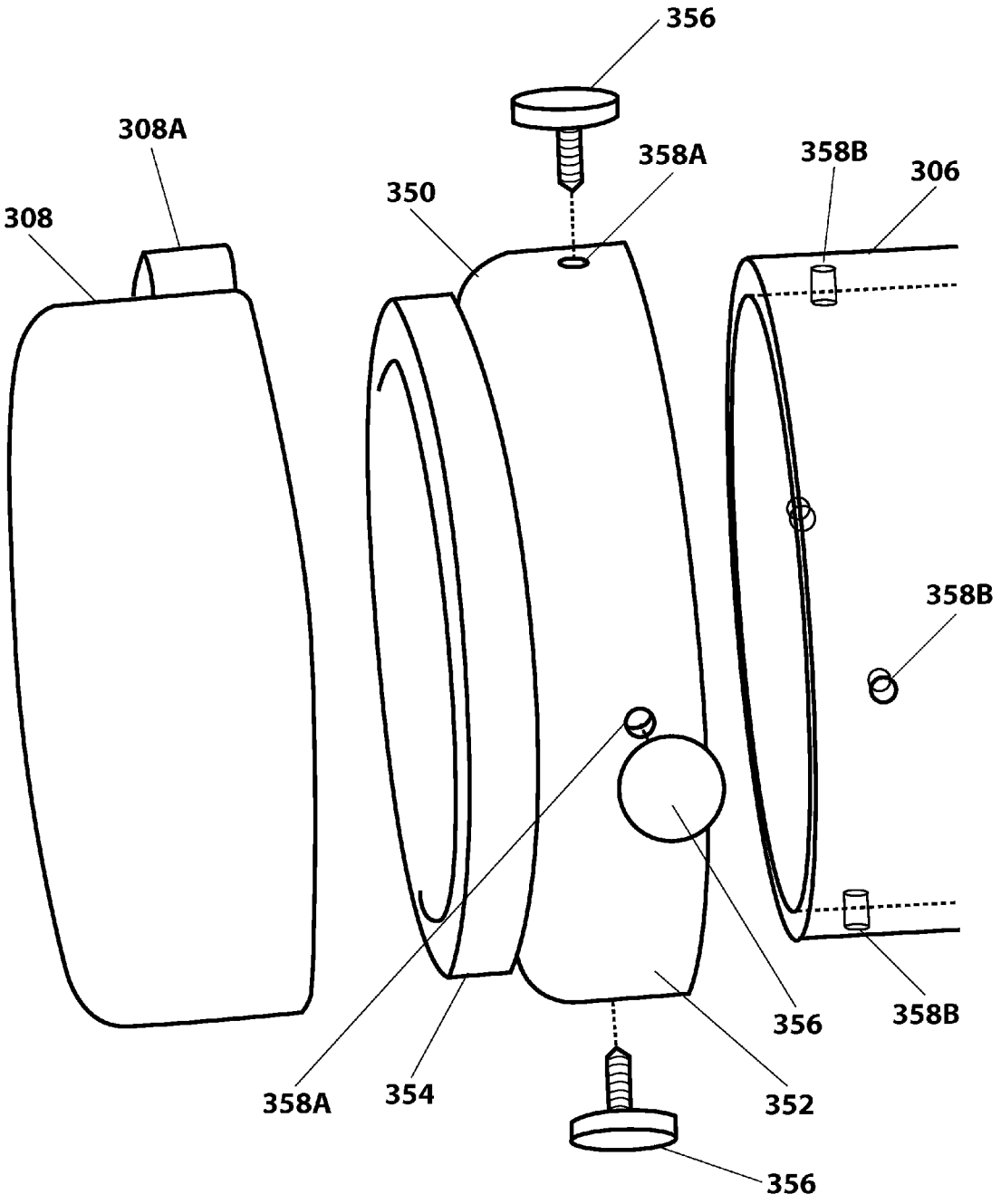

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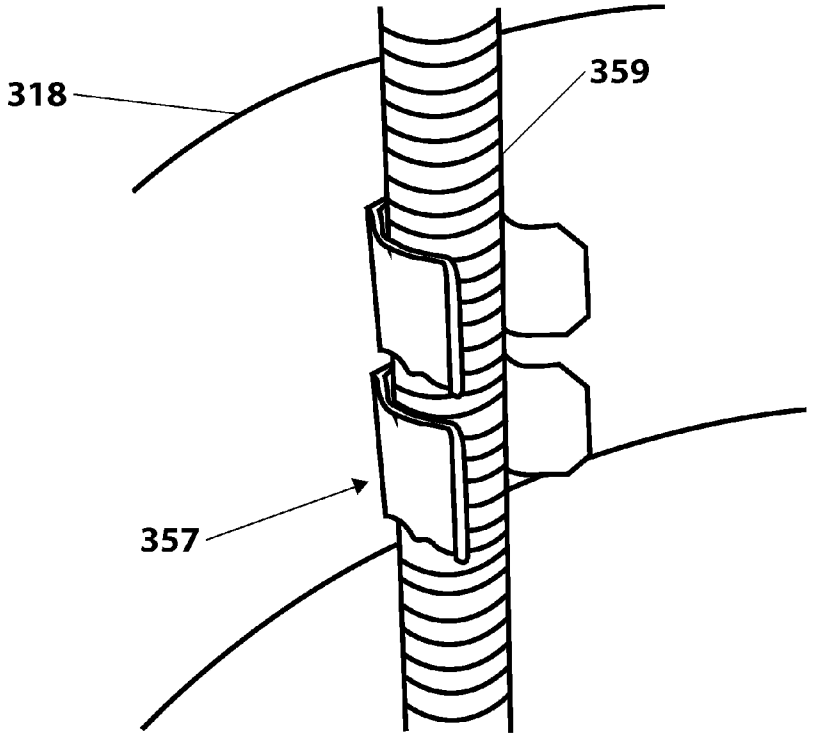


Figure 27B

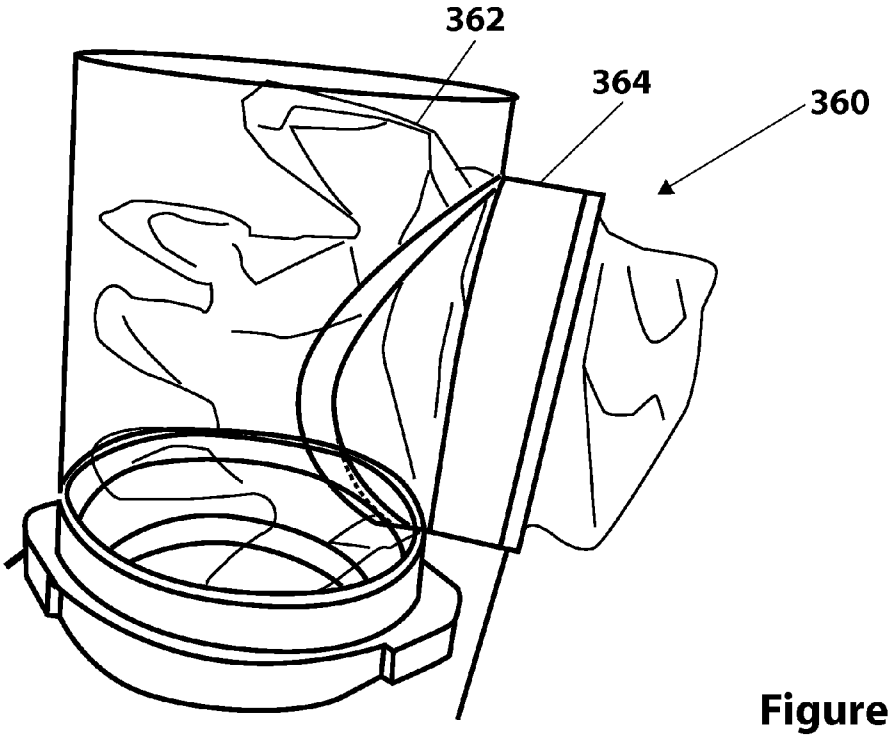
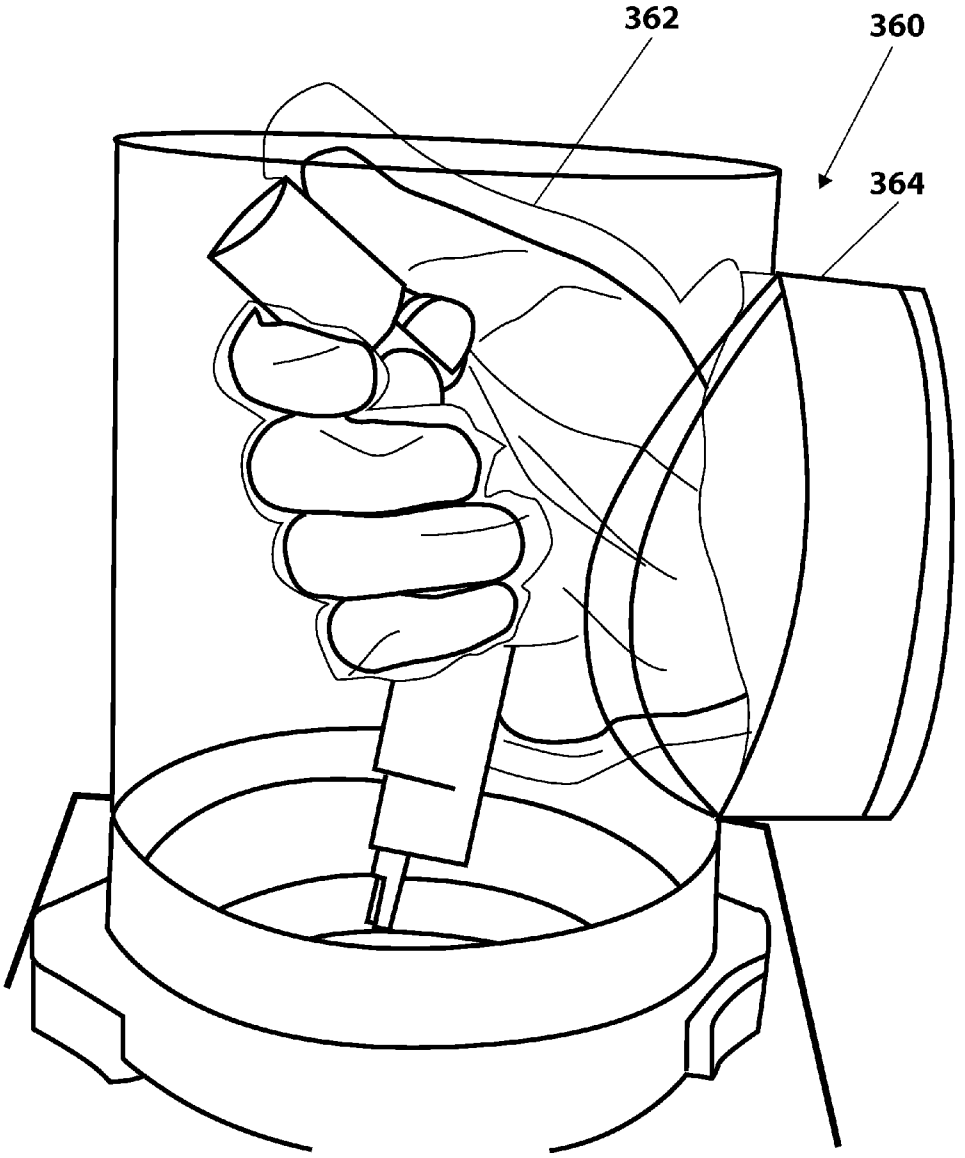


Figure 28A



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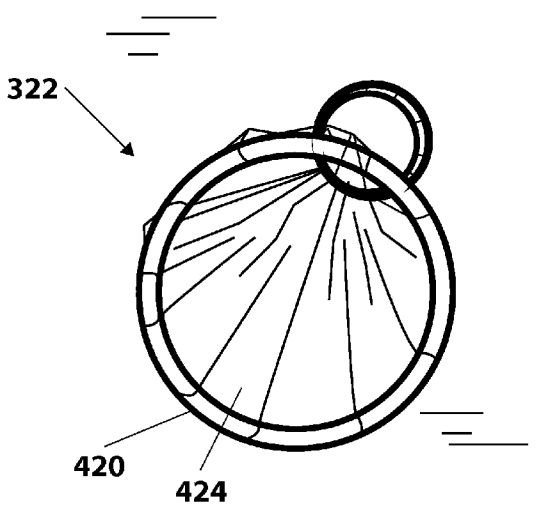

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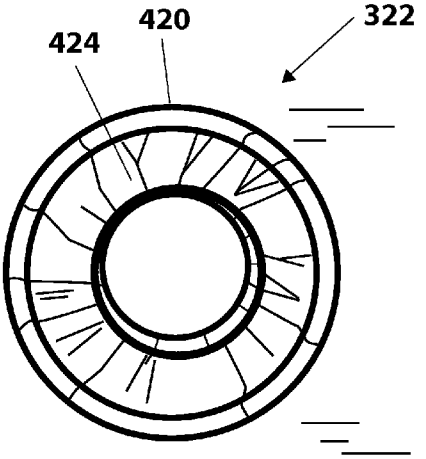


Figure 29B

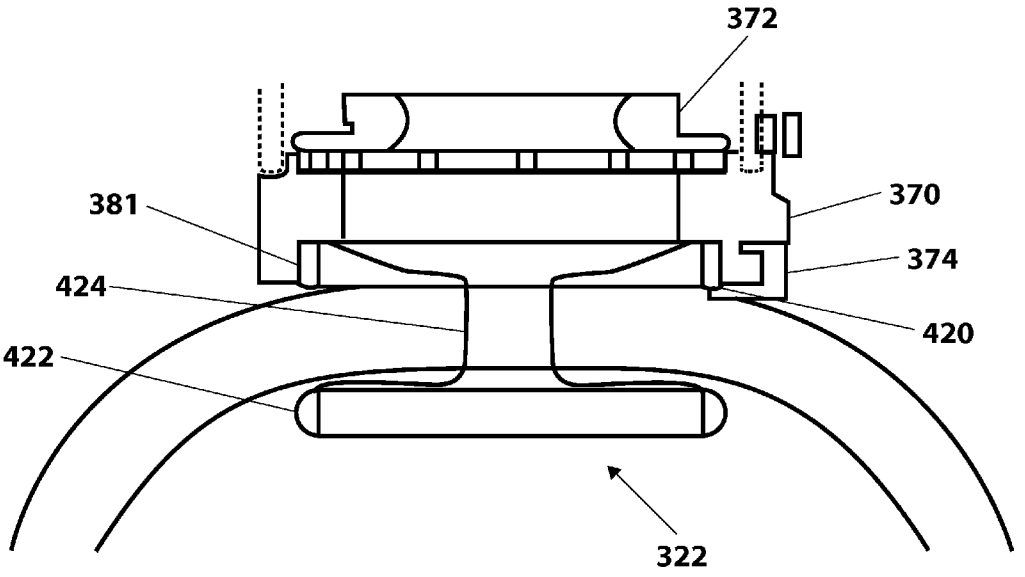


Figure 30

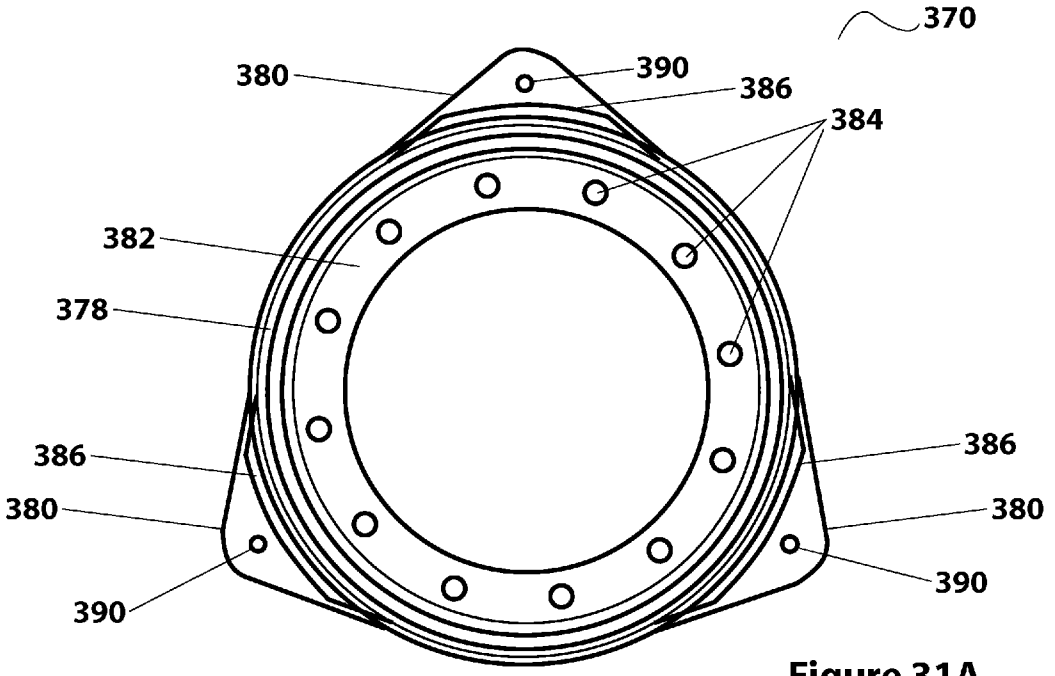


Figure 31A

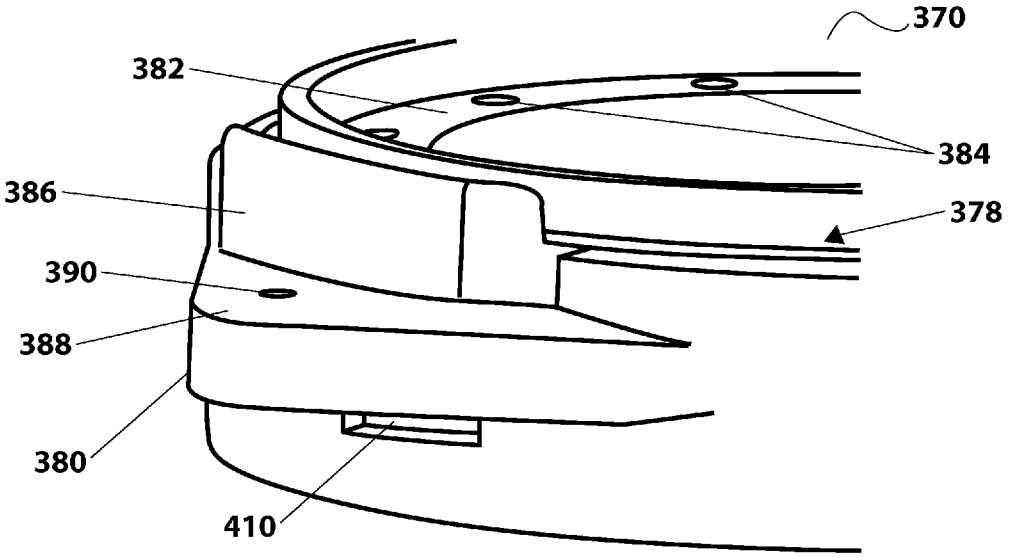


Figure 31B

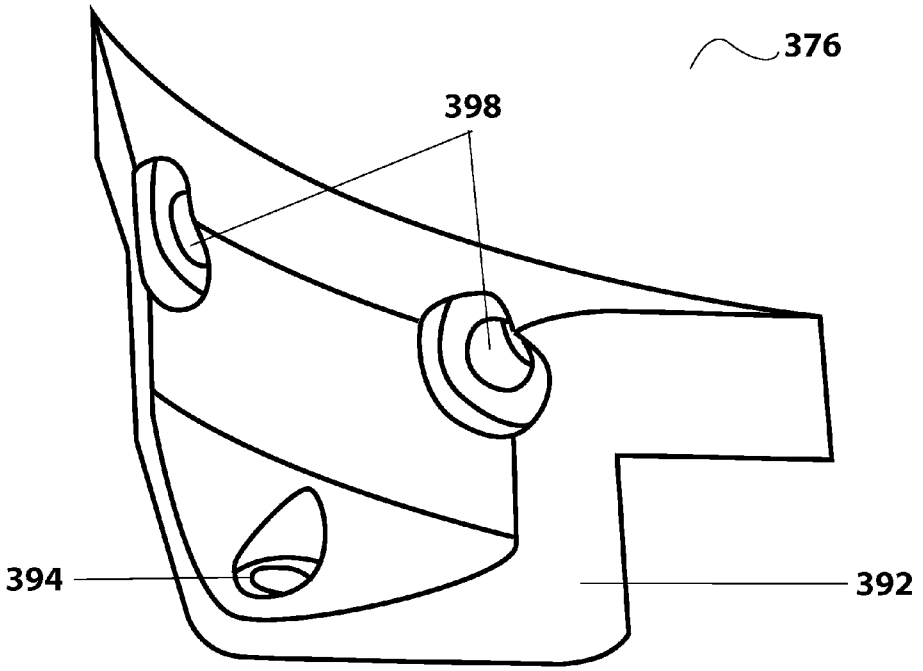


Figure 32

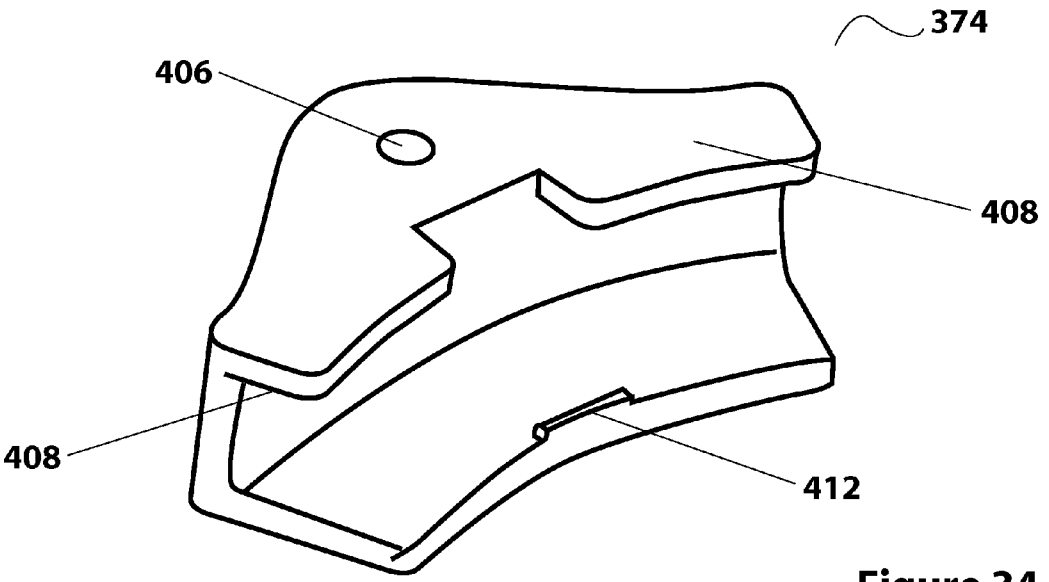


Figure 34

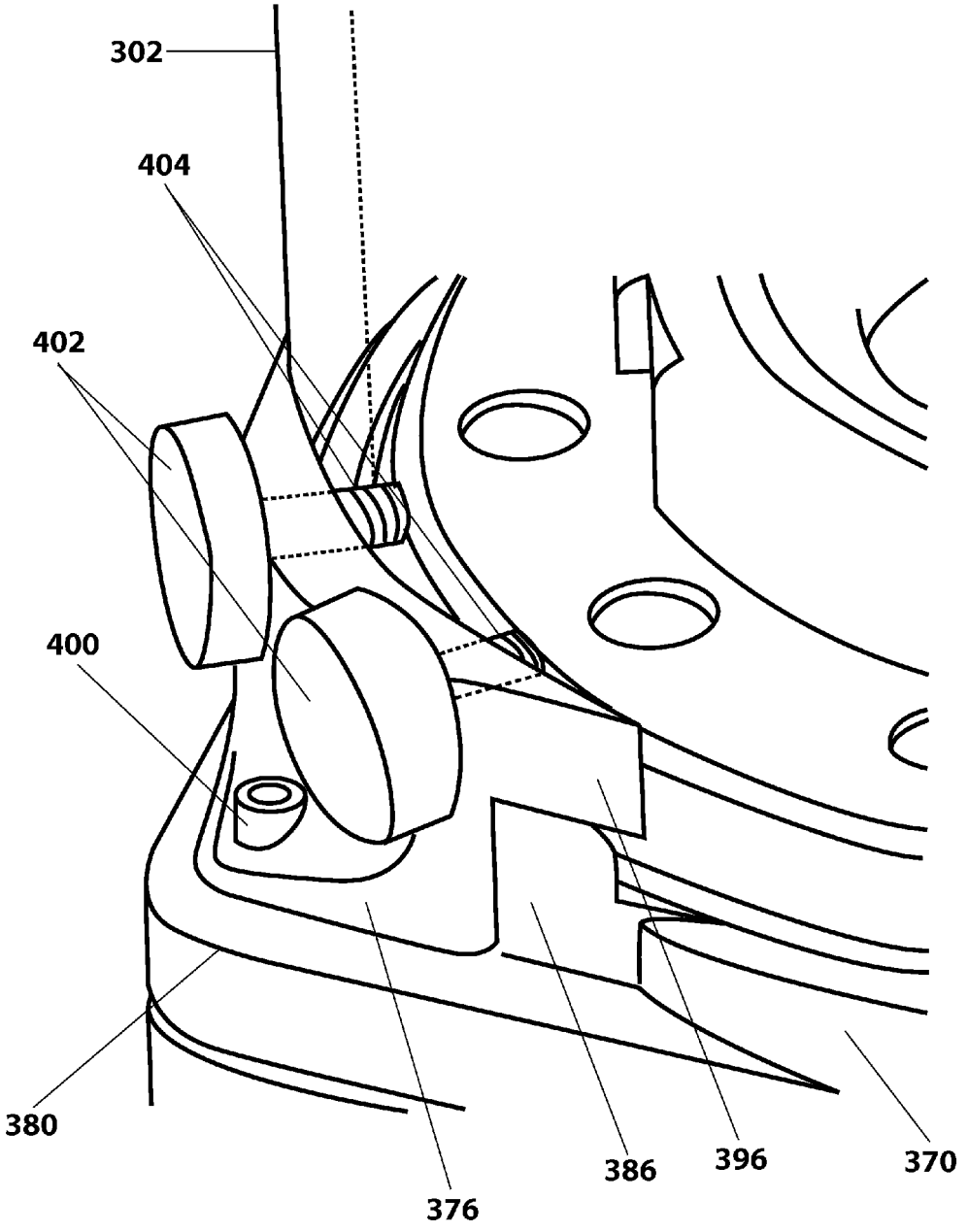


Figure 33

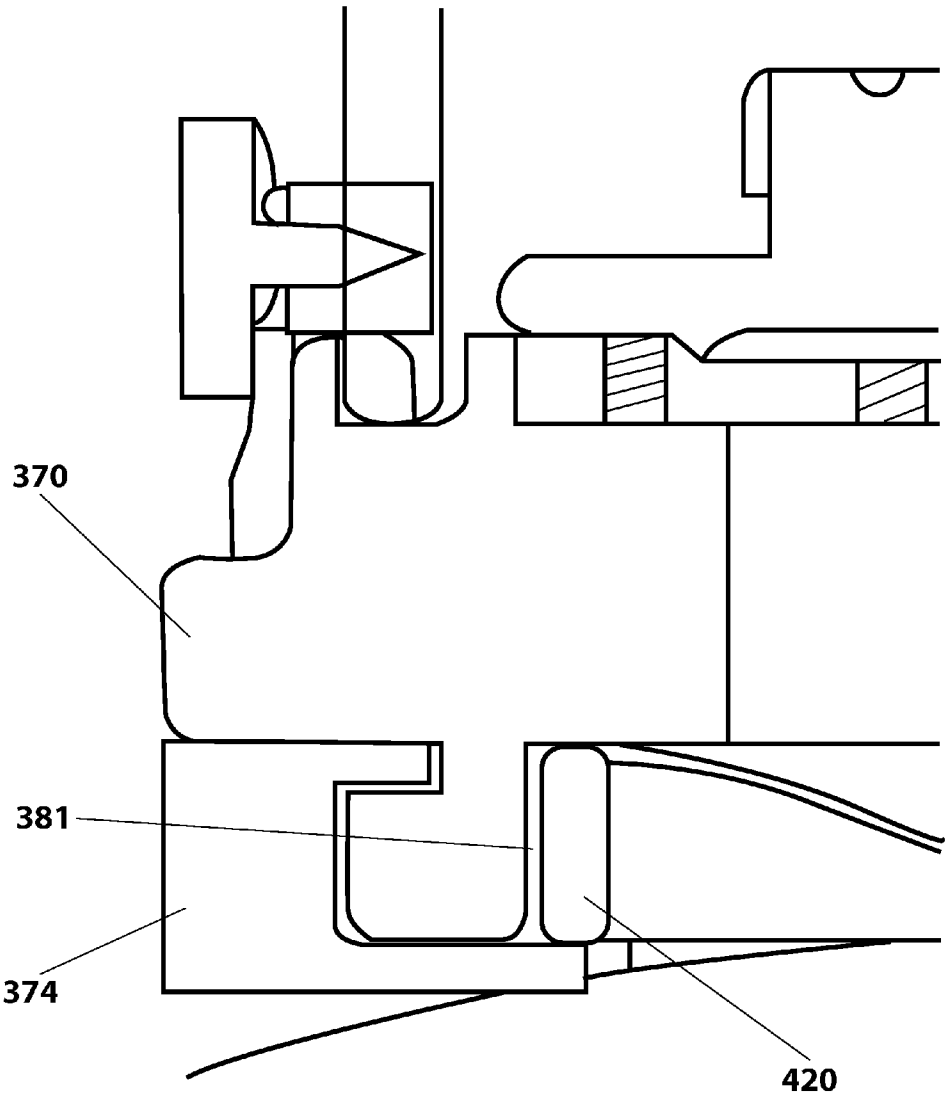


Figure 35

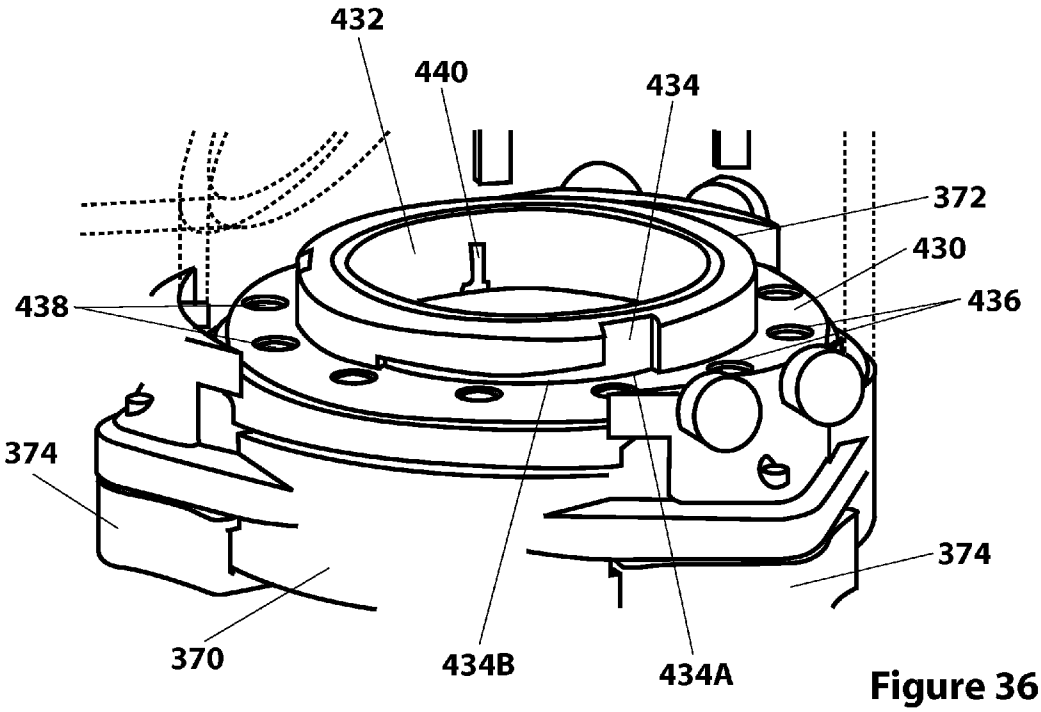


Figure 36

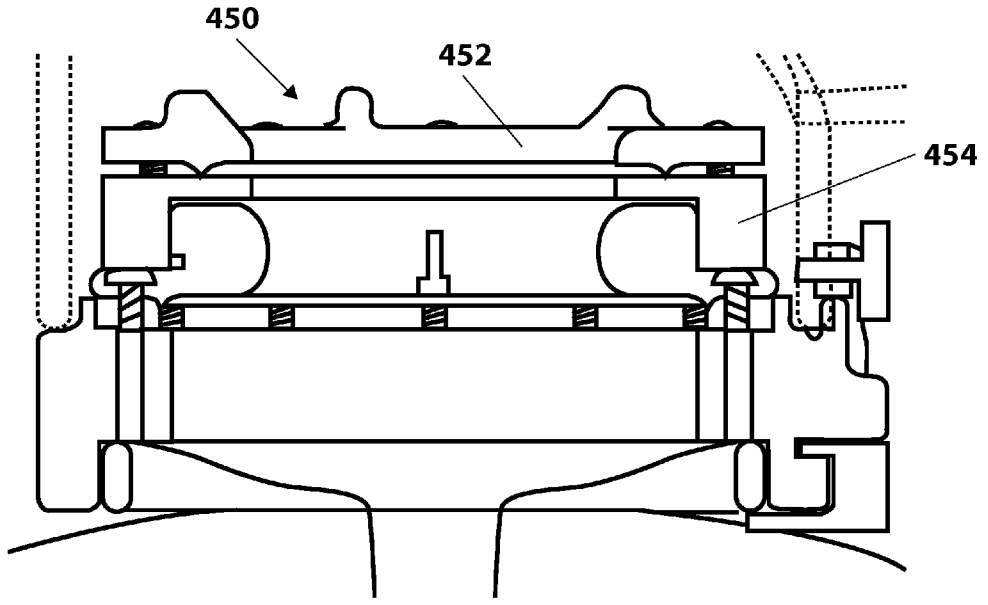


Figure 37A

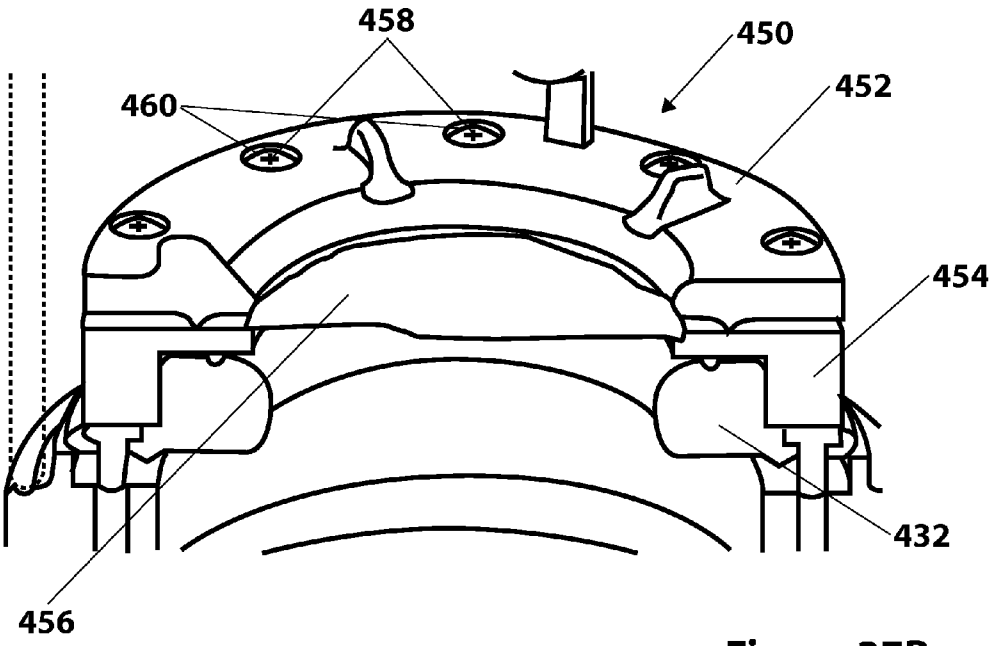


Figure 37B

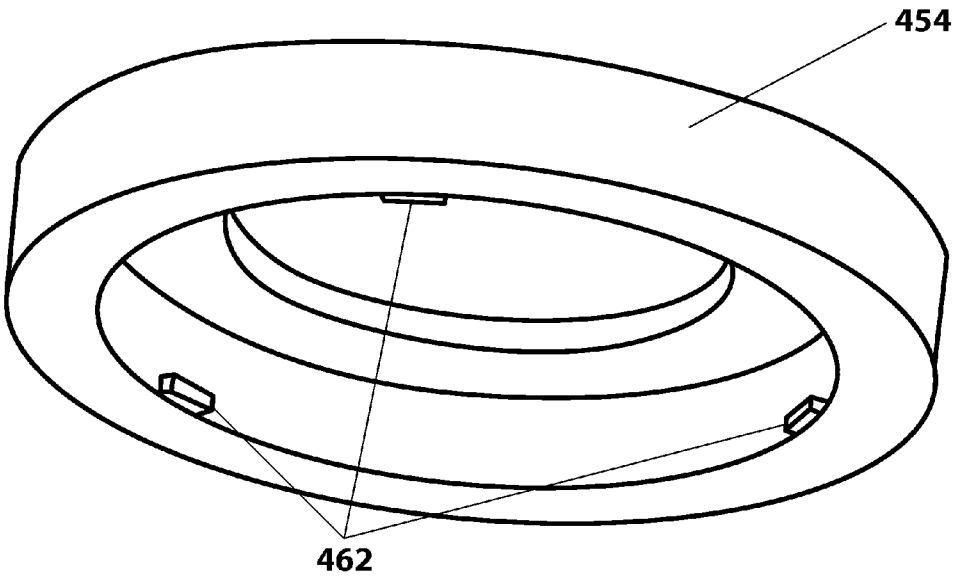


Figure 37C

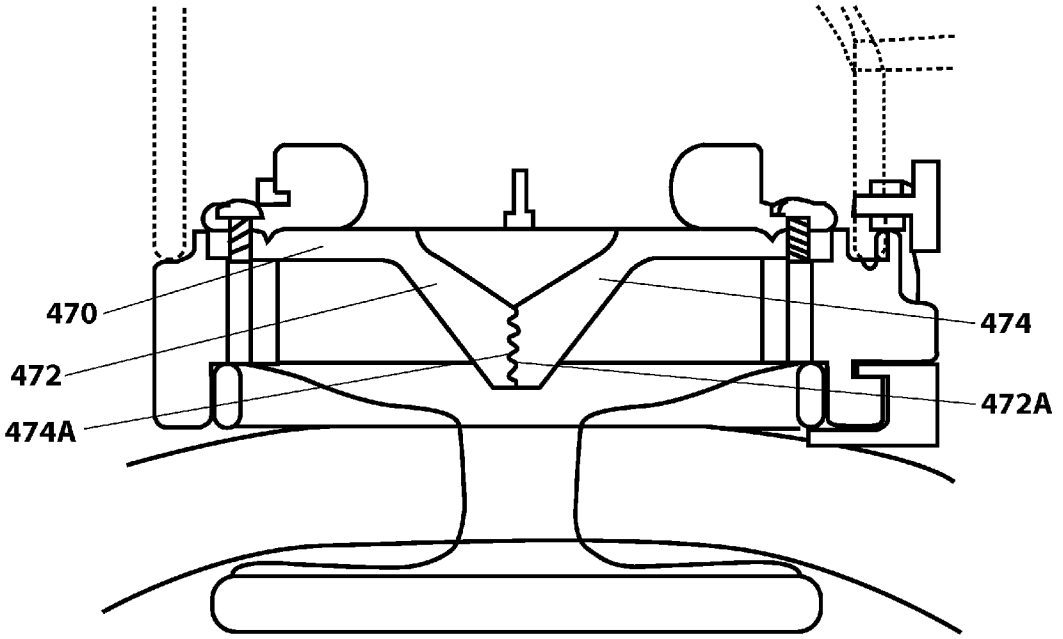


Figure 38A

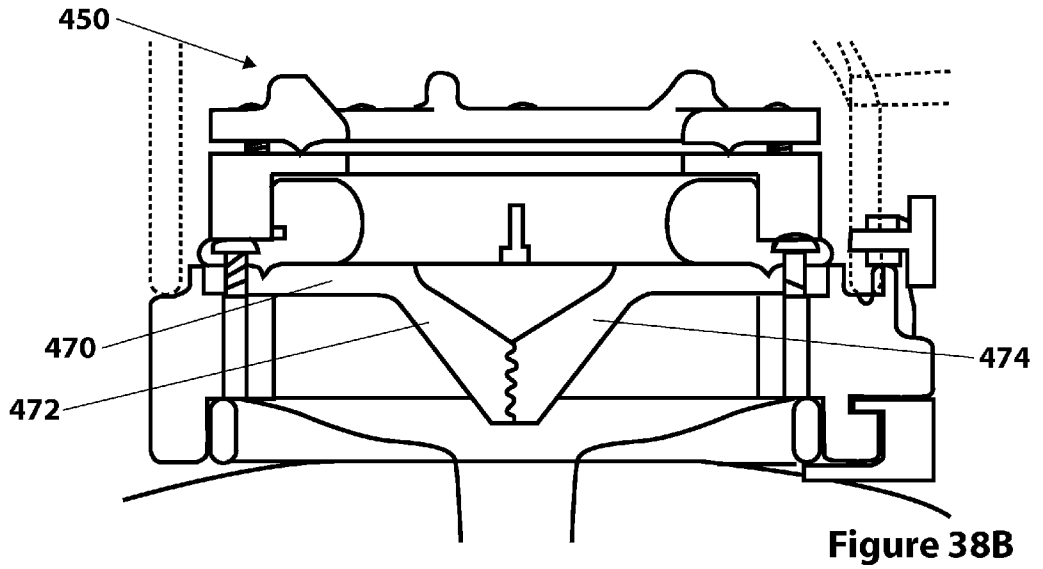


Figure 38B

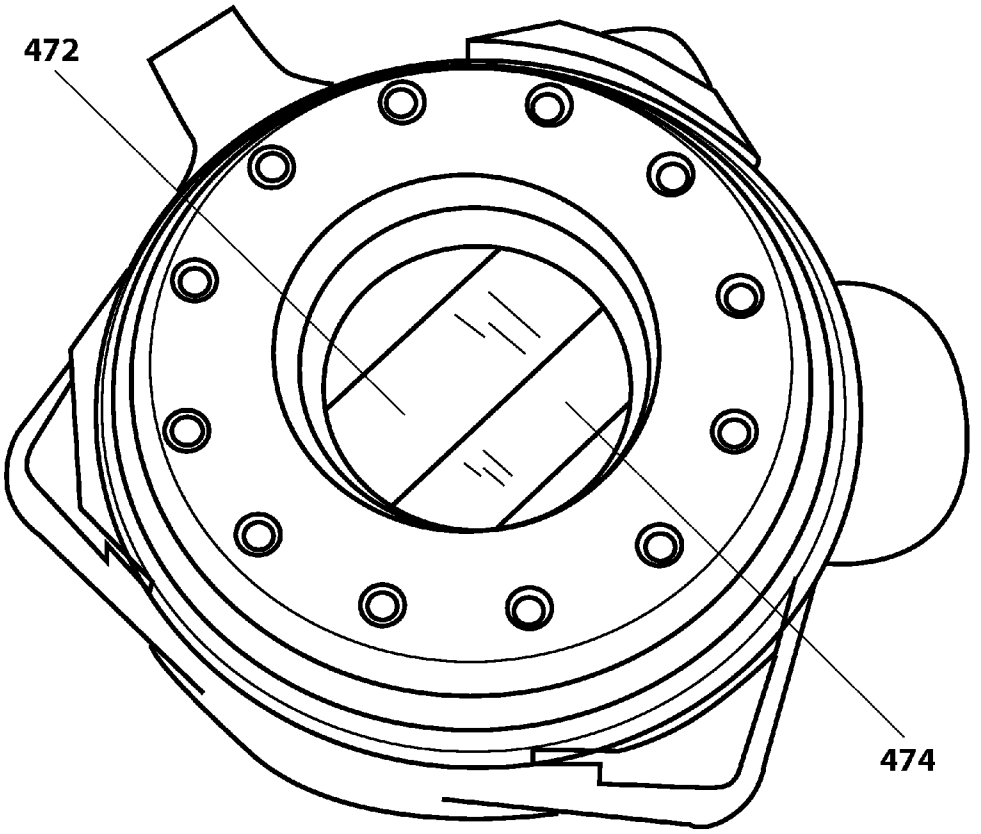


Figure 38C

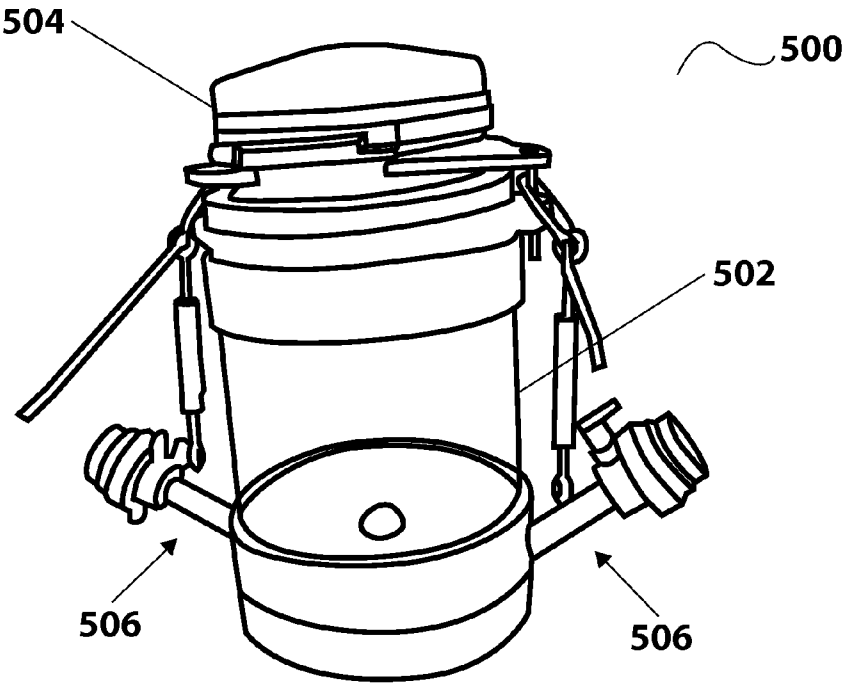


Figure 39A

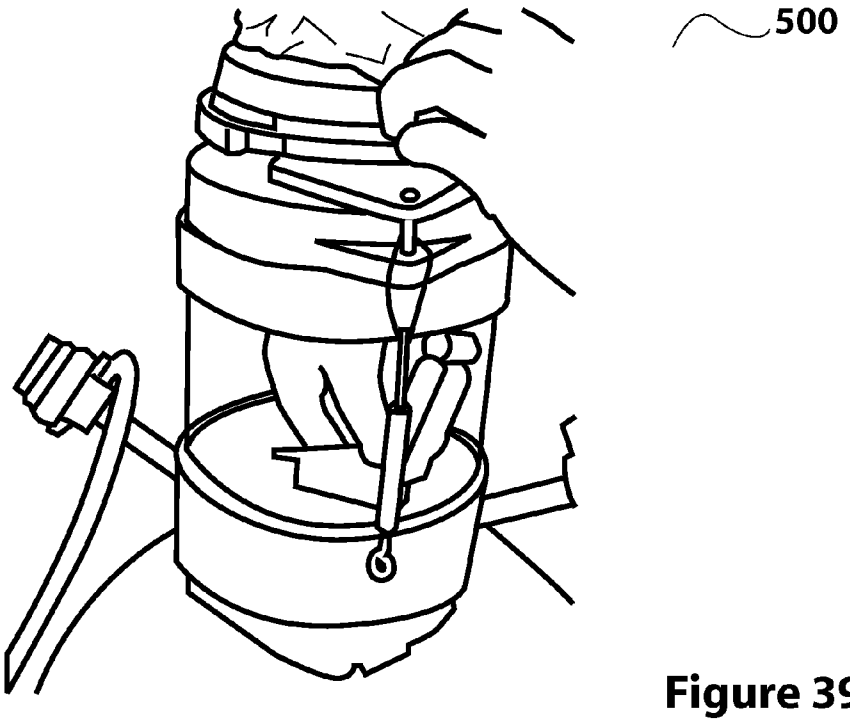


Figure 39B

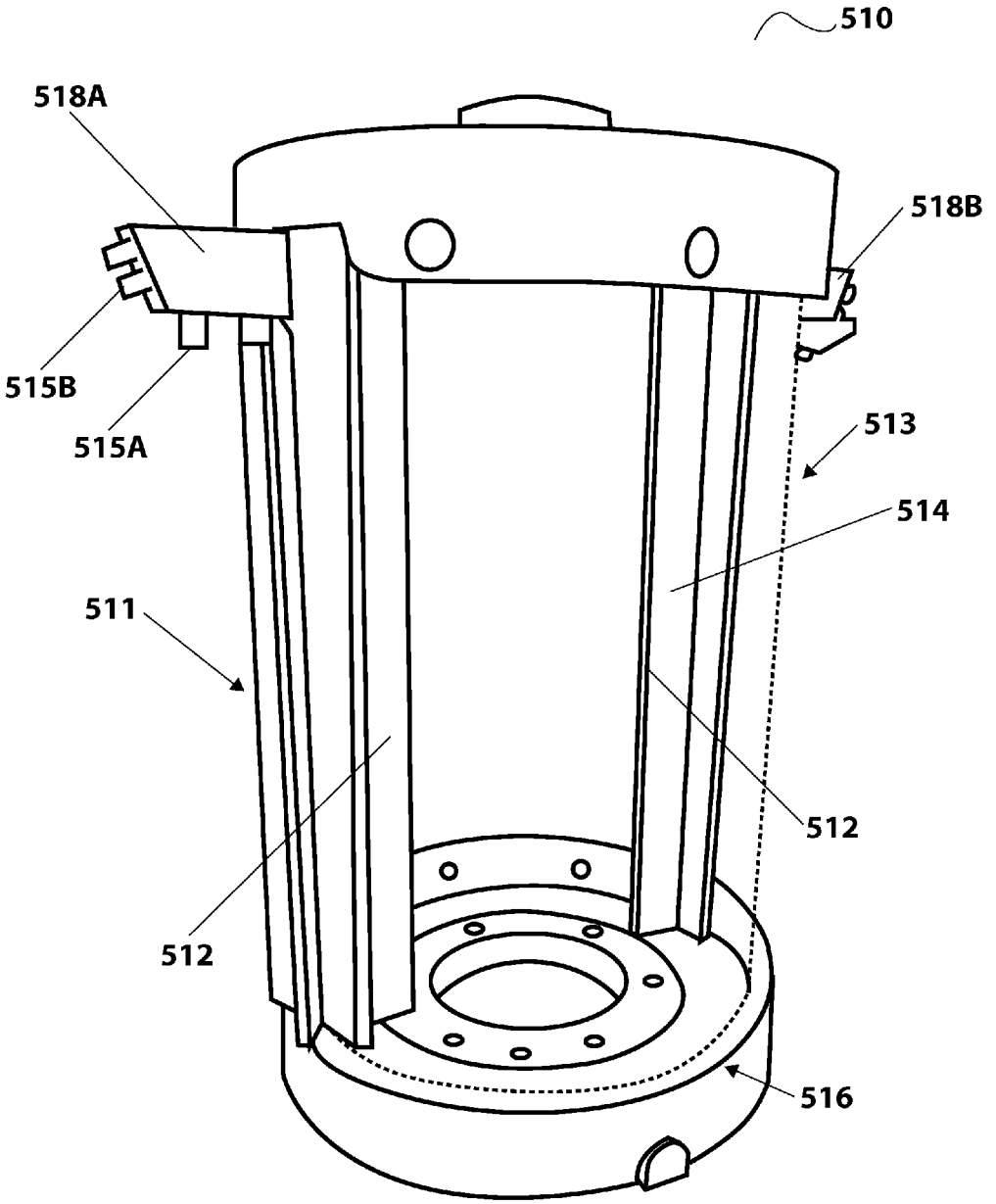


Figure 40

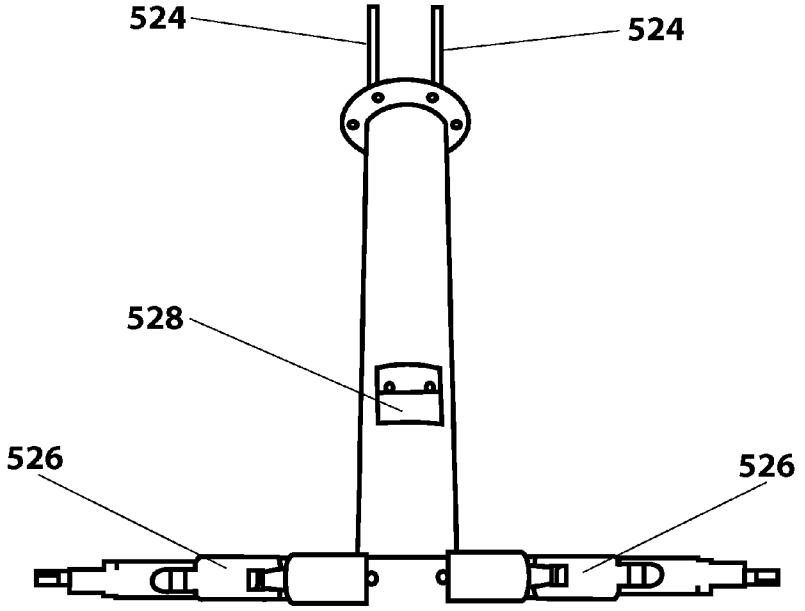


Figure 41A

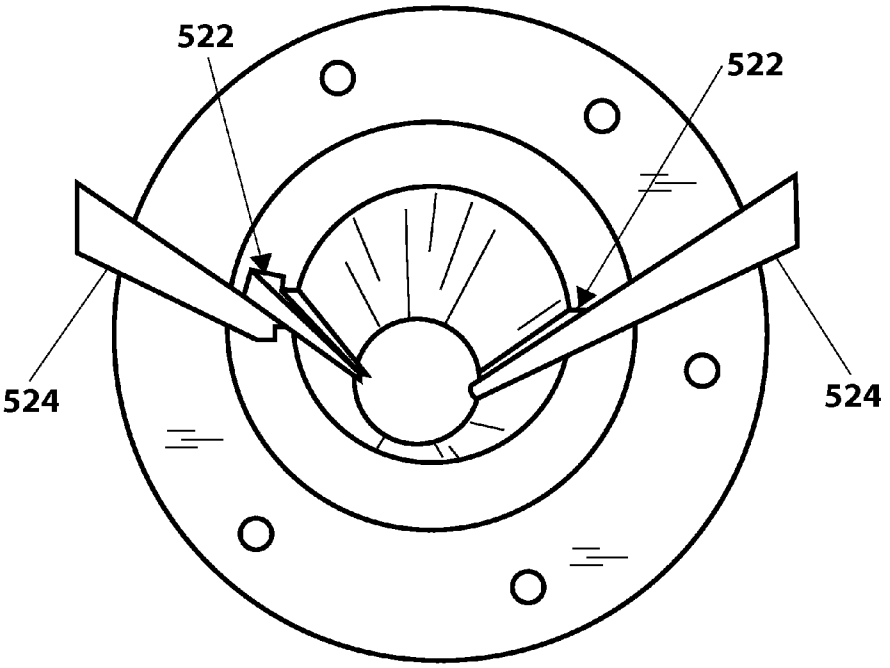


Figure 41B

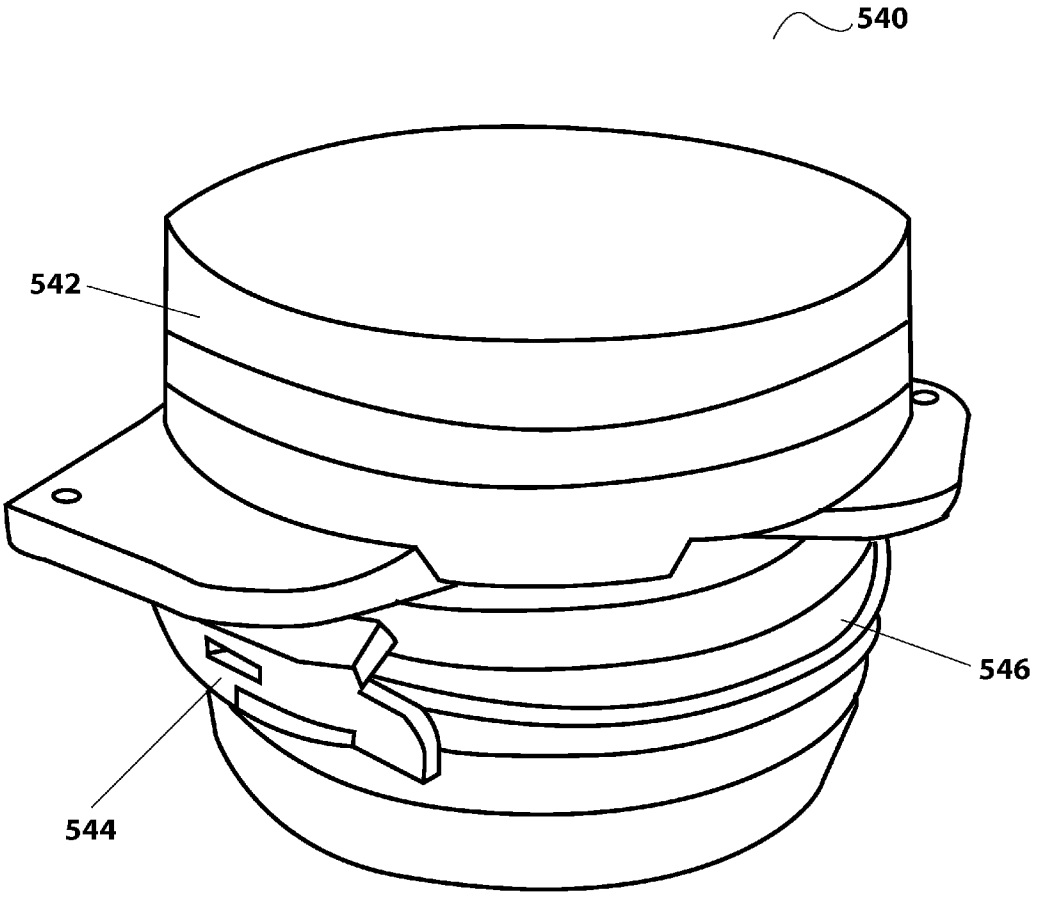


Figure 42

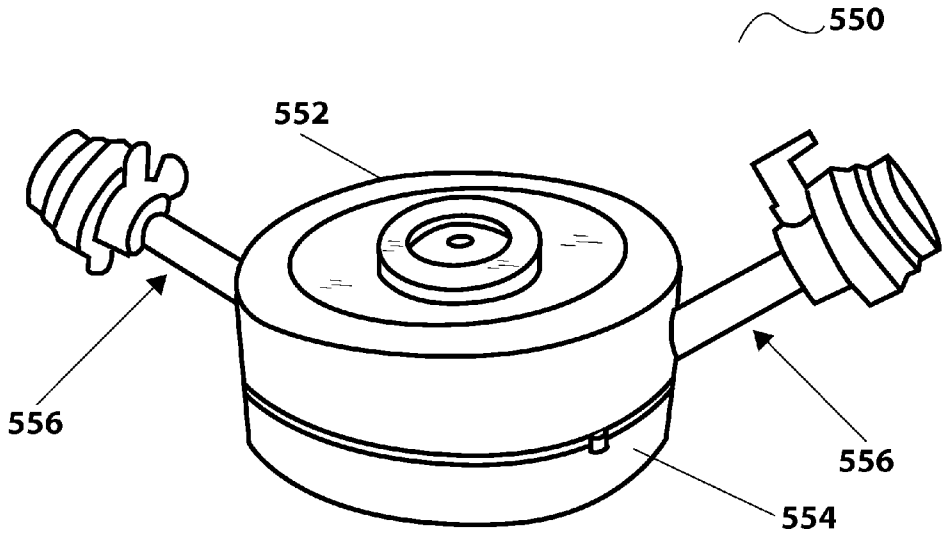


Figure 43

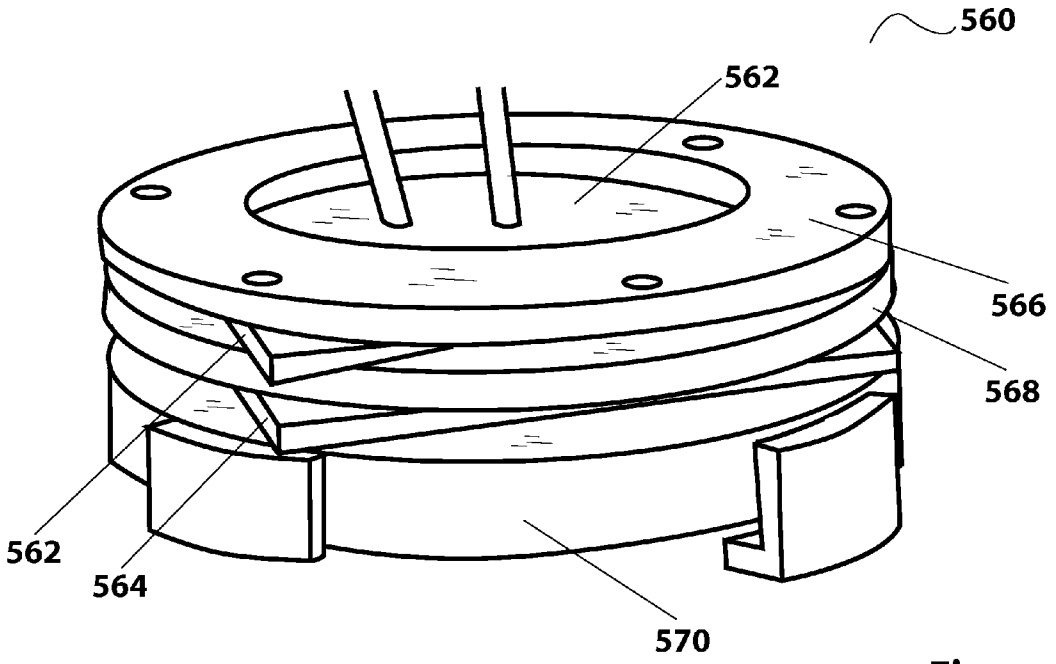


Figure 44

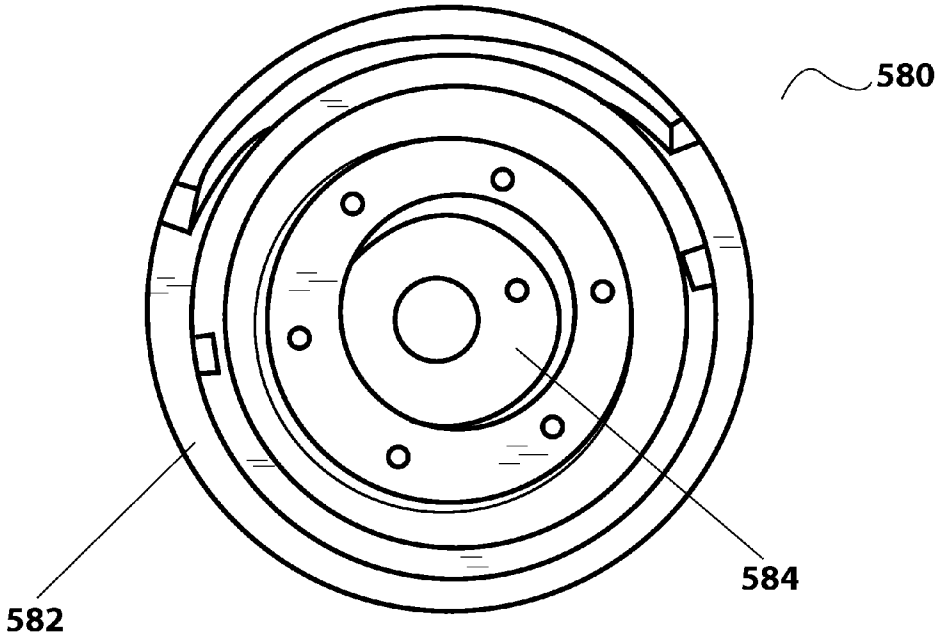


Figure 45A

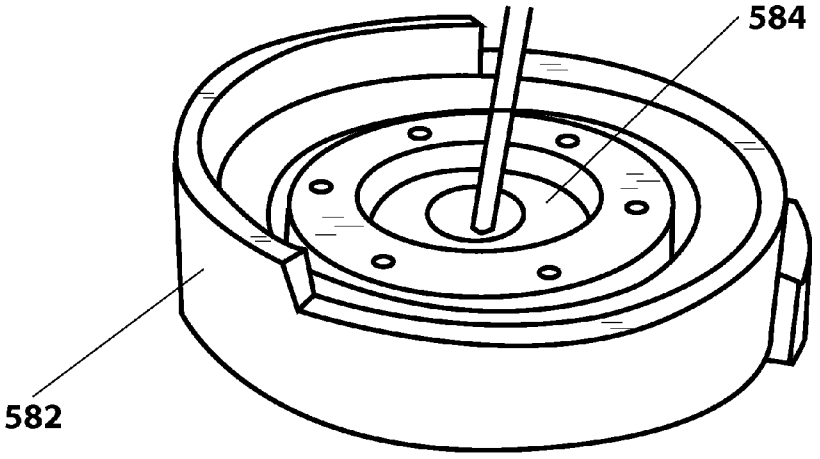


Figure 45B

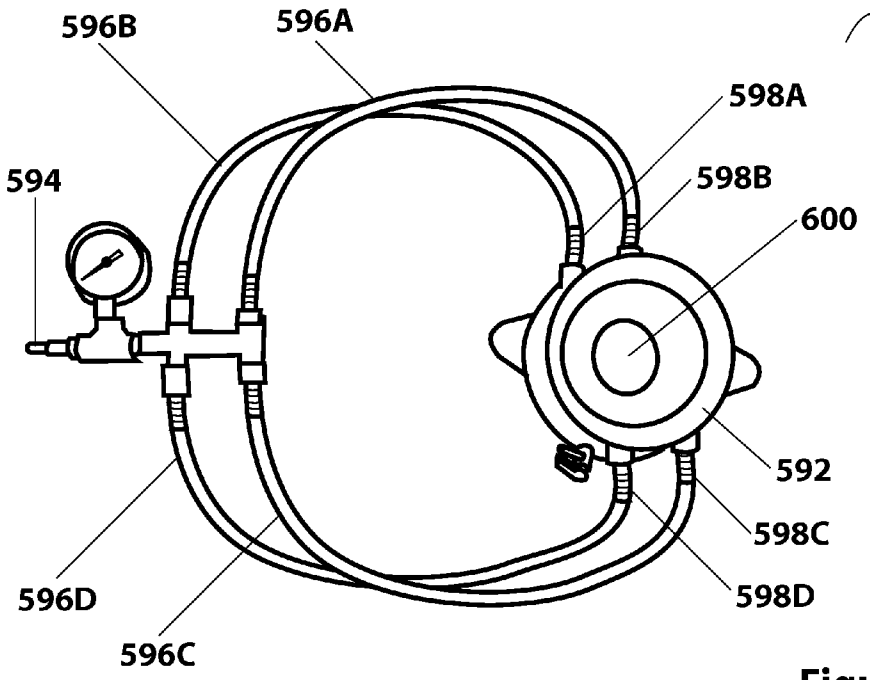


Figure 46A

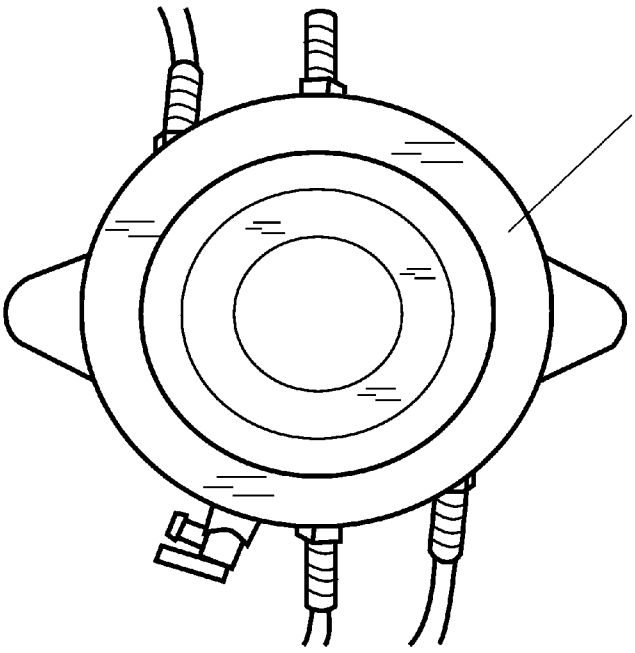


Figure 46B

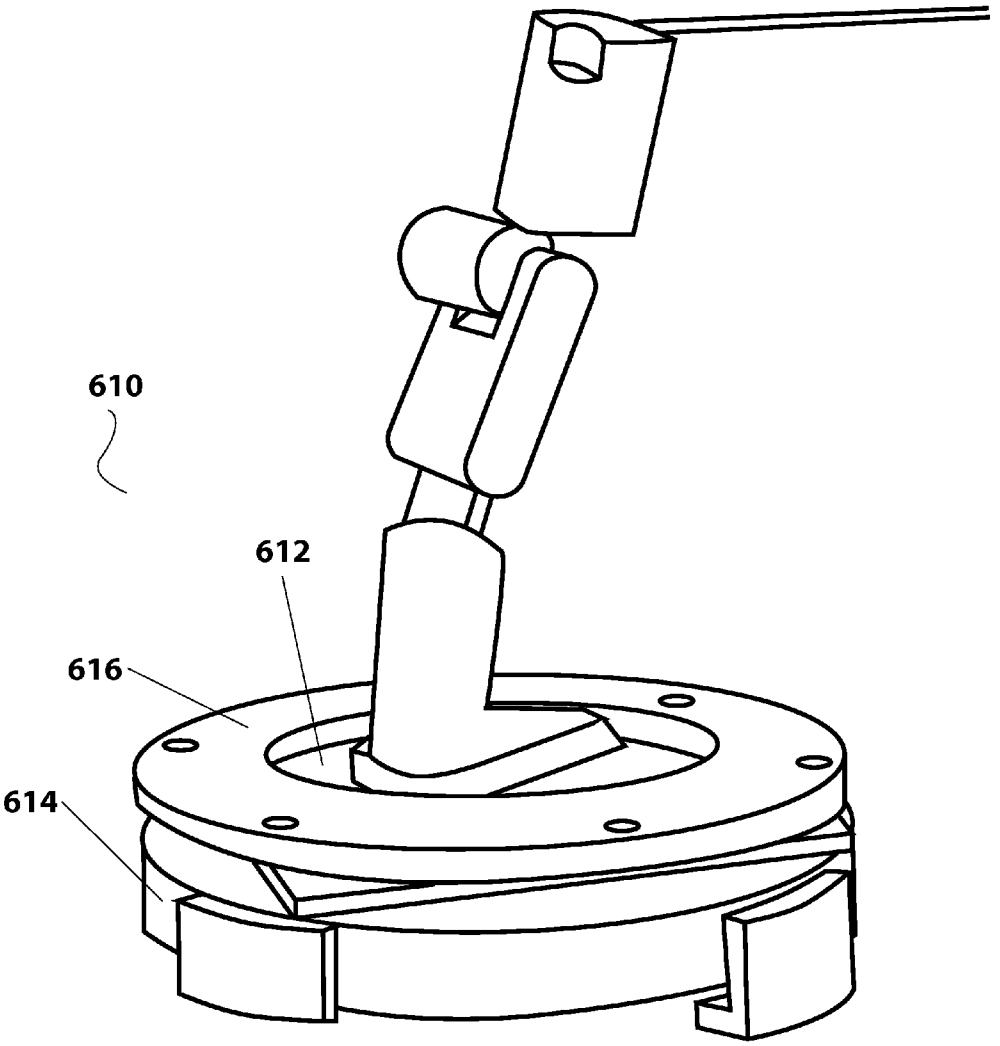


Figure 47

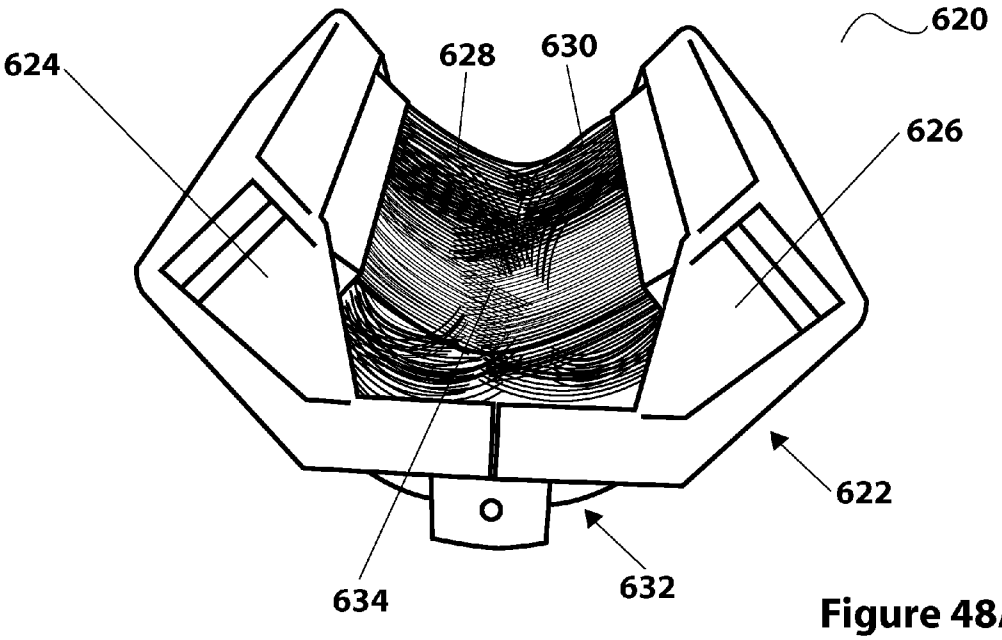


Figure 48A

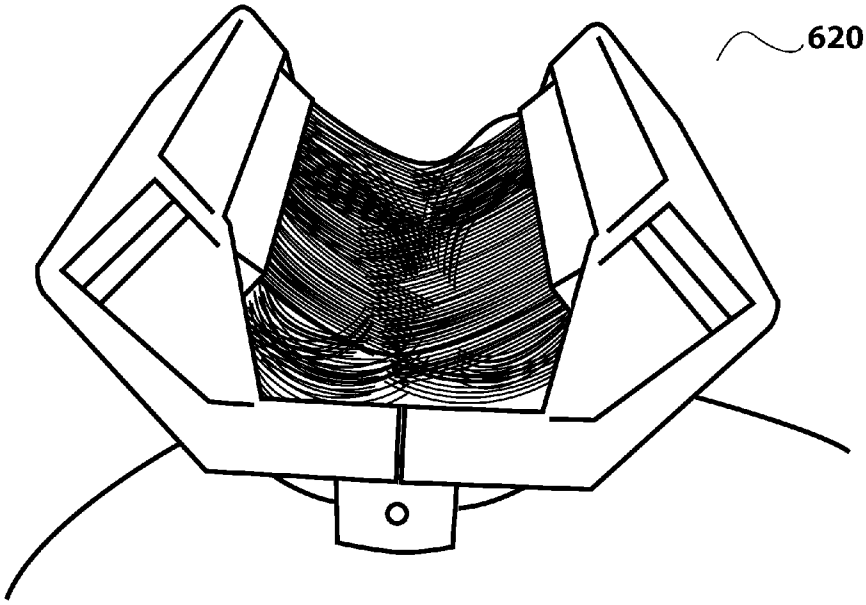


Figure 48B

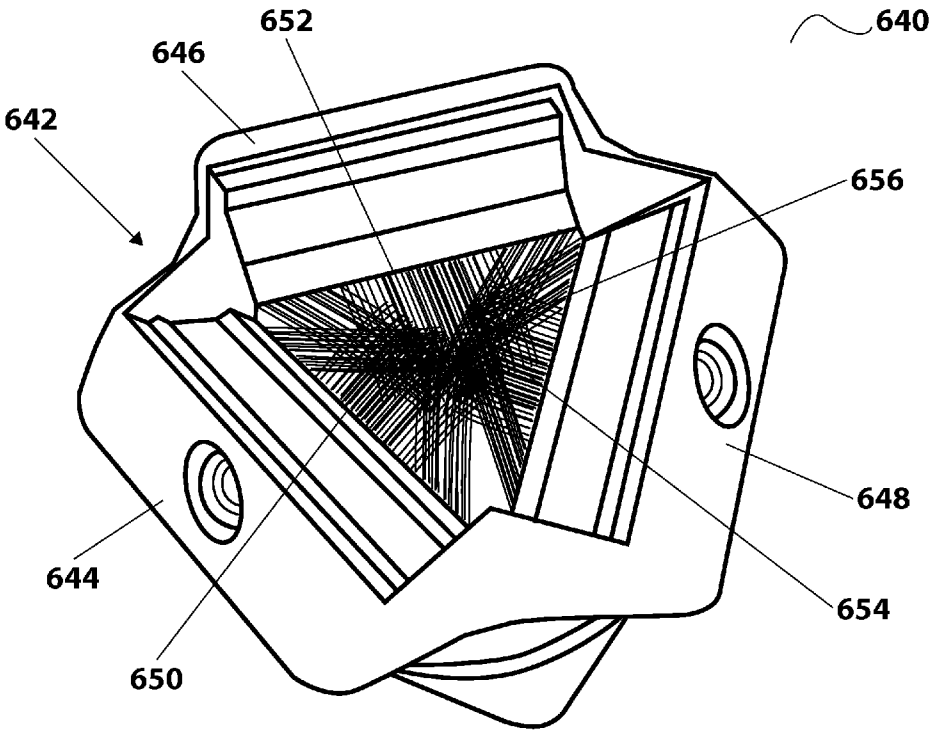


Figure 49A

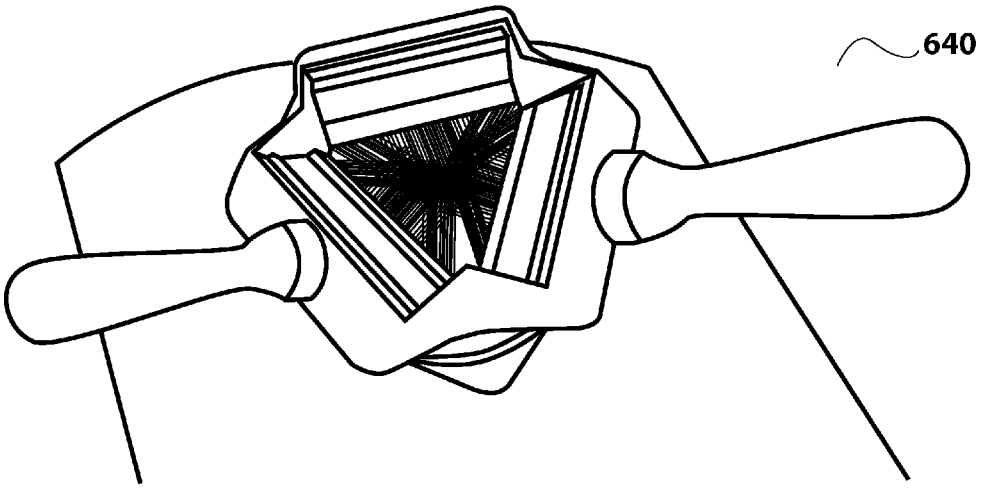


Figure 49B

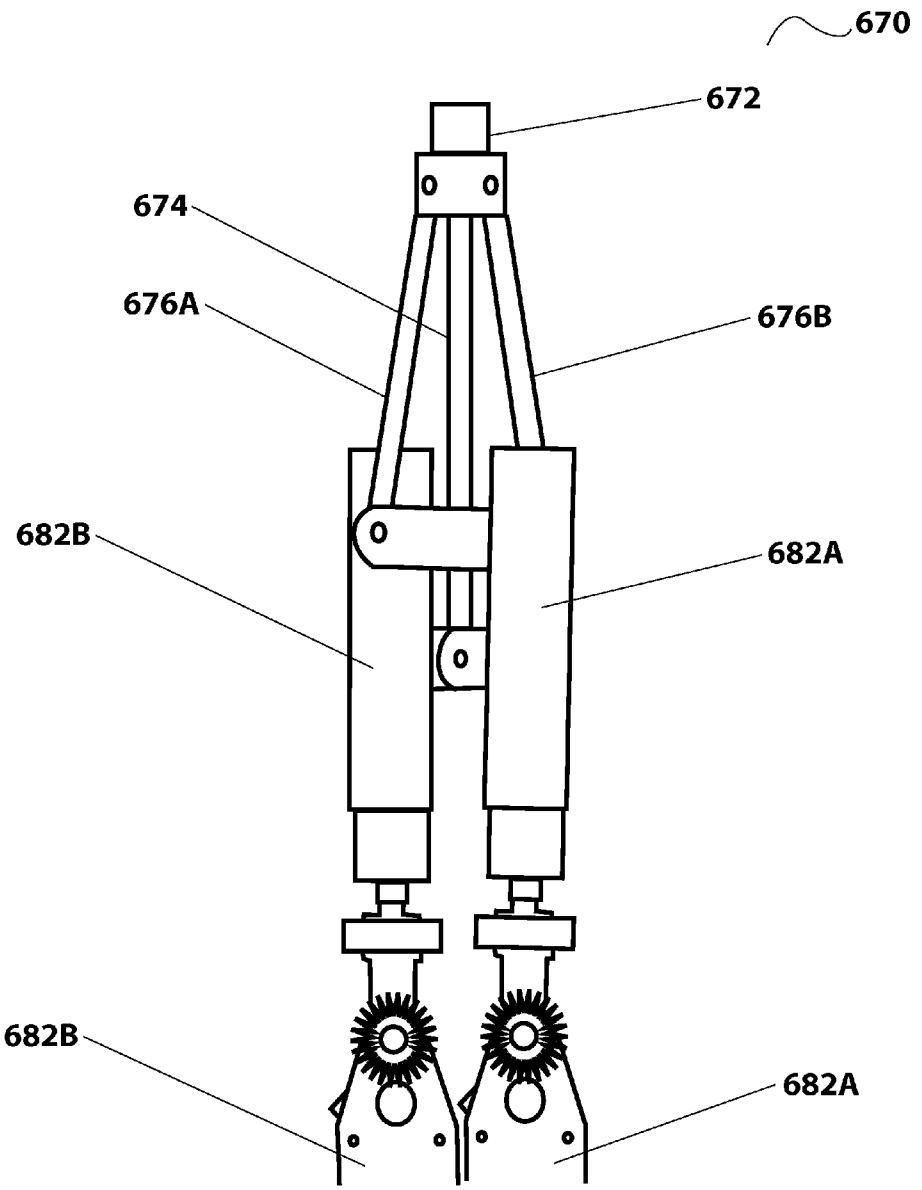


Figure 50A

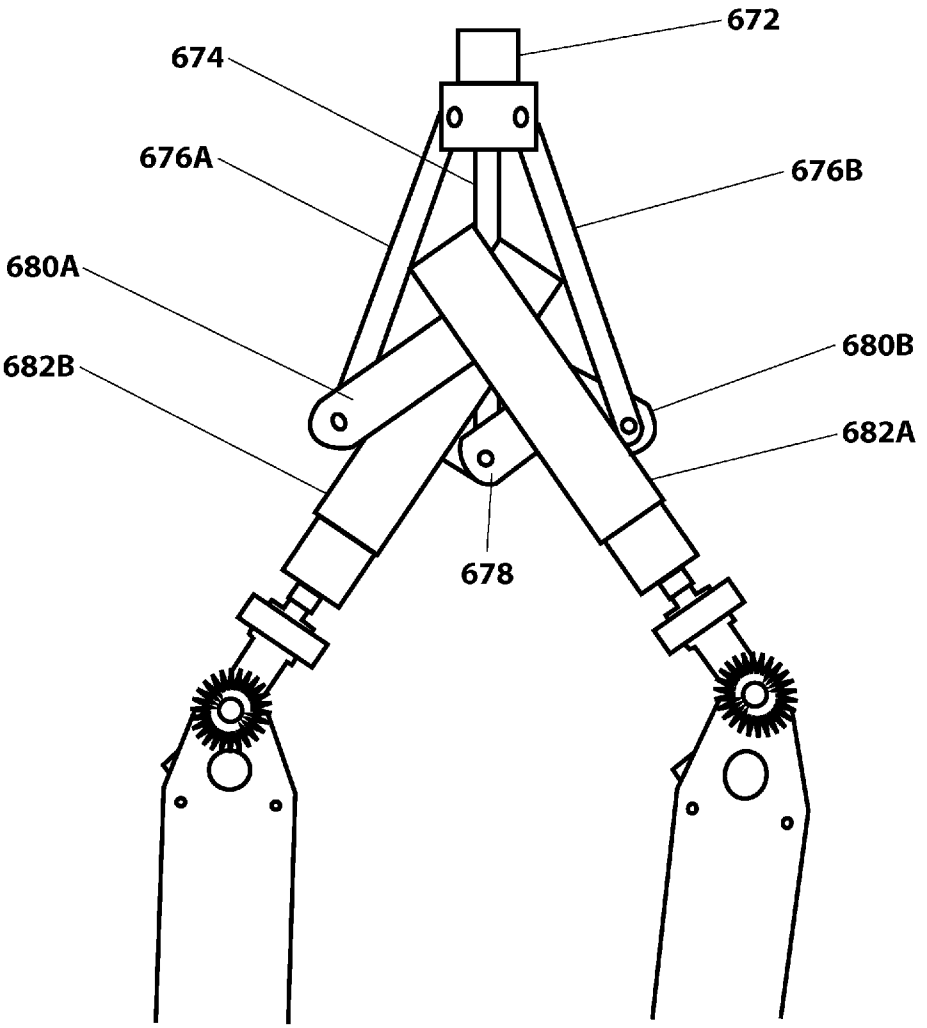


Figure 50B

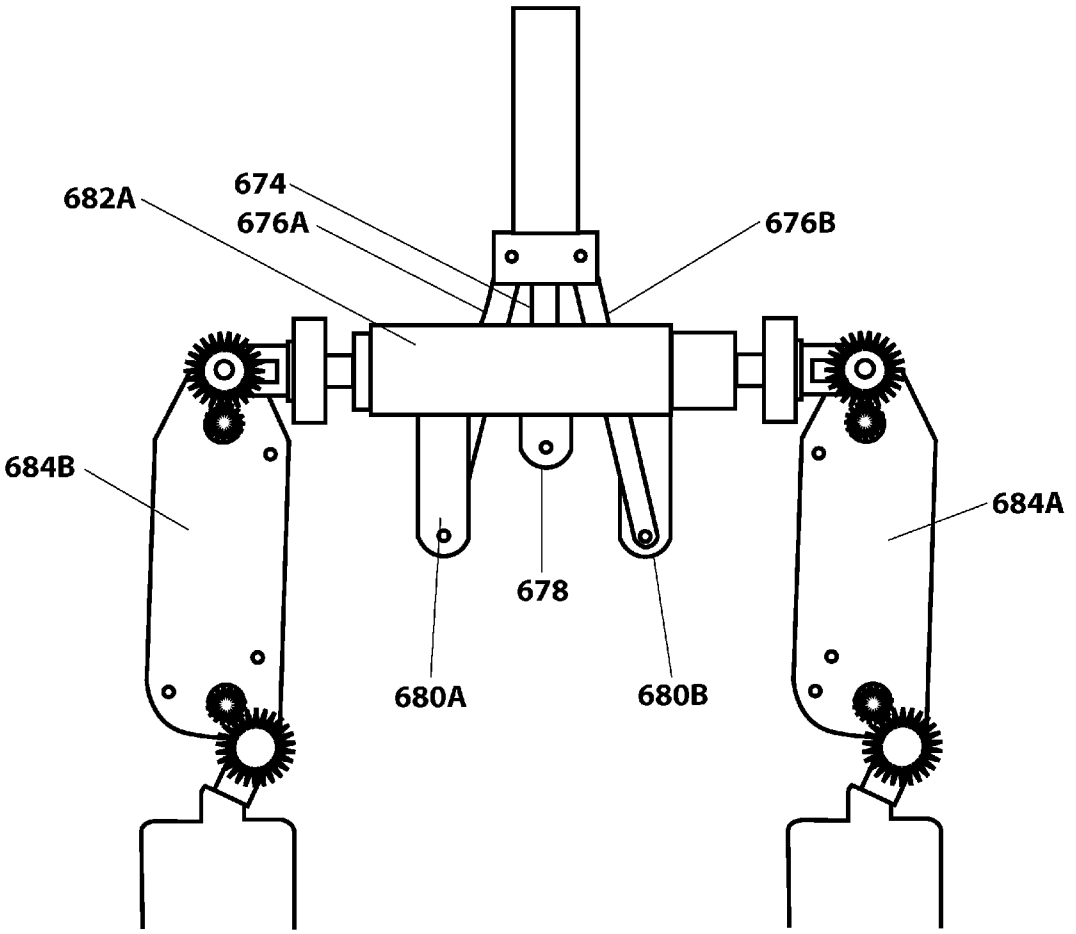


Figure 50C

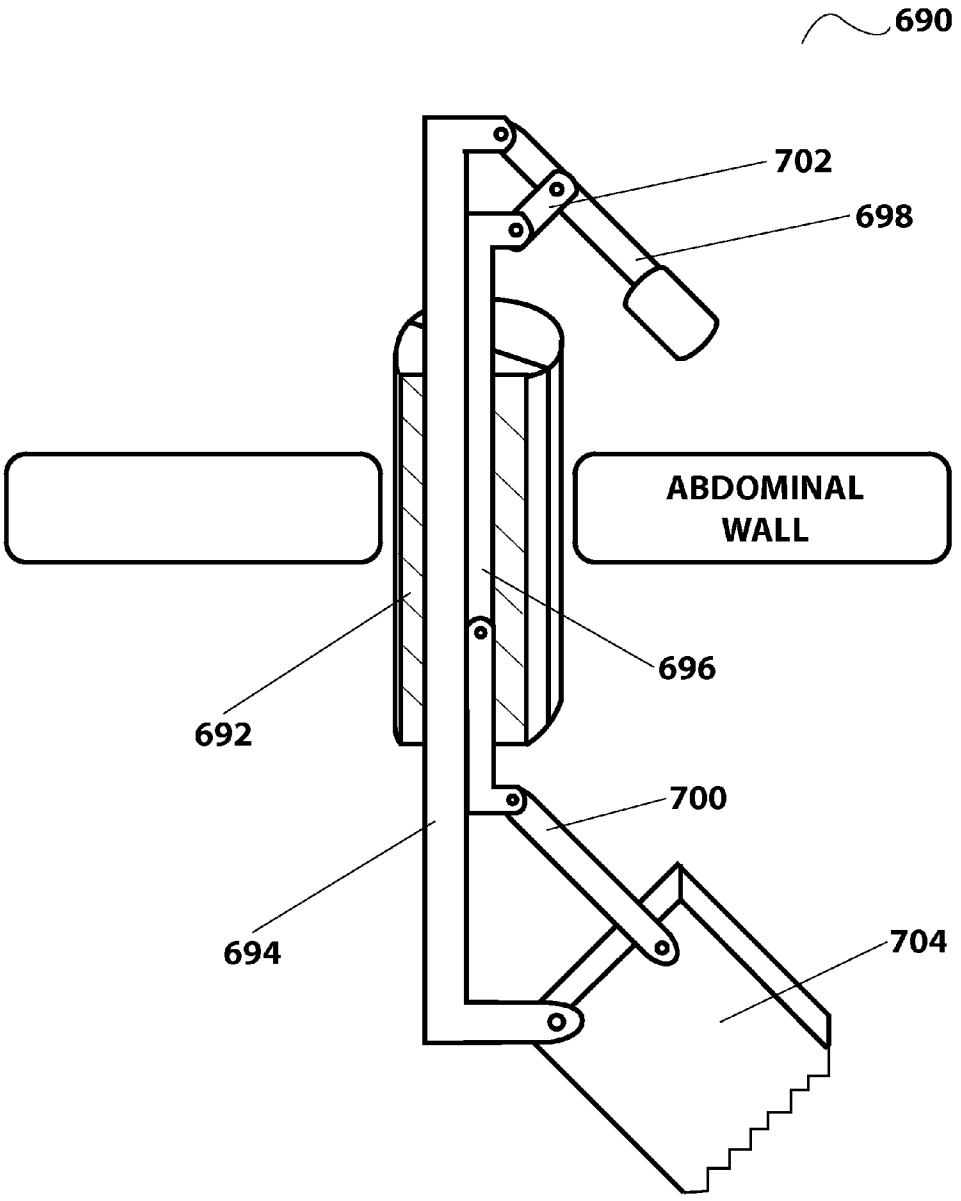


Figure 51A

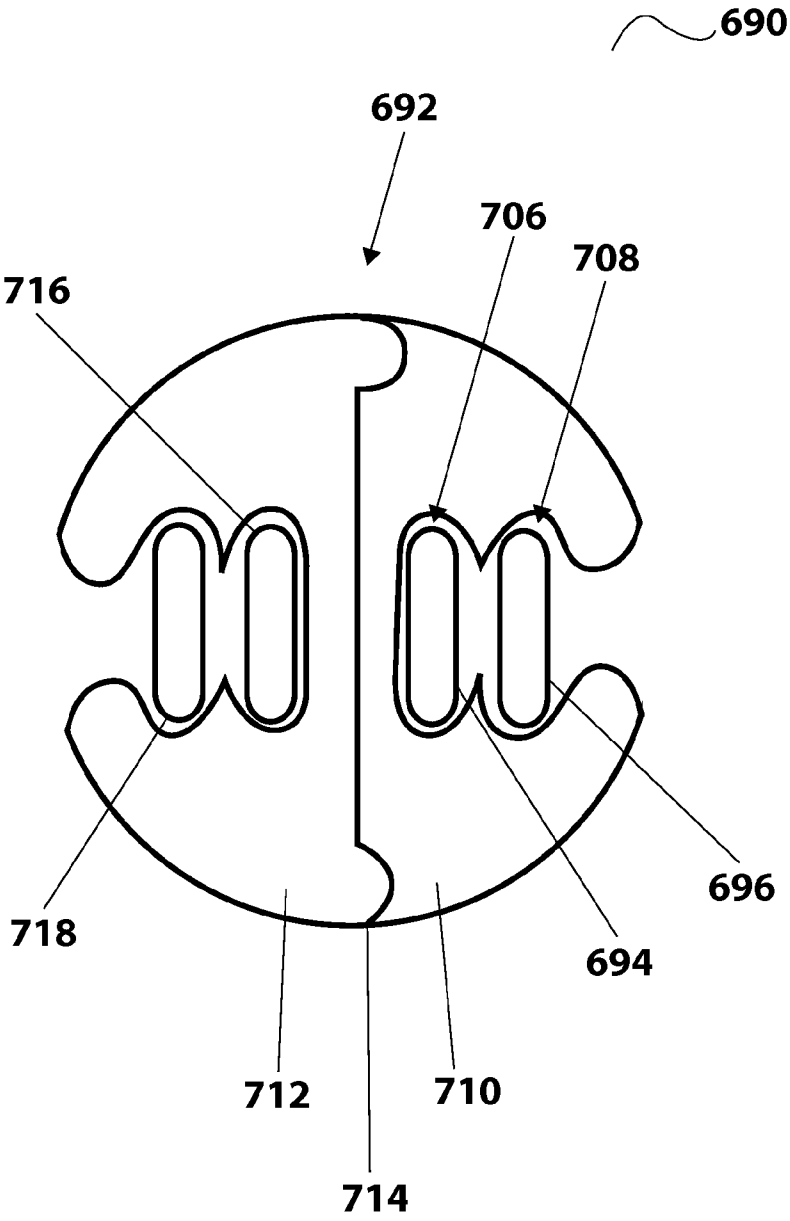


Figure 51B

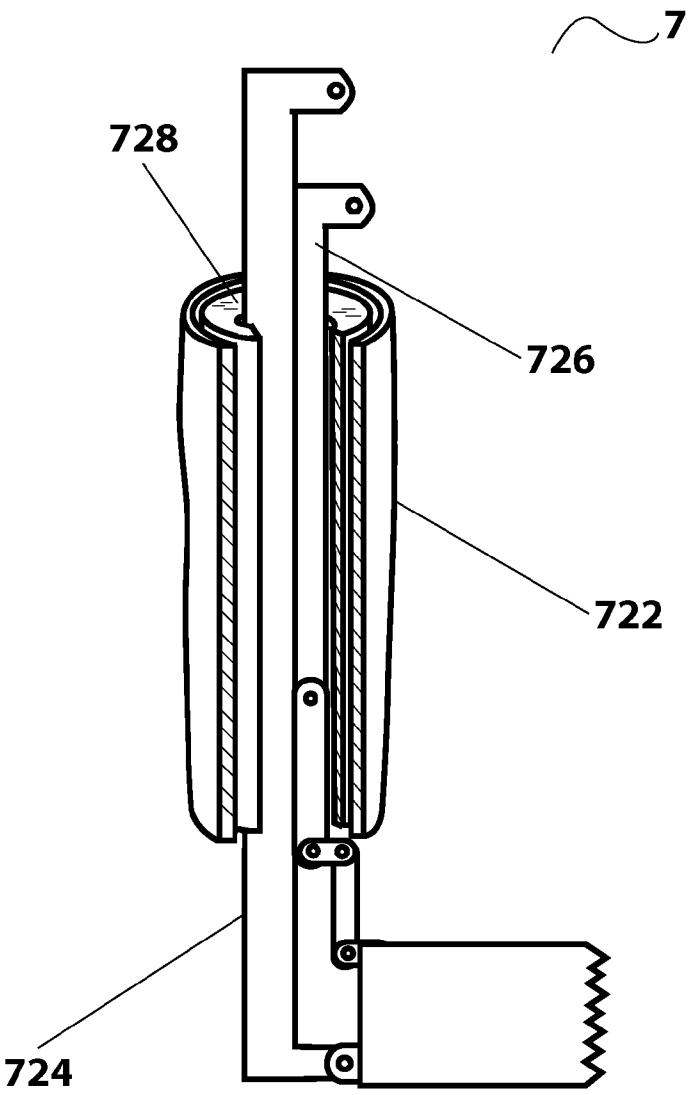


Figure 52

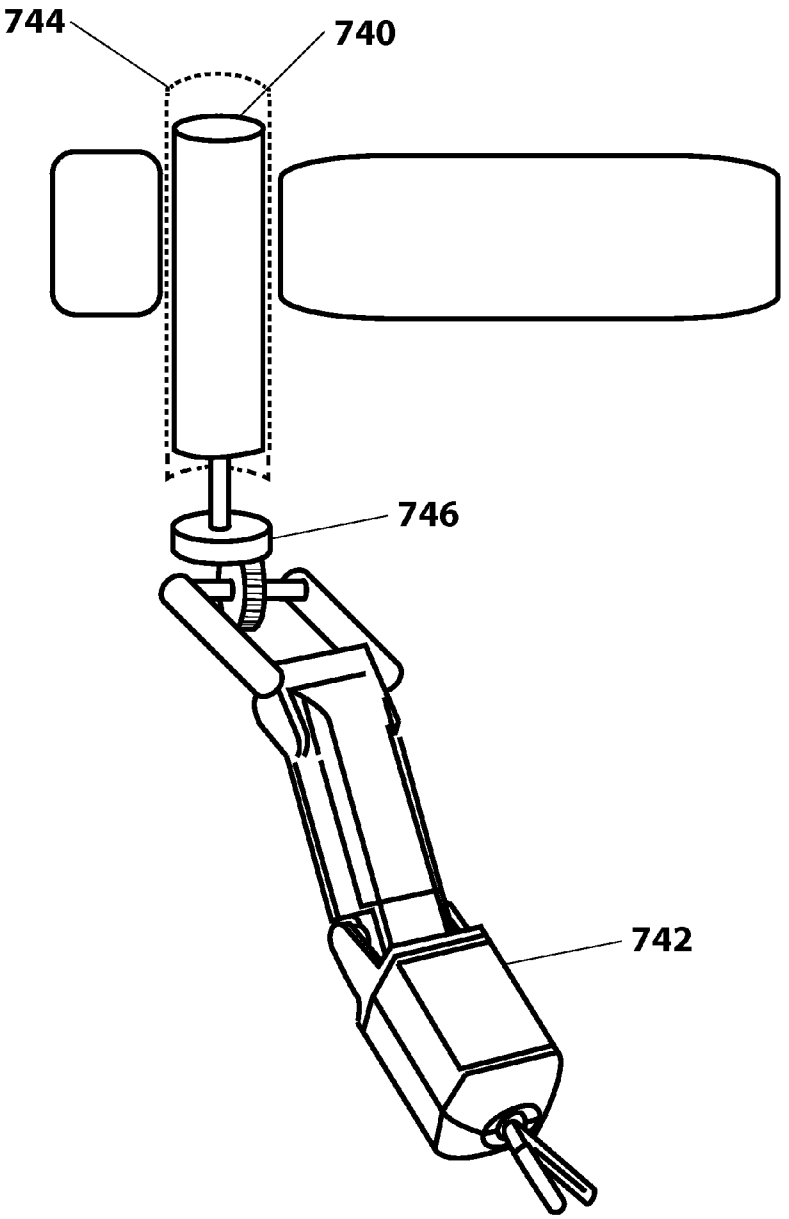


Figure 53

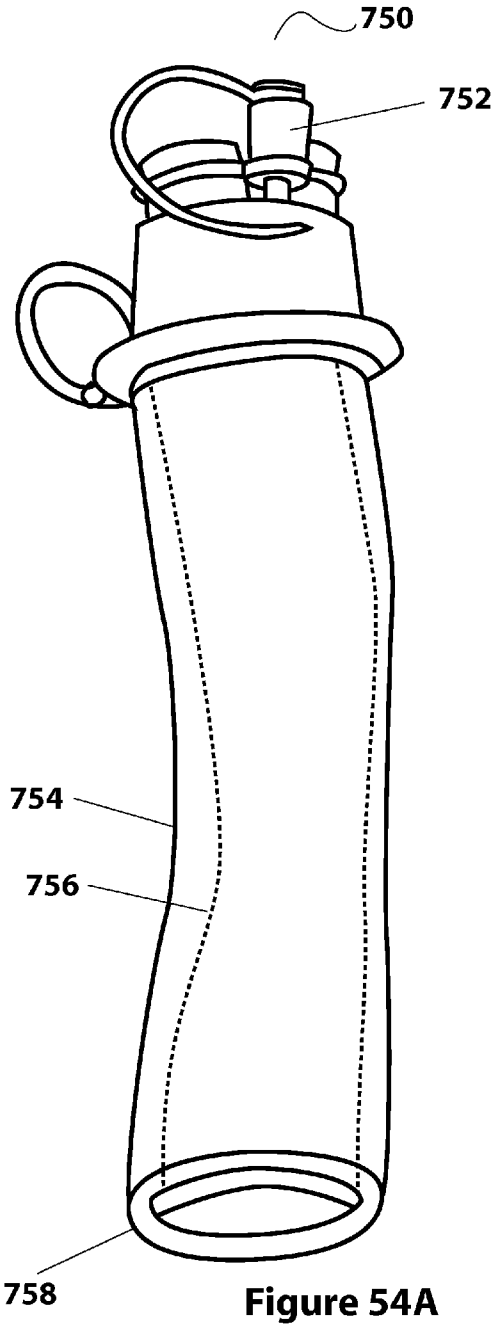


Figure 54A

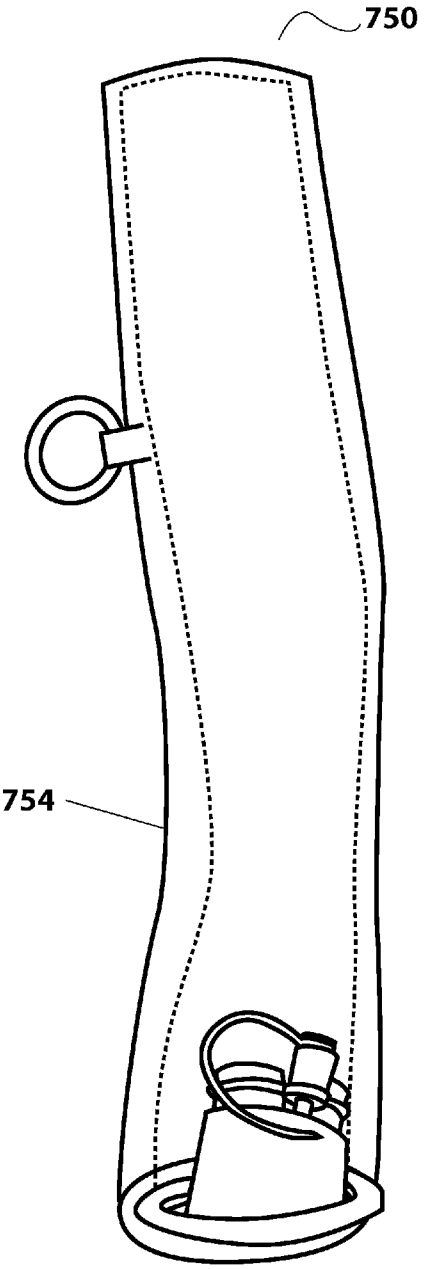


Figure 54B

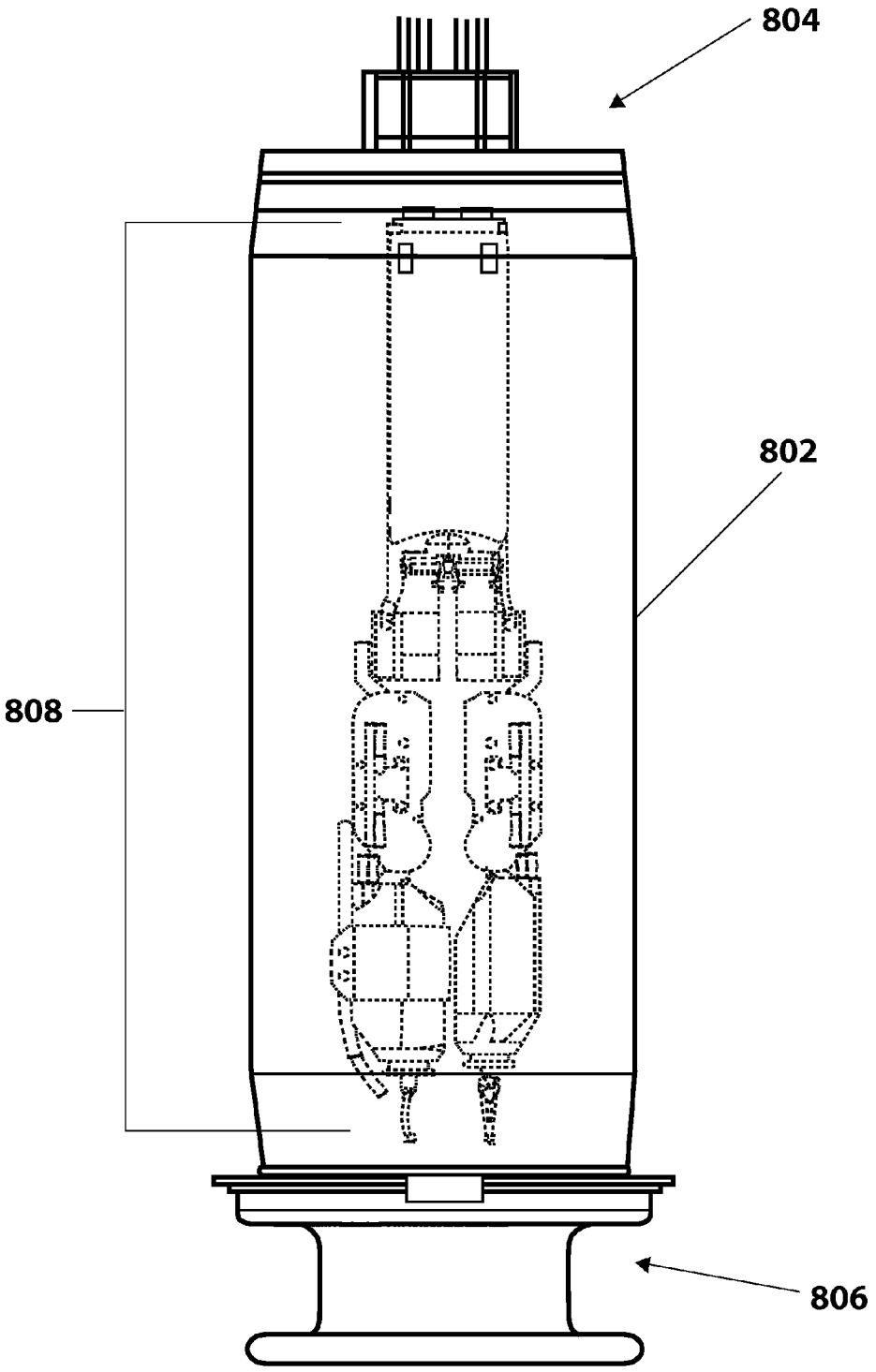


Figure 55

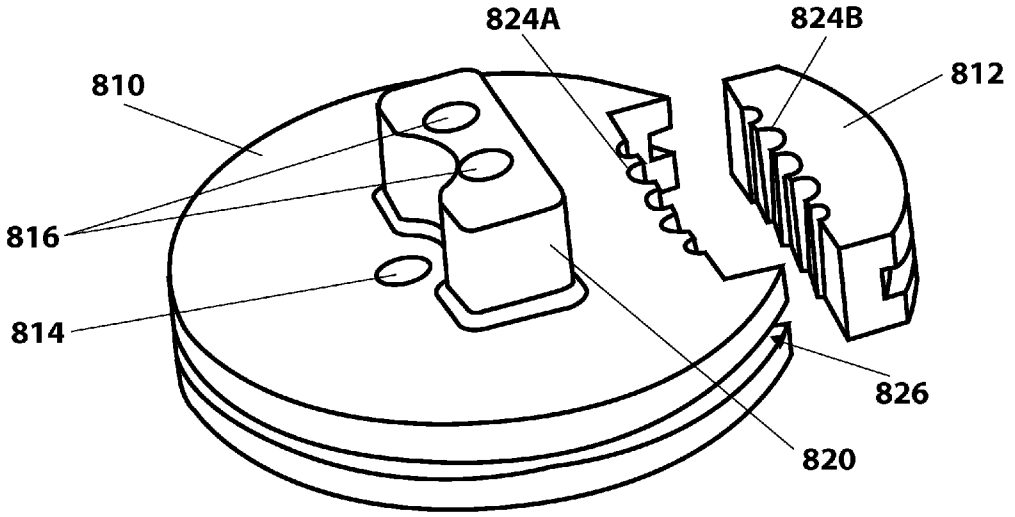


Figure 56A

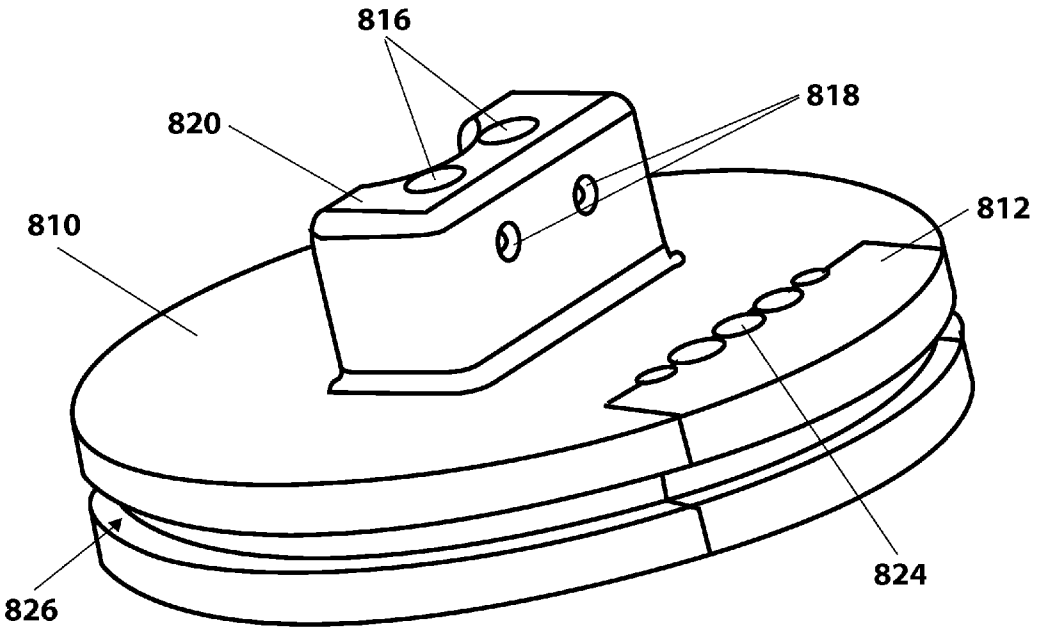


Figure 56B

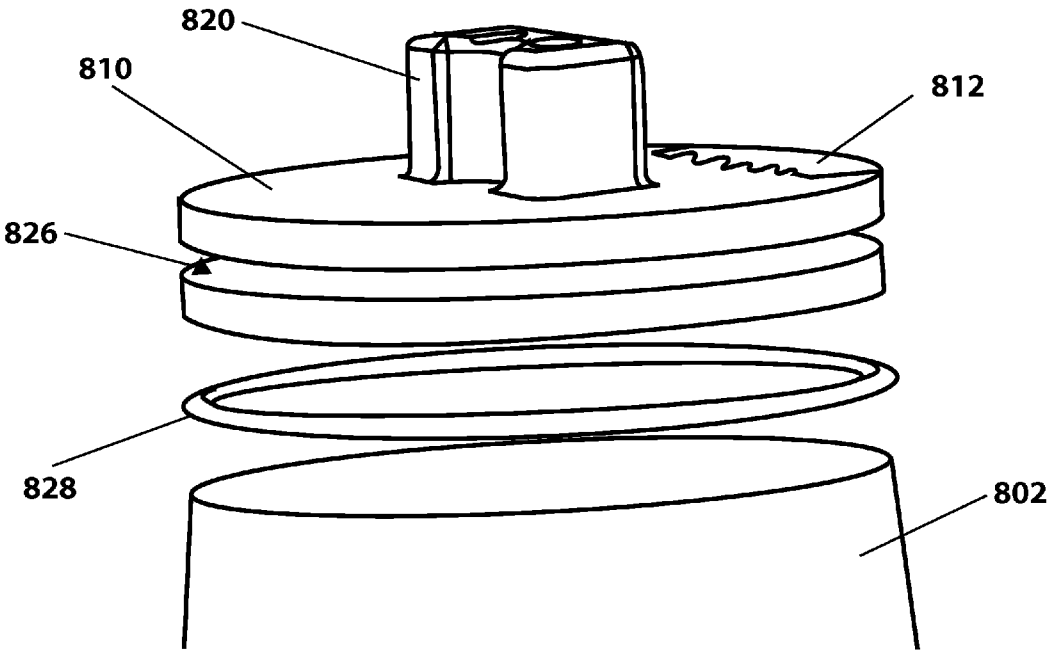


Figure 57A

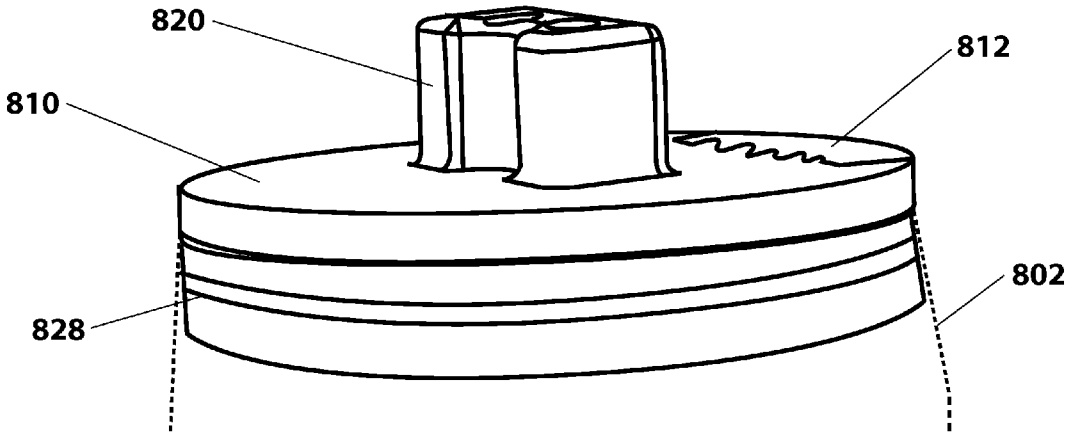


Figure 57B

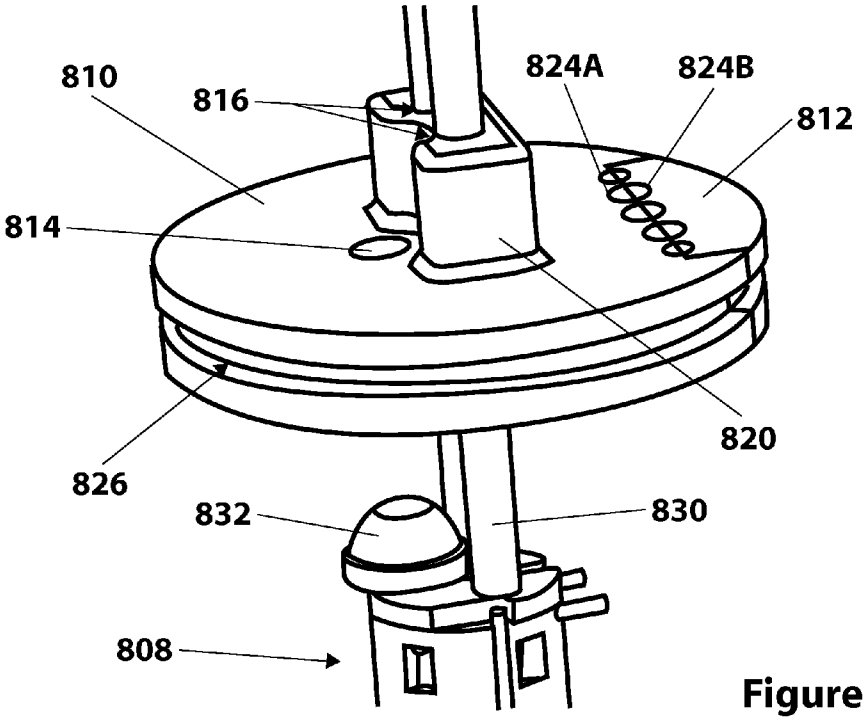


Figure 58A

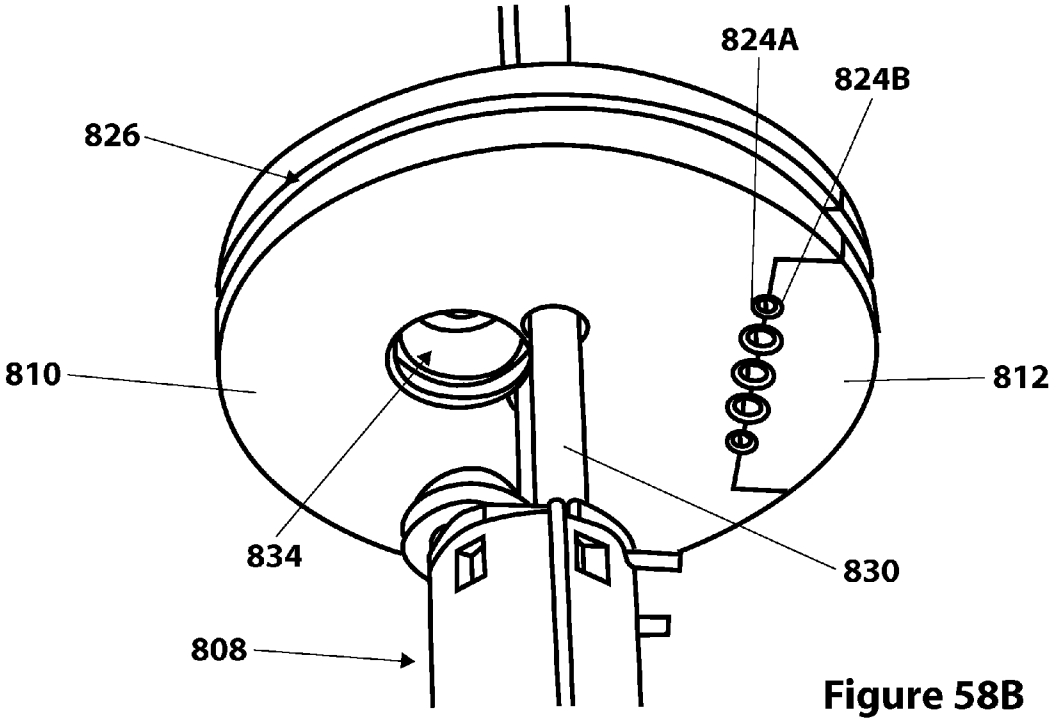


Figure 58B

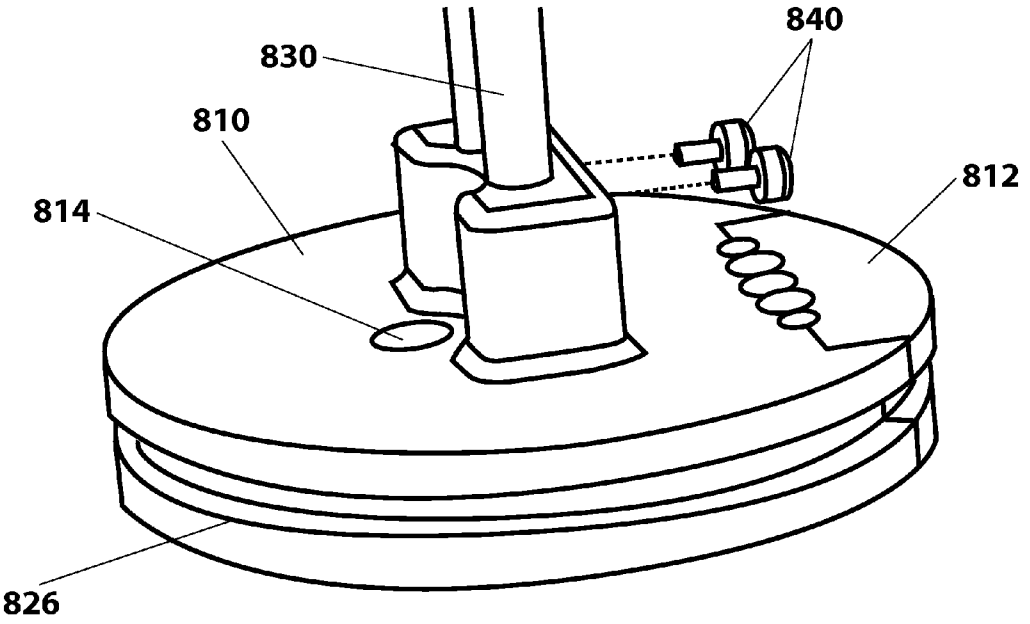


Figure 59A

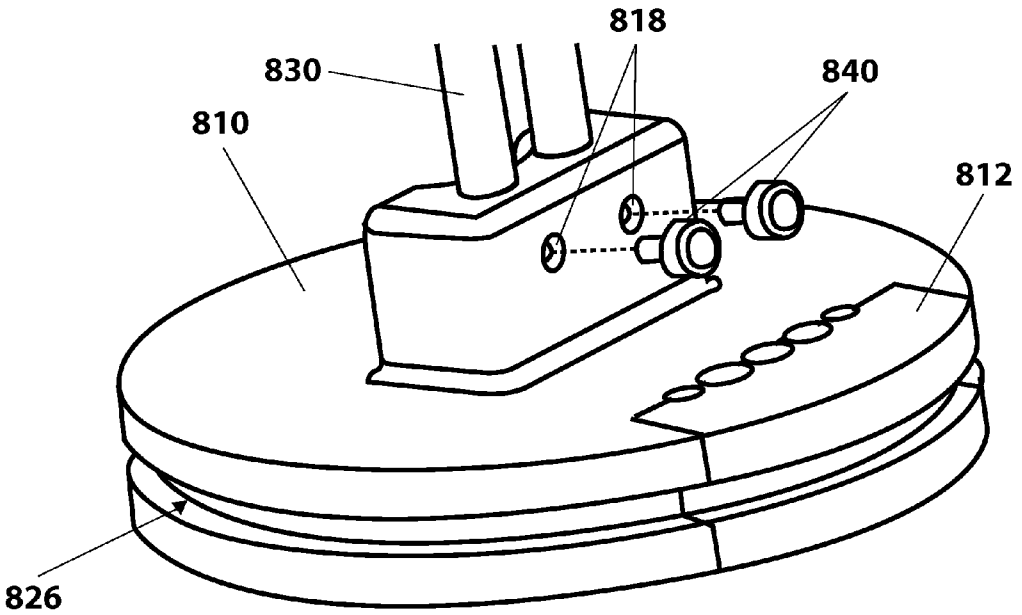


Figure 59B

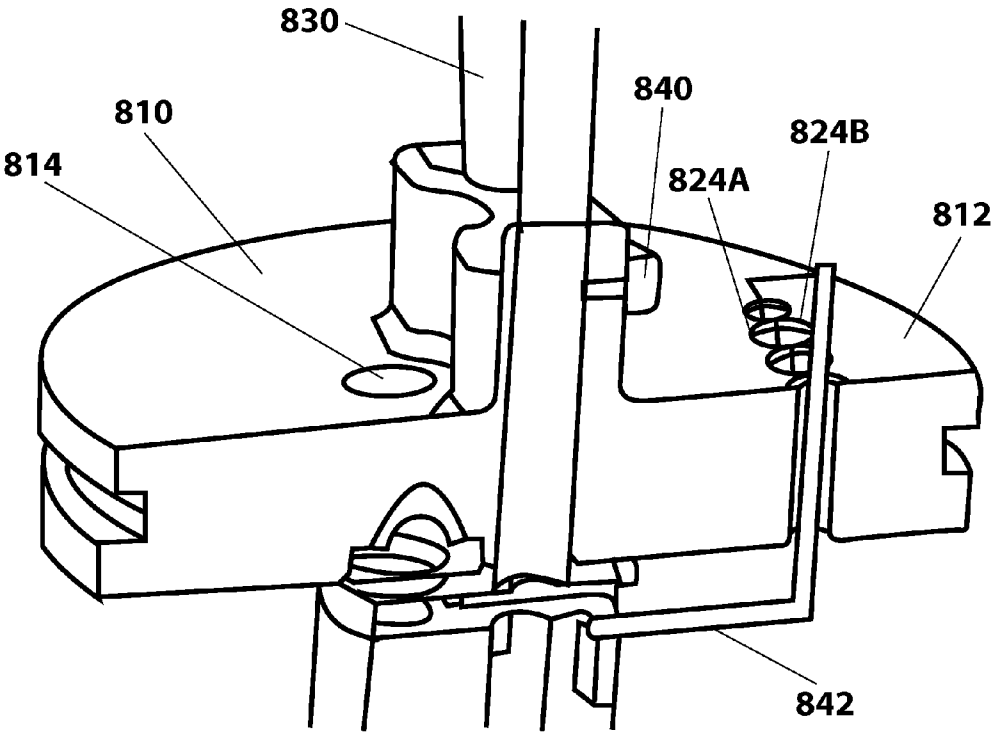


Figure 60

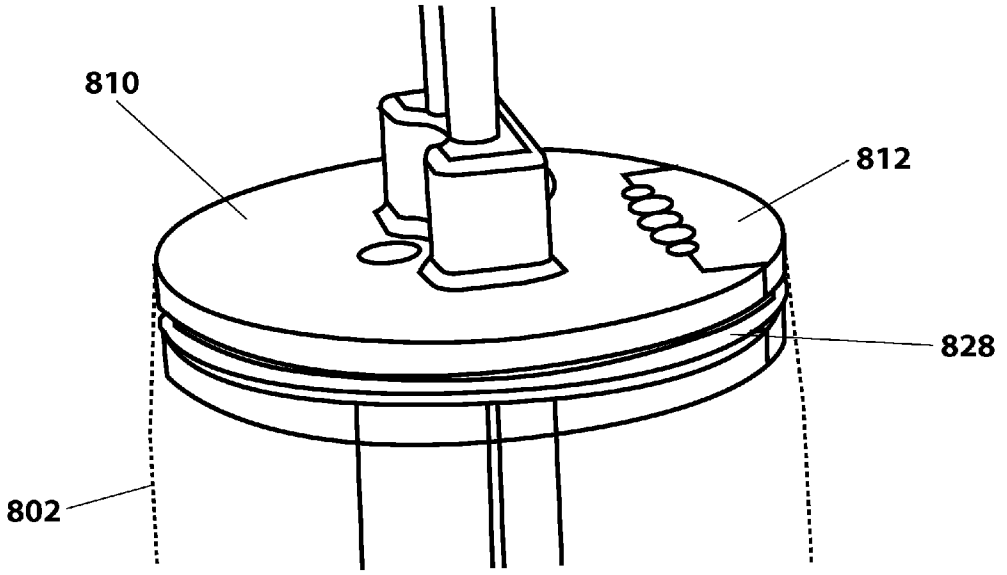


Figure 61A

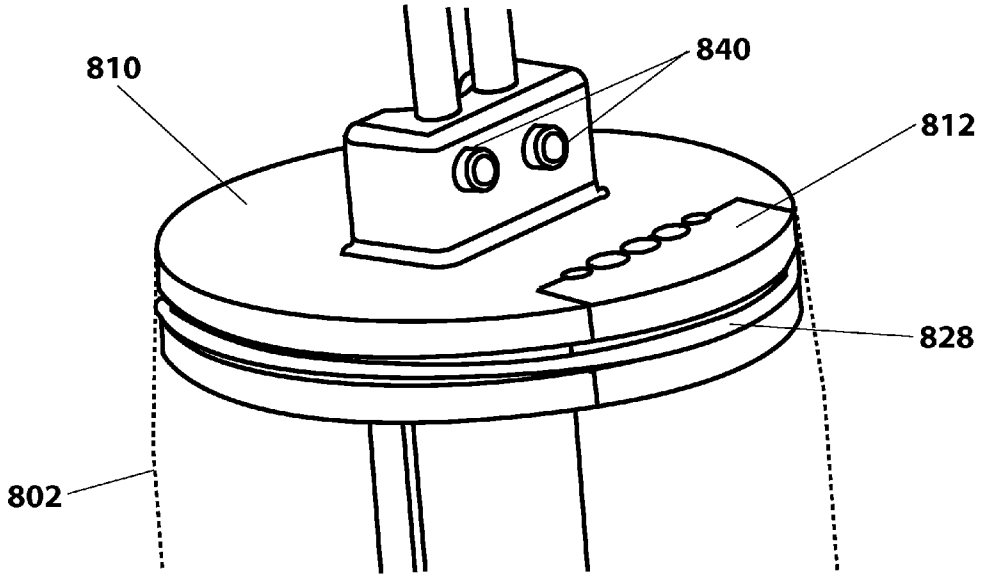


Figure 61B

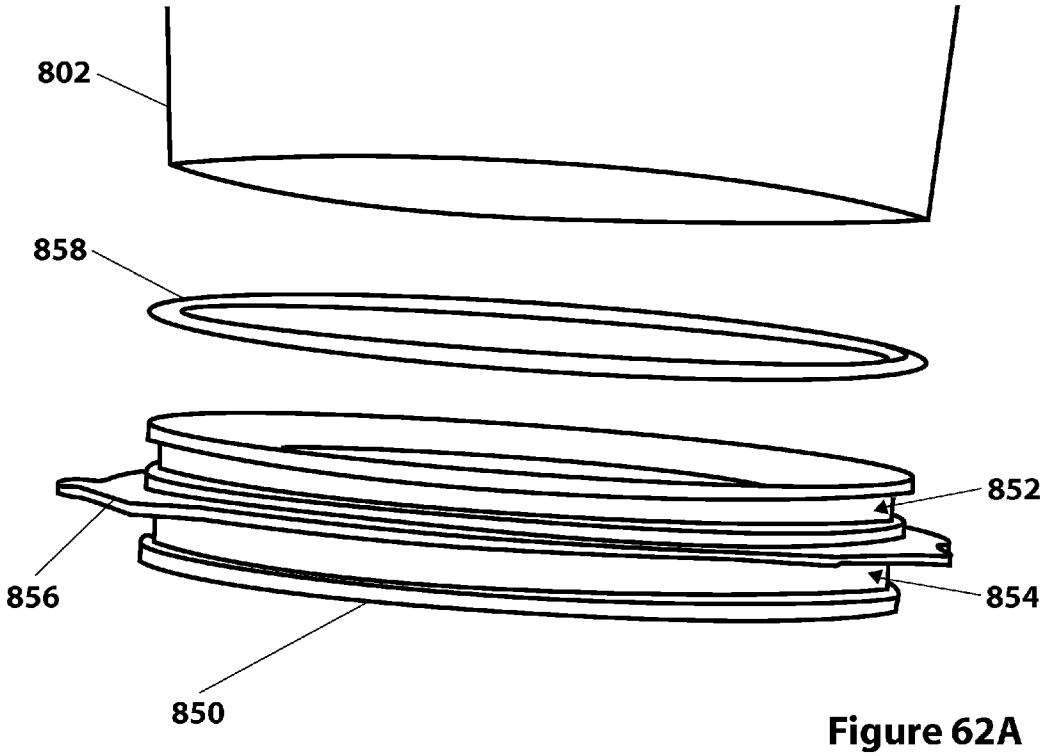


Figure 62A

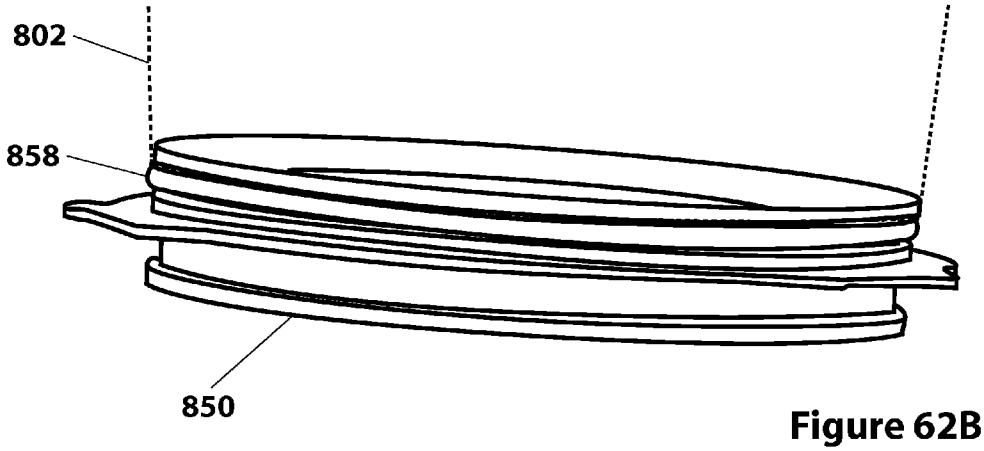


Figure 62B

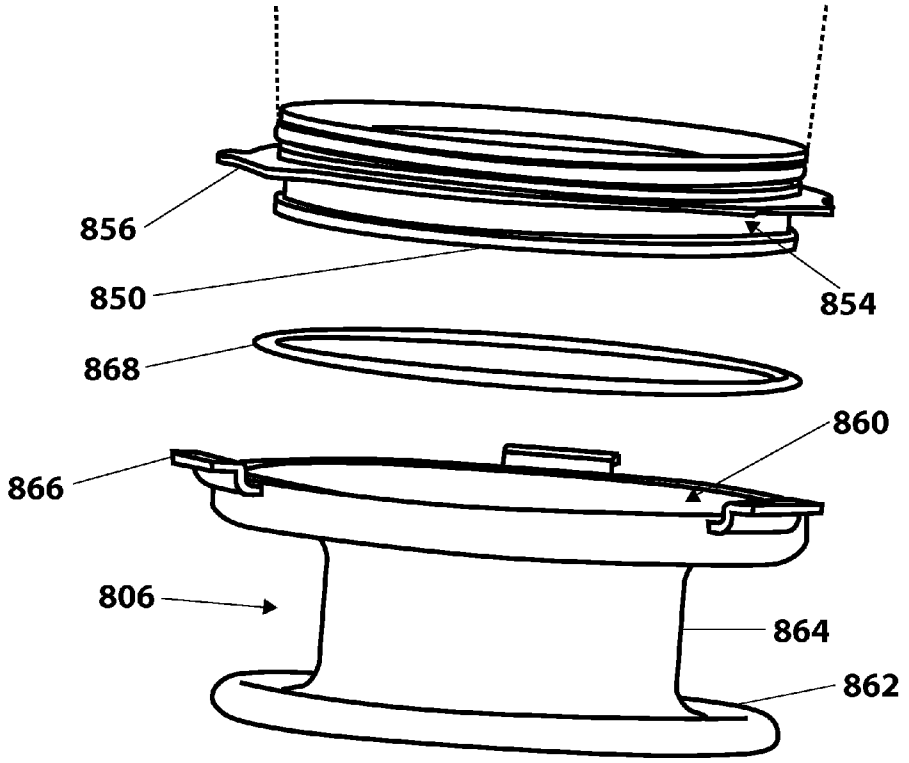


Figure 63A

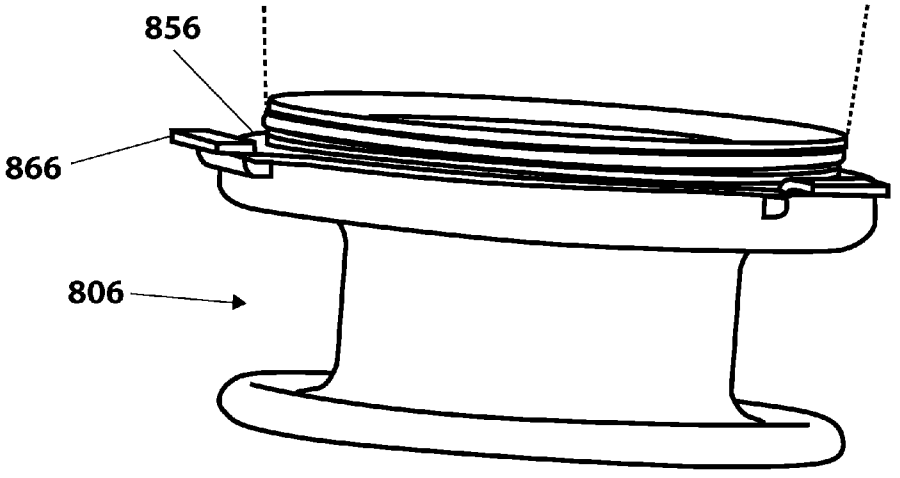


Figure 63B

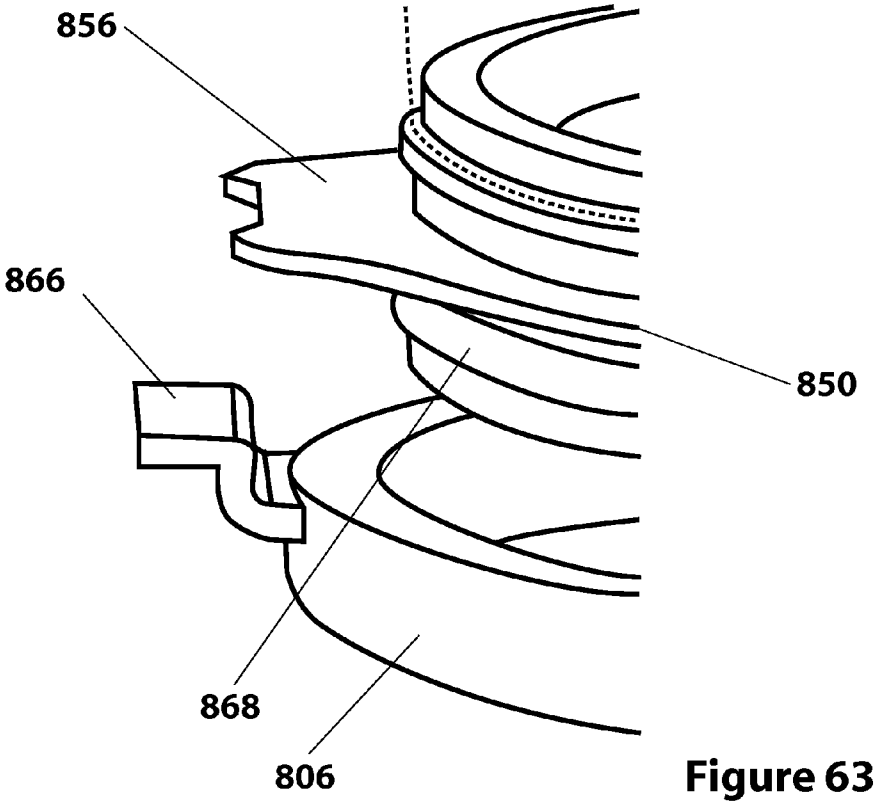


Figure 63C

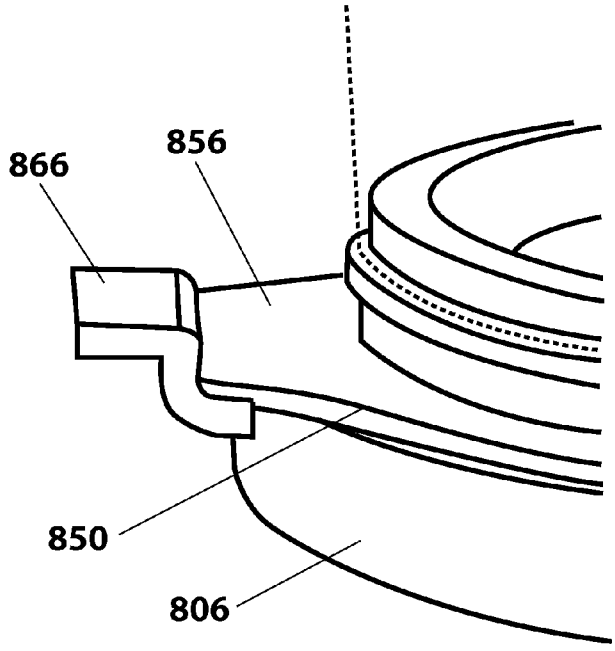


Figure 63D

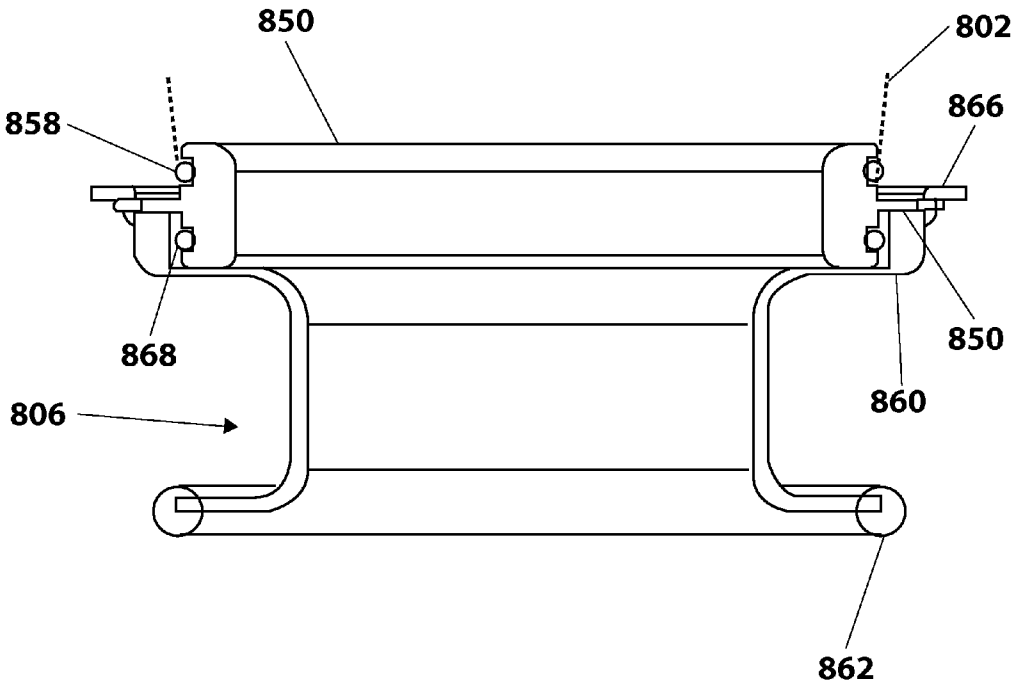
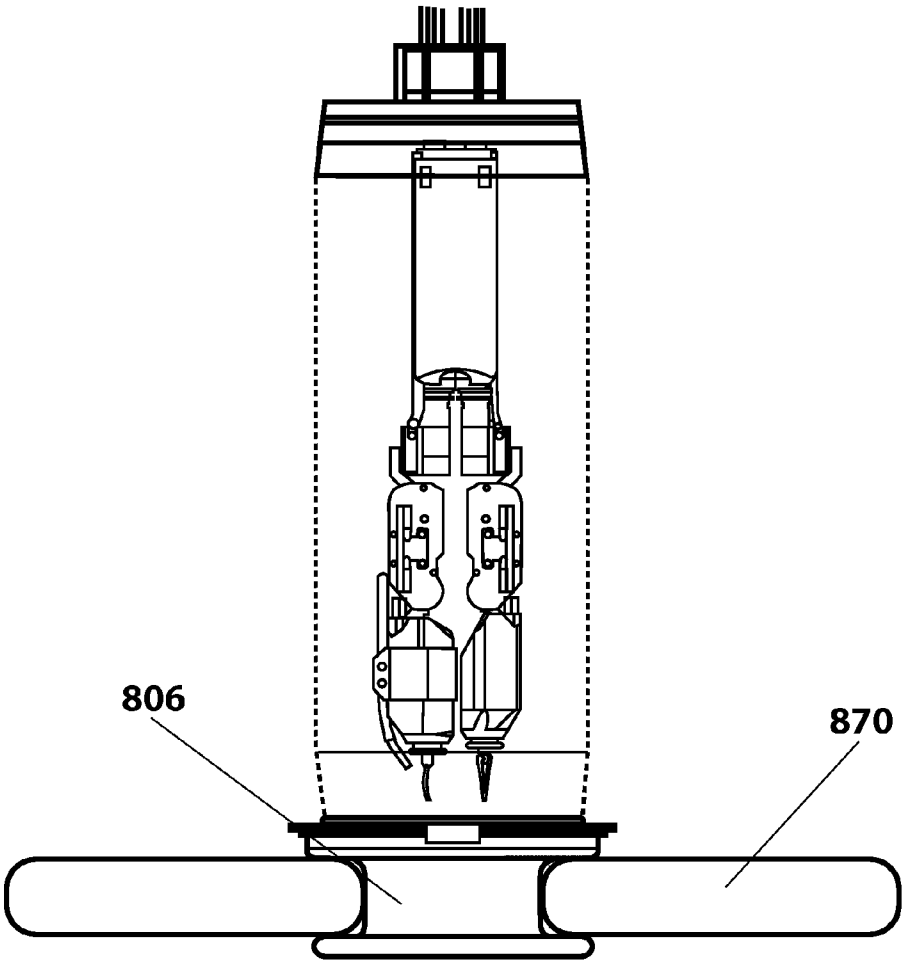


Figure 63E



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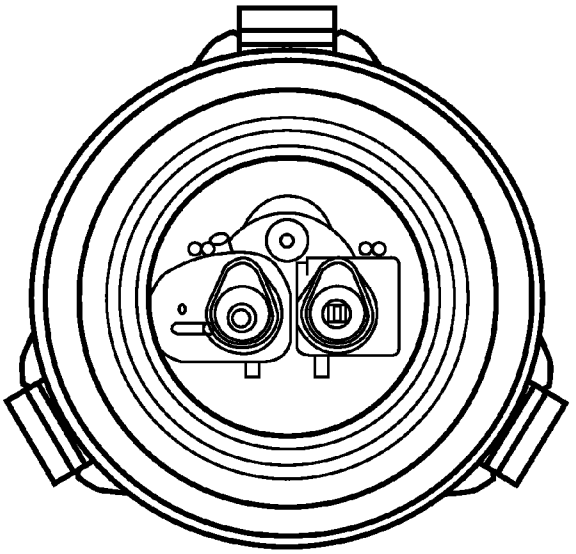


Figure 64B

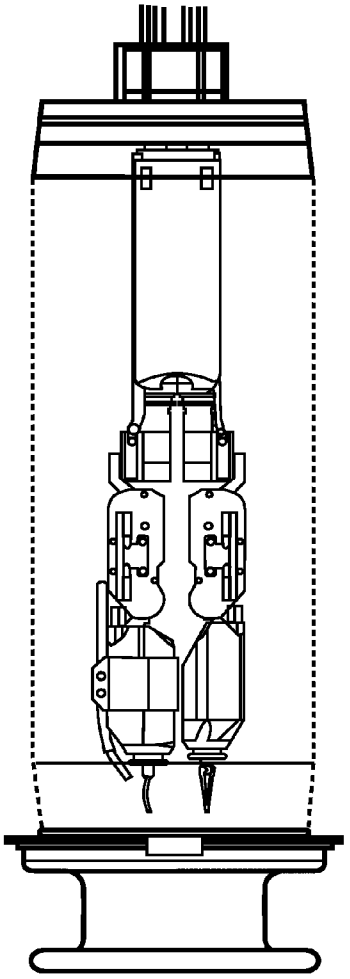
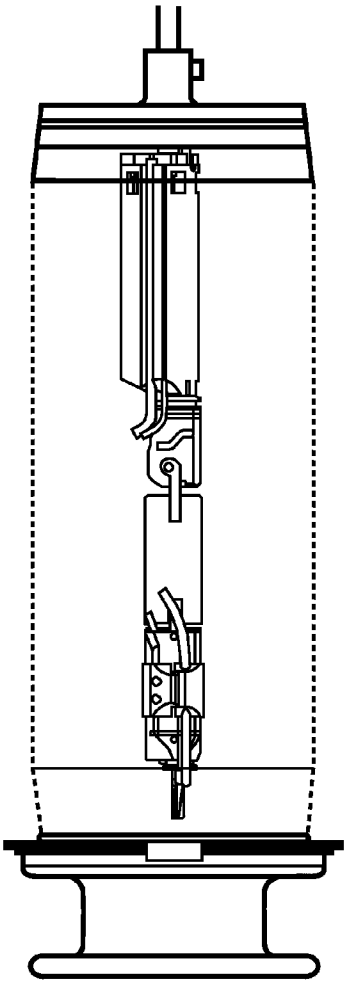


Figure 65A



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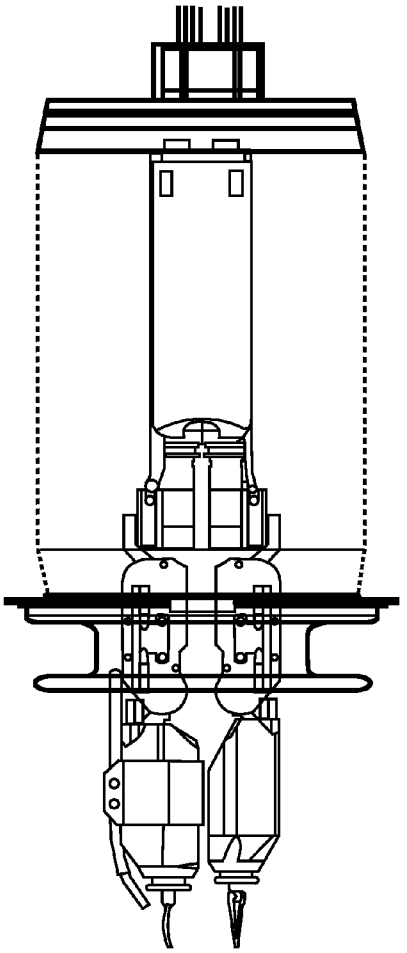

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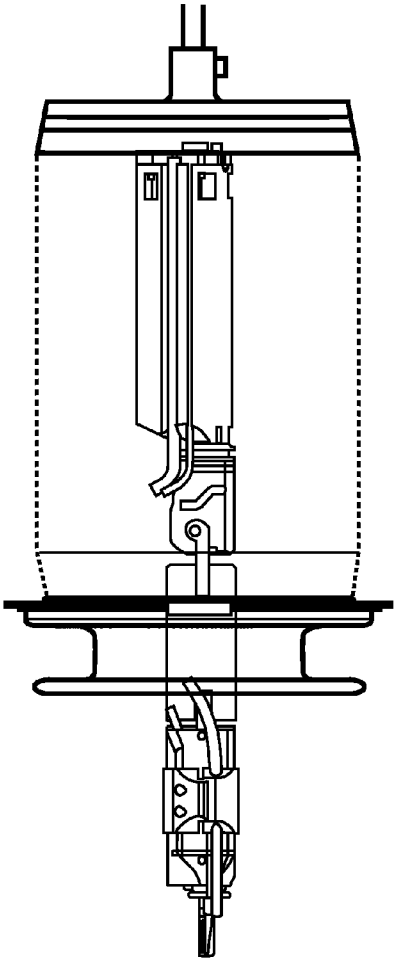
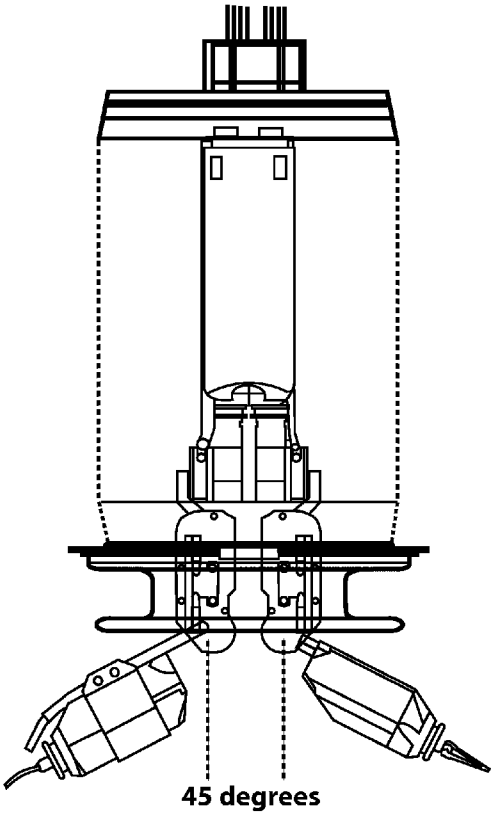


Figure 66B



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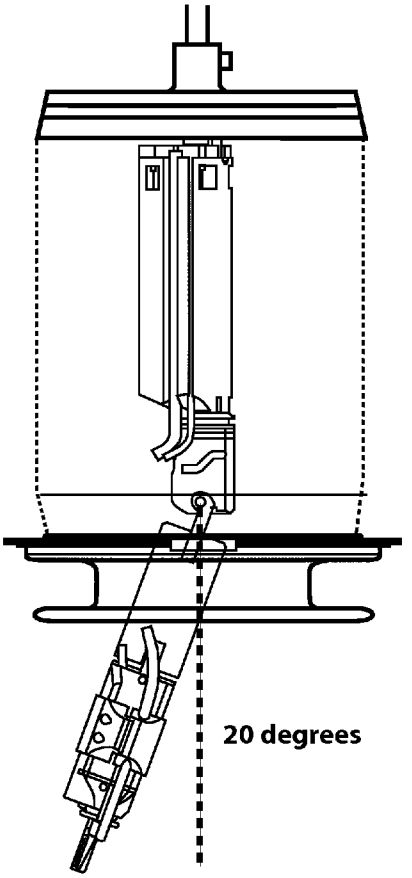


Figure 67B

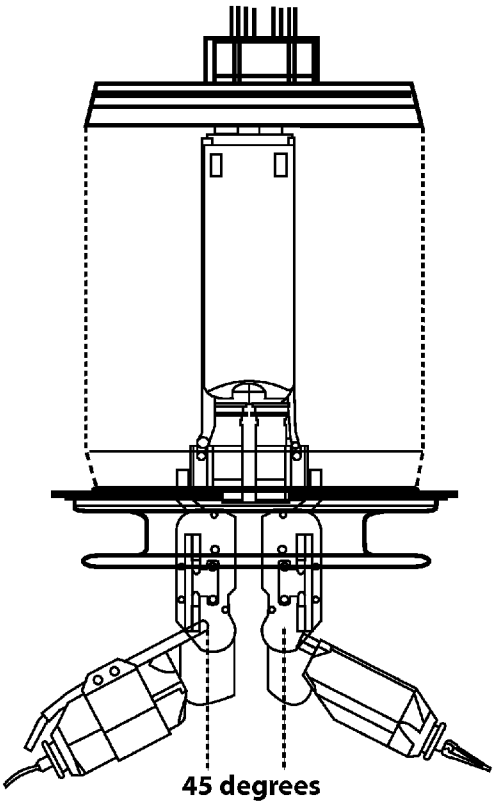


Figure 68A

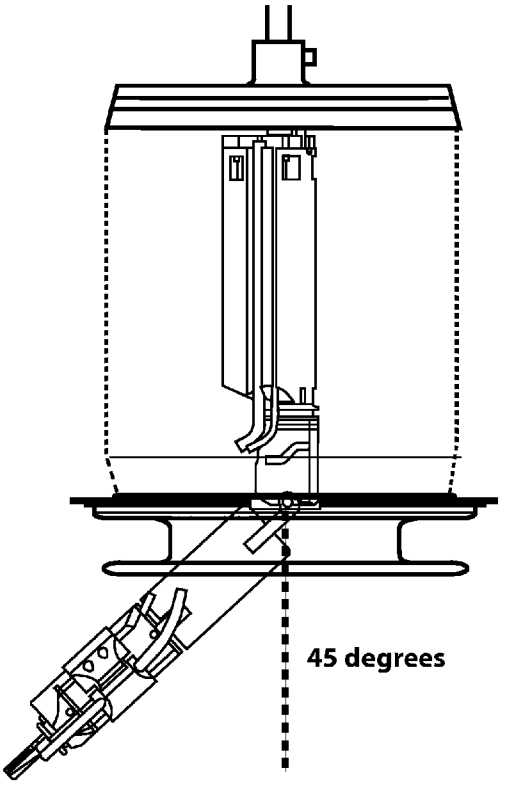
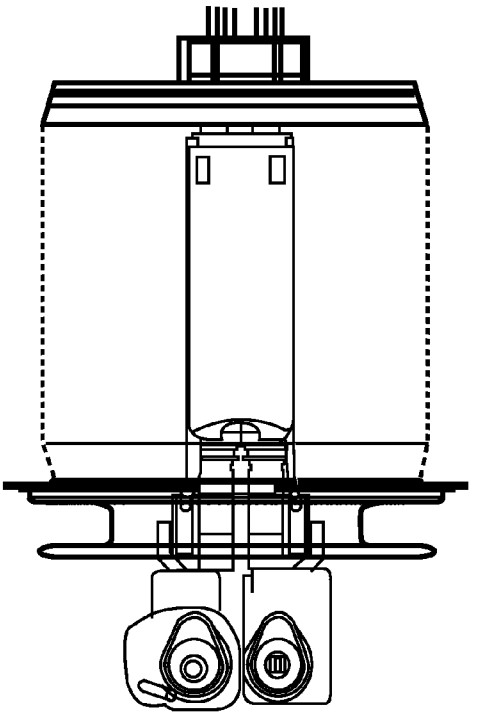


Figure 68B



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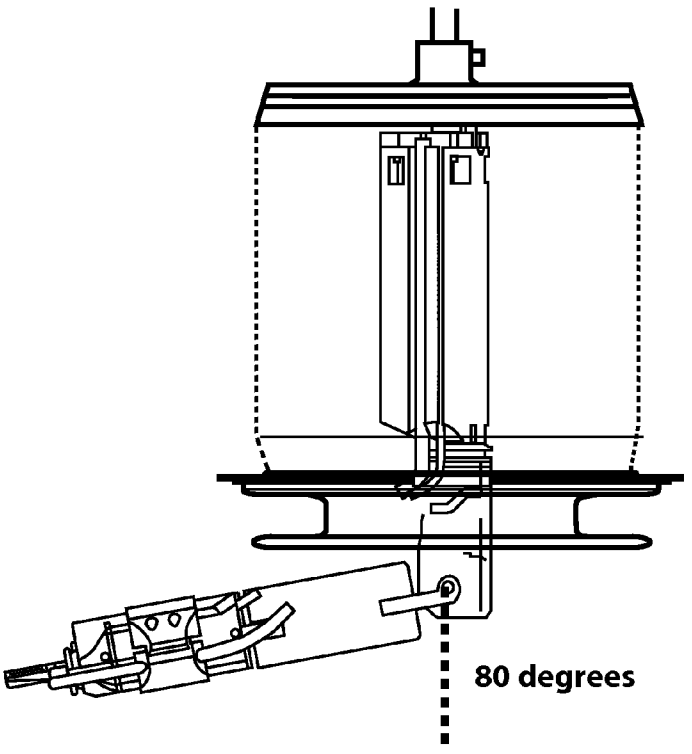
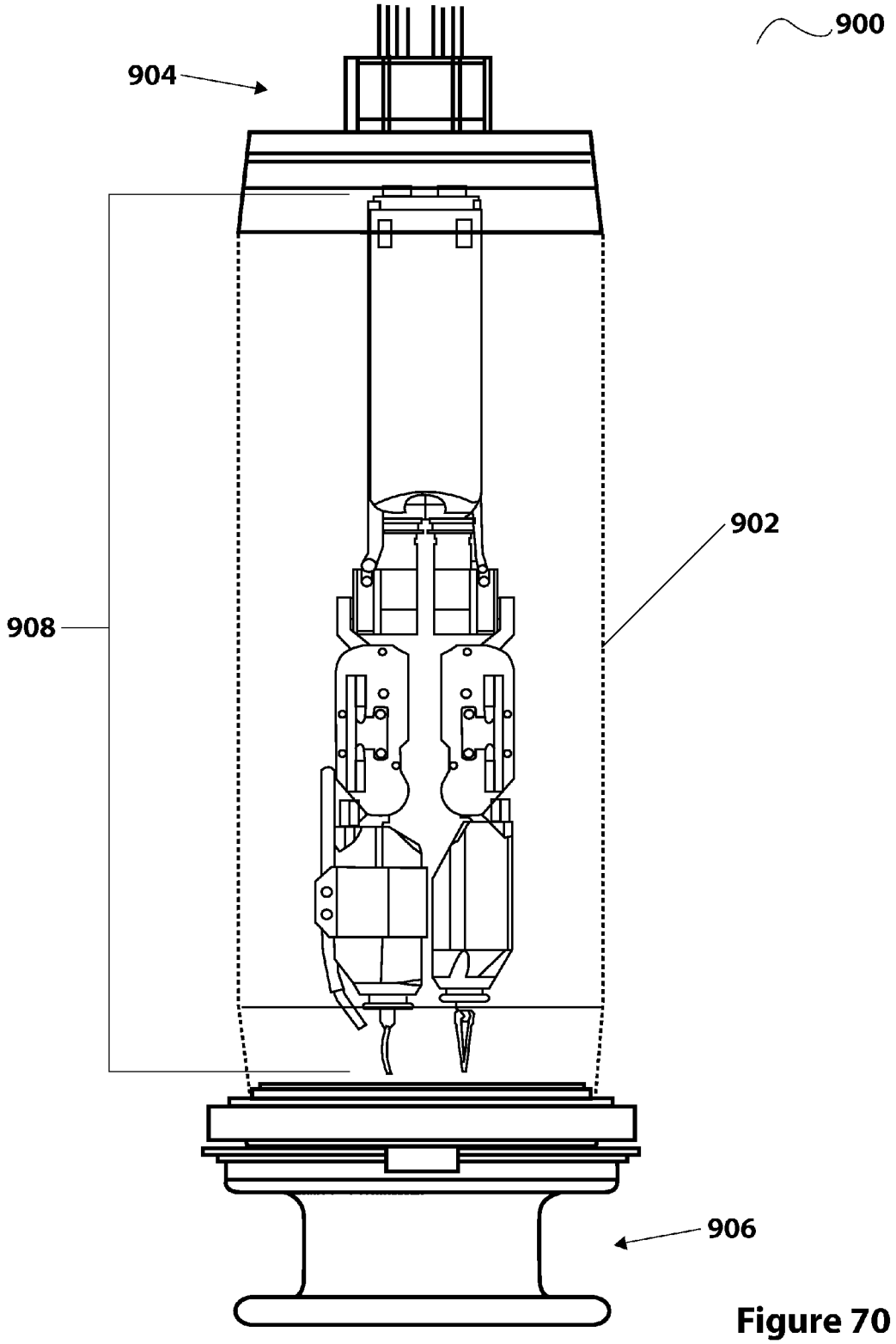


Figure 69B



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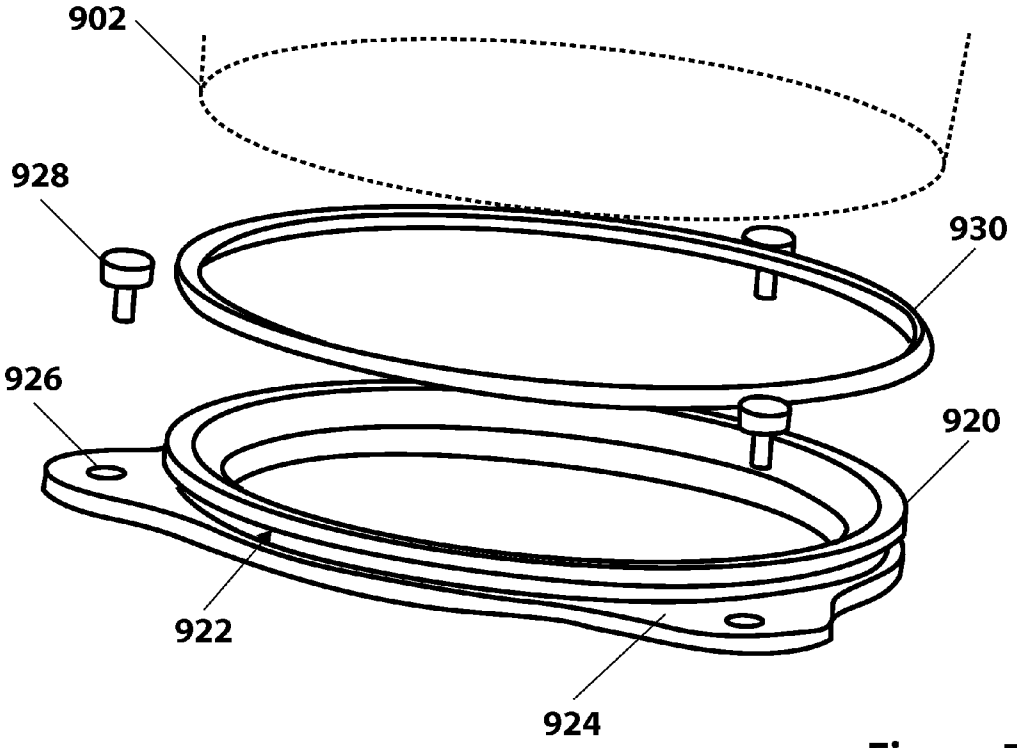


Figure 71A

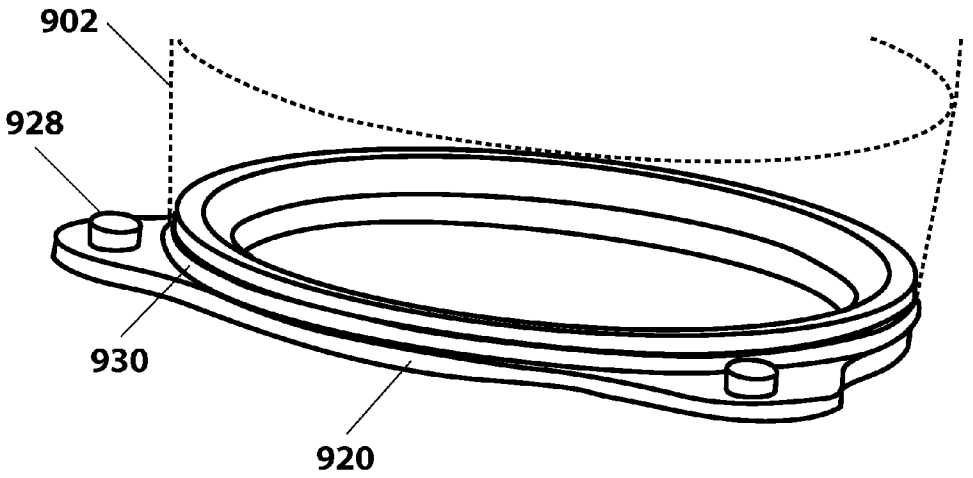


Figure 71B

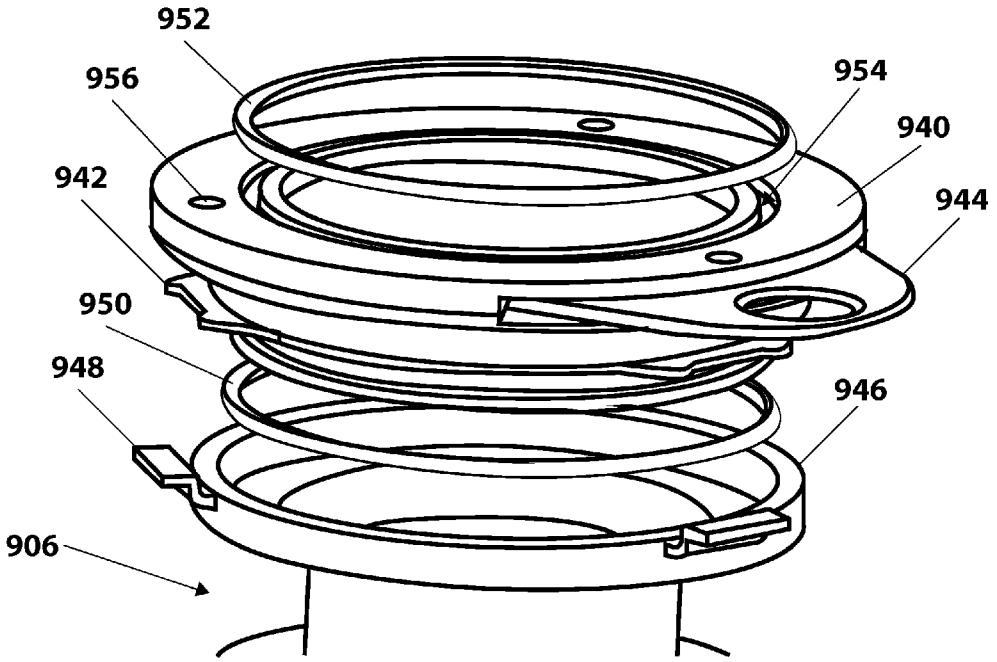


Figure 72A

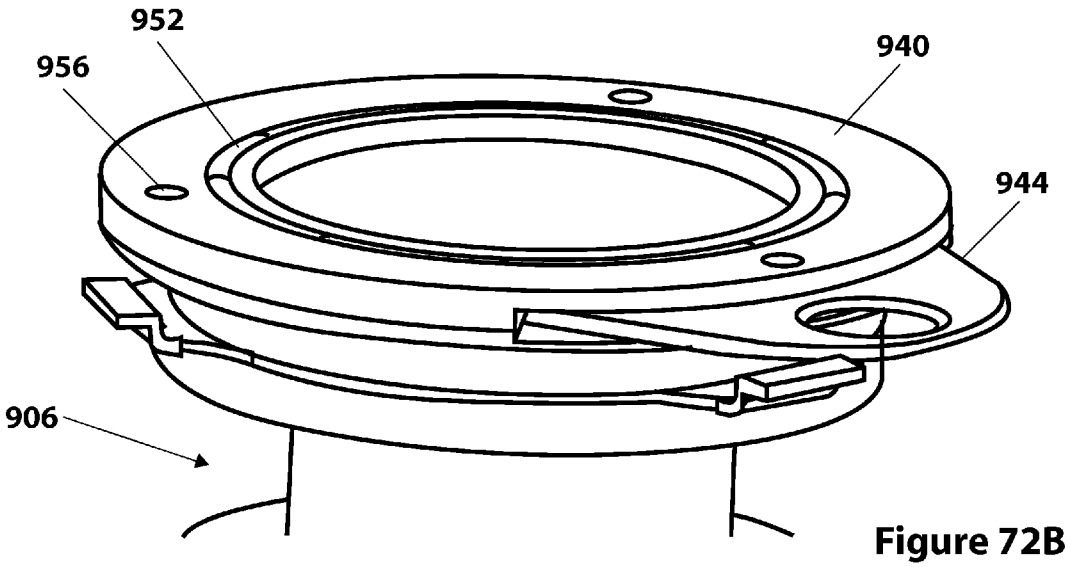
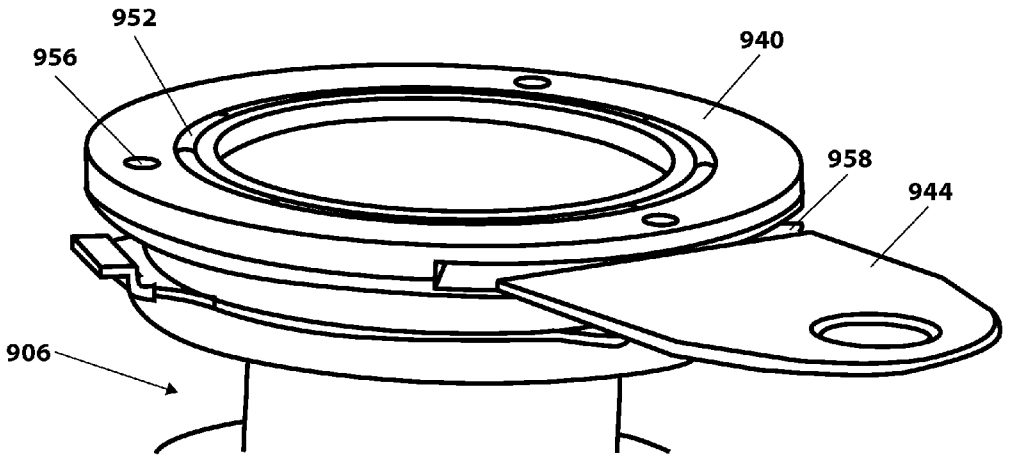


Figure 72B



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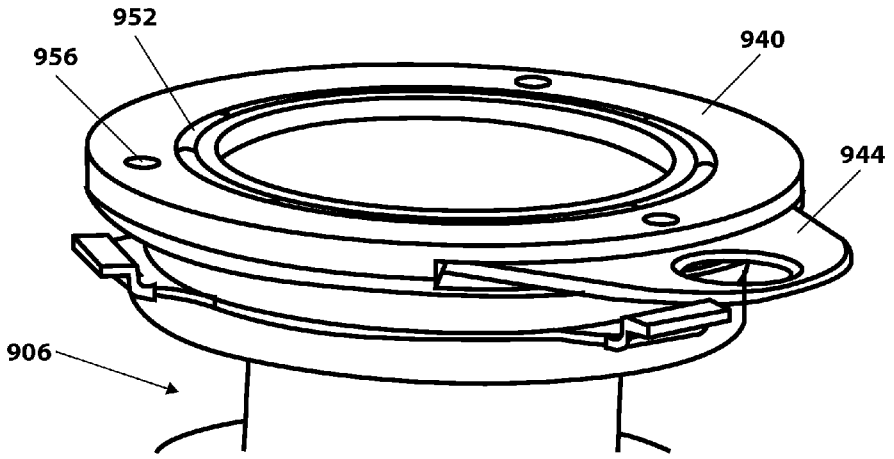


Figure 73B

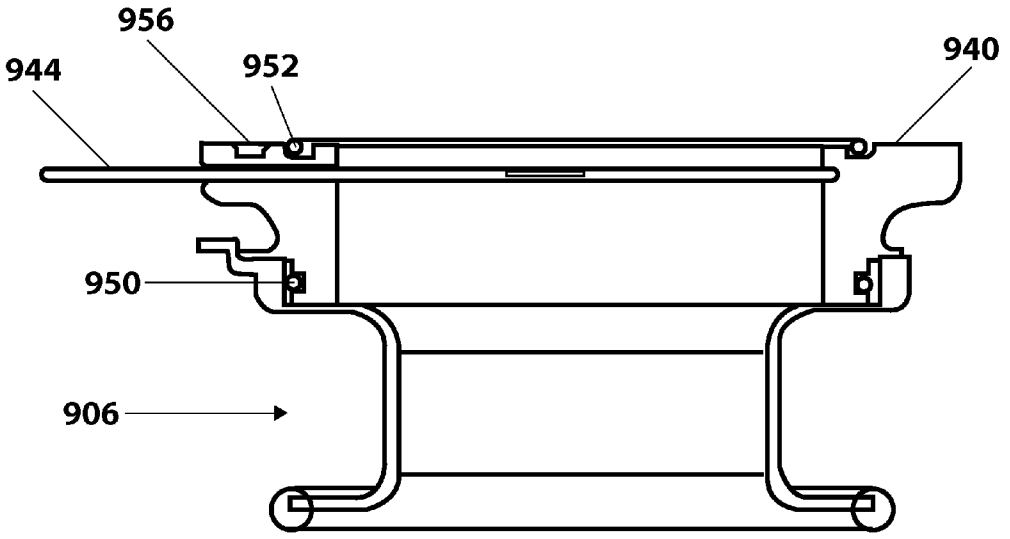


Figure 74A

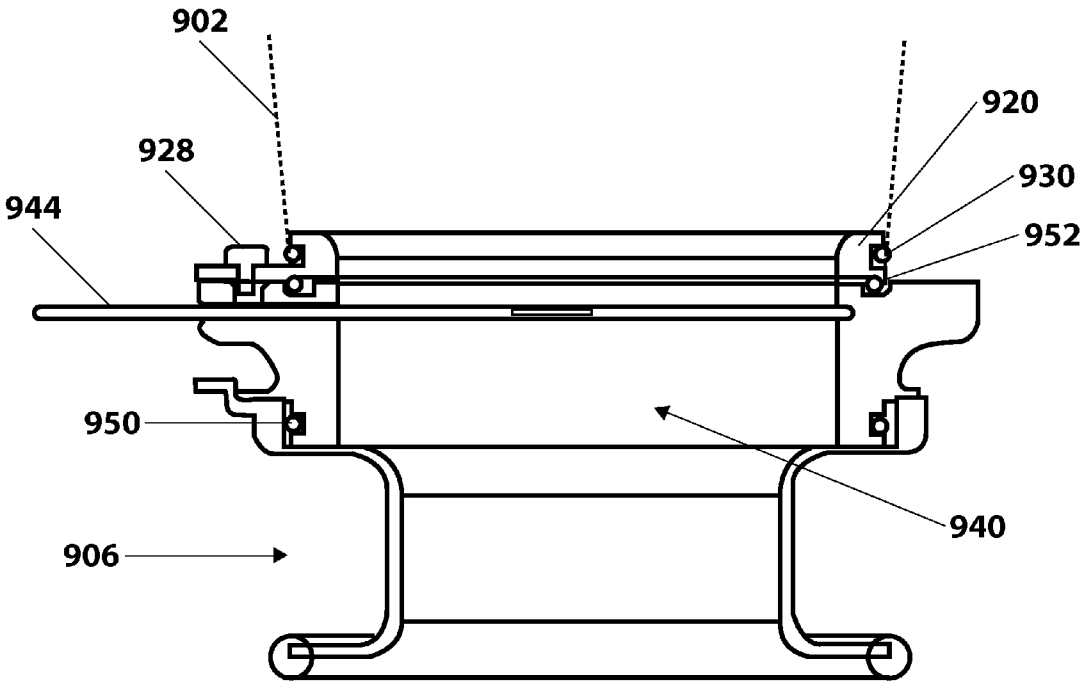


Figure 74B

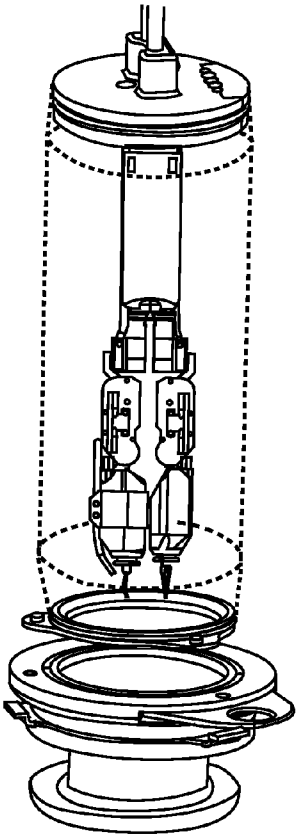


Figure 75A

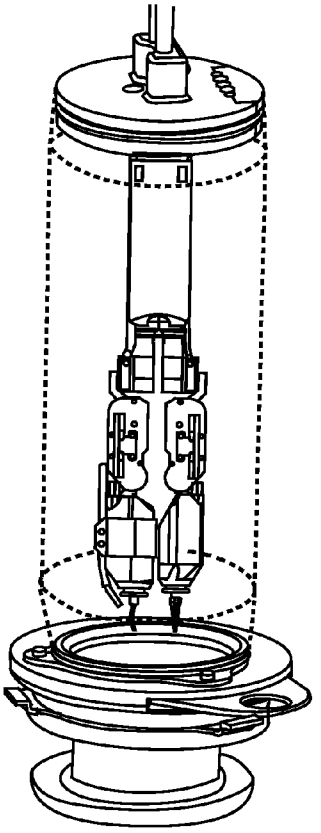


Figure 75B

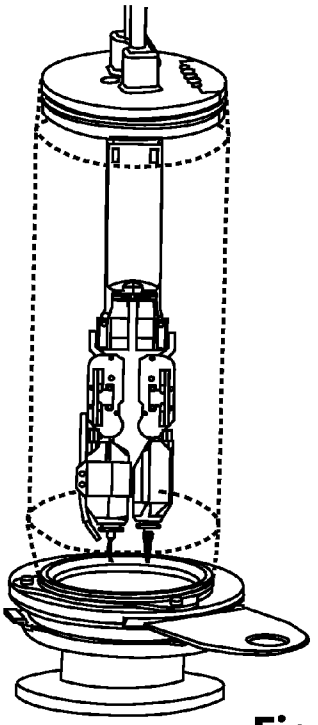
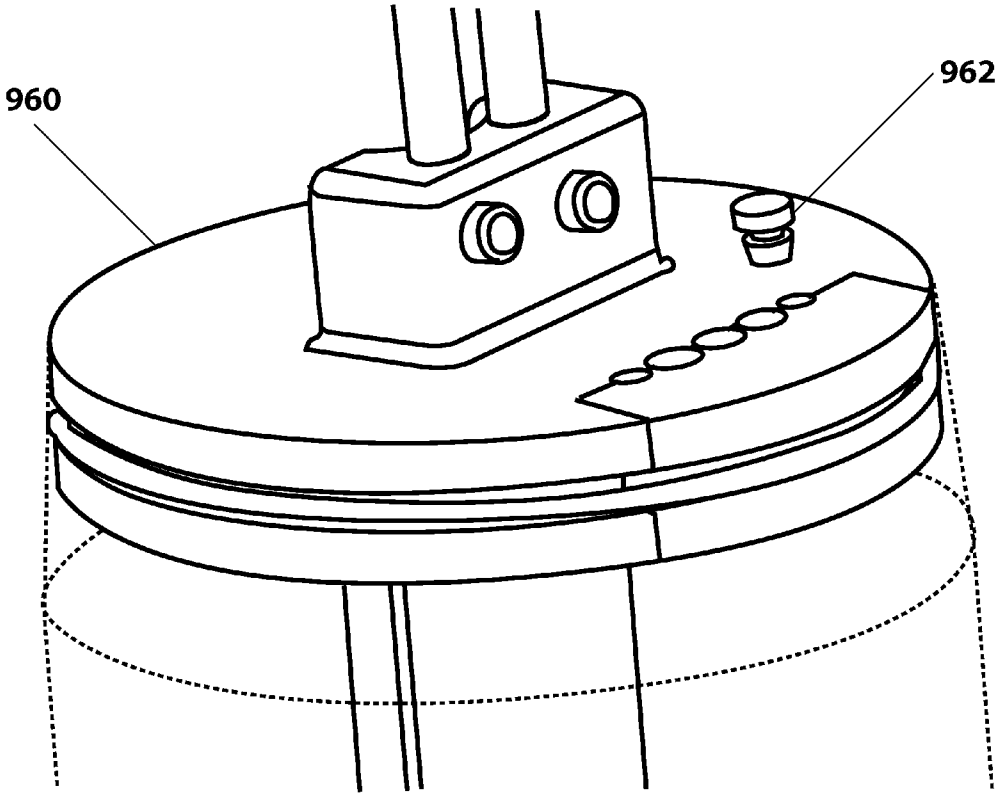


Figure 75C



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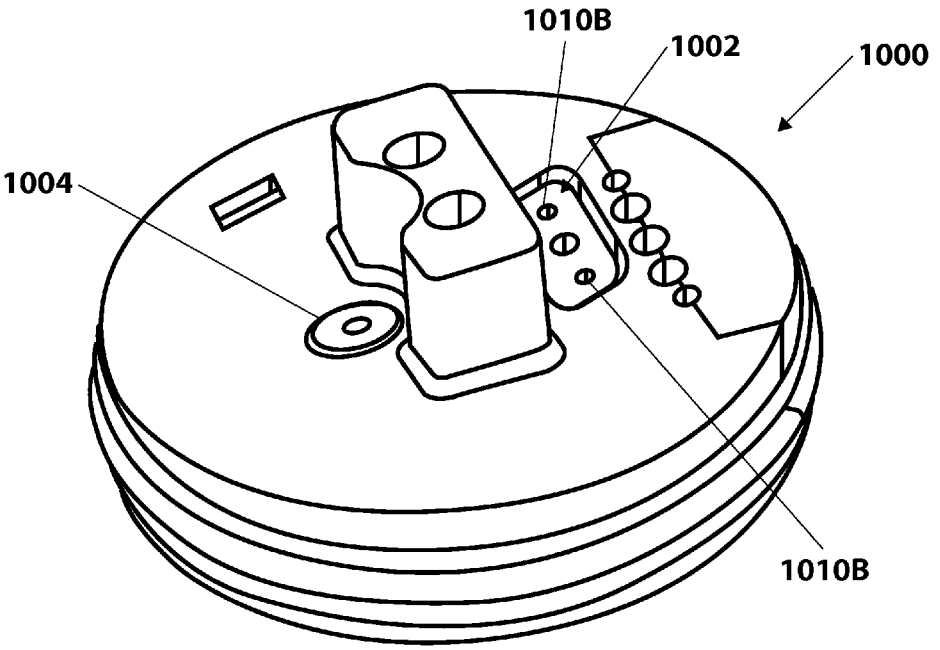


Figure 77A

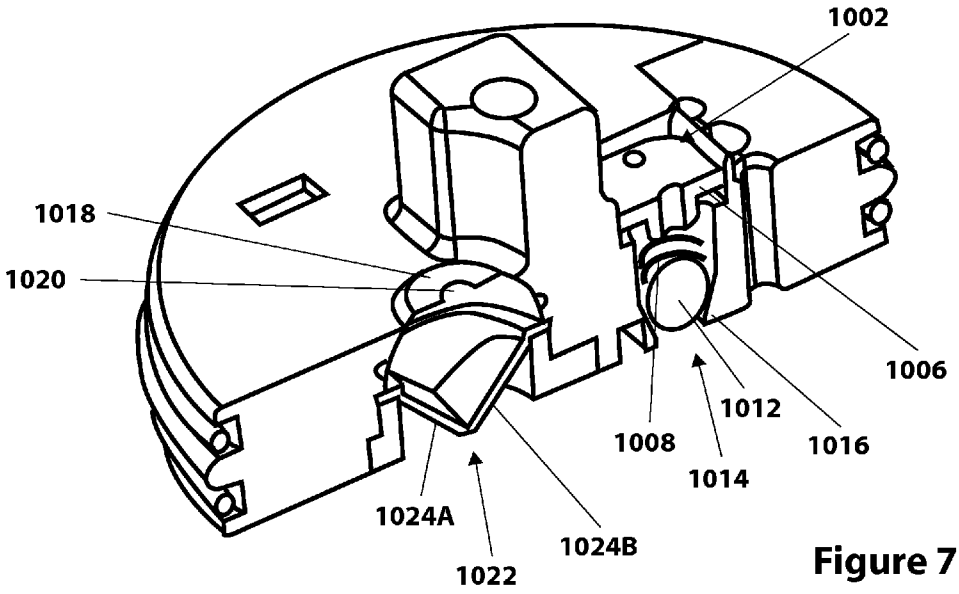


Figure 77B

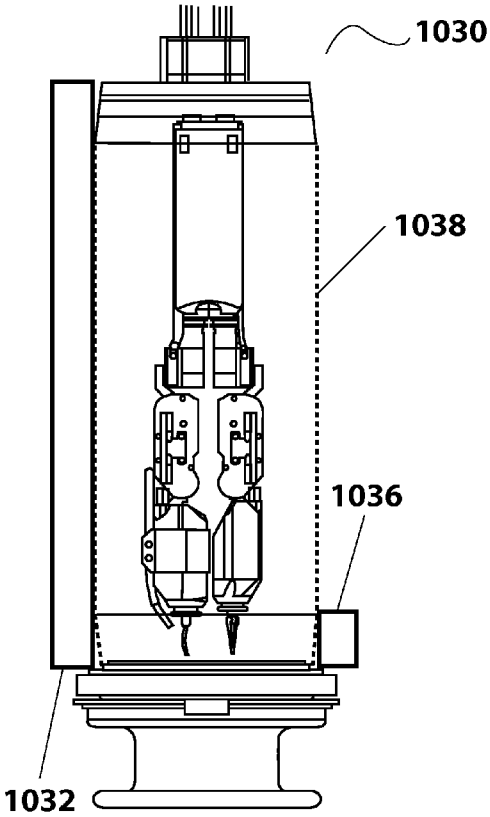
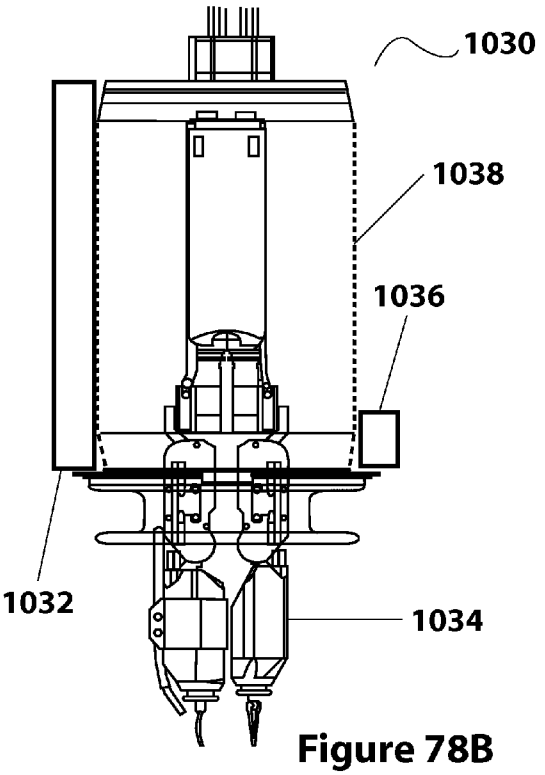


Figure 78A



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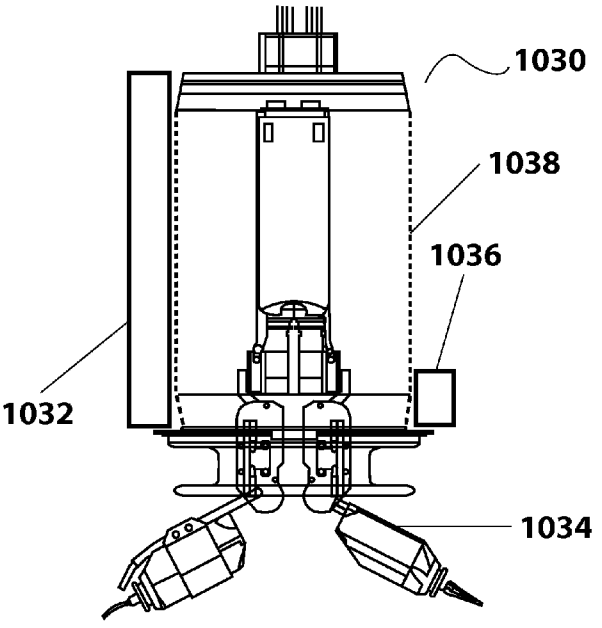
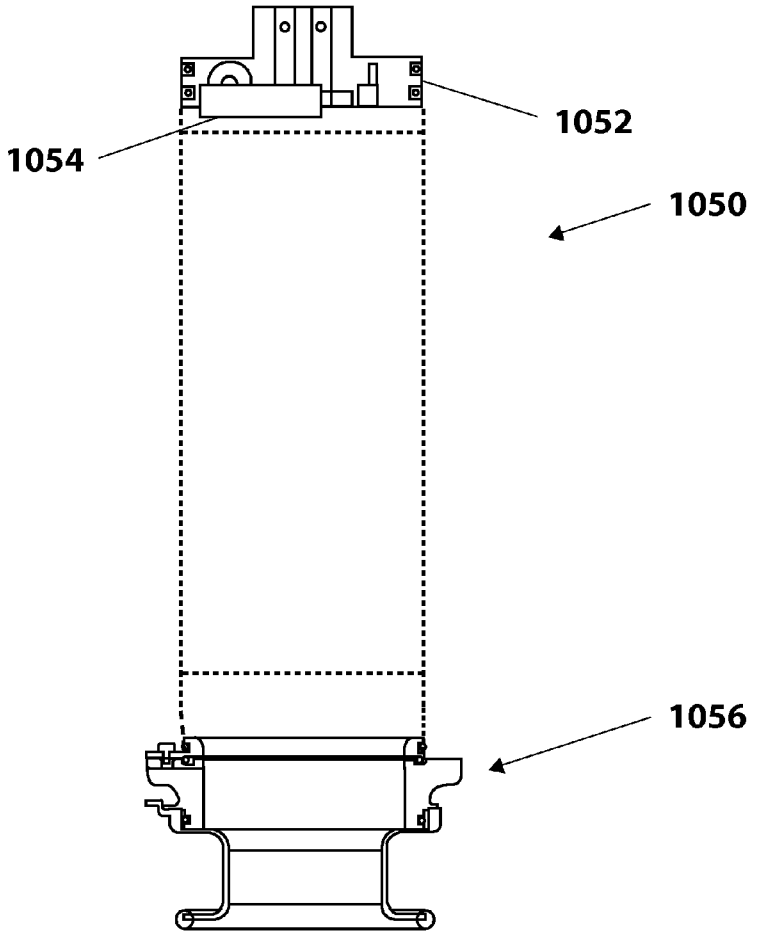


Figure 78C



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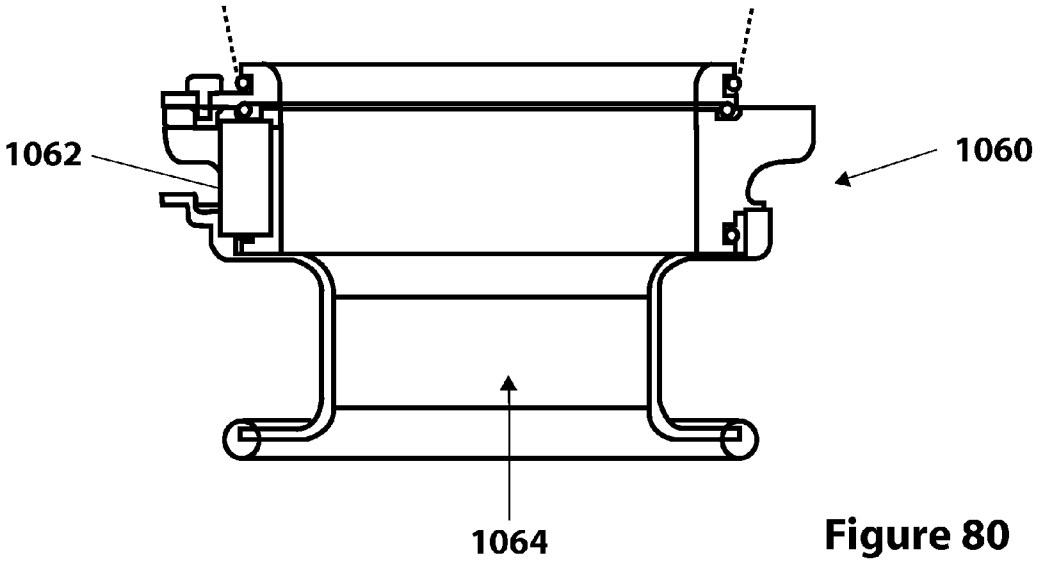

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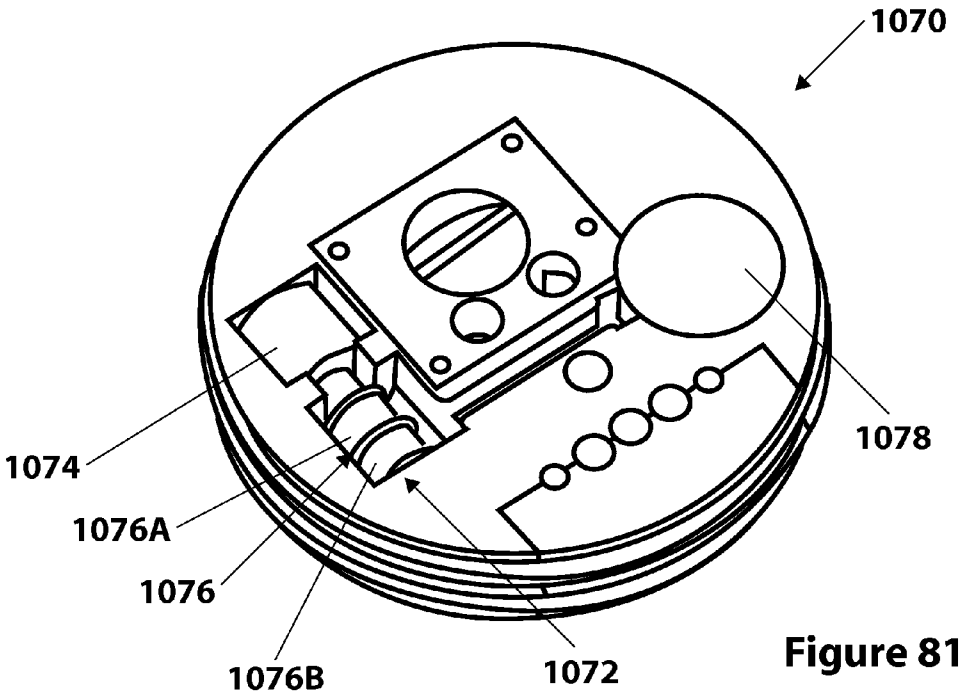

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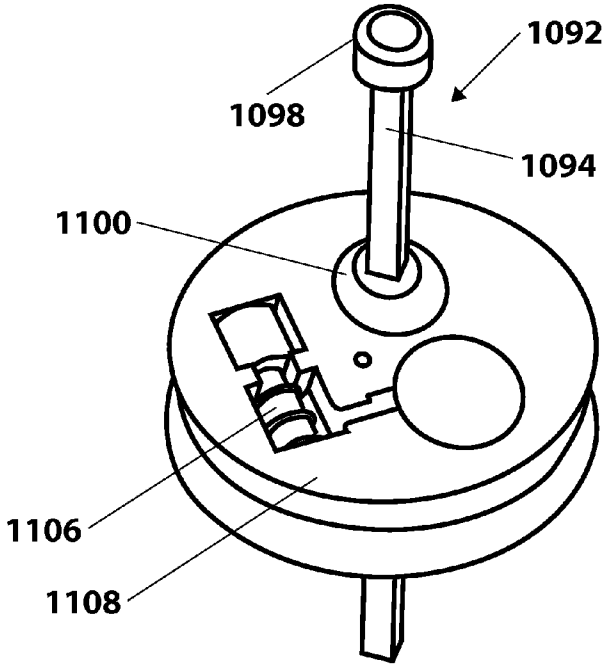


Figure 82A

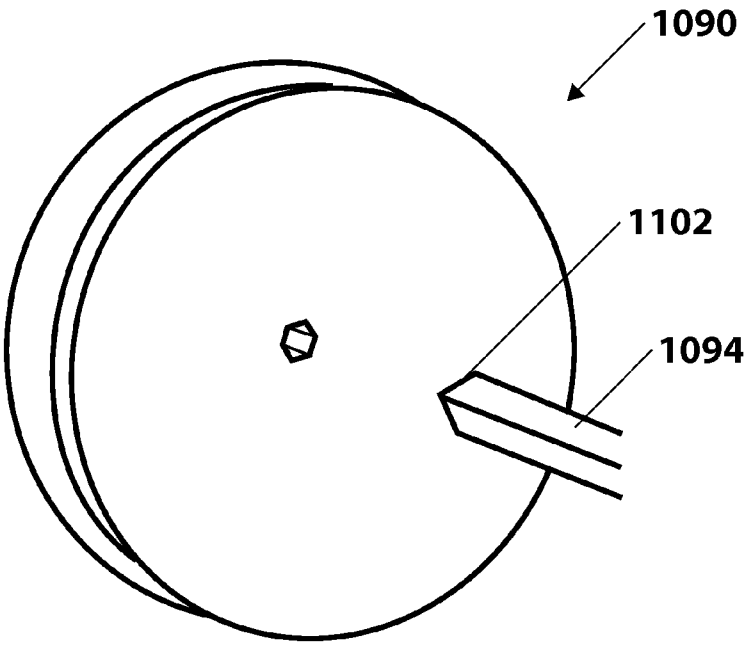


Figure 82B

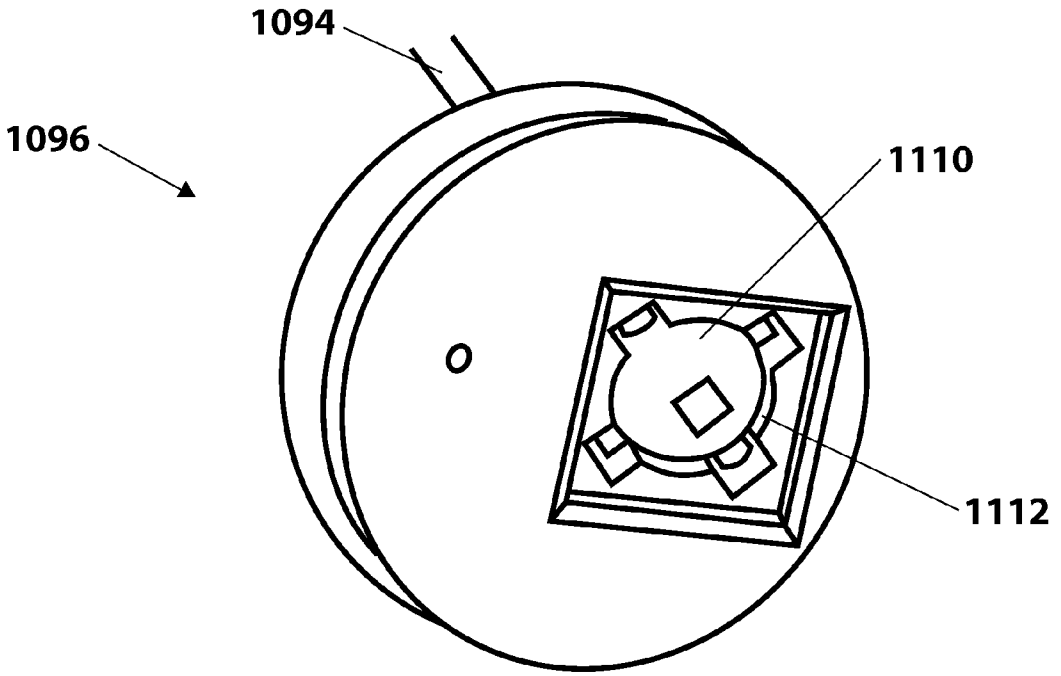


Figure 82C

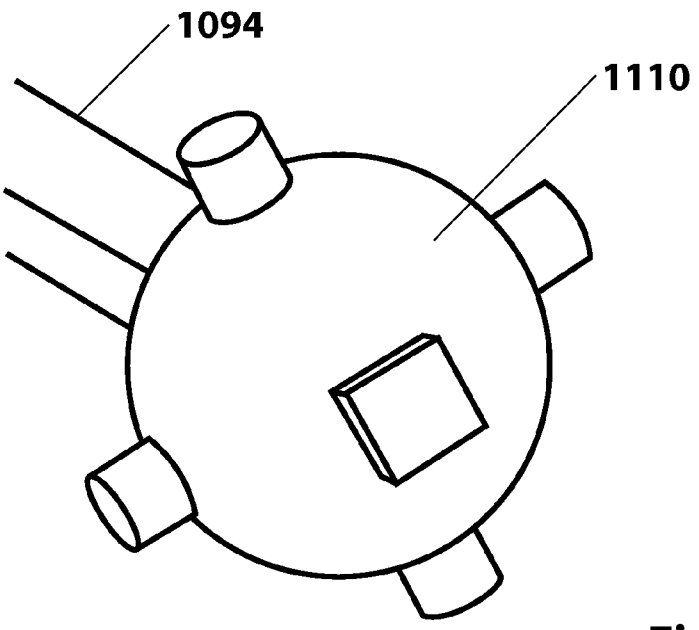


Figure 82D

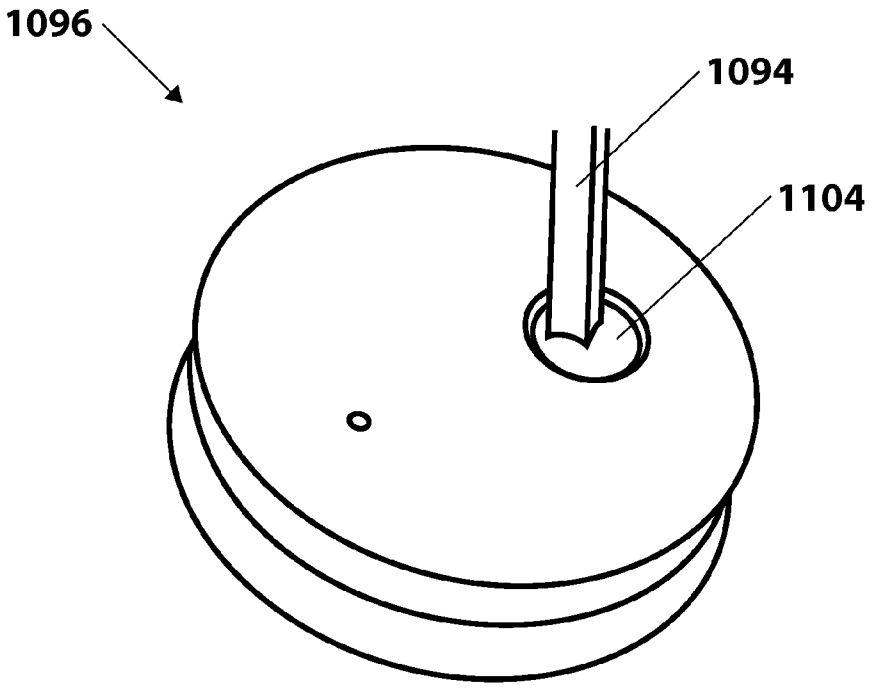
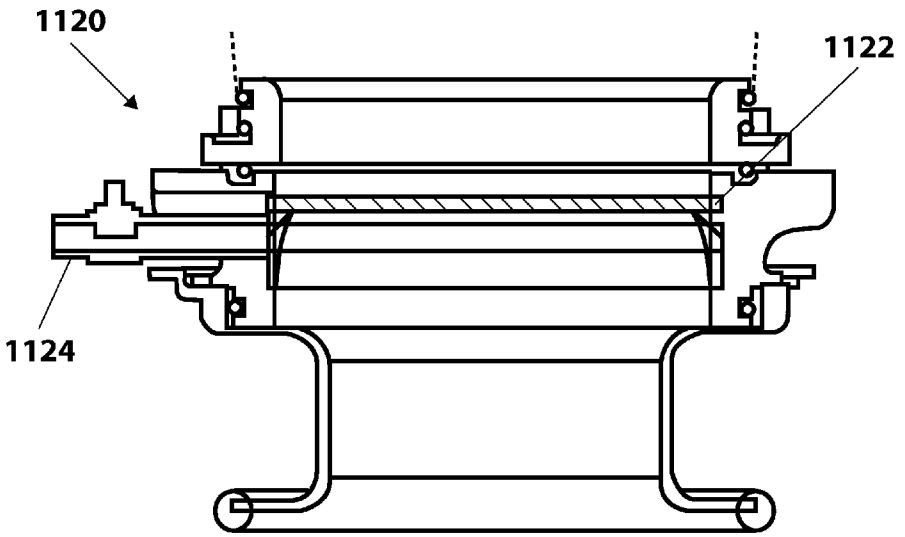


Figure 82E



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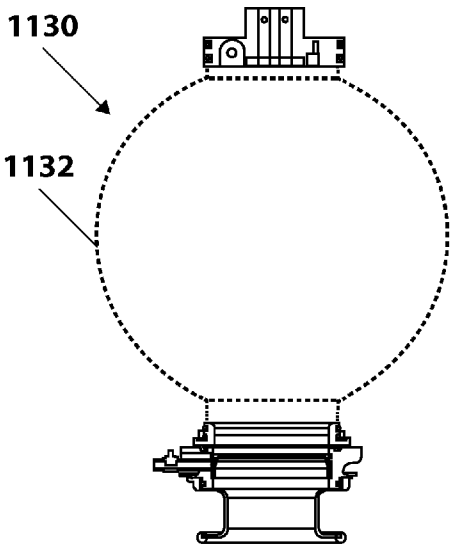


Figure 84A

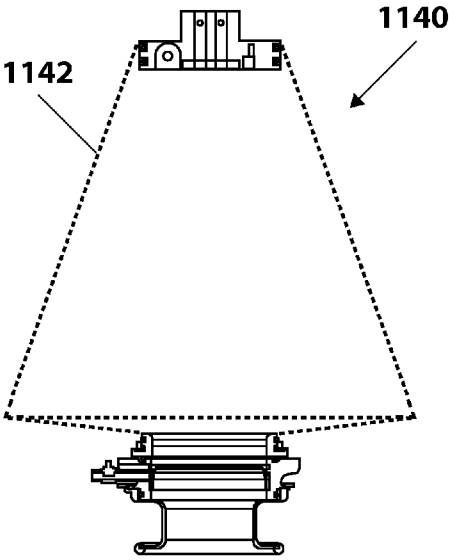
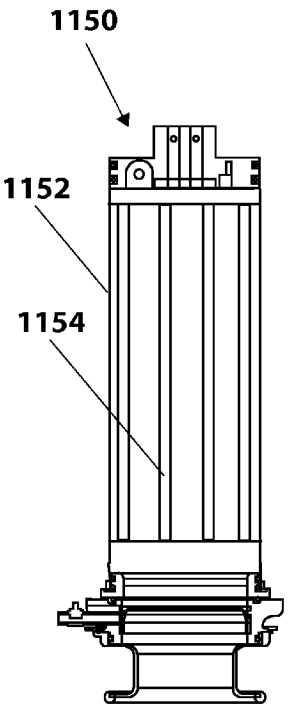


Figure 84B



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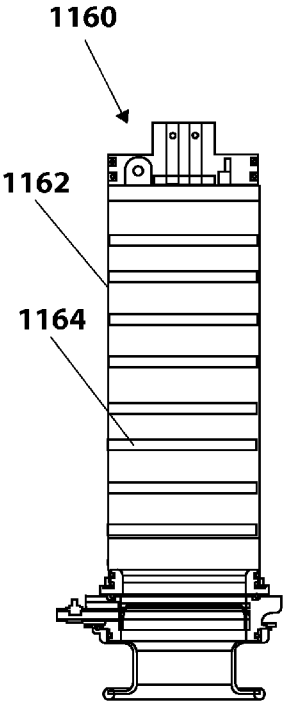

Figure 85B

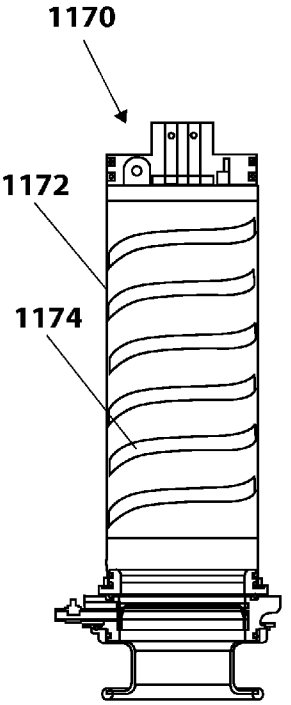

Figure 85C

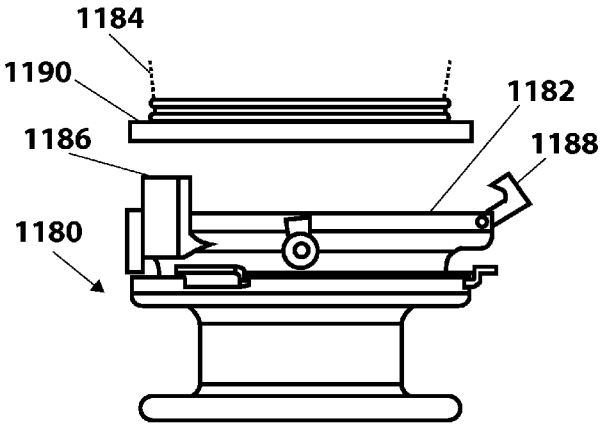

Figure 86A

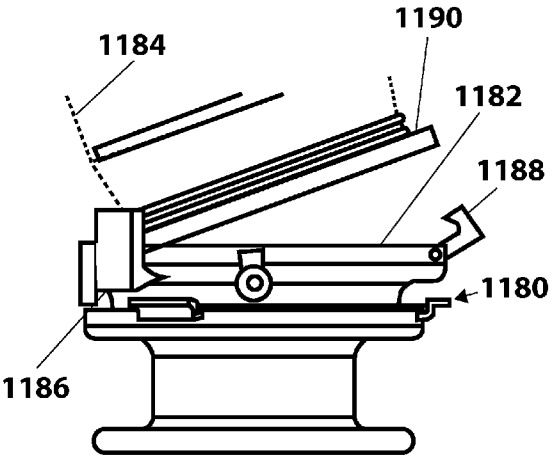

Figure 86B

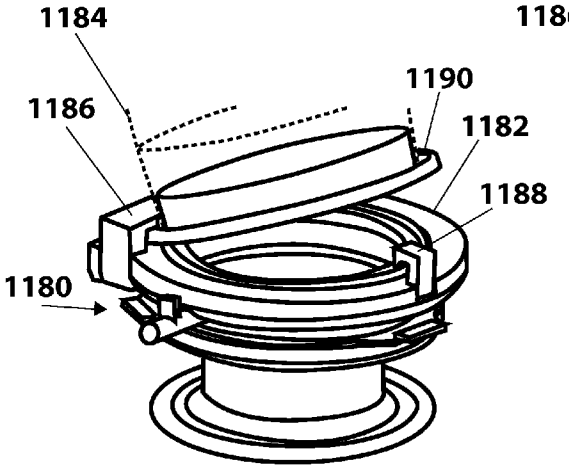

Figure 86C

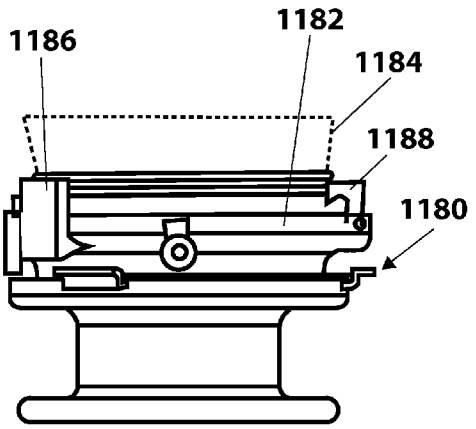

Figure 86D

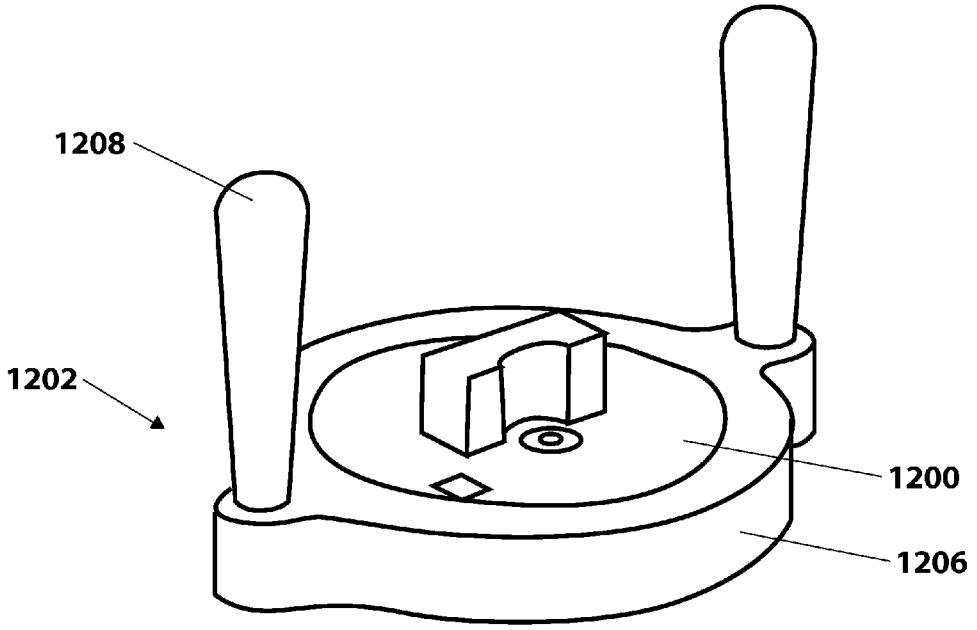

Figure 87A

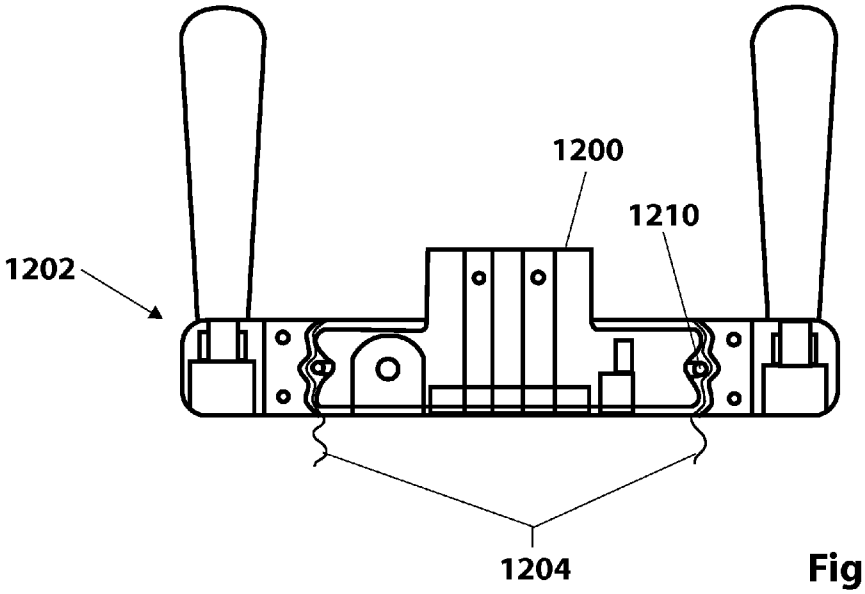

Figure 87B

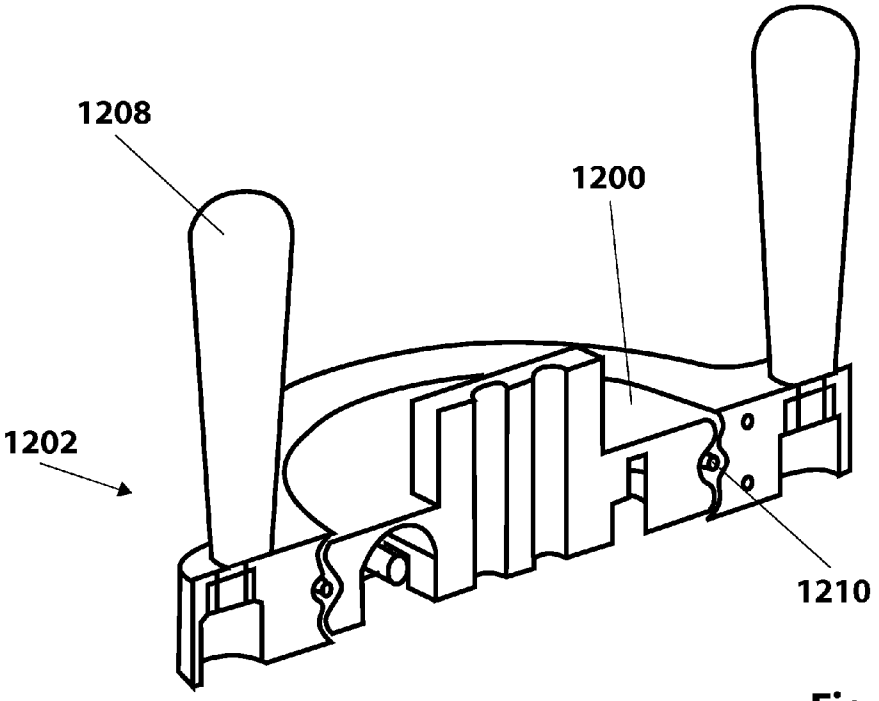

Figure 87C

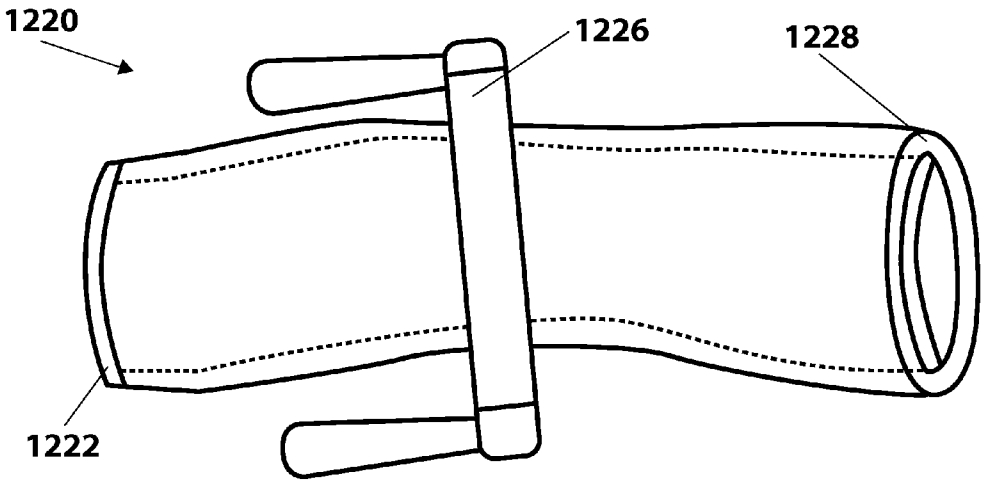

Figure 88A

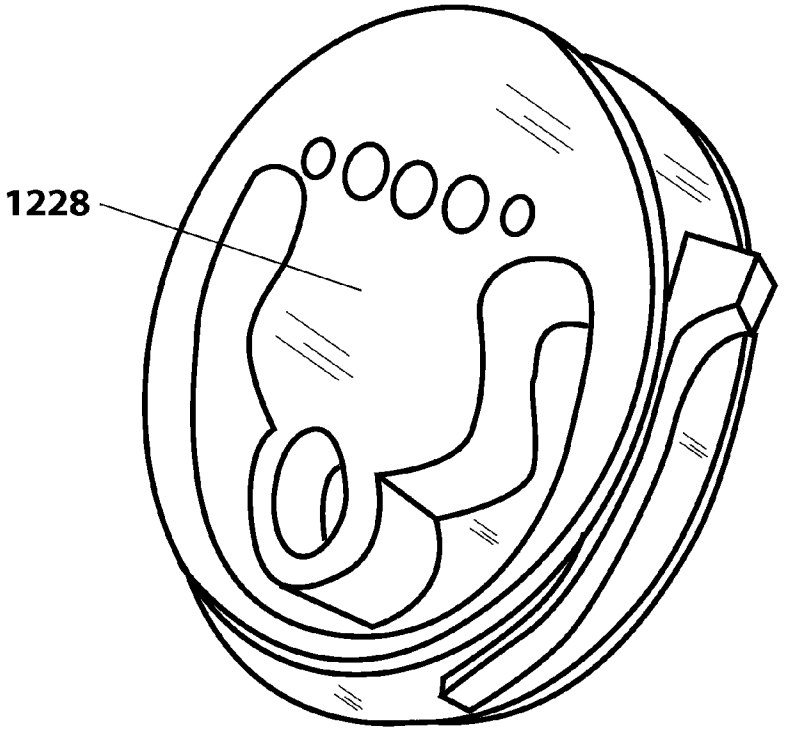

Figure 88B

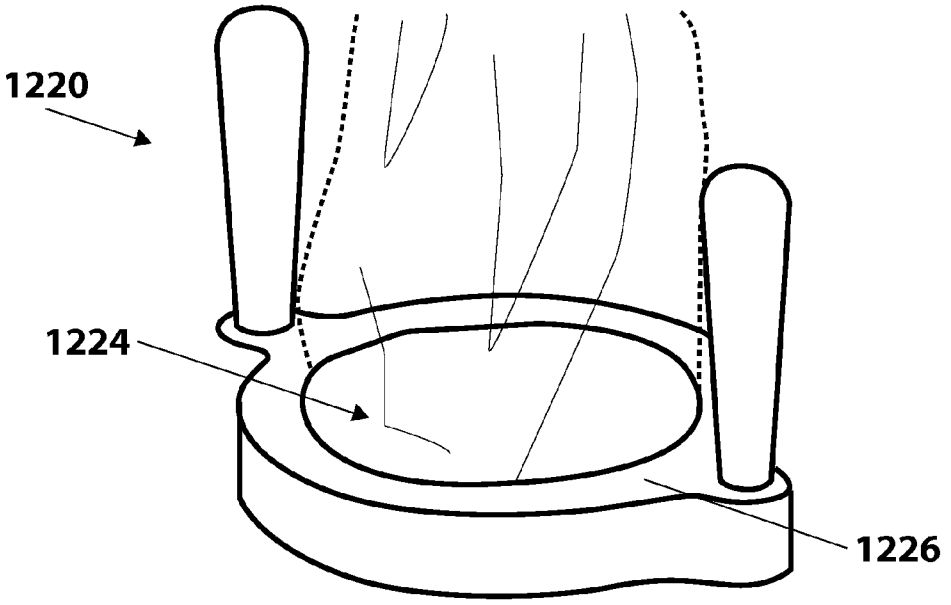

Figure 88C

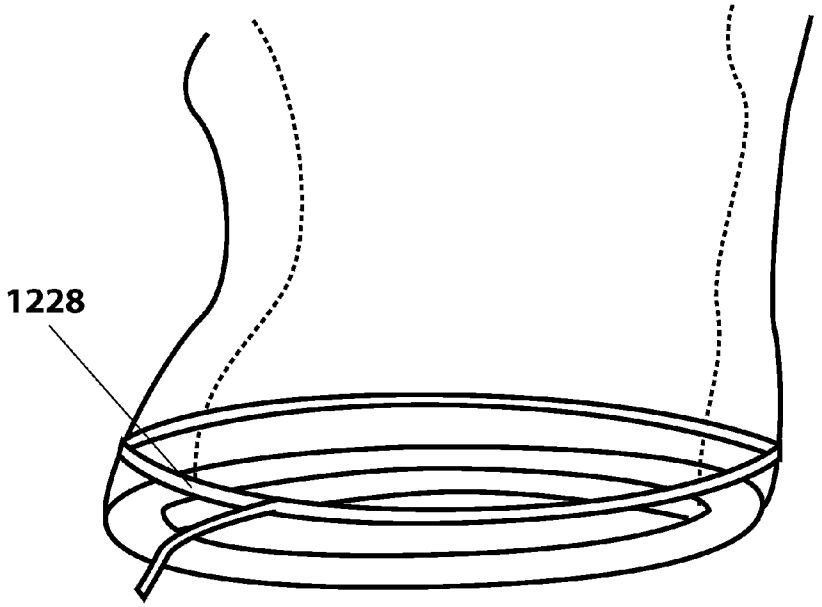

Figure 88D

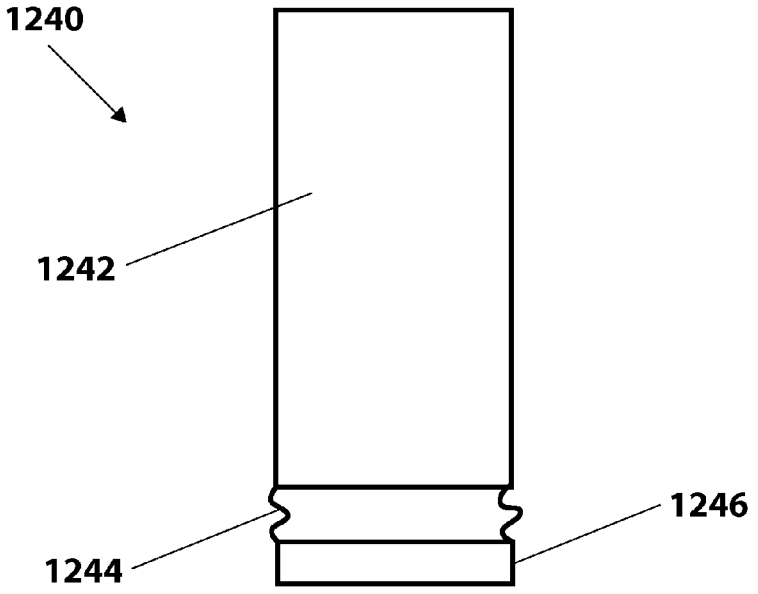

Figure 89

METHODS, SYSTEMS, AND DEVICES FOR SURGICAL ACCESS AND INSERTION

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to Provisional Application No. 61/584,947, filed Jan. 10, 2012; and Provisional Application No. 61/683,483, filed Aug. 15, 2012, both of which are hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] The various embodiments herein relate to systems, devices, and/or methods relating to surgical procedures, and more specifically for accessing an insufflated cavity of a patient and/or positioning surgical systems or devices into the cavity.

BACKGROUND OF THE INVENTION

[0003] Invasive surgical procedures are essential for addressing various medical conditions. When possible, minimally invasive procedures such as laparoscopy are preferred.

[0004] However, known minimally invasive technologies such as laparoscopy are limited in scope and complexity due in part to 1) mobility restrictions resulting from using rigid tools inserted through access ports, and 2) limited visual feedback. Further, the technologies are also limited due to difficulties relating to maintaining access to the surgical cavity while also maintaining insufflations of the cavity.

[0005] There is a need in the art for improved surgical methods, systems, and devices.

BRIEF SUMMARY OF THE INVENTION

[0006] Discussed herein are various surgical access and insertion devices and methods.

[0007] In Example 1, a surgical insertion device comprises a canister defining a lumen, a top cap coupled to a proximal end of the canister, and an incision port removably coupled to a distal end of the canister. The canister is sized to receive a surgical device in the lumen. The top cap comprises at least one lumen defined in the top cap, wherein the at least one lumen is configured to receive a support rod. The incision port comprises a fluidic sealing component configured to maintain a fluidic seal.

[0008] Example 2 relates to the surgical insertion device according to Example 1, wherein the lumen is fluidically sealed in relation to ambient air.

[0009] Example 3 relates to the surgical insertion device according to Example 1, wherein the canister comprises a flexible material or a substantially rigid material.

[0010] Example 4 relates to the surgical insertion device according to Example 1, wherein the canister comprises a flexible portion and a substantially rigid portion.

[0011] Example 5 relates to the surgical insertion device according to Example 1, wherein the canister has a cylindrical shape, a spherical shape, or a conical shape.

[0012] Example 6 relates to the surgical insertion device according to Example 1, wherein the canister comprises at least one rib structure.

[0013] Example 7 relates to the surgical insertion device according to Example 1, wherein the fluidic sealing component comprises a sealable sleeve device, a flexible seal component, a removable lid seal component, or a flap seal component.

[0014] Example 8 relates to the surgical insertion device according to Example 1, wherein the top cap comprises at least one of a pressure relief valve, at least one threaded lumen, a detachable cable harness, and a clamp projection.

[0015] Example 9 relates to the surgical insertion device according to Example 1, further comprising an outer handle set coupleable to the top cap.

[0016] Example 10 relates to the surgical insertion device according to Example 1, further comprising at least one measurement mechanism coupled to the top cap or the incision port.

[0017] Example 11 relates to the surgical insertion device according to Example 1, wherein the canister comprises at least one access port, wherein the at least one access port is a hand access port or a side access port.

[0018] In Example 12, a surgical insertion device comprises a flexible canister defining a lumen, a top cap coupled to a proximal end of the canister, an incision port removably coupled to a distal end of the canister, and a first measurement mechanism coupled with the top cap or the incision port. The canister is sized to receive a surgical device in the lumen. The top cap comprises at least one lumen defined in the top cap, wherein the at least lumen is configured to receive a support rod. The incision port comprising a fluidic sealing component is configured to maintain a fluidic seal. The first measurement mechanism is configured to measure the insertion depth of the surgical device.

[0019] Example 13 relates to the surgical insertion device according to Example 12, wherein the first measurement mechanism comprises a sensor, a string measurement system, a substantially rigid structure system, or a camera.

[0020] Example 14 relates to the surgical insertion device according to Example 12, wherein the fluidic sealing component comprises a sealable sleeve device, a flexible seal component, a removable lid seal component, or a flap seal component.

[0021] Example 15 relates to the surgical insertion device according to Example 12, wherein wherein the top cap comprises at least one of a pressure relief valve, at least one threaded lumen, a detachable cable harness, and a clamp projection.

[0022] Example 16 relates to the surgical insertion device according to Example 12, further comprising a second measurement mechanism coupled to the top cap or the incision port, the second measurement mechanism configured to measure any tilt of the flexible canister.

[0023] In Example 17, a surgical insertion device comprises a canister defining a lumen, a top cap coupled to a proximal end of the canister, and an incision port removably coupled to a distal end of the canister. The canister is sized to receive a surgical device in the lumen, wherein the surgical device is a robotic surgical device comprising two arms. The top cap comprises a pressure relief valve and at least one lumen defined in the top cap, wherein the at least one lumen is configured to receive a support rod. The incision port comprises a fluidic sealing component configured to maintain a fluidic seal.

[0024] Example 18 relates to the surgical insertion device according to Example 17, wherein the fluidic sealing compo-

nent comprises a sealable sleeve device, a flexible seal component, a removable lid seal component, or a flap seal component.

[0025] Example 19 relates to the surgical insertion device according to Example 17, wherein the top cap comprises at least one of at least one threaded lumen, a detachable cable harness, and a clamp projection.

[0026] Example 20 relates to the surgical insertion device according to Example 17, further comprising at least one measurement mechanism coupled to the top cap or the incision port.

[0027] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention. As will be realized, the invention is capable of modifications in various obvious aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] FIG. **1**A is a side view of an external pressurized system or apparatus, according to one embodiment.

[0029] FIG. **1**B is a perspective view of the external pressurized system or apparatus of FIG. **1**A with a surgical device positioned therein.

[0030] FIG. **2**A is an exploded side view of the external pressurized system or apparatus of FIG. **1**A.

[0031] FIG. **2**B is an exploded perspective view of the external pressurized system or apparatus of FIG. **1**A.

[0032] FIG. **3**A is an exploded side view of a top cap, according to one embodiment.

[0033] FIG. **3**B is an exploded perspective view of the top cap of FIG. **3**A.

[0034] FIG. **4**A is an exploded perspective view of a port, according to one embodiment.

[0035] FIG. **4**B is an exploded side view of the port of FIG. **4**A.

[0036] FIG. **5**A is an upper perspective view of a base ring and port ring, according to one embodiment.

[0037] FIG. **5**B is a lower perspective view of the base ring and port ring of FIG. **5**A.

[0038] FIG. **6**A is a top schematic view of a sealable sleeve device being positioned in an incision, according to one embodiment.

[0039] FIG. **6**B is a top schematic view of the sealable sleeve device of FIG. **6**A being positioned in an incision, according to one embodiment.

[0040] FIG. **6**C is a top schematic view of the sealable sleeve device of FIG. **6**A being positioned in an incision, according to one embodiment.

[0041] FIG. **6**D is a top schematic view of the sealable sleeve device of FIG. **6**A being positioned in an incision, according to one embodiment.

[0042] FIG. **7**A is a side view of a fully assembled port, according to one embodiment.

[0043] FIG. **7**B is a perspective view of the fully assembled port of FIG. **7**A.

[0044] FIG. **8**A is a side view of the coupling of a canister and connector ring, according to one embodiment.

[0045] FIG. **8**B is a side view of the coupling of the canister and connector ring of FIG. **8**A.

[0046] FIG. **9** is a side view of an external pressurized system or apparatus with a surgical device positioned therein, according to one embodiment.

[0047] FIG. **10** is a perspective view of the external pressurized system or apparatus of FIG. **9**, in which the surgical device has been urged out of the system or apparatus and into the patient's cavity.

[0048] FIG. **11** is a perspective view of the external pressurized system or apparatus of FIG. **10**, in which the canister has been removed.

[0049] FIG. **12** is a perspective view of an balloon seal insertion system or apparatus, according to one embodiment.

[0050] FIG. **13**A is a perspective view of an balloon seal insertion system or apparatus, according to one embodiment.

[0051] FIG. **13**B is an exploded perspective view of the balloon seal insertion system or apparatus of FIG. **13**A.

[0052] FIG. **14**A is a perspective view of a port housing, according to one embodiment.

[0053] FIG. **14**B is a cutaway perspective view of the port housing of FIG. **14**A.

[0054] FIG. **14**C is a cutaway perspective view of the port housing of FIG. **14**A.

[0055] FIG. **15** is a perspective view of a standard sealable sleeve device, according to one embodiment.

[0056] FIG. **16**A is a cutaway side view of a balloon seal insertion system or apparatus, according to one embodiment.

[0057] FIG. **16**B is a cutaway perspective view of the balloon seal insertion system or apparatus of FIG. **16**A.

[0058] FIG. **17**A is a cutaway perspective view of a balloon seal insertion system or apparatus with a first arm of a surgical device disposed therethrough, according to one embodiment.

[0059] FIG. **17**B is a cutaway perspective view of the balloon seal insertion system or apparatus of FIG. **17**A in which the first arm is positioned using a connection rod.

[0060] FIG. **18** is a cutaway perspective view of a rubber seal access/insertion device, according to one embodiment.

[0061] FIG. **19**A is an exploded side view of a rubber seal access/insertion device, according to one embodiment.

[0062] FIG. **19**B is an exploded perspective view of the rubber seal access/insertion device of FIG. **19**A.

[0063] FIG. **20** is an exploded perspective view of the separate rubber seals of a rubber seal access/insertion device, according to one embodiment.

[0064] FIG. **21** is a top view of a rubber seal access/insertion device, according to one embodiment.

[0065] FIG. **22** is a base ring of a rubber seal access/insertion device, according to one embodiment.

[0066] FIG. **23** is a side view of a rubber seal access/insertion device, according to one embodiment.

[0067] FIG. **24**A is a side view of an external pressurized system or apparatus having one or more additional access ports, according to one embodiment.

[0068] FIG. **24**B is another side view of the external pressurized system or apparatus of FIG. **24**A.

[0069] FIG. **24**C is a top view of the external pressurized system or apparatus of FIG. **24**A.

[0070] FIG. **24**D is a perspective view of the external pressurized system or apparatus of FIG. **24**A.

[0071] FIG. **24**E is another top view of the external pressurized system or apparatus of FIG. **24**A.

[0072] FIG. **24**F is a cutaway side view of the external pressurized system or apparatus of FIG. **24**A along the cross-section shown with the dotted line in FIG. **24**E.

[0073] FIG. **25** is a perspective view of an access port with a hand disposed therethrough, according to one embodiment.

[0074] FIG. **26** is a top view of another access port, according to another embodiment.

[0075] FIG. **27**A is a perspective view of a port adaptor ring coupling an access port to a tube, according to one embodiment.

[0076] FIG. **27**B is a perspective view of a device access port having a device attachment component, according to one embodiment.

[0077] FIG. **28**A is a perspective view of a glove port, according to one embodiment.

[0078] FIG. **28**B is a perspective view of the glove port in FIG. **28**A in use.

[0079] FIG. **29**A is a top schematic view of a sealable sleeve device being positioned in an incision, according to one embodiment.

[0080] FIG. **29**B is a top schematic view of the sealable sleeve device of FIG. **29**A being positioned in an incision, according to one embodiment.

[0081] FIG. **30** is a cutaway side view of an incision port, according to one embodiment.

[0082] FIG. **31**A is a top view of a base ring of an incision port, according to one embodiment.

[0083] FIG. **31**B is a perspective view of the base ring of FIG. **31**A.

[0084] FIG. **32** is a perspective view of a tube bracket, according to one embodiment.

[0085] FIG. **33** is a perspective view of a tube bracket coupling a main tube to a base ring, according to one embodiment.

[0086] FIG. **34** is a perspective view of a sleeve clamp, according to one embodiment.

[0087] FIG. **35** is a cutaway side view of an incision port, according to one embodiment.

[0088] FIG. **36** is a perspective view of an incision port with an internal coupling component, according to one embodiment.

[0089] FIG. **37**A is a cutaway side view of an incision port coupled to a port seal, according to one embodiment.

[0090] FIG. **37**B is a cutaway perspective view of the incision port and the port seal of FIG. **37**A.

[0091] FIG. **37**C is a perspective view of the underside of a base seal ring, according to one embodiment.

[0092] FIG. **38**A is a cutaway side view of an incision port having a flap seal component, according to one embodiment.

[0093] FIG. **38**B is a cutaway side view of an incision port having a flap seal component and coupled to a port seal, according to one embodiment.

[0094] FIG. **38**C is a perspective top view of the incision port and a port seal of FIG. **38**B.

[0095] FIG. **39**A is a perspective side view of an external pressurized device, according to another embodiment.

[0096] FIG. **39**B is a perspective side view of the external pressurized device of FIG. **39**A.

[0097] FIG. **40** is a side view of an external pressurized device having two slots, according to a further embodiment.

[0098] FIG. **41**A is a side view of a positioning tube, according to one embodiment.

[0099] FIG. **41**B is a top view of the positioning tube of FIG. **41**A.

[0100] FIG. **42** is a perspective view of a stacked incision port, according to one embodiment.

[0101] FIG. **43** is a perspective view of an incision port having two seals, according to one embodiment.

[0102] FIG. **44** is a perspective view of an incision port having two seals, according to another embodiment.

[0103] FIG. **45**A is a top view of an incision port, according to a further embodiment.

[0104] FIG. **45**B is a perspective view of the incision port of FIG. **45**A.

[0105] FIG. **46**A is a top view of an air barrier incision port system, according to one embodiment.

[0106] FIG. **46**B is a top view of the air barrier port of the port system of FIG. **46**A.

[0107] FIG. **47** is a perspective side view of a rubber seal incision port, according to one embodiment.

[0108] FIG. **48**A is a perspective side view of a dual brush incision port, according to one embodiment.

[0109] FIG. **48**B is another perspective side view of the dual brush incision port of FIG. **48**A.

[0110] FIG. **49**A is a perspective top view of a triple brush incision port, according to one embodiment.

[0111] FIG. **49**B is a perspective side view of the triple brush incision port of FIG. **49**A.

[0112] FIG. **50**A is a side view of an insertion device, according to one embodiment.

[0113] FIG. **50**B is another side view of the insertion device of FIG. **50**A.

[0114] FIG. **50**C is another side view of the insertion device of FIG. **50**A.

[0115] FIG. **51**A is a side view of an insertion device, according to another embodiment.

[0116] FIG. **51**B is a top view of the insertion device of FIG. **51**A.

[0117] FIG. **52** is a side view of an insertion device, according to a further embodiment.

[0118] FIG. **53** is a side view of a surgical device positioned in a positioning rod, according to one embodiment.

[0119] FIG. **54**A is a side view of an internal pressurized bag device, according to one embodiment.

[0120] FIG. **54**B is another side view of the internal pressurized bag device of FIG. **54**A.

[0121] FIG. **55** is a side view of another external pressurized system or apparatus, according to one embodiment.

[0122] FIG. **56**A is a perspective side view of a top cap, according to one embodiment.

[0123] FIG. **56**B is another perspective side view of the top cap of FIG. **56**A.

[0124] FIG. **57**A is a perspective side view of a top cap and a canister, according to one embodiment.

[0125] FIG. **57**B is another perspective side view of the top cap and canister of FIG. **57**A.

[0126] FIG. **58**A is a perspective view of a top cap with a portion of a device assembly positioned therethrough, according to one embodiment.

[0127] FIG. **58**B is a perspective view of the underside of the top cap of FIG. **58**A.

[0128] FIG. **59**A is a perspective view of a top cap with a portion of a device assembly positioned therethrough, according to one embodiment.

[0129] FIG. **59**B is a another perspective view of the top cap of FIG. **59**A.

[0130] FIG. **60** is a cutaway perspective view of a top cap, according to one embodiment.

[0131] FIG. **61**A is a perspective side view of a top cap coupled to a canister with a portion of a device assembly positioned therethrough, according to one embodiment.

[0132] FIG. **61**B is another perspective side view of the top cap of FIG. **61**A.

[0133] FIG. **62**A is a perspective side view of a base coupling component, according to one embodiment.

[0134] FIG. **62**B is another perspective side view of the base coupling component of FIG. **62**A.

[0135] FIG. **63**A is a perspective side view of a base coupling component and an access port, according to one embodiment.

[0136] FIG. **63**B is another perspective side view of the base coupling component and the access port of FIG. **63**A.

[0137] FIG. **63**C is a perspective side view of a portion of the base coupling component and the access port of FIG. **63**A.

[0138] FIG. **63**D is another perspective side view of a portion of the base coupling component and the access port of FIG. **63**A.

[0139] FIG. **63**E is a cutaway side view of the base coupling component and the access port of FIG. **63**A.

[0140] FIG. **64**A is side view of an external pressurized system or apparatus with a base coupling component and access port, according to one embodiment.

[0141] FIG. **64**B is a top view of the external pressurized system of FIG. **64**A.

[0142] FIG. **65**A is a side view of an external pressurized system or apparatus with a base coupling component and access port, according to one embodiment.

[0143] FIG. **65**B is another side view of the external pressurized system or apparatus of FIG. **65**A.

[0144] FIG. **66**A is a side view of an external pressurized system or apparatus when the robotic device is lowered through an opening created by an access port, according to one embodiment.

[0145] FIG. **66**B is another side view of the external pressurized system or apparatus of FIG. **66**A.

[0146] FIG. **67**A is a side view of an external pressurized system or apparatus in which the forearms of the robotic device are positioned at an angle of or near 45° in relation to the upper arms, according to one embodiment.

[0147] FIG. **67**B is another side view of the external pressurized system or apparatus of FIG. **67**A.

[0148] FIG. **68**A is a side view of an external pressurized system or apparatus in which the forearms of the robotic device are positioned in a particular position, according to one embodiment.

[0149] FIG. **68**B is another side view of the external pressurized system or apparatus of FIG. **67**A.

[0150] FIG. **69**A is a side view of an external pressurized system or apparatus in which the forearms of the robotic device are positioned in an appropriate starting position for a procedure, according to one embodiment.

[0151] FIG. **69**B is another side view of the external pressurized system or apparatus of FIG. **67**A.

[0152] FIG. **70** is a side view of an external pressurized system or apparatus having a flexible container, according to another embodiment.

[0153] FIG. **71**A is a perspective side view of a base coupling component, according to one embodiment.

[0154] FIG. **71**B is another perspective side view of the base coupling component of FIG. **71**A.

[0155] FIG. **72**A is a perspective side view of a port attachment having a removable lid and an access port, according to one embodiment.

[0156] FIG. **72**B is another perspective side view of the port attachment and access port of FIG. **72**A.

[0157] FIG. **73**A is a perspective side view of a port attachment having a removable lid and an access port, according to one embodiment.

[0158] FIG. **73**B is another perspective side view of the port attachment and access port of FIG. **73**A.

[0159] FIG. **74**A is a cutaway side view of a port attachment having a removable lid and an access port, according to one embodiment.

[0160] FIG. **74**B is another cutaway side view of the port attachment and access port of FIG. **74**A.

[0161] FIG. **75**A is a perspective side view of an external pressurized insertion device having a port attachment with a removable lid, according to one embodiment.

[0162] FIG. **75**B is another perspective side view of the external pressurized insertion device of FIG. **75**A.

[0163] FIG. **75**C is another perspective side view of the external pressurized insertion device of FIG. **75**A.

[0164] FIG. **76** is a perspective side view of a top cap having a pressure relief valve, according to one embodiment.

[0165] FIG. **77**A is a perspective side view of a top cap having a pressure relief valve and port seal, according to one embodiment.

[0166] FIG. **77**B is a perspective cutaway view of the top cap of FIG. **77**A.

[0167] FIG. **78**A is a side view of an insertion device having an actuator and sensor package.

[0168] FIG. **78**B is another side view of the insertion device of FIG. **78**A.

[0169] FIG. **78**C is another side view of the insertion device of FIG. **78**A.

[0170] FIG. **79** is a side cutaway view of an insertion device having a measurement mechanism associated with the top cap, according to one embodiment.

[0171] FIG. **80** is a side cutaway view of an incision port of an insertion device having a measurement mechanism associated with the incision port, according to one embodiment.

[0172] FIG. **81** is a top view of a top cap of an insertion device having a string measurement system, according to one embodiment.

[0173] FIG. **82**A is a top view of a top cap of an insertion device having a substantially rigid structure measurement mechanism, according to one embodiment.

[0174] FIG. **82**B is an underside view of the top cap of FIG. **82**A.

[0175] FIG. **82**C is an underside view of an incision port of the insertion device of FIG. **82**A.

[0176] FIG. **82**D is a perspective view of the substantially rigid structure having a pegged ball of the insertion device of FIG. **82**A.

[0177] FIG. **82**E is a top view of the incision port of FIG. **82**C.

[0178] FIG. **83** is a cutaway side view of an incision port having an insufflations port, according to one embodiment.

[0179] FIG. **84**A is a cutaway side view of an insertion device having a spherically shaped canister, according to one embodiment.

[0180] FIG. **84**B is a cutaway side view of an insertion device having a conically shaped canister, according to one embodiment.

[0181] FIG. **85**A is a cutaway side view of an insertion device having a canister with vertical rib structures, according to one embodiment.

[0182] FIG. **85**B is a cutaway side view of an insertion device having a canister with horizontal rib structures, according to one embodiment.

[0183] FIG. **85**C is a cutaway side view of an insertion device having a canister with spiral-shaped rib structures, according to one embodiment.

[0184] FIG. **86**A is a side view of a base coupler that can be releasably coupled to a canister, according to one embodiment.

[0185] FIG. **86**B is another side view of the base coupler and canister of FIG. **86**A.

[0186] FIG. **86**C is another side view of the base coupler and canister of FIG. **86**A.

[0187] FIG. **86**D is another side view of the base coupler and canister of FIG. **86**A.

[0188] FIG. **87**A is a perspective side view of a top cap and outer handle set, according to one embodiment.

[0189] FIG. **87**B is a cutaway side view of the top cap and outer handle set of FIG. **87**A.

[0190] FIG. **87**C is a perspective cutaway view of the top cap and outer handle set of FIG. **87**A.

[0191] FIG. **88**A is a side view of an insertion device, according to one embodiment.

[0192] FIG. **88**B is a perspective view of a top cap of the insertion device of FIG. **88**A.

[0193] FIG. **88**C is a perspective view of a mobile seal and outer handle set of the insertion device of FIG. **88**A.

[0194] FIG. **88**D is a perspective view of an incision port of the insertion device of FIG. **88**A.

[0195] FIG. **89** is a side view of an insertion device having a substantially non-flexible canister portion and a substantially flexible canister portion, according to one embodiment.

DETAILED DESCRIPTION

[0196] The various embodiments described herein relate to systems, devices, and/or methods for accessing an insufflated cavity of a patient and/or positioning surgical systems or devices into the cavity.

[0197] Certain embodiments provide for insertion of the surgical systems/devices into the cavity while maintaining sufficient insufflation of the cavity. Further embodiments minimize the physical contact of the surgeon or surgical users with the surgical devices/systems during the insertion process. Other implementations enhance the safety of the insertion process for the patient and the systems/devices. For example, some embodiments provide visualization of the system/device as it is being inserted into the patient's cavity to ensure that no damaging contact occurs between the system/device and the patient. In addition, certain embodiments allow for minimization of the incision size/length. Further implementations reduce the complexity of the access/insertion procedure and/or the steps required for the procedure. Other embodiments relate to devices that have minimal profiles, minimal size, or are generally minimal in function and appearance to enhance ease of handling and use.

[0198] It is understood that any of the various embodiments disclosed herein could also be automated or made into fully automatic devices/systems and thus could be used by lightly-trained users, such as on the battlefield or during a space mission or the like.

[0199] One embodiment relates to an external pressurized system or apparatus. For example, one implementation of an external pressurized system or apparatus **10** is depicted in FIG. **1**A. The apparatus **10** has a canister **12** with a top cap **14** coupled to a top portion **16** of the canister **12**. In this embodiment, the canister **12** has a port **18** that is coupled to the canister **12** at a base portion **20** of the canister **12**. The port **18** is positioned in an incision in the skin **22** of the patient, thereby providing access to a cavity **24** of the patient. As shown in FIG. **1**B, the apparatus **10** is configured to receive a surgical device **26** such that the device **26** can be inserted into the patient cavity **24** through the port **18** of the apparatus **10**.

[0200] In one implementation, the canister **12** is made of a hard plastic, such as, for example, poly(methyl methacrylate) ("PMMA"). Alternatively, the canister **12** can be made of any known rigid material that can be used in medical devices. It is understood that certain embodiments of the canister **12** are transparent, such as those depicted in the figures provided. The transparent canister **12** allows for the user to see the surgical device **26** during insertion. Alternatively, the canister **12** is not transparent and the device **26** can be inserted without being able to view the device **26** in the canister **12**.

[0201] FIGS. **2**A and **2**B provide an exploded view of the external pressurized apparatus **10** according to one embodiment. As discussed above, the top cap **14**, also depicted in FIGS. **3**A and **3**B, is coupled to the top portion **16** of the canister **12**. The top cap **14** has a seal **30** that is held in place with a cover **32**. According to one implementation, the cover is coupled to the top cap **14** with bolts, other similar mechanical fasteners, or any other known mechanism, device, or method for coupling two such components together.

[0202] In one implementation as best shown in FIGS. **2**B and **3**B, the seal **30** has an orifice **34** defined in the seal **34**. As best shown in FIG. **1**B, the orifice **34** is configured to receive a positioning rod **28**, as described in further detail below. In one embodiment, the seal **30** is made of some type of rubber. Alternatively, the seal **30** can be made of any number of known materials that can be used to provide a fluid seal around a smooth rod, including a gel material or the like. In a further alternative, the top cap **14** can have any known configuration that provides a seal having an orifice or other type of access for a positioning rod **28** or the like.

[0203] As best shown in FIGS. **2**A, **2**B, **4**A, and **4**B, the port **18** (also referred to herein as an "incision port"), in accordance with one implementation, has multiple components. In this particular embodiment, the port **18** has a connector ring **40**, a base ring **42**, a port ring **44**, and a sealable sleeve device **46**. The sealable sleeve device **46** has an upper sleeve ring **46**A and a lower sleeve ring **46**B, both of which are coupled together by a flexible sleeve **46**C. In certain embodiments, the flexible sleeve **46**C has elastic properties. As best shown in FIGS. **5**A and **5**B, the port ring **44** has multiple teeth or protrusions **44**A defined in a top portion of the ring **44** in a circular configuration around a hole **50**. In addition, in one embodiment, the ring **44** has a lip **52** extending from the bottom portion of the ring **44** and defining an outer edge of the hole **50**. As described below, this lip **52** can be positioned within the incision made in the patient, thereby defining the smallest circumference of the incision. Further, the port ring **44** has three guide projections **54** extending from the top portion of the ring **44**, which can aid in keeping the base ring **42** positioned appropriately when it is placed on top of the port ring **44** as described below. In addition, according to one embodiment, the port ring **44** can also have indentations **60**

around its circumference that allow a user to grasp the port ring **44** during use as described below. Alternatively, the port ring **44** can have any exterior feature or mechanism that a user can use to better grasp the ring **44**.

[0204] As also shown in FIGS. **5**A and **5**B, the base ring **42** has an underside that has multiple indentations **42**B defined in the ring **42**. In one embodiment, the indentations **42**B correspond to the protrusions **44**A in the port ring **44** such that the base ring **42** and port ring **44** can be coupled and rotational force can be transferred from one to the other, as described in further detail below. Alternatively, the features on the base ring **42** and the port ring **44** can be ridges that can easily couple together. In a further alternative, the features can be any known features or physical components that can be coupled together to allow for transmission of rotational force as described herein. In addition, as best shown in FIG. **5**B, the underside of the base ring **42** has an exterior lip or ridge **62**, according to one embodiment. When the base ring **42** is in contact with the port ring **44**, the ridge **62** is in slidable contact with the port ring **44**. In one implementation, the contact of the ridge **62** with the port ring **44** can provide a better seal that the ridges **42**B, **44**A provide alone. As such, this seal can be a secondary seal that can actually be strengthened as the sleeve device **46** is rotated and the two rings **42**, **44** are urged together.

[0205] The connector ring **40** is configured to be coupleable with the canister **12**, as will be described in further detail below. In addition, the connector ring **40** is coupleable to the rest of the port **18** by being configured to be coupleable to the base ring **42**. In one embodiment, as best shown in FIG. **2**B, the connector ring **40** has multiple threaded holes **40**A defined through the ring **40** that correspond to multiple threaded holes **42**A defined through the base ring **42**, such that screws, bolts, or the like can be inserted into and through the threaded holes **40**A, **42**A of the two rings **40**, **42**, thereby coupling the two rings **40**, **42** together. Alternatively, any known coupling components or methods can be used to couple the two rings **40**, **42**.

[0206] The base ring **42** is coupleable to the port ring **44**. When the base ring **42** is placed on and in contact with the top of the port ring **44**, the protrusions **44**A are positioned in the indentations **42**B and rotational friction is established such that any rotational force applied to the base ring **42** will be transmitted to the port ring **44** (or vice versa) without any slippage between the two rings **42**, **44**. Further, the base ring **42** and port ring **44** are coupled such that the holes **48**, **50** in each ring **42**, **44** correspond as well. Alternatively, any known coupling components or methods can be used to couple the two rings **42**, **44** in the same fashion.

[0207] In use, the external pressurized system **10** can be used to insert a surgical device or system into a cavity of a patient. One method of insertion will now be described, but it is understood that the embodiments disclosed herein are not limited to a single procedure and instead can be used in any procedure that falls within the spirit of the various implementations contemplated herein.

[0208] In one embodiment, the port **18** is placed in an incision in the following manner to create a seal for the incision that fluidly seals the patient's cavity from the ambient air outside the patient. First, an incision is made in the patient that provides access to the patient's target cavity. In one embodiment, the cavity is the peritoneal cavity, but the target could be any known cavity. Once the incision has been made, the sealable sleeve device **46** is positioned in the incision, for example as shown in FIGS. **6**A, **6**B, **6**C, and **6**D. In this embodiment, the device **46** is positioned through incision **58**. The device **46** is positioned in the incision by inserting the lower sleeve ring **46**B (not shown in FIGS. **6**A-**6**D) through the incision **58** such that the lower ring **46**B is positioned within the patient and the upper ring **46**A is positioned outside the patient, with the sleeve **46**B extending through the incision **58**. According to one embodiment, the lower sleeve ring **46**B of the device **46** is a flexible ring **46**B that can be deformed such that the ring **46**B can be inserted through the incision **58**.

[0209] In one embodiment, prior to positioning the sealable sleeve device **46** in the incision **58** as described above, the device **46** is first positioned in a similar fashion through the hole **50** in the port ring **44** and the hole **48** in the base ring **42**. That is, the lower sleeve ring **46**B is deformed and inserted through the hole **50** and the hole **48**, thereby resulting in the upper sleeve ring **46**A being positioned on the top portion of the base ring **42** (which is positioned on the top portion of the port ring **44**) and the lower sleeve ring **46**B being positioned on the bottom portion of the port ring **44**. The lower sleeve ring **46**B is then inserted through the incision **58** in the patient as described above. Alternatively, the sealable sleeve device **46** can be positioned through the hole **50** in the port ring **44** and the hole **48** in the base ring **42** after the device **46** has been positioned through the incision **58**.

[0210] Once the lower ring **46**B is inserted through the incision **58** as shown in FIG. **6**A and further positioned in the hole **50** in the port ring **44**, the upper ring **46**A is positioned over the incision **58** such that the incision **58** is centered within the ring **46**A, as shown in FIG. **6**B. For ease of understanding, the port ring **44** is not depicted in these figures. The sealable sleeve **46** is then tightened to create a seal and position the lower ring **46**B snugly to the underside of the incision **58** and the upper ring **46**A snugly to the top portion of the base ring **42**. This tightening occurs by rotating the upper ring **46**A. In one embodiment, the upper ring **46**A is less flexible (more rigid) than the lower ring **46**B, thereby allowing a user to grasp it and rotate it. FIG. **6**C depicts the sealable sleeve device **46** after the ring **46**A has been rotated, thereby causing the sleeve **46**C to gather and begin to close the opening in the sleeve **46**C (or "collapse on itself"). FIG. **6**D shows the sleeve device **46** after the user has successfully rotated the ring **46**A to the point that a seal is formed in the sleeve **46**C by closing the opening therein.

[0211] It is understood that the base ring **42** and the port ring **44** are intended to be generally rotatable relative to each other during the process of positioning the port **18** and thereby sealing the incision **58**. That is, when the base ring **42** is initially positioned on the port ring **44**, the two rings **42**, **44** are rotatable in relation to each other. This relative rotation of the two rings **42**, **44** allows for rotation of the sleeve device **46**, thereby resulting in the seal created by the sleeve device **46** when it is sufficiently constricted. However, when the sleeve device **46**, the port ring **44**, and the base ring **42** are positioned in the incision **58** and the sealable sleeve device **46** is tightened to close the hole in the incision **58** as described above, the elasticity of the sleeve **46**C urges the base ring **42** and port ring **44** together as described above, causing the bottom surface of the base ring **42** and the top surface of the port ring **44** to come into contact such that the ridges **44**A on the port ring **44** couple with the ridges **42**B on the base ring **42** as described above. The interfacing ridges **44**A, **42**B provide an interface or coupling that will result in rotational coupling of the rings

42, 44 when the rings are in contact, but also is releasable when desired. It is understood that the more force applied to urge the two rings 42, 44 together (the more that the sleeve device 46 is rotated), the more secure the coupling of the ridges 44A, 44B becomes.

[0212] Once the sleeve device 46, the port ring 44, and the base ring 42 are positioned in the incision 58 as described above, the connector ring 40 is coupled to the base ring 42. In one embodiment as described above, the connector ring 40 is coupled to the base ring 42 via nuts or bolts. Alternatively, any standard coupling device or method can be used. Once the connector ring 40 is coupled to the base ring 42, the port 18 is fully assembled, as shown in FIGS. 7A and 7B.

[0213] According to one embodiment, the coupling of the connector ring 40 to the base ring 42 as shown in FIG. 7A, in combination with the tightening of the sleeve device 46 as described above, creates a fluid seal that seals the patient's cavity from the ambient air outside the patient. More specifically, at this point the sealable sleeve device 46 provides a seal as best shown in FIG. 6D. One of ordinary skill in the art understands that this fluidic seal is sufficient to maintain the increased air pressure of the insufflated cavity of the patient.

[0214] Once this seal is established, the canister 12 with the medical device/system 26 positioned inside can be coupled to the connector ring 40 as best shown in FIG. 1B such that the device/system 26 can then be inserted into the insufflated cavity 24 of the patient. Prior to that coupling, the device/system 26 (coupled to a positioning rod 28) must be positioned in the canister 12. While it is understood that any number of known procedures within the spirit of the embodiments contemplated herein could be used to position the device/system 26 in the canister 12, one implementation provides for—prior to coupling the canister 12 to the port 18—inserting the device/system 26 through the open end (not shown) at the base portion 20 of the canister 12 (as best depicted in FIG. 1A) and inserting the positioning rod 28 through the orifice 34 defined in the seal 30 in the top cap 14. It is understood that the positioning rod 28, in accordance with some embodiments, can have one or more lumens therein that can contain one or more connection components (such as wires, cords, or the like) that connect the device/system 26 to an external controller of some kind, thereby allowing for the controller to control the device/system 26 via the connection component(s).

[0215] Once the device/system 26 is positioned in the canister 12 with the positioning rod 28 extending out of the top cap 14 through the orifice 34 in the seal 30 as best shown in FIG. 1B, the canister 12 can be coupled to the connector ring 40. In one embodiment as best shown in FIGS. 8A and 8B, the base portion 20 of the canister 12 has at least 2 projections 12A extending from the canister 12 that correspond to the slots 40B in the connector ring 40. More specifically, in the implementation depicted in FIGS. 8A and 8B, the canister 12 has 4 projections 12A (one of which is not shown) that correspond to 4 slots 40B in the connector ring 40. To couple the canister 12 to the ring 40, the four projections 12A are inserted into the slots 40B and the canister 12 is rotated in a counterclockwise fashion to position the projections 12A in the fully coupled position in the slots 40B as shown in FIG. 8B. Alternatively, any known coupling mechanism, device, or procedure can be used to couple the canister 12 to the ring 40.

[0216] Once the canister 12 is coupled to the port 18 as best shown in FIG. 9, a seal has been achieved that fluidically separates and seals fluid within the canister 12 from fluid outside the canister 12. At this point, the pressure inside the canister 12 is increased until it matches the pressure of the insufflated cavity 24. By equalizing the pressure in the canister 12 to the pressure in the insufflated cavity 24, the device/system 26 positioned in the canister 12 can then be inserted into the cavity 24 through the seal created by the sealable sleeve device 46 without causing a loss of pressure or loss of insufflation in the cavity 24. According to one embodiment, the fluidic seal is maintained in the canister 12 by the seal created between the canister 12 and the port 18 and further by the seal created between the positioning rod 28 and the seal 30. More specifically with respect to the positioning rod 28 and the seal 30, it is understood that the rod 28 is sized to contact the inner circumference of the orifice 34 in the seal 30, thereby resulting in an airtight fluidic seal between the rod 28 and the seal 30. It is understood that, at this point, if a user wants to adjust the positioning of the device/system 26, the user can do so using the positioning rod 28.

[0217] Once the air pressure in the canister 12 is substantially the same as the air pressure in the insufflated cavity 24, the device/system 26 is moved out of the canister 12, through the port 18 and the incision 58, and into the patient's cavity 24. According to one embodiment as best shown in FIG. 1B, the device/system 26 can be moved through the port 18 and into the cavity 24 using the positioning rod 28, which is coupled at its distal end to the device/system 26. That is, a user can grasp a proximal end of the rod 28 and move the rod 28 in a distal direction as desired to move the device/system 26 distally out of the canister 12 and into the cavity 24. In those implementations in which the device/system is a robotic device having operational arms, the device, including the arms, can be advanced through the port 18 and into the insufflated cavity 24. It is understood that the user can also turn the rod 28 to turn the device/system 26 as needed/desired as well. In this fashion, the user can position the device/system 26 as desired within the patient's cavity 24 in order to perform a procedure.

[0218] In alternative embodiments, the positioning rod 28 can be a larger rod than that depicted in these figures such that the rod 28 can have multiple lumens defined within the rod 28, including one or more larger lumens that could be used for tool and/or camera insertion. Insufflation after removal of the canister 12 could also be accomplished through such a rod 28. In a further alternative, instead of a rod, a port such as a known SILS port could be used.

[0219] Once the device/system 26 has been inserted into, and is positioned as desired in, the patient's cavity 24, the fluidic seal is re-established between the insufflated cavity 24 and the interior of the canister 12 via the sealable sleeve device 46. As a result, the pressure inside the canister 12 can be lowered until it is substantially equal to the ambient pressure. At that point, the canister 12 can be de-coupled from the connector ring 40. That is, according to one embodiment, the canister 12 is rotated in the clockwise direction, thereby urging the projections 12A out of the slots 40B in the ring 40. Once the canister 12 is removed, as best shown in FIG. 11, only the port 18 itself remains with the fluidic seal established by the combination of the port 18 components, including the sealable sleeve device 46 as described above. Thus, the user can freely position and operate the device/system using the positioning rod 28 (and, in some embodiments, the external controller (not shown) connected to the device/system via the connection component(s)). For example, the removal of the canister 12 can provide for additional accessibility and free-

dom of movement for the rod **28**. As such, the medical procedure using the system/device **26** is typically performed once the canister **12** is removed as shown in FIG. **11**.

[0220] Another access and insertion embodiment relates to a balloon seal insertion method and device for inserting a surgical device/system into a patient's cavity and performing a surgical procedure using a balloon seal insertion device that operates to maintain a fluidic seal around the surgical device such that the higher air pressure of the insufflated cavity is not lost during the procedure. One example of a balloon seal insertion device **100** being used to position and operate a surgical device **102** in a patient's insufflated cavity **106** is depicted in FIG. **12**. As depicted, the insertion device **100** is positioned on the patient's skin (schematically depicted as **106**) and through the incision in the skin (not shown). The connecting rod **104** coupled to the device **102** is positioned through the insertion device **100**, with the surgical device **102** positioned within the patient's insufflated cavity **108**.

[0221] As best shown in FIGS. **12**, **13**A, and **13**B, the insertion device **100** can maintain a fluidic seal during a surgical procedure because the device **100** has an expandable seal **114** (also referred to as an "expandable balloon" or "balloon" herein) disposed through a hole **112** defined in the port housing **110** of the device **100**. The balloon **114** provides a fluidic seal around any surgical device positioned through the hole **112** because the balloon **114** is flexible, expandable, and elastic. As such, as the balloon **114** is inflated, it provides "odd geometry molding," which means it can be expanded around, come into contact with, and conform to the shape of any object positioned through the hole **112**, thereby creating a fluidic seal around that object, regardless of its shape.

[0222] As best shown in FIG. **13**B, the insertion device **100** comprises a port housing **110** that defines a hole **112** as discussed above. As also discussed above, the balloon **114** is positioned within the hole **112**. The housing **110** further has two balloon inflation/deflation ports **116**A, **116**B and a cavity insufflation/deflation port **118**. In addition, the housing **110** has two attachment components **120** configured to allow for the attachment of the coupling components **122**. The coupling components **122** are used to couple the housing **110** to a standard sealable sleeve **46** as will be discussed below.

[0223] The ports **116**A, **116**B, **118** are configured to receive various types of standard valves and/or connections such as Luer locks, each of which is configured to provide an interface for external tubes, hoses, or the like for providing inflation or deflation as desired/needed. In this specific embodiment, two connections **124**, **126** are Luer locks and one connection **128** is a Schrader valve. According to one implementation, a Schrader valve is used for connection **128** in port **116**B to accommodate connection to a standard air pump while also providing a release valve to deflate the balloon seal **114** when necessary. It is understood that any other known valves or connections used with medical devices—such as, for example, any connections using standard UNF or NPT size fittings—can be used in place of connections **124**, **126**, **128** with various implementations of this device **100**.

[0224] It is understood that the various ports **116**A, **116**B, **118** are intended to couple to external hoses, tubes, or the like, one or more of which are in turn coupled to external air pressure sources. It is further understood that one or all of the external air pressure sources can be an insufflation device or an air pump typically used for inflation of a medical device. In one embodiment, the external air pressure source is a self-regulating device that self-regulates the level of the air pressure. Alternatively, the external air pressure source can be any known air pressure source that is used with inflatable medical devices.

[0225] According to one embodiment, the balloon **114** has a top ring **140**, a bottom ring **144**, and an expandable body **142** connecting the two rings **140**, **144**. It is understood that these parts of the balloon **114** can be part of a single integral piece that makes up the balloon **114**. Alternatively, the balloon **114** can be made up of separate components. The top ring **140** is positioned on and coupled to the top lip **130** on the top portion of the hole **112**, while the bottom ring **144** is positioned on and coupled to the bottom lip **132** on the bottom portion of the hole **112**, as best shown in FIGS. **14**B and **14**C. In accordance with one implementation, the rings **140**, **144** can be coupled to the lips **130**, **132** chemically (a glue or other type of adhesive) or mechanically (clamps, screws, or any other known mechanical attachment mechanisms). Alternatively, the expandable seal **114** can be any known expandable device or component that is used with medical devices and can provide a fluidic seal via odd geometry molding. In one embodiment, the balloon **114** is comprised of latex or some type of rubber. Alternatively, the balloon **114** can be made of any known material used in medical devices that is expandable, elastic, and can provide a fluidic seal via odd geometry molding.

[0226] In one implementation, the thickness of the seal **114** can be modified to influence how the seal **114** operates. For example, various parts of the seal **114** can have different thicknesses to influence the way in which the seal **114** expands when it is inflated. Alternatively, the seal **114** can have a single thickness that can be varied to influence the resistance of the seal **114** when an object is inserted through it. Alternatively, the thickness can be varied for other reasons as well. In a further alternative embodiment, in addition to at least one expandable elastic material, an additional material or materials can be added to the seal **114**. For example, a fabric or other type of material that is less elastic and/or less expandable can be included in the seal **114** to influence or control the way the seal **114** expands when it is inflated. For example, a fabric could be included in a top and bottom portion of the seal **114** to prevent the seal **114** from expanding vertically (up or down) and thereby influence the seal **114** to expand horizontally.

[0227] In the embodiment as shown, the attachment components **120** are threaded holes configured to receive screws or bolts or the like. Further, in this implementation, the threaded holes **120** are positioned on opposite sides of the housing **110**. Alternatively, any appropriate known attachment component **120** can be used to allow for attachment of the coupling components **122** to the housing **110**. Further, it is understood by one of ordinary skill that the number and positioning of the attachment components **120** on the housing can vary as desired to allow for different configurations and different types of coupling components **122**.

[0228] FIGS. **14**A, **14**B, and **14**C depict additional details about the configuration of the port housing **110**, according to one embodiment. More specifically, as best shown in FIG. **14**B (which depicts a cross-section of the housing **110**), the port housing **110** has two balloon inflation/deflation lumens **150**A, **150**B defined in the housing **110**. The balloon inflation/deflation lumen **150**A provides a fluid connection between the balloon inflation/deflation port **116**A and the hole **112**, thereby allowing for inflation or deflation of the expandable seal **114** via the port **116**A. Similarly, the balloon inflation/deflation lumen **150**B provides a fluid connection

between the balloon inflation/deflation port **116**B and the hole **112**, thereby also allowing for inflation or deflation of the expandable seal **114** via the port **116**B.

[0229] As best shown in FIG. **14**C (which depicts a different cross-section of the housing **110**), the port housing **110** also has a cavity insufflation/deflation lumen **152** defined in the housing **110** that provides a fluid connection between the cavity insufflation/deflation port **118** and patient's cavity **108** which is in fluid communication with the underside of the housing **110** when the housing is positioned on the incision in the patient. This lumen **152** thus allows for insufflation or deflation of the patient's cavity **108** via the port **118**.

[0230] In use, the device **100** is positioned on the incision **160** in the patient in combination with a standard sealable sleeve device **162** as best shown in FIGS. **16**A and **16**B. The standard sealable sleeve device **162** is shown in FIG. **15**. It has an upper ring **164** and a lower ring **166** that are coupled together by a flexible sleeve **168**. According to one embodiment, the device **162** is substantially similar to the sealable sleeve device described above with respect to FIGS. **2**A, **2**B, **6**A, **6**B, **6**C, and **6**D.

[0231] In one implementation, the sealable sleeve device **162** is first positioned in the incision **160**. It is understood that the sleeve device **162** can be inserted using steps similar to those described above. Alternatively, any known insertion steps can be used to insert the device **162** into the incision such that the upper ring **164** is positioned outside of the incision **160** and the lower ring **166** is positioned inside the patient's cavity, with the sleeve **168** disposed through the incision **160** itself, as best shown in FIG. **16**A.

[0232] Once the sleeve device **162** is positioned in the incision **160**, the housing **110** is coupled to the sleeve device **162** as best shown in FIGS. **16**A and **16**B. More specifically, according to one implementation, the housing **110** is positioned over the upper ring **164** of the sleeve device **162** such that the upper ring **164** is positioned into the circular indentation or notch **170** defined in the bottom of the housing **110**. The configuration of the notch **170** corresponds to the configuration of the upper ring **164** and thus is configured to receive the upper ring **164** such that the ring **164** fits snugly into the notch **170**.

[0233] Once the ring **164** is positioned in the notch **170**, the coupling components **122** are coupled to the attachment components **120** on the housing **110** and thereby firmly couple the housing **110** to the sleeve device **162**. The coupling components **122** in this embodiment are components having a vertical piece **122**A and a horizontal piece **122**B. The vertical pieces **122**A are coupled to the attachment components **120** using a screw or bolt or similar mechanism. As best shown in FIG. **16***a*, when the vertical pieces **122**A are coupled to the attachment components **120**, the horizontal pieces **122**B are positioned under the housing **110** such that they are also positioned under the upper ring **164** disposed in the notch **170**. As such, the coupling components **122** operate to retain or lock the upper ring **164** in the notch **170**. As a result, the retention of the upper ring **164** into the notch **170** can provide a fluidic seal between the housing **110** and sleeve device **162**. Alternatively, any appropriate known interface between the housing **110** and sleeve device **162** that provides a fluidic seal can be used.

[0234] Once the housing **110** and sleeve device **162** are coupled, the balloon **114** can be inflated using either port **116**A or port **116**B or both. When the balloon **114** has been sufficiently inflated such that the expandable body **142** of the balloon **114** contacts itself, a fluidic seal is created between the patient's cavity and the ambient air outside the patient's body. Once this fluidic seal is established, the patient's cavity **108** can be insufflated using port **118** to the desired pressure inside the cavity **108** and the appropriate devices and/or instruments can be inserted into the cavity **108** through the expanded balloon **114** seal with loss of pressure inside the cavity **108**.

[0235] In one particular example as depicted in FIGS. **17**A and **17**B, a device/system having two robotic arms **180**, **182** are positioned in the patient's cavity **108** through the expanded balloon **114** seal. More specifically, the first robotic arm **180** is inserted into the expanded balloon **114** seal in FIG. **17**A. Due to the odd geometry formation of the expanded balloon **114**, the fluidic seal is maintained even as the first arm **180** is being inserted through the balloon **114**. Once the first arm **180** is successfully inserted into the cavity **108** and positioned as desired as shown in FIG. **17**B using a connection rod **184**, the second arm **182** is inserted into the balloon **114** seal. Again, the odd geometry formation of the balloon **114** allows this to occur without losing the fluidic seal and thus without losing the higher pressure of the insufflated cavity **108**.

[0236] Returning to FIG. **12**, this figure depicts a final position of the robotic system having two arms **180**, **182**. With the arms **180**, **182** positioned as desired, the system can now be operated by a user or surgeon to perform the desired procedure.

[0237] It is contemplated that alternative embodiments of the balloon seal devices could have more than one balloon seal provided in a single device. Those two or more balloon seals could be provided in various configurations. For example, in one configuration, in addition to the central seal similar to that described above, a second seal could be provided off to one side of the first seal and positioned at an angle so that any device or object inserted through the second seal would be inserted at an angle. It is understood that these two or more balloon seals could be pneumatically connected to the same air pressure source(s), or, alternatively, each seal could be pneumatically separate so that each has its own pressure source and can be set at its own independent level of air pressure.

[0238] Another access and insertion embodiment relates to a rubber seal insertion method and device for inserting a surgical device/system into a patient's cavity and performing a surgical procedure using a rubber seal access/insertion device that operates to maintain a fluidic seal at the incision such that the higher air pressure of the insufflated cavity is not lost during the procedure. One example of a rubber seal access/insertion device **200** is depicted in cross-sectional view in FIG. **18**. As depicted, the access/insertion device **200** is positioned on the patient's skin (schematically depicted as **202**) over the incision **206** in the skin **202** and is coupled to a standard sealable sleeve device **204**, which is disposed through the incision **206**.

[0239] As best shown in FIGS. **19**A and **19**B, the access/insertion device **200** has a base ring **210** that is coupleable to the sleeve device **204**. The device **200** also has three seals **212**A, **212**B, **212**C positioned between the base ring **210** and the first top ring **214**. In some embodiments, the device **200** has only the first set of seals (**212**A, **212**B, **212**C) and the first top ring **214**. In alternative embodiments such as the implementation as shown, the device **200** also has a second set of three seals **216**A, **216**B, **216**C positioned between the first top ring **214** and a second top ring **218**. In this implementation,

the first and second top rings **214**, **126** are coupled to the base ring **210**, thereby maintaining the first set of seals **212**A, **212**B, **212**C and second set of seals **216**A, **216**B, **216**C in place such that each of the sets of seals **212**, **216** and the two top rings **214**, **218** maintain a fluidic seal. According to one embodiment, a set of screws or bolts are positioned through the holes **210**A, **214**A, **218**A defined in the outer circumference of each of the base ring **210**, the first top ring **214**, and the second top ring **218**, respectively, and fastened to fix the rings **210**, **214**, **218** in place. Alternatively, any known device or mechanism for holding or fixing the rings **210**, **214**, **218** (and thus the seals **212**, **214**) in place can be used.

[0240] According to one embodiment, the fluidic seal created by the set of seals (**212**A, **212**B, **212**C, for example) is created by providing separate rubber seals having different types of openings defined in each such seal. For example, as best shown in FIG. **20**, in this implementation, the seals **212**A, **212**B, **212**C each have two different openings formed through them that are different from the corresponding openings in the other seals. Seal **212**A has two substantially circular holes **230**A, **230**B formed through the seal **212**A. The hole **230**A is larger, is positioned more centrally on the seal **212**A, and is intended to receive a surgical device or system such as a robotic surgical device. The hole **230**B is smaller, is positioned closer to an edge of the seal **212**A, and is intended to receive a peripheral device or component such as a trocar, a camera, or some other accessory tool. These holes **230**A, **230**B are intended to provide a fluidic seal around the perimeter of any object(s) passed through them.

[0241] In contrast, seal **212**B has two slits **232**A, **232**B formed through the seal **212**B. The slit **232**A is larger and is positioned in a location that corresponds to hole **230**A, while slit **232**B is smaller and is positioned in a location that corresponds to hole **230**B. Similarly, seal **212**C has a larger slit **234**A positioned in a location corresponding to hole **230**A and slit **232**A and further has a smaller slit **234**B positioned in a location corresponding to hole **230**B and slit **232**B. In addition, the slits **234**A, **234**B in seal **212**C are positioned at a 90 degree angle with respect to the slits **232**A, **232**B in seal **212**B. According to one implementation, the combination of the slits **232**A, **232**B in seal **212**B with the slits **234**A, **234**B in seal **212**C results in a stronger fluid seal that can withstand the increased pressure of the insufflated cavity **208** of the patient without the slits opening and allowing that increased pressure to be lost.

[0242] By incorporating two sets of seals **212**, **216** as shown in FIGS. **19**A, **19**B, the overall fluidic seal created by the device **200**, even when surgical devices are inserted through the device **200**, is further strengthened. More specifically, as best shown in FIG. **19**B, the first top ring **214** defines a hole **214**B at its center. When the first top ring **214** is positioned between the first set of seals **212** and the second set of seals **216**, the hole **214**B in the first top ring **214** creates a cavity between the two sets of seals **212**, **214**. As such, according to one embodiment, any loss of the fluidic seal in one set of the seals (either **212** or **214**) will not cause a loss of the overall fluidic seal or leak pressure directly from the patient's cavity **208** into the ambient air outside the patient. Hence, the cavity created by the first top ring **214** can minimize the overall pressure loss from any such leak.

[0243] In accordance with one implementation, each of the seals **212**A, **212**B, **212**C, **216**A, **216**B, **216**C is a relatively thin sheet of rubber. Alternatively, each of the seals can be made of any known flexible material that can serve as a seal in a medical device. In one exemplary embodiment, each of the seals is about 0.125 inches thick. Alternatively, the thickness of each of the seals can vary between about 0.0625 and about 0.25 inches thick. In a further alternative, each set of three seals **212**, **216** can be replaced with a single seal having a thickness ranging from about 0.1875 inches to about 0.75 inches. This thickness in a single seal, according to some embodiments, can provide substantially the same type of fluidic seal strength as the set of three thin seals.

[0244] As discussed above, according to certain embodiments, the device **200** has only one set of seals **212**A, **212**B, **212**C and only the first top ring **214**. While such embodiments do not have the cavity created by the first top ring **214** as described above, the device **200** with a single set of seals **212** can still provide a sufficient fluidic seal. For example, such a device **200** would provide a sufficient fluidic seal for insertion of any robotic device having sufficiently smooth external features and surfaces. In addition, a device **200** with a single set of seals **212** can reduce the size of the overall device **200** and can potentially reduce any trauma to the surgical device inserted through the device **200** as a result of only having to pass through a single set of seals **212**.

[0245] FIG. **21**, according to one implementation, depicts a top view of the device **200**. More specifically, FIG. **21** shows the second top ring **218** positioned over the seal **216**A. The holes **236**A, **236**B in the seal **216**A are visible as well.

[0246] In use, the rubber seal access/insertion device **200** can be positioned for use in the following manner. First, as described above with respect to other embodiments, according to one implementation, the sealable sleeve device **204** is first positioned in the incision **206**. It is understood that the sleeve device **204** can be inserted using steps similar to those described above. Alternatively, any known insertion steps can be used to insert the device **204** into the incision such that the upper ring **240** is positioned outside of the incision **206** and the lower ring **242** is positioned inside the patient's cavity, with the sleeve **244** disposed through the incision **206** itself, as best shown in FIG. **18**.

[0247] Once the sleeve device **204** is positioned in the incision **206**, the base ring **210** (and thus the entire device **200**) is coupled to the sleeve device **204** as best shown in FIGS. **18** and **22**. More specifically, according to one implementation, the base ring **210** is positioned over the upper ring **240** of the sleeve device **204** such that the upper ring **240** is positioned into the circular indentation or notch **250** defined in the bottom of the base ring **210**. The configuration of the notch **250** corresponds to the configuration of the upper ring **240** and thus is configured to receive the upper ring **240** such that the ring **240** fits snugly into the notch **250**.

[0248] Once the upper ring **240** is positioned in the notch **250**, the coupling components **220** are coupled to the attachment components **252** on the base ring **210** and thereby firmly couple the base ring **210** to the sleeve device **204**. The coupling components **220** in this embodiment are components having a vertical piece **220**A and a horizontal piece **220**B as best shown in FIG. **19**A or **22**. The vertical pieces **220**A are coupled to the attachment components **252** using a screw or bolt or similar mechanism. As best shown in FIG. **18**, when the vertical pieces **220**A are coupled to the attachment components **252**, the horizontal pieces **220**B are positioned under the base ring **210** such that they are also positioned under the upper ring **240** disposed in the notch **250**. As such, the coupling components **220** operate to retain or lock the upper ring **240** in the notch **250**. As a result, the retention of the upper

ring **240** into the notch **250** can provide a fluidic seal between the base ring **210** and sleeve device **204**. Alternatively, any appropriate known interface between the base ring **210** and sleeve device **204** that provides a fluidic seal can be used.

[0249] Once the device **200** and sleeve device **204** are coupled as best shown in FIGS. **18** and **23**, a fluidic seal has been established between the patient's cavity **208** and the external air outside of the patient. At this point, the patient's cavity can be insufflated to the desired amount of air pressure. Subsequently, one or more surgical devices can be inserted through the seals **212**, **216** at the appropriate holes/slits and into the patient's insufflated cavity **208**. In one embodiment, each arm of a robotic surgical device can be separately and consecutively inserted through the larger hole (and larger slits) of the seals and into the cavity **208**. Alternatively, any known devices can be inserted into the cavity **208** so long as they fit through the holes and slits as contemplated herein.

[0250] Another embodiment of an access/insertion device relates to another external pressurized system or apparatus similar to the system or apparatus depicted in FIGS. **1-11** and described in detail above. Like the device in FIGS. **1-11**, the instant device is coupled to a port that is positioned over and/or in an incision in the skin of the patient, thereby providing access to a cavity of the patient. However, in the instant implementations as shown in FIGS. **24A-38** and discussed below, the external pressurized system/apparatus has a external body having one or more access ports for the insertion of not only surgical devices, but also additional equipment and/or the hands of one or more users or medical professionals, providing access to the interior of the pressurized system/apparatus without loss of the higher pressure inside the system/apparatus.

[0251] For example, one implementation of such an external pressurized system or apparatus **300** is depicted in FIGS. **24A-24F**. As best shown in FIGS. **24C** (top view) and **24D** (perspective view), the device **300** has an external body **302** having a main tube (also referred to as the "canister") **304**, a left hand tube **306** with a left hand access port **308**, a right hand tube **310** with a right hand access port **312**, and a side access tube **314** with a side access port **316**. In addition, the main tube **304** has a device port **318** coupled to a top portion of the tube **304**.

[0252] The bottom portion of the main tube **304** is coupleable to an incision port **320**, as best shown in FIGS. **24A** and **24B**. In turn, as best shown in FIG. **24F**, the incision port **320** is coupleable to a standard sealable sleeve device **322**, which can be positioned in the incision **324** made in the patient's skin **326** to access a target cavity **328** of the patient. The incision port **320** and its coupling to both the main tube **304** and the sealable sleeve device **322** are described in detail below.

[0253] In the depicted implementation, the left and right hand access ports **308**, **312** can be configured to allow a user or medical professional to insert her or his hands through the ports **308**, **312** and into the interior of the body **302**. Further, the side access tube **314** with access port **316** can be used for storage of equipment and/or for assistance of another user by inserting her or his hand through the port **316**. In addition, the device access port **318** can be configured such that various medical devices/systems can be inserted into the body **302** through the port **318**. Alternatively, any of the access ports **308**, **312**, **316**, **318** can be configured to allow for insertion of hands and/or equipment/devices. Further, in various alternative embodiments, it is understood that the body **302** could have a main tube **304** with one, two, or more than three additional tubes with access ports for various uses, including any of those discussed above. It is also understood that various embodiments contemplated herein include tubes and/or ports that are different sizes or shapes than those depicted. For example, in some implementations, the tubes and/or ports could be square or oval in shape.

[0254] In one implementation, the external body **302** (the main tube **304** and the access tubes **306**, **310**, **314**) is made of a hard plastic, such as, for example, poly(methyl methacrylate) ("PMMA"). Alternatively, the body **302** can be made of any known rigid material that can be used in medical devices. It is understood that certain embodiments of the body **302** are transparent, such as those depicted in the figures provided. The transparent body **302** allows for the user to see the interior of the tubes **304**, **306**, **310**, **314** including any equipment or devices being inserted during the procedure. Alternatively, the body **302** is not transparent and the equipment/devices can be inserted without being able to view them in the device **300**.

[0255] According to one implementation, the sealable sleeve device **322**, as best shown in FIGS. **24F**, **29A**, **29B**, and **30**, can be a standard, commercially available device as described in the various embodiments above. The device **322** has an upper ring **420** and a lower ring **422** that are coupled together by a flexible sleeve **424**. According to one embodiment, the device **322** is substantially similar to the sealable sleeve device described above with respect to FIGS. **2A**, **2B**, **6A**, **6B**, **6C**, and **6D**.

[0256] According to one embodiment, the access ports **308**, **312**, **316**, **318** are standard commercially-available ports that allow various objects, including devices or hands, to be inserted through them and into a surgical space. One example of an access port **340** in use is depicted in FIG. **25**. As shown in that figure, the port **340** allows for insertion of a hand through the port **340**. Another exemplary access port **342** is depicted in FIG. **26**. This port **342** is the GelSeal® port that is commercially available from Applied Medical in Rancho Santa Margarita, Calif. In this embodiment, the port **342** has a body **344**, a rigid support ring **346**, and a moveable clamp lever **348** that can be used to tighten the port **342** and thus secure the port **342** to any ringed object to which it is attached. More specifically, the clamp lever **348** is depicted in three different positions. In position A, the lever **348** is in the open position A and the port **342** thus has its widest circumference. In position B, the lever **348** is midway between the open position A and the closed position C and the port **342** has a circumference that is less than when it is in the open position A. Finally, in position C, the lever **348** is positioned against the port **342** in the closed position C and the port **342** has its smallest circumference. In use, the lever **348** is typically in position A when the port **342** is positioned and then the lever **348** is moved to position C to clamp the port **342** in place. In one embodiment, the body **344** is made of the soft, gel-like material in the product as provided by Applied Medical. Alternatively, the body **344** can be made of any material that allows for objects and/or hands to be inserted through the material such that the fluidic seal is maintained so that the higher pressure of the surgical cavity is not lost when an object is inserted through the material.

[0257] In accordance with one implementation as shown in FIG. **27A**, the access ports **308**, **312**, **316**, **318** are coupled to the tubes **304**, **306**, **310**, **314** via a port adaptor ring **350**. The port adaptor ring **350** has a first ring portion **352** that is sized to mate with any one of the tubes **304**, **306**, **310**, **314** of the

body **302**. (In this particular depiction, the left hand access tube **306** is used as an example.) The ring **350** also has a second ring portion **354** that is sized to mate with a port—in this case the left hand access port **308**.

[0258] According to one embodiment, the first ring portion **352** is coupled to the tube **306** by positioning the first ring portion **352** over the end of the tube **306** and holding the first ring portion **352** in place using thumb screws **356** that are inserted through threaded holes **358**A in the first ring portion **352** and into threaded holes **358**B in the tube **306**. Alternatively, any attachment devices or mechanisms, such as bolts, clamps, or the like, can be used to attach the first ring portion **352** to the tube **306** (and, by extension, to any of the tubes **304**, **306**, **310**, **314**). In one embodiment, a gasket (not shown), such as a foam or rubber gasket, is positioned between the tube **306** and the first ring port **352** to ensure that a fluidic seal is established between the two components.

[0259] The access port **308**, in accordance with one implementation, is coupled to the second ring portion **354** in a fashion similar to that described above. That is, the clamp lever **308**A on the port **308** is placed in position A, and the port **308** is positioned over the second ring portion **354**. Then the lever **308**A is moved into the closed position—position C—such that the port **308** is clamped onto the second ring portion **354**. Alternatively, any known mechanism or method for coupling a port similar to port **308** to a device component can be used.

[0260] According to one embodiment as shown in FIG. **27**B, the device access port **318** can have one or more additional structures to allow a user to easily stabilize or position a surgical device within the body **302** of the device **300** prior to or during use. More specifically, the device access port **318** in certain implementations has one or more device attachment components **357** (also referred to as "device clips") positioned along the inner lumen of the port **318**. The device clip **357** is configured to retain a device such as a positioning rod **359** within the clip **357**, thereby providing a way to couple a portion of the surgical device being used for the intended procedure to the interior of the body **302**. In one embodiment, the attachment component **357** is an actual clip as shown in FIG. **27**B. Alternatively, the component **357** can be a notch or other type of specifically configured indentation **357** defined in the inner lumen of the port **318** that is configured to receive a medical device such as a positioning rod **359** or the like. In a further alternative, the attachment component **357** can be any mechanical or structural mechanism or component that allows for coupling to a medical device. In further embodiments, such attachment components **357** can be positioned elsewhere in the body **302**, such as, for example, on an interior port of another access port or elsewhere on an interior portion of one of the tubes.

[0261] In various alternative embodiments, other types of access ports can be used instead of the ports described above and depicted in FIGS. **24**-**27**B. For example, in one specific alternative implementation, one or more glove ports can be used such as the glove port **360** depicted in FIGS. **28**A and **28**B. The glove port **360** has a glove component **362** coupled to a glove port ring **364**. In various embodiments, the glove port **360** could be coupled at the glove port ring **362** to one or more of the tubes **304**, **306**, **310**, **314** on the body **302**. In one embodiment, the glove port ring **362** is coupled to the tube via a clamp lever similar to the clamp lever described with respect to FIG. **26**. Alternatively, any known coupling mechanism can be used. Unlike the access ports **308**, **312**, **316**, **318**, the glove port **360** does not require that a fluidic seal be established around the surgeon's arm or whatever object is inserted through it. As such, the glove port **360** can help to ensure that the pressure differential between the patient's cavity and the ambient air outside the patient will be maintained. In one embodiment, the glove port **360** has a pressure relief valve (not shown) that can be used to adjust the volume, thereby accounting for the volume change caused when a user inserts her or his hand into the body **302** using the glove component **362**. FIG. **28**B depicts the glove port **360** in use.

[0262] As mentioned above, the incision port **320** is configured to be coupleable to both the main tube **304** and to the sealable sleeve device **322**, as shown in FIGS. **24**F and **29**. As best shown in FIGS. **24**A and **30**, the incision port **320** has a base ring **370**. The upper portion of the base ring **370** can be coupled to an internal coupling component **372**, which can couple to the port seal **450** as described in further detail below. Further, the lower portion of the base ring **370** can be coupled to external coupling components **374** (also referred to in certain embodiments as "sleeve clamps"), which couple the ring **370** to the sealable sleeve device **322**. In addition, the base ring **370** can also be coupled to coupling components **376** (also referred to in certain embodiments as "tube brackets"), which couple the ring **370** to the main tube **304** of the device **300**.

[0263] FIGS. **31**A and **31**B depict the base ring **370**, according to one implementation. The ring **370** has a curved indentation or notch **378** configured to receive and couple with the bottom portion of the main tube **304**. In addition, the ring **370** has three bracket receiving components **380** configured to receive the tube brackets **376**. Further, as best shown in FIGS. **24**F, **30**, and **35**, the bottom portion of the ring **370** defines a circular indentation or lumen **381** that is configured to be positioned over and receive the upper ring **420** of the sleeve device **322**. The ring **370** also has multiple holes **384** defined in an interior ring **382**. The multiple holes **384** correlate to holes **436** in the base plate **430** of the internal coupling component **372**, as described in detail below. Each of the bracket receiving components **380** have a projection **386** and horizontal portion **388** on which the tube bracket **376** is positioned and a hole **390** that corresponds to the hole **394** in the tube bracket **376** as described in detail below. In one embodiment, a gasket (not shown), such as a silicon, foam or rubber gasket, is provided between the notch **378** and the bottom portion of the main tube **304** to strengthen the fluidic seal between the two components.

[0264] FIG. **32** depicts a tube bracket **376**, according to one embodiment. The tube bracket **376** has a base portion **392** having a hole **394** defined therein that corresponds to the hole **390** in the bracket receiving component **380** on the base ring **370**. The bracket **376** also has a tube contacting portion **396** having two holes **398** defined therein that correspond to the holes **404** in the bottom portion of the main tube **302**, as described below.

[0265] According to one embodiment, the tube bracket **376** is used to couple the main tube **302** to the base ring **370**, as shown in FIG. **33**. More specifically, the tube bracket **376** is positioned on the bracket receiving components **380**, with the base portion **392** of the bracket **376** positioned on the horizontal portion **388** and the tube contacting portion **396** positioned on the projection **386**. In that position, the bracket **376** is coupled to the base ring **370** by inserting a threaded screw **400** through hole **394** in the bracket **376** and into hole **390** in the ring **370**. Further, the bracket **376** is coupled to the main

tube **302** by inserting two threaded screws **402** through holes **398** in the bracket **376** and into holes **404** in the tube **302**. Thus, the tube **302** is attached in position against the incision port **320** and specifically the base ring **370** using the brackets **376**. In the embodiments depicted in FIGS. **24**A-**24**F, there are three tube brackets **376**—spaced about 120 degrees from each other around the circumference of the port **320**—that are used to couple the tube **302** to the port **320**. Alternatively, two brackets or more than three brackets could be used in different positions around the port **320**. In a further alternative, any known type of coupling mechanism could be used to keep the tube **302** coupled to the port **320**.

[0266] As discussed above, the incision port **320** is coupled to the sealable sleeve device **322** using the sleeve clamps **374**. FIG. **34** depicts one embodiment of a sleeve clamp **374**. The clamp **374** has a hole **406** defined in a top portion of the clamp **374**, projections **408** configured to fit into the notches **410** defined under the bracket receiving components **380** on the base ring **370** (as best shown in FIG. **31**B), and a projection **412** configured to help retain the upper ring **420** of the sealable sleeve device **322** in position on the clamp **374**, as discussed below. The hole **406** corresponds to the hole **394** in the bracket **376** and the hole **390** in the base ring **370** such that when the sleeve clamp **374** is positioned under the bracket receiving component **380** of the base ring **370** and the threaded screw is inserted through hole **394** and hole **390**, it is also threaded into hole **406** such that the sleeve clamp **374** is coupled to the base ring **370**.

[0267] As best shown in FIGS. **30** and **35**, when the port **320** is positioned over the sleeve device **322** such that the upper ring **420** is positioned within the lumen **381** on the bottom portion of the base ring **370**, the sleeve clamp **374** can be coupled to the base ring **370** as described and the upper ring **420** of the sealable sleeve device **322** is contacted by the clamp **374** and thereby retained in its desired position as shown. Further, the notch **412** in the clamp **374** can further help to retain the upper ring **420**. In one embodiment, a gasket (not shown), such as a foam, rubber, or silicone gasket, is placed between the upper ring **420** and the underside of the base ring **370**, thereby providing a stronger fluidic seal between the two components.

[0268] As discussed above, according to one embodiment, the upper portion of the base ring **370** can be coupled to an internal coupling component **372**, as best shown in FIGS. **24**A, **30**, and **36**. The internal coupling component **372** has a base plate **430** and a male component **432** projecting from the base plate **430**. The base plate **430** has multiple holes **436** defined in the plate **430**. These holes **436** correspond to the holes **384** defined in the interior ring **382** of the base ring **370** such that screws **438** (or bolts or any other known coupling mechanisms) can be used to couple the base plate **430** to the interior ring **382** of the base ring **370** as shown. In addition, the interior portion of the male component **432** has two device attachment components **440** (also referred to herein as "device clips") (only one such clip **440** is shown in FIG. **36**). Each device clip **440** is configured to be able to allow a user to couple a positioning rod (as described elsewhere herein) or some other device component to the clip **440** before or during a surgical procedure, thereby stabilizing or maintaining the position of the device.

[0269] As best shown in FIG. **36**, the male component **432** has three notches **434** formed or engineered on its outer circumference (one of which is fully depicted in FIG. **36**). The notches **434** have a vertical portion **434**A and a horizontal portion **434**B in communication with the vertical portion **434**A. Each notch **434** is configured to received a corresponding projection formed on an internal circumference of any device intended to couple with the male component **432**. As such, to couple the device to the male component **432**, the device is positioned over the male component **432** with the projections on the device positioned over the corresponding notches **434** on the male component **432**. The device is then positioned onto the male component **432** such that each projection moves along the vertical portion **434**A of the notch **434** until it reaches the horizontal portion **434**B. At that point, the device can be rotated and thereby move each projection circumferentially along the horizontal portion **434**B of the notch **434**, thereby coupling the device to the male component **432** of the internal coupling component **372**.

[0270] In one implementation, as best shown in FIGS. **37**A, **37**B, and **37**C, one of the components that can be coupled to the internal coupling component **372** is a port seal **450**. The port seal **450** has a seal clamp **452** coupled to a base seal ring **454**. A seal component **456** is positioned between the clamp **452** and the ring **454** so that the coupling of the clamp **452** to the ring **454** fixes the seal component **456** in place in the port seal **450**. In one embodiment as shown, the seal clamp **452** has multiple holes **458** defined in the clamp **452** that correspond to holes (not shown) in the base seal ring **454** such that threaded screws **460** (or bolts, or the like) can be inserted through the holes **458** and into the holes in the ring **454** to couple the two components together. Alternatively, any other known attachment mechanisms can be used. In one embodiment, a gasket (not shown), such as a foam, silicone, or rubber gasket, can be positioned between the male component **432** and the base seal ring **454** to strengthen the fluidic seal between the two components.

[0271] The seal clamp **452**, in one embodiment, has multiple projections **464** extending from the top surface of the clamp **424**. These projections **464** can be easily grasped by a user to place the port seal **450** on the male component **432** or remove it therefrom. Further, as best shown in FIG. **37**C, the underside of the base seal ring **454** has three projections **462** disposed on the inner circumference of the ring **454**. The three projections **462** correspond to the three notches **434** defined in the outer circumference of the male component **432** such that the base seal ring **454** can be coupled to the male component **432** as described above.

[0272] According to one implementation, the seal component **456** (also referred to herein as a "flexible seal component" or an "elastic seal component") is a circular sheet of flexible or elastic material that is configured to allow a device or other equipment to be inserted through the seal component **456** (or to allow the seal component **456** to be positioned over such equipment, like a positioning rod, as described in further detail below). In one embodiment, the seal component **456** is a circular rubber sheet having a small hole (not shown) in the sheet through which equipment can be inserted. Alternatively, the seal component **456** can be any known material configured to maintain a fluidic seal when a device or equipment is inserted through the seal component **456**.

[0273] In accordance with one embodiment, a different type of seal component can also be incorporated into the device **300**. As shown in FIGS. **38**A, **38**B, and **38**C, a flap seal component **470** is provided. The flap seal component **470** has two flaps—a first flap **472** and a second flap **474**—that contact each other at a midpoint in the component **470**. Each of the flaps **472**, **474** has ridges or teeth **472**A, **474**A on the surfaces

that are in contact such that the ridges **472**A on flap **472** correspond to the ridges **474**A on flap **474** and thus interface or couple with each other. In one implementation as shown, the flap seal component **470** is positioned between the base ring **370** and the internal coupling component **372**. According to one implementation, the configuration of the flaps **472**, **474** extended downward toward the patient's cavity and the coupled ridges **472**A, **474**A can provide structural strength to prevent a mechanical failure (also referred to as a "blowout") in which the flaps **472**, **474** are forced outward by the higher air pressure until the flaps **472**, **474** are extending outward away from the patient's cavity and the fluidic seal is lost.

[0274] In one embodiment as shown in FIG. **38**A, the flap seal component **470** can be incorporated into the incision port **320** and used when the port seal **450** is not coupled to the port **320**. Alternatively, as shown in FIG. **38**B, the flap seal component **470** can be incorporated into the incision port **320** and used when the port seal **450** is coupled to the port **320**.

[0275] In use, the various embodiments disclosed or contemplated herein relating to access and insertion systems, devices, and methods that relate specifically to an external device having one or more ports for the insertion of not only medical devices, but also related equipment and/or the hands of one or more medical professionals to access the interior of the device during medical procedures while being able to maintain a higher air pressure within the device that is substantially the same as the insufflated cavity of the patient. According to one implementation, the high pressure is around 18 mmHg above atmospheric pressure, which is around the amount of pressure that is used to insufflate a patient's abdominal cavity during a laparoscopic procedure. Alternatively, any known higher pressure amount that is used during medical procedures can be used.

[0276] The method of using the device **300**, according to one embodiment, includes at least some of the following steps. First, as described above with respect to other embodiments, according to one implementation, the sealable sleeve device **322** is first positioned in the incision **324** (see FIGS. **24**F, **29**A, **29**B, and **30**). It is understood that the sleeve device **322** can be inserted using steps similar to those described above. Alternatively, any known insertion steps can be used to insert the device **322** into the incision **324** such that the upper ring **420** is positioned outside of the incision **324** and the lower ring **422** is positioned inside the patient's cavity, with the sleeve **424** disposed through the incision **324** itself, as best shown in FIG. **30**.

[0277] Next, the incision port **320** and the device **300** are coupled to the sealable sleeve device **322**. As best shown in FIGS. **30**, **33**, and **35**, the base ring **370** of the incision port **320** is positioned over the upper ring **420** of the sleeve device **322** such that the upper ring **420** is positioned in the lumen **381** on the bottom portion of the base ring **370**. In addition, the bottom portion of the main tube **304** of the device body **302** can be positioned in the curved notch **378** on the base ring **370**. At this point, both the device **300** and the sleeve device are positioned as desired with respect to the incision port **320** and must be coupled to the port **320**. To do so, the tube brackets **376** and the sleeve clamps **374** are positioned on the base ring **370** as described above and fixed in place using the threaded screws **400**. Then the threaded screws **402** are placed as well. As such, the incision port **320** is coupled to both the device **300** and the sleeve device **322** and a fluidic seal is created between the interior of the body **302** and the exterior.

[0278] According to one embodiment, at least one medical device or piece of equipment that will be used during the procedure can be placed in the body **302** prior to coupling the body **302** to the incision port **320**. For example, in one embodiment, the device **480** disposed within the body **302** as best shown in FIGS. **24**A, **24**B, **24**D, and **24**F can be positioned within the body **302** and, in some implementations, secured to a device clip **357** (as shown in FIG. **27**B). More specifically, in the particular embodiment depicted in FIGS. **24**A, **24**B, **24**D, and **24**F, the device **480** is made up of two arms **482**A, **482**B that are positioned within the body **302**. Alternatively, any medical device that will be used for the surgical procedure could be positioned within the body **302** in the same or a similar fashion.

[0279] It is understood, in accordance with one implementation, that the port seal **450** is not coupled to the internal coupling component **372** (which is coupled to the incision port **320**) at this point during the placement of the device **300**. As such, according to one embodiment, the port seal **450** is stored in the side access tube **314** while the body **302** is being coupled to the port **320**, as best shown in FIGS. **24**B, **24**C, and **24**D. Alternatively, the port seal **450** can be uncoupled from the internal coupling component **372** and placed in the side access tube **314** prior to positioning the medical device inside the body **302** and coupling the body **302** to the incision port **320**.

[0280] Once the device **300** is coupled to the incision port **320** and the incision port **320** is coupled to the sealable sleeve device **322**, the fluidic seal within the device **300** has been established, and the patient's cavity can be insufflated. This insufflation will result in an increase in air pressure within the patient's cavity and within the device **300** (because neither the port seal **450** nor the flap seal **470** is nt coupled to the internal coupling component **372**).

[0281] Once insufflation is achieved, the device **480** is positioned through the incision port **320** and into the patient's cavity. More specifically, the user or medical professional inserts her or his hands into the left and right hand access ports **308**, **312** and moves the medical device through the incision port **320** and into position within the cavity. At this point, if the medical device has a positioning rod **359**, that rod **359** can be coupled to a device clip **440** on the interior of the male component **432** of the internal coupling component **372** of the port **320**, thereby establishing, maintaining, or fixing the position of the medical device within the patient's cavity. Alternatively, the device can be positioned and maintained in that position using any type of mechanism or method, including some type of device or method independent of the device **300**.

[0282] Once the medical device is positioned as desired, the port seal **450** can be positioned in place over the device (or the positioning rod **359**—or rods—of the device). That is, the user reaches in through the hand access ports **308**, **312** and removes the seal **450** from the side access tube **314** and placed over the device/rod **359** so that the device and/or rod **359** is inserted through the seal component **456** of the seal **450** and then coupled to the male component **432** of the internal coupling component **372** as described above.

[0283] Once the port seal **450** is in place, the body **302** can be removed from the incision port **320**. More specifically, the user can remove the threaded screws **402** and then remove the main tube **304** from the port **320**. The fluidic seal between the patient's cavity and the ambient air outside the patient's body is maintained by the port seal **450**.

[0284] The user/medical professional can then begin performing the medical procedure.

[0285] An alternative external pressurized device embodiment is depicted in FIGS. **39**A and **39**B. In this embodiment, the device **500** is a single tube **502** having a single access port **504** disposed at the top of the tube **502**. The access port **504** serves to establish a fluidic seal when a medical device or a surgeon's hand is inserted through the port **504**. The tube **502** also has two camera ports **506** extending from a bottom portion of the tube **502**. According to one implementation, the tube **502** is configured to couple to an incision port, including any incision port disclosed elsewhere herein or any known incision port.

[0286] A further embodiment depicted in FIG. **40** is another alternative external pressurized device **510**. The device **510** has a tube **514** that is coupleable to an incision port **516** and has two slots **511**, **513** formed on opposite sides of the tube **514**. These slots **511**, **513** provide fluid communication between the interior of the tube **514** and the exterior of the tube **514**. In one embodiment, the rod slots **512** are each configured to receive a positioning rod. The device **510** further has two slot seals **512**, with one seal **512** positioned in each of the slots **511**, **513**. These slot seals **512** are configured to maintain a fluidic seal at each of the slots **511**, **513** such that an object can be positioned through either or both slots **511**, **513** and the fluidic seal is not lost. The tube **514** also has two sets of device attachment components **518**A, **518**B (also referred to as "rod clips"). Each set of rod clips **518**A, **518**B has two device clips—a horizontal clip **515**A and an angled clip **515**B.

[0287] In use, a device can be positioned within the tube **514** such that a positioning rod coupled to the device extends out of the tube **514** through one of the slots **511**, **513**. The device can be fixed in position in the tube **514** by coupling the positioning rod to the horizontal clip **515**A. The patient's cavity can then be insufflated. When ready, the positioning rod can be moved down the slot (**511** or **513**) such that the device is being moved down the interior of the tube **514** and inserted through the port **516** and into the patient's cavity. At this point, the positioning rod is angled upward and clipped to the angled clip **515**B, thereby fixing the positioning of the device inside the patient's cavity.

[0288] Another implementation relates to a positioning tube **520** as depicted in FIGS. **41**A and **41**B. In this embodiment, the positioning tube **520** can also act as a large positioning rod. The tube **520** has two guide slots **522** defined in or attached to an inner portion of the tube **520**. The guide slots **522** are each configured to receive a positioning rod **524**. In this implementation, each device **526** (or device arm) is coupled to an end of one of the positioning rods **524** and can be inserted through the tube **520** and into the patient's cavity. Due to the size of the tube **520**, the devices **526** must be inserted one at a time. Alternatively, the tube **520** can be sized so that both devices **526** can be inserted at the same time. The tube **520** also has an air lock **528** disposed in the tube **520**. The air lock **528** is configured to be capable of fluidically dividing the tube **520** into two fluidically separate compartments when the air lock **528** is closed.

[0289] In use, the positioning tube **520** (having a robotic arm **526** disposed within the tube **520**) can be inserted through any of the various incision ports described elsewhere herein. When the tube **520** is positioned so that the distal end of the tube **520** is extending into the patient's cavity, a seal is created at the top of the top by placing a seal cap (not shown) on the top of the tube **520**. Once the inside of the tube **520** is sealed, the positioning rod **524** can be urged distally and thereby the arm **526** is urged out of the tube **520** and into the patient's cavity. If a second arm **526** is going to be inserted, the air lock **528** is then closed. That is, the air lock **528** is closed to create a fluidic seal between the top of the tube **520** and the bottom of the tube **520**. Once the air lock **528** is in place, the seal cap is removed, and the second arm **526** can be positioned in the tube **520**. At this point, the seal cap can be replaced, the air lock **528** can be released, and the second arm **526** can be inserted into the patient's cavity.

[0290] Several additional embodiments relate to various types of incision ports. For example, FIG. **42** depicts a stacked incision port **540**. The port **540** actually has two access ports **542**, **544** that are coupled together, with a cavity **546** between the two access ports **542**, **544**. In one embodiment, the access ports **542**, **544** are commercially available GelSeal® ports. The cavity **546** between the two access ports **542**, **544** strengthens the overall fluidic seal of the port **540**. In other words, the cavity **546** reduces the amount of air pressure loss because any air pressure loss is lost in the cavity and not lost to the ambient air, thereby reducing the overall loss.

[0291] Another incision port embodiment is depicted in FIG. **43**. This incision port **550** actually has two seals combined in the port: a rubber seal **552** and a flap seal **554**. The port **550** also has two camera ports **556** extending out from the port **550**. In one embodiment, the rubber seal **552** has three different rubber disks (not shown) similar to the different disks depicted in FIG. **20** and described above. The disks in this rubber seal **552** can have openings/incisions that differ for each disk in the same fashion as the disks shown in FIG. **20**. Alternatively, the rubber seal **552** can be similar to any rubber or flexible seal described elsewhere herein. The flap seal **554**, according to one embodiment, is similar to the flap seal depicted in FIGS. **38**A-**38**C.

[0292] FIG. **44** depicts another incision port embodiment. More specifically, this port is a two-seal port **560** having a first rubber seal **562** and a second rubber seal **564**. The port **560** also has a base ring **570**, a middle ring **568**, and a top ring **566**. The middle ring **568** creates a cavity (not shown) between the two seals **562**, **564** that is configured to compartmentalize any lose of pressure by either of the seals **562**, **564**. The presence of the cavity makes this embodiment fairly similar to the incision port depicted in FIG. **42**. According to one embodiment, each sheet of rubber **562**, **564** is about 0.5 inches thick and has a single slit (not shown) formed through the middle of it. Alternatively, each sheet **562**, **564** can have two openings (not shown) formed through the middle of it.

[0293] FIGS. **45**A and **45**B depict a further incision port embodiment. This port is a three-sheet rubber seal port **580** having a single ring **582** in which three sheets of rubber (only the top sheet **584** is shown). In one embodiment, each of the three sheets has an opening in it that corresponds to the openings in the other two sheets. In a further embodiment, the openings are similar to those depicted in FIG. **20** and described. Alternatively, each sheet can have two corresponding openings.

[0294] FIGS. **46**A and **46**B depict a further incision port system embodiment. This system is an air barrier port system **590** having an air barrier port **592**. This port **592** is coupled to four air tubes **596**A, **596**B, **596**C, **596**D that are coupled to an air intake port **594**. In operation, high pressure air is provided at the air intake port **594** and is forced through the four tubes **596**A-D and into the port **592**. The four tube connections

598A, 598B, 598C, 598D are positioned on the port 592 such that the air is forced into a channel (not shown) that encircles the hole 600 in the port 592. The air is then forced through a circular nozzle (not shown) in communication with the channel (not shown) that projects the air out of the nozzle and across the hole 600. The air flow projected across the hole 600, according to one implementation, is both directed and has a high velocity—both of which have an impact on the creation of an air barrier. As a result, an air barrier is created in the hole 600 defined in the port 592. That is, the high velocity air movement across or within the hole 600 creates a fluidic seal that is sufficient to maintain the insufflation of a patient's cavity.

[0295] FIG. 47 depicts another incision port embodiment—in this case, a one-sheet rubber seal port 610 having a single sheet of rubber 612 (other flexible seal material) positioned between a base ring 614 and a top ring 616. In one embodiment, the sheet has slit (not shown) formed in it through which a surgical device or other equipment can be inserted. Alternatively, the sheet can have two slits or other types of openings.

[0296] Another incision port embodiment is shown in FIGS. 48A and 48B. This port is a dual brush port 620. This port 620 has a body 622 with a first brush holder 624 and a second brush holder 626. The first brush 628 is positioned in the first brush holder 624 and the second brush 630 is positioned in the second brush holder 626. Further, the body 622 has an opening 632 formed in a bottom portion of the body 622 that can provide access to the patient's cavity. The brush bristles of the two brushes 628, 630 are mingled and meshed together at the brush seal 634 such that the mesh of bristles creates a fluidic seal that is sufficient to maintain a patient's insufflated cavity.

[0297] FIGS. 49A and 49B depict another brush port—in this case, a triple brush port 640. This port 640 has a body 642 with first, second, and third brush holders 644, 646, 648. The first brush 650 is positioned in the first brush holder 644, the second brush 652 is positioned in the second brush holder 646, and the third brush 654 is positioned in the third brush holder 648. Further, the body 642 has an opening (not shown) formed in a bottom portion of the body 642 that can provide access to the patient's cavity. The brush bristles of the three brushes 650, 652, 654 are mingled and meshed together at the brush seal 656 such that the mesh of bristles creates a fluidic seal that is sufficient to maintain a patient's insufflated cavity.

[0298] According to another implementation, FIGS. 50A, 50B, and 50C depict an insertion device 670 that can be used to insert both arms of a robotic surgical device into a patient's cavity. The insertion device 670 has an insertion tube 672 through which an insertion rod 674 is slidably disposed. In addition, the device has a first arm 676A and a second arm 676B, both of which are coupled to the distal end of the tube 672. The first arm 676A is coupled to an end bracket 680A coupled to an end of the first device body 682A, while the second arm 676B is coupled to an end bracket 680B coupled to an end of the second device body 682B. Further, the insertion rod 674 is coupled to two center brackets (only bracket 678A is visible in the figures)—one center bracket 678A coupled to a middle portion of the first body 682A and a second center bracket (not shown) coupled to a middle portion of the second body 682B.

[0299] In use, the insertion device 670 can be used to insert a two-armed surgical device through a hole (such as an incision, a port, or the like) and into a patient's cavity prior to operating the device within the cavity. To accomplish this insertion, the insertion device 670 initially maintains an insertion configuration (as best shown in FIG. 50A) such that the surgical device has its smallest circumferential profile, thereby allowing it to pass through smaller holes. Once the surgical device has been inserted into the patient's cavity, the insertion device 670 can be moved into its deployed configuration (as best shown in FIG. 50C) such that the surgical device is in its operational configuration. To accomplish this, a user or surgeon retracts the insertion rod 674 in a proximal direction (away from the surgical device. This retraction of the rod 674 urges the two center brackets (with only center bracket 678A of body 682A depicted) in the same proximal direction. Because the two end brackets 680A, 680B are retained in substantially the same position by the two arms 676A, 676B, the result is that the two device bodies 682A, 682B move through a transition depicted in FIG. 50B and into the operational configuration depicted in FIG. 50C. At this point, the user or surgeon can use the surgical device, including its two arms 684A, 684B to perform the planned surgery or procedure.

[0300] There are numerous device access and insertion devices and methods disclosed in the instant application. All of the various devices and methods that allow for access to a cavity and insertion of devices having two arms can also generally be used with respect to devices that can be uncoupled into separate arms so as to allow each arm to be inserted individually. In one embodiment, one advantage of inserting each arm separately is that inserting a first arm and then a second arm in a serial manner (and possibly more arms) can likely be accomplished through a smaller incision when compared to inserting both arms simultaneously.

[0301] FIGS. 51A and 51B depict an alternative embodiment of an insertion device 690 (in the same spirit as the insertion device depicted in FIGS. 50A-C). While the above embodiment in FIGS. 50A-C depict an insertion device for use with a two-armed device, this insertion device 690 is used with a single arm 704 or with two arms that are inserted separately. That is, in this embodiment, a single device arm 704 is coupled to the insertion device 690. As shown, this device is positioned through an insertion tube 692 (which can also be a positioning or support rod). The device has two moveable rods 694, 696 slidably disposed within the support rod 692. The first moveable rod 694 is coupled at its distal end to a first robotic arm 704 and at its proximal end to a control lever 698. The second moveable rod 696 is coupled at its distal end to a coupling link 700 (that is coupled to the arm 704) and at is proximal end to a coupling link 702 (that is coupled to the lever 698).

[0302] In use, the lever 698 can be actuated to cause the first and second rods 694, 696 to move in relation to each other. This movement of the rods 694, 696 can be used to move the arm 704 and thereby position the arm 704 as desired or needed inside the patient's cavity.

[0303] As shown in FIG. 51B, which is a cross-section of the support rod 692, showing that the support rod 692 can have two separate lumens 706, 708 or slots, one for each of the moveable rods 694, 696. In one embodiment, the first moveable rod 694 is positioned in the first lumen 706 and the second moveable rod 696 is positioned in the second lumen 708.

[0304] In a further embodiment, it is understood that this support rod 692 could have two halves—a right half 710 and a left half 712—that are coupleable at the mating feature 714.

Alternatively, the two halves can be coupleable by any known mechanical means. The right half **710** is configured to hold the first and second rods **694**, **696** relating to the first (or right) arm **704**, while the left half is configured to hold the first and second rods **716**, **718** relating to a second (or left) arm (not shown). This embodiment can thus be used with two arms, with each arm being inserted and positioned separately.

[0305] FIG. **52** depicts another embodiment in which two separate arms can be inserted and positioned separately by using an overtube **722**. In this device **720**, the first moveable rod **724** and second moveable rod **726** are still positioned within a support rod **728**. However, in this embodiment, the support rod **728** is positioned within an overtube **722**. The overtube **722** can be pass over the top of the support rod **728** in order to couple the support rod **728** to a second support rod (not shown) or another half of a support rod. This embodiment is another way to couple the two support rods or two halves of a support rod just as the mating feature **714** accomplishes that task in the prior embodiment.

[0306] Of course, as shown in FIG. **53**, in any embodiment in which the surgical device or robotic arm has a motor **740** provided that can be positioned in the positioning or support rod **744** and is coupled to the robotic arm **742**, there is no need for a separate insertion device. Instead, the arm **742** can easily be positioned by actuating the motor **740** and transfer the motive force through the beveled gears **746** and to the arm **742**.

[0307] FIGS. **54**A and **54**B depict a different type of access/insertion device in comparison to the devices described above. Unlike the above devices, which are generally incision ports or devices positioned outside the patient's cavity, the internal pressurized bag device **750** shown in these two figures is initially positioned in the patient's cavity. The device **750** has a port seal **752**, an outer sleeve **754**, and an inner sleeve **756**. The outer sleeve **754** is releasably sealed at the distal end **758**. That is, the outer sleeve **754** has a releasable seal that can be intentionally broken or released at a desired time during the procedure, as described below.

[0308] In use, the entire device **750** can be positioned through an incision port such that the inner and outer sleeves **754**, **756** are positioned inside the patient's cavity with the port seal **752** coupled to the incision port (thereby creating a fluidic seal). Once the device **750** is positioned, the patient's cavity can be insufflated, and the outer sleeve **754** can be pressurized to a pressure that is greater than the pressure of the insufflated cavity, thereby expanding the outer sleeve **754** to its maximum expansion (and, in some cases, making the outer sleeve **754** substantially rigid). At this point, the surgical device can be inserted through the incision port and into the outer sleeve **754** and positioned as desired. At this point, the outer sleeve **754** can be removed by releasing the releasable seal at the distal end of the sleeve **754**. That is, the releasable seal could be a chemical seal such as an adhesive that can be deactivated by applying a different composition to it. Alternatively, the releasable seal could be a mechanical release such as a pull cord or something of the like. In a further alternative, the releasable seal could be any known mechanism or method for being able to release the seal. Once the seal is released, the outer sleeve **754** can be pulled out of the cavity over the inner sleeve **756** and other components as best shown in FIG. **54**B.

[0309] FIG. **55** depicts another implementation of an external pressurized system or apparatus **800**. The apparatus **800** has a container **802** with a top cap **804** coupled to a top portion of the container **802**. In this embodiment, the container **802** has a port **806** that is coupled to the container **802** at a base portion of the container **802**. The port **806** is configured to be positionable in an incision in the skin of the patient, thereby providing access to a cavity of the patient. As shown in FIG. **55**, the apparatus **800** is configured to receive a surgical device **808** such that the device **808** can be inserted into the patient cavity through the port **806** of the apparatus **800**.

[0310] According to one embodiment, in contrast to the canister **12** described above and depicted in FIGS. **1**A-**10**, the container **802** in this device **800** is made of a flexible material such as, for example, polyethylene plastic, latex, nylon, or silicone rubber. As such, the container **802** can be manipulated and configurable with respect to the shape of the container **802**, and more specifically can be compressed longitudinally such that the height of the container **802** can be reduced during insertion of a robotic device into a patient's cavity. This will be described in further detail herein.

[0311] The top cap **804** is depicted in further detail in FIGS. **56**A-**61**B. As shown in FIGS. **56**A and **56**B, the top cap **804** has a cap body **810**, a detachable cable harness **812**, an access lumen **814**, support rod lumens **816**, threaded lumens **818**, and a clamp projection **820**. The cap **804** has a notch **822** defined in the cap **804** that is configured to receive the harness **812**. In addition, the notch **822** has five channels **824**A defined or formed in the notch **822**. The channels **824**A match with the channels **824**B defined in the detachable harness **812** such that when the harness **812** is positioned in the notch **822** and thus coupled with the cap body **810**, the channels **824**A and the channels **824**B match up to form lumens **824** as best shown in FIG. **56**B. In one implementation, the lumens **824** can be formed in different sizes and configured to receive various cables and/or suction/irrigation tubes the extend from an external controller through the top cap **804** to the surgical device **808**.

[0312] In addition, the cap body **810** has a groove **826** formed or defined around the outer edge of the body **810**, including the outer edge of the harness **812**, such that when the harness **812** is coupled to the body **810**, an O-ring can be positioned around the outer edge of the body **810** in the groove **826**.

[0313] FIGS. **57**A and **57**B depict the top cap **804** being coupled to the canister **802**. The flexible canister **802** is positioned over the peripheral edge of the body **810** as best shown in FIG. **57**B and an elastic ring (also referred to as an "O-ring") **828** is positioned around the canister **802** at the groove **826** such that a portion of the canister **802** is positioned between the body **810** and the ring **828** in the groove **826** and the ring **828** urges the canister **802** into the groove **826**, thereby creating a fluidic seal between the canister **802** and the top cap **804**. Additionally, in one alternative embodiment, silicone sealant can be applied to the groove **826** to enhance the strength of the fluidic seal. In accordance with one implementation, the O-ring **828** can also help to secure the cap body **810** and the harness **812** together. In a further alternative, the O-ring **828** can be any elastic member that can be used to maintain a fluidically sealed coupling of the canister **802** and the top cap **804**. In yet another alternative, any coupling mechanism can be used.

[0314] FIGS. **58**A and **58**B depict a portion of the device assembly **808** being positioned through the top cap **804**. More specifically, the support rods **830** coupled to the device **808** are slidably positioned through the lumens **816** in the cap body **810**. Further, according to one implementation, a por-

tion of the device **808** also couples to or mates with the top cap **804**. More specifically, a stabilization protrusion **832** on the device **808** is coupleable with a mating hole **834** defined or formed in an underside of the body **810** as best shown in FIG. **58**B. The positioning of the stabilization protrusion **832** in the mating hole **834** creates a pathway from lumen **814** into and through the stabilization protrusion **832**, thereby allowing for passage of additional tools or cameras through the device **800** without losing pressure.

[0315] As shown in FIGS. **59**A, **59**B, and **60**, the top cap **804** is coupled to the support rods **830** with two threaded set screws **840**. The set screws **840** are threaded through lumens **818** as best shown in FIG. **59**B. More specifically, the set screws **840** can be screwed into the threaded lumens **818** until the screws **840** contact the support rods **830**. The set screws **840** are configured to exert pressure on the support rods **830**, thereby creating frictional resistance that helps to secure the support rods **830** and thus the device **808** to the top cap **804**.

[0316] As best shown in FIG. **60**, a connection cable **842** that is coupled at its distal end to the robotic device **808** is positioned through one of the lumens **824**. It is understood that other cables can be positioned through the additional lumens **824** as well. In accordance with one embodiment, the cables are positioned in the channels **824**A or **824**B prior to coupling the harness **812** to the body **810**. Alternatively, one or more of the cables can be inserted through one of the lumens **824** after the body **810** and harness **812** are coupled together.

[0317] FIGS. **61**A and **61**B show the container **802** coupled to the top cap **804**.

[0318] FIGS. **62**A and **62**B depict the base coupling component (also referred to as the "base coupler") **850** that is coupled to a bottom portion of the container **802**. The base coupler **850** has an upper groove **852**, a lower groove **854**, and three coupling protrusions (also referred to as "coupling notches") **856** that extend from a portion of the coupler **850** between the upper and lower grooves **852**, **854**.

[0319] Like with the top cap **804** described above, the container **802** is coupled to the base coupler **850** using an O-ring **858**. More specifically, the container **802** is positioned over the upper portion of the coupler **850** such that the container **802** is positioned over the upper groove **852** and adjacent to or against the three protrusions **856**. The O-ring **858** is positioned over the container **802** at the upper groove **852** such that the O-ring **858** urges a portion of the container **802** into the groove **852**, thereby creating a fluidic seal between the container **802** and the base coupler **850**.

[0320] FIGS. **63**A, **63**B, **63**C, **63**D, and **63**E depict the coupling of the base coupler **850** to the access port **806**. The access port **806** has a top portion (or "top ring") **860**, a bottom portion (or "bottom ring") **862**, and a middle portion (or "neck") **864**. The top ring **860** has three coupling protrusions (also referred to as "coupling tabs") **866** that extend from a portion of the top ring **860** and are configured to mate with the coupling notches **856**.

[0321] In one embodiment, the access port **806** is a known standard device used in hand-assisted laparoscopic surgery. As is understood in the art, the access port **806** provides a structured open pathway through the cavity wall, such as the abdominal wall. at the incision site. In one particular example, the access port **806** is a commercially available retractor port **806** called the DEXTRUS® Retractor, which is available from Ethicon Endo-Surgery.

[0322] As best shown in FIGS. **63**A and **63**B, the base coupler **850** is coupled to the access port **806** using an O-ring **868**. More specifically, the O-ring **868** is positioned in the lower groove **854** of the coupler **850** and the top ring **860** is positioned over the lower portion of the coupler **850** and the O-ring **868** in the groove **854** such that the O-ring **868** is compressed between the coupler **850** and the top ring **860**, thereby creating a fluidic seal between those two components.

[0323] As best shown in FIGS. **63**C and **63**D, as the top ring **860** is positioned over the lower portion of the coupler **850** and the O-ring **868** as described above, the coupling tabs **866** of the access port **806** are coupled with the coupling notches **856** of the base coupler **850**, thereby enhancing the stability of the coupling of the coupler **850** and the access port **806**.

[0324] FIG. **63**E depicts the entire coupling of the container **802** to the access port **806** via the coupler **850** as described above. Further, FIGS. **64**A and **64**B depict the external pressurized insertion device **800** in use, with the device **800** coupled to an access port **806** that is positioned in an incision in a patient's skin **870**.

[0325] In use, according to one embodiment, the access port **806** and the external pressurized device **800** are positioned for a surgical procedure in the following manner. As an initial matter, according to one embodiment, the robotic device **808** is positioned inside the insertion device **800** prior to placing the port **806** and the device **800** in the appropriate surgical position. That is, the robotic device **808** is positioned inside the container **802**, the support rods **830** coupled to the device **808** are secured to the top cap **804** with the set screws **840**, any connection cables coupled to the device **808** are positioned through the lumens **824** in the top cap **804**, and the flexible container **802** is coupled and fluidically sealed to the top cap **804** and the base coupler **850** via the O-rings **828**, **858**. Alternatively, the robotic device **808** is positioned inside the insertion device **800** after positioning the port **806** and device **800**. Regardless, as far as positioning the port **806** and device **800**, the port **806** is positioned first in certain implementations. That is, in one embodiment, the bottom ring **862** is first inserted through the incision previously made in the patient's cavity wall. Once the ring **862** is positioned through the incision and inside the cavity, the ring **862** can help constrain the entire port **806** within the incision by expanding to a diameter that is greater than the diameter of the incision, as best shown in FIG. **64**A. In one embodiment, the container **802** and the coupler **850** are coupled to the access port **806** prior to positioning the port **806** in the incision. Alternatively, the port **806** is first positioned in the incision, and then the coupler **850** and the container are coupled to the port **806**. Regardless, once the access port **806** and insertion device **800** are positioned, the patient's cavity can then be insufflated. Due to the fluidic communication between the cavity and the interior of the container **802** that is created by the access port **806**, the entire interior of the insertion device **800** will be under the same pressure as the cavity.

[0326] In accordance with one implementation, once the access port **806** and insertion device **800** are positioned correctly, the process of inserting the robotic device **808** into the patient's insufflated cavity can take place in the following manner as best shown in FIGS. **65**A-**69**B. Initially, the robotic device **808** begins with both arms parallel and vertical to the incision, as best shown in FIGS. **65**A and **65**B. Then, the robot **808** is lowered through the opening created by the access port **806** as shown in FIGS. **66**A and **66**B. In accordance with one embodiment, as best shown by comparing FIGS. **65**A and

65B with FIGS. 66A and 66B, as the robot 808 is lowered, the flexible container 802 shrinks in height by allowing portions of the flexible material of the container 802 to "crumple" or begin forming folds such that the top cap 804 moves closer to the access port 806.

[0327] As best shown in FIGS. 67A and 67B, according to one embodiment, once the "elbow joints" of the arms of the robotic device 808 have cleared the cavity wall and access port 806, the forearms are rotated at the elbow joints until the forearms are positioned at an angle of or near 45° in relation to the upper arms (as best shown in FIG. 67A). Concurrently, the "upper arms" are rotated at the "shoulder joints" until the upper arms are positioned at an angle of or near 20°, as best shown in FIG. 67B. This rotation of the forearms and upper arms can help to ensure that the device 808 will fit within the patient's target cavity so that any contact of the robotic device 808 with any internal tissues or organs is minimized or eliminated. Alternatively, the forearms and upper arms can be rotated to any angle that minimizes the risk of contact with tissues or organs.

[0328] As best shown in FIGS. 68A and 68B, according to one embodiment, the device 808 can be inserted further into the patient's cavity by further positioning the arms of the device 808 while the container 802 continues to crumple, thereby resulting in further shrinkage of the insertion device 800. More specifically, the upper arms can be rotated further until they are positioned at an angle of or near 45°, as best shown in FIG. 68B. This process of moving the device 808 further into the cavity while positioning the arms to avoid contact with organs or tissues and causing the container 802 to crumple is continued until the shoulder joints of the device 808 have cleared the cavity wall and access port 806.

[0329] At this point, as best shown in FIGS. 69A and 69B, the forearms can be rotated back to center and the upper arms can be further rotated up, leaving the arms in an appropriate starting position for a surgical procedure. Once in the desired starting position, the device 808 can be locked or otherwise stabilized in place using a known external clamping mechanism such as, for example, an Iron Intern®, which is commercially available from Automated Medical Products Corp.

[0330] FIG. 70 depicts another implementation of an external pressurized system or apparatus 900. The apparatus 900 has a container 902 with a top cap 904 coupled to a top portion of the container 902. In this embodiment, the container 902 has a port 906 that is coupled to the container 902 at a base portion of the container 902. The port 906 is configured to be positionable in an incision in the skin of the patient, thereby providing access to a cavity of the patient. As shown in FIG. 70, the apparatus 900 is configured to receive a surgical device 908 such that the device 908 can be inserted into the patient cavity through the port 906 of the apparatus 900.

[0331] According to one embodiment, like the container 802 described above and depicted in FIGS. 55-69B, the container 902 in this device 900 is made of a flexible material such as, for example, polyethylene plastic, latex, nylon, or silicone rubber.

[0332] In this embodiment, the top cap 904, the container 902, and the robotic device 908 are substantially similar to the top cap 804 and container 802 depicted and described above. All the various features and components described above apply to these top cap 904, container 902, and device 908 embodiments as well.

[0333] FIGS. 71A and 71B depict the base coupling component (also referred to as the "base coupler") 920 that is coupled to a bottom portion of the container 902. The base coupler 920 has a groove 922 and three coupling protrusions 924 that extend from the coupler 920. In accordance with one implementation, each of the coupling protrusions 924 has a lumen 926 configured to receive a thumb screw 928. The container 902 is coupled to the base coupler 920 using an O-ring 930. More specifically, the container 902 is positioned over the upper portion of the coupler 920 such that the container 902 is positioned over the groove 922 and adjacent to or against the three protrusions 924. The O-ring 930 is positioned over the container 902 at the groove 922 such that the O-ring 930 urges a portion of the container 902 into the groove 922, thereby creating a fluidic seal between the container 902 and the base coupler 920.

[0334] In this embodiment, the insertion device 900 has a port attachment 940 that is coupleable to the base coupler 920 and the access port 906 such that the port attachment 940 is positioned between the coupler 920 and the port 906. The port attachment 940 has a removable lid 944 that maintains a fluidic seal when the lid 944 is in place on the port attachment 940, thereby making it possible to maintain insufflation of the patient's cavity even when the insertion device 900 is not yet coupled to the access port 906.

[0335] FIGS. 72A and 72B depict the coupling of the port attachment 940 to the access port 906. The port attachment 940 has three coupling notches 942 similar to the coupling notches 856 described and depicted above. In addition, the port attachment 940 has a removable lid 944 (also referred to as a "removable seal component," "removable lid seal component," or "removable seal component") that provides a fluidic seal when it is positioned in its closed position in relation to the port attachment 940. In the embodiment depicted in FIGS. 72A and 72B, the removable lid 944 is a slidable lid 944.

[0336] Like the access port 806 described and depicted above, this access port 906 (as best shown in FIG. 72A) has a top ring 946 that has three coupling protrusions (also referred to as "coupling tabs") 948 that extend from a portion of the top ring 946 and are configured to mate with the coupling notches 942 in the port attachment 940.

[0337] As best shown in FIG. 72A, the port attachment 940 has an O-ring 950 that can be positioned between the port attachment 940 and the access port 906 such that the O-ring 950 creates a fluidic seal when the two components are coupled together.

[0338] In use, the port attachment 940 can be coupled to the access port 906 by positioning the bottom portion of the port attachment 940 in the top portion of the top ring 946 with the O-ring 950 positioned between the two components, with the coupling notches 942 on the port attachment 940 mating with the coupling protrusions 948 on the top ring 946.

[0339] The port attachment 940 also has another O-ring 952 that is configured to be positioned in the groove 954 formed in the top of the port attachment 940. In one embodiment, the O-ring 952 can be placed in the groove 954 to help create an airtight seal when the port attachment 940 is coupled to the base coupler 920.

[0340] Further, the port attachment 940 also has three threaded lumens 956 in the top of the attachment 940. In one embodiment, these lumens 956 are configured to receive the thumb screws 928 that are positioned through the lumens 926 in the base coupler 920, thereby allowing for coupling the base coupler 920 to the port attachment 940 via the screws 928. Of course, it is understood that other coupling mecha-

nisms besides thumb screws can be used. In various alternative embodiments, any known attachment or coupling mechanism or component can be used. Some non-limiting examples include magnets, quick clamps, quarter turn features, snap-in features, and the like.

[0341] As best shown in FIGS. **73**A and **73**B, the slidable lid **944** can be moved between a closed position (as shown in FIG. **73**B) and an open position (as shown in FIG. **73**A). In this embodiment, the slidable lid **944** is positioned in the port attachment **940** via a lid slot **958** in the port attachment **940**. In the open position, tools or robotic devices can be passed through the port attachment **940** and the access port **906**. In the closed position, a fluid seal is established between the lid **944** and the port attachment **940**, which makes it possible to insufflate the patient's cavity prior to attaching the insertion assembly **900**. It is understood that while this embodiment of the removable lid **944** is a slidable lid **944**, any other known method or device for establishing a fluidic seal could be used. Non-limiting examples include a mechanical iris, leaf shutter, or any other known method of providing a removable fluidic seal.

[0342] FIGS. **74**A and **74**B depict cross-sectional views of the entire lower subassembly as described above, including the base coupler **920**, the port attachment **940**, and the access port **906**. More specifically, FIG. **74**A shows the port attachment **940** coupled to the access port **906**, with the slidable lid **944** fully inserted into the port attachment **940** in the closed position, thereby creating a fluidic seal. FIG. **74**B shows all three components coupled together, including the base coupler **920**, the port attachment **940**, and the access port **906**.

[0343] FIGS. **75**A, **75**B, and **75**C depict the external pressurized insertion device **900** in use, according to one embodiment. Once the access port **906** is positioned in the incision as discussed above, the port attachment **940** can be coupled to the port **906**, as best shown in FIG. **75**A. With the slidable lid **944** in the closed position, a fluidic seal is established between the port attachment **940** and the port **906** such that the patient's cavity can be insufflated to the desired Insufflation pressure. The insertion device **900** can then be coupled to the port attachment **940** as best shown in FIG. **75**B. Once the base coupler **920** is coupled to the port attachment **940** such that a fluidic seal is established between the two components, the slidable lid **944** can then be moved to its open position (or fully remove) as best shown in FIG. **75**C, thereby providing fluidic communication between the patient's cavity and the interior of the insertion device **900**, resulting in equalized pressure in the device **900** and the cavity. The robotic device **908** can be inserted via any of the same steps as described previously. If the device **908** completes the desired surgical procedure and a different robotic device or other type of tool needs to be used, the robotic device **908** can be removed from the cavity, the slidable lid **944** can be replaced in the closed position, and the base coupler **920** can be removed from port attachment **940**. This allows pressure to be maintained within the cavity, even during tool changes.

[0344] FIG. **76** depicts an alternative embodiment having a top cap **960** that has a pressure relief valve **962**. During the process of lowering either of the robotic devices **808**, **908** out of the insertion device embodiments **800**, **900** and into the cavity as described above with respect to insertion devices **800** and **900**, there is a pressure increase in the patient's cavity due to the decreasing change in volume of the container **802**, **902**. The pressure relief valve **962** can be configured to release pressure if the internal insufflation pressure increases above a typical value, thereby aiding the process of inserting the robotic device **808**, **908** such that the attendant will not need to wait for the pressure to equalize between the cavity and the insertion device **800**, **900**.

[0345] Another implementation of a top cap **1000** having a pressure relief valve **1002** is depicted in FIGS. **77**A and **77**B. This cap **1000** also has a dual port seal component **1004** that can be configured to receive one or more surgical instruments or devices such as a standard laparoscopic tool. Alternatively, it is contemplated that a top cap can have only one of the pressure relief valve **1002** or the dual seal component **1004**.

[0346] As best shown in FIG. **77**B, according to one implementation, the pressure relief valve **1002** has an adjustment component (also referred to as an adjustment "door," "wall," or "button," or "block") **1006** that is operably coupled to (or positioned against) one end of a tension spring **1008** and has two holes **1010**A, **1010**B that are configured to receive retention mechanisms such as bolts, screws, or other such standard devices or components configured to hold the adjustment component **1006** in place. The other end of the spring **1008** is coupled to a valve ball **1012** that is positioned against a rim **1016** of an opening **1014** on the underside of the top cap **1000**. The spring **1008** is configured to urge the ball **1012** toward the opening **1014** such that the ball **1012** (which has a larger outer diameter than the inner diameter of the rim **1016**) contacts the rim **1016** of the opening **1014** and thereby establishes a fluidic seal between the ball **1012** and the rim **1016**. In this embodiment, the adjustment block **1006** is adjusted using the retention mechanisms to move the block **1006** toward or away from the ball **1012**, thereby increasing or decreasing, respectively, the force applied by the spring **1008** against the ball **1012** (and thereby increasing or decreasing, respectively, the strength of the seal between the ball **1012** and the rim **1016** of the opening **1014**). Thus, the adjustment block **1006** can be used to adjust the strength of the seal based on the target maximum pressure threshold such that when the target maximum pressure threshold is reached (such as while lowering either of the robotic devices **808**, **908** out of the insertion device embodiments **800**, **900** as described above), the ball **1012** is urged away from the rim **1016** and the seal between the rim **1016** and the ball **1012** is broken such that the pressure is reduced by the gas escaping through the valve **1002**.

[0347] In an alternative embodiment, any known pressure relief valve for use in medical devices can be incorporated into the top cap **1000**.

[0348] Continuing with FIG. **77**B, the dual port seal component **1004** in this embodiment has two seal components: an elastic circular seal **1018** defining an opening **1020** and a flap seal **1022** in fluid communication with the circular seal **1018**. The elastic circular seal **1018** is configured to form a strong seal around the smooth surfaces of a standard laparoscopic tool positioned through the opening **1020**. In one implementation, the flap seal **1022** is a secondary seal that provides a fluid seal when no tool is positioned through the dual port seal component **1004**. That is, when no tool is positioned therethrough, the two flaps **1024**A, **1024**B are urged into contact with each other by the pressure in the patient's insufflated cavity such that the two flaps **1024**A, **1024**B form a fluidic seal.

[0349] In an alternative embodiment, any known port seal component for use in establishing a fluidic seal with a laparoscopic tool positioned therethrough can be used.

[0350] According to various additional implementations, the insertion devices disclosed or contemplated herein can

have one or more sensors or other types of measurement mechanisms for measuring the insertion depth of the surgical device being inserted into the patient's cavity.

[0351] As an example, FIGS. **78**A, **78**B, and **78**C depict an automatic insertion device **1030** having a flexible container **1038** and an actuator and sensor package **1032**. The actuator can be any known actuation device, including, for example, motor and gears, motor and timing belts, linear screw, pneumatics, hydraulics, or the like. The sensor could be any known sensing device, including, for example, a potentiometer, an encoder, optical sensors, or the like. When actuated, the actuator and sensor package **1032** lowers the surgical device **1034** through the incision. That is, as shown in FIG. **78**B, the top portion of the device **1030** is urged toward the bottom portion of the device **1030** such that the overall height of the device **1030** is reduced and the surgical device **1034** is moved distally out of the bottom portion of the insertion device **1030**. As the insertion occurs, the sensor in the package **1032** is configured to read the distance the surgical device **1034** has been inserted into the patient's cavity. Based on this distance, in one embodiment, the control program of the surgical device **1034** can actuate the motors of the surgical device **1034** to move the arms into desirable positions so as to avoid making contact with any organs or a cavity wall. The process can then be reversed to remove the surgical device **1034** from the incision. In another implementation, an additional actuator **1036** could be used to grossly position the surgical device **1034** during the insertion process or during the surgery in order to access multiple quadrants of the patient's cavity. This actuator **1034** rotates the upper portion of the insertion device **1030** relative to the access port. This rotation is possible because of the flexible nature of the container **1038**.

[0352] FIG. **79** depicts another embodiment of an insertion device **1050** having one or more measurement mechanisms **1054** for measuring the insertion depth of the surgical device that is being inserted into the patient's cavity using the insertion device **1050**. In this embodiment, the insertion depth of the surgical device is determined by measuring the relative distance between the top cap **1052** and the port **1056**. Further, in this embodiment, the measurement mechanism **1054** is a sensor **1054** that is coupled to, integrated into, or otherwise associated with the top cap **1052**. Alternatively, the top cap **1052** can have two or more sensors **1054**. According to one embodiment, the sensor **1054** uses ultrasonic or infrared energy and transmits the energy toward the port **1056**. The energy is reflected by the port **1056** back to the sensor **1054**. In this embodiment, the sensor **1054** is a range finder that can utilize the energy reflected back from the port **1056** to determine the distance between the top cap **1052** and the port **1056**. The distance between the top cap **1502** and the port **1056** can then be used to calculate the insertion depth of the surgical device.

[0353] In an alternative embodiment using a continuous sensor system, the insertion device **1050** has not only the sensor **1054** associated with the top cap **1052**, but also a sensor (not shown) associated with the port **1056**. In this implementation, the sensor **1054** emits energy that is received by the sensor associated with the port **1056**, which triggers the sensor associated with the port **1056** to transmit energy back to the sensor **1054** associated with the top cap **1052**. The sensor **1054** or a separate controller can then calculate the distance between the top cap **1052** and the port **1056**, which can then be used to calculate the insertion depth of the surgical device.

[0354] In a further alternative, the measurement mechanism **1054** in the top cap **1052** is a camera **1054**. The camera **1054** can utilize known image processing techniques on known features of the surgical device to determine the insertion depth of the device.

[0355] FIG. **80** depicts another embodiment relating to a port **1060** of an insertion device having one or more measurement mechanisms **1062** for measuring the insertion depth of a surgical device. In this implementation, as the surgical device (not shown) is urged through the port **1060** and into the patient's cavity, characteristics of the surgical device can be detected using the measurement mechanism(s) **1060** associated with the port **1060**. And those characteristics can be used to estimate or determine the insertion depth of the surgical device. In one embodiment, the measurement mechanism **1062** is a camera **1062** that can use image processing to capture and recognize the portion of the surgical device that is passing through the opening **1064** in the port **1060**. Alternatively, the surgical device can be marked with some type of markers that are easily recognized by the image processing technology. Upon recognition of the device portion or the marker, the camera **1062** or a separate processor or controller can calculate the insertion depth of the surgical device based on that information.

[0356] In a further implementation, the measurement mechanism **1062** is an RFID sensor **1062** that can sense one or more RFID markers (not shown) that are coupled to or implanted in the surgical device (not shown) passing through the port **1060**. Alternatively, the RFID markers in this embodiment could also contain extra information that could be used in a two-way communication system. That is, one or more of the markers associated with the surgical device could be configured to transmit information through the same RF link to the sensor and/or a controller.

[0357] FIG. **81** depicts another embodiment of an insertion device having a measurement mechanism that measures the relative distance between the top cap and the port to determine the insertion depth of the surgical device. This embodiment relates to a top cap **1070** that has a string measurement system **1072**, which, in some embodiments, is a string potentiometer system **1072**. The string measurement system **1072** is a system in which a string is extended from the top cap **1070** to the port (not shown) at the bottom of the insertion device (not shown) and the amount of string that extends from a rotatable drum is measured. In this embodiment, the system **1072** has a rotatable sensor **1074**, a rotatable drum **1076**, a spring-loaded string dispenser **1078**, and string (not shown) extending from the dispenser and around the drum **1076**. According to one embodiment, the sensor **1074** is a potentiometer **1074**, and in some specific embodiments, the sensor **1074** is a multiple-turn potentiometer **1074**. The rotatable sensor **1074** is coupled to the rotatable drum **1076** such that the sensor **1074** rotates when the drum **1076** rotates. In one embodiment as shown, the drum **1076** is a dual drum **1076** having a measurement string drum half **1076**A and a spring-loaded string drum half **1076**B. More specifically, the string that extends down to the port (not shown) of the insertion device (not shown) wraps around the measurement string drum half **1076**A, while a separate spring-loaded string (not shown) that is coupled at the other end to the spring-loaded string dispenser **1078** wraps around the spring-loaded string drum half **1076**B.

[0358] Alternatively, the system **1072** can have a single string (not shown). For example, in one embodiment, a string

(not shown) is coupled directly to the rotatable sensor **1074**. In a further embodiment, the string measurement system **1072** can be used to measure the tilt of the insertion device (or the canister of the insertion device). According to one implementation, the string measurement system **1072** uses three strings to measure the tilt.

[0359] In use, the sensor **1074** can detect the distance between the top cap **1070** and the port (not shown) by sensing the number of turns of the drum **1076**, as the number of turns is directly related to the length of the string extending down to the port (not shown) and thus directly related to the distance between the top cap **1070** and the port (not shown). This information can be used to calculate the insertion depth of the surgical device.

[0360] In an alternative embodiment, more than one measurement mechanism can be incorporated into an insertion device. That is, a first measurement mechanism can be incorporated into the insertion device to measure the insertion depth of the surgical device while a second measurement mechanism can be incorporated to measure the amount of "tilt" in the insertion device. It is understood that this could be any combination of the measurement devices that are capable of measuring depth and/or tilt. It is further understood that any known device for measuring tilt as described herein can be used within the insertion devices contemplated herein. In this context, "tilt" is intended to mean the angle of the longitudinal axis of the canister in relation to the plane parallel to the radius of the incision port. Several embodiments of the canisters and insertion devices herein are configured to allow for such tilt, which can be utilized to better position the surgical device in the cavity once it has exited the interior of the canister prior to or during a procedure.

[0361] FIGS. **82**A, **82**B, **82**C, **82**D, and **82**E depict yet another implementation of an insertion device having a measurement mechanism that measures the relative distance between the top cap and the port to determine the insertion depth of the surgical device. This embodiment relates to a top cap **1090** that has a substantially rigid structure measurement system **1092**. The measurement system **1092** is a system in which a substantially rigid structure **1094** extends from the top cap **1090** to the port **1096** at the bottom of the insertion device and the displacement of the structure **1094** is measured to determine the distance between the top cap **1090** and the port **1096**, which can be used to calculate the insertion depth of the surgical device.

[0362] In this embodiment, as shown in FIG. **82**A, the substantially rigid structure is a square bar **1094** that has a coupler **1098** at the top of the bar **1094**. The bar **1094** extends through a seal **1100** in the top cap **1090** (as best shown in FIG. **82**A), through a hole **1102** in the underside of the top cap **1090** (as best shown in FIG. **82**B), and through a hole **1104** in the port **1096** (as best shown in FIG. **82**E). In one embodiment, the hole **1102** in the top cap **1090** is square and thus the square bar **1094** cannot rotate in relation to the top cap **1090** (and thus can't rotate in relation to the insertion device). According to one implementation, the seal **1100** in the top cap **1090** is an elastomeric seal **1100**. Alternatively, the seal **1100** is any seal that can maintain the pressure in the insertion device with the bar **1094** disposed therethough.

[0363] In one embodiment, the actual measurement of the displacement of the square bar **1094** is accomplished using a string measurement system such as the system described above with respect to FIG. **81**. The coupler **1098** on the top end of the square bar **1094** is configured to be coupleable to a string (not shown) that is coupled in turn to the drum **1106** of the string measurement system **1108**. In one embodiment the string measurement system **1108** operates in the same fashion as the similar system above.

[0364] As best shown in FIGS. **82**C, **82**D, and **82**E, the bottom of the square bar **1094** is constrained in the port **1096** via a pegged ball **1110** having four pegs that is positioned in a cavity **1112** defined in the underside of the port **1096**, wherein the cavity **1112** is in fluid communication with the hole **1104** in the top side of the port **1096**. The cavity **1112** is configured to match the configuration of the pegged ball **1110** as shown (with the four slots in the cavity **1112** matching with the four pegs of the ball **1110**) such that the ball **1110** can move within the cavity **1112** in a way that allows angular offset but not rotation about the longitudinal axis of the bar **1094**. According to one embodiment, the combination of this constraint and the rotational constraint at the top cap **1090** allows the surgical device to be maneuvered into the body (that is, the insertion device can be tilted as described elsewhere herein and thereby maneuver and position the surgical device), but will maintain the centerline of the robot lined up with the insertion point.

[0365] In an alternative embodiment, the substantially rigid structure is another shape other than square. In a further implementation, the structure can have any shape that can match with a hole in the top cap such that the structure cannot rotate in relation to the top cap. Alternatively, the substantially rigid structure can be made up of more than one bar. For example, in one alternative embodiment, there can be two substantially rigid structures extending from the top cap to the port. In a further alternative, there are three or more structures.

[0366] Various other implementations of measurement mechanisms can be envisioned that fall within the scope and spirit of the embodiments disclosed herein. For example, while various embodiments discussed above relate to measurement of the relative distance between the top cap and the port, other alternative embodiments can measure the relative angular and linear displacement between the top and bottom of the insertion device. In addition, while various embodiments discuss above relate to sensors configured to emit and/or sense particular types of energy (such as infrared or ultrasonic energy), it is understood than any type of wireless technology that would work with a sensor can be used.

[0367] It is understood that any of these measurement technologies can be incorporated into any of the insertion device embodiments disclosed herein.

[0368] FIG. **83** depicts an alternative embodiment of an incision port **1120** that can be used with any of the insertion devices described above. In this implementation, the incision port **1120** has a slidable lid **1122** similar to the lid depicted in FIGS. **72**A-**75**C. Further, the port **1120** also has an insufflation port **1124** that is in fluidic communication with the interior lumen or opening of the incision port **1120**. In this embodiment, the insufflation port **1124** is a flow valve port **1124** that is positioned on the port **1120** such that it is below the slidable lid **1122**. In one implementation, the insufflation port **1124** is used to insufflate the patient's cavity or to provide supplemental insufflation during a procedure. In use, the lid **1122** is positioned in the closed position to establish a fluid seal in the cavity (and in the insertion device, as described elsewhere above), and then gas is added to the patient's cavity via the insufflation port **1124**.

[0369] FIGS. **84**A and **84**B depict alternative insertion device embodiments that, unlike the cylindrical canisters described above, have canisters with different shapes. More specifically, FIG. **84**A is an insertion device **1130** with a flexible canister **1132** that is spherical in shape. Further, FIG. **84**B is an insertion device **1140** with a flexible canister **1142** that is conical in shape. According to one embodiment, during compression, the spherical and conical canisters **1132**, **1142** collapse or compress or otherwise allow the top cap to be moved toward the incision port such that the walls of the canisters **1132**, **1142** expand or move outward. That is, the canisters **1132**, **1142** do not bend inward and thereby interfere with the surgical device disposed within the canisters **1132**, **1142** during collapse or compression of the canisters **1132**, **1142**.

[0370] FIGS. **85**A, **85**B, and **85**C depict alternative insertion device embodiments that have canisters that are reinforced with rib structures. More specifically, FIG. **85**A is an insertion device **1150** with a flexible canister **1152** having vertical rib structures **1154**. FIG. **85**B is an insertion device **1160** with a flexible canister **1162** having horizontal rib structures **1164**. Further, FIG. **85**C is an insertion device **1170** with a flexible canister **1172** having spiral-shaped rib structures **1174**. In accordance with one embodiment, the rib structures in these exemplary embodiments create the structure of each canister while the flexible material in the canisters maintain the pressure therein. Alternatively, any combination of the rib structures can also be incorporated into a canister. In one implementation, the rib structures provide reinforcement for each canister such that the structures reduce the amount of undesired bending or collapsing of the canister during use.

[0371] FIGS. **86**A, **86**B, **86**C, **86**D depict an embodiment of a base coupler **1182** (of an incision port **1180**) that is releasably coupled to the canister **1184** of the incision device. In this embodiment, the surgical device (not shown) can be positioned in the canister **1184** prior to the procedure and then releasably coupled to the incision port **1180**. The coupler **1182** has at least one fixed support **1186** and at least one releasable latch **1188**. According to one embodiment, there are two fixed supports **1186** (one is not visible). The canister **1184** has a lip **1190** on the bottom of the canister that can couple with the coupler **1182**. In use, the canister **1184** is positioned against the top of the coupler **1182** in a tilted position as shown in FIGS. **86**B and **86**C such that the lip **1190** is positioned under the two fixed supports **1186**. Then the entire bottom of the canister **1184** is placed into contact with the coupler **1182**, thereby creating a seal between the lip **1190** and the coupler **1182**. When the lip **1190** is positioned correctly, the latch **1188** is moved into the latched position such that the lip **1190** is retained in its position against the coupler **1182** via the two fixed supports **1186** and the latch **1188** as best shown in FIG. **86**D.

[0372] FIGS. **87**A, **87**B, and **87**C depict an embodiment of an insertion device having top cap **1200** that is coupled to an outer handle set **1202** such that the top cap **1200** and handle set **1202** can be moved relative to the flexible canister **1204**. The outer handle set **1202** has an outer ring **1206** that is positioned around the outer circumference of the top cap **1200** such that there is a fluid seal established between the two components. In one embodiment, the fluidic seal is enhanced by a rubber seal **1210** disposed between the top cap **1200** and outer ring **1206**. Further, the set **1202** also has two handles **1208** coupled to the ring **1206** such that a user or medical professional can easily grasp the set **1202**. More specifically, as best shown in FIG. **87**B, the top cap **1200** and outer handle set **1202** are moved down over the walls of the flexible canister **1204** such that the canister **1204** walls are disposed between the top cap **1200** and the handle set **1202**. Thus, unlike certain embodiments above, the top cap **1200** is not fixed to the top of the canister **1204**, but rather can be moved distally toward the bottom of the canister **1204** while pulling the walls of the canister **1204** through the seal of the top cap **1200** and outer handle set **1202** so as to reduce any bunching of the canister walls **1204** during compression of the device. In use, the top cap **1200** is free to slide within the flexible canister **1204** and is controlled via the outer handle set **1202**, which has handles **1208** that provide direct control of the position and orientation of the top cap **1200**.

[0373] FIGS. **88**A, **88**B, **88**C, and **88**D depict an alternative embodiment of an insertion device **1220** having top cap **1222** (as best shown in FIGS. **88**A and **88**B, a mobile seal **1224** (as best shown in FIG. **88**C, an outer handle set **1226** (as best shown in FIGS. **88**A and **88**C) coupled to the mobile seal **1224**, and an incision port **1228** (as best shown in FIGS. **88**A and **88**D). This embodiment differs from the previous embodiment in that the top cap **1222** in this device **1220** is not mobile and instead is coupled to the proximal end of the device **1220** as shown in FIG. **88**A. Further, this embodiment has a mobile seal **1224** that is capable of moving along the length of the device **1220** in the same fashion as the top cap **1200** described above and depicted in FIGS. **87**A-**87**C. Further, the outer handle set **1226** is coupled to the mobile seal **1224**, instead of the top cap **1222**.

[0374] According to one embodiment, the top cap **1222** in this device **1220** is the primary seal of the device **1220** such that it is not essential that the mobile seal **1224** maintains a fluidic seal as it is moved along the length of the device **1220**. As such, the top cap **1222** can have all the sealing features and components of any of the top cap embodiments described above, including seals and access openings for wires, suction, irrigation, and auxiliary tools. In accordance with one implementation, the mobile seal **1224** is used primarily, along with the outer handle set **1226**, to position the surgical device into the patient's cavity. The mobile seal **1224** and the outer handle set **1226** are coupled together, according to one embodiment, in a similar fashion and with similar components as the outer handle set **1202** and the top cap **1200** described above. When the outer handle set **1226** is moved, the mobile seal **1224** moves as well, and the handle set **1226** and seal **1224** can be moved relative to the canister walls in the same way as the top cap **1200** and handle set **1202** above.

[0375] According to one implementation, the external circumference of the mobile seal **1224** is non-circular such that coupling the seal **1224** to the outer handle set **1226** restrains the mobile seal **1224** from any axial movement in relation to the handle set **1226**. As an example, the outer circumference of the seal **1224** can have the shape of a hexagon or an ellipse. Alternatively, any mechanism or component to restrain such axial movement can be used.

[0376] In one embodiment, the interface of the mobile seal **1224** and outer handle set **1226**—where the canister is positioned and must pass through—need not provide a fluidic seal. Further, in certain implementations, the additional mechanisms or components such as ball bearings or surfaces conducive to movement can be incorporated into the interface, thereby enhancing the ability of the canister wall to pass through the interface easily. It is understood that these mecha-

nisms or components can be incorporated into the seal **1224** or the handle set **1226** or both.

[0377] FIG. **89** depicts an alternative embodiment of an insertion device **1240** having a substantially non-flexible canister portion **1242** that is coupled to a flexible canister portion **1244**, which in turn is coupled to the incision port **1246**. In this embodiment, the top cap (not shown) can be coupled to an outer handle set similar to that described above such that the top cap can move along the non-flexible canister portion **1242** with ease. The flexible canister portion **1244** provides a flexible connection or interface (which could also be described as a "ball joint like" interface) that allows the movement of the surgical device as needed. That is, the flexible canister portion **1244** enhances the ability to tilt the insertion device **1240** as described above, thereby enhancing the ability to move the surgical device during insertion and during any procedure being performed. In one implementation, the coupling of the top cap and the outer handle set can be a magnetic connection so as to avoid the necessary sealing. Alternatively, different canister shapes and sizes can be envisioned. Further, the flexible canister portion can be located elsewhere on the device. In a further alternative, more than one flexible canister portion can be provided.

[0378] It is understood with respect to all of the various embodiments described herein that the medical devices being inserted into the patient are any known medical or surgical devices for performing procedures within a cavity of a patient. In certain embodiments, it is understood that the medical devices are robotic surgical devices having one or two arms. In various alternatives, the robotic surgical devices or systems can have or use three or more arms. In further alternatives, the devices (or additional devices) can be cameras or camera systems. Yet other alternatives, include the use of "helper" tools that can be inserted along with one or more medical devices or robotic devices.

[0379] Although the present invention has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

What is claimed is:

1. A surgical insertion device comprising:

(a) a canister defining a lumen, wherein the canister is sized to receive a surgical device in the lumen;

(b) a top cap coupled to a proximal end of the canister, the top cap comprising at least one lumen defined in the top cap, wherein the at least one lumen is configured to receive a support rod; and

(c) an incision port removably coupled to a distal end of the canister, the incision port comprising a fluidic sealing component configured to maintain a fluidic seal.

2. The surgical insertion device of claim **1**, wherein the lumen is fluidically sealed in relation to ambient air.

3. The surgical insertion device of claim **1**, wherein the canister comprises a flexible material or a substantially rigid material.

4. The surgical insertion device of claim **1**, wherein the canister comprises a flexible portion and a substantially rigid portion.

5. The surgical insertion device of claim **1**, wherein the canister has a cylindrical shape, a spherical shape, or a conical shape.

6. The surgical insertion device of claim **1**, wherein the canister comprises at least one rib structure.

7. The surgical insertion device of claim **1**, wherein the fluidic sealing component comprises a sealable sleeve device, a flexible seal component, a removable lid seal component, or a flap seal component.

8. The surgical insertion device of claim **1**, wherein the top cap comprises at least one of a pressure relief valve, at least one threaded lumen, a detachable cable harness, and a clamp projection.

9. The surgical insertion device of claim **1**, further comprising an outer handle set coupleable to the top cap.

10. The surgical insertion device of claim **1**, further comprising at least one measurement mechanism coupled to the top cap or the incision port.

11. The surgical insertion device of claim **1**, wherein the canister comprises at least one access port, wherein the at least one access port is a hand access port or a side access port.

12. A surgical insertion device comprising:

(a) a flexible canister defining a lumen, wherein the canister is sized to receive a surgical device in the lumen;

(b) a top cap coupled to a proximal end of the canister, the top cap comprising at least one lumen defined in the top cap, wherein the at least lumen is configured to receive a support rod;

(c) an incision port removably coupled to a distal end of the canister, the incision port comprising a fluidic sealing component configured to maintain a fluidic seal; and

(d) a first measurement mechanism coupled with the top cap or the incision port, the first measurement mechanism configured to measure the insertion depth of the surgical device.

13. The surgical insertion device of claim **12**, wherein the first measurement mechanism comprises a sensor, a string measurement system, a substantially rigid structure system, or a camera.

14. The surgical insertion device of claim **12**, wherein the fluidic sealing component comprises a sealable sleeve device, a flexible seal component, a removable lid seal component, or a flap seal component.

15. The surgical insertion device of claim **12**, wherein the top cap comprises at least one of a pressure relief valve, at least one threaded lumen, a detachable cable harness, and a clamp projection.

16. The surgical insertion device of claim **12**, further comprising a second measurement mechanism coupled to the top cap or the incision port, the second measurement mechanism configured to measure any tilt of the flexible canister.

17. A surgical insertion device comprising:

(a) a canister defining a lumen, wherein the canister is sized to receive a surgical device in the lumen, wherein the surgical device is a robotic surgical device comprising two arms;

(b) a top cap coupled to a proximal end of the canister, the top cap comprising a pressure relief valve and at least one lumen defined in the top cap, wherein the at least one lumen is configured to receive a support rod; and

(c) an incision port removably coupled to a distal end of the canister, the incision port comprising a fluidic sealing component configured to maintain a fluidic seal.

18. The surgical insertion device of claim **17**, wherein the fluidic sealing component comprises a sealable sleeve device, a flexible seal component, a removable lid seal component, or a flap seal component.

19. The surgical insertion device of claim **17**, wherein the top cap comprises at least one of at least one threaded lumen, a detachable cable harness, and a clamp projection.

20. The surgical insertion device of claim **17**, further comprising at least one measurement mechanism coupled to the top cap or the incision port.

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