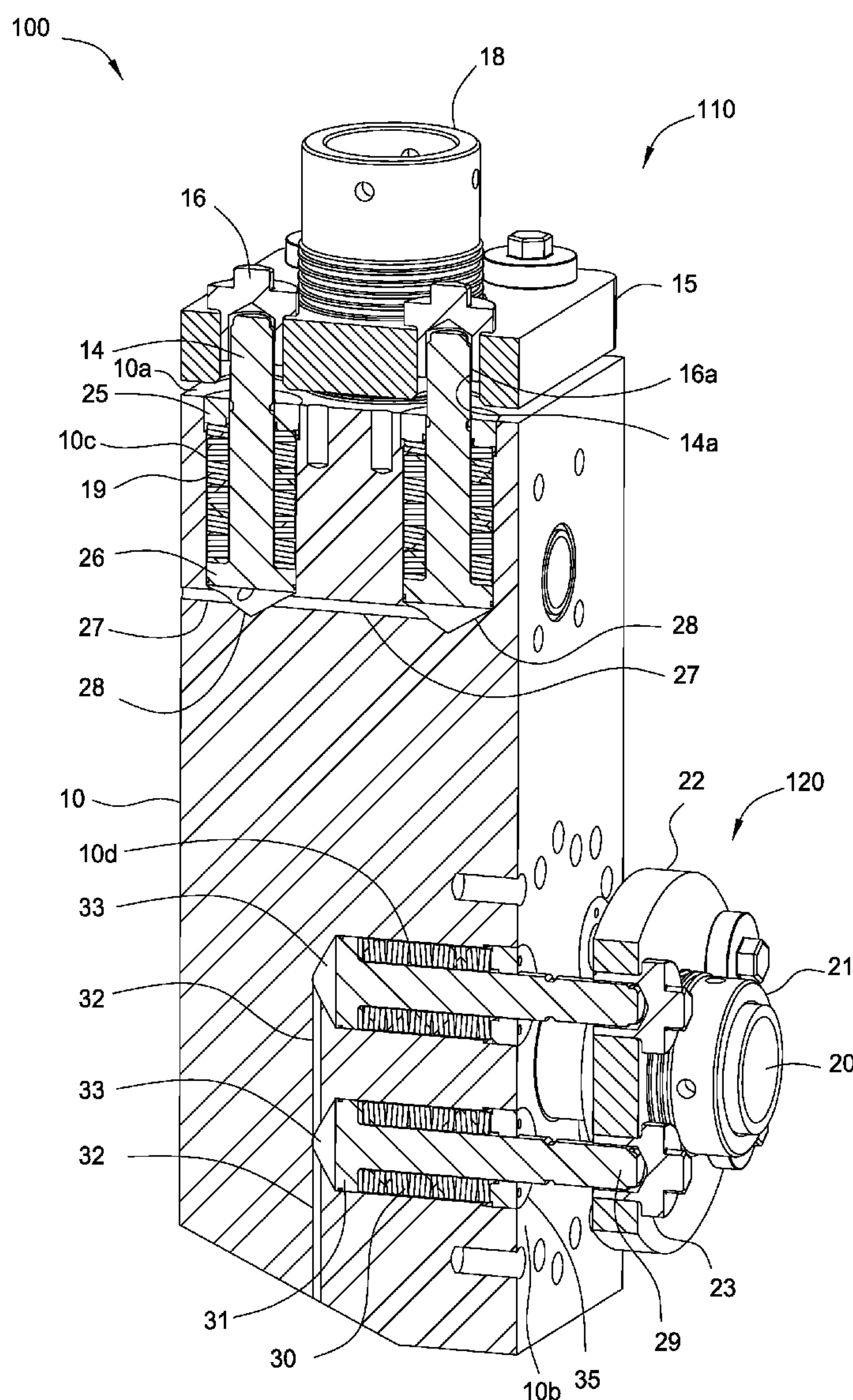


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(19) **United States**(12) **Patent Application Publication**
PATTERSON et al.(10) **Pub. No.: US 2017/0107983 A1**(43) **Pub. Date: Apr. 20, 2017**(54) **VALVE COVER AND LINER RETAINER FOR
A FLUID END OF A PUMP**(52) **U.S. Cl.**
CPC **F04B 53/168** (2013.01)(71) Applicant: **FORUM US, INC**, Houston, TX (US)(57) **ABSTRACT**(72) Inventors: **Stephen PATTERSON**, Kilbimie (GB);
Sohaib ANWER, Houston, TX (US)(21) Appl. No.: **14/882,884**(22) Filed: **Oct. 14, 2015****Publication Classification**(51) **Int. Cl.**
F04B 53/16 (2006.01)

A valve cover assembly and a liner retainer assembly configured to retain a plug, a liner, and/or a liner seal within or against a module or retention body of a fluid end of a pump. The valve cover assembly and the liner retainer assembly include pistons coupled to a retaining flange or a threaded gland. A bias applied to the pistons biases the retaining flange and a threaded gland that is coupled to the retaining flange, or the piston alone, into engagement with the module or retention body to retain the plug, the liner, and/or the liner seal on the module.



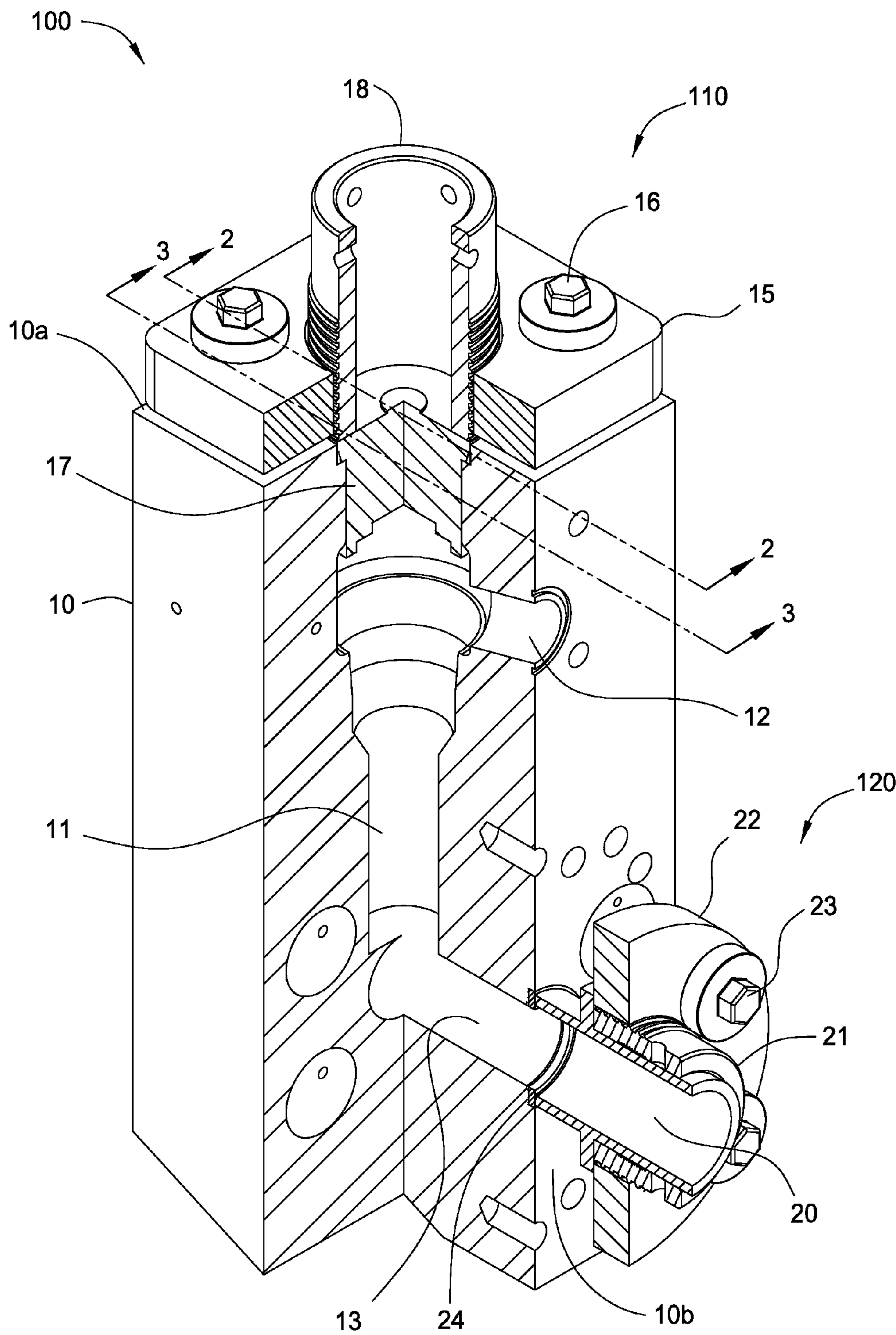


FIG. 1

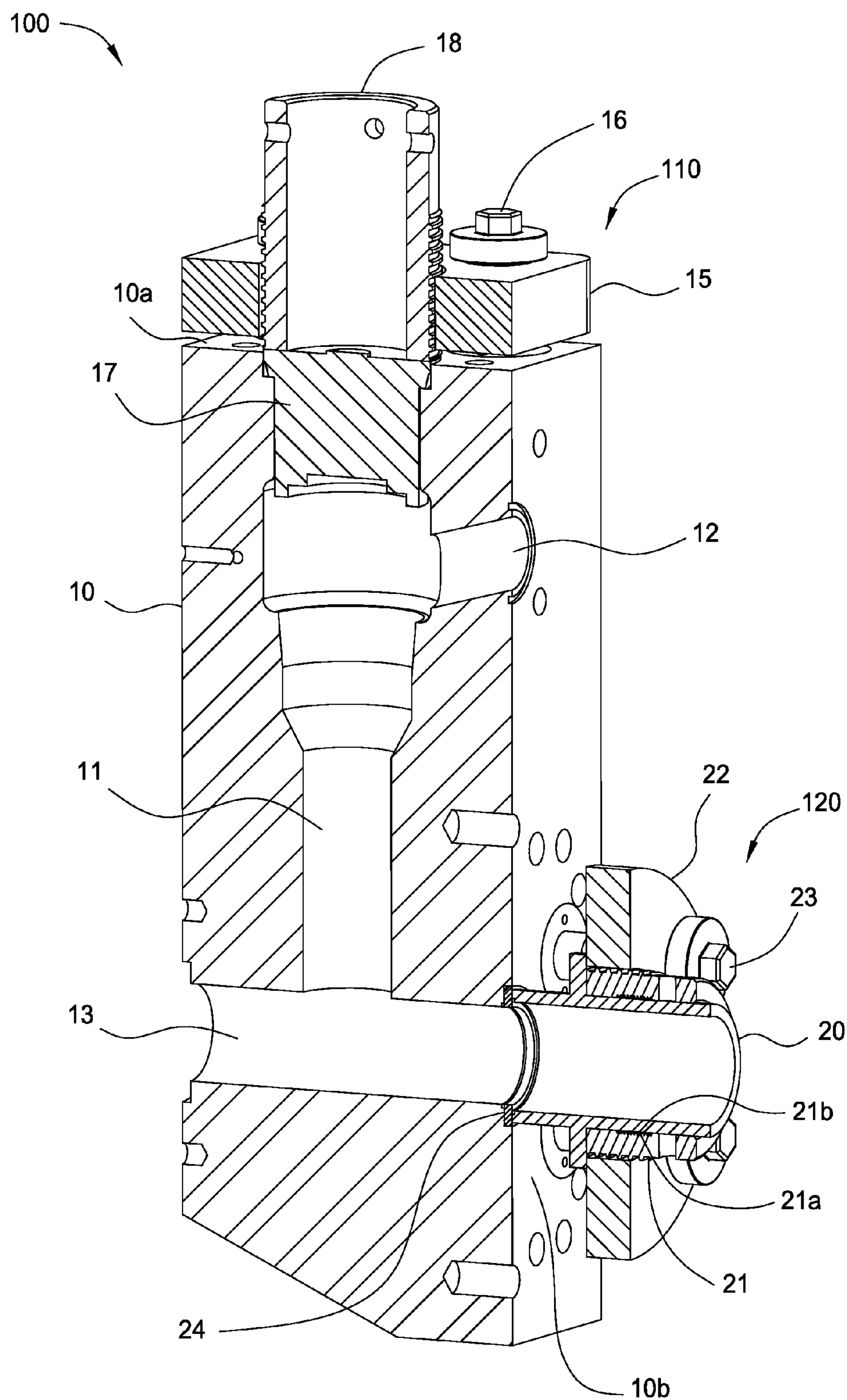


FIG. 2

FIG. 3

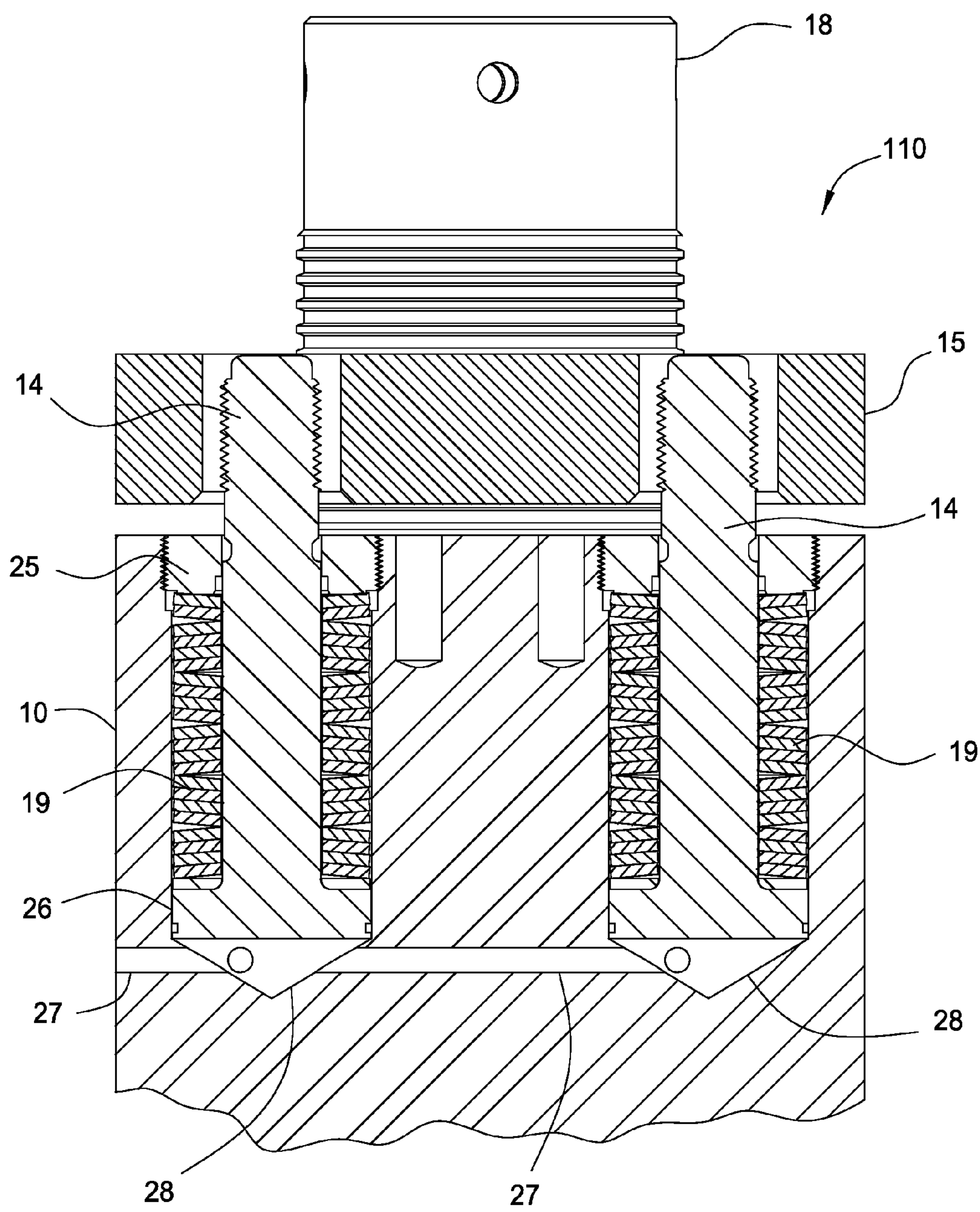


FIG. 4A

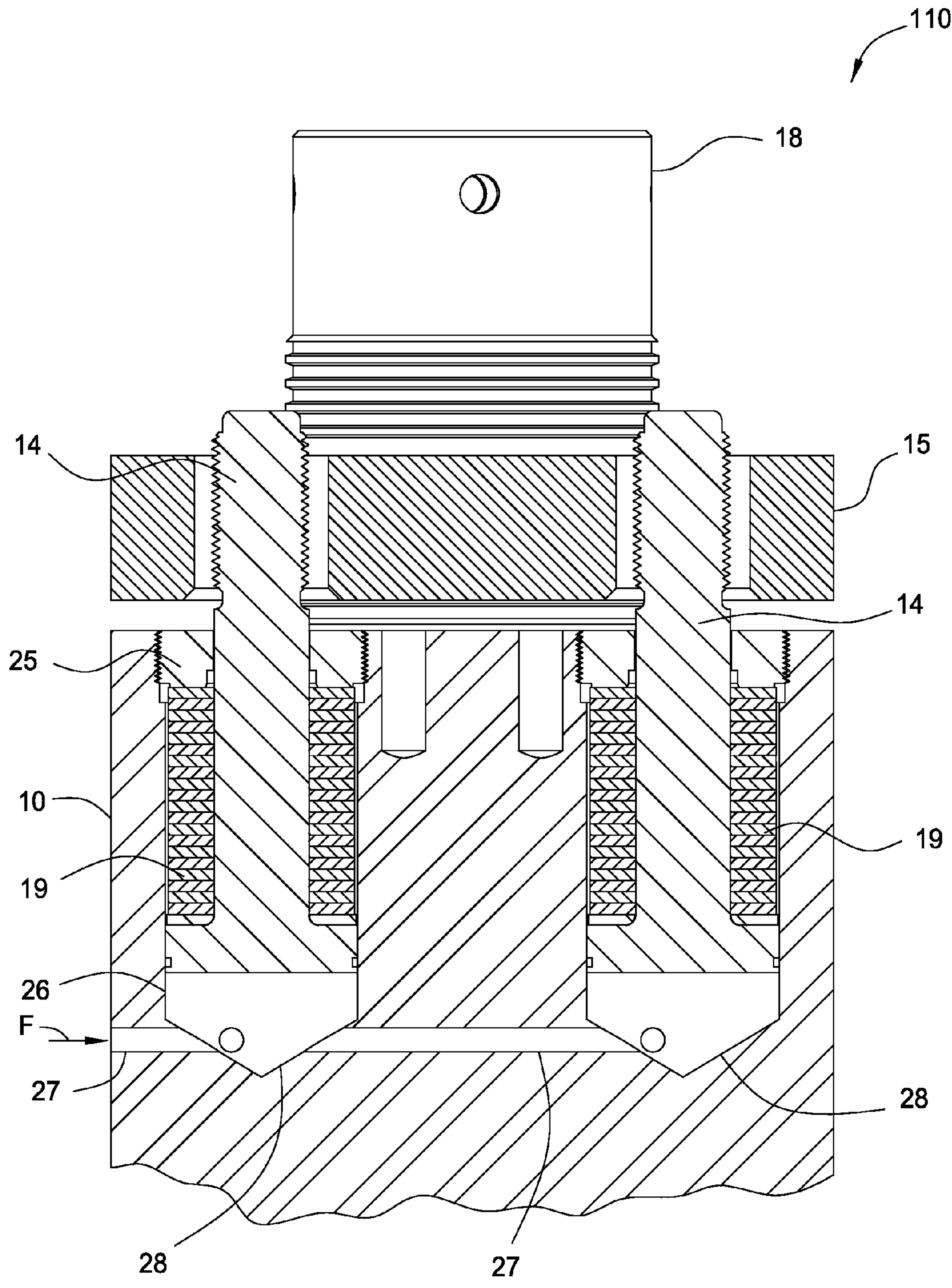


FIG. 4B

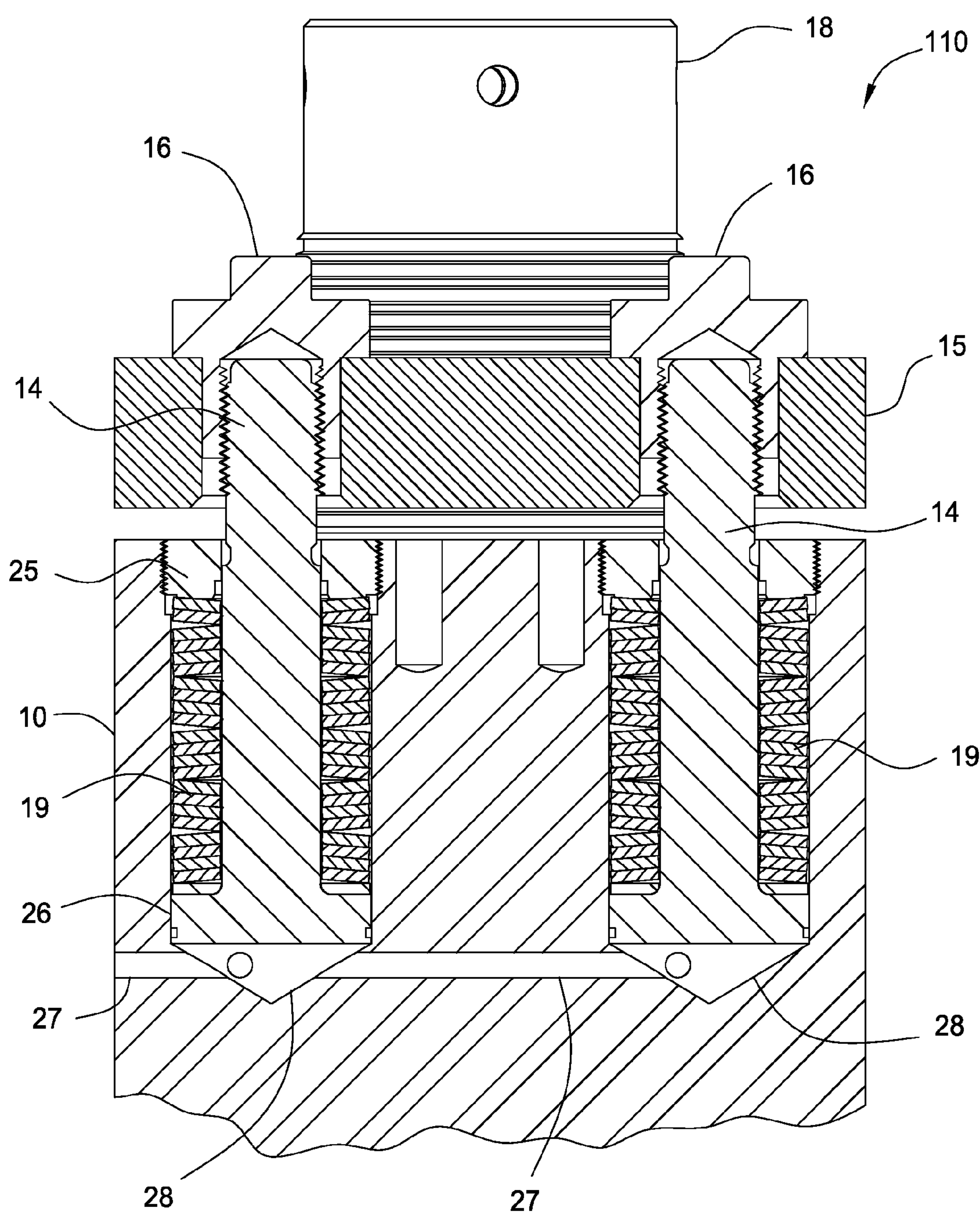


FIG. 4C

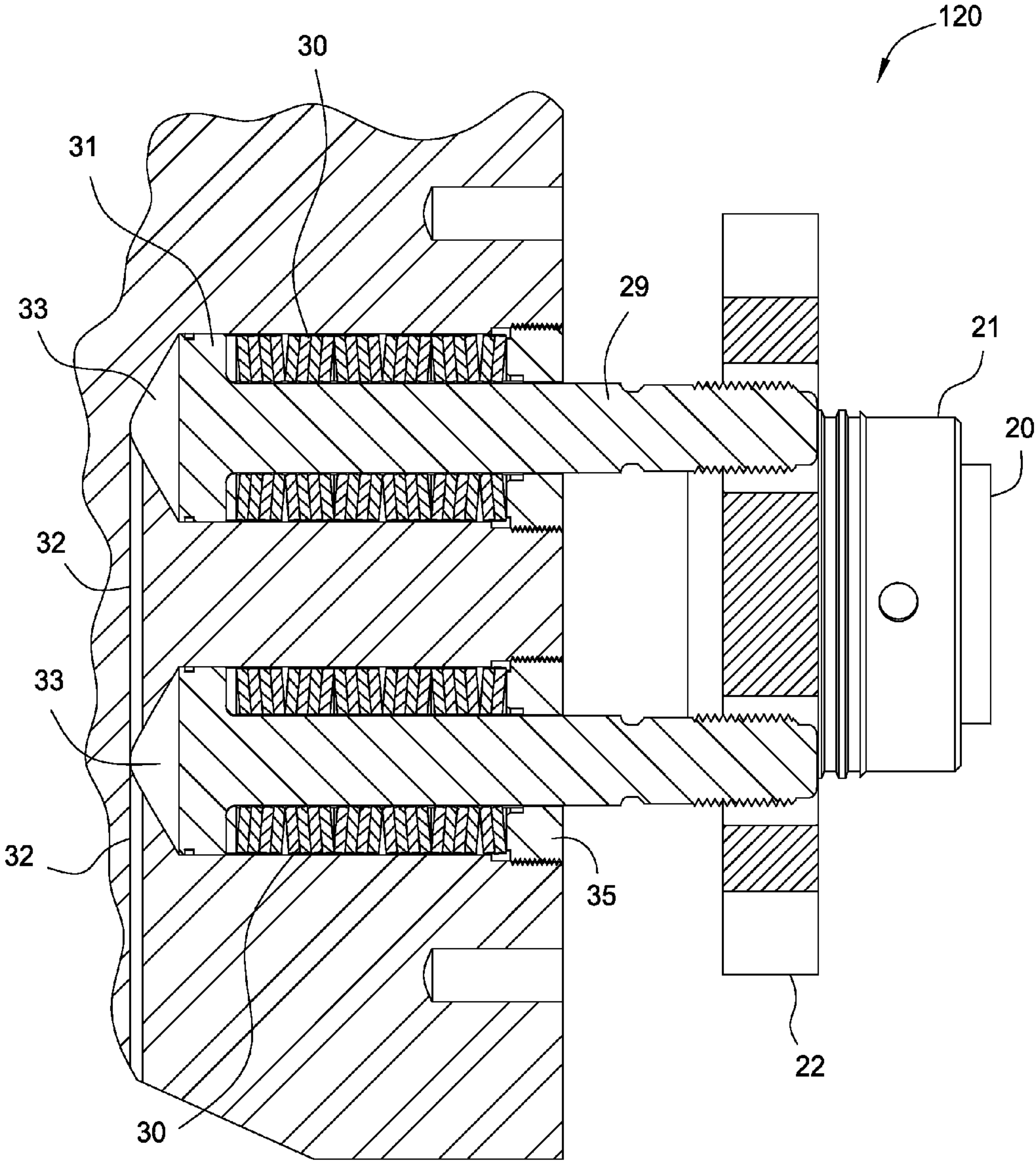


FIG. 5A

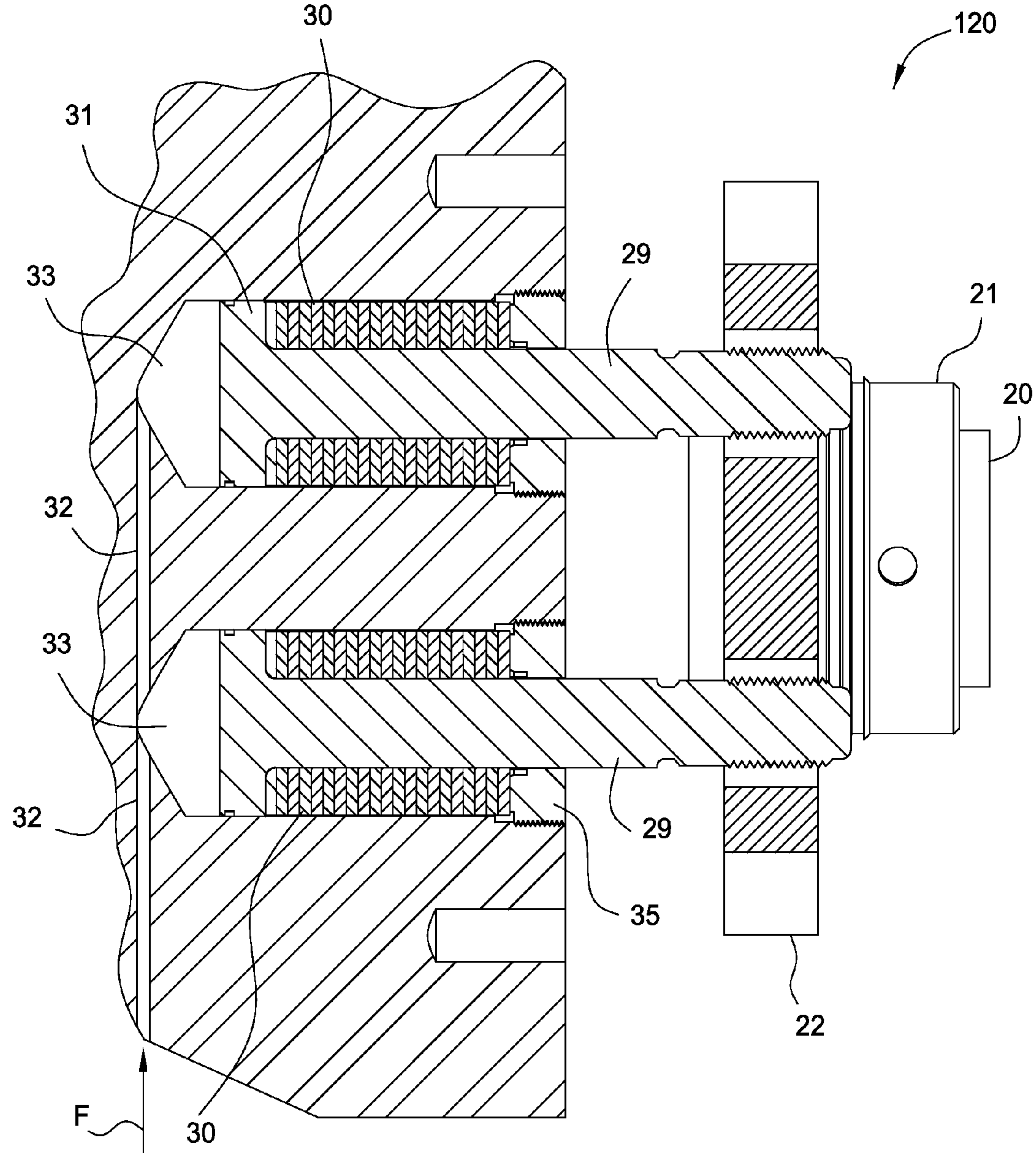


FIG. 5B

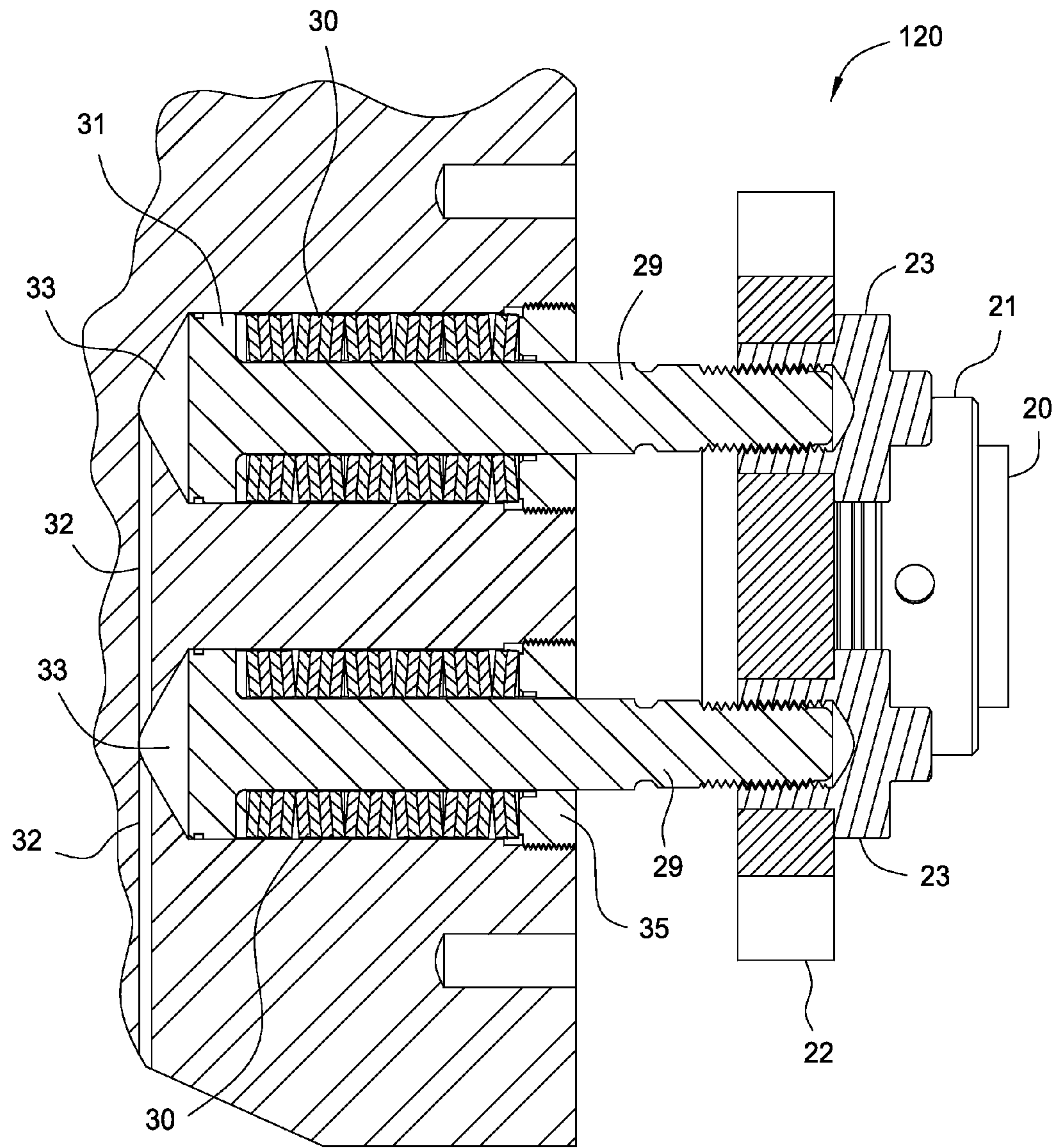


FIG. 5C

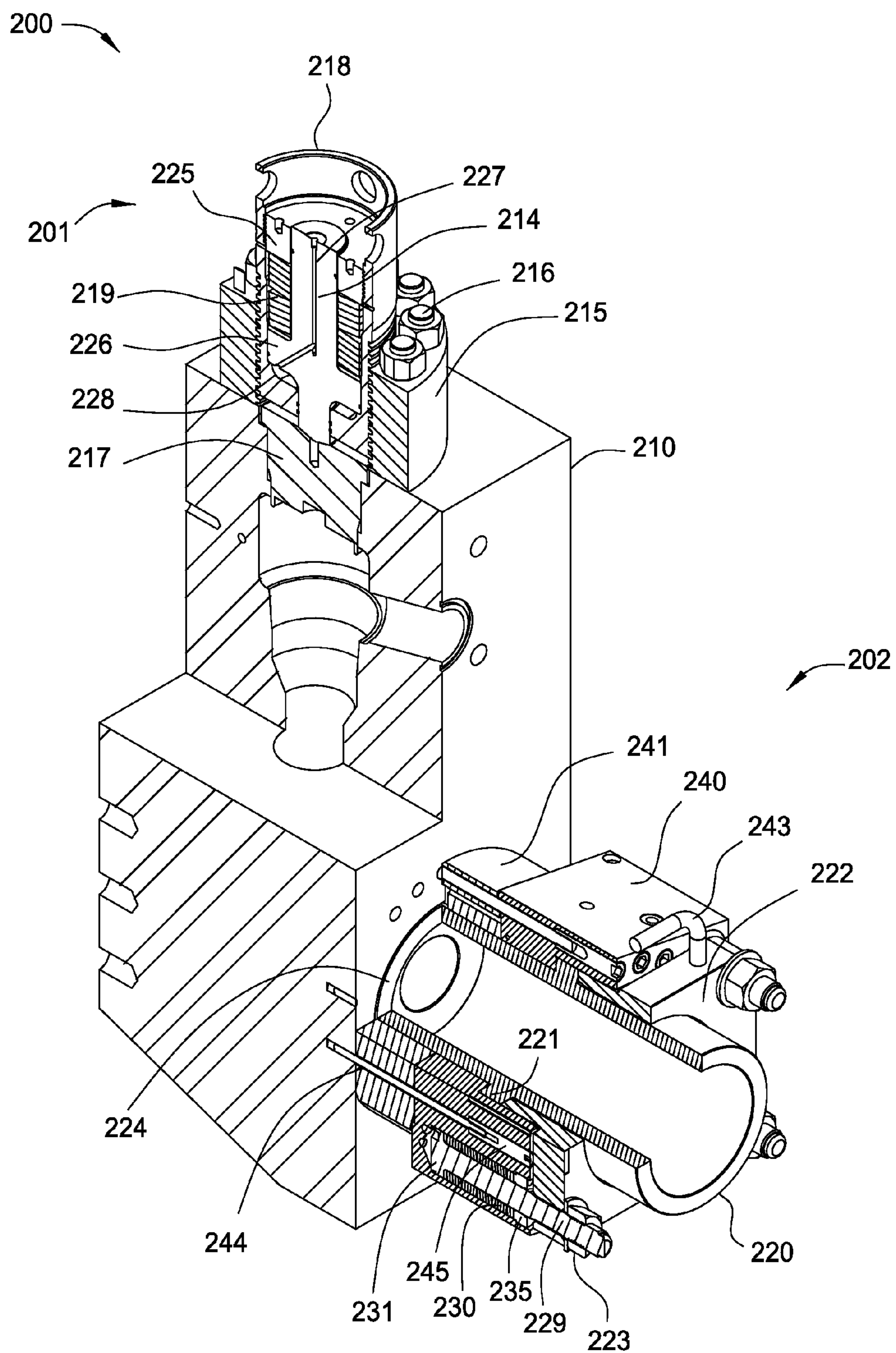


FIG. 6

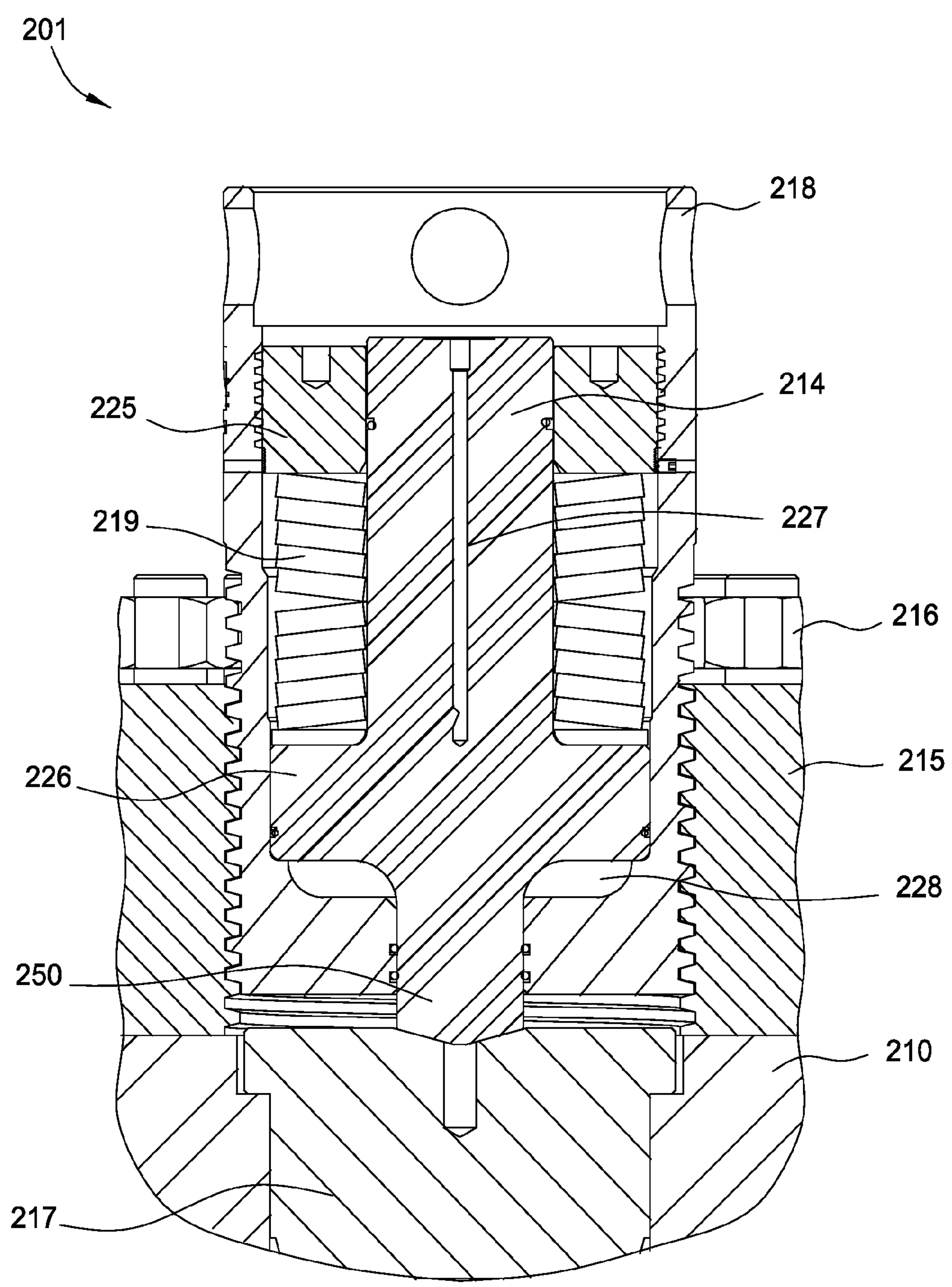


FIG. 7A

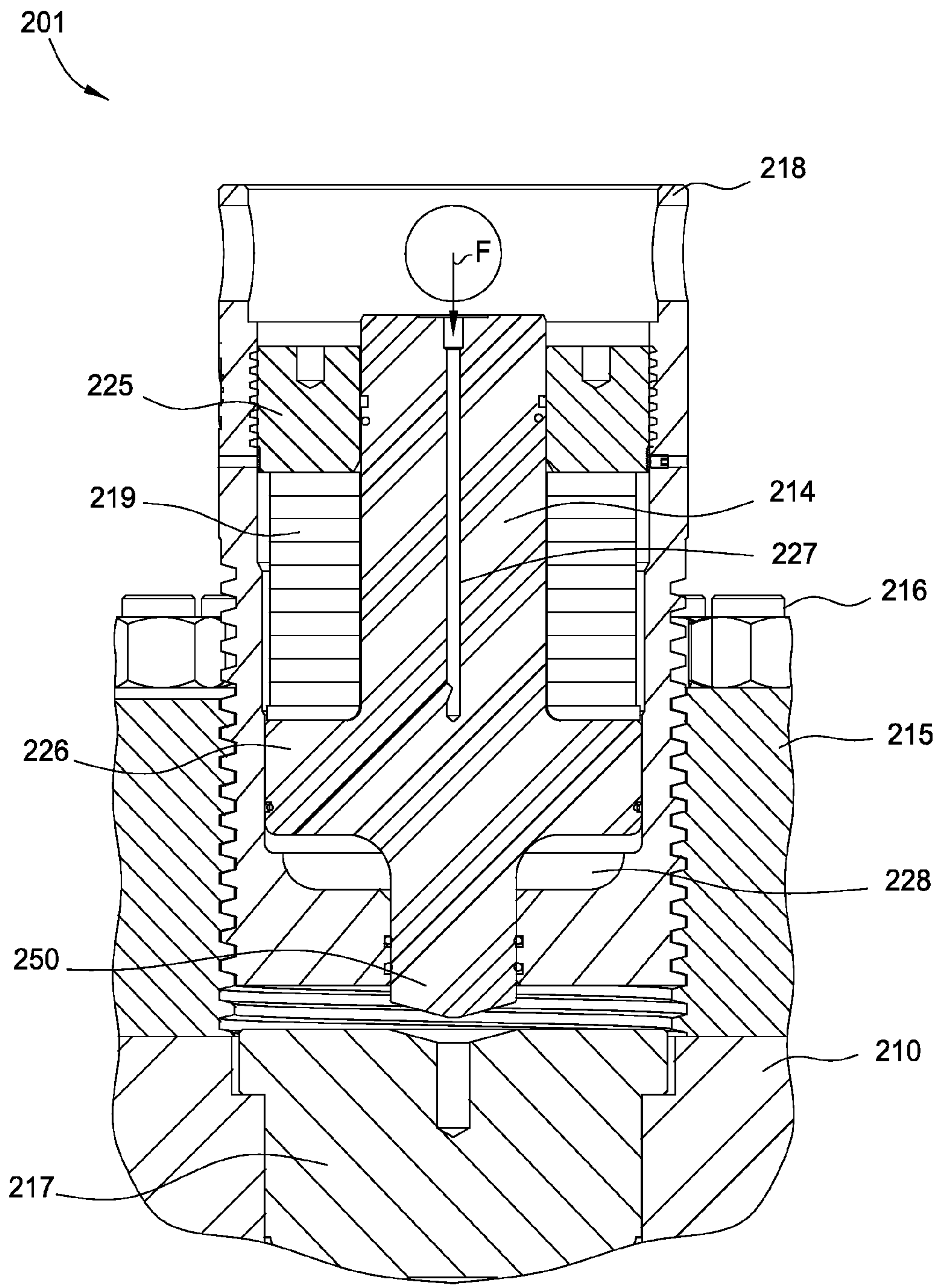


FIG. 7B

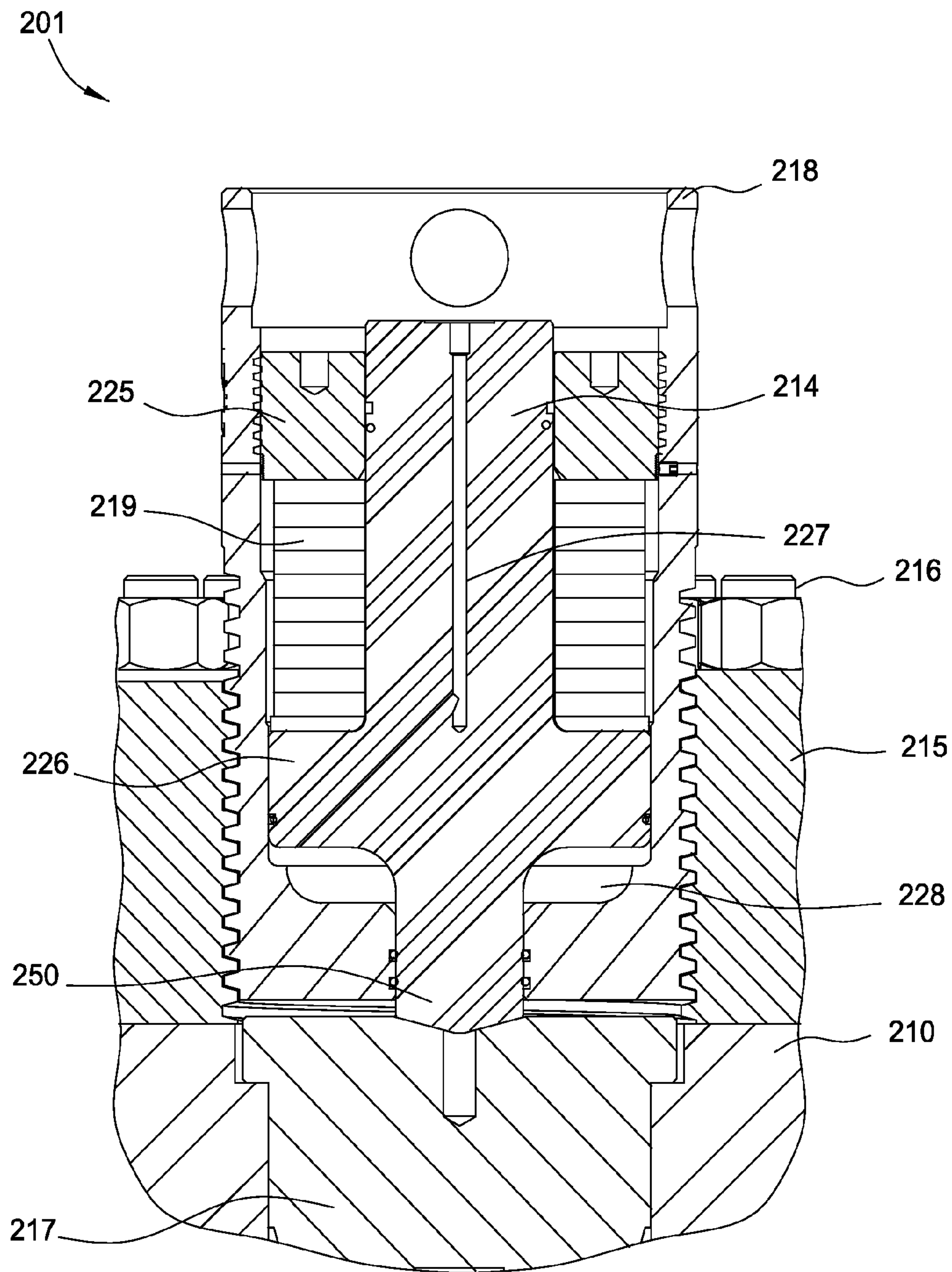


FIG. 7C

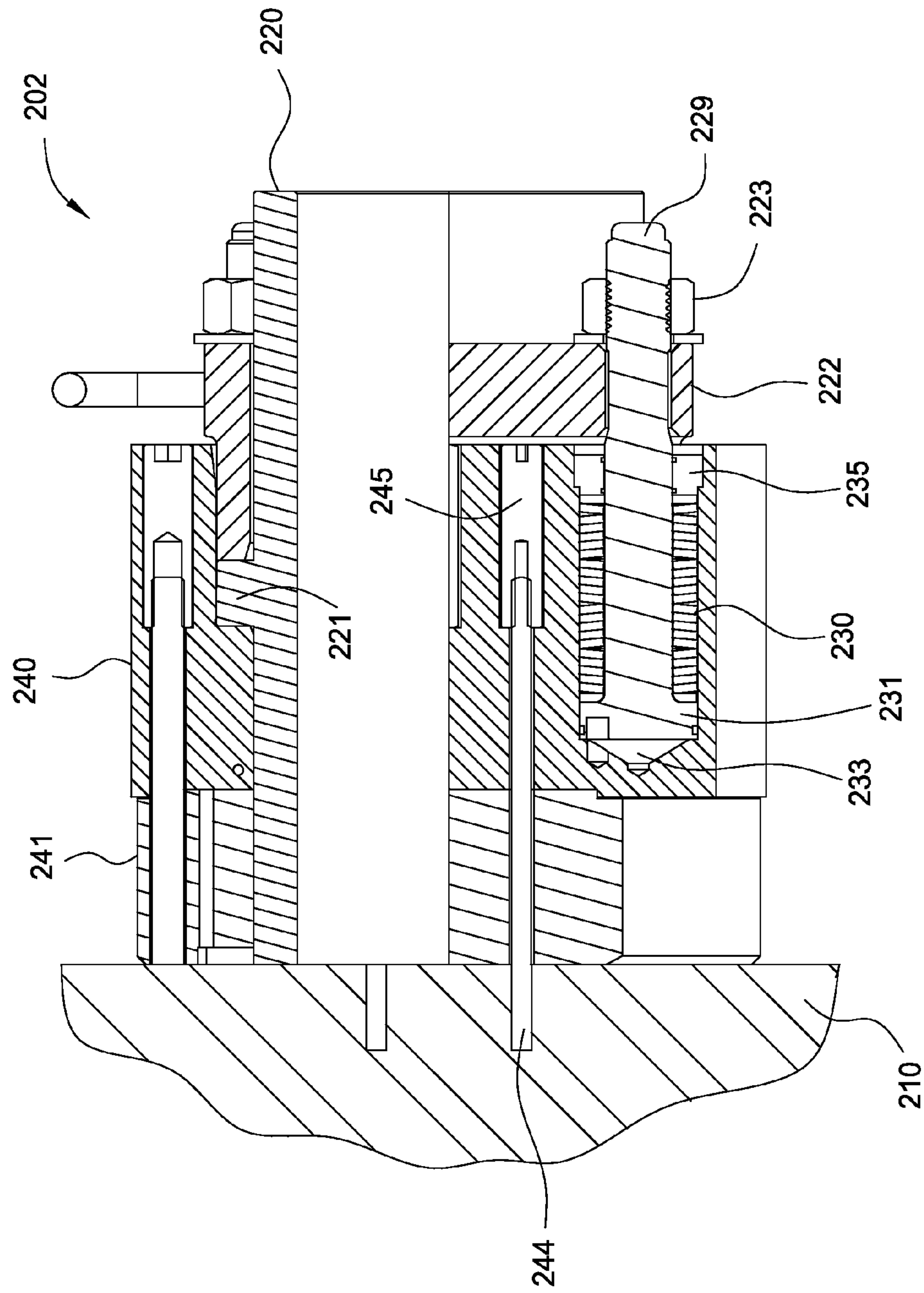


FIG. 8A

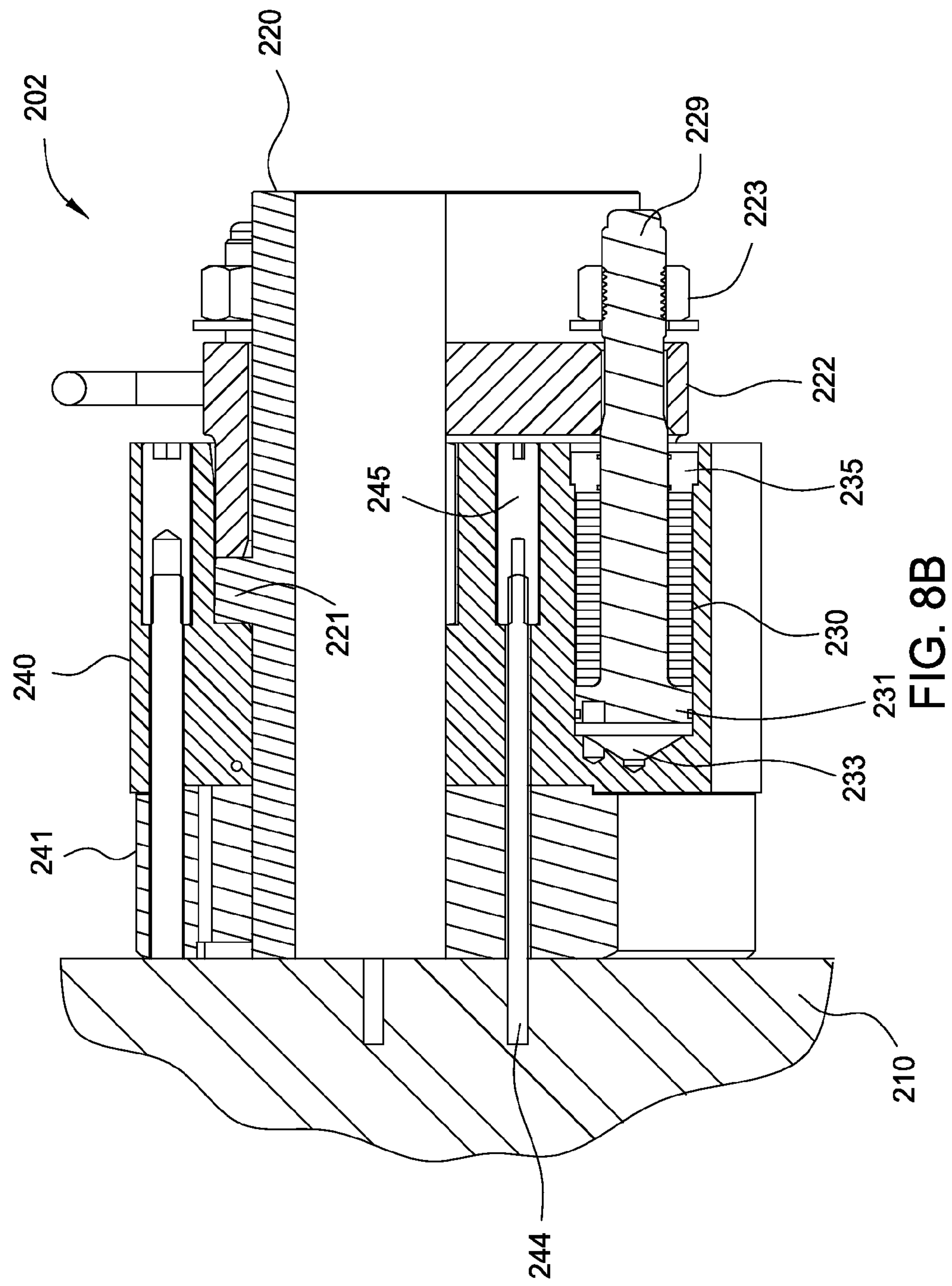


FIG. 8B

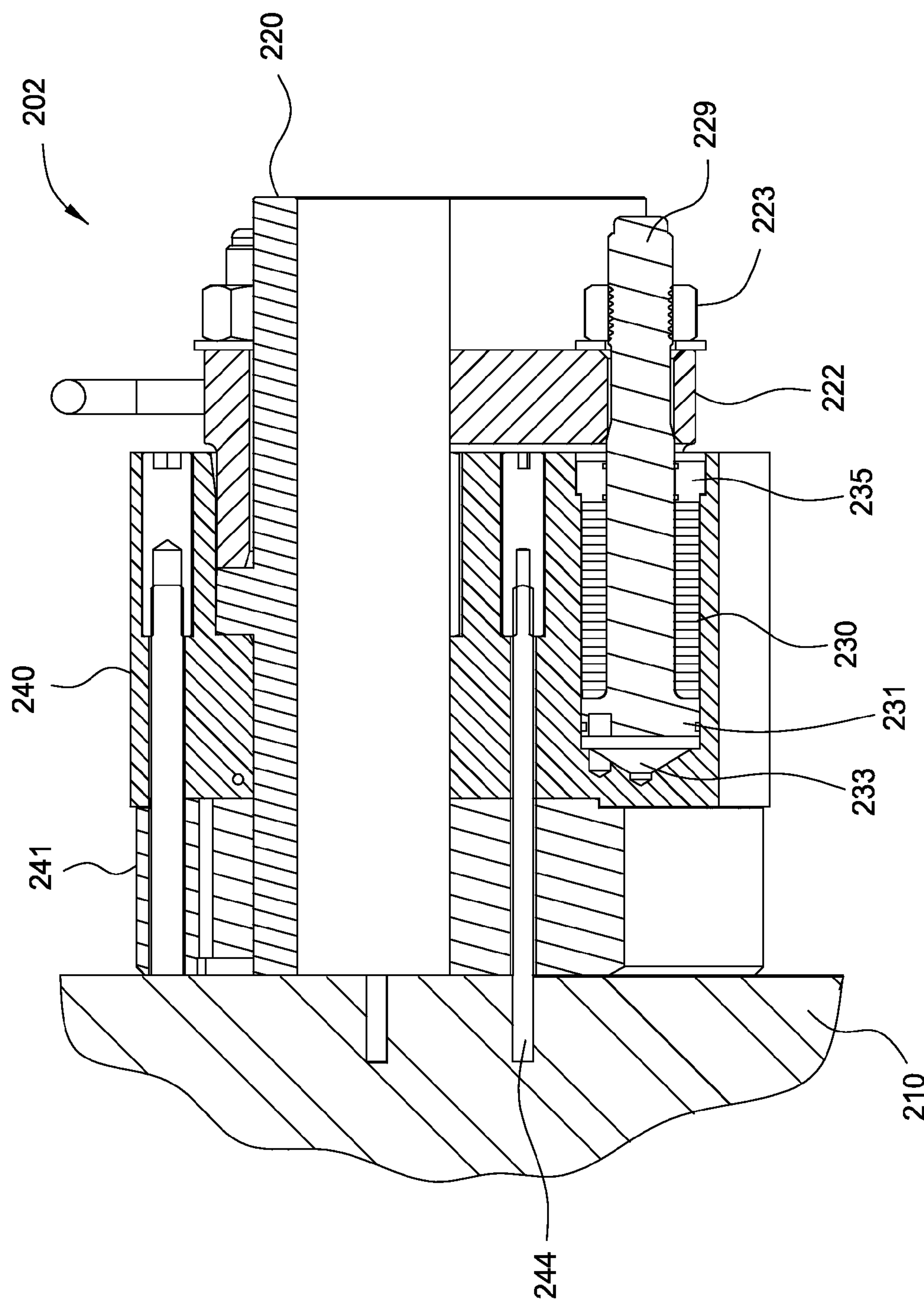


FIG. 8C

VALVE COVER AND LINER RETAINER FOR A FLUID END OF A PUMP

BACKGROUND

[0001] Field of the Disclosure

[0002] Embodiments of the present disclosure generally relate to a fluid end module that integrates a valve cover and/or liner retention system.

[0003] Description of the Related Art

[0004] Multiplex reciprocating pumps are commonly used in the oil and gas industry. The pumps are used to pump fluids at high pressure into one or more wells comprising boreholes that are drilled into the ground. Multiplex pumps comprise a power end housing a crankshaft and a crosshead, and a fluid end having fluid bores in which individual plungers having intake and discharge valves reciprocate. Connecting rods connect the crosshead to the plungers to cause reciprocating motion of the plungers in the fluid bores to move fluid from a suction end to a discharge end of the fluid bores. The fluid end components (e.g. screw glands, covers, valves, pistons, liners, seals, etc.) have to be replaced frequently because the fluids pumped through the fluid end are abrasive, corrosive, and/or are pumped at high pressures and flow rates, which cause wear on the fluid end components.

[0005] Removing one or more fluid end components, and installing replacement components therein, can be difficult due to space limitations and custom tools, which may be required for the installation/removal of components. Access to the fluid end may be limited by the presence of adjacent heavy machinery, including the power end of the pump, which limits the amount of working space available to access components needing to be replaced. Installing and removing a valve cover or a liner retainer of the fluid end, for example, requires using a long cheater bar, tommy bar, or C-spanner and a heavy hammer to provide sufficient torque to unbolt the valve cover or liner retainer, and the limited clearance between the fluid end and adjacent equipment may make it impossible to insert a long bar in a location to access the components being replaced. Also, hammering the long cheater bar, tommy bar, or C-spanner by swinging the heavy hammer to unbolt the valve cover or the liner retainer of the fluid end, when combined with the limited amount of working space, increases safety hazard risks for the workers installing/removing these components.

[0006] Therefore, there is a continuous need for new and improved fluid end designs with components that are easy to install/remove and that increase worker safety.

SUMMARY OF THE DISCLOSURE

[0007] In one embodiment, an assembly comprises a body; a piston extending from the body; a biasing member biasing the piston into the body; and a retaining flange coupled to the piston, wherein the retaining flange is biased toward the body by a bias applied to the piston by the biasing member.

[0008] In one embodiment, a method of installing an assembly comprises positioning a retaining flange relative to a body such that a piston extending from the body extends into an opening of the retaining flange; supplying pressurized fluid into a chamber formed in the body to move the piston against a bias applied on the piston by a biasing member disposed within the body; coupling a flange retain-

ing nut to the piston such that the flange retaining nut engages the retaining flange; and forcing the retaining flange toward the body by the force applied to the piston by the biasing member.

[0009] In one embodiment, an assembly comprises a module; a threaded gland coupled to the module; a piston at least partially disposed within the threaded gland; and a biasing member disposed within the threaded gland and biasing the piston toward the module.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] So that the manner in which the above recited features can be understood in detail, a more particular description of the embodiments, briefly summarized above, may be had by reference to embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments and are therefore not to be considered limiting of its scope, for the embodiments may admit to other equally effective embodiments.

[0011] FIG. 1 illustrates a first sectional view of a fluid end, according to one embodiment disclosed herein.

[0012] FIG. 2 illustrates a second sectional view of the fluid end, according to one embodiment disclosed herein.

[0013] FIG. 3 illustrates a third sectional view of the fluid end, according to one embodiment disclosed herein.

[0014] FIGS. 4A, 4B, and 4C illustrate enlarged sectional views of a valve cover, according to one embodiment disclosed herein.

[0015] FIGS. 5A, 5B, and 5C illustrate enlarged sectional views of a liner retainer, according to one embodiment disclosed herein.

[0016] FIG. 6 illustrates a first sectional view of another fluid end, according to one embodiment disclosed herein.

[0017] FIGS. 7A, 7B, and 7C illustrate enlarged sectional views of another valve cover, according to one embodiment disclosed herein.

[0018] FIGS. 8A, 8B, and 8C illustrate enlarged sectional views of another liner retainer, according to one embodiment disclosed herein.

DETAILED DESCRIPTION

[0019] FIG. 1 and FIG. 6 illustrate fluid ends **100**, **200** of a multiplex reciprocating pump. Examples of a multiplex reciprocating pump that can be used with the embodiments disclosed herein are described in U.S. Patent Application Publication No. 2013/0263932, filed on Mar. 15, 2013, the contents of which are herein incorporated by reference in its entirety. Although the embodiments of the fluid ends **100**, **200** are described herein as a component of a multiplex reciprocating pump, the embodiments of the fluid ends **100**, **200** can be used with other types of equipment.

[0020] As illustrated in FIG. 1 and FIG. 2, the fluid end **100** includes a module **10** (e.g., a unitary metallic body) having an intermediate flow bore **11** in fluid communication with a discharge flow bore **12** at one end thereof and a suction flow bore **13** at an opposite end thereof. The internal components of the fluid end **100**, including a reciprocating plunger to pump fluid into the suction flow bore **13** and a valve to control fluid flow into the discharge flow bore **12**, have not been illustrated for clarity of the description of the fluid end **100**. The fluid end **100** includes a valve cover assembly **110** on one side **10a** thereof, and a liner retainer

assembly 120 at a second side 10b thereof. The valve cover assembly 110 and the liner retainer assembly 120 are located at opposite ends of the flow bores 11, 12, 13.

[0021] The valve cover assembly 110 includes a retaining flange 15 that is attached to one side 10a of the module 10 by one or more flange retaining nuts 16. The retaining flange 15 includes a threaded bore into which a threaded gland 18 is threaded to retain a plug 17 within the module 10. The threaded gland 18 can be un-threaded from the retaining flange 15 to remove the plug 17 and provide access to the components within the module 10 without having to remove the retaining flange 15. The retaining flange 15, the threaded gland 18, and the plug 17 are configured to contain pressurized fluid flowing through the flow bores 11, 12, 13 within the body 10 during operation of the fluid end 100.

[0022] The liner retainer assembly 120 includes a retaining flange 22 that is attached to the second side 10b of the module 10 by one or more flange retaining nuts 23. The retaining flange 22 includes a threaded bore within which a threaded gland 21 is received to retain a liner 20 against a liner seal 24 that is held within the module 10. The threaded gland 21 includes internal threads that are threaded into engagement with external threads formed on the outer surface from the liner 20. The retaining flange 22, the threaded gland 21, the liner 20, and the liner seal 24 are configured to contain pressurized fluid flowing through the flow bores 11, 12, 13 within the body 10 during operation of the fluid end 100.

[0023] As illustrated in FIG. 3, the valve cover assembly 110 further includes one or more pistons 14 that are at least partially disposed within bores 10c extending inwardly of the module 10. The pistons 14 are biased inwardly of the module 10 by one or more biasing members 19, such as springs, which at a first end thereof bear against a circumferential flange portion 26 extending around the pistons 14. The biasing members 19 and the pistons 14 are retained within the bores 10c of the module 10 by one or more piston retaining nuts 25 that are coupled to the module 10, and against which a second end of the biasing members 19 bear.

[0024] The piston retaining nuts 25 are threaded into threaded counterbores extending into the one side 10a of the module 10 to contain the biasing members 19 and the pistons 14 within the module 10. One or more seals can be disposed between the pistons 14 and the piston retaining nuts 25, as well as between the flange portions 26 of the pistons 14 and the module 10, to form a seal between adjacent surfaces. Pressurized fluid can be supplied into chambers 28, which are formed within the module 10 below the pistons 14, via one or more fluid paths 27 disposed through the module 10 to cause the pistons 14 to move against the force of the biasing members 19, as further described below with respect to FIGS. 4A-4C.

[0025] The pistons 14, in combination with the flange retaining nuts 16, are configured to bias the retaining flange 15 against the one side 10a of the module 10. The pistons 14 extend through the biasing members 19 and the piston retaining nuts 25, and into corresponding openings formed in the retaining flange 15 for connection therein to the flange retaining nuts 16. The flange retaining nuts 16 include an inner threaded bore 16a which is threaded into engagement with the threaded upper ends 14a of the pistons 14 until a shoulder of the flange retaining nuts 16 contacts the upper surface of the retaining flange 15. To secure the retaining flange 15 to one side 10a of the module 10, the biasing

members 14 apply a force onto the flange portion 26 of the pistons 14 to bias the pistons 14 inwardly of the bores 10c, which biases the flange retaining nuts 16 and the retaining flange 15 over which they are positioned against the one side 10a of the module 10, thereby biasing the threaded gland 18 against the plug 17. Thus, the valve cover assembly 110 provides a force on the plug 17 to effectively seal and contain pressurized fluid within the module 10 during operation of the fluid end 100.

[0026] As further illustrated in FIG. 3, the liner retainer assembly 110 likewise includes one or more pistons 29 that are at least partially disposed within bores 10d extending inwardly of the module 10 at the second side 10b. The pistons 29 are biased inwardly of the module 10 by one or more biasing members 30, such as springs, which contact a flange portion 31 of the pistons 29. The biasing members 30 and the pistons 29 are retained within the bores 10d of the module 10 by one or more piston retaining nuts 35 that are coupled to the module 10, and against which a second end of the biasing members 30 bear.

[0027] The piston retaining nuts 35 are threaded into threaded counterbores of the module 10 to contain the biasing members 30 and the pistons 29 within the module 10. One or more seals can be disposed between the pistons 29 and the piston retaining nuts 35, as well as between the flange portions 31 of the pistons 29 and the module 10, to form a seal between adjacent surfaces. Pressurized fluid can be supplied into chambers 33, which are formed within the module 10 below the pistons 29, via one or more fluid paths 32 disposed through the module 10 to move the pistons 29 against the force of the biasing members 30, as further described below with respect to FIGS. 5A-5C.

[0028] The pistons 29 extend through the biasing members 30 and the piston retaining nuts 35, and into corresponding openings formed in the retaining flange 22 for connection to the flange retaining nuts 23. The flange retaining nuts 23 are threaded into engagement with the upper ends of the pistons 29 until a shoulder of the flange retaining nuts 23 contacts the upper surface of the retaining flange 22. In this manner, the biasing members 30 apply a bias against the flange portion 31 of the pistons 29, which pulls the flange retaining nuts 23 and the retaining flange 22 toward the module 10, thereby forcing the threaded gland 21 and the liner 20 against the liner seal 24. The liner retainer assembly 110 provides a force on the liner seal 24 to effectively seal and contain pressurized fluid within the module 10 during operation of the fluid end 100.

[0029] FIG. 4A, FIG. 4B, and FIG. 4C illustrate sectional views of the valve cover assembly 110 during installation, according to one embodiment. Referring to FIG. 4A, after the plug 17 is installed in the module 10 (as shown in FIG. 2), the retaining flange 15 is positioned on the module 10 such that the pistons 14 extend through the corresponding openings formed in the retaining flange 15. The threaded gland 18 can be threaded into the retaining flange 15 and onto the plug 17 (as shown in FIG. 2).

[0030] Referring to FIG. 4B, pressurized fluid (identified by reference arrow "F") is supplied into the chambers 28 via the fluid paths 27. The pressurized fluid forces the pistons 14 to extend further outwardly from the module 10 against the force of the biasing members 19 and thereby compress the biasing members 19. The pressurized fluid is supplied at a pressure sufficient to generate a force on the flange portion 26 of the pistons 14 that compresses the biasing members 19

between the flange portion 26 and the piston retaining nuts 25. While the chambers 28 are pressurized and the pistons 14 are compressing the biasing members 19, the flange retaining nuts 16 can be threaded onto the upper ends of the pistons 14 until the shoulder of the flange retaining nuts 16 contacts the upper surface of the retaining flange 15.

[0031] Referring to FIG. 4C, after the flange retaining nuts 16 are coupled to the pistons 14, the pressurized fluid is vented from the chambers 28 and/or the pressure within the chambers 28 is reduced such that the biasing members 19 create a force on the pistons 14 that forces the pistons 14 to pull the retaining flange 15 and the threaded gland 18 against the plug 17 to seal off the flow bores 11, 12, 13 of the module 10. In this manner, the plug 17 is held within the module 10 by the force produced by the biasing members 19 acting on the pistons 14.

[0032] To remove the retaining flange 15, the installation process described with respect to FIGS. 4A-4C can be repeated in reverse order. Pressurized fluid may be supplied into the chambers 28 to force the pistons 14 to compress the biasing members 19 and at least partially extend the flange retaining nuts 16 away from the retaining flange 15 to unscrew the flange retaining nuts 16 from the pistons 14. The pressurized fluid can be released from the chambers 29 before unthreading the threaded gland 18 from the retaining flange 15. Alternatively, the threaded gland 21 can be unscrewed while supplying pressurized fluid into the chambers 28. By extending the flange retaining nuts 16 away from the module 10, the frictional sticking force between the underside of the flange retaining nuts 16 and the retaining flange 15 is reduced or eliminated, enabling the removal of the flange retaining nuts 16 and the retaining flange 15 without the high torque required in the prior art.

[0033] FIG. 5A, FIG. 5B, and FIG. 5C illustrate sectional views of the liner retainer assembly 120 during installation, according to one embodiment. Referring to FIG. 5A, after the liner seal 24 and the liner 20 are installed in the module 10 (as shown in FIG. 2), the retaining flange 22 is positioned on the module 10 such that the pistons 29 extend through the corresponding openings formed in the retaining flange 22. The threaded gland 21 can be threaded into the retaining flange 22 and onto a shoulder of the liner 20.

[0034] Referring to FIG. 5B, a pressurized fluid (identified by reference arrow "F") is supplied into the chambers 33 via the fluid paths 32. The pressurized fluid forces the pistons 29 to extend further outwardly from the module 10 against the force of the biasing members 30. The pressurized fluid is supplied at a pressure sufficient to generate a force on the flange portion 31 of the pistons 29 that compresses the biasing members 30 between the flange portion 31 and the piston retaining nuts 35. While the chambers 33 are pressurized and the pistons 29 are compressing the biasing members 30, the flange retaining nuts 23 are threaded onto the upper ends of the pistons 19 until the shoulder of the flange retaining nuts 23 contacts the upper surface of the retaining flange 22.

[0035] Referring to FIG. 5C, after the flange retaining nuts 23 are coupled to the pistons 29, the pressurized fluid can be released from the chambers 33 and/or the pressure within the chambers 33 can be reduced such that the biasing members 30 create a force on the pistons 29 that biases the pistons 29 inwardly of the module 10 to bias the retaining flange 22 and the threaded gland 21 against the liner 20 and the liner seal 24 to seal off the flow bores 11, 12, 13 of the module 10. In

this manner, the liner seal 24 is held within the module 10 by the force produced by the biasing members 30 acting on the pistons 29.

[0036] To remove the retaining flange 22, the installation process described with respect to FIGS. 5A-5C can be repeated in reverse order. Pressurized fluid may be supplied into the chambers 33 to force the pistons 29 to compress the biasing members 19 and at least partially extend the flange retaining nuts 23 away from the retaining flange 22 to unscrew the flange retaining nuts 23 from the pistons 29. The pressurized fluid can be released from the chambers 33 before unthreading the threaded gland 21 from the retaining flange 22. Alternatively, the threaded gland 21 can be unscrewed while supplying pressurized fluid into the chambers 33. As with the retaining flange 15, the retaining flange 22 is thus removed with lower unthreading torque on the flange retaining nuts 23.

[0037] FIG. 6 illustrates a sectional view of a fluid end 200. The fluid end 200 has many similar elements as the fluid end 100 and a full description of all the elements will not be repeated for brevity. Some elements of the fluid end 200 that are similar to the elements of the fluid end 100 are identified with the same reference number but having a 200 series designation. The embodiments of the fluid end 200 can be used with the embodiments of the fluid end 100 and vice versa.

[0038] The fluid end 200 includes a module 210 (e.g., a unitary metallic body) having a valve cover assembly 201 coupled to one side, and a liner retainer assembly 202 coupled to another side. The valve cover assembly 201 and the liner retainer assembly 202 are located at opposite ends of one or more flow bores formed through the module 210. The valve cover assembly 201 and the liner retainer assembly 201 are configured to effectively seal and contain pressurized fluid within the module 210 during operation of the fluid end 200.

[0039] The valve cover assembly 201 includes a retaining flange 215 that is attached to the module 210 by one or more flange retaining nuts/bolts 216. The retaining flange 215 includes a threaded bore into which a threaded gland 218 is threaded to retain a plug 217 within the module 210. The threaded gland 218 can be un-threaded from the retaining flange 215 to remove the plug 217 and provide access to the components within the module 210 without having to remove the retaining flange 215. The retaining flange 215, the threaded gland 218, and the plug 217 are configured to contain pressurized fluid flowing through the flow bores within the module 210 during operation of the fluid end 200.

[0040] The valve cover assembly 201 further includes a piston 214 that is at least partially disposed within a bore of the threaded gland 218. The piston 214 is biased toward the module 210 by one or more biasing members 219, such as springs, which at a first end thereof bear against a flange portion 226 extending around the piston 214. The biasing members 219 and the piston 214 are retained within the bore of the threaded gland 218 by a piston retaining nut 225 that is coupled to the threaded gland 218, and against which a second end of the biasing members 219 contact. An upper portion of the piston 214 extends through a bore of the piston retaining nut 225.

[0041] The piston retaining nut 225 is threaded into engagement with internal threads formed in the bore of the threaded gland 218 to contain the biasing members 219 and the piston 214. One or more seals can be disposed between

the piston 214 and the piston retaining nut 225, as well as between the piston 214 and the threaded gland 218, to form a seal between adjacent surfaces. Pressurized fluid can be supplied into a chamber 228, which is formed within the threaded gland 218 below the flange portion 226 of the piston 214, via one or more fluid paths 227 that are disposed through the piston 214. The pressurized fluid supplied into the chamber 228 causes the piston 214 to move against the force of the biasing members 219, as further described below with respect to FIGS. 7A-7C.

[0042] The liner retainer assembly 202 is coupled to another side of the module 210. The liner retainer assembly 202 includes a retaining flange 222 that is attached to a retention body 240 by one or more pistons 229 and one or more flange retaining nuts 223. The retaining flange 222 has one or more handles 243 for ease of handling during installation and removal. A spacer 241 is positioned between the retention body 240 and the module 210. One or more nuts 245 and bolts 244 are used to couple the retention body 240 and the spacer 241 to the module 210.

[0043] The retaining flange 222, the retention body 240, and the spacer 241 include a bore through which a liner 220 is positioned to secure a liner seal 224 within the module 210. The liner 220 includes an outer shoulder 221 that is disposed between one end of the retaining flange 222 and an inner shoulder of the retention body 240. The retaining flange 222, the retention body 240, the spacer 241, the liner 220, and the liner seal 224 are configured to contain pressurized fluid flowing through the flow bores within the module 210 during operation of the fluid end 200.

[0044] The pistons 229 are biased toward the module 210 (and inwardly relative to the retention body 240) by one or more biasing members 230, such as springs, which contact a flange portion 231 of the pistons 229 at a first end. The biasing members 230 and the pistons 229 are retained within the retention body 240 by one or more piston retaining nuts 235 that are coupled to the retention body 240, and against which a second end of the biasing members 230 contact. The piston retaining nuts 235 are threaded into threaded counterbores of the retention body 240 to contain the biasing members 230 and the pistons 229. One or more seals can be disposed between the pistons 229 and the piston retaining nuts 235, as well as between the flange portions 231 of the pistons 229 and the retention body 240, to form a seal between adjacent surfaces.

[0045] An upper portion of the pistons 229 extends through the biasing members 230 and the piston retaining nuts 235, and into corresponding openings formed in the retaining flange 222 for connection to the flange retaining nuts 223. The flange retaining nuts 223 are threaded into engagement with the upper ends of the pistons 229 until the flange retaining nuts 223 contact the upper surface of the retaining flange 222. The biasing members 230 apply a bias against the flange portion 231 of the pistons 229, which pulls the flange retaining nuts 223 and the retaining flange 222 against the outer shoulder 221 of the liner 220, thereby forcing or retaining the liner 220 against the liner seal 224, as further described below with respect to FIGS. 8A-8C.

[0046] FIG. 7A, FIG. 7B, and FIG. 7C illustrate sectional views of the valve cover assembly 201 during installation, according to one embodiment. Referring to FIG. 7A, the retaining flange 215 is bolted to the module 210 using the flange retaining nuts/bolts 216. The plug 217 is installed in the module 210 before or after the retaining flange 215 is

attached to the module 210. The threaded gland 218 is threaded into the retaining flange 215 until a lower portion 250 of the piston 214 engages a top surface of the plug 217. The lower portion of 250 of the piston 214 is disposed through a bore formed in the bottom end of the threaded gland 218.

[0047] Referring to FIG. 7B, pressurized fluid (identified by reference arrow "F") is supplied into the chamber 228 via the fluid paths 227. The pressurized fluid forces the piston 214 to move away from the plug 217 and against the force of the biasing members 219, thereby compressing the biasing members 219. The pressurized fluid is supplied at a pressure sufficient to generate a force on the flange portion 226 of the piston 214 that compresses the biasing members 219 between the flange portion 226 and the piston retaining nut 225.

[0048] Referring to FIG. 7C, while the chamber 228 is pressurized and the piston 214 is compressing the biasing members 219, the threaded gland 218 can be threaded further into the retaining flange 215 until the lower portion 250 of the piston 214 engages the top surface of the plug 217. The pressurized fluid is then vented from the chamber 228 and/or the pressure within the chamber 228 is reduced such that the biasing members 219 create a force on the piston 214 that forces the piston 214 against the plug 217. In this manner, the plug 217 is held within the module 210 by the force produced by the biasing members 219 acting on the pistons 214. To remove the retaining flange 215, the installation process described with respect to FIGS. 7A-7C can be repeated in reverse order.

[0049] FIG. 8A, FIG. 8B, and FIG. 8C illustrate sectional views of the liner retainer assembly 202 as shown in FIG. 6 during installation, according to one embodiment. Referring to FIG. 8A, the spacer 241 and the retention body 240 are coupled to the module 210 via the nuts 245 and bolts 244. The liner 220 is inserted into the bores of the retention body 240 and the spacer 241 and against the liner seal 224 disposed within the module 210 (as shown in FIG. 6). The retaining flange 222 is inserted into the bore of the retention body 240 such that the outer shoulder 221 of the liner 220 is disposed between the inner shoulder of the retention body 240 and the bottom end of the retaining flange 222. The pistons 229 extend through corresponding openings formed in the retaining flange 222, and the flange retaining nuts 223 are threaded onto the pistons 229 to couple the retaining flange 222 to the retention body 240.

[0050] Referring to FIG. 8B, a pressurized fluid is supplied into chambers 233 formed within the retention body 240 below the flange portion 231 of the pistons 229. The pressurized fluid forces the pistons 229 to extend outwardly from the retention body 240 against the force of the biasing members 230. The pressurized fluid is supplied at a pressure sufficient to generate a force on the flange portion 231 of the pistons 229 that compresses the biasing members 230 between the flange portion 231 and the piston retaining nuts 235. While the chambers 233 are pressurized and the pistons 229 are compressing the biasing members 230, the flange retaining nuts 223 are threaded further onto the upper ends of the pistons 229 and into contact with the upper surface of the retaining flange 222.

[0051] Referring to FIG. 8C, after the flange retaining nuts 223 are threaded further onto the pistons 229, the pressurized fluid can be released from the chambers 233 and/or the pressure within the chambers 233 can be reduced such that

the biasing members 230 create a force on the pistons 229 that biases the retaining flange 222 against the outer shoulder 221 of the liner 220. In this manner, the liner seal 224 is held within the module 210 by the force produced by the biasing members 230 acting on the pistons 229 to force the retaining flange 222 against the liner 220. To remove the retaining flange 222, the installation process described with respect to FIGS. 8A-8C can be repeated in reverse order.

[0052] One advantage of the valve cover assembly 110, 201 and the liner retainer assembly 120, 202 is an increase in worker safety by eliminating the need for using heavy (sledge) hammers during installation and removal. Another advantage is a reduction of the installation and removal time by utilizing a bias member force rather than force supplied by threading a fastener into a retaining flange to seal around the openings in the sides of the modules 10, 210 of the fluid ends 100, 200. Another advantage is that existing fluid end modules can be modified for use with the valve cover assembly 110, 201 and the liner retainer assembly 120, 201 as described herein.

[0053] While the foregoing is directed to certain embodiments, other and further embodiments may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

1. An assembly, comprising:
a body;
a piston extending from the body;
a biasing member biasing the piston into the body; and
a retaining flange coupled to the piston, wherein the retaining flange is biased toward the body by a bias applied to the piston by the biasing member.
2. The assembly of claim 1, wherein the body comprises a module of a fluid end or a separate retention body coupled to the module of the fluid end.
3. The assembly of claim 1, wherein the piston includes a flange portion disposed within the body, and wherein the bias of the biasing member is applied to the flange portion.
4. The assembly of claim 1, wherein the retaining flange is coupled to the piston by a flange retaining nut which engages the retaining flange.
5. The assembly of claim 1, wherein the biasing member is retained within the body by a piston retaining nut that is coupled to the body.
6. The assembly of claim 1, wherein a chamber is formed within the body at a position below the piston such that application of pressurized fluid into the chamber moves the piston against the bias of the biasing member.
7. The assembly of claim 1, further comprising a threaded gland coupled to the retaining flange and configured to retain at least one of a plug, a liner, and a liner seal within or against the module.
8. The assembly of claim 1, wherein the body comprises a separate retention body coupled to a module of a fluid end, and wherein the retaining flange is biased toward the retention body to retain a liner against the module.

9. A method of installing an assembly, comprising:
positioning a retaining flange relative to a body such that a piston extending from the body extends into an opening of the retaining flange;
supplying pressurized fluid into a chamber formed in the body to move the piston against a bias applied on the piston by a biasing member disposed within the body;
coupling a flange retaining nut to the piston such that the flange retaining nut engages the retaining flange; and
forcing the retaining flange toward the body by the force applied to the piston by the biasing member.

10. The method of claim 9, wherein the body comprises a module of a fluid end or a separate retention body coupled to the module of the fluid end.

11. The method of claim 9, further comprising reducing pressure within the chamber such that the force applied to the piston by the biasing member forces the piston into the body.

12. The method of claim 9, wherein the piston includes a flange portion disposed within the body, and wherein the force of the biasing member is applied to the flange portion.

13. The method of claim 9, further comprising threading a threaded gland into the retaining flange to retain at least one of a plug, a liner, and a liner seal within or against the module.

14. The method of claim 9, wherein the body comprises a separate retention body coupled to a module of a fluid end, and wherein the retaining flange is biased toward the retention body to retain a liner against the module.

15. An assembly, comprising:
a module;
a threaded gland coupled to the module;
a piston at least partially disposed within the threaded gland; and
a biasing member disposed within the threaded gland and biasing the piston toward the module.

16. The assembly of claim 15, wherein the biasing member is retained within the threaded gland by a piston retaining nut that is coupled to the threaded gland.

17. The assembly of claim 15, wherein the piston includes a flange portion disposed within the threaded gland, and wherein the bias of the biasing member is applied to the flange portion.

18. The assembly of claim 17, wherein a chamber is formed within the threaded gland at a position below the flange portion such that application of pressurized fluid into the chamber moves the piston against the bias of the biasing member.

19. The assembly of claim 18, wherein a fluid path is formed through the piston to supply pressurized fluid to the chamber.

20. The assembly of claim 19, wherein a lower portion of the piston extends through a bore formed in a bottom end of the threaded gland.

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