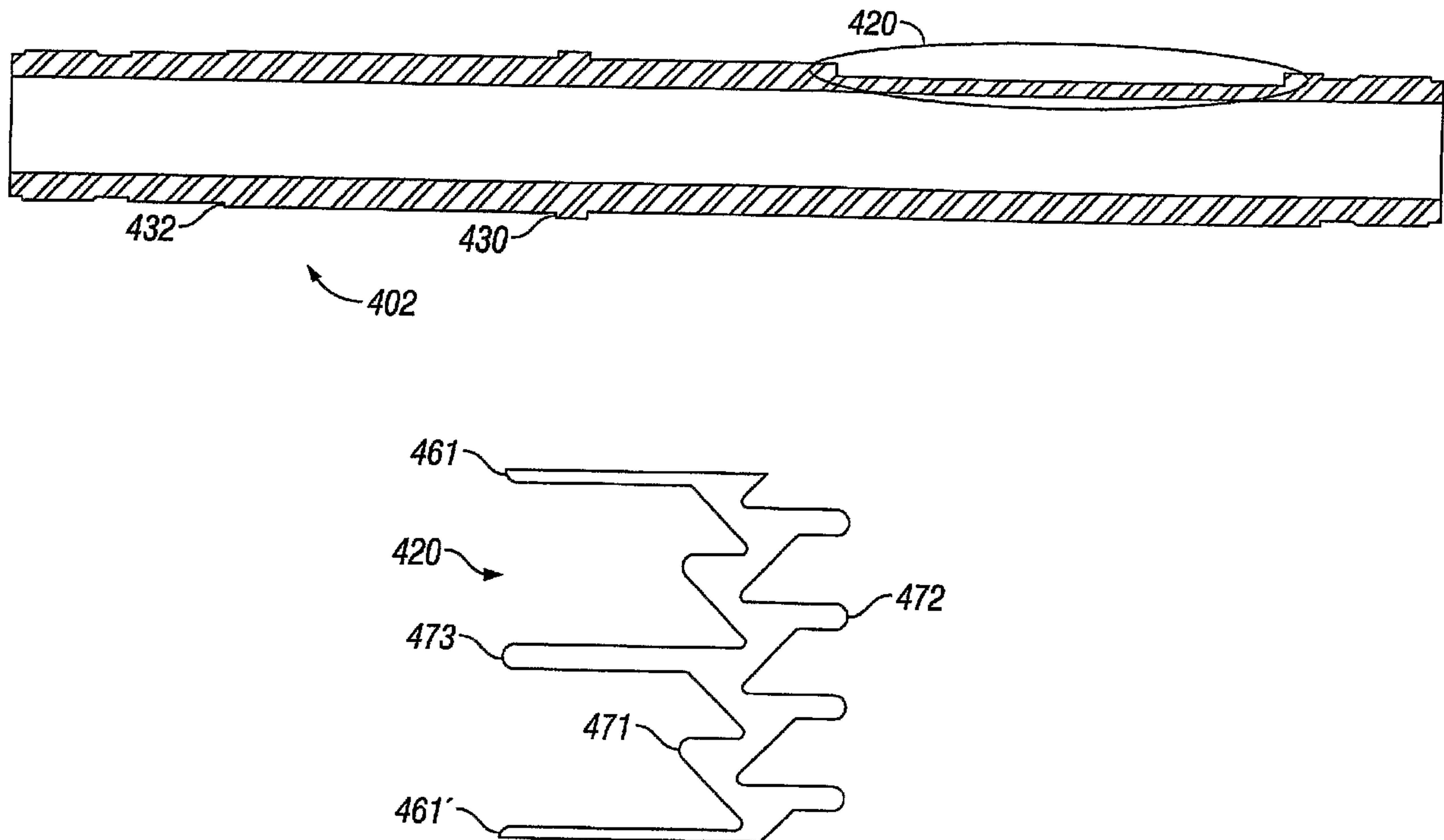




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(57) **Abrégé/Abstract:**

System, devices, and methods are described relating to the treatment (e.g., perforating, fracturing, foam stimulation, acid treatment, cement treatment, etc.) of well-bores (e.g., cased oil and/or gas wells). In at least one example, a method is provided for treatment of a region in a well, the method comprising: positioning, in a well-bore, a packer above the region of the well-bore, fixing, below the region, an expansion packer, treating the region, the treatment fixing the packer, moving the expansion packer, and moving the packer after the moving of the expansion packer.

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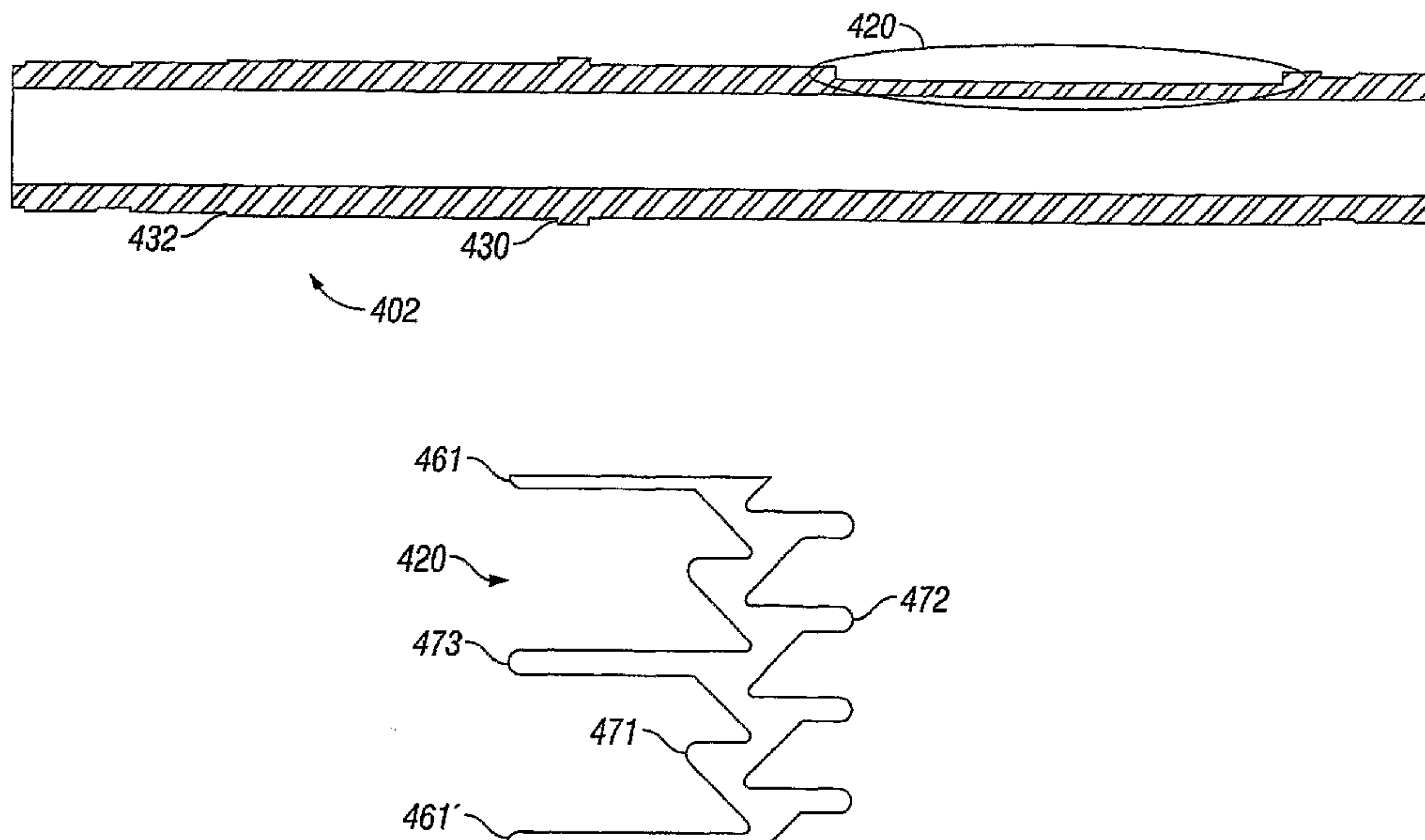
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(57) Abstract: System, devices, and methods are described relating to the treatment (e.g., perforating, fracturing, foam stimulation, acid treatment, cement treatment, etc.) of well-bores (e.g., cased oil and/or gas wells). In at least one example, a method is provided for treatment of a region in a well, the method comprising: positioning, in a well-bore, a packer above the region of the well-bore, fixing, below the region, an expansion packer, treating the region, the treatment fixing the packer, moving the expansion packer, and moving the packer after the moving of the expansion packer.

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## Well Treatment Device, Method, and System

### Background

[0001] The invention relates to tools and methods of treatment of well-bores that are used,  
5 for example, in the exploration and production of oil and gas.

[0002] In many of the well-bores (as illustrated, for example, in U.S. Patent No. 6,474,419,) so-called “packers” are run in on a work string (for example, coiled tubing), to allow for treatment of the well-bore by perforation of casing and/or fracturing operations.  
10 The packers become stuck in the well-bore, however, resulting in lost tools and, sometimes, loss of the entire well.

[0003] There is a need, therefore, for improved well treatment devices, systems, and methods.

Summary of the Invention

[0004] It is an object of at least some examples of the present invention to provide for well-treatment devices, systems, and methods, that reduce the chance of having a tool stuck in a well and/or for more efficient well-treatment procedures.

[0005] In at least one example of the invention, a method is provided for treatment of at least one region in a well, the method comprising:

positioning, in a well-bore, a first packer above the region of the well-bore,  
fixing, below the region, an expansion packer,  
treating the region,  
moving the expansion packer longitudinally in the well, and  
moving the first packer after the moving of the expansion packer.

[0006] In at least one, more specific example, the moving of the expansion packer comprises longitudinally moving a mandrel with respect to the first packer. In a more specific example, the moving of the expansion packer comprises movement of a packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve. In an even more specific example, the first packer comprises a cup packer; in at least some alternative examples, the first packer comprises an expansion packer (for example, a compressible expansion packer).

[0007] In still a more specific example, a further step is provided of opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the packer mandrel. In at least one such example, the opening a valve occurs below the expansion packer.

[0008] In a further example, the step of moving the first packer comprises, first, lowering the first packer below the treated region, and the step of moving the first packer then comprises raising the first packer after the step of lowering the first packer.

[0009] According to still another example of the invention, a system is provided for treatment of the region in a well, the system comprising: a first packer, a first packer mandrel disposed radially inward of the first packer, an expansion packer, an expansion packer mandrel disposed radially inward of the expansion packer, means for treating the region,

wherein the means for treating the region is disposed between the first packer and the expansion packer, means for moving the expansion packer, and means for moving the first packer after the moving of the expansion packer.

[0010] In at least one such system, the means for moving of the expansion packer comprises means for longitudinally moving a mandrel with respect to the first packer. In a further system, the means for moving of the expansion packer comprises a packer mandrel having a substantially rigid connection (either direct or indirect) a first packer mandrel, wherein the first packer mandrel slides within the first packer sleeve. In at least one further example, a means is provided for equalizing pressure above and below the expansion packer before the moving of the first packer. In some such examples, the means for equalizing comprises a valve operated by movement of the packer mandrel and communicating the region with a portion of the well-bore below the expansion packer. At least one acceptable valve comprises an opening below the expansion packer.

[0011] In still a further example, the means for treating the region comprises a substantially cylindrical member having slots disposed therein.

[0012] In yet other examples, means for moving the expansion packer comprises a shoulder on the mandrel engaging a guide, and the means for moving the first packer after the moving of the expansion packer comprises:

- a first packer sleeve slideably mounted on the first packer mandrel,
- a shoulder on the mandrel, and
- a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the mandrel.

[0013] According to another example of the invention, a packer system is provided comprising:

- a mandrel,
- a sleeve disposed around the mandrel in a longitudinally sliding relation, and
- a packer element fixed to the sleeve.

[0014] In at least one such example, a shoulder resides on the sleeve abutting a shoulder on the packer element; a thimble engages the packer element at a first thimble surface; and a

retainer ring is threaded on the sleeve. The retaining ring engages the thimble on a second thimble surface. In still another example, a first wiper ring is attached to a first end of the sleeve, and a second wiper ring is attached to the retainer ring. In at least some such examples, a seal is disposed between the sleeve end of the housing.

[0015] In some further examples, the sleeve comprises a packer element carrier section having an outer threaded diameter and a stroke housing, the stroke housing having an inner threaded diameter engaging the outer threaded diameter of the packer element carrier. In even further examples, a wiper is connected to an interior diameter of the stroke housing; a seal is disposed between the stroke housing and the mandrel; and a seal is disposed between the stroke housing and the packer element carrier section. In at least some such examples, the packer element carrier section comprises a shoulder; the packer element is disposed between the shoulder and a retainer; and the retainer is threaded to the packer element carrier. In at least one example, a debris barrier is disposed in an interior surface of the retainer. In some examples, the packer element comprises a cup packer element. In further examples, the packer element comprises an expansion packer (e.g. compressible) element.

[0016] According to still a further example of the invention, a method is provided for treating a well, the method comprising:

- positioning a compressible expansion packer in the well-bore, the expansion packer being rigidly-connected to an expansion packer mandrel connect to a work string,
- setting the expansion packer in the well-bore with a longitudinal motion of the work string,
- treating the well,
- opening a valve below the expansion packer with a further longitudinal motion of the work string, and
- raising the packer.

[0017] At least one such method further comprises positioning a packer in the well-bore above the expansion packer, rigidly connected to a cup packer sleeve. The cup packer sleeve is slideably connected to a cup packer mandrel, and the cup packer mandrel is connected to the work string and to the packer mandrel (at least indirectly).

[0018] In at least a further example of the invention, a system is provided for treating a well-bore on a work string, the system comprising:

an expansion packer mandrel for substantially rigid-connection to the work string,  
means for setting a compressible expansion packer in a well-bore with a longitudinal motion of the work string,  
means for treating the well,  
means, below the expansion packer, for equalizing a pressure differential across the expansion packer, and  
means for raising the expansion packer.

[0019] In at least one such example, the means for setting the compressible expansion packer comprises at least one J-slot on the expansion packer mandrel interacting with at least one J-pin on a slip ring disposed about the expansion packer mandrel.

[0020] In at least a further example, the means for treating the well comprises a substantially cylindrical member having slots therein.

[0021] In still another non-limiting example, the means for equalizing comprises a valve.

[0022] In yet a further example, the means for raising the expansion packer comprises a stop surface (e.g., a shoulder) on the mandrel and a stop surface on the expansion packer, wherein the stop surfaces interact to cause the expansion packer to be raised during vertical motion of the expansion packer mandrel.

[0023] In still another example of the invention, a method is provided for treating multiple zones in a cased well-bore, the method comprising:

fixing an expansion packer of a work string below a first zone,  
perforating the cased well-bore above the expansion packer,  
applying between the work string and the cased well-bore, a stimulation fluid through the perforated well-bore,  
equalizing the pressure above and below the expansion packer,  
fixing the expansion packer at a second zone, the second zone being over the first zone,



perforating the cased well-bore above the expansion packer,  
applying, between the work string and the cased well-bore, a stimulation fluid  
through the perforated well-bore,  
equalizing the pressure above and below the expansion packer, and  
raising the expansion packer.

[0024] In at least one such method the equalizing comprises opening a valve below the expansion packer. In a further example, the opening comprises moving a valve port connected to an expansion packer mandrel from contact with a valve seat connected to a drag sleeve.

[0025] Still a further example of the invention provides a system for treating multiple zones in a cased well-bore, the system comprising:

means for perforating the cased well-bore above the expansion packer,  
means for applying, between the work string and the cased well-bore, a stimulation fluid (e.g. fracturing fluid, foam, etc.) through the perforated well-bore,  
means for equalizing the pressure above and below the expansion packer, and  
means for raising the expansion packer.

[0026] In at least one such system, the means for equalizing comprises a valve below the expansion packer. In a further system, the means for equalizing also comprises a valve port connected (directly or indirectly) to an expansion packer mandrel, the valve port reciprocating from contact with a valve seat connected to a drag sleeve. In still another example, the means for perforating the cased well comprises a jetting tool; while, in yet another example, the means for applying comprises a surface pump connected between the well casing and the work string, and the means for raising the expansion packer comprises a connection between an expansion packer guide and an expansion packer mandrel.

[0027] An even further example of the invention provides an expansion packer device comprising:

a mandrel having a substantially cylindrical bore therethrough,  
a compressible packer element disposed about the mandrel,  
a set of casing-engaging elements disposed about the mandrel,  
a set of drag elements disposed about the mandrel,

a set of slots in an outer surface of the mandrel,  
a set of slot-engaging elements engaging the set of slots and disposed about the mandrel, the slot-engaging elements being longitudinally and radially moveable about the mandrel,  
a valve port located outside the cylindrical bore and below the set of slots, and  
a valve seat located outside the valve port.

[0028] In at least one such expansion packer, the valve port is located below the mandrel. In a further example of the invention, a drag sleeve is provided in a longitudinally-slideable relation to the mandrel, and the drag sleeve comprises the valve seat. In yet a further example, the drag sleeve further comprises openings above the valve seat. In still another example, the valve seat is longitudinally adjustable with respect to the valve port. In an even further example, the valve port is located below the mandrel and is positioned between elastomer, grooved seals that have, for example, a concave surface.

[0029] In at least one example, the drag sleeve also comprises: a slide member in longitudinally-slideable engagement with the mandrel and a seat housing, longitudinally and adjustably attached to the slide member. In at least one such example, the seat housing is threaded to the slide member. In a further such example, rotation of the seat housing on threads connecting the seat housing to the slide member adjusts a longitudinal distance the valve ports travel to engage the valve seat.

[0030] Still another example of the invention provides a well fracturing tool comprising:  
a cylinder having longitudinal slots therein,  
threads located at a packer-engaging end of the cylinder,  
wherein a portion of the slots located closest to the packer-engaging end is between about 10" and about 14" from the packer-engaging end.

[0031] In at least one such tool, the portion of the slots located closest to the packer-engaging end is about 13" from the packer-engaging end.

[0032] The above list of examples is not given by way of limitation. Other examples and substitutes for the listed components of the examples will occur to those of skill in the art. Further, as used throughout this document the description of relative positions between parts

that relate to vertical position are also intended to apply to non-vertical well bores. For example, in a well-bore having a slanted component, or even a horizontal component, a port is "above" or "over" another port if it is closer (along the well-bore) to the surface than the other port. Thus, a cup packer that is in a horizontal well-bore is "above" an expansion packer in the same well-bore if, when the cup packer is removed from the well-bore, it precedes the expansion packer.

Detailed Description of the Drawings

[0033] Figure 1 is a side view of an example embodiment of the invention.

[0034] Figure 1A is a side view of an enlargement of a portion of the example of Figure 1.

[0035] Figure 2 is a side view of a set of enlargements of a portion of the example of Figures 1 and 1A.

[0036] Figure 3 is a sectional view of a portion of an example of the invention.

[0037] Figures 3A – 3D are sectional views of a portion of an example of the invention.

[0038] Figure 4 is a sectional view of a portion of an example of the invention.

[0039] Figures 4A – 4B are sectional views of a portion of an example of the invention.

[0040] Figure 4C is a flattened view of a portion of a surface of a cylindrical member example of the invention.

[0041] Figures 4D – 4K are sectional views of a portion of an example of the invention.

[0042] Figures 5A – 5D are sectional views of an example of the invention in a “run-in” state.

[0043] Figures 6A – 6D are sectional views of an example of the invention in a “treat” state.

[0044] Figures 7A – 7D are sectional views of an example of the invention in a “pressure relief” state.

[0045] Figures 8A – 8B are side views of an example of the invention treating multiple strata.

[0046] Figures 9 – 10 are side views of an example method of use according to an example of the invention.

[0047] Figures 11A – 11C are sectional views of an example of the invention.

Detailed Description of Example Embodiments

[0048] Referring now to Figure 1, a well-site, generally designated by the numeral 1, is seen. In the figure, a well-head 5 that is attached to the ground 3 has blow-out preventers 7 attached to the well head 5. A lubricator 9 is seen connected under injector 11 that injects coiled tubing 12, through lubricator 9, blow-out preventer 7, well-head 5, and into the well-bore. In many situations, the well-bore is cased with casing 15. Seen in the well-bore at an oil and/or gas, strata 13 is an example of the present invention straddling the oil and/or gas strata 13.

[0049] In Figure 1A, an enlargement of the example from Figure 1 is seen in which a cup packer 308 is connected through centralizer section 503, spacer joint 510, ported section 511, expansion packer section 404, and well-bore engagement section 701. Figure 2 and Figures 2A-2F show enlargements of each of the sections discussed above.

[0050] Referring now to Figure 3, a cross-section of an example cup-packer assembly is seen comprising a top connector section 301 that is connected by threads to mandrel 303. A socket set screw 304 prevents connector 301 and mandrel 303 from unscrewing. An O-ring seal 302 (for example, an SAE size 68-227, NBR90 Shore A, 225 PSI tensile, 175% elongation, increases the pressure that can be handled by the assembly, allowing a relatively low pressure thread 317 for the connector.) In at least one example, thread 317 comprises \*2.500-8 STUD ACME 2G, major diameter 2.500/2.494, pitch diameter 2.450/2.430, minor diameter 2.405/2.385, blunt start thread. As used in this example, many of the dimensions (and even other threads) have been found useful in the design of a 5½" casing tool. Similar dimensions, threaded connections, etc., are used in the examples seen in the figures, which will not be described in detail, that also allow for lower pressure treads with secondary seals to be used. Other dimensions and pressure sealing arrangements will be used in other size tools (for example, 4½" and 7" tools) and other pressure considerations that will occur to those of skill in the art.

[0051] Further, connections other than threads, and/or other materials, will be used by those of skill in the art without departing from the invention. In at least one example of the parts seen in the figures, the following rules of thumb are observed (dimensions in inches): (1) machined surfaces .X - .XX 250 RMS, .XXX 125 RMS, (2) inside radii .030-.060; (3) corner breaks .015 x 45°; (4) concentricity between 2 machined surfaces within .015 T.I.R.; (5)

normality, squareness, parallelism of machined surfaces .005 per inch to a max of .030 for a single surface; (6) all thread entry & exit angles to be 25° – 45° off of thread axis. A thread surface finish of 125 is acceptable. Materials useful in many examples of the invention include: 4140-4145 steel, 110,000 MYS, 30-36c HRc. Other rules of thumb that will be useful in other embodiments will occur to others of skill in the art, again without departing from the invention.

[0052] In the example shown, cup retainer 306 holds thimble 307 against cup element 308, which is, itself, held against a shoulder 314a of cup carrier sleeve 309. Cup retainer 306 is threaded to cup carrier sleeve 309, causing cup element 308 to be slideably mounted along and around mandrel 303. Being slideable around mandrel 303 allows cup element 308 to spin, allowing it to clear debris more easily than if it were not able to move in that dimension.

[0053] Cup carrier sleeve 309 is connected, in the illustrated example, by threads and an O-ring seal 313 to stroke housing 310. A piston-T-seal (for example, a Parker 4115-B001-TP031) prevents flow of fluid and pressure from entering between stroke housing 310 and mandrel 303. By using a low-pressure thread (such as an "SB" thread), a wide torque range is enabled, which allows "make up" of the work string with smaller tools. A wiper ring (for example, Parker SHU-2500) is used at the end of stroke housing 310. Similarly, wiper ring 305 also operates as a debris-barrier.

[0054] In operation, which is described more below, cup element 308 slides on cup holder 309 about mandrel 303. Shoulder 314a of cup carrier sleeve 309 and shoulder 314b of mandrel 303 define the travel distance that the mandrel 303 and cup carrier sleeve 309 are able to slide, longitudinally, with respect to each other. Since connector 301 is fixed longitudinally to mandrel 303, if the coiled tubing (which is attached to connector 301) is pulled from above, mandrel 303 will move upward and slide within cup sleeve carrier 309; therefore, cup element 308 does not have to move in order to move mandrel 303. Therefore, tools (such as expansion-packers) that are below cup element 308 can be manipulated longitudinally without the need to move a cup packer fixed above them.

[0055] In at least one example, an expansion packer that is longitudinally operable with J-slots is used, and the travel distance is sufficient to allow a stroke that is larger than the length of the J-slots. It has been found that it is especially useful to allow some distance greater than

the J-slots because, when an expansion packer is being positioned and set, drag elements on the packer (e.g., springs, pads, etc.) will slip. For a 5 ½" tool, for example, about 10" has been found to be sufficient for the travel distance between shoulders 314a and 314b to allow for a 6" J-slot travel.

[0056] Referring now to Figure 4, an example expansion packer assembly is seen. In the illustrated example, expansion packer mandrel 402 is connected by threads backed by a set screw 417 to an upper element 401 (for example, a slotted "sub" used for applying fracturing fluid in some examples). Therefore, when the work string is lifted from above, expansion packer mandrel 402 is lifted. Expansion packer mandrel 402 includes a shoulder 430 against which setting cone 405 abuts. Expansion packer element 404 is slid up against setting cone 405, and guide ring 403 is slid up against expansion packer element 404. The attachment of upper element 401 against guide 403 holds guide 403 against a shoulder 432 in mandrel 402; and, therefore, when setting cone 405 is pushed toward guide 403, longitudinally, element 404 is compressed and expands radially outward from mandrel 402, due to the rigid connection of guide 403 backed by upper element 401. Likewise, when mandrel 402 is lifted from above, shoulder 432 causes guide 403 to move longitudinally away from setting cone 405, allowing decompression and elongation of packer element 404.

[0057] In operation, when a cup packer is set (as seen in Figure 1) above an oil and/or gas containing strata 13, and an expansion packer is set below an oil and/or gas containing strata 13, well treatment (for example, perforation and/or fracturing operations) occur. After treatment, it is desirable to move the expansion packer and/or the cup packer. However, many times, there is a pressure differential across the expansion packer. To relieve that pressure differential, at least one valve port 421 is provided outside of the mandrel 402.

[0058] In the illustrated example, port 421 operates with a valve-seat surface 425 (which has a diameter less than the diameter of surface 423 above openings 421'). Openings 421' are located in equalizing sleeve 416. Ports 421 are provided, in the illustrated example, by threading equalizing housing 600 onto mandrel 402; a set screw is again used to prevent the elements from becoming detached. Referring now to Figure 4D, ports 421 are sealed against surface 425 in equalizing sleeve 416 (Figure 4E) by seals 602a – 602d (for example, nitrile elastomer between about 70 to 90 shore hardness; in higher temperature viton elastomer). Other elastomers will occur to those of skill in the art. In some examples, the seal material



consists essentially of NBR 80 shore A, 2000 PSI Tensile, 300% Elongation. Further, a concave is seen in seals 602a-602d. Such a concave allows a reduction of force needed to put the seal into the seal bore. The dimensions of the seals 602a-602d in some examples are substantially the same as if two o-rings were located in housing 600; for example, the concave in seals 602a-602d is about the same size as the gap that would be formed by two o-rings positioned side-by-side.

[0059] Figure 4K shows an example of seals 602a-602d. For an equalizing housing 600 having a diameter between about 2.640 inches to about 2.645 inches (which is particularly useful in a 4 ½" tool), with a groove width of between about .145" and about .155", and seals 602a-602d have a protrusion distance 645 of about .020 inches from housing 600, while the radius of curvature of concave surface 643 is about .06 inches. In at least one 5 ½" tool example, grooves 603a-603d are between about .145 inches and about .155 inches, and the radius of curvature of groove surface 643 is about .06 inches.

[0060] It will be noted that there is no requirement for a "longitudinal opening" of the type described in U.S. Patent No. 6,474,419, nor is there a need for a valve extending up into the packer mandrel. A significant advantage of the example valve ports being, outside the mandrel (and, in at least some cases, below the mandrel) is that a larger flow path is available than with valves located within the mandrel. This allows the tool to be run in the well-bore faster and causes the tool to have less problems with debris.

[0061] Referring again to Figures 4 and 4F (taken through line "A" of Figure 4G), 4G, 4H, 4I, and 4J, equalizing sleeve 416 is connected by threads to lower component 414 that is slideably mounted (longitudinally and radially in the example shown) around mandrel 402. Lower component 414 covers J-pins 413 that engage a J-slot 420 that is formed in the surface of mandrel 402. J-pins 413 are held in a slip-ring 412 (described in more detail below) that spins around mandrel 402. Threaded to lower component 414 is a slip-stop-ring 410. Again, a set screw 418 prevents lower component 414 and slip-stop-ring 410 from unscrewing. Slip-stop-ring 410 is seen in the top portion of Figure 4 connected to slip ring 409 by slip ring screw 411 (for example, ASME B 18.3 hexagon socket-cap head-screw, 5 1/16" – 18 UNTC x 2.750 long, ASTM A574 alloy steel).

[0062] On the bottom of Figure 4, 180° from slip ring screw 411, slip springs 408 are seen. Springs 408 reside in channel 426 and bias rocker slip 406 against rocker slip retaining ring 407; the biasing action of springs 408 operates against retaining ring 407, causing rocker slip 406 to be biased toward mandrel 402. Therefore, when the packer assembly is being run into the well-bore, the teeth on rocker slip 406 are not engaged with the well-bore.

[0063] Referring now to Figure 4A, mandrel 402 is seen alone, where shoulder 430 and shoulder 401 are more easily seen. Further, J-slot 420 is seen machined into the surface of mandrel 402, in the illustrated example.

[0064] Figure 4B shows the actual shape of J-slot 402, which is formed (e.g., machined) circumferentially around mandrel 402. The top line 461 and bottom line 461' actually do not exist. Those are the lines on which the J-slot 420 joins on the outside of mandrel 402.

[0065] Figure 4F shows slip ring 412, which, in the example embodiment of Figure 4J (taken along line B of Figure 4F) comprises two halves, 412a and 412b, each of which includes a threaded receptacle 481 that mates with threads 483 of J-pin 413 (Figure 4I). Fixing J-pins to slip ring 412, rather than floating them without a substantially fixed, radial connection, reduces wear and other problems caused by debris interfering between J-pins 413 and slip ring 412.

[0066] With the two J-pins 413 (Figure 4), each set 180° apart, there are three states for the expansion packer assembly, depending on where the J-pins are located. During the process in which the expansion packer is being run into the well-bore, the J-pins reside in slot 471. Once the expansion packer is in place, an operator lifts the work string (e.g. coiled tubing) from the surface, which lifts mandrel 402. J-pin 413 then shifts from position 471 (Figure 4B) to position 472. During that shifting, the drag pads 429 (Figure 4) of rocker slip 406 cause friction between the rocker slip 406 and the well-bore. This allows the mandrel 402 to move upward and the J-pin to change positions. Mandrel 402 is then pushed down from above, causing J-pin 413 to again shift from position 472 to position 473 (Figure 4B). This shift causes setting cone 405 (Figure 4) to engage rocker slips 406, causing them to move outward and engage the well-bore. Further movement downward of mandrel 402 causes mandrel shoulder 430 (Figure 4) to move away from setting cone 405, and expansion packer

element 404 expands against the well-bore, sealing the lower portion of the well-bore from the portion of the well-bore above element 404. In this position, ports 421 have moved past opening 421' and are sealed against surface 425.

[0067] When mandrel 402 is again lifted (after treatment operations), J-pin 413 again shifts into position 472 (Figure 4B), causing ports 421 (Figure 4) to again be in fluid communication with opening 421', and pressure is equalized above and below packer element 404. As will be seen in more detail below, the alignments of ports 421 with opening 421' occurs while packer element 404 may still be substantially engaged with the well-bore.

[0068] Also, during treatment operations (such as well fracturing, when fluids containing sand may be used), it has been found that the upper cup packer 308 (Figure 3) can become stuck. However, the cup packer element 308 is mounted on cup carrier sleeve 309, so that cup mandrel 303 (and, therefore, expansion packer mandrel 402) can slide without the need to move cup element 308. This allows the setting and the operation of pressure release below a fixed cup element.

[0069] Referring now to Figure 3A, an assembly view of the cup element assembly is seen. Cup carrier sleeve 309 is positioned to be slid into the cup element assembly such that surface 320a of the cup element 308 engages surface 320b of cup carrier sleeve 309. In various embodiments, cup element 308 comprises an elastomer (for example, an elastomer seal -- for example NBR 80 Shore A), and a spring 308a is imbedded in the elastomer material, mounted to cup element ring 308b, as shown. In many examples, there is a slight outward taper of the inner surface 308c of cup element 308. Thimble 307 holds cup element 308 against cup carrier sleeve 309 by pressing cup surface 316a against cup carrier sleeve shoulder 316b by engaging thimble surface 318a with cup surface 318b. As mentioned with reference to Figure 3, the threading of a cup retainer ring 306 onto sleeve 309 at threads 315 holds the thimble 307, cup element 308 and cup carrier sleeve 309 together.

[0070] Referring now to Figure 3C, the cup carrier sleeve is positioned to be slid over cup mandrel 303 (left to right in the Figure) such that surface 314a of cup carrier sleeve 309 is stopped by shoulder 314a of mandrel 303. A seal 313 is applied around mandrel 303, as shown. Referring now to Figure 3B, stroke housing 310 is slid over mandrel 303 (from the right as in the Figure); then, pin threads 319 on cup carrier sleeve 309 mate with box threads

319' on stroke housing 310. The connection between cup carrier sleeve 309 and stroke housing 310 is sealed with another seal 313. At the end of stroke housing 310 a wiper ring (not shown) is mounted in wiper ring receptacle 312 (Figure 3B). Figure 3D shows a common seal 313 used in connection with stroke housing 310 and cup carrier sleeve 309.

[0071] Referring to Figures 5A-5D, an example of a system is seen in the "run-in" position (that is, the "state" or positions of the components when seen run into a well-bore). In Figure 5A, connector 301 comprises two components 301a and 301b. The form of connector 301 varies depending on a variety of considerations including size, type of work string, treatment method, and other considerations that will occur to those with skill in the art. Cup retainer 306 is run up against connector 301a, and the cup sleeve carrier and stroke housing are in a compressed position with respect to cup mandrel 303.

[0072] In Figure 5B, cup mandrel 303 is seen connected to a centralizer 503 that includes a gauge receptacle 505. In some example embodiments, centralizer 503 does not include a gauge receptacle; however, in the illustrated example, gauge receptacle 505 is provided so that an instrument (for example, a pressure gauge) may be positioned in the well during treatment operations. Having pressure measurements from an area close to the location of treatment helps interpretations of the quality of the treatment compared with pressure readings taken at the surface.

[0073] Figure 11A shows an example centralizer 503 with gauge receptacle 505 drilled through, as more fully illustrated in Figure 11B, taken through line "A" of Figure 11A. There, barrel 571 of centralizer 503 is surrounded by extensions 573, at least one of which has been drilled through to accept a gauge in receptacle 505. The gauge is mounted, in various embodiments, in many ways that will occur to those of skill in the art; there is no particularly best way to mount such a gauge in receptacle 505.

[0074] Centralizer 503 is seen in Figure 5B connected to space cylinder 510, which is, in turn, connected to ported member 401, which includes port 511. For simplicity, not all of ported member 401 is seen in Figure 5B.

[0075] A more complete view of ported member 401 is seen in Figure 4C, where slots 511 are formed in a generally cylindrical member 401 that includes an erosion zone 551 between

slots 511 and also includes a box thread connector end 553 for connection to an expansion packer assembly. The erosion zone 551 allows erosion of the ported member 401 to occur during treatment -- rather than having erosion occur to the expansion packer assembly. In a 5½" tool, for example, erosion zone 551 is between about 12 inches and about 15 inches long. An optimal length for erosion zone 551 has been found to be about 13 inches. Also seen in erosion zone 551 are flats 562 machined into member 401 to allow for a tool to engage member 401 in order to thread member 401 to, for example, spacer 510 and connector 301. Such flats are also provided on other elements (e.g., flats 563 of connector 301B of Figure 5A, flats 564 of centralizer 503 of Figure 6B, flats 565 of spacer 510 of Figure 7A, and flats 567 of equalizing sleeve 416 of Figure 5C). Such flats may be provided on other components used in and/or with the present invention.

[0076] Referring now to Figure 5C, a lower portion of ported member 401 is seen connected to expansion packer mandrel 402. Because J-pin 413 is in position 471 (Figure 4B) of J-slot 420, the expansion packer assembly is said to be in a "run-in" position, wherein communication between valve port 421 and opening 421' allows fluid communication between the inner bores of mandrel 402, slotted member 401, spacer cylinder 510, centralizer 503, cup packer mandrel 303, and connector 301 (which is attached, in some examples, to a coiled tubing work string.)

[0077] Referring now to Figure 6A-6D, the system is seen in the treatment position wherein J-pin 413 has been shifted from position 471 to position 472 of Figure 4B and then to position 473 by, first, lifting on the coiled tubing, which causes the interconnected mandrels to lift with respect to drag pads 429 that drag against well casing 15. Because of the drag of drag pads 429 mandrel 402 rises, and communication is maintained through ports 421 out of opening 421'. The raising of mandrel 402 causes J-slot 413 and slip ring 412 rotate so that J-pin 413 will engage position 472 (Figure 4B). From position 472, the coiled tubing is lowered, causing mandrel 402 to be lowered with respect to J-pin 413. Such movement causes J-pin 413 to be directed toward position 473 of J-slot 420 (Figure 4B), allowing further lowering of mandrel 402.

[0078] The further lowering, best seen in Figure 6C causes valve ports 421 to be closed against surface 425 and causes setting cone 405 to engage rocker slips 406. Rocker cone 405 forces rocker slips 406 outward to engage casing 15, halting the downward motion of setting

cone 405. Further downward motion of mandrel 402 causes guide 403 to compress expansion packer element 404, which then engages and seals against well casing 15. In such a position, fluid (for example, well fracturing fluid) passes through the bore of connector 301, mandrel 303, centralizer 503 and connector member 510, enters into ported member 401 (Figure 6B), and passes out of port 511.

[0079] The casing at this location has (in some examples) been perforated, causing perforations 22 to communicate the interior of the well casing with oil and/or gas strata 13 (Figure 1). Due to the nature of fracturing fluid, which usually contains solids (for example, sand), and pressure in the bore of slotted member 401, the fracturing fluid passes through perforations 22 (Figure 6B) fracturing zone 13 (Figure 1) and increasing the ability of oil and/or gas to flow from zone 13 into well casing 15.

[0080] Referring again to Figures 6A-6D, fracturing fluid substantially fills the annulus between member 401 and casing 15 (Figure 6B); it then passes above and below slotted member 401. The fluid is stopped by packer element 404 (Figure 6C) and cup packer element 308 (Figure 6A) which is expanded to due the increase in pressure in the annulus between mandrel 303 and casing 15.

[0081] Upon completion of the well treatment, it is desirable to disengage expansion packer 404 and cup packer 308 from well casing 15. However, there is, in many instances, a pressure differential across expansion packer 404 (high pressure above expansion packer 404 and lower pressure below.) Pulling up on expansion packer 404 is difficult due to this pressure, creating a need to relieve the pressure differential. Pulling on cup packer element 308 is, in many instances, not possible; debris during the treatment operation collects above thimble 307. Therefore, the ability of the cup assembly to allow mandrel 303 to slide within cup sleeve carrier 309 without moving cup packer element 308 allows valve ports 421 to become unsealed and communicate with opening 421' with a very small movement of expansion packer guide 403 in a longitudinally vertical direction. During such motion, J-pin 13 (Figure 4B) slides from position 473 again toward position 472, and port 421 and opening 421' are brought into communication (Figure 7C). Pressure is therefore relieved above and below expansion packer element 404 and further vertical movement of mandrel 402 is therefore facilitated. As mandrel 402 continues to rise, guide 403 continues to decompress

element 404 to a point where fluid flows between packer element 404 and well casing 15. Shoulder 430 of packer mandrel 402 engages cone 405 to lift cone 405.

[0082] At this point, J-pin 413 may be brought in alignment with position 471 (Figure 4B) so that a downward motion can be applied to mandrel 303 (Figure 7A and Figure 3) in order to bring connector 301 in contact with cup retainer 306, thimble 307, and cup packer 308. Upon contact, cup packer 308 is forced downward in well casing 15, breaking up and loosening the debris that has been preventing vertical motion of cup packer element 308.

[0083] In some examples, an increase in pressure is applied to the region above cup packer 308 by pumping fluid from above and the annulus between mandrel 303 and well casing 15. In some instances, such an increase facilitates compression of cup packer element 308 from above to disengage cup packer 308 from well casing 15 and allow debris to flow past cup packer 308 into lower portions of well casing 15. In other examples, pumping is not conducted, and the solids and debris suspend slightly in well casing 15; such suspension then allows a vertical motion of mandrel 303 to cause cup packer element 308 to move up well casing 15. In further examples, cup packer 308 is lowered past perforations 22 where it is believed that the debris flows out of perforations 22 into the formation -- facilitating a clearer casing 15 -- thus allowing for vertical motion of cup packer 308.

[0084] Referring again to Figures 5D, 6D, and 7D, attached to equalizing sleeve 416 is locator assembly 612, which is used to give an indication to the operator of when the locator passes a joint or collar in the casing; such locators and other means of locating position in casings are well known to those of skill in the art.

[0085] Referring now to Figure 8A, expansion packer 404 is seen sealing casing 15 below an oil an/or gas containing strata 13a; cup packer element 308 seals casing 15 above an oil an/or gas containing strata 13a, which is in communication with the interior of casing 15 through perforations 22. Dashed arrows show the flow of well fracturing fluid through slot 511 and into strata 13a. After treatment of strata 13a, the packers are disengaged; and, as seen in Figure 8B, they are repositioned to seal above and below an oil an/or gas containing strata 13b, which is then treated. In many well-bores, there are many different, vertically-spaced strata to be treated. Therefore, in many such situations, it is desired to treat the lowest most portion 13a, disengage packers 404 and 308, raise the assembly to straddle strata 13b,

and then treat strata 13b. This process is continued from a lower portion of the well-bore to an upper region for as many oil and/or gas bearing strata as exist in the well-bore.

[0086] However, in some examples (see Figure 9) there is communication between the first oil and/or gas bearing strata 13a and the second oil and/or gas bearing strata 13b; the fact or extent of the communication may or may not be known when treatment is conducted. In such circumstances, fluid (seen as dashed lines in Figure 9) passes through slot 511, into strata 13a, up into strata 13b, and out of perforations 22 in strata 13b. This causes additional debris to be deposited over cup 308. If cup 308 cannot be disengaged, it is then difficult if not impossible to actually treat strata 13a without loss of the packer tool.

[0087] The sliding nature of cup packer element 308 allows recovery of the packer tool in many cases, and it also allows treatment of multiple strata 13 that are in communication with each other. In such a treatment, the straddle distance (between packers 308 and 404) is increased, as seen in Figure 10. Use of a sliding cup carrier sleeve such as seen in Figure 3 or any other longitudinally slideable cup 308 allows the straddle distance to be increased so that multiple zones can be treated in one treatment step. Spacer elements between the cup packer elements (which comprise, in many instances simple cylinders with bores) are used in some examples to.

[0088] In some treatment situations, a cup packer is unneeded. For example, after a well-bore has been formed and casing has been set, the casing needs to be perforated; and, in many cases, the strata 13 needs to be fractured. In many well-bores, there are multiple strata to be perforated and fractured, spaced along the well and separated by non oil and/or gas bearing strata. During treatment, it is desirable to isolate a previously-treated strata from the strata being treated, and so treatment is carried out from the lower-most strata to be treated first. An expansion packer is set below the strata being treated, thus isolating the lower portion of the well from the strata being treated. If the casing above the zone being treated has not been perforated, then there is no communication between the well and the strata above the strata being treated. Treatment of multiple strata are then accomplished, in at least one example, by a method comprising the steps of: fixing an expansion packer of a work string below a first strata; perforating the casing above the expansion packer; applying, between the work string and the cased well-bore, a stimulation fluid (e.g., fracturing fluid) through the perforations, equalizing the pressure above and below the expansion packer; fixing the expansion packer



up at a second zone, the second zone being over the first zone; perforating the casing above the expansion packer; applying, between the work string and the cased well-bore, a stimulation fluid through the perforations; equalizing the pressure above and below the expansion packer; and again raising the expansion packer. The application of the treatment  
5 fluid between the work string and the cased well-bore allows pressure measurements at the surface to more accurately represent the pressure at the perforations without having to account for the friction of fluid passing through the work string bore and through slots (e.g., 511) that would be used if the treatment fluid were passed through the work string.

10 [0089] In at least one example when a treatment process of perforation and treatment between the work string and the well casing is used, no cup packer is positioned in the well-bore, in order to allow the treatment fluid to flow between the work string and the casing. However, again in some examples, in place of the slotted member 401, a jetting tool (as is commonly known in the art), is used with a liquid and sand to perforate casing 15.

15

[0090] Other examples of the invention will occur to those of skill in the art without departing from the scope of the invention, which is intended to be defined solely by the claims below and their equivalents. Nothing in the previous portions of this document, the abstract, or the drawings, is intended as a limitation on the scope of the claims.

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1. A system of treatment of a region in a well, the system comprising:
  - a first packer,
  - a first packer mandrel disposed radially inward of the first packer,
  - an expansion packer,
  - an expansion packer mandrel disposed radially inward of the expansion packer,
  - means for treating the region, wherein the means for treating the region is disposed between the first packer and the expansion packer,
  - means for moving the expansion packer, and means for moving the first packer after the moving of the expansion packer; and
  - wherein the means for moving the first packer after the moving of the expansion packer comprises:
    - a first packer sleeve slideably mounted on the first packer mandrel,
    - a shoulder on the first packer mandrel, and
    - a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.
2. A system as in claim 1 wherein the means for moving of the expansion packer comprises means for longitudinally moving a mandrel with respect to the first packer.
3. A system as in claim 1, further comprising means for equalizing pressure above and below the expansion packer before the moving of the first packer.
4. A system as in claim 3, wherein the means for equalizing comprises a valve.
5. A system as in claim 4 wherein the valve is operated by movement of the packer mandrel and communicating the region with a portion of the well-bore below the expansion packer.
6. A system as in claim 4, wherein the valve comprises an opening below the expansion packer.
7. A system as in claim 1 wherein the first packer comprises a cup packer element.

8. A system for treating a well-bore on a work string, the system comprising:
  - an expansion packer mandrel for substantially rigid-connection to the work string,
  - means for setting a compressible expansion packer in a well-bore with a longitudinal motion of the work string,
  - means for treating the well,
  - means, below the expansion packer, for equalizing a pressure differential across the expansion packer,
  - means for raising the expansion packer; and
  - wherein the means for raising the expansion packer comprises a stop surface on the mandrel and a stop surface on the expansion packer, wherein the stop surfaces interact to cause the expansion packer to be raised during vertical motion of the expansion packer mandrel.
9. A system as in claim 8 wherein the means for setting the compressible expansion packer comprises at least one J-slot on the expansion packer mandrel interacting with at least one J-pin on a slip ring disposed about the expansion packer mandrel.
10. A system as in claim 8 wherein the means for treating the well comprises a substantially cylindrical member having slots therein.
11. A system as in claim 8 wherein the means for equalizing comprises a valve.
12. A system as in claim 11 wherein the valve comprises an opening below the expansion packer.
13. A system as in claim 11 wherein the valve is operated by movement of the packer mandrel and communicating across the expansion packer with a portion of the well-bore below the expansion packer.
14. A method of treatment of a region in a well, the method comprising:

positioning, in a well-bore, a first packer above the region of the well-bore,  
fixing, below the region, an expansion packer,  
positioning, below the region, an expansion packer mandrel,  
treating the region,  
moving, with respect to the first packer and after treating the region, the  
expansion packer longitudinally in the well, and  
moving the first packer after the moving of the expansion packer; and  
wherein a stop surface on the expansion packer mandrel and a stop surface on the  
expansion packer interact to cause the expansion packer to be raised  
during upward motion of the expansion packer mandrel.

15. A method as in claim 14, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.

16. A method as in claim 15 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.

17. A method as in claim 16, wherein the opening a valve occurs below the expansion packer.

18. A method as in claim 14, wherein the moving the first packer comprises, first, lowering the first packer.

19. A method as in claim 18, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

20. A method as in claim 18, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.

21. A method as in claim 18 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
22. A method as in claim 14, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
23. A method as in claim 22, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
24. A method as in claim 22, wherein the first packer comprises an expansion packer.
25. The method of claim 14 further comprising positioning a first packer mandrel disposed radially inward of the first packer, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.
26. A method as in claim 25, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.
27. A method as in claim 26 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.
28. A method as in claim 27, wherein the opening a valve occurs below the expansion packer.
29. A method as in claim 25, wherein the moving the first packer comprises, first, lowering the first packer.

30. A method as in claim 29, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
31. A method as in claim 29, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
32. A method as in claim 29 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
33. A method as in claim 25, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
34. A method as in claim 33, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
35. A method as in claim 33, wherein the first packer comprises an expansion packer.
36. The method of claim 14 further comprising positioning a first packer mandrel above the region of the well-bore, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.
37. A method as in claim 36, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.

38. A method as in claim 37 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.
39. A method as in claim 38, wherein the opening a valve occurs below the expansion packer.
40. A method as in claim 36, wherein the moving the first packer comprises, first, lowering the first packer.
41. A method as in claim 40, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
42. A method as in claim 40, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
43. A method as in claim 40 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
44. A method as in claim 36, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
45. A method as in claim 44, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
46. A method as in claim 44, wherein the first packer comprises an expansion packer.
47. A method of treatment of the region in a well, the method comprising:  
positioning, in a well-bore, a first packer above the region of the well-bore,  
fixing, below the region, an expansion packer,

positioning an expansion packer mandrel disposed radially inward of the expansion packer,  
treating the region,  
moving, the expansion packer longitudinally in the well, and  
moving the first packer after the moving of the expansion packer; and  
wherein a stop surface on the expansion packer mandrel and a stop surface on the expansion packer interact to cause the expansion packer to be raised during upward motion of the expansion packer mandrel.

48. A method as in claim 47, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.

49. A method as in claim 48 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.

50. A method as in claim 49, wherein the opening a valve occurs below the expansion packer.

51. A method as in claim 47, wherein the moving the first packer comprises, first, lowering the first packer.

52. A method as in claim 51, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

53. A method as in claim 51, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.



54. A method as in claim 51 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
55. A method as in claim 47, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
56. A method as in claim 55, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
57. A method as in claim 55, wherein the first packer comprises an expansion packer.
58. The method of claim 47 further comprising positioning a first packer mandrel disposed radially inward of the first packer, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.
59. A method as in claim 58, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve.
60. A method as in claim 59 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.
61. A method as in claim 60, wherein the opening a valve occurs below the expansion packer.
62. A method as in claim 58, wherein the moving the first packer comprises, first, lowering the first packer.

63. A method as in claim 62, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
64. A method as in claim 62, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
65. A method as in claim 58 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
66. A method as in claim 58, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
67. A method as in claim 66, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
68. A method as in claim 66, wherein the first packer comprises an expansion packer.
69. The method of claim 47 further comprising positioning a first packer mandrel above the region of the well-bore, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.
70. A method as in claim 69, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve.

71. A method as in claim 70 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.
72. A method as in claim 71, wherein the opening a valve occurs below the expansion packer.
73. A method as in claim 69, wherein the moving the first packer comprises, first, lowering the first packer.
74. A method as in claim 73, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
75. A method as in claim 73, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
76. A method as in claim 73 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
77. A method as in claim 69, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
78. A method as in claim 77, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
79. A method as in claim 77, wherein the first packer comprises an expansion packer.
80. A method of treatment of the region in a well, the method comprising:  
positioning, in a well-bore, a first packer above the region of the well-bore,

fixing, below the region, an expansion packer having an expansion packer mandrel directly or indirectly rigidly-connected to a first packer mandrel, treating the region, moving, with respect to the first packer and after treating the region, the expansion packer longitudinally in the well, and moving the first packer after the moving of the expansion packer; and wherein a stop surface on the expansion packer mandrel and a stop surface on the expansion packer interact to cause the expansion packer to be raised during upward motion of the expansion packer mandrel.

81. A method as in claim 80, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.

82. A method as in claim 81 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.

83. A method as in claim 82, wherein the opening a valve occurs below the expansion packer.

84. A method as in claim 83, wherein the moving the first packer comprises, first, lowering the first packer.

85. A method as in claim 84, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

86. A method as in claim 84, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.

87. A method as in claim 84 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.

88. A method as in claim 80, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.

89. A method as in claim 88, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.

90. A method as in claim 88, wherein the first packer comprises an expansion packer.

91. The method of claim 80 further comprising positioning a first packer mandrel disposed radially inward of the first packer, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

92. A method as in claim 91, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve.

93. A method as in claim 92 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.

94. A method as in claim 93, wherein the opening a valve occurs below the expansion packer.

95. A method as in claim 94, wherein the moving the first packer comprises, first, lowering the first packer.

96. A method as in claim 95, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
97. A method as in claim 95, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
98. A method as in claim 95 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
99. A method as in claim 91, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
100. A method as in claim 99, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
101. A method as in claim 99, wherein the first packer comprises an expansion packer.
102. The method of claim 80 further comprising positioning a first packer mandrel above the region of the well-bore, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.
103. A method as in claim 102, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve.

104. A method as in claim 103 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.
105. A method as in claim 104, wherein the opening a valve occurs below the expansion packer.
106. A method as in claim 105, wherein the moving the first packer comprises, first, lowering the first packer.
107. A method as in claim 106, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
108. A method as in claim 106, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
109. A method as in claim 106 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
110. A method as in claim 102, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
111. A method as in claim 110, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
112. A method as in claim 110, wherein the first packer comprises an expansion packer.
113. A method of treatment of the region in a well, the method comprising:

positioning, in a well-bore, a first packer above the region of the well-bore,  
positioning a first packer mandrel disposed radially inward of the first packer,  
fixing, below the region, an expansion packer,  
treating the region,  
moving, with respect to the first packer and after treating the region, the expansion packer longitudinally in the well, and  
moving the first packer after the moving of the expansion packer; and  
wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

114. A method as in claim 113, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve.

115. A method as in claim 114 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.

116. A method as in claim 115, wherein the opening a valve occurs below the expansion packer.

117. A method as in claim 116, wherein the moving the first packer comprises, first, lowering the first packer.

118. A method as in claim 117, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.



119. A method as in claim 117, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.

120. A method as in claim 117 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.

121. A method as in claim 113, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.

122. A method as in claim 121, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.

123. A method as in claim 121, wherein the first packer comprises an expansion packer.

124. A method of treatment of the region in a well, the method comprising:

positioning, in a well-bore, a first packer above the region of the well-bore,

positioning a first packer mandrel above the region of the well-bore,

fixing, below the region, an expansion packer,

treating the region,

moving, with respect to the first packer and after treating the region, the

expansion packer longitudinally in the well, and

moving the first packer after the moving of the expansion packer; and

wherein moving the first packer comprises a first packer sleeve slideably mounted

on the first packer mandrel, a shoulder on the first packer mandrel, and a

shoulder on the first packer sleeve disposed to stop longitudinal movement

of the shoulder on the first packer mandrel.

125. A method as in claim 124, wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve.

126. A method as in claim 124 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel.
127. A method as in claim 126, wherein the opening a valve occurs below the expansion packer.
128. A method as in claim 127, wherein the moving the first packer comprises, first, lowering the first packer.
129. A method as in claim 128, wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.
130. A method as in claim 128, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
131. A method as in claim 128 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
132. A method as in claim 124, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
133. A method as in claim 132, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
134. A method as in claim 132, wherein the first packer comprises an expansion packer.
135. A method of treatment of the region in a well, the method comprising:  
positioning, in a well-bore, a first packer above the region of the well-bore,

fixing, below the region, an expansion packer,  
 positioning, below the region, an expansion packer mandrel,  
 treating the region,  
 moving the expansion packer longitudinally in the well,  
 moving the first packer after the moving of the expansion packer;  
 wherein a stop surface on the expansion packer mandrel and a stop surface on the  
     expansion packer interact to cause the expansion packer to be raised  
     during upward motion of the expansion packer mandrel;  
 wherein the moving the first packer comprises, first, lowering the first packer; and  
 wherein the positioning the first packer comprises, first, lowering the first packer  
     below the treated region.

136. The method of claim 135 further comprising positioning a first packer mandrel disposed radially inward of the first packer, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

137. The method of claim 135 further comprising positioning a first packer mandrel above the region of the well-bore, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

138. A method of treatment of the region in a well, the method comprising:  
     positioning, in a well-bore, a first packer above the region of the well-bore,  
     fixing, below the region, an expansion packer,  
     positioning an expansion packer mandrel disposed radially inward of the  
         expansion packer,  
     treating the region,  
     moving the expansion packer longitudinally in the well,

moving the first packer after the moving of the expansion packer;  
 wherein a stop surface on the expansion packer mandrel and a stop surface on the  
 expansion packer interact to cause the expansion packer to be raised  
 during upward motion of the expansion packer mandrel;  
 wherein the moving the first packer comprises, first, lowering the first packer; and  
 wherein the positioning the first packer comprises, first, lowering the first packer  
 below the treated region.

139. The method of claim 138 further comprising positioning a first packer mandrel disposed radially inward of the first packer, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

140. The method of claim 138 further comprising positioning a first packer mandrel above the region of the well-bore, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

141. A method of treatment of the region in a well, the method comprising:  
 positioning, in a well-bore, a first packer above the region of the well-bore,  
 fixing, below the region, an expansion packer having an expansion packer  
 mandrel directly or indirectly rigidly-connected to a first packer mandrel,  
 treating the region,  
 moving the expansion packer longitudinally in the well,  
 moving the first packer after the moving of the expansion packer;  
 opening a valve, thereby communicating the region with the portion of the well-  
 bore below the expansion packer, wherein the opening is caused by  
 movement of the expansion packer mandrel;

wherein a stop surface on the expansion packer mandrel and a stop surface on the expansion packer interact to cause the expansion packer to be raised during upward motion of the expansion packer mandrel;

wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve;

wherein the opening a valve occurs below the expansion packer;

wherein the moving the first packer comprises, first, lowering the first packer; and

wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

142. A method of treatment of the region in a well, the method comprising:

positioning, in a well-bore, a first packer above the region of the well-bore, fixing, below the region, an expansion packer having an expansion packer mandrel directly or indirectly rigidly-connected to a first packer mandrel, positioning a first packer mandrel disposed radially inward of the first packer, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel;

treating the region,

opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel

moving the expansion packer longitudinally in the well, and

moving the first packer after the moving of the expansion packer; and

wherein a stop surface on the expansion packer mandrel and a stop surface on the expansion packer interact to cause the expansion packer to be raised during upward motion of the expansion packer mandrel;

wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve;  
 wherein the opening a valve occurs below the expansion packer;  
 wherein the moving the first packer comprises, first, lowering the first packer; and  
 wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

143. A method of treatment of the region in a well, the method comprising:  
 positioning, in a well-bore, a first packer above the region of the well-bore,  
 fixing, below the region, an expansion packer having an expansion packer mandrel directly or indirectly rigidly-connected to a first packer mandrel,  
 positioning a first packer mandrel above the region of the well-bore, and wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel  
 treating the region,  
 opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel;  
 moving the expansion packer longitudinally in the well, and  
 moving the first packer after the moving of the expansion packer; and  
 wherein a stop surface on the expansion packer mandrel and a stop surface on the expansion packer interact to cause the expansion packer to be raised during upward motion of the expansion packer mandrel;  
 wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve;  
 wherein the opening a valve occurs below the expansion packer;  
 wherein the moving the first packer comprises, first, lowering the first packer; and

wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

144. A method of treatment of the region in a well, the method comprising:  
 positioning, in a well-bore, a first packer above the region of the well-bore,  
 positioning a first packer mandrel disposed radially inward of the first packer,  
 fixing, below the region, an expansion packer,  
 treating the region,  
 opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel;  
 moving the expansion packer longitudinally in the well, and  
 moving the first packer after the moving of the expansion packer; and  
 wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel;  
 wherein the moving of the expansion packer comprises movement of the expansion packer mandrel and the first packer mandrel wherein the first packer mandrel slides within the first packer sleeve;  
 wherein the opening a valve occurs below the expansion packer;  
 wherein the moving the first packer comprises, first, lowering the first packer;  
 wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

145. A method of treatment of the region in a well, the method comprising:  
 positioning, in a well-bore, a first packer above the region of the well-bore,  
 positioning a first packer mandrel above the region of the well-bore,  
 fixing, below the region, an expansion packer,  
 treating the region,

opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the expansion packer mandrel;  
 moving the expansion packer longitudinally in the well, and  
 moving the first packer after the moving of the expansion packer; and  
 wherein moving the first packer comprises a first packer sleeve slideably mounted on the first packer mandrel, a shoulder on the first packer mandrel, and a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel;  
 wherein the opening a valve occurs below the expansion packer;  
 wherein the moving the first packer comprises, first, lowering the first packer;  
 wherein the positioning the first packer comprises, first, lowering the first packer below the treated region.

146. A packer system comprising:

a mandrel,  
 a sleeve disposed around the mandrel in a longitudinally sliding relation,  
 a packer element fixed to the sleeve,  
 a packer carrier section having an outer threaded diameter,  
 a stroke housing, the stroke housing having an inner threaded diameter engaging the outer threaded diameter of the packer carrier,  
 a wiper connected to an interior diameter of the stroke housing,  
 a seal disposed between the stroke housing and the mandrel, and  
 a seal disposed between the stroke housing and the packer carrier section.

147. A packer system as in claim 146, further comprising:

a shoulder on the sleeve abutting a shoulder on the packer element,  
 a thimble engaging the packer element at a first thimble surface, and  
 a retainer ring threaded on the sleeve, the retainer ring engaging the thimble on a second thimble surface.



148. A packer system as in claim 146, further comprising:  
a wiper ring attached to a first end of the sleeve,  
a retainer ring threaded on the sleeve, and  
a second wiper ring attached to the retainer ring.
149. A packer system as in claim 146, further comprising: a seal disposed in the sleeve end of the housing.
150. A packer system as in claim 146 wherein:  
the packer carrier section comprises a shoulder,  
the packer element is disposed between the shoulder and a retainer, and the  
retainer is threaded to the packer carrier.
151. A packer system as in claim 150 further comprising a debris barrier disposed in an interior surface of the retainer.
152. A packer system as in claim 146 wherein the packer element comprises a cup packer.
153. A packer system as in claim 146 wherein the packer element comprises an expansion packer.
154. An expansion packer device comprising:  
a mandrel having a substantially cylindrical bore therethrough,  
a compressible packer element disposed about the mandrel,  
a set of casing-engaging elements disposed about the mandrel,  
a set of drag elements disposed about the mandrel,  
a set of slots in an outer surface of the mandrel,  
a set of slot-engaging elements engaging the set of slots and disposed about the  
mandrel, the slot-engaging elements being longitudinally and radially  
moveable about the mandrel,  
a valve port located outside the cylindrical bore and below the set of slots,

a valve seat located outside the valve port, and the valve seat is longitudinally adjustable with respect to the valve port.

155. An expansion packer as in claim 154, wherein the valve port is located below the mandrel.
156. An expansion packer as in claim 154, further comprising a drag sleeve in a longitudinally-slideable relation to the mandrel, the drag sleeve comprising the valve seat.
157. An expansion packer as in claim 156, wherein the drag sleeve further comprises openings above the valve seat.
158. An expansion packer as in claim 156 wherein the drag sleeve comprises:  
a slide member in longitudinally-slideable engagement with the mandrel,  
a seat housing, longitudinally and adjustably attached to the slide member.
159. An expansion packer as in claim 158, wherein the seat housing is threaded to the slide member.
160. An expansion packer as in claim 158, wherein rotation of the seat housing on threads connecting the seat housing to the slide member adjusts a longitudinal distance the valve ports travel to engage the valve seat.
161. An expansion packer as in claim 154, wherein the valve port is located below the mandrel.
162. An expansion packer as in claim 161, wherein the valve port is surrounded above and below by seals having a concave therein.
163. A packer system comprising:  
a mandrel,

a sleeve disposed around the mandrel in a longitudinally sliding relation,  
 a packer element fixed to the sleeve,  
 a shoulder on the sleeve abutting a shoulder on the packer element,  
 a thimble engaging the packer element at a first thimble surface, and  
 a retainer ring threaded on the sleeve, the retaining ring engaging the thimble on a  
 second thimble surface.

164. A packer system comprising:

a mandrel,  
 a sleeve disposed around the mandrel in a longitudinally sliding relation,  
 a packer element fixed to the sleeve,  
 a wiper ring attached to a first end of the sleeve, and  
 a second wiper ring attached to the retainer ring.

165. A packer system comprising

a mandrel,  
 a sleeve disposed around the mandrel in a longitudinally sliding relation, and  
 a packer element fixed to the sleeve,  
 wherein the sleeve comprises:  
 a packer carrier section having an outer threaded diameter, and  
 a stroke housing, the stroke housing having an inner threaded diameter  
 engaging the outer threaded diameter of the cup carrier.

166. A packer system as in Claim 165, further comprising:

a wiper connected to an interior diameter of the stroke housing,  
 a seal disposed between the stroke housing and the mandrel, and  
 a seal disposed between the stroke housing and the packer carrier section.

167. A packer system as in Claim 165 wherein:

the packer carrier section comprises a shoulder,

the packer element is disposed between the shoulder and a retainer, and the retainer is threaded to the packer carrier.

168. A packer system as in Claim 167 further comprising a debris barrier disposed in an interior surface of the retainer.

169. A packer system comprising:

a mandrel,

a sleeve disposed around the mandrel in a longitudinally sliding relation, and

a packer element fixed to the sleeve,

wherein the packer element comprises an expansion packer.

170. A method of treatment of the region in a well, the method comprising:

positioning, in a well-bore, a first packer above the region of the well-bore,

fixing, below the region, an expansion packer,

treating the region,

moving the expansion packer longitudinally in the well, and

moving the first packer after the moving of the expansion packer.

171. A method as in Claim 170, wherein the moving of the expansion packer comprises movement of a packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.

172. A method as in Claim 171 further comprising opening a valve, thereby communicating the region with the portion of the well-bore below the expansion packer, wherein the opening is caused by movement of the packer mandrel.

173. A method as in Claim 172, wherein the opening a valve occurs below the expansion packer.

174. A method as in Claim 170, wherein the moving the first packer comprises, first, lowering the first packer.
175. A method as in Claim 174, wherein the lowering of the first packer comprises, first, lowering the first packer below the treatment region.
176. A method as in Claim 174, wherein the moving the first packer comprises raising the first packer after the lowering of the first packer.
177. A method as in Claim 174 wherein, during the lowering, fluid pressure in an annulus between the well-bore and the work string is maintained at substantially the same level as just before the lowering or less.
178. A method as in Claim 170, further comprising equalizing pressure above and below the expansion packer before the moving of the first packer.
179. A method as in Claim 178, wherein the equalizing comprises opening a valve, thereby communicating the region with a portion of the well-bore below the expansion packer.
180. A method as in Claim 178, wherein the first packer comprises an expansion packer.
181. A system of treatment of a region in a well, the system comprising:  
a first packer,  
a first packer mandrel disposed radially inward of the first packer,  
an expansion packer,  
an expansion packer mandrel disposed radially inward of the expansion packer,  
means for treating the region, wherein the means for treating the region is  
disposed between the first packer and the expansion packer,  
means for moving the expansion packer, and  
means for moving the first packer after the moving of the expansion packer.

182. A system as in Claim 181 wherein the means for moving of the expansion packer comprises means for longitudinally moving a mandrel with respect to the first packer.

183. A system as in Claim 181, wherein the means for moving of the expansion packer comprises an expansion packer mandrel and a first packer mandrel wherein the first packer mandrel slides within a first packer sleeve.

184. A system as in Claim 181, further comprising means for equalizing pressure above and below the expansion packer before the moving of the first packer.

185. A system as in Claim 184, wherein the means for equalizing comprises a valve.

186. A system as in Claim 185 wherein the valve is operated by movement of the packer mandrel and communicating the region with a portion of the well-bore below the expansion packer.

187. A system as in Claim 185, wherein the valve comprises an opening below the expansion packer.

188. A system as in Claim 181 wherein the means for moving the first packer after the moving of the expansion packer comprises:

a first packer sleeve slideably mounted on the first packer mandrel

a shoulder on the first packer mandrel, and

a shoulder on the first packer sleeve disposed to stop longitudinal movement of the shoulder on the first packer mandrel.

189. A system as in Claim 181 wherein the first packer comprises a cup packer element.

190. A method of treating a well-bore, the method comprising:

positioning a compressible expansion packer in the well-bore, the compressible expansion packer being rigidly-connected to an expansion packer mandrel that is connected to a work string,  
setting the expansion packer in the well-bore with a longitudinal motion of the work string,  
treating the well,  
opening a valve below the expansion packer with a further longitudinal motion of the work string, and  
raising the packer.

191. A method as in Claim 190, further comprising positioning a further packer element in the well-bore above the expansion packer, the further packer element being connected to a sleeve that is slideably connected to a further packer mandrel, the further packer mandrel being connected to the work string and the packer mandrel.

192. A method as in Claim 191 wherein the further packer comprises a cup element.

193. A system for treating a well-bore on a work string, the system comprising:  
an expansion packer mandrel for substantially rigid-connection to the work string,  
means for setting a compressible expansion packer in a well-bore with a longitudinal motion of the work string,  
means for treating the well,  
means, below the expansion packer, for equalizing a pressure differential across the expansion packer,  
means for raising the expansion packer.

194. A system as in Claim 193 wherein the means for setting the compressible expansion packer comprises at least one J-slot on the expansion packer mandrel interacting with at least one J-pin on a slip ring disposed about the expansion packer mandrel.

195. A system as in Claim 193 wherein the means for treating the well comprises a substantially cylindrical member having slots therein.

196. A system as in Claim 193 wherein the means for equalizing comprises a valve.

197. A system as in Claim 193 wherein the means for raising the expansion packer comprises a stop surface on the mandrel and a stop surface on the expansion packer, wherein the stop surfaces interact to cause the expansion packer to be raised during vertical motion of the expansion packer mandrel.

198. A method of treating multiple zones in a cased well-bore, the method comprising:  
fixing an expansion packer of a work string below a first zone,  
perforating the cased well-bore above the expansion packer,  
applying between the work string and the cased well-bore, a stimulation fluid  
through the perforated well-bore,  
equalizing the pressure above and below the expansion packer,  
fixing the expansion packer up at a second zone, the second zone being over the  
first zone,  
perforating the cased well-bore above the expansion packer,  
applying, between the work string and the cased well-bore, a stimulation fluid  
through the perforated well-bore,  
equalizing the pressure above and below the expansion packer, and  
raising the expansion packer.

199. A method as in Claim 198 wherein the equalizing comprises opening a valve below the expansion packer.

200. A method as in Claim 198 wherein the opening comprises moving a valve port connected to an expansion packer mandrel from contact with a valve seat connected to a drag sleeve.



201. A system for treating multiple zones in a cased well-bore on a work string, the system comprising:
- an expansion packer coupled to the work string,
  - means for perforating the cased well-bore above the expansion packer,
  - means for applying, between the work string and the cased well-bore, a stimulation fluid through the perforated well-bore,
  - means for equalizing the pressure above and below the expansion packer, and
  - means for raising the expansion packer.
202. A system as in Claim 201 wherein the means for equalizing comprises a valve below the expansion packer.
203. A system as in Claim 201 wherein the means for equalizing further comprises a valve port connected to an expansion packer mandrel moveable from contact with a valve seat connected to a drag sleeve.
204. A system as in Claim 201 wherein the means for perforating the cased well comprises a jetting tool.
205. A system as in Claim 201 wherein the means for applying comprises a surface pump connected between the well casing and the work string.
206. A system as in Claim 201 wherein the means for raising the expansion packer comprises a connection between an expansion packer guide and an expansion packer mandrel.
207. An expansion packer device comprising:
- a mandrel having a substantially cylindrical bore therethrough,
  - a compressible packer element disposed about the mandrel,
  - a set of casing-engaging elements disposed about the mandrel,
  - a set of drag elements disposed about the mandrel,
  - a set of slots in an outer surface of the mandrel,

a set of slot-engaging elements engaging the set of slots and disposed about the mandrel, the slot-engaging elements being longitudinally and radially moveable about the mandrel,  
a valve port located outside the cylindrical bore and below the set of slots, and  
a valve seat located outside the valve port.

208. An expansion packer as in Claim 207, wherein the valve port is located below the mandrel.

209. An expansion packer as in Claim 207, further comprising a drag sleeve in a longitudinally-slideable relation to the mandrel, the drag sleeve comprising the valve seat.

210. An expansion packer as in Claim 209, wherein the drag sleeve further comprises openings above the valve seat.

211. An expansion packer as in Claim 207, wherein the valve seat is longitudinally adjustable with respect to the valve port.

212. An expansion packer as in Claim 211, wherein the valve port is located below the mandrel.

213. An expansion packer as in Claim 212, wherein the valve port is surrounded above and below by seals having a concave therein.

214. An expansion packer as in Claim 209 wherein the drag sleeve comprises:  
a slide member in longitudinally-slideable engagement with the mandrel,  
a seat housing, longitudinally and adjustably attached to the slide member.

215. An expansion packer as in Claim 214, wherein the seat housing is threaded to the slide member.

216. An expansion packer as in Claim 214, wherein rotation of the seat housing on threads connecting the seat housing to the slide member adjusts a longitudinal distance the valve ports travel to engage the valve seat.

217. A method of treating a well-bore, the method comprising:

positioning a compressible expansion packer in the well-bore, the compressible expansion packer being rigidly-connected to an expansion packer mandrel that is connected to a work string,

setting the expansion packer in the well-bore with a longitudinal motion of the work string,

treating the well,

opening a valve below the expansion packer with a further longitudinal motion of the work string,

raising the packer, and

positioning a further packer element in the well-bore above the expansion packer, the further packer element being connected to a sleeve that is slideably connected to a further packer mandrel disposed radially inward of the further packer, and a shoulder on the further packer mandrel, and a shoulder on the sleeve disposed to stop longitudinal movement of the shoulder on the further packer mandrel, the further packer mandrel being connected to the work string and the packer mandrel.

218. A method as in Claim 217 wherein the further packer comprises a cup element.

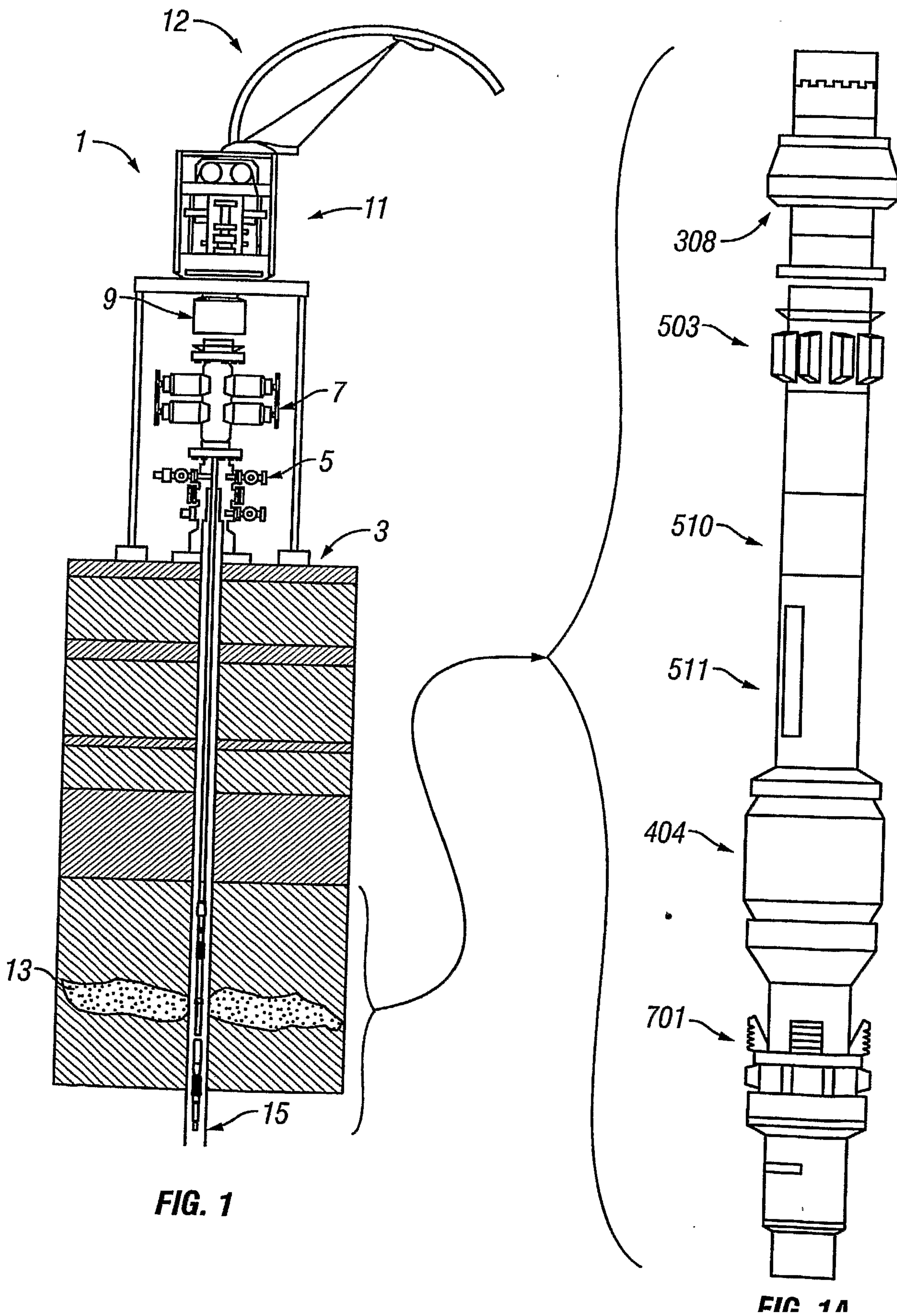


FIG. 1

FIG. 1A

2/18

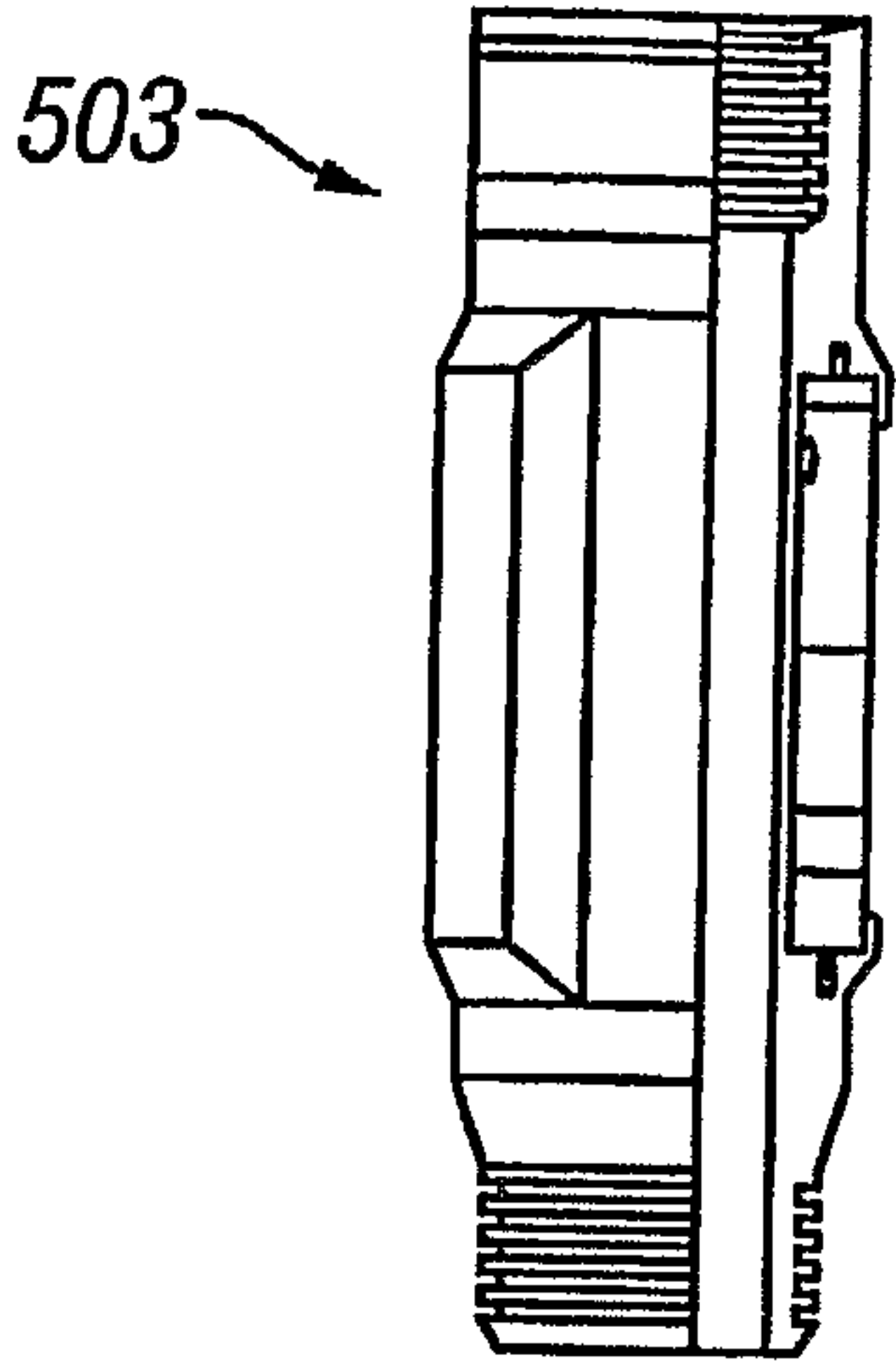


FIG. 2B

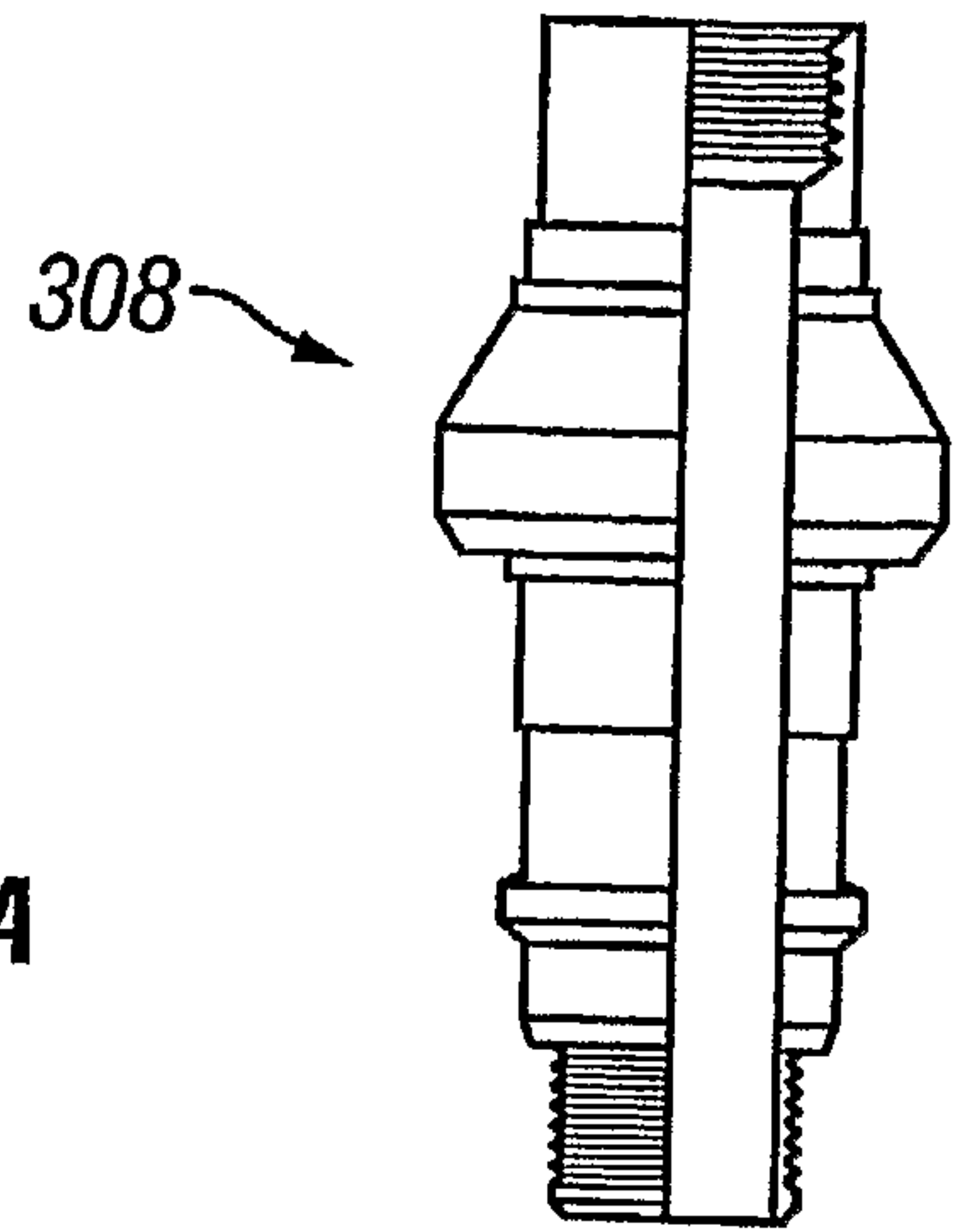


FIG. 2A

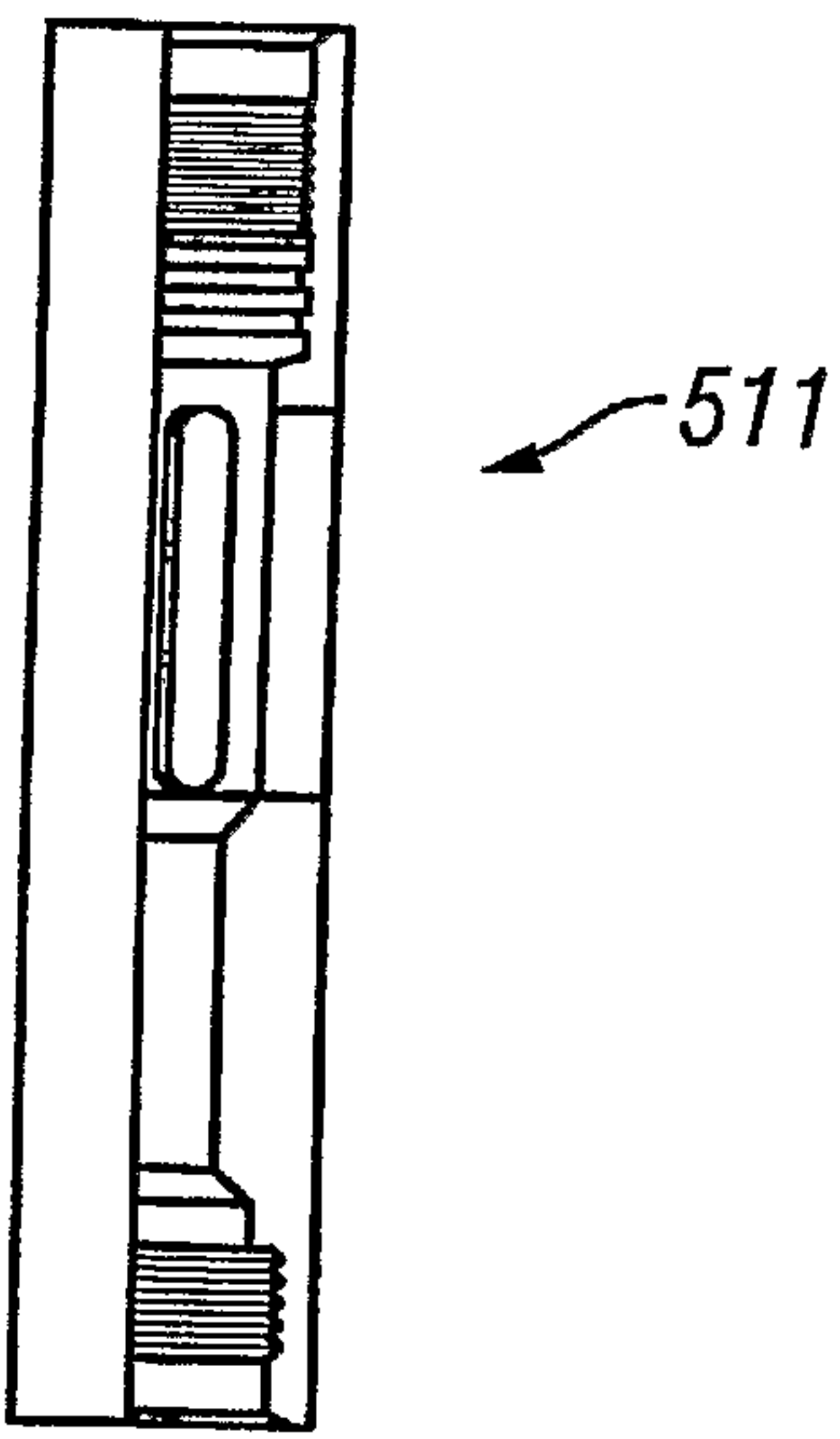


FIG. 2D

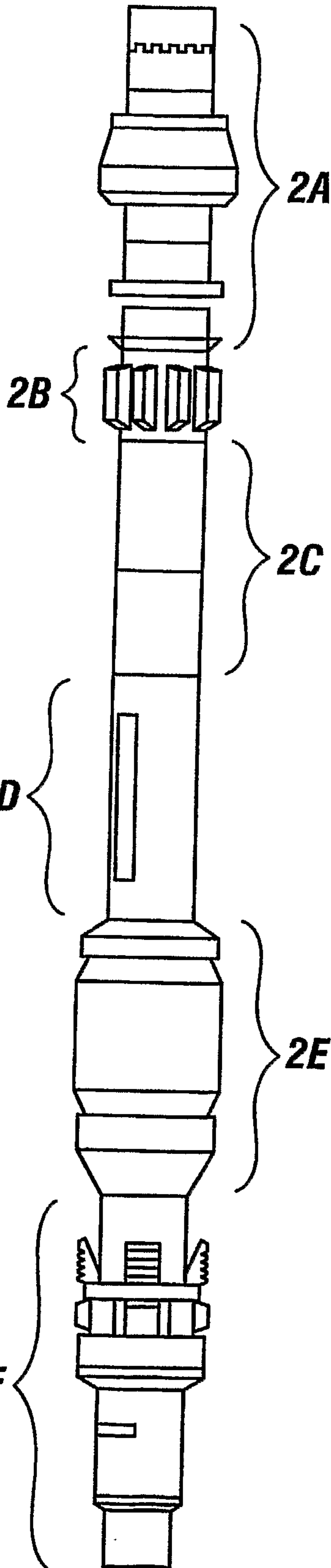


FIG. 2

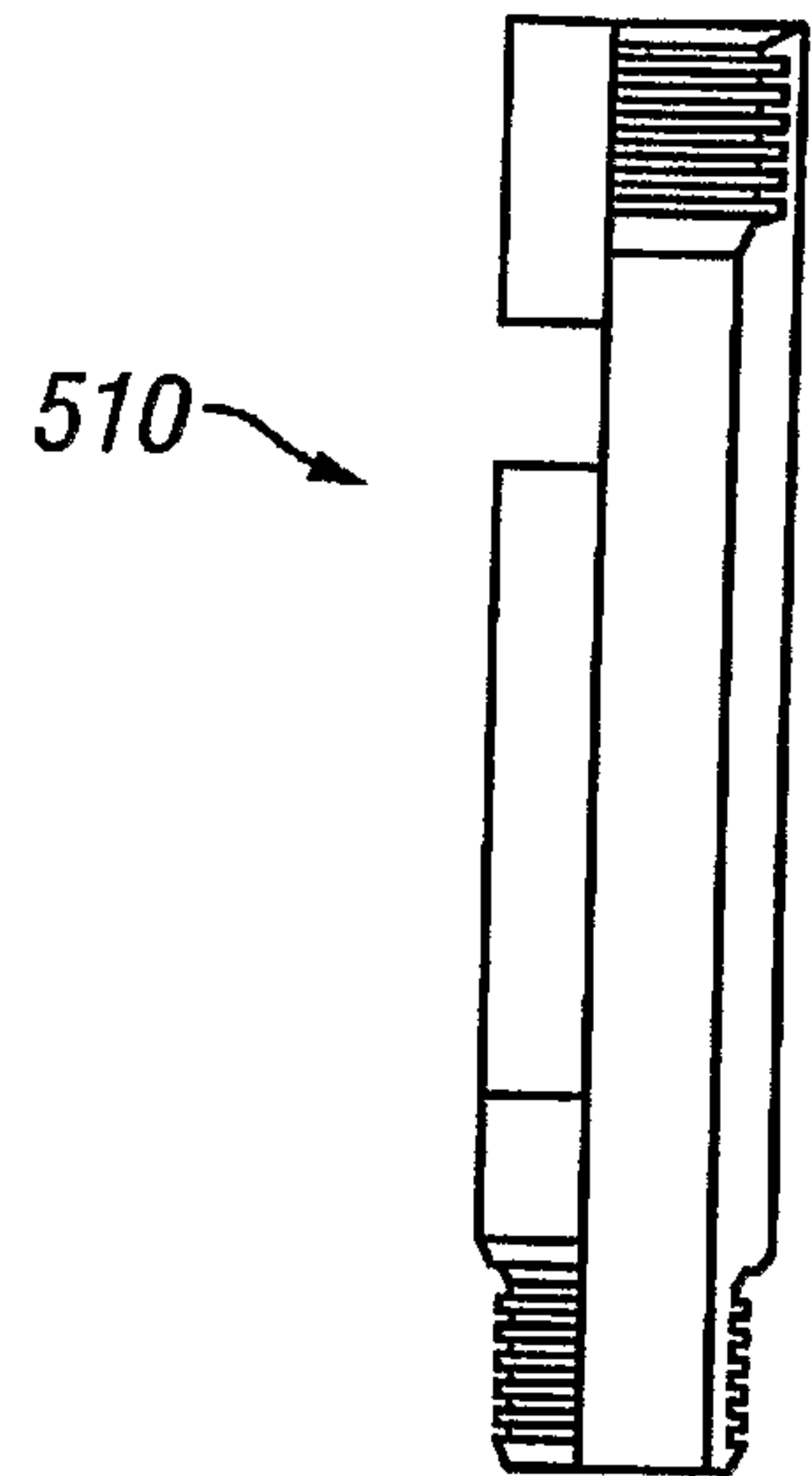


FIG. 2C

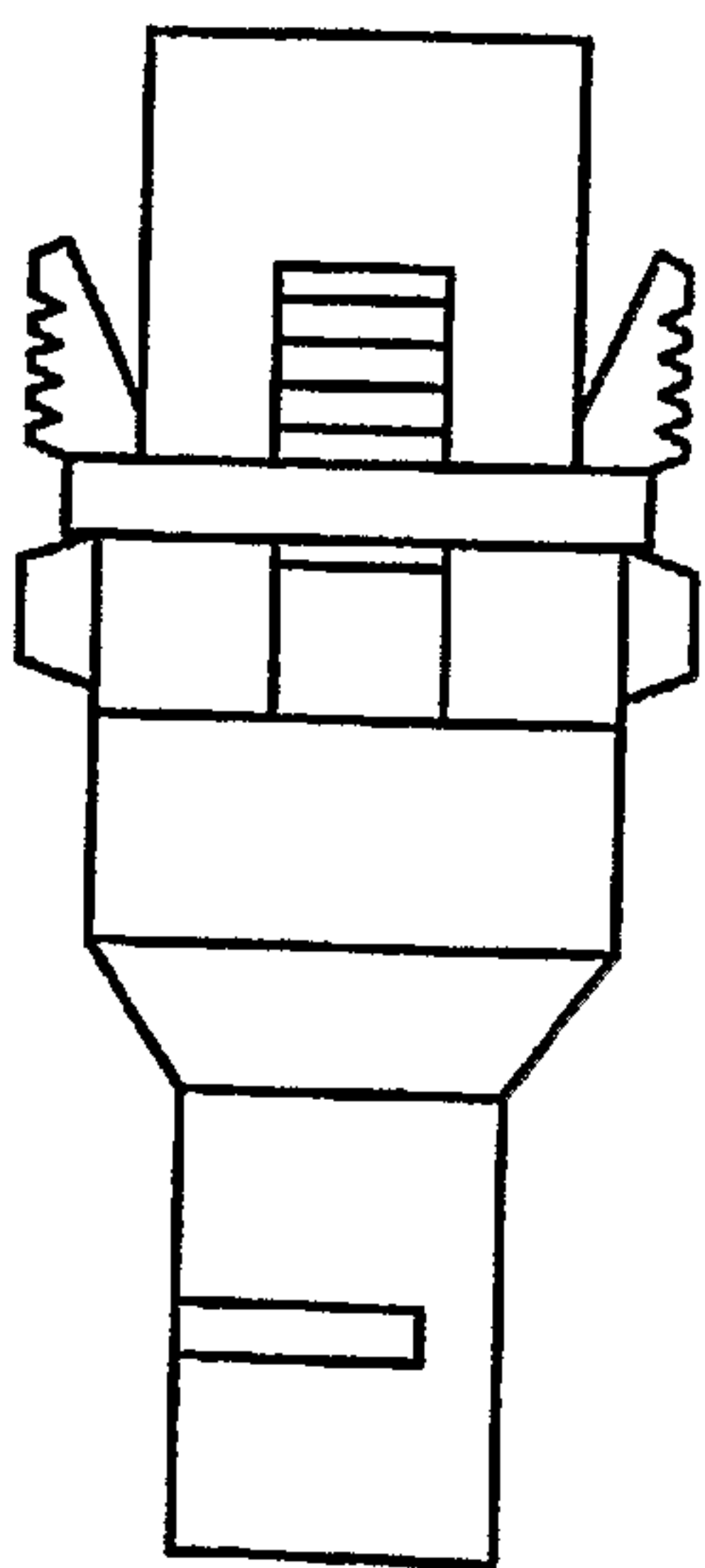


FIG. 2F

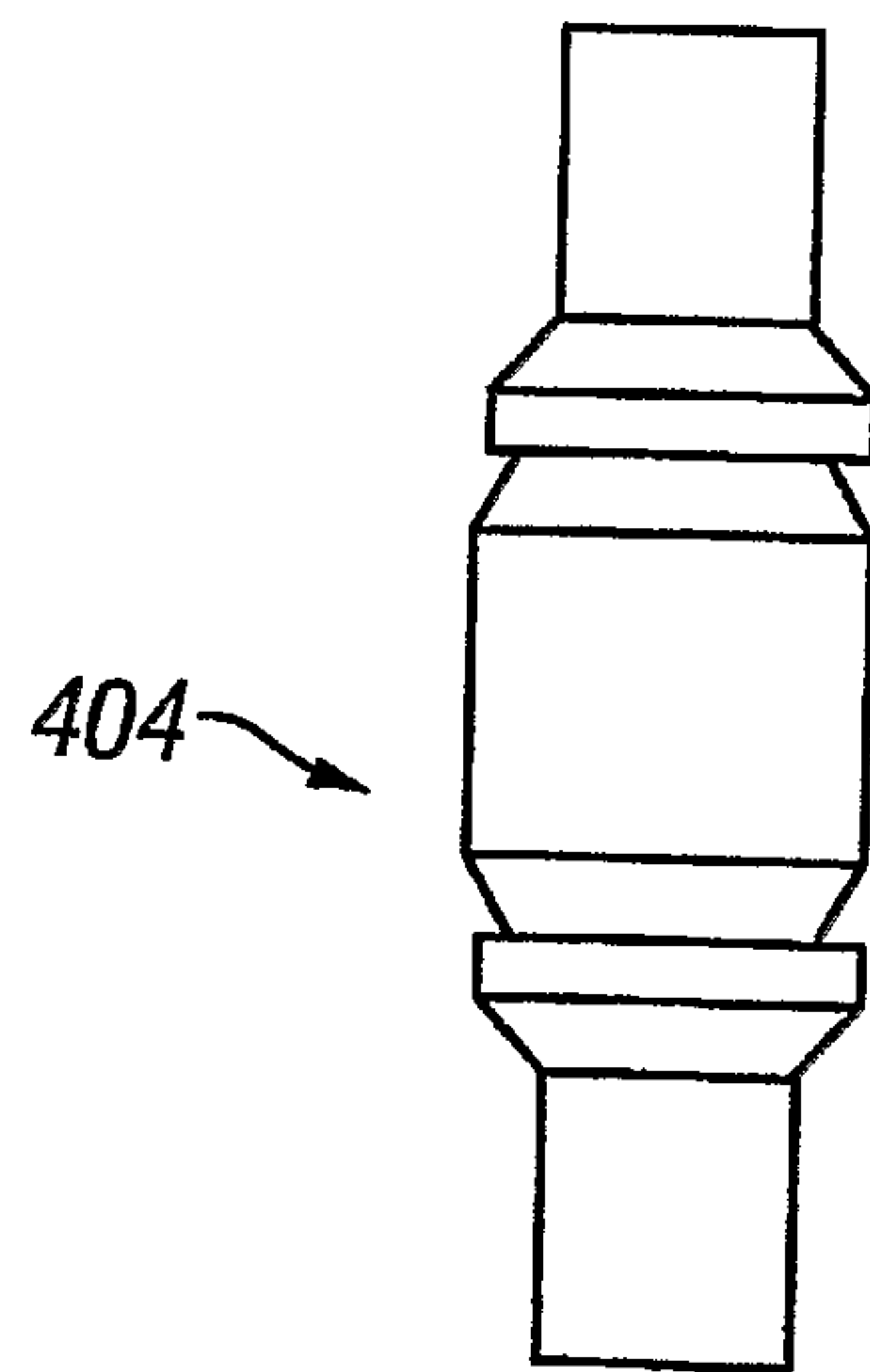


FIG. 2E

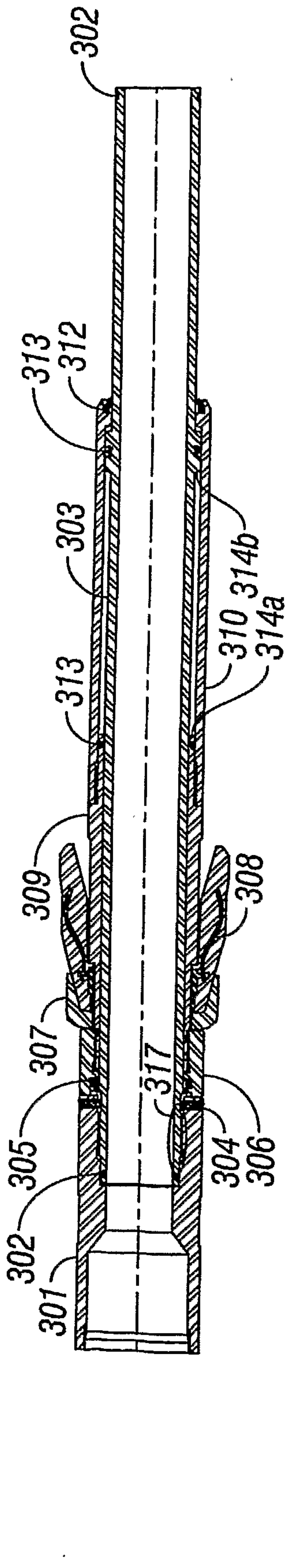


FIG. 3

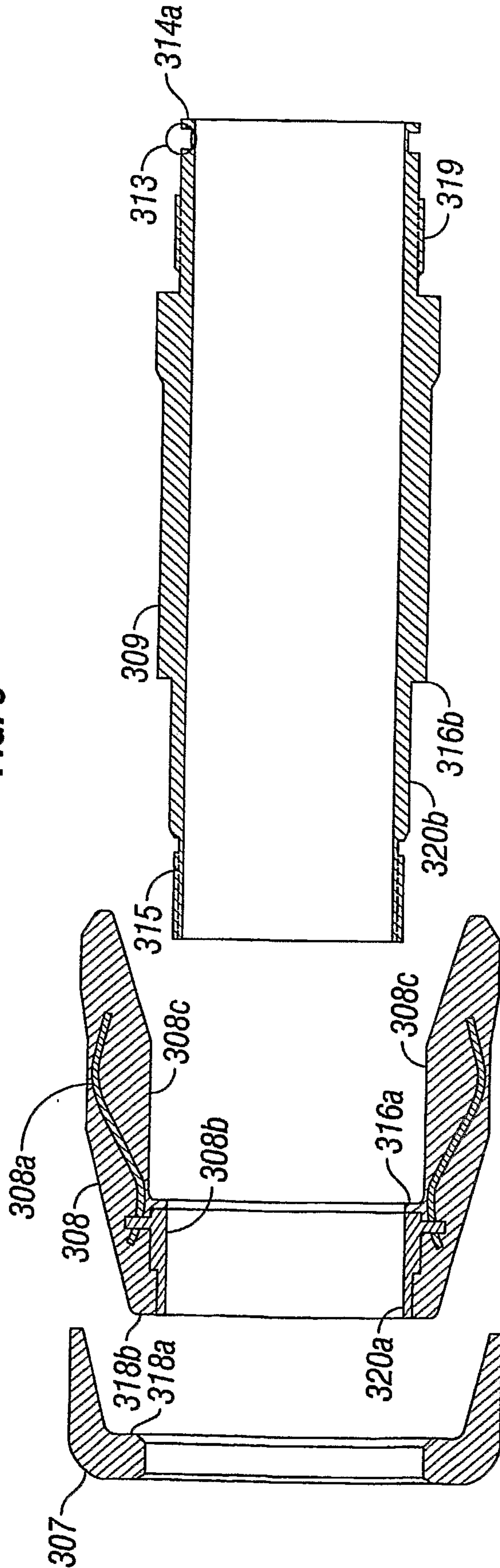


FIG. 3A

FIG. 3B

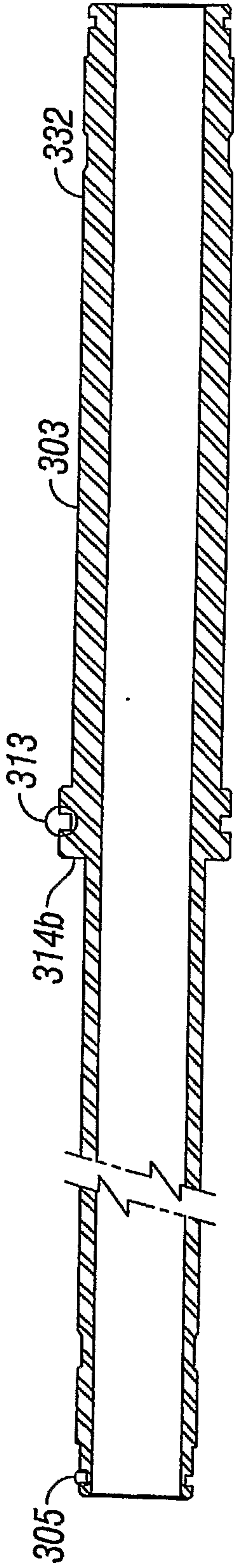


FIG. 3C

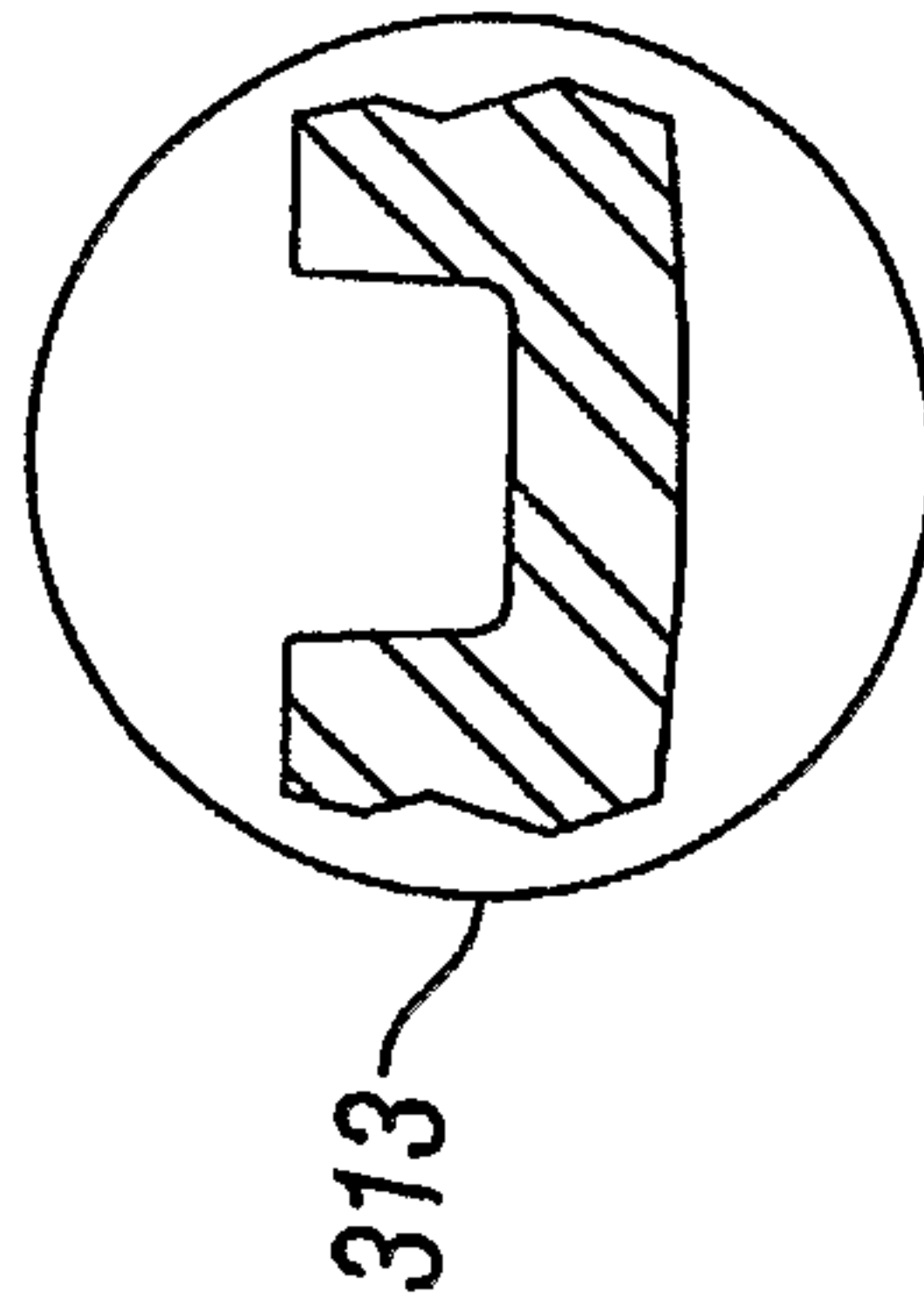


FIG. 3D

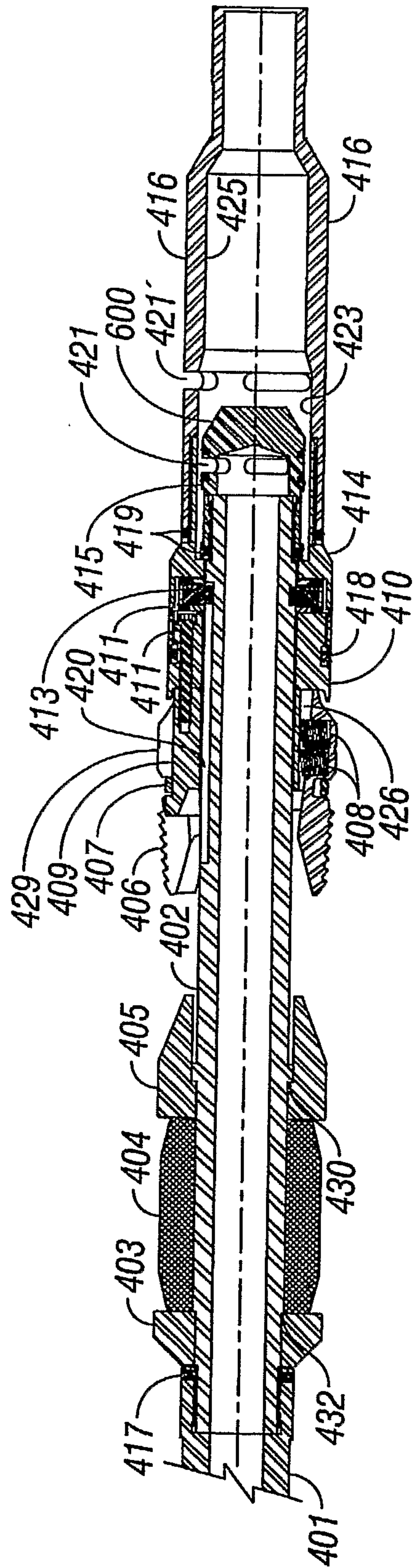
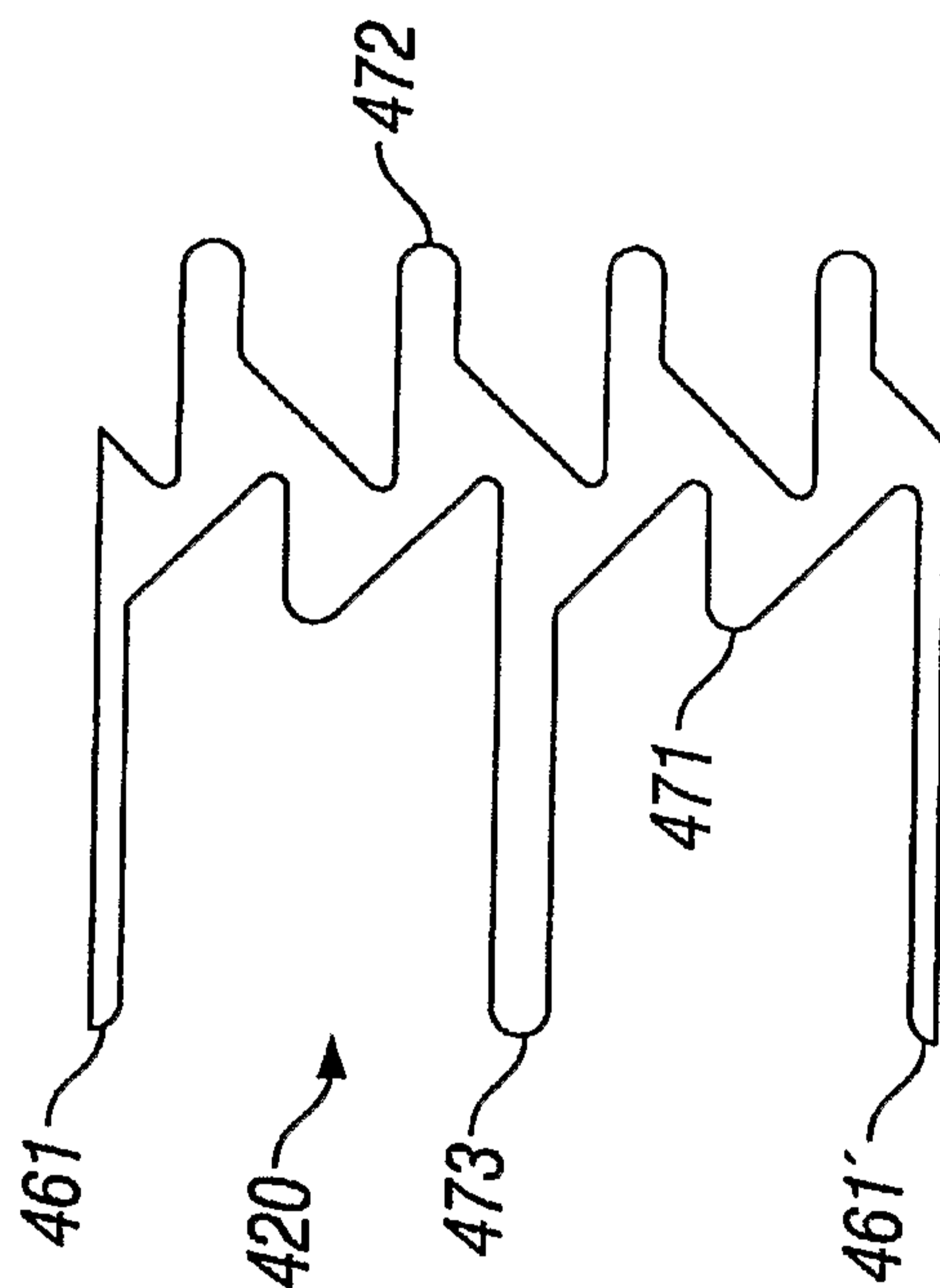
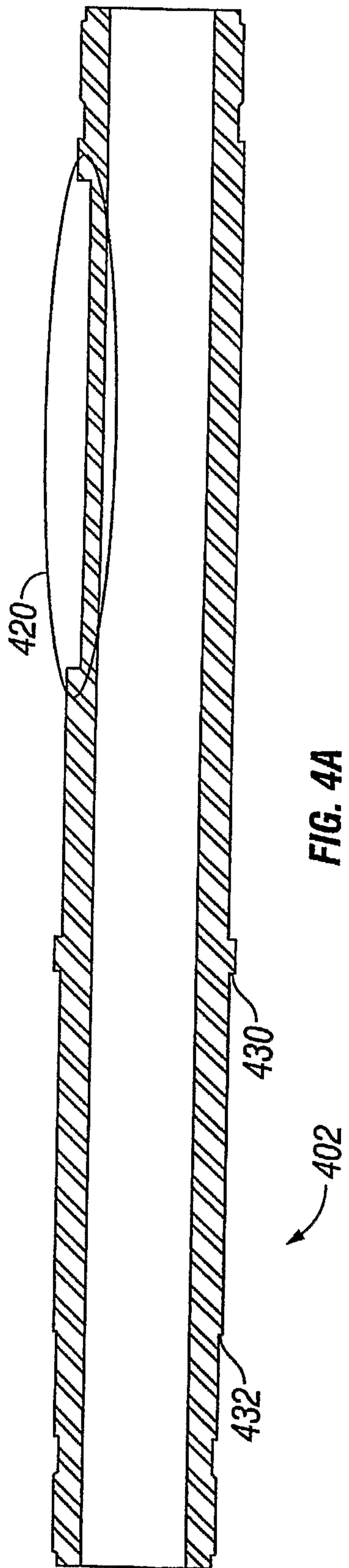


FIG. 4





6/18

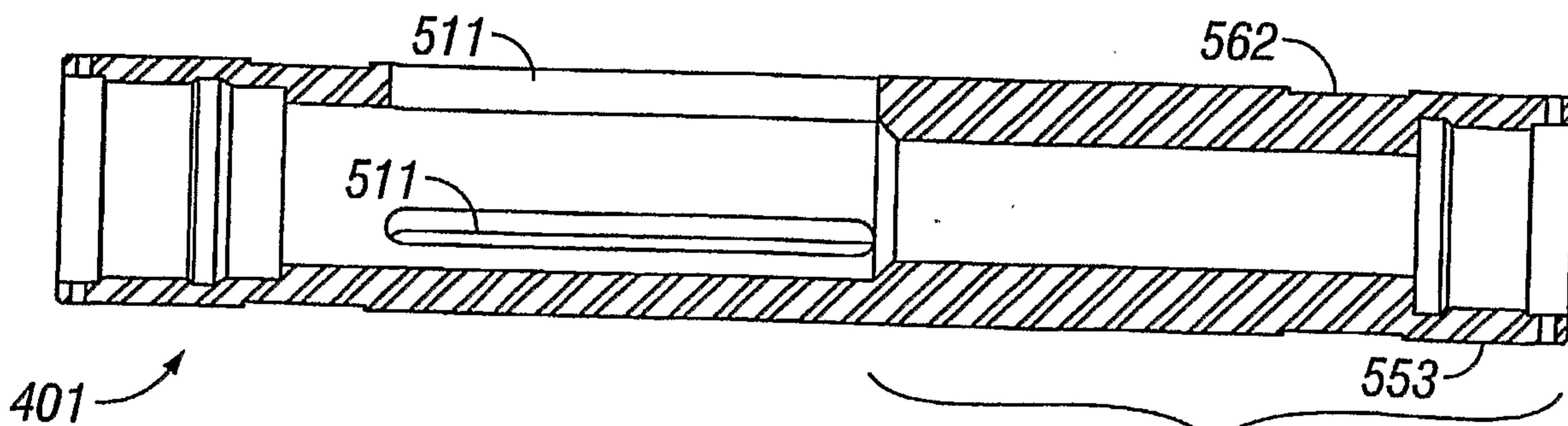


FIG. 4C

551

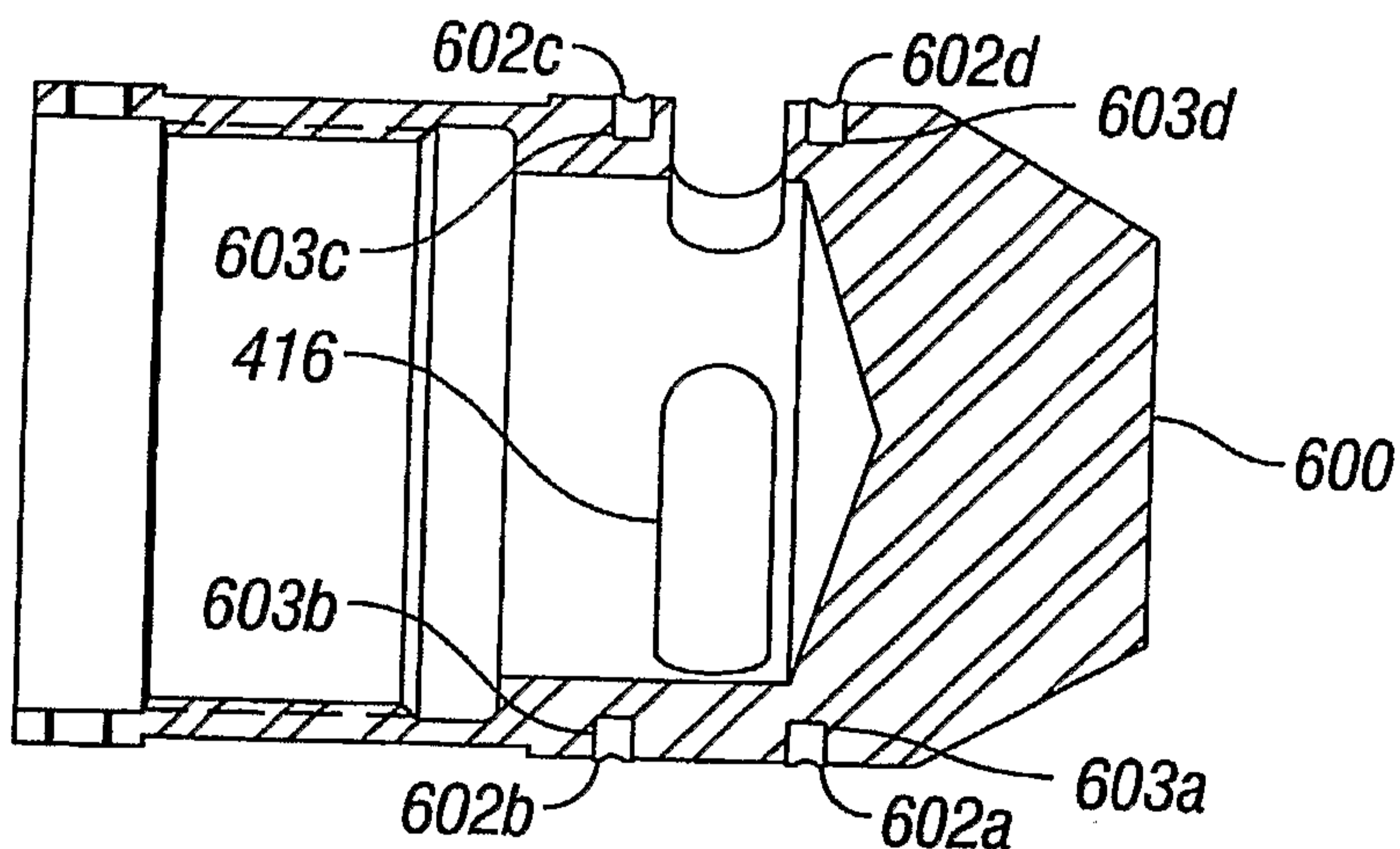


FIG. 4D

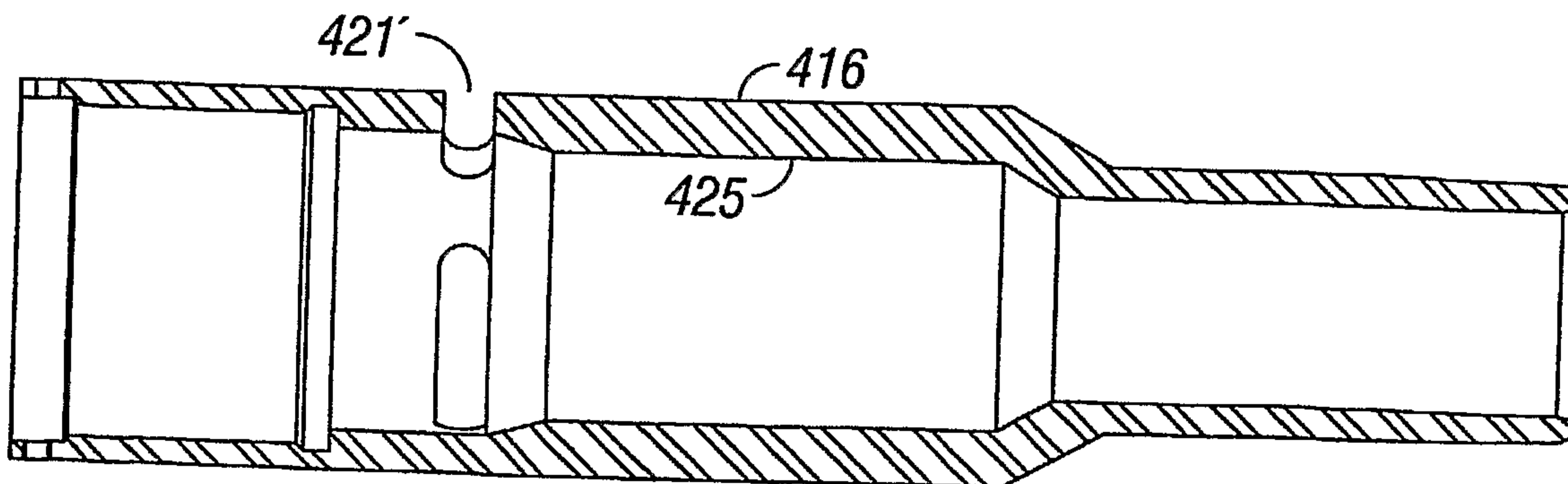


FIG. 4E

7/18

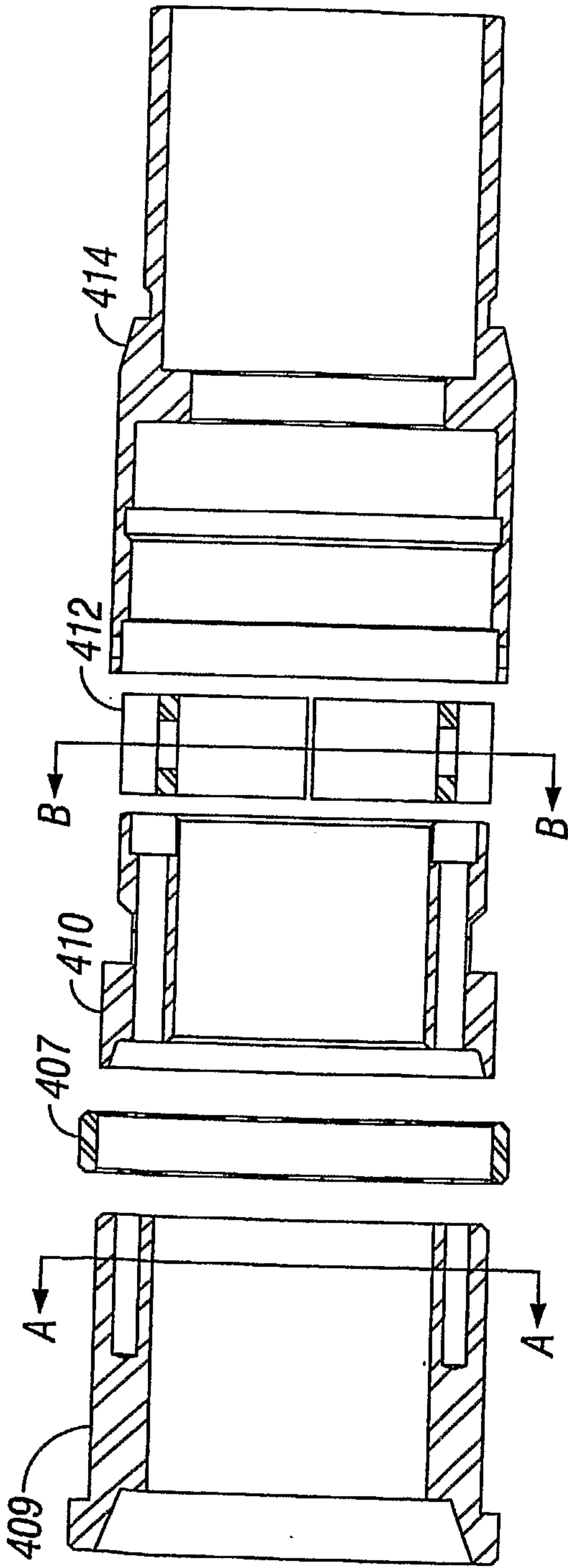


FIG. 4F

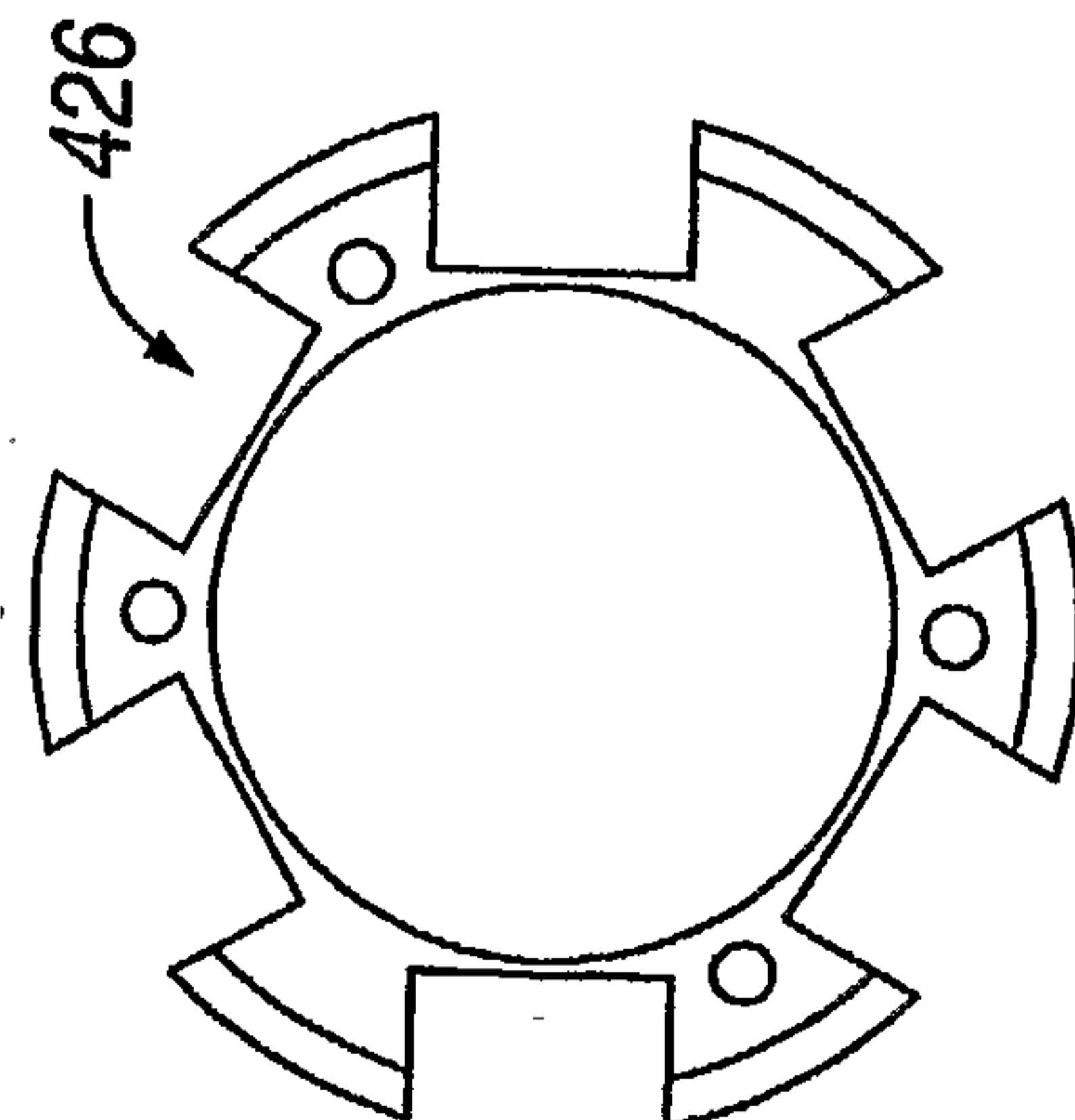


FIG. 4G

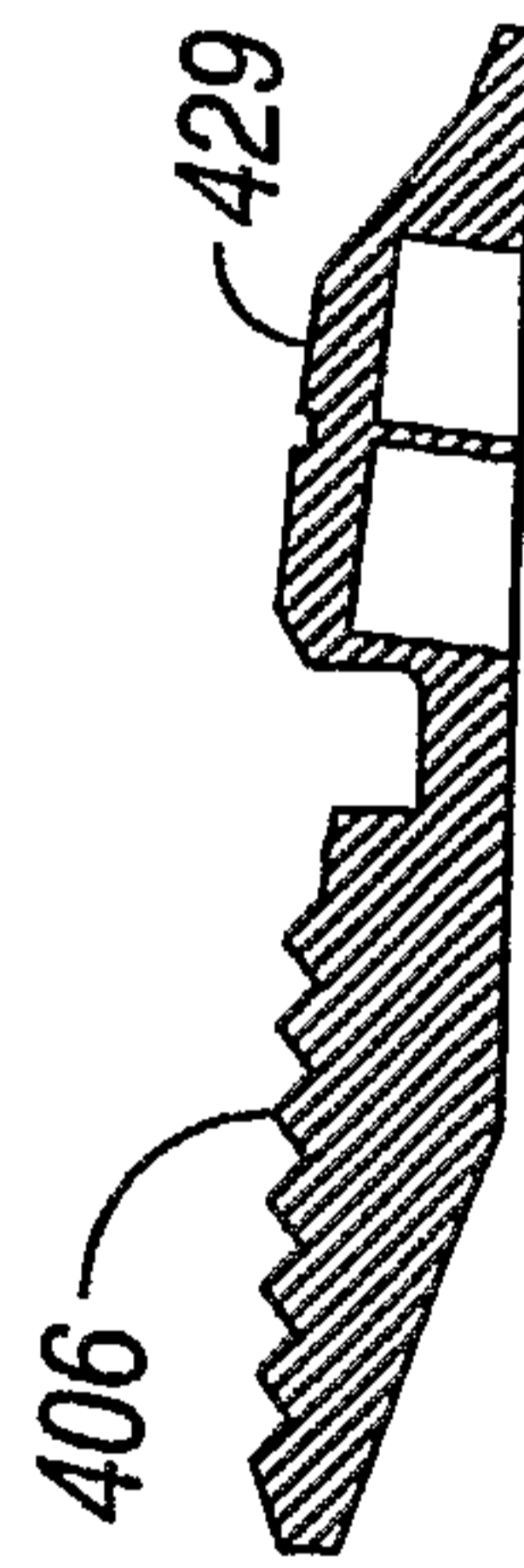


FIG. 4H

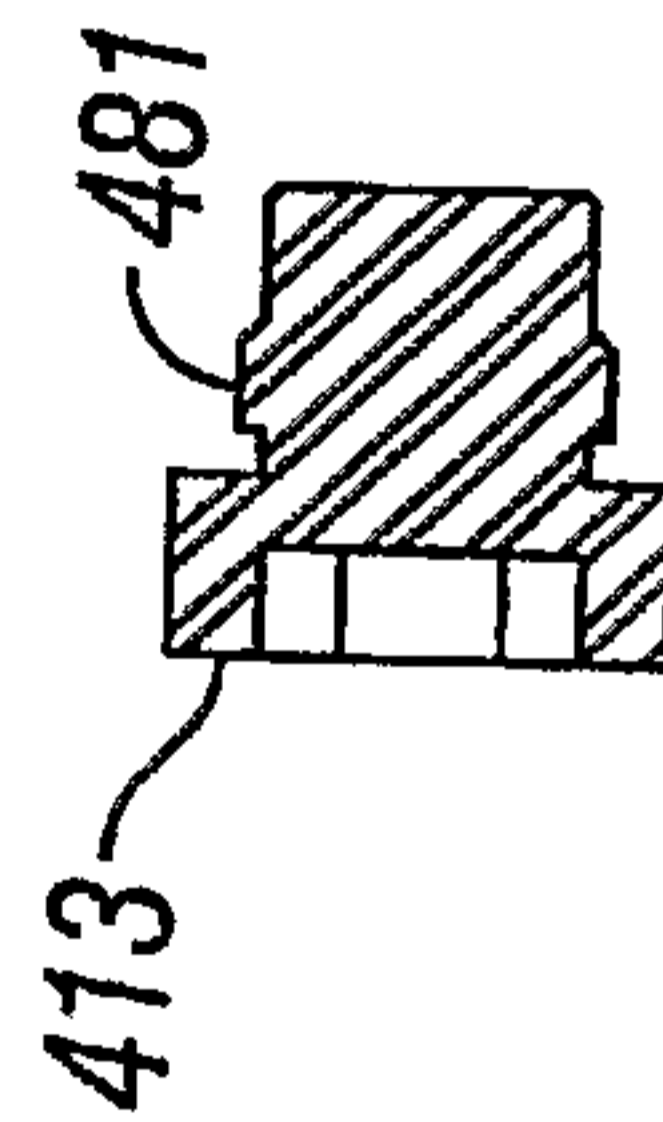


FIG. 4I

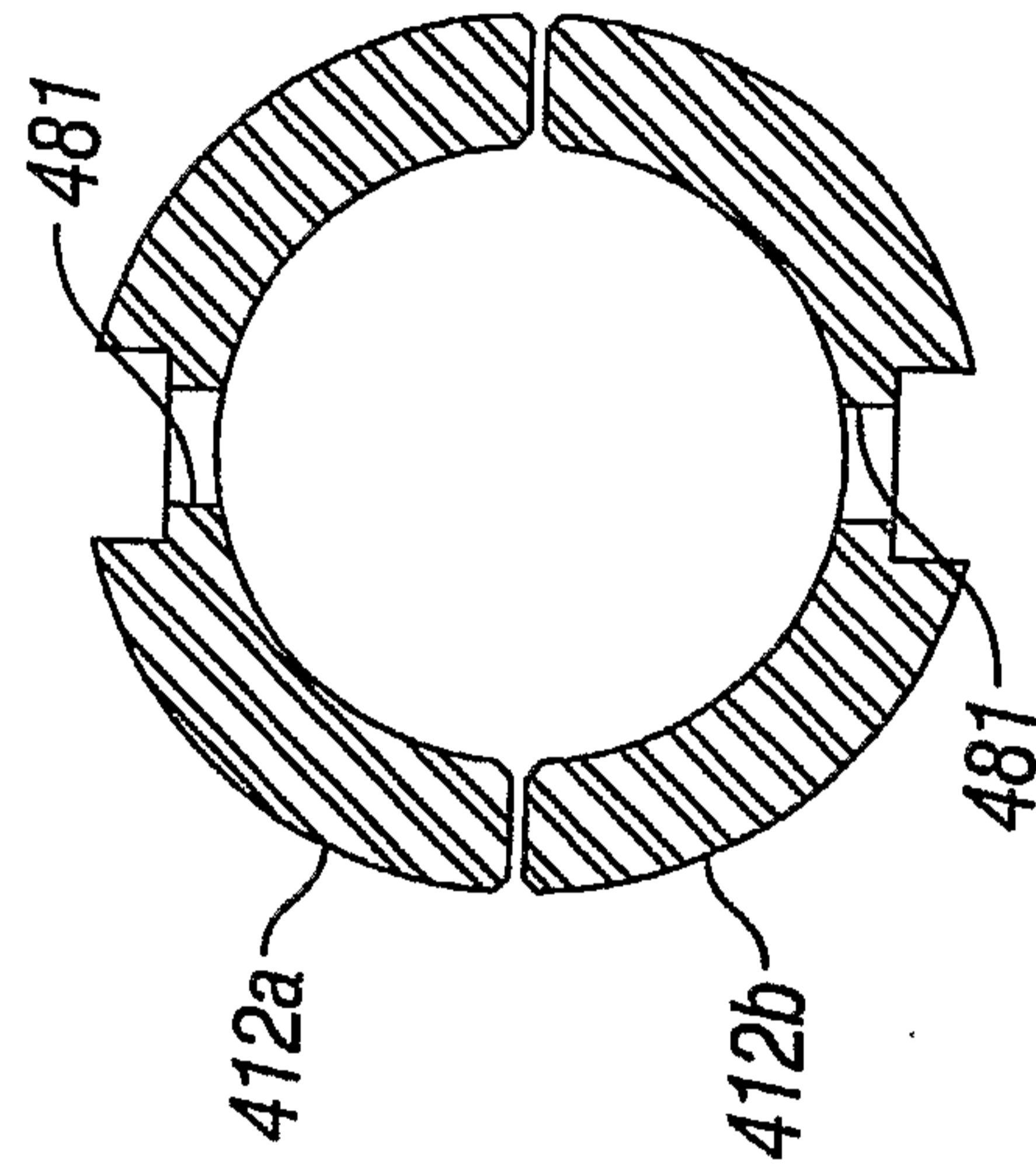


FIG. 4J

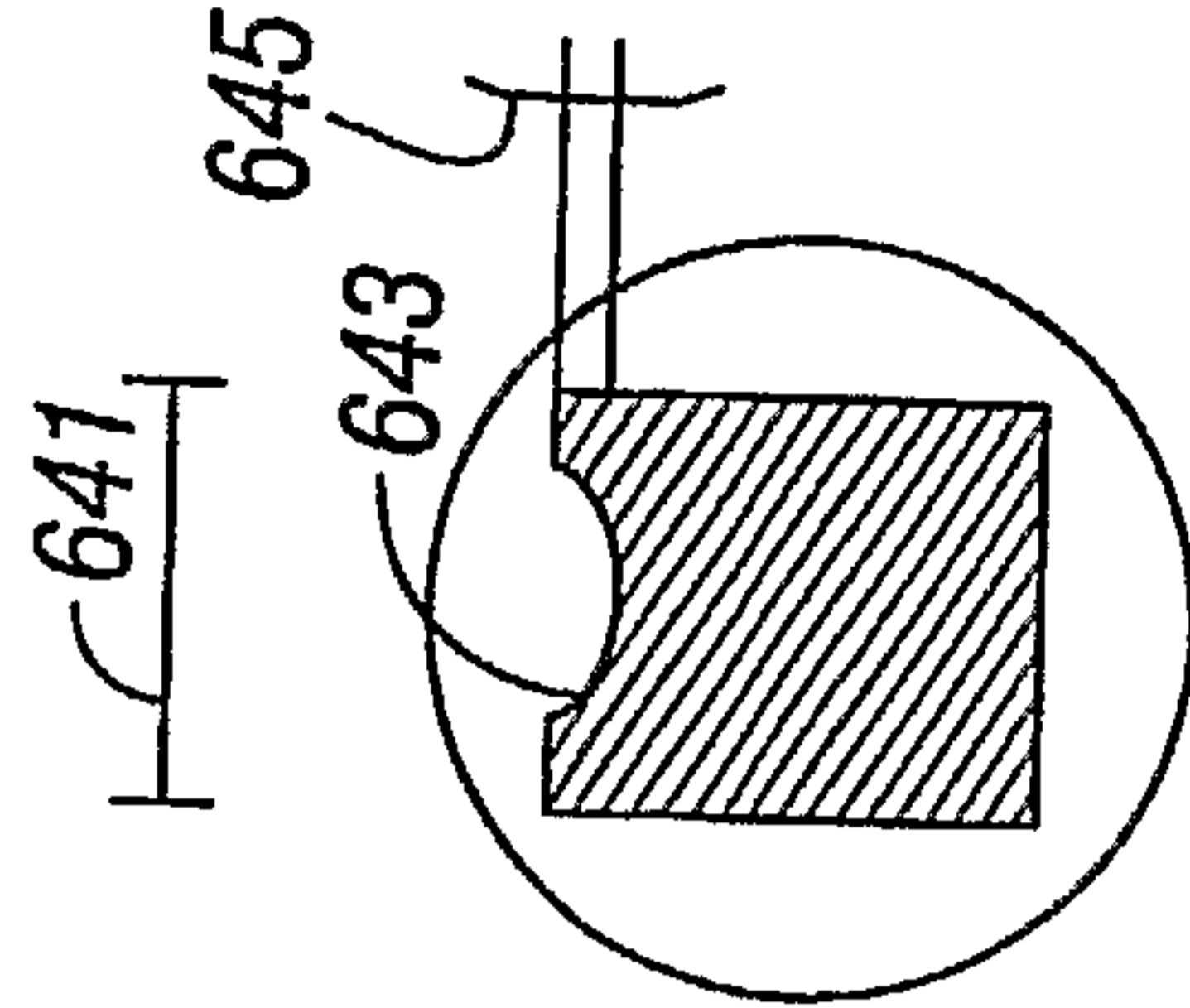


FIG. 4K

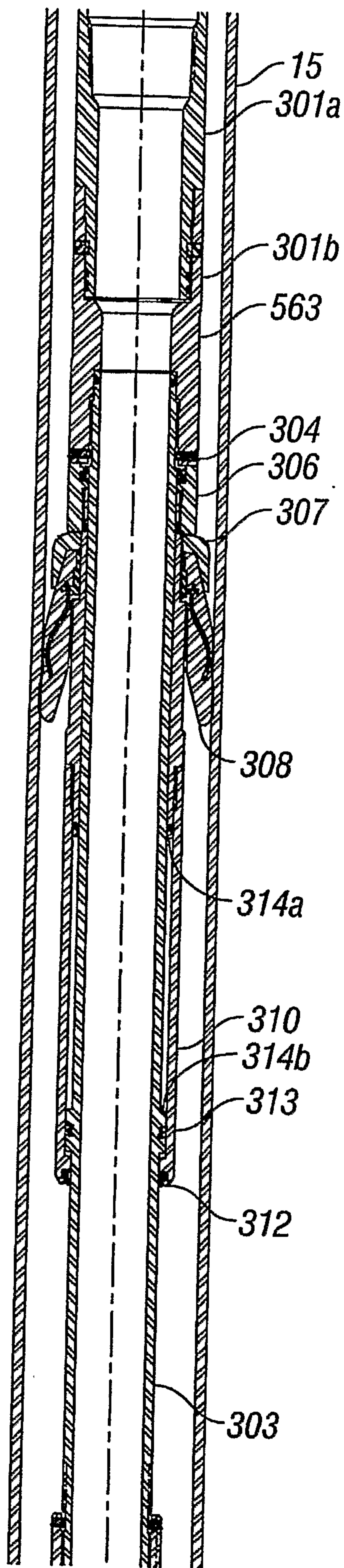


FIG. 5A

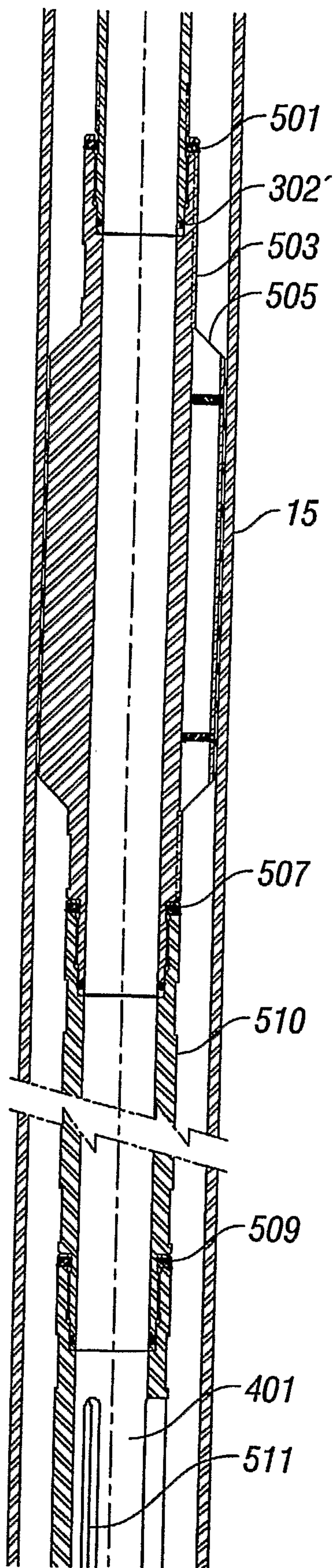


FIG. 5B

9/18

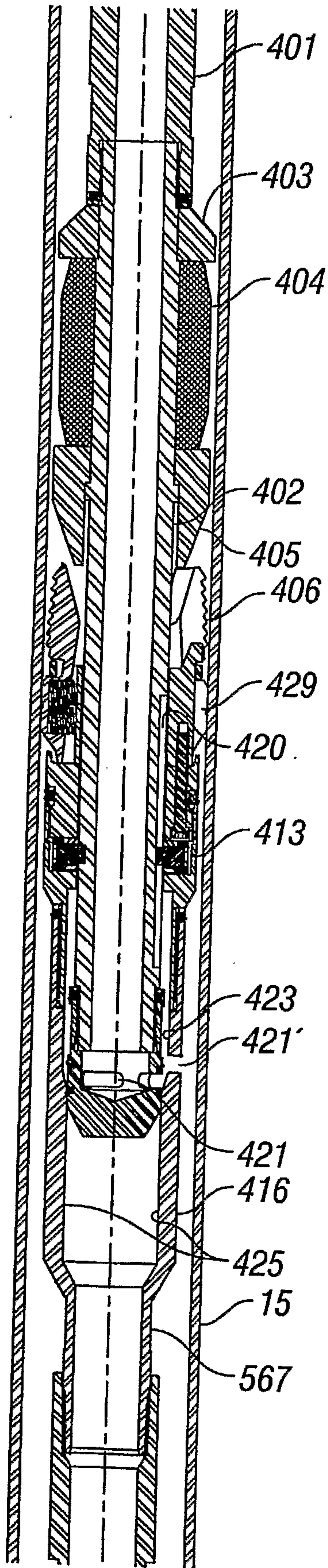


FIG. 5C

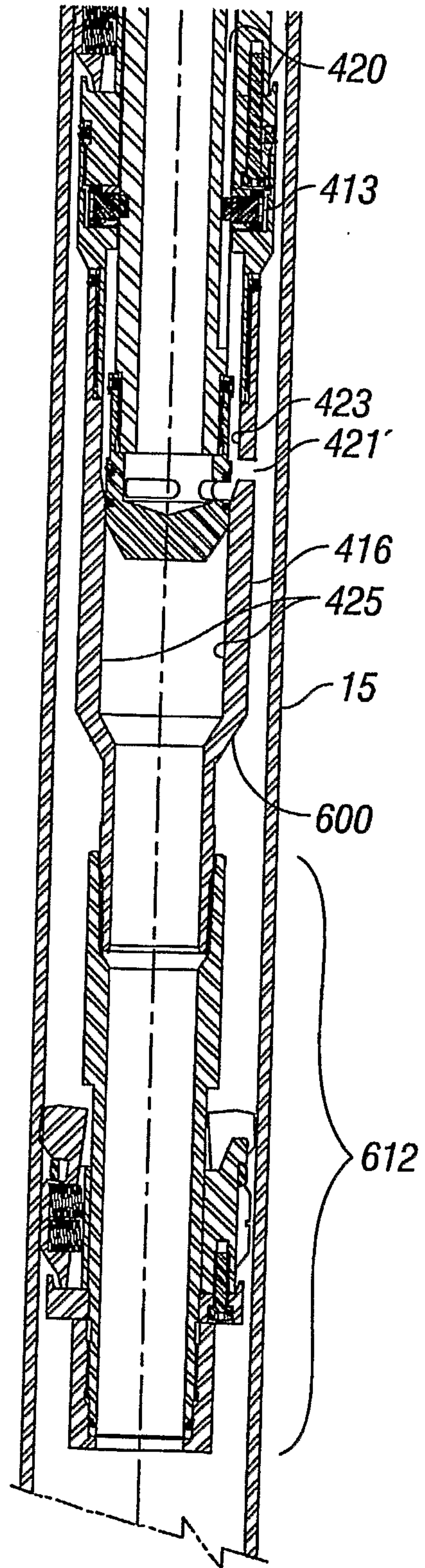


FIG. 5D

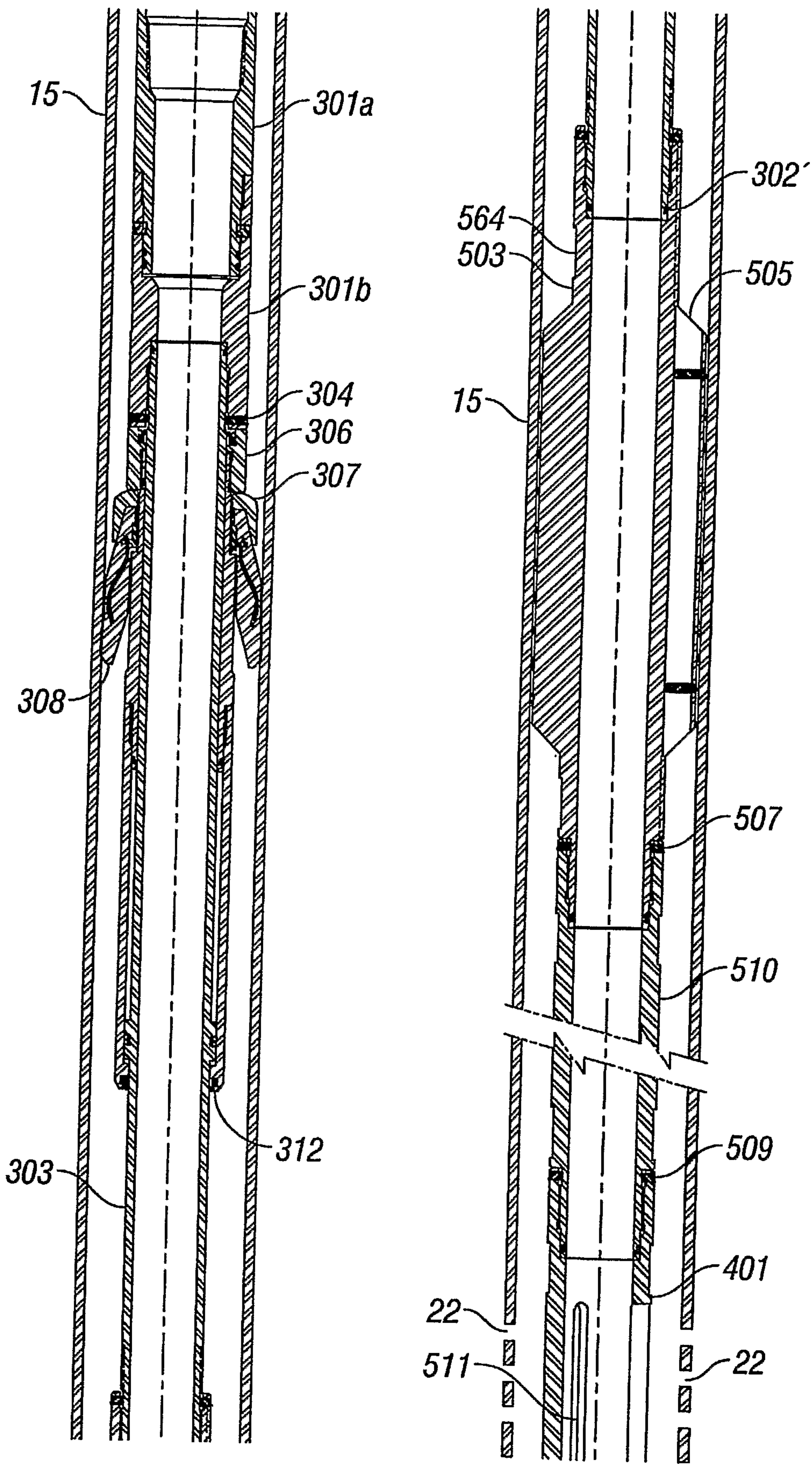


FIG. 6A

FIG. 6B

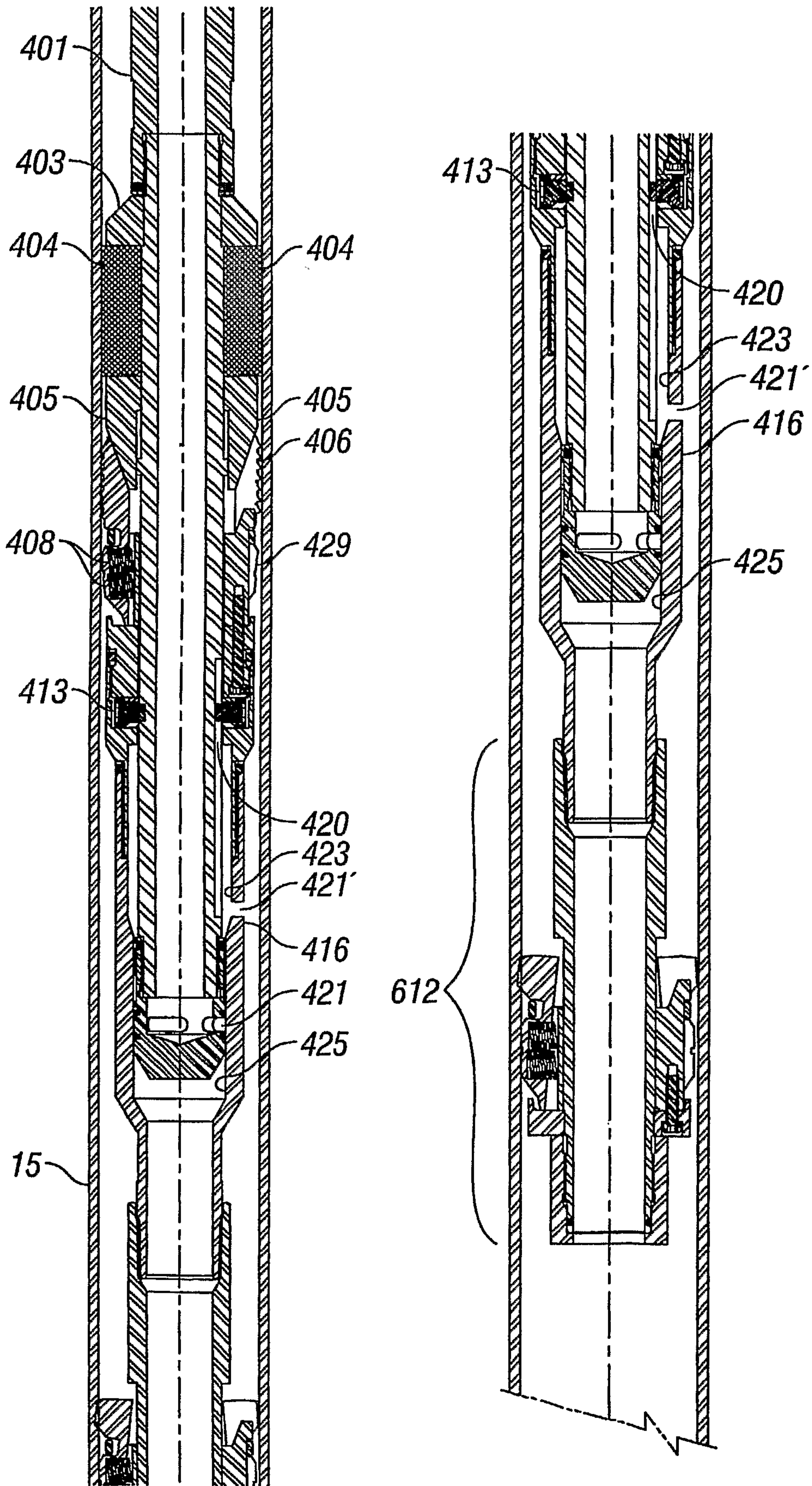


FIG. 6C

FIG. 6D

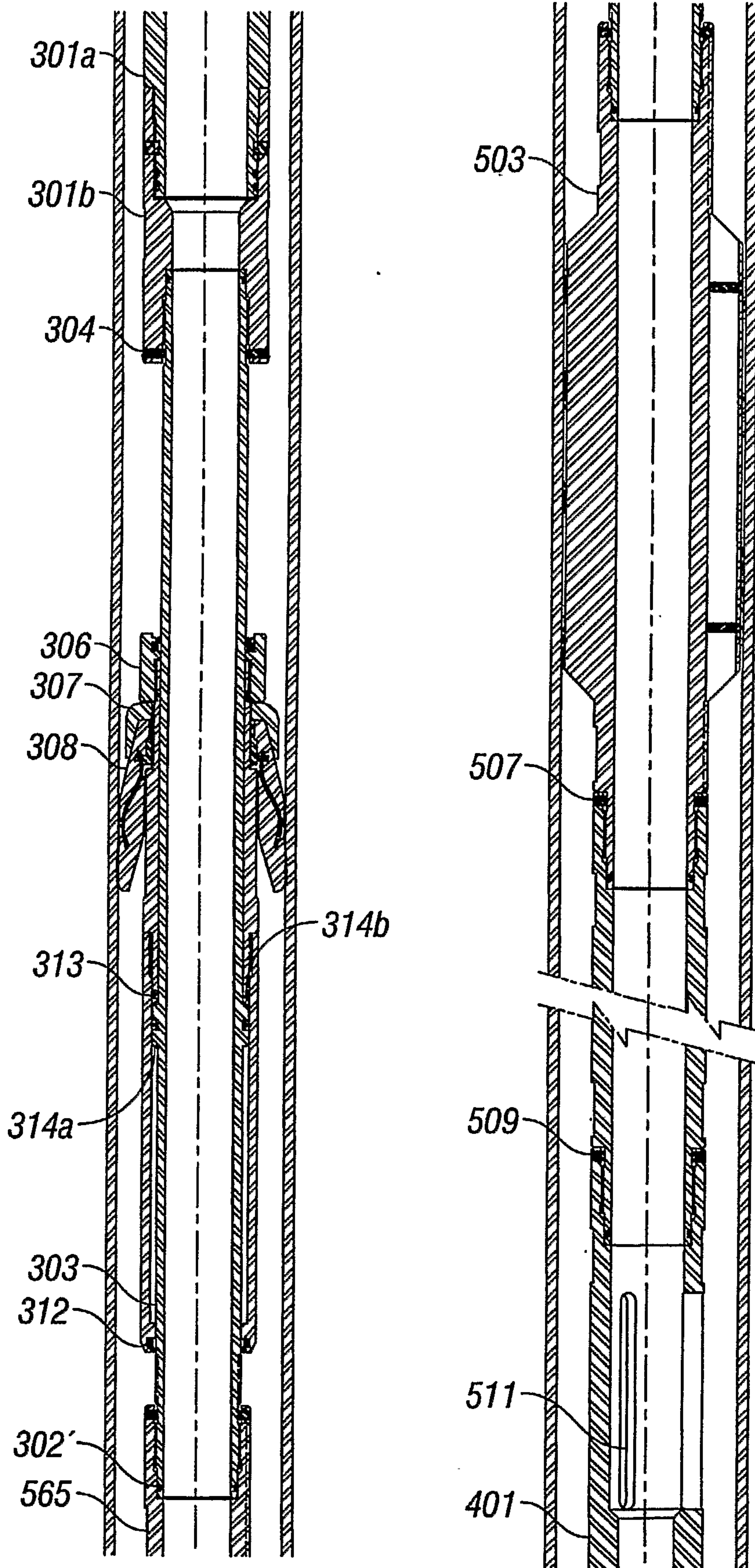


FIG. 7A

FIG. 7B

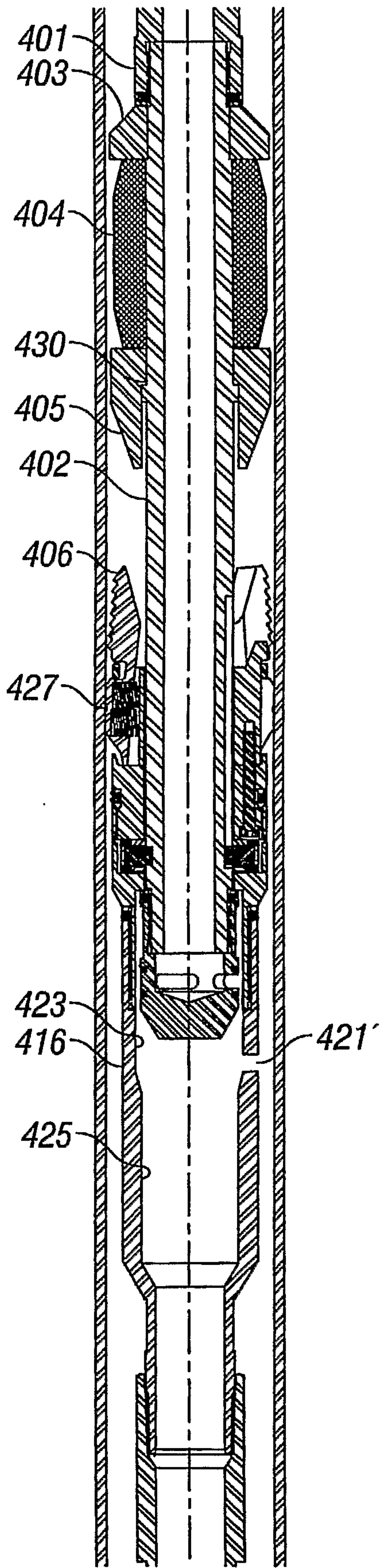


FIG. 7C

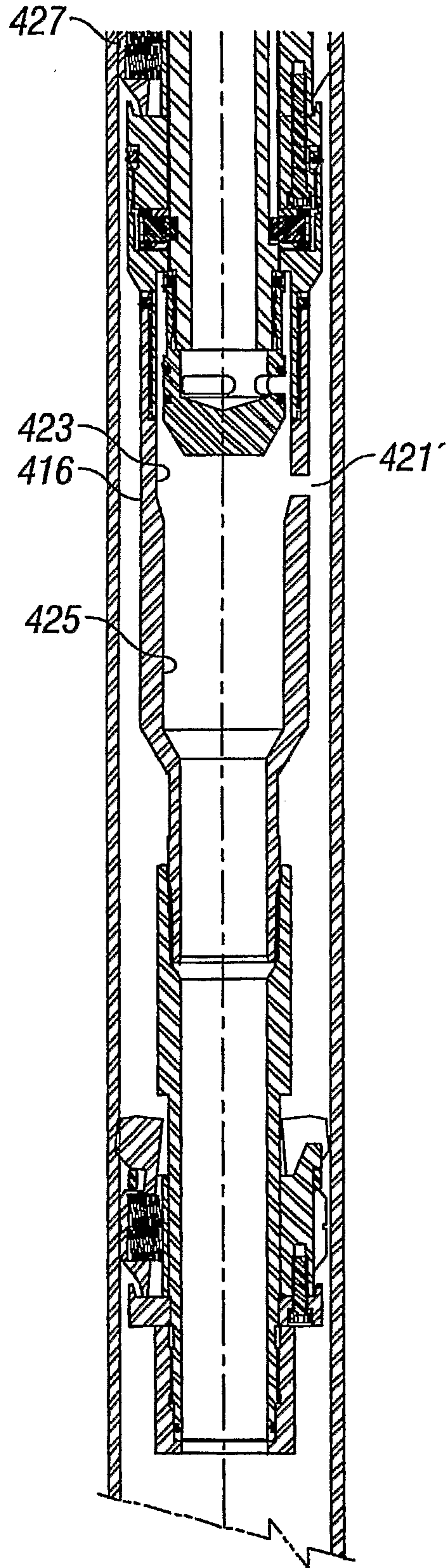


FIG. 7D



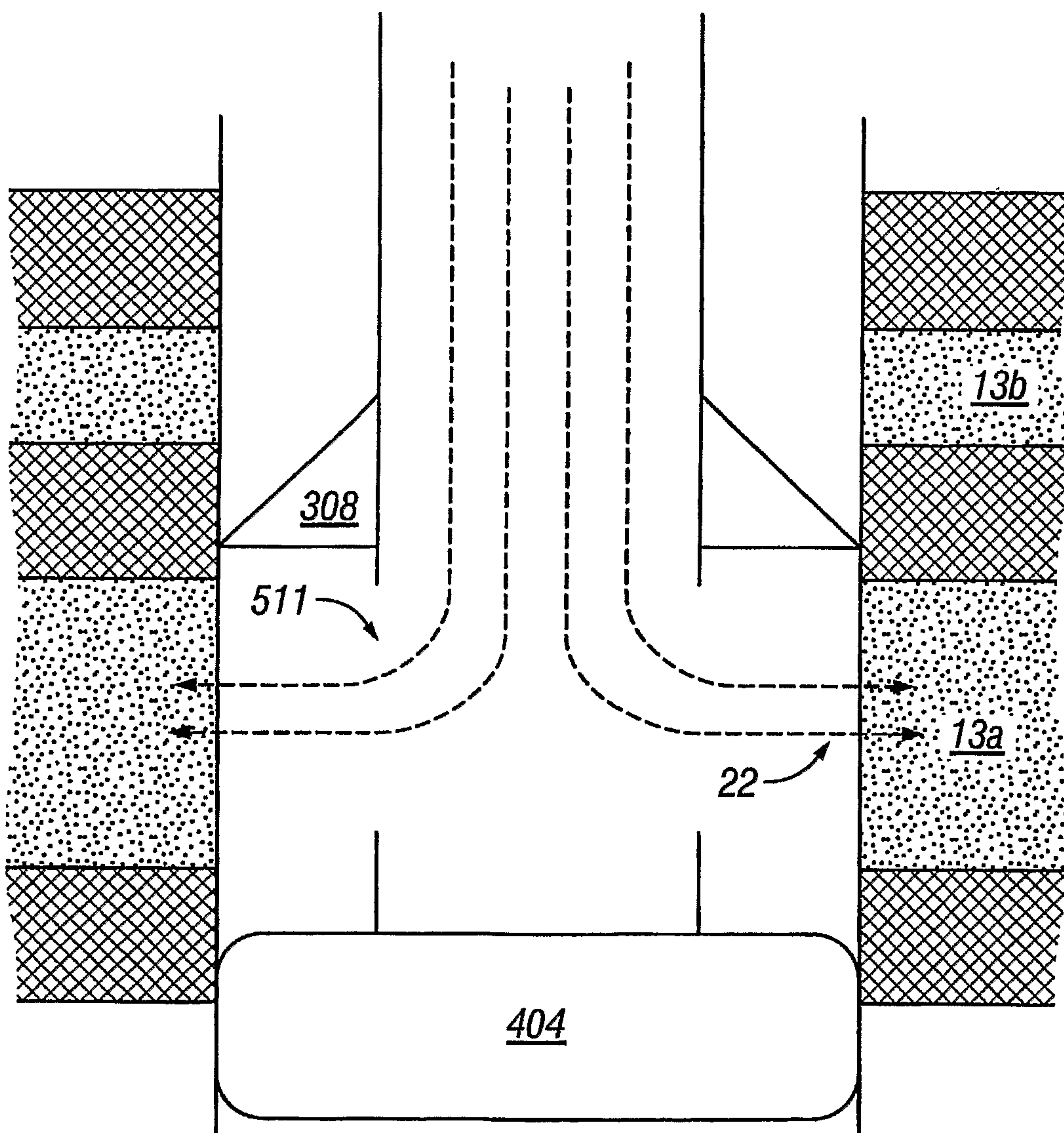
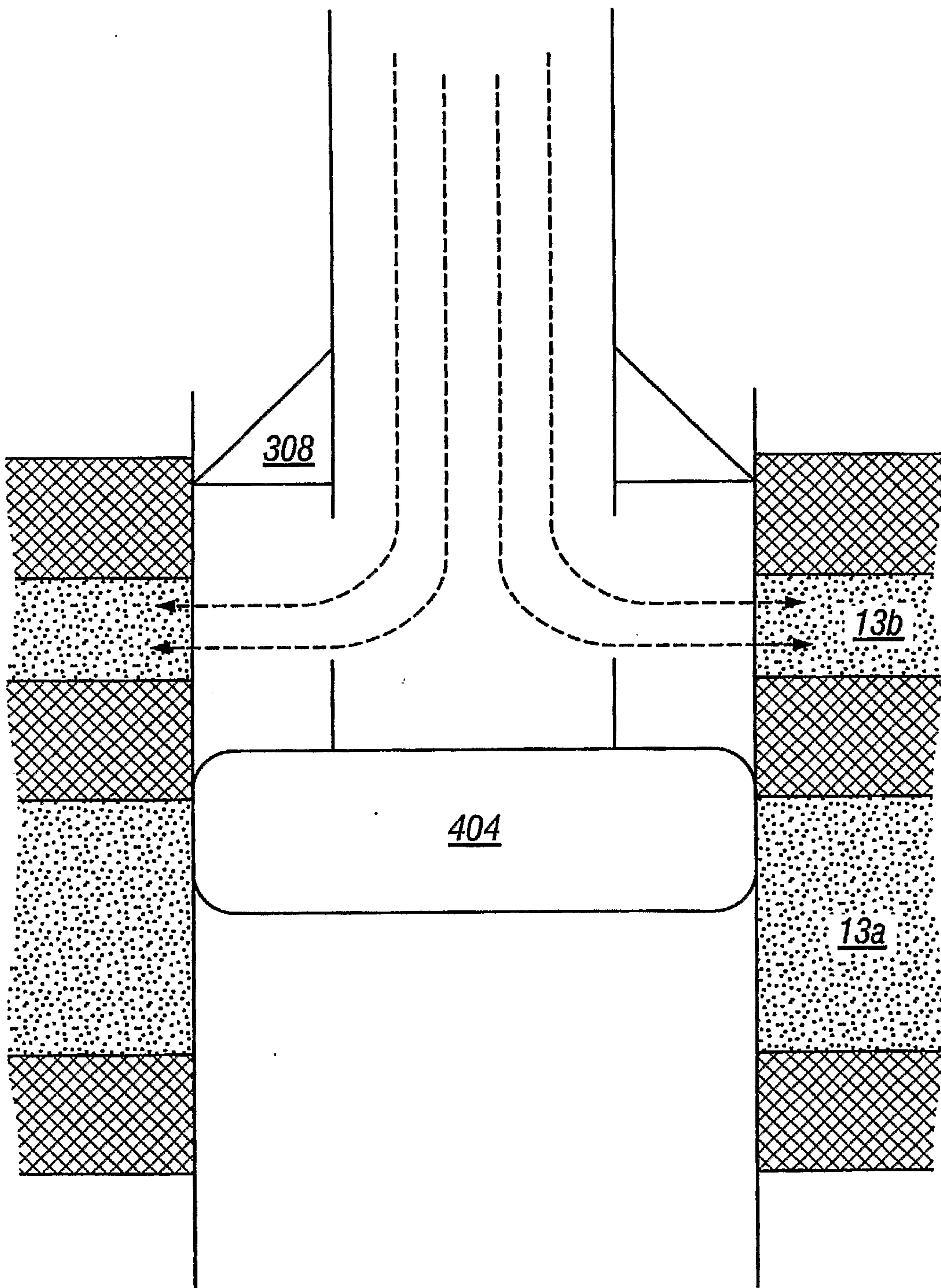


FIG. 8A

**15/18**



**FIG. 8B**

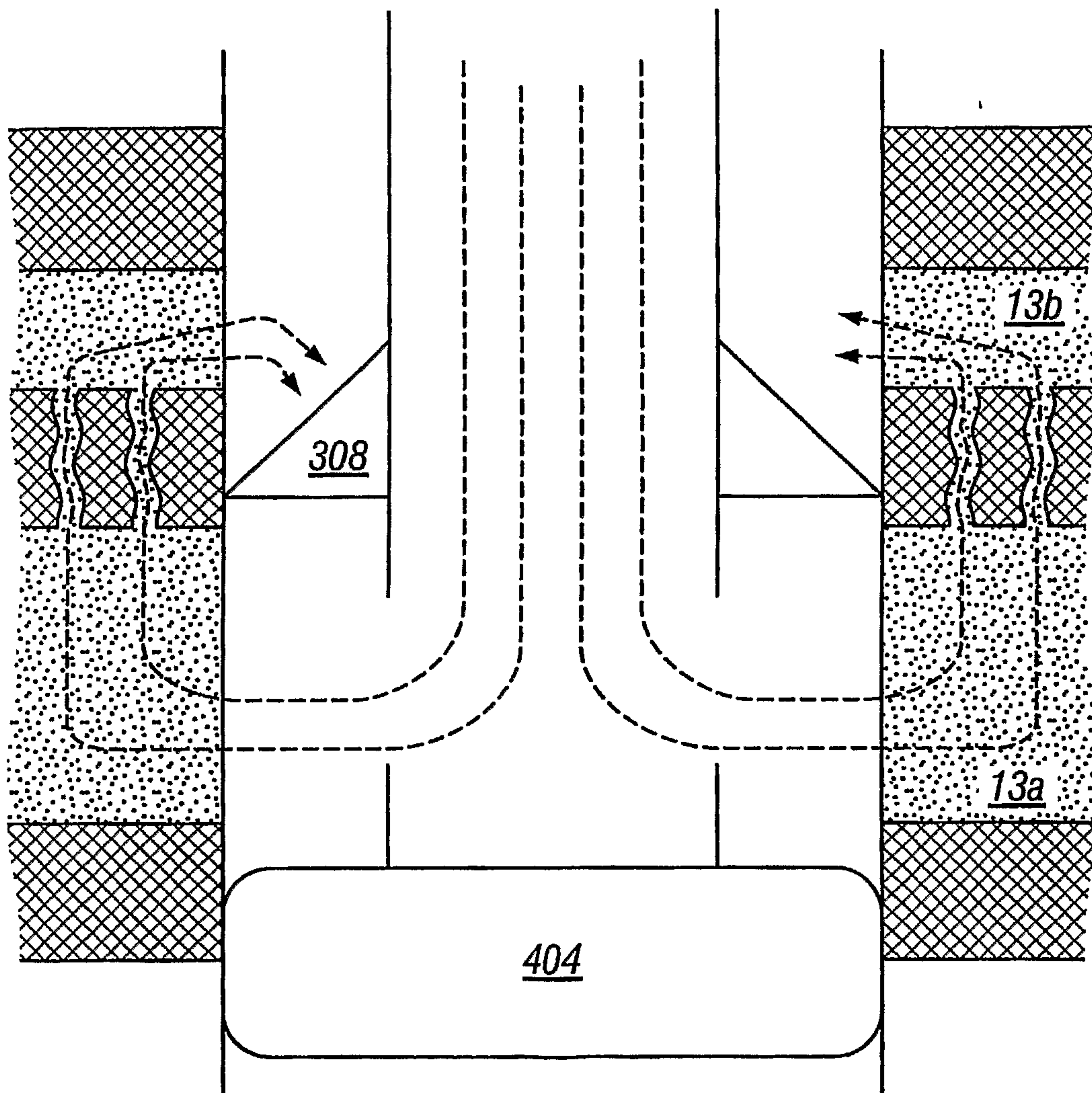


FIG. 9

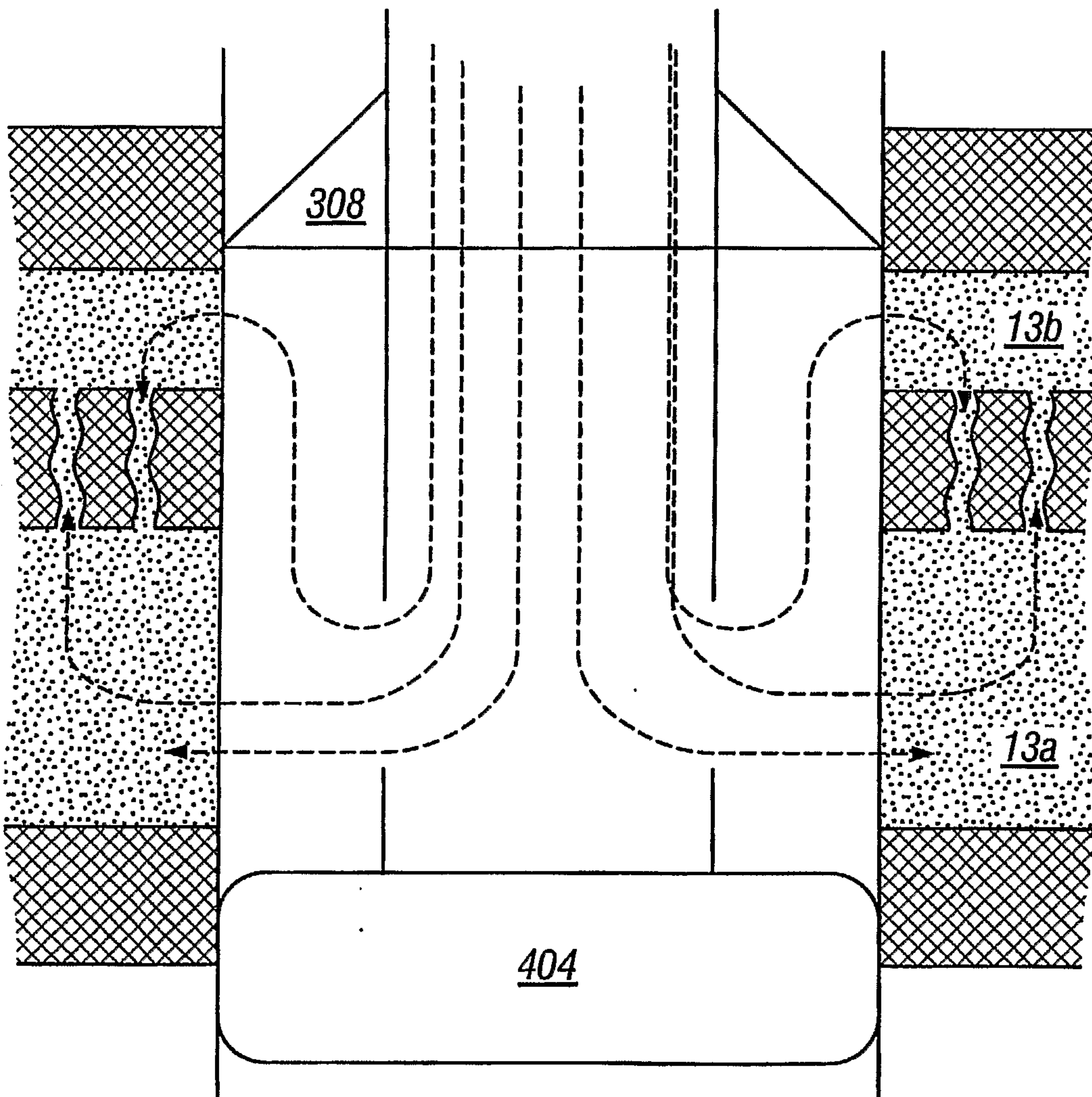


FIG. 10

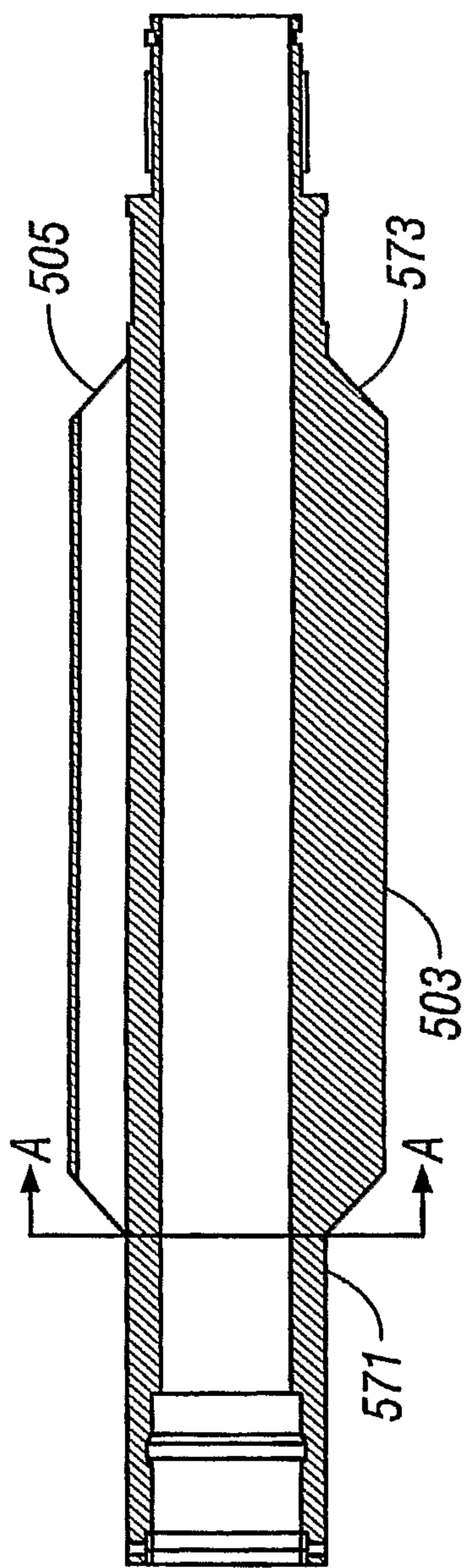


FIG. 11A

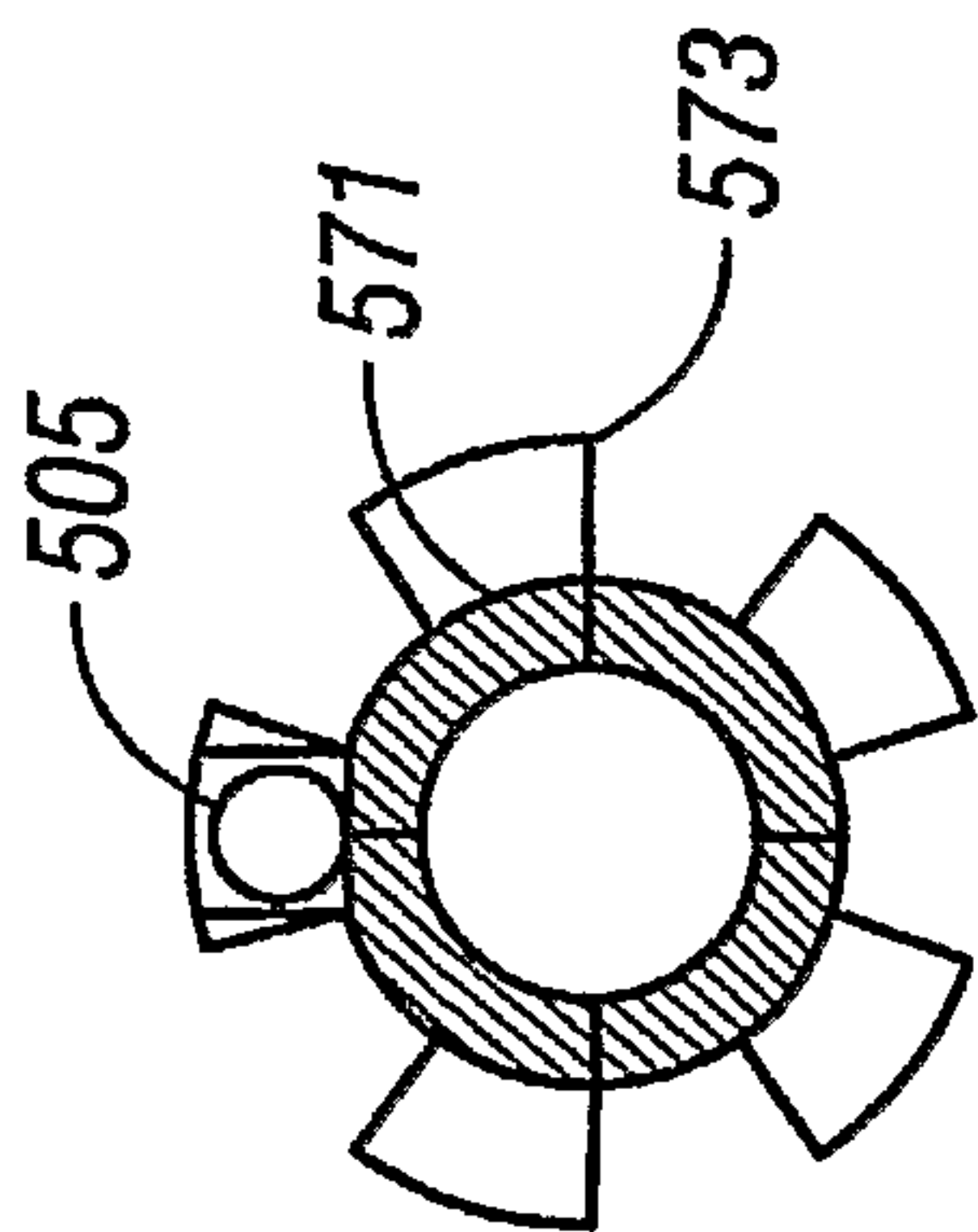


FIG. 11B

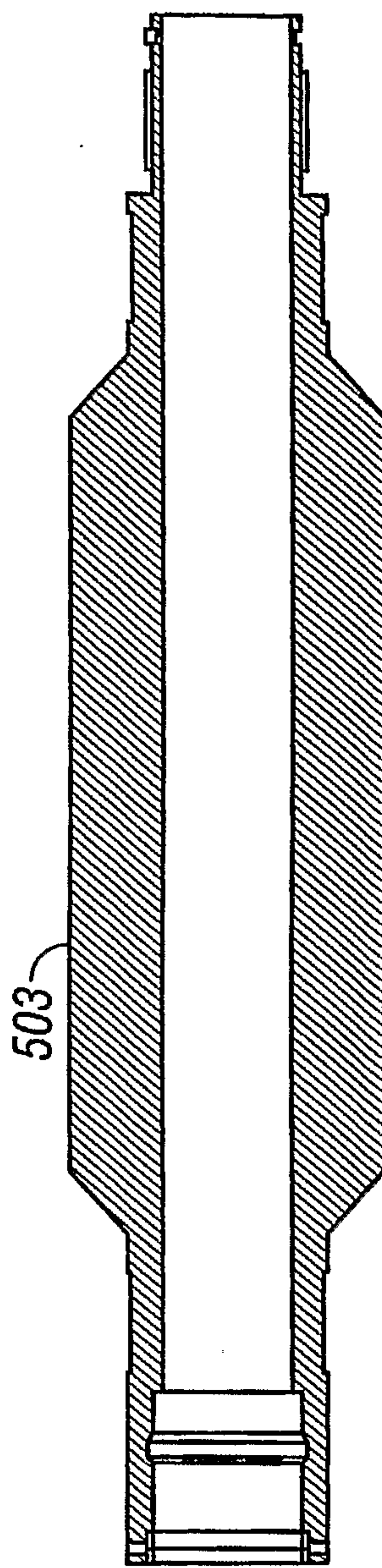


FIG. 11C

