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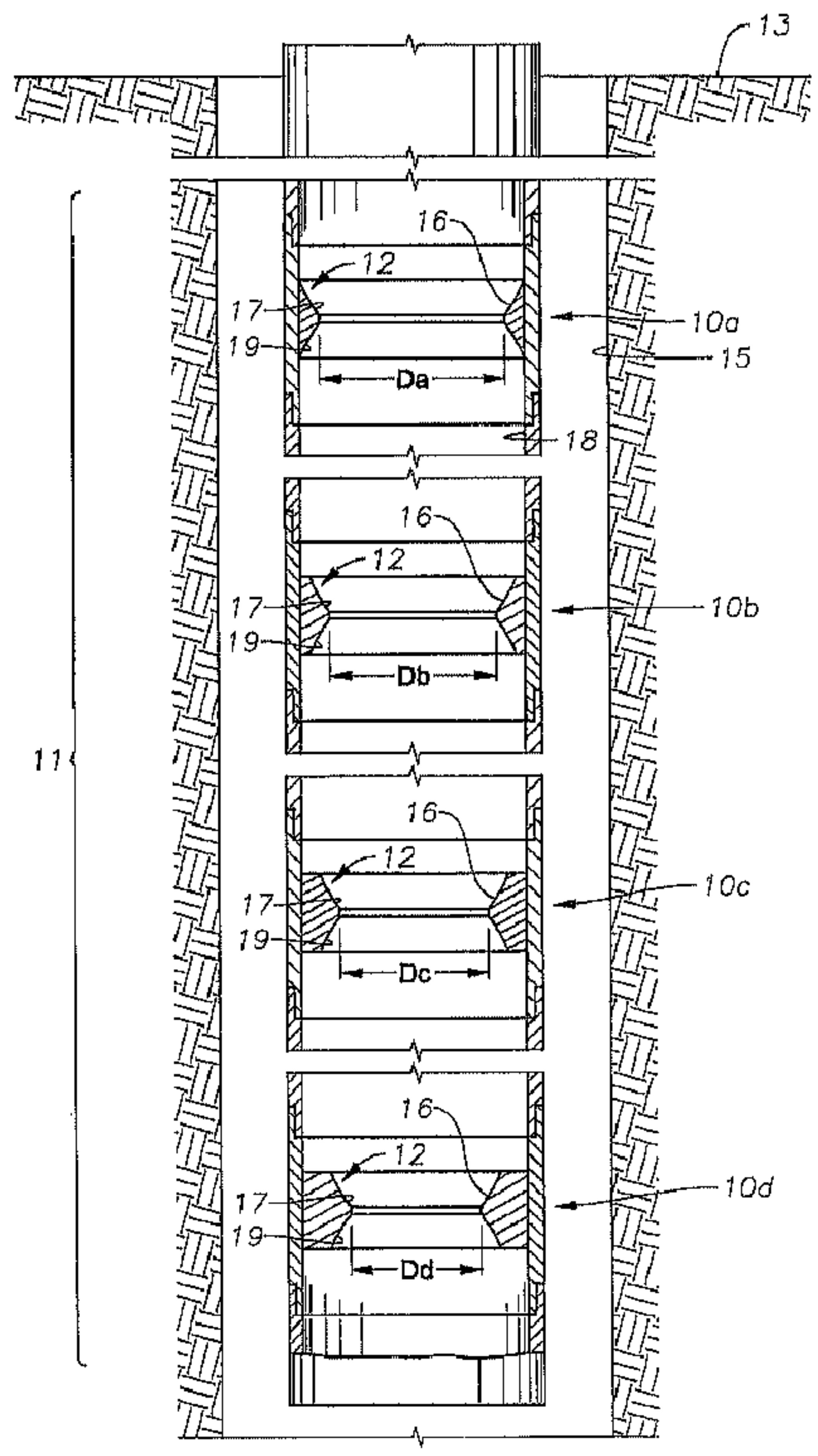
(72) **Inventeurs/Inventors:**
UMPHRIES, DON, US;
WILLIGER, GABE, US

(73) **Propriétaires/Owners:**
UMPHRIES, DON, US;
WILLIGER, GABE, US

(74) **Agent:** GOWLING LAFLEUR HENDERSON LLP

(54) **Titre : SYSTEME DE RECUPERATION ET DE PERFORATION DE CONDUITE SANS FIL**
(54) **Title: WIRELESS PIPE RECOVERY AND PERFORATING SYSTEM**



(57) **Abrégé/Abstract:**
A system for positioning a wireless pipe recovery tool in a wellbore, the system having a series of locator pipe subs inserted along the length of a pipe string in a wellbore, wherein each locator pipe sub has a seat disposed around its internal periphery so as to

(57) **Abrégé(suite)/Abstract(continued):**
form an aperture of s smaller diameter than the diameter of the pipe sub. The pipe subs have apertures of varied diameter and are consecutively arranged along the pipe string so that the aperture diameters decrease with increasing depth. A locator housing selected from a plurality of locator housings of varied outer diameter is attached to the wireless pipe recovery tool, the outer diameter of the locator housing selected to be slightly larger than the aperture in which the tool is intended to seat.

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(72) Inventors; and
(71) Applicants : **UMPHRIES, Don** [US/US]; 6402 Rabbit Run Rd., New Iberia, Louisiana 70560 (US). **WILLIGER, Gabe** [US/US]; 6600 Villa Rd., Dallas, Texas 75252 (US).

(74) Agents: **TIDWELL, Mark A.** et al.; IP Section, 2323 Victory Avenue, Suite 700, Dallas, Texas 75219 (US).

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(54) Title: WIRELESS PIPE RECOVERY AND PERFORATING SYSTEM

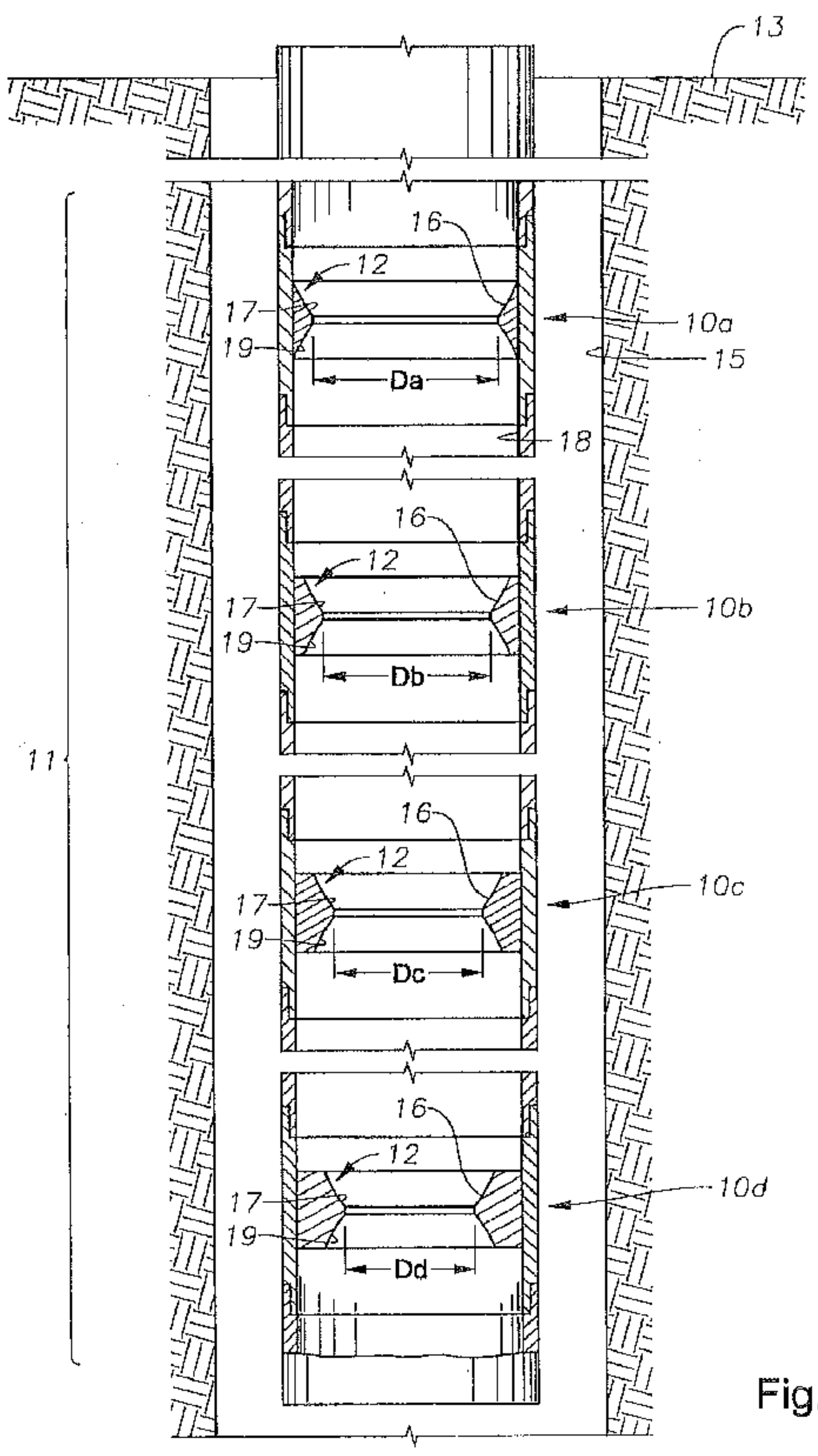

Fig. 1

(57) Abstract: A system for positioning a wireless pipe recovery tool in a wellbore, the system having a series of locator pipe subs inserted along the length of a pipe string in a wellbore, wherein each locator pipe sub has a seat disposed around its internal periphery so as to form an aperture of s smaller diameter than the diameter of the pipe sub. The pipe subs have apertures of varied diameter and are consecutively arranged along the pipe string so that the aperture diameters decrease with increasing depth. A locator housing selected from a plurality of locator housings of varied outer diameter is attached to the wireless pipe recovery tool, the outer diameter of the locator housing selected to be slightly larger than the aperture in which the tool is intended to seat.

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DESCRIPTION

WIRELESS PIPE RECOVERY AND PERFORATING SYSTEM

[001]

BACKGROUND OF THE INVENTION

Field of the Invention

[002] The present invention relates to a system and method for landing/positioning a device at a known depth within a tubing string of wellbore without the use of eline, wireline, slickline or similar vehicle lowered from the surface. The present invention is preferably utilized with explosive devices to position a charge in a tubing string for purposes of perforating, cutting, pipe recovery, plugging or similar exercises. More particularly, the invention relates to placement of explosive charges within a tubing string by utilizing restrictions formed in the drill string at known depths to engage explosive devices dropped or otherwise pumped down the drill string.

SUMMARY OF THE INVENTION

[003] The present invention provides a series of profile subs which distributed within a pipe string to form a plurality of spaced apart flanges internally disposed around the perimeter of the pipe string along its length. Each flange is characterized by a cross-sectional profile of varying shape with an aperture of a predetermined diameter formed therein. The profile subs are arranged so that the flanges form a series of ever decreasing inner diameter restrictions as the pipe string extends deeper into a wellbore. Utilized in conjunction with these profile subs

are a plurality of housings of varying external diameter. These housings are configured to be secured to the exterior of a down hole tool or device, such as a firing head, to permit the device to be landed on a flange at a desired depth. The known distance from the flange to precisely where the device functions in the drillstring is critical to the ability to predict what device is best suited to achieving the desired result.

[004] More specifically, the intent is to install these profile subs strategically throughout a pipe string, such as a drill string, drill pipe, drill collars, tubing, tubulars or casing, from largest diameter restriction profile to smallest diameter restriction profile so that a device of known designed outer diameter, when dropped or pumped from the surface through the pipe string, will pass through the pipe string until the device strikes a profile beyond which it cannot pass, namely a profile with an inner diameter smaller than the outer diameter of the device. A metal to metal (or other) seal will enable pressure to be applied to the device for various purposes, such as, for example, triggering of a firing head. The type of device utilized in the system can be any tool utilized in down hole applications.

[005] Although not intended to be limited for use with any particular device, the system is particularly useful in pipe recovery operations that may use tools such as a perforating gun, a jet cutter, a severing tool, torch cutter or a chemical cutter.

[006] An additional embodiment of the invention incorporates a restriction or internal profile as described above with a specially designed heavyweight drill collar or sub. The heavyweight sub includes a section with a reduced external diameter, relative to the upper and lower portions of the sub. Utilizing an internal profile positioned above the reduced external diameter section of the heavyweight sub, a device to be activated (such as a jet cutter or torch cutter) can be positioned so that the explosive charge is located adjacent the section of the sub with the external diameter, thereby permitting the heavyweight sub to be easily cut. Significantly, once the cut is made and the upper section of drillstring is withdrawn, the severed end of the reduced section at the top of the drillstring still remaining in the borehole is easily accessed by conventional "fishing" grappling technology because the severed end is not excessively flared. This reduced external diameter pipe section also facilitates perforating operations previously made very difficult if not impossible by the thickness of the drill collar. The tensile strength of the sub is designed such that it exceeds the weakest link in the remaining drillstring so that the sub is not the weak point in the drillstring.

[007] A sleeve or bushing may be installed over the reduced external diameter section of the heavyweight sub to ensure that the sub buckling threshold of the sub is maintained.

BRIEF DESCRIPTION OF THE DRAWINGS

[008] FIG. 1 illustrates the cross-section of a pipe string with a series of flanges disposed therein to form decreasing restrictions along the length of the pipe string.

[009] FIG. 2 illustrates one possible profile of a housing that can be attached to device, such as a firing head.

[010] FIG. 3 illustrates a housing mounted on an object and seated on a flange.

[011] FIG. 4 illustrates a heavy weight sub that can be utilized with the system of the invention to more easily cut thick walled subs.

[012] FIG. 5 illustrates a sleeve that can be utilized in conjunction with the heavy weight sub of Fig.4 to add strength to the heavy weight sub prior to cutting operations.

[013] FIG. 6 illustrates a firing head employing a housing configured to seat in a flange as shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[014] As shown in Fig. 1, the invention consists of a series of subs 10a, 10b, 10c, 10d, with internal profiles 12 of varying diameter "D" forming restrictions in the interior annulus of the subs. The subs are arranged in a pipe string 11 extending from the surface 13 into a wellbore 15 so that the largest diameter profile or restriction is nearest to the surface, with ever decreasing (in diameter) profiles, such that the deepest/lowest sub in the string has the smallest diameter profile or restriction. For example, in Fig. 1, profile 12a of sub 10a, nearest the surface 13, has the largest diameter D_a restriction, while profile 12d of sub 10d, deepest in wellbore 15, has the smallest diameter D_d restriction. The consecutive diameters D_a, D_b, D_c and D_d decrease with depth in wellbore 15. In any event, the flanges are disposed to engage the outer housing 14 (shown in Fig. 2) of a tool, device or object being pumped, dropped or otherwise lowered or inserted or conveyed along the pipe string.

[015] In one preferred embodiment, the pipe subs 10 are only approximately two feet long and can be readily threaded into a pipe string during make-up. In one embodiment of the invention, up to five pipe subs 10 are provided and arranged so that the restriction diameter between consecutive subs decreases from the first sub (nearest the surface) to the last sub (deepest in the wellbore) in the pipe string, wherein another embodiment, at least five such pipe subs are provided. In one embodiment of the invention, at least ten pipe subs 10 are provided and arranged so that the restriction diameter between consecutive subs decreases from the first sub (nearest the surface) to the last sub (deepest in the wellbore) in the pipe string. In one embodiment of the invention, at least twenty pipe subs 10 are provided and arranged so that the restriction diameter between consecutive subs decreases from the first sub (nearest the surface) to the last sub (deepest in the wellbore) in the pipe string. In one embodiment of the invention, at least fifty pipe subs 10 are provided and arranged so that the restriction diameter between consecutive subs decreases from the first sub (nearest the surface) to the last sub (deepest in the wellbore) in the pipe string. Of course, the number of pipe subs and restrictions will depend on the length of the overall pipe string and the diameter of the pipe in which restrictions are formed.

[016] While the restrictions may take any shape, in the preferred embodiment, the restrictions are formed of a lip or flange 16 symmetrically disposed around the interior 18 of a pipe sub 10, thereby forming an aperture axially aligned relative to the pipe sub. Those skilled in the art will appreciate that the flange 16 need not extend fully around the interior of the pipe sub so long as an aperture functioning as a restriction is formed, thereby creating a seat on which an object can land. Nor does the aperture need to be symmetrical or axially formed relative to the pipe sub, so long at the overall system comprises apertures of varying size arranged in consecutive order as described herein. For example, flange 16 may take the form of one or more tabs, fingers or projections extending into the annulus of a pipe sub so as to form a "restriction" therein.

[017] In one embodiment, the flange 16 has an upper surface 17 and a lower surface 19. The upper surface 17 is contoured so as to engage an object provided with similarly contoured profile, thereby permitting a seal to be formed between the object and the flange when the object is seated on upper surface 17. In the example of Figure 1, upper surface 17 is curved to form a concave profile and disposed to receive an object with a correspondingly rounded or football shape (such as is shown on housing 14 of Fig. 2). Once an object is seated, a seal is formed between the object and the flange 16 as pressure is applied to the object by the fluid column above the object or otherwise by the downwardly pumped fluid to the extent the object is disposed to pass fluid therethrough. In one example, if the object is an explosive device, pressure from the surface applied to the upper end of the explosive device not only maintains the seal as described, but may also be utilized to activate the explosive charge below the seal.

[018] While the tool, device or object conveyed in a pipe string may be externally shape itself for landing on and engaging a flange 16, the intent of the invention is to provide a universal locator housing 14 that can be secured to the exterior of a variety of standard down hole devices or tools, thereby providing flexibility in the system for use with whatever tool and for whatever purpose is desired. Thus, in one embodiment of the invention, locator housing 14 may be integrally formed as part of the device with which it is utilized, while in another embodiment of the invention, housing 14 may be secured to the exterior of such device. For example, housing 14 may be provided with internal threads 20, such as shown in Fig. 2, disposed to engage the external threads 22 provided on the external surface of a device 24. Of course, while threads are described as the attachment mechanism, any fasteners or locking system may be utilized so long as housing 14 is secured to a device 24 to create the external landing profile described herein.

[019] Likewise, while the locator housing 14 shown in Fig. 2 had an elongated, convex shaped external surface having the profile of a football, the housing 14 may be of any desired shape so long as it is capable of engaging the corresponding flange with which the housing is intended to land. It is the outer most diameter or perimeter dimension that is the key since it is this dimension that determines if the housing will engage a particular restriction or pass through the restriction. In another preferred embodiment, for example, housing 14 could simply be a ring or collar or external flange of a predetermined outer diameter disposed to seat against a corresponding internal flange within a pipe section. In this regard, while it is desirable that a seal be formed between the object and the flange, it is not a necessity with respect to positioning of the object at a specific, known location.

[020] In one preferred embodiment, locator housing 14 is secured on (or otherwise integrally formed with) a flow-through tube 26, shown in Fig. 2, which allows fluid to flow by the location at which the housing 14 has landed. Thus, fluid may continue to be used downstream of the flange for various purposes. Preferably, flow-through tube 26 is universally configured to attach to a variety of tools. In the embodiment of Fig. 2, for example, flow-through tube 26 is disposed to thread onto the end of device 24. Those skilled in the art will appreciate that in embodiments employing a flow-through tube or similar vehicle, the length of tube 26 can readily be altered to place the device 24 at a location a predetermined distance away from the flange 16 on which housing 14 is seated. More specifically, flow-through tube 26 has an interior annulus 28. The upsteam end of tube 26 is provide with pressure/flow ports 30 which permit flow to continue through tube 26 once housing 14 is seated on flange 16. Moreover, ports 30 permit flow through tube 36 once an operation is complete. As such, upon retrieval of tube 26, the formation of a fluid column above tube 26 is avoided. In this same vein, tube 26 may also be provided with a fishing head 32 or similar structure to permit retrieval of the tube. Threads 22 are disposed on the exterior of tube 26 thereby permitting housing 14 to be readily secured thereto. As mentioned above, the length of tube 26 can be altered as desired to adjust the positioning of device 24 relative to housing 14 (and the flange 16 on which housing 14 is seated.) Of course, while a flow-through tube 26 is most desirable for this placement method, any type of hollow or solid body vehicle can be used for placement of a tool using this method. In one embodiment, it is the ability to select a vehicle of a varied length that forms one novel feature of the invention.

[021] Of course, while an embodiment having flow-though capabilities is desirable, it is not a necessity. Thus, flow-through tube 26 could simply be an elongated, solid or hollow tube, rod, shaft or other placement vehicle capable of attachment to a device 24 so as to position the device 24 at a desired distance away from (generally below) the flange on which housing 14 has landed. By adjusting the length of such vehicle, the specific placement of device 24 within a wellbore can be achieved. Notably, while the invention generally contemplates that the device 24 will be positioned below a landing flange, the system may also be utilized to position a device above a landing flange. In such case, the housing 14 would be downstream or below the device 24 to which it is attached.

[022] With more specific reference to Fig. 2, in this illustration of the invention, device 24 is a firing head 34. As shown, tube 26 is secured to the upper end of firing head 34 so that the annulus 28 of tube 26 is in fluid communication with the interior of firing head 34. In this embodiment, firing head 34 is a direct pressure firing head that can be activated using pressure provided by the fluid passing through tube 26. Firing head 26 is provided with flow access ports 38 which are exposed during the firing process.

[023] With reference to Fig. 3, housing 14 is shown mounted on a tube 26 and seated against a flange 16c. As can be seen, the outer diameter OD of housing 14 is slightly larger than the inner diameter D_c of the restriction formed by flange 16c, such that housing 14 seats against flange 16c after having passed through the larger diameter restrictions D_a and D_b of flanges 16a and 16b, respectively. In seating against flange 16c, a metal to metal seal is formed between housing 14 and flange 16c. Tubing 26 may also be provided with an additional set of flow ports 38 to permit flow before, during or after an operation, as desired.

[024] In any event, the housing 14 generally seats in the restriction above where the desired operation is to take place, thereby sealing off the upper end of the tubing string from the location of the operation. The downward fluid pressure against housing 14 maintains the seal during such operation. Fluid passing through apertures 30 into the interior of tube 26 can be utilized to control the desired operation.

[025] Turning to Fig. 4, an additional component of the system can include a sub 40 specifically configured to be easily cut when a charge is positioned adjacent thereto utilizing the flange 16 and housing 14 described herein. Specifically, heavyweight or thick-walled subs are commonly found on the lower end of a pipe strings in wellbores. Those skilled in the art can appreciate that such subs are more difficult to cut, sever or perforate than standard subs due to the thicker walls characteristic of heavyweight subs. Such subs typically require much greater amounts of explosive for these operations. Naturally, larger charges tend to result in greater damage in the area of the detonation, which could frustrate the purpose of the operation, such as recovery efforts. For example, severing of a heavyweight sub utilizing a standard severing tool typically results in a large flare at the point of the cut. This large flare can inhibit access to and recovery of the pipe below the flare.

[026] In the invention, sub 40 is generally provided with an out diameter "d" to correspond with the outer diameter of the drill string with which sub 40 is utilized. A portion "b" of sub 40, however, is provided with an outer diameter "c" that is less than outer diameter "d". Since the interior annulus 42 of sub 40 is preferably of a constant inner diameter along the length of sub 40, the result is that the wall thickness along portion "b" is less than the wall thickness along the rest of sub 40, permitting sub 40 to be more easily cut, perforated or severed along portion "b" relative to the thicker walled portions of sub 40. In the preferred embodiment, sub 40 includes a flange 16, positioned upstream of portion "b" a distance of "a". Thus, knowing distance "a" and utilizing a firing head such as is shown in Fig. 2 and a placement vehicle such as flow-through tube 26, an explosive device can be precisely positioned within sub 40 adjacent portion "b." Those skilled in the art will appreciate that sub 40 can be integrally formed or can be formed in two or more attachable sections. For example, portion "b" may be externally threaded to secure to internal threads provided in the ends of sub 40 with larger diameters "d."

[027] An optional blowout plug 60 may also be provide in the wall of sub 40. Plug 60 can be utilized when circulation through sub 40 is impeded, which could prevent housing 14 from properly seating on flange 16. By opening plug 60, circulation through sub 40 can be enhanced, thereby allowing housing 14 (attached to a device 24) to be pumped down the pipe string until it is seated as desired.

[028] Those skilled in the art will appreciate that the reduced portion "b" of sub 40 not only permits the use of less explosive during cutting operations, it results in less damage to the downstream portion of the sub 40. In other words, the system leaves very little flare or destruction of the reduced portion "b" of sub 40, thereby permitting the severed portion to be more easily fished than prior art subs, which were typically lost below the cut.

[029] With reference to Fig. 5, sub 40 may be provided with a bushing or sleeve 46 disposed to strengthen portion "b" of sub 40 during run-in and operations prior to severing. As shown sleeve 46 if formed of an elongated tube 48 approximately the length of portion "b" of sub 40. At a first end, tube 48 is provide with interior threads 50 which are disposed to engage with exterior threads 52 provided on sub 40 at the approximate upstream transition point between the thin walled diameter "c" and the thick walled diameter "d" of sub 40. A lag screw may be provided at the first end to further secure tube 48 to the upper end of sub 40. At the second end of tube 48, it is seen that no such threads are provided. Rather, the end and interior surface of tube 48 are disposed to seat in a notch 50 disposed around the perimeter of sub 40, thereby forming a metal to metal seal therebetween. In one embodiment of the invention, tube 48 may include apertures 53 to allow fluid flow into the annular space 54 formed between the exterior of portion "b" and the interior of tube 48. While sleeve 46 provides anti-buckling support during normal operations, those skilled in the art will appreciate that upon severing, sleeve 46, being threadingly engaged with sub 40, remains attached to the portion of sub 40 that is withdrawn or pulled from the wellbore following a cutting operation. Moreover, sleeve 46 is desirable because it maintains a uniform diameter for sub 40, and hence, keeps annulus 54 free of debris prior to severing of portion "b" of sub 40.

[030] As further illustrated in Fig. 5, in another embodiment of the invention, a ring 56 can be provided at the top of sub 40 in the pin box 58 during make-up, thereby providing a flange 14 as described above. Ring 56 can simply be inserted into box 58 and positioned as shown or ring 56 may be secured therein, such as, for example, by providing ring 56 with external threads disposed to engage a portion of the threads in pin box 58 prior to stabbing in another pipe joint.

[031] While those skilled in the art will understand that the device can be any type of tool or equipment that might otherwise be conveyed into a pipe string, in one preferred embodiment illustrated in FIG. 6, the device is a firing head 34 that employs a housing 14 configured to seat on a flange 16 (see Fig. 1) is shown. In this embodiment, housing 14 is integrated with firing head 34 and includes a fishing neck 32 and ports 30 and 38 as previously described. Firing head 34 is designed to be pumped or dropped down a pipe string as described above without the aid of a conveyance vehicle, such as coiled tubing. One of the unique features of the this embodiment is that firing head 34 is disposed to permit fluid flow through it. As such, following firing, the firing head can be fished from the wellbore without having a fluid column built up above the firing head during retrieval. Specifically, in this embodiment of the invention, a piston 60 is slidingly mounted in annulus 28. Piston 60 has an upper pressure surface 62 in fluid communication with annulus 28. As such, fluid within annulus 28 can be utilized to activate piston 60. Piston 60 is attached to firing pin 64. Firing pin 64 is secured in place by one or more shearing pins 66 designed to shear under a predetermined pressure applied to pressure surface 62. In a first "unfired" position (shown in Fig. 6), piston 60 is adjacent ports 38 in the outer wall of the tubular member. O-rings 68 maintain the seal between piston 60 and the tubular member. When sufficient fluid pressure is applied to the upper pressure surface 62 of piston 60, pins 66 shear and piston 60 is axially displaced within annulus 28 to a second "fired" position, thereby causing firing pin 64 to strike percussion detonator 70, resulting in activation of firing head 34.

[032] As piston 60 is displaced in the manner described above, ports 38 are exposed to annulus 28, permitting fluid communication therebetween. Thus, as firing head 34 is fished out of the wellbore, fluid passes through port 30 into annulus 28 and back out of ports 38, preventing the formation of a fluid column over the firing head. In this regard, the pressure drop within firing head 34 when ports 38 are exposed or open provides confirmation that firing head 34 has been activated as desired, i.e., fired. The dual port arrangement is particularly desirable since the system is retrieved via a fishing neck and is not incorporated into a pipe string, where the aforementioned retrieval problems relating to a water column would not be experienced.

[033] Piston 60 and firing pin 64 need not be separate components. Rather, firing pin 64 can simply be provided with an upper pressure surface exposed to annulus 28 for actuation of firing pin 64. Likewise, rather than providing a piston 60 to inhibit flow through ports 38, a sleeve can be provided over ports 38, that upon actuation of firing pin 64, is axially shifted so as to expose ports 38.

[034] Those skilled in the art will appreciate that the system described herein provides certainty as to the depth of a tool in a pipe string. Once a housing has landed on a seat, the exact distance to a desired area of operation is known.

[035] An additional benefit of the system is that a symmetrically disposed flange within an annulus allows tools positioned with the system to be centralized in a pipe string resulting in substantially improved performance of the explosives relating to the pipe recovery system.

[036] Furthermore, by creating a seal between a housing and a flange 16, uphole pressure can be utilized to induce a desired operation, such as actuation of firing head.

[037] While the system of the invention is best utilized in the context of a vertical wellbore, those skilled in the art will understand that the invention may also be utilized in other elongated tubing sections where a fluid is pumped through the tube and an operation at a precise distance into the tube is required, including without limitation, horizontal wellbores, sewer lines, pipe lines and the like.

[038] Likewise, while the system preferably eliminates the need for eline, wireline, slickline or similar vehicles as a method for placement of a device, the system may still be utilized in conjunction with such vehicles to control the travel of such devices through the pipe string.

CLAIMS:

1. A system for positioning a downhole service tool in the interior of a pipe string, said system comprising:
   a. a plurality of tubular sub-sections distributed between selected pipe joints in a pipe string length comprising a plurality of pipe joints joined coaxially from a first to second end thereof, each sub-section having a bore substantially coaxial with a bore of said pipe string and a substantially circular aperture in a cross-section of said bore with an inside diameter distinctive to each sub-section, means for securing at a respective immovable position along the axis of said pipe string each aperture of said plurality of sub-sections, said distinctive aperture diameters diminishing incrementally by successive positions from said first to second ends: and
   b. an axially elongated tool assembly including a downhole service tool disposed for independent transport along a said pipe string bore, said tool assembly having a cross-sectional profile adapted to engage a specific one of said apertures with a fluid pressure seal to isolate a first end pipe string bore from a second end pipe bore.

2. A system for positioning a downhole service tool as described by claim 1 wherein said tool assembly includes a fluid pressure actuated valve to selectively by-pass said specific aperture with fluid flow in a direction from said first end toward said second end.

3. A system for positioning a downhole service tool as described by claim 2 wherein said pressure actuated valve comprises a fluid pressure displaced piston to open a fluid flow route from said pipe bore past said specific aperture.

4. A system for positioning a downhole service tool as described by claim 3 further comprising firing pin means secured to said pressure displaced piston wherein displacement of said piston shears a retention means for firing pin displacement.

5. A system for positioning a downhole service tool as described by claim 1 wherein said service tool is an explosive device.

6. A system for positioning a downhole service tool as described by claim 5 wherein said downhole service tool comprises a firing head for said explosive device.

7. A system for positioning a downhole service tool as described by claim 1 wherein said tool assembly is adapted for transport along said pipe string bore by pump pressure.

8. A system for positioning a downhole service tool as described by claim 1 wherein said tool assembly is adapted for freefall transport along said pipe string bore.

9. A system for positioning a downhole service tool as described by claim 1 wherein said service tool includes an attachment mechanism at one distal end thereof.

10. A system for positioning a downhole service tool as described by claim 9 wherein said attachment mechanism is a fishing neck.

11. A system for positioning a downhole service tool as described by claim 1 wherein said selected pipe joints are sections of drill pipe and said tubular subsections are interspersed with said drill pipe sections along said pipe string.

12. A system for positioning a downhole service tool as described by claim 1 wherein said pipe string length comprises an easily cut sub below a designated aperture, said easily cut sub having a substantially constant internal flow bore and a tubular pipe segment between first and second end sections, said end sections having a first outer diameter, said tubular segment between said end sections having a second outer diameter less than said first outer diameter whereby said tubular segment has a smaller annulus section than said end sections and a sleeve segment surrounding said tubular segment between said end sections having an outside diameter substantially the same as said first outer diameter and an inside diameter greater than said second outer diameter.

13. A system for positioning a downhole service tool as described by claim 12 wherein said sleeve is secured to said first end section.

14. A system for positioning a downhole service tool as described by claim 13 wherein said sleeve overlies a portion of said second end section.

15. A system for positioning a downhole service tool as described by claim 14 having a free axial separation from said second end section and torque transmitting assembly with said second end section.

16. A system for positioning a downhole service tool as described by claim 12 wherein said sleeve is perforated along the length thereof.

17. A method of accurately placing a downhole service tool at a specified location along the length of a pipe string in a wellbore, said method comprising the steps of:

providing a plurality of pipe subsections in a pipe string make-up, said subsections distributed at measured locations along a length of said pipe string;

providing immovable bore restrictions in said pipe subsections substantially normal to an axis of said pipe string, an effective aperture diameter of said bore restrictions being less than an inside bore diameter of said pipe string;

sequencing the positions of said subsections in said pipe string, from a top end to a bottom end, by progressively reduced effective diameters of said apertures;

providing a tool assembly including a downhole service tool secured thereto for axial bore transport along said pipe string;

providing an aperture closure surface around said tool assembly distinctive to a specific one of said restriction apertures whereby said closure surface is adapted to substantially close said respective aperture with a fluid seal, said closure surface having a known axial separation distance from said service tool;

providing said tool assembly with a fluid flow path past said sealed aperture in a flow direction from above said restriction to below said restriction;

providing a fluid flow obstruction in said flow path that is displaced by fluid pressure in said pipe string bore above said aperture;

depositing said tool assembly in said pipe bore for traversal thereof until engaging a distinctive restriction and sealing said aperture;

increasing fluid pressure within said pipe string above said distinctive restriction to displace said fluid flow obstruction; and,

detecting a release of fluid pressure within said pipe string upon opening of said flow path to verify the location of said service tool.

18. A method as described by claim 17 wherein said service tool is an explosive device.

19. A method as described by claim 17 wherein displacement of said fluid flow obstruction releases an explosive device firing pin.

20. A method as described by claim 17 wherein said service tool is conveyed down said pipe string by dropping the tool down said pipe string.

21. A method as described by claim 17 wherein said service tool is conveyed down said pipe string suspended from a wireline.

22. A method as described by claim 17 wherein said service tool is conveyed down said pipe string suspended from a coiled tubing.

23. A method as described by claim 17 further comprising the steps of determining the location within the pipe string where a tool is to be positioned, identifying the closest bore restriction in the pipe string to said location; calculating the distance between the location and the identified restriction; and securing an elongated extension to the downhole tool between the downhole tool and the housing, said extension selected to approximately coincide with the calculated distance.

24. A method as described by claim 23 wherein said determined location is below the identified restriction.

25. A method as described by claim 23 wherein said determined location is above the identified restriction.

26. A method as described by claim 17 wherein said downhole tool comprises a firing head.

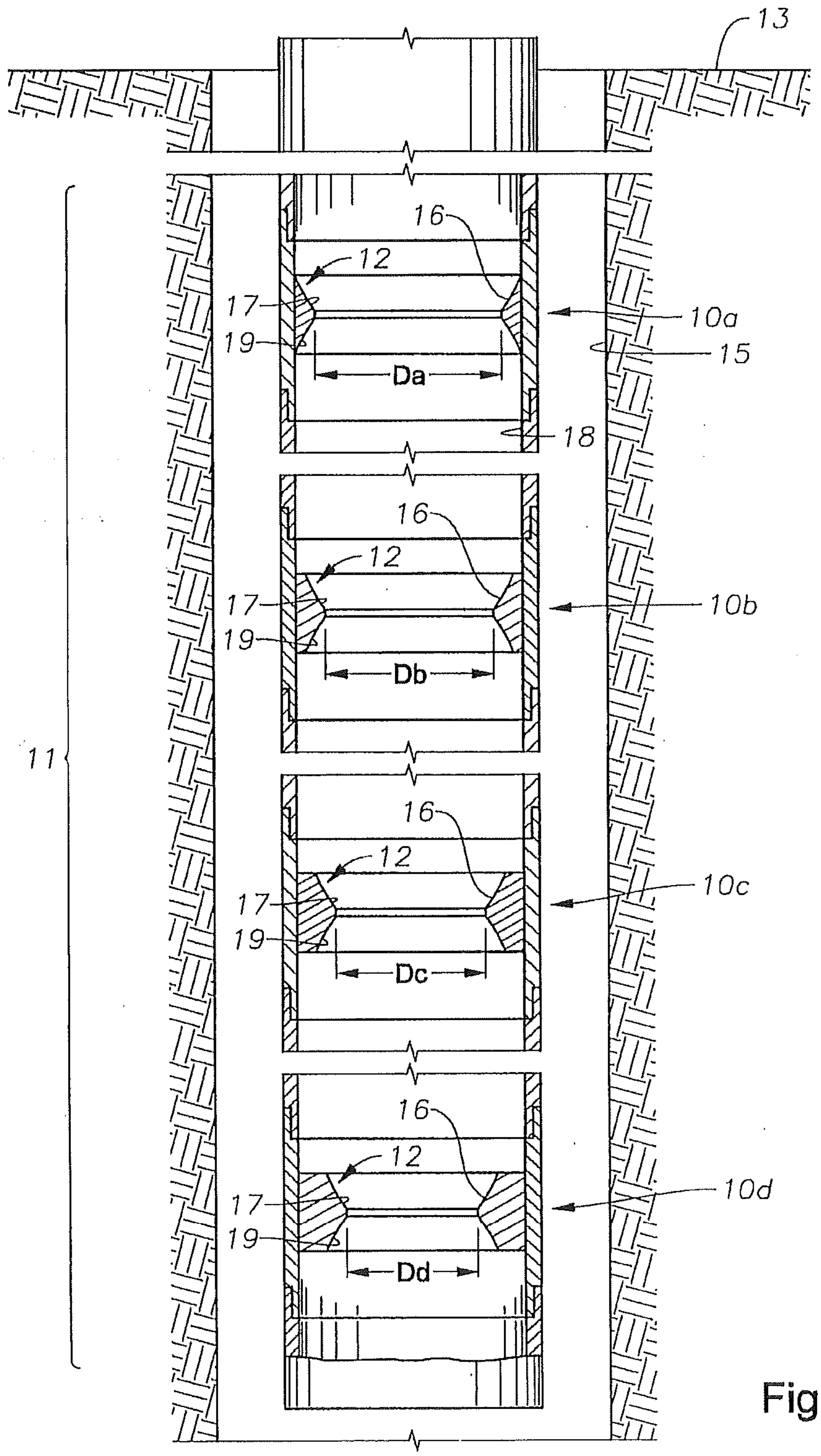


Fig. 1

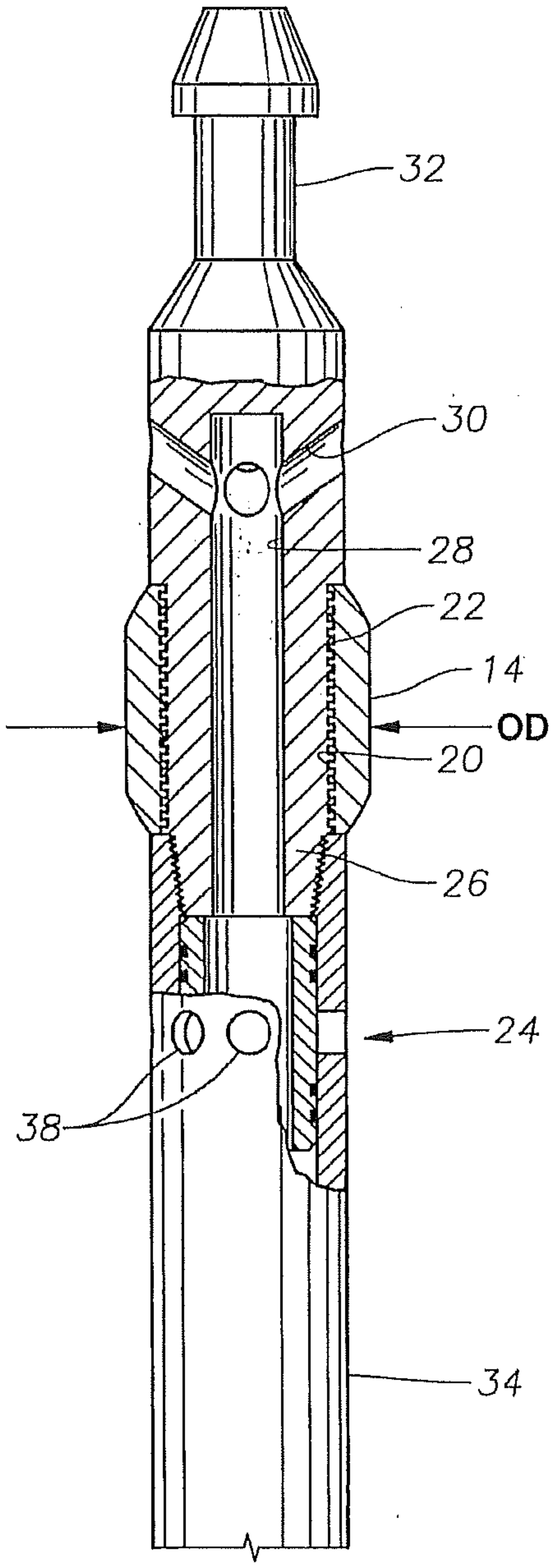


Fig. 2

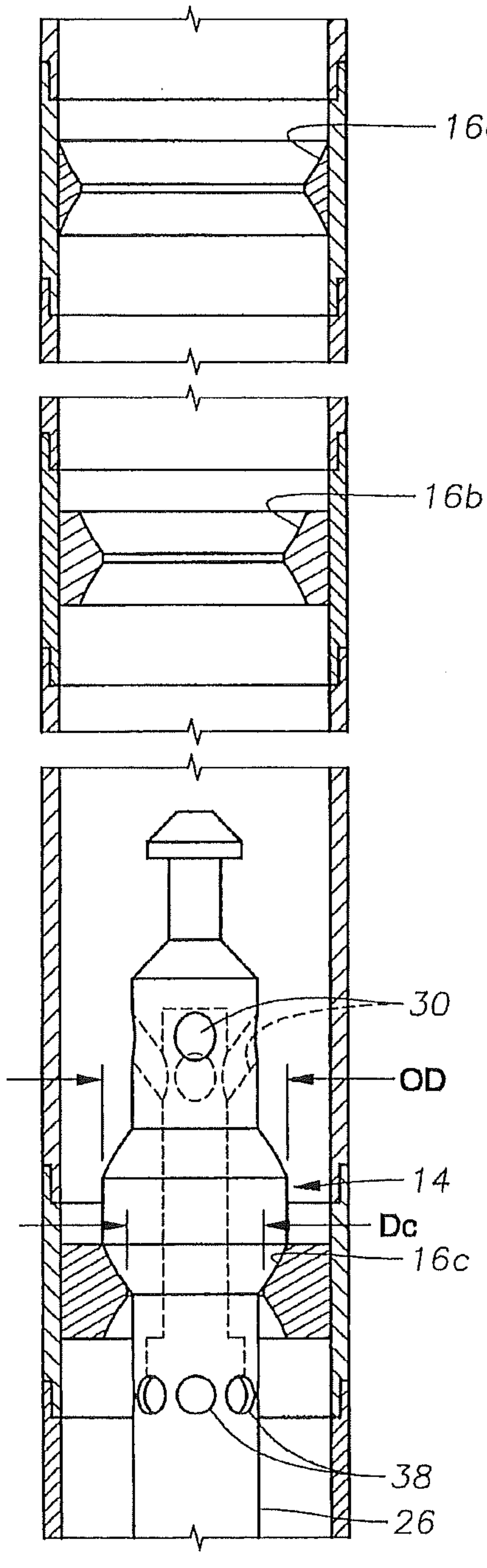


Fig. 3

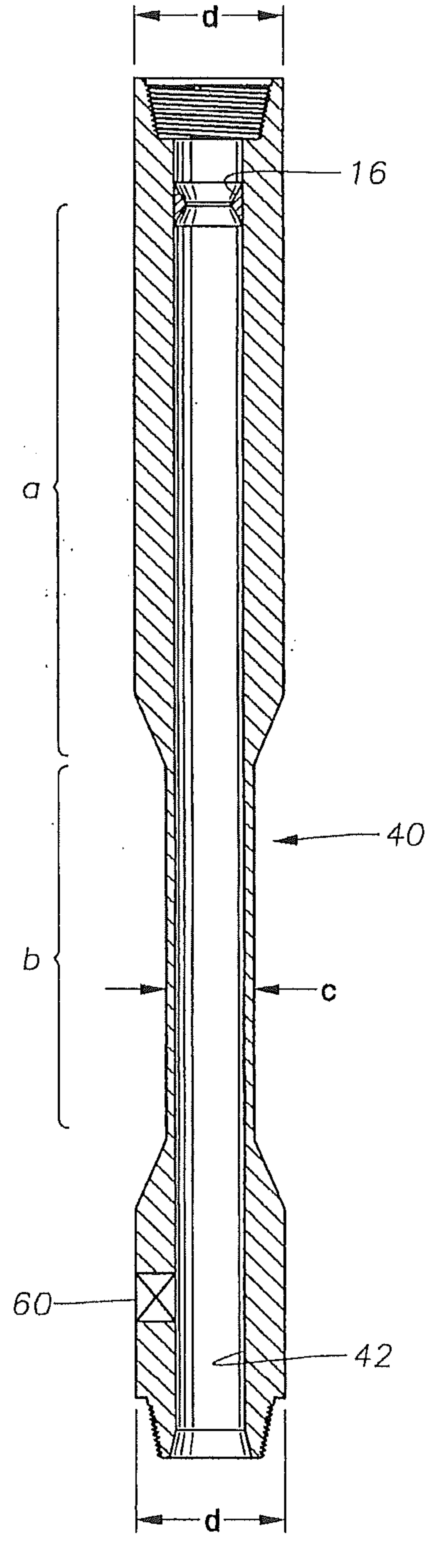


Fig. 4

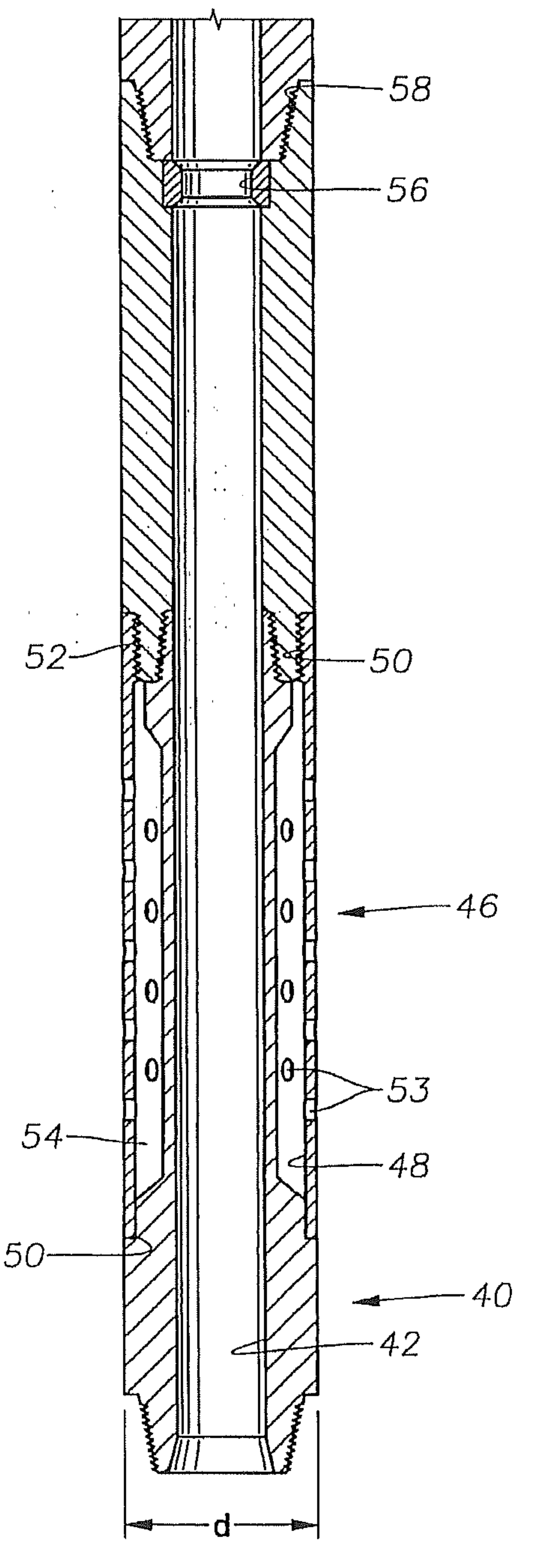


Fig. 5

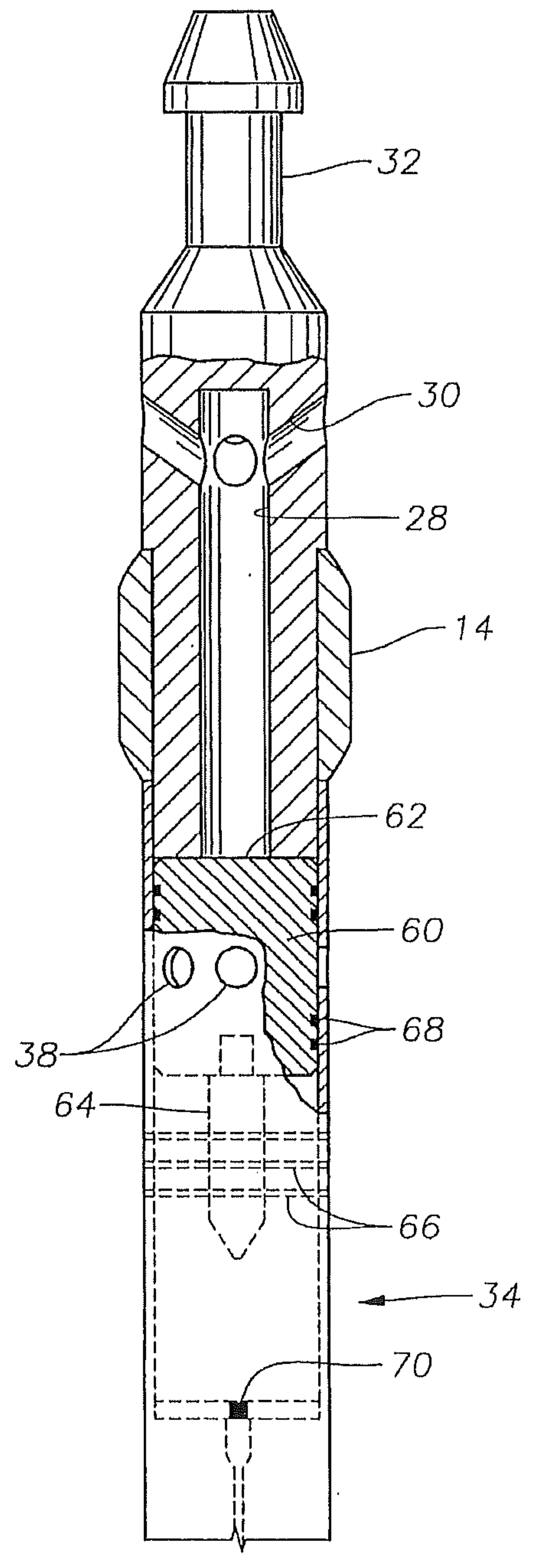
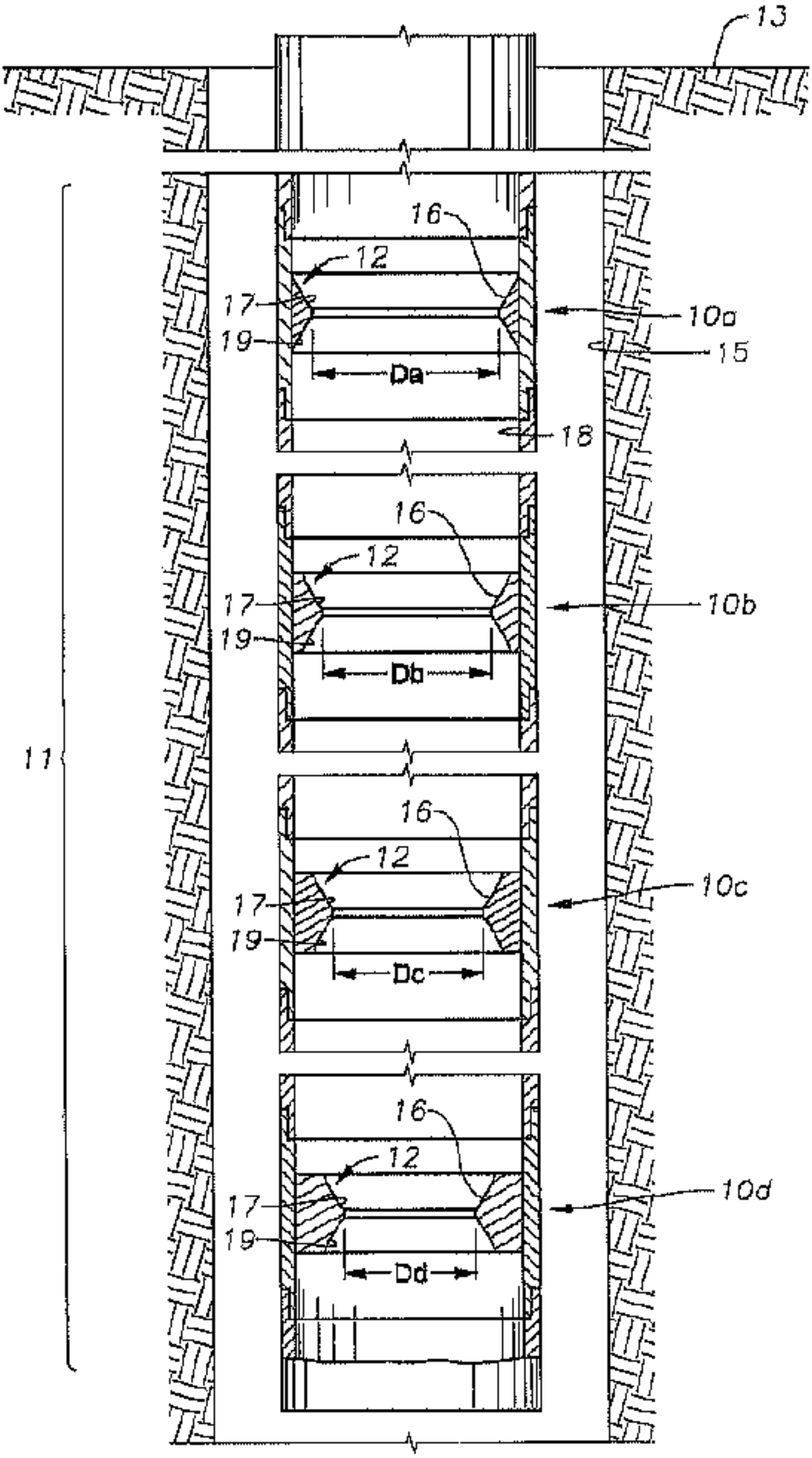


Fig. 6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