



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.04.2012 Bulletin 2012/14

(51) Int Cl.:
E21B 43/10 (2006.01)

(21) Application number: **10183095.8**

(22) Date of filing: **30.09.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
BA ME RS

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(54) **Drill pipe**

(57) The present invention relates to an expansion device to be inserted in a casing or well tubular structure for expanding an annular barrier downhole. The annular barrier comprises a tubular structure for mounting as part of the well tubular structure, an expandable sleeve surrounding the tubular structure, and a connection part connecting the expandable sleeve with the tubular structure. The tubular structure has an opening and two projecting

elements decreasing an inner diameter of the tubular structure. The expansion device comprises a tubular part extending between a first and a second end part, the tubular part comprising at least one opening arranged between the first and the second end; an inner face surrounding an inner space; and an outer face. Furthermore, the expansion device comprises at least a first and second sealing element sealingly connected to the outer face at the first and second end parts of the tubular part.

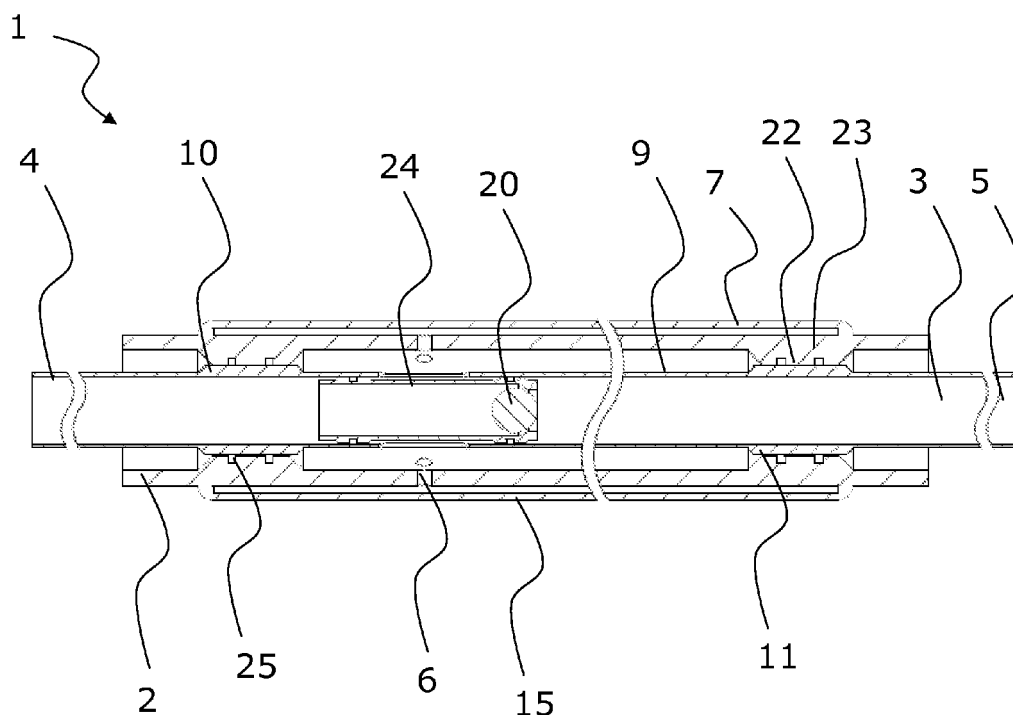


Fig. 11

Description

Field of the Invention

[0001] The present invention relates to an expansion device to be inserted in a casing or well tubular structure for expanding an annular barrier downhole. The annular barrier comprises a tubular structure for mounting as part of the well tubular structure, an expandable sleeve surrounding the tubular structure, and a connection part connecting the expandable sleeve with the tubular structure. In addition, the invention relates to a drill pipe and coiled tubing, both comprising the expansion device, and to a method for expanding an annular barrier positioned outside a casing downhole and a method for inserting an expansion device into a casing downhole.

Background Art

[0002] In wellbores, annular barriers are used for different purposes, such as for providing a barrier for flowing between an inner and an outer tubular structure or between an inner tubular structure and the inner wall of the borehole. The annular barriers are mounted as part of the well tubular structure. An annular barrier has an inner wall surrounded by an annular expandable sleeve. The expandable sleeve is typically made of an elastomeric material, but may also be made of metal. The sleeve is fastened at its ends to the inner wall of the annular barrier.

[0003] In order to seal off a zone between an inner and an outer tubular structure or a well tubular structure and the borehole, a second annular barrier is used. The first annular barrier is expanded on one side of the zone to be sealed off, and the second annular barrier is expanded on the other side of that zone, and in this way, the zone is sealed off.

[0004] The expansion of the annular barriers is performed by means of expansion devices which are adapted to pressurise a space outside the annular barrier to be expanded. However, the design of the known expansion devices is often complex, which may make them difficult to use.

[0005] It is thus desirable to provide a solution where the expansion device for expanding an annular barrier has a simple, yet reliable design.

Summary of the Invention

[0006] It is an object of the present invention to wholly or partly overcome the above disadvantages and drawbacks of the prior art. More specifically, it is an object to provide an improved expansion device for expanding an annular barrier outside a casing downhole.

[0007] The above objects, together with numerous other objects, advantages, and features, which will become evident from the below description, are accomplished by a solution in accordance with the present invention by an expansion device to be inserted in a casing or well tubular

structure for expanding an annular barrier downhole, the annular barrier comprising a tubular structure for mounting as part of the well tubular structure, an expandable sleeve surrounding the tubular structure, and a connection part connecting the expandable sleeve with the tubular structure, the tubular structure having an opening and two projecting elements decreasing an inner diameter of the tubular structure, the expansion device comprising

- a tubular part extending between a first and a second end part, the tubular part comprising:
 - at least one opening arranged between the first and the second end,
 - an inner face surrounding an inner space, and
 - an outer face,
- at least a first and second sealing element sealingly connected to the outer face at the first and second end parts of the tubular part,

wherein each sealing element is arranged at a distance corresponding to a distance between the projecting elements to sealingly connect with the projecting parts, thereby creating an outer space there between.

[0008] In an embodiment, the tubular part may be a wash down.

[0009] Furthermore, the invention relates to an expansion device to be inserted in a casing for expanding an annular barrier downhole, the expansion device comprising

- a tubular part extending between a first and a second end, the tubular part comprising:
 - at least one opening arranged between the first and the second end,
 - an inner face surrounding an inner space, and
 - an outer face,
- at least a first and second sealing element sealingly connected to the outer face at the first and second ends of the tubular part,

wherein each sealing element has an annular part and an annular flange projecting partly towards the opening, the annular flange of the first sealing element projecting from the first end towards the opening, and the annular flange of the second sealing element projecting from the second end towards the opening, thereby creating an outer space there between.

[0010] The expansion device may further comprise a slidable sleeve having a slidable sleeve opening, being slidably connected with the tubular part on the outer face from a closed position to an open position in which the slidable sleeve opening is aligned with the tubular opening.

[0011] Furthermore, the slidable sleeve may be moved from the closed position to the open position by means of a ball closing a orifice in the slidable sleeve.

[0012] In an embodiment of the invention, the annular flange may project in an angle from the annular part, the angle being less than 60 degrees, preferably less than 45 degrees.

[0013] In another embodiment, the sealing element may have a V-, a U-, an L-, an M- or an S-cross-sectional shape, or the like.

[0014] Furthermore, the sealing element may be an annular cup seal.

[0015] Moreover, several sealing elements may be arranged at the first and second ends of the tubular part.

[0016] In addition, the sealing elements may be arranged with a predetermined distance between them.

[0017] Also, at least the annular flange may be made of a flexible/resilient material.

[0018] Additionally, the annular flange may have an inherent resiliency.

[0019] Moreover, the material may be an elastomer.

[0020] In addition, at least the annular flange may comprise a reinforcement element.

[0021] The reinforcement element may be a grid or a web imbedded in the flexible material.

[0022] Furthermore, the flexible/resilient material may comprise a SMA-metal.

[0023] The expansion device may further comprise a holding means for holding the annular flange towards the annular part to reduce an outer diameter of the annular flange.

[0024] In addition, the holding means may be a spring device, a rubber band, a burst string or the like.

[0025] In an embodiment, the tubular part may comprise several openings.

[0026] Furthermore, the tubular part may be sealed off at least at one end.

[0027] Moreover, the one end of the tubular part may be sealed off by a ball closing.

[0028] Additionally, the inner space may be adapted to be pressurised.

[0029] The expansion device may further comprise a pressure building device and a heating device for heating the fluid.

[0030] Furthermore, the inner space is pressurised by building up a pressure in a fluid or a gas.

[0031] The present invention furthermore relates to a downhole system comprising the expansion device as described above and a driving unit, such as a downhole tractor.

[0032] Additionally, the invention relates to a drill pipe comprising the expansion device as described above.

[0033] Moreover, the invention relates to a coiled tubing comprising the expansion device as described above.

[0034] In addition, the invention relates to a method for expanding an annular barrier positioned outside a casing downhole, comprising the steps of:

- positioning an expansion device as described above opposite an opening in the casing opposite which the annular barrier is positioned,
- pressurising an inner space of the expansion device, whereby the pressure via an opening forces a first and a second sealing element towards an inner face of the casing wall, thereby creating a pressurised outer space, and
- expanding the annular barrier by pressuring an inner space of the annular barrier via the opening in the casing.

[0035] In an embodiment, the inner space of the expansion device may be sealed off at one end before and/or during the pressuring.

[0036] Moreover, the expansion device may be sealed off by a ball closure at the one end.

[0037] Finally, the present invention relates to a method for inserting an expansion device as described above into a casing downhole, comprising the steps of:

- reducing an outer diameter of an annular flange of the sealing element of the expansion device by pressing the annular flange towards an annular part,
- maintaining the annular flange in the reduced diameter by means of a holding means,
- inserting the expansion device into the casing,
- moving the expansion device into a position opposite an opening in the casing opposite which an annular barrier is positioned, and
- releasing the holding means in order for the annular flange to retain its original diameter, whereby the expansion device is ready for expansion.

[0038] In an embodiment, the holding means may be released during pressurising of an inner space of the expansion device.

[0039] Furthermore, the outer diameter of the annular flange may be reduced after expansion of the annular barrier and before a step of removing the expansion device from the casing.

[0040] Finally, the outer diameter may be reduced when the inner space of the expansion device is pressurised.

Brief Description of the Drawings

[0041] The invention and its many advantages will be described in more detail below with reference to the accompanying schematic drawings, which for the purpose of illustration show some non-limiting embodiments and in which

Fig. 1 shows an expansion device inserted in a casing downhole,

Fig. 2 shows the expansion device of Fig. 1, having one end closed,

Fig. 3 shows the expansion device of Fig. 1 during expansion of an annular barrier,

Fig. 4 shows another embodiment of the expansion device,

Fig. 5 shows yet another embodiment of the expansion device,

Fig. 6 shows a sealing element,

Fig. 7 shows another embodiment of the sealing element,

Figs. 8A and 8B show the sealing element having a reinforcing element,

Figs. 9A and 9B show yet another embodiment of the sealing element,

Figs. 10A and 10B show another embodiment of the expansion device, and

Fig. 11 shows a partly cross-sectional view of the expansion device.

[0042] All the figures are highly schematic and not necessarily to scale, and they show only those parts which are necessary in order to elucidate the invention, other parts being omitted or merely suggested.

Detailed description of the invention

[0043] Fig. 1 shows an expansion device 1 inserted in a casing 2 downhole opposite an annular barrier 15 before expanding the annular barrier. The expansion device 1 comprises a tubular part 3 having an inner face 7 enclosing an inner space 8 and an outer face 9 onto which two sealing elements 10, 11 have been sealingly fastened. The tubular part 3 has an opening 6 arranged opposite the opening 16 in the annular barrier 15. The first 10 of the two sealing elements is arranged at a first end 4 of the tubular part 3, and the second sealing element 11 is arranged at a second end 5 of the tubular part so that there is a mutual distance between them. Each sealing element 10, 11 has an annular part 12 and an annular flange 13. The annular flange 13 projects from the annular part 12 towards the opening 16. Thus, the first 10 and second 11 sealing elements, the outer face 9 of the tubular part 3 and the inner face 7 of the casing 2 all enclose an outer space 14 which is pressurised in order to expand the annular barrier 15.

[0044] The expansion device 1 further comprises a closing element 20 in the form of a ball cooperating with a ball seat. The ball 20 flows with the pressurised fluid in the inner space 8 of the tubular part 3, and when it hits the ball seat, the tubular part 3 is closed, as shown in Fig. 2.

[0045] The expansion device 1 is connected to an ordinary drill pipe 25 or coiled tubing by means of a threaded connection 26 so that the tubular part 3 forms part of the drill pipe 25.

[0046] As can be seen in Figs. 1-3, the annular flanges 13 of the sealing elements 10, 11 project inwards towards the opening 16, and when the ball 20 closes one end of the drill pipe 25, the pressure is built up in the inner space 8 and thus also in the outer space 14. Hereby, the pressure pushes the flanges 13 towards the inner face 7 of the casing 2 against which the flanges 13 seal, causing the pressure to be built up inside the outer space 14 as well. In addition, the pressurised fluid flows further into the inner space 8 of the annular barrier 15, and the pressure increases until the expandable sleeve 17 of the annular barrier is expanded, as shown in Fig. 3.

[0047] In Fig. 4, the tubular part 3 of the expansion device 1 is closed at one end, and no additional closing element 20 is needed to pressurise the expansion device 1. In this way, the expansion device 1 is the end part of the drill pipe 25.

[0048] The expansion device 1 of Fig. 5 comprises two first sealing elements 10 at the first end 4 of the tubular part 3 and two second sealing elements 11 at the second end 5 of the tubular part. By having two sealing elements 10, 11 in each end, a double barrier is created for safety reasons.

[0049] The expansion device 1 may also be connected to a driving unit, such as a downhole tractor, instead of being connected with drill pipe 25.

[0050] The sealing element 10, 11 has a base annular part 12 sealingly surrounding the tubular part 3. The annular part 12 extends in a radial direction of the tubular part 3. The annular flange 13 projects from the annular part 12 in angle α from the radial direction, as shown in Fig. 6. The angle α is less than 60 degrees, preferably less than 45 degrees. The sealing element 10, 11 is cup seal formed in a solid and flexible and resilient material, such as an elastomeric polymer.

[0051] In Fig. 7, the sealing element 10, 11 has a cross-sectional shape, such as a V-shape, so that the projecting flange 13 and the annular part 12 together form a V when seen in a cross-sectional view. In another embodiment, the sealing element 10, 11 may have a U-, an L-, an M-, or an S-cross-sectional shape.

[0052] The sealing element 10, 11 may also comprise a reinforcement element 18, as shown in Figs. 8A and 8B. The reinforcement element 18 is shaped as a coiled spring made of Shape Memory Alloy (SMA) so that when the spring is subjected to heat, its diameter expands, as shown in Fig. 8B. The heat may be supplied by injecting heated fluid down the drill pipe 25.

[0053] In Figs. 9A and 9B, the reinforcement element 18 is shaped as fingers. The fingers have a spring force which is released when the holding means 19 is removed. Until then, the holding means 19 maintains the reduced diameter of the flange 13 of the sealing element 10, 11, as shown in Fig. 9A.

[0054] In Figs. 8A-9B, the reinforcement element 18 is embedded in the sealing element 10, 11, but in another embodiment, the reinforcing element may be arranged on the outside of the flange 13. The reinforcement element 18 may be a grid, a web, fingers or arms embedded in the flexible material or arranged on the outside of the sealing element 10, 11.

[0055] The holding means 19 may have any suitable design, one of which is shown in Figs. 10A and 10B. The holding means 19 is connected with the ball seat of the closing element 20, and when the ball flows and hits against the seat, the seat is moved until the axial groove 21 stops it from moving further. This axial movement results in an axial movement of the holding means 19, and the holding means is thus moved out of engagement with the flange 13 of the sealing element 10, 11. When the holding means 19 is moved away from the flange 13, the flange projects outwards due to the resilient spring force.

[0056] The holding means 19 may have any suitable design, and as shown in Fig. 9A, it may break when the pressure forces the flange 13 to project towards the inner face 7 of the casing 2. The holding means 19 may also be a rubber band rolling off along the inclining surface of the back side of the flange 13 when the pressure pressurises from the front to force the flange outwards. The holding means 19 may also be a burst string rupturing when the pressure forces the flange 13 outwards.

[0057] In Fig. 11, the expansion device 1 to be inserted in a casing 2 for expanding an annular barrier 15 downhole cooperates with the annular barrier on providing two sealing connections between the device and the annular barrier in order to build up a pressure inside the expansion device, inside the annular space surrounding the expansion device and inside the space between the expandable sleeve and the tubular structure of the annular barrier. The annular barrier 15 comprises a tubular structure for mounting as part of the well tubular structure 2. The expandable sleeve 7 surrounds the tubular structure, and a connection part 23 connects the expandable sleeve with the tubular structure. The tubular structure has an opening and two projecting elements 22 decreasing an inner diameter of the tubular structure and thus the thickness of the tubular structure in two positions on opposite sides of the opening in the tubular part 3. The tubular part 3 of the expansion device 1 extends between the first 4 and the second 5 end parts, and at least a first 10 and a second 11 sealing element sealingly is connected to the outer face 9 at the first and second end parts 4, 5 of the tubular part 3. Each sealing element 10, 11 is arranged at a distance corresponding to a distance between the projecting elements 22 to sealingly connect with the projecting elements 22. In this way, the sealing elements 10, 11 of the expansion device 1 seal against the projecting elements 22 of the tubular part 3 and thereby create an outer space 14 there between.

[0058] The expansion device 1 comprises a slidable sleeve 24 having an internal seat in which a ball 20 dropped down into the fluid flowing in the tubular part 3

seats in order to close an orifice in the seat of the slidable sleeve. When the ball 20 has closed the slidable sleeve 24, a pressure is built in the inner space 8 until the pressure actuated on the ball is large enough to move the sleeve from a closed position to an open position. In its open position, the opening of the slidable sleeve 24 and the opening in the tubular structure are aligned, and the pressure is built up even further to expand the expandable sleeve 7.

[0059] In this embodiment, the tubular part 3 is a wash down, a drill pipe or another tubing. The tubular part 3 of the expansion device 1 is connected with the wash down, drill pipe, etc. as a part thereof, and is subsequently lowered into the well.

[0060] The projecting elements 22 may have sealing O-rings 25 or the like seals in grooves in order to provide a better seal.

[0061] The expansion device 1 may further comprise a pressure building device, such as a pump, situated on the surface on a rig or a vessel.

[0062] By fluid or well fluid is meant any kind of fluid that may be present in oil or gas wells downhole, such as natural gas, oil, oil mud, crude oil, water, etc. By gas is meant any kind of gas composition present in a well, completion, or open hole, and by oil is meant any kind of oil composition, such as crude oil, an oil-containing fluid, etc. Gas, oil, and water fluids may thus all comprise other elements or substances than gas, oil, and/or water, respectively.

[0063] By a casing is meant any kind of pipe, tubing, tubular, liner, string etc. used downhole in relation to oil or natural gas production.

[0064] In the event that the tool is not submersible all the way into the casing, a downhole tractor can be used to push the tool all the way into position in the well. A downhole tractor is any kind of driving tool capable of pushing or pulling tools in a well downhole, such as a Well Tractor®.

[0065] Although the invention has been described in the above in connection with preferred embodiments of the invention, it will be evident for a person skilled in the art that several modifications are conceivable without departing from the invention as defined by the following claims.

Claims

1. An expansion device (1) to be inserted in a casing or well tubular structure (2) for expanding an annular barrier (15) downhole, the annular barrier comprising a tubular structure for mounting as part of the well tubular structure, an expandable sleeve (7) surrounding the tubular structure, and a connection part (23) connecting the expandable sleeve with the tubular structure, the tubular structure having an opening and two projecting elements (22) decreasing an inner diameter of the tubular structure, the expansion

device comprising

- a tubular part (3) extending between a first (4) and a second (5) end part, the tubular part comprising:

- at least one opening (6) arranged between the first and the second end,
- an inner face (7) surrounding an inner space (8), and
- an outer face (9),

- at least a first (10) and second (11) sealing element sealingly connected to the outer face at the first and second end parts of the tubular part,

wherein each sealing element is arranged at a distance corresponding to a distance between the projecting elements to sealingly connect with the projecting parts, thereby creating an outer space (14) there between.

2. An expansion device (1) to be inserted in a casing (2) for expanding an annular barrier (15) downhole, the expansion device comprising

- a tubular part (3) extending between a first (4) and a second (5) end, the tubular part comprising:

- at least one opening (6) arranged between the first and second end parts,
- an inner face (7) surrounding an inner space (8), and
- an outer face (9),

- at least a first (10) and second (11) sealing element sealingly connected to the outer face at the first and second end parts of the tubular part,

wherein each sealing element has an annular part (12) and an annular flange (13) projecting partly towards the opening, the annular flange of the first sealing element projecting from the first end part towards the opening, and the annular flange of the second sealing element projecting from the second end parts towards the opening, thereby creating an outer space (14) there between.

3. An expansion device according to claim 1 or 2, further comprising a slidable sleeve (24) having a slidable sleeve opening, being slidably connected with the tubular part on the outer face from a closed position to an open position in which the slidable sleeve opening is aligned with the tubular opening.

4. An expansion device according to claim 3, wherein the slidable sleeve is moved from the closed position to the open position by means of a ball (20) closing a orifice in the slidable sleeve.

5. An expansion device according to any of claims 2-4, wherein the annular flange projects in an angle from the annular part, the angle (α) being less than 60 degrees, preferably less than 45 degrees.

6. An expansion device according to any of claims 2-5, wherein the sealing element has a V-, a U-, an L-, an M- or an S-cross-sectional shape, or the like.

7. An expansion device according to any of claims 2-6, wherein at least the annular flange is made of a flexible/resilient material.

8. An expansion device according to claim 7, wherein the material is an elastomer.

9. An expansion device according to any of claims 2-8, wherein at least the annular flange comprises a reinforcement element (18).

10. An expansion device according to claim 9, wherein the reinforcement element is a grid or a web imbedded in the flexible material.

11. An expansion device according to any of claims 2-10, wherein one end part of the tubular part is sealed off by a ball closing (20).

12. An expansion device according to any of claims 2-10, wherein the inner space is pressurised by building up a pressure in a fluid or a gas.

13. A downhole system comprising the expansion device according to any of the preceding claims and a driving unit, such as a downhole tractor.

14. A drill pipe comprising the expansion device according to any of the claims 1 to 12.

15. A coiled tubing comprising the expansion device according to any of the claims 1 to 12.

16. A method for expanding an annular barrier (15) positioned outside a casing downhole, comprising the steps of:

- positioning an expansion device according to any of the claims 1 to 12 opposite an opening in the casing opposite which the annular barrier is positioned,
- pressurising an inner space (8) of the expansion device, whereby the pressure via an opening (6) forces a first and a second sealing ele-

ment towards an inner face (24) of the casing wall, thereby creating a pressurised outer space, and

- expanding the annular barrier by pressuring an inner space of the annular barrier via the opening in the casing. 5

17. A method according to claim 16, wherein the inner space of the expansion device is sealed off at one end part before and/or during the pressuring. 10

18. A method for inserting an expansion device according to any of the claims 1 to 12 into a casing down-hole, comprising the steps of: 15

- reducing an outer diameter of an annular flange of the sealing element of the expansion device by pressing the annular flange towards an annular part, 20
- maintaining the annular flange in the reduced diameter by means of a holding means,
- inserting the expansion device into the casing,
- moving the expansion device into a position opposite an opening in the casing opposite which an annular barrier is positioned, and 25
- releasing the holding means in order for the annular flange to retain its original diameter, whereby the expansion device is ready for expansion. 30

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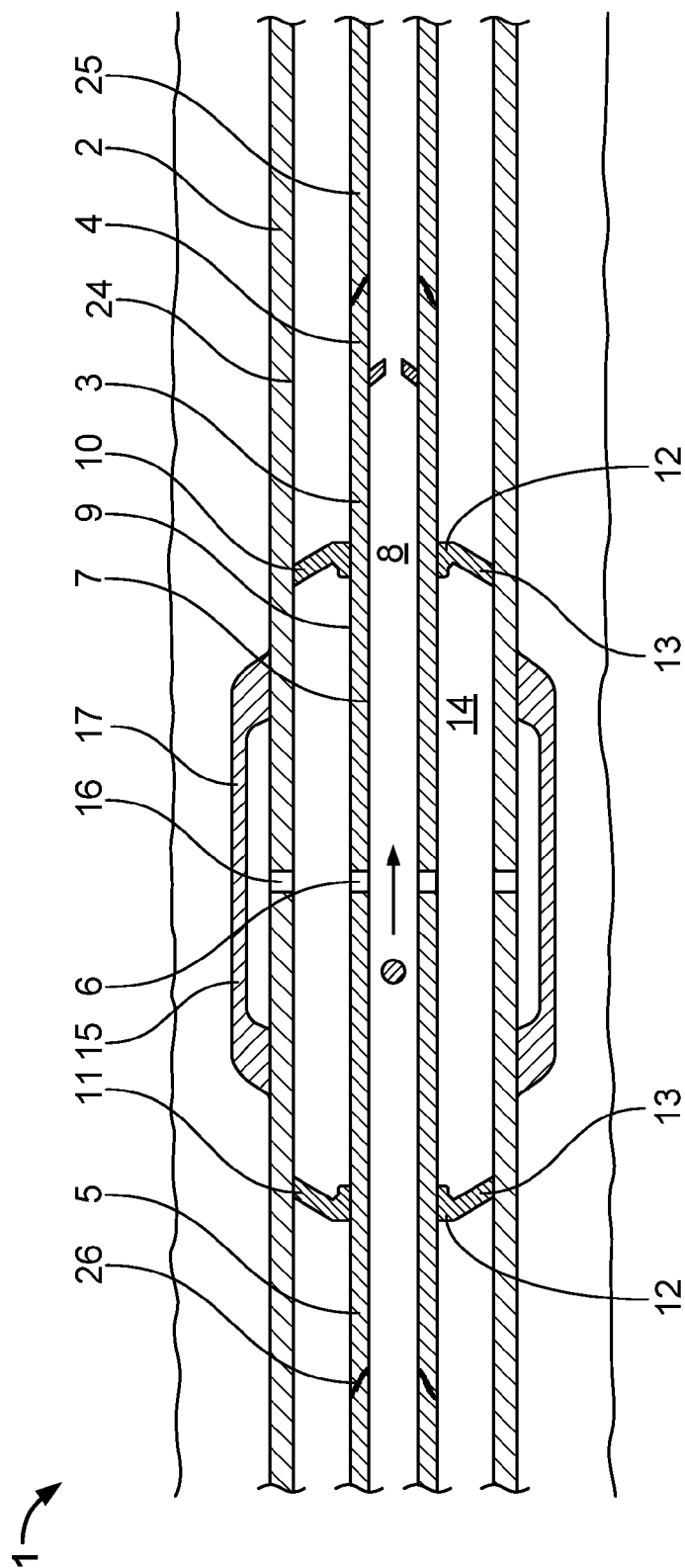


FIG. 1

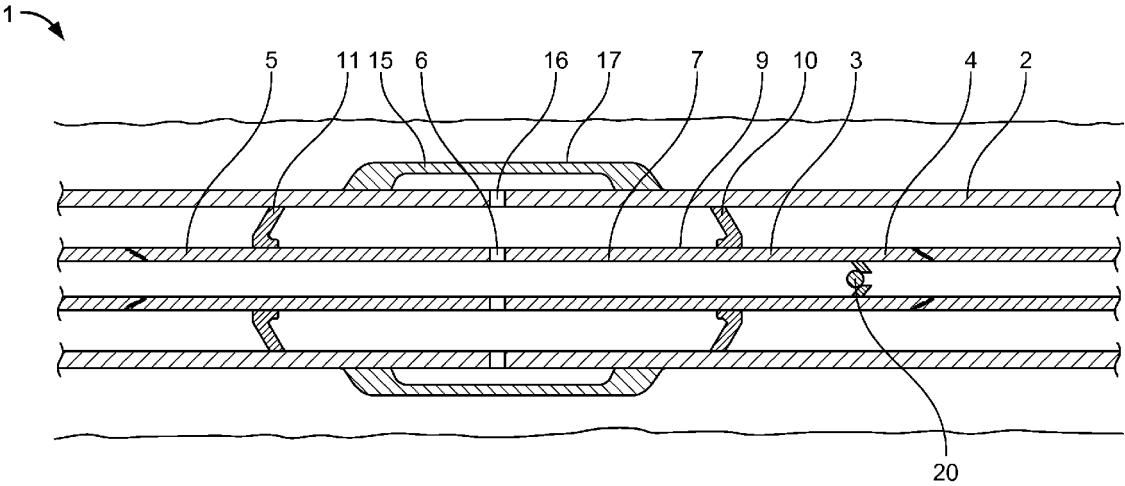


FIG. 2

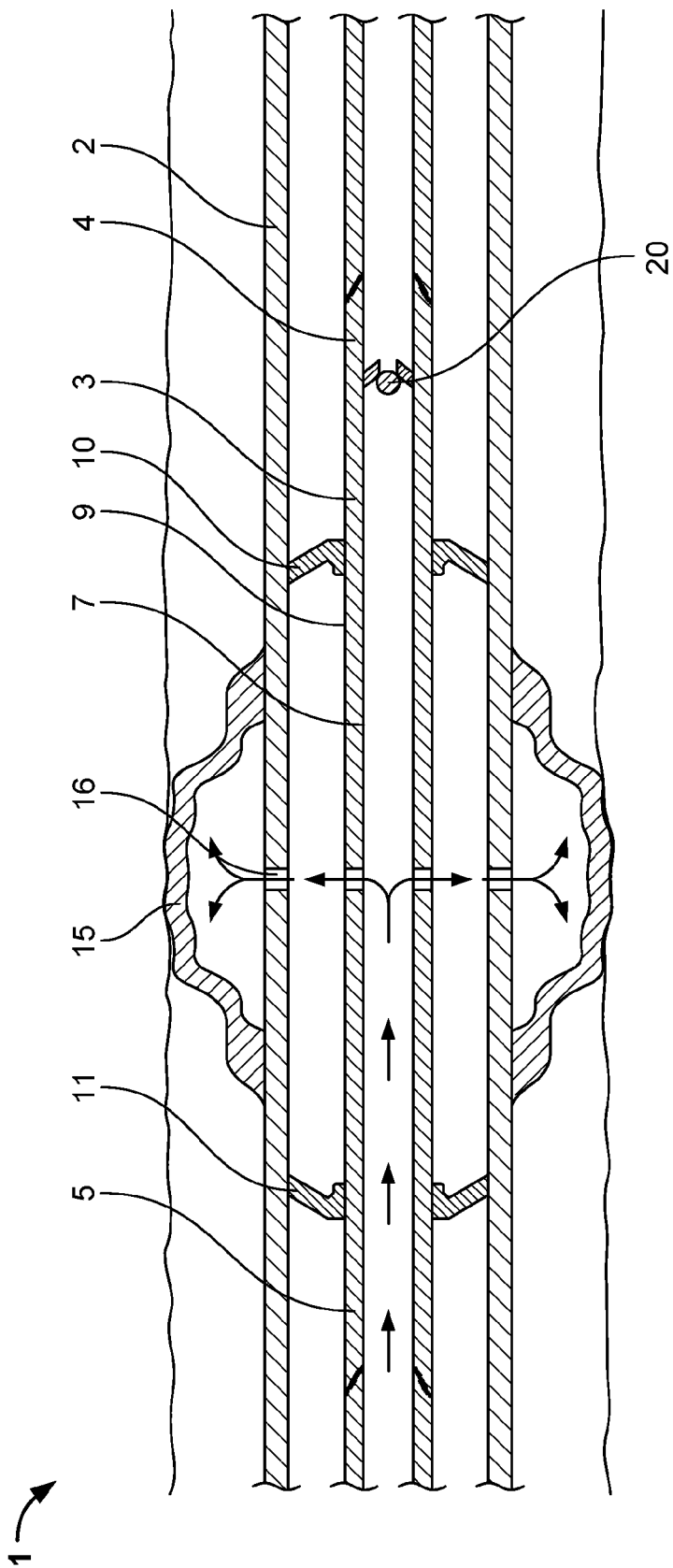


FIG. 3

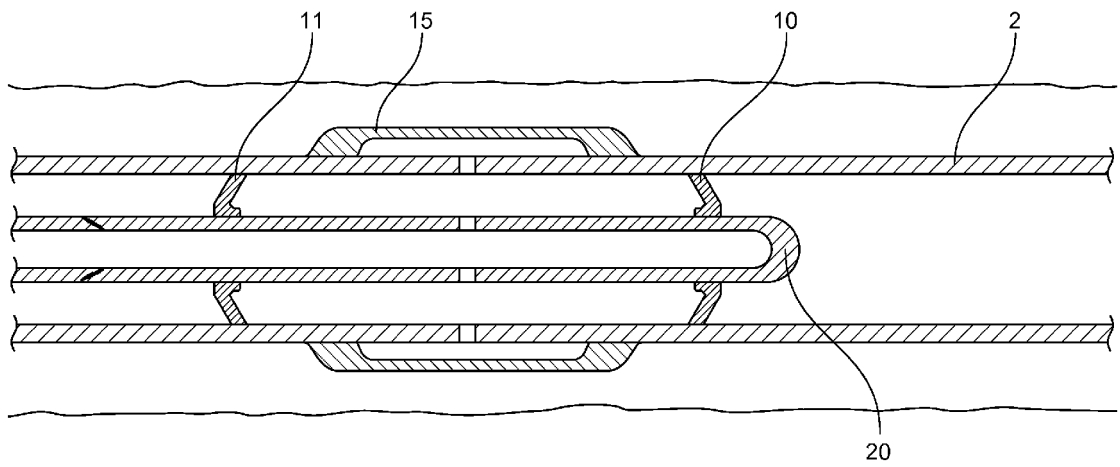


FIG. 4

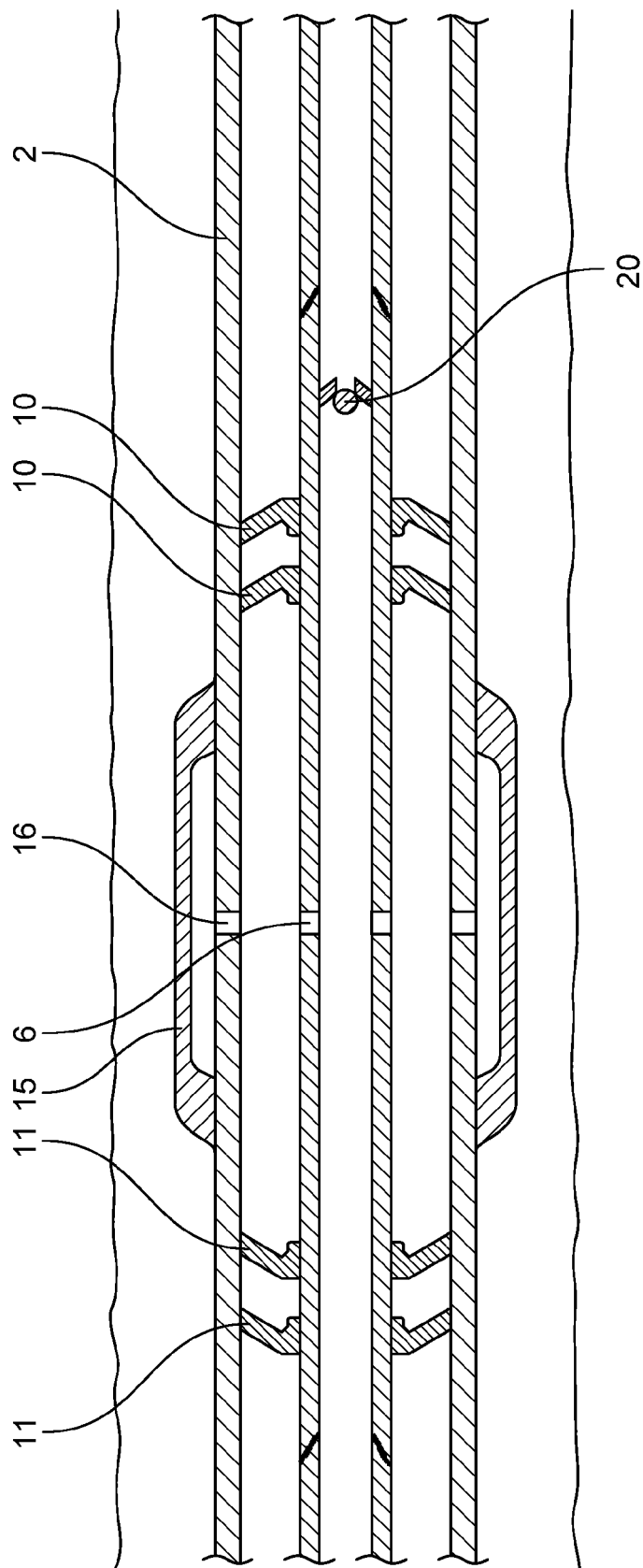


FIG. 5

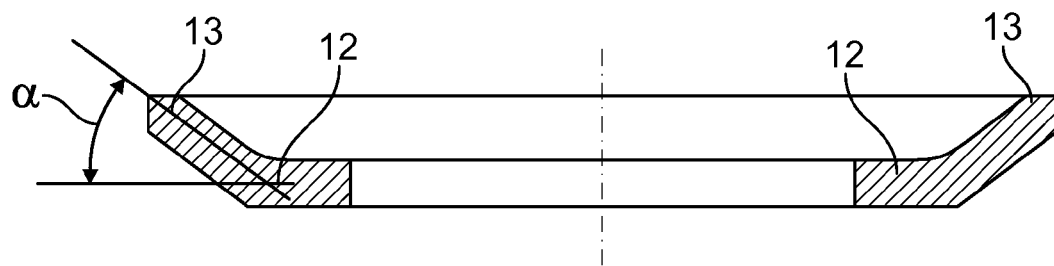


FIG. 6

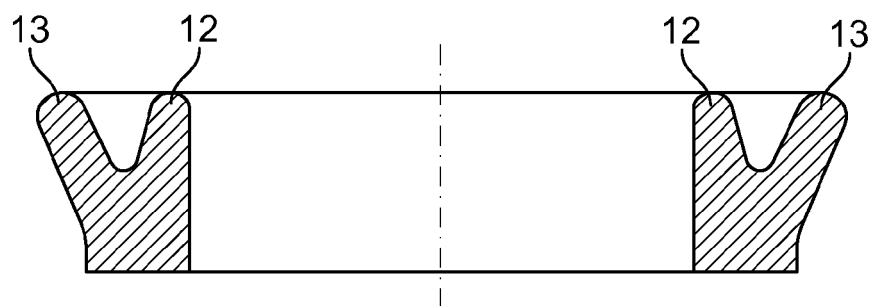


FIG. 7



FIG. 8A

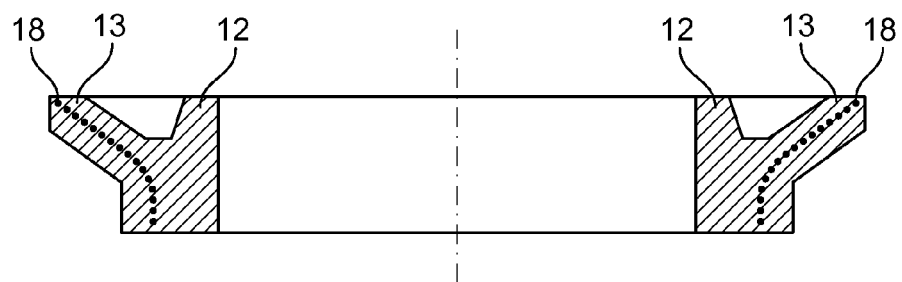


FIG. 8B

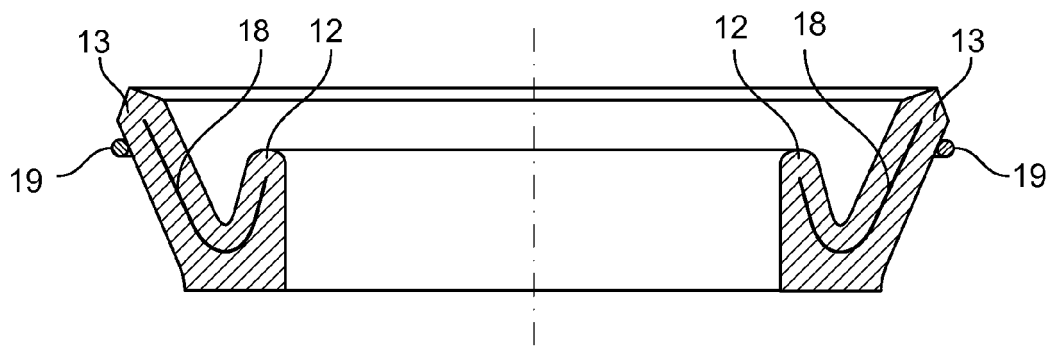


FIG. 9A

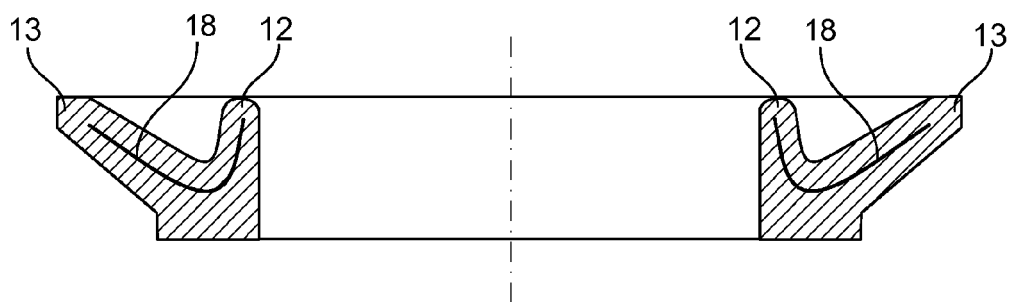


FIG. 9B

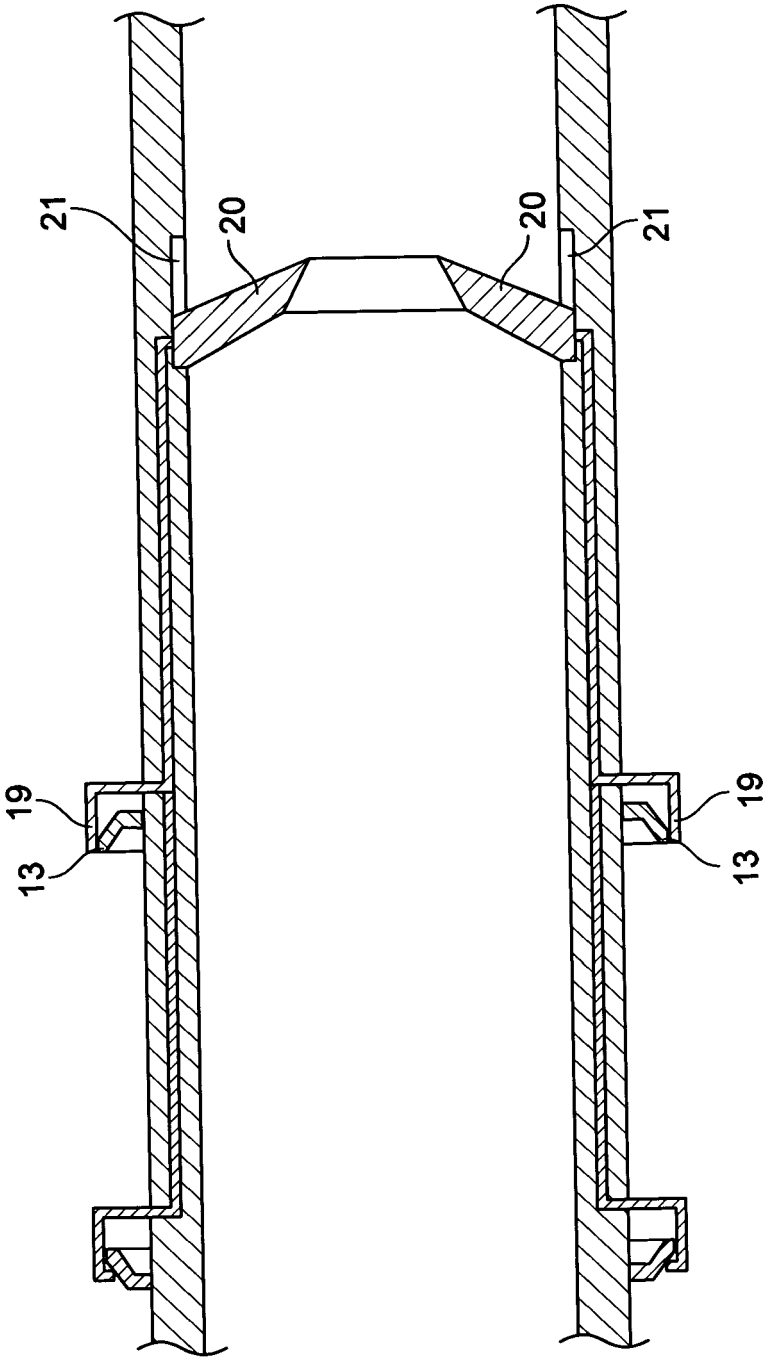


FIG. 10A

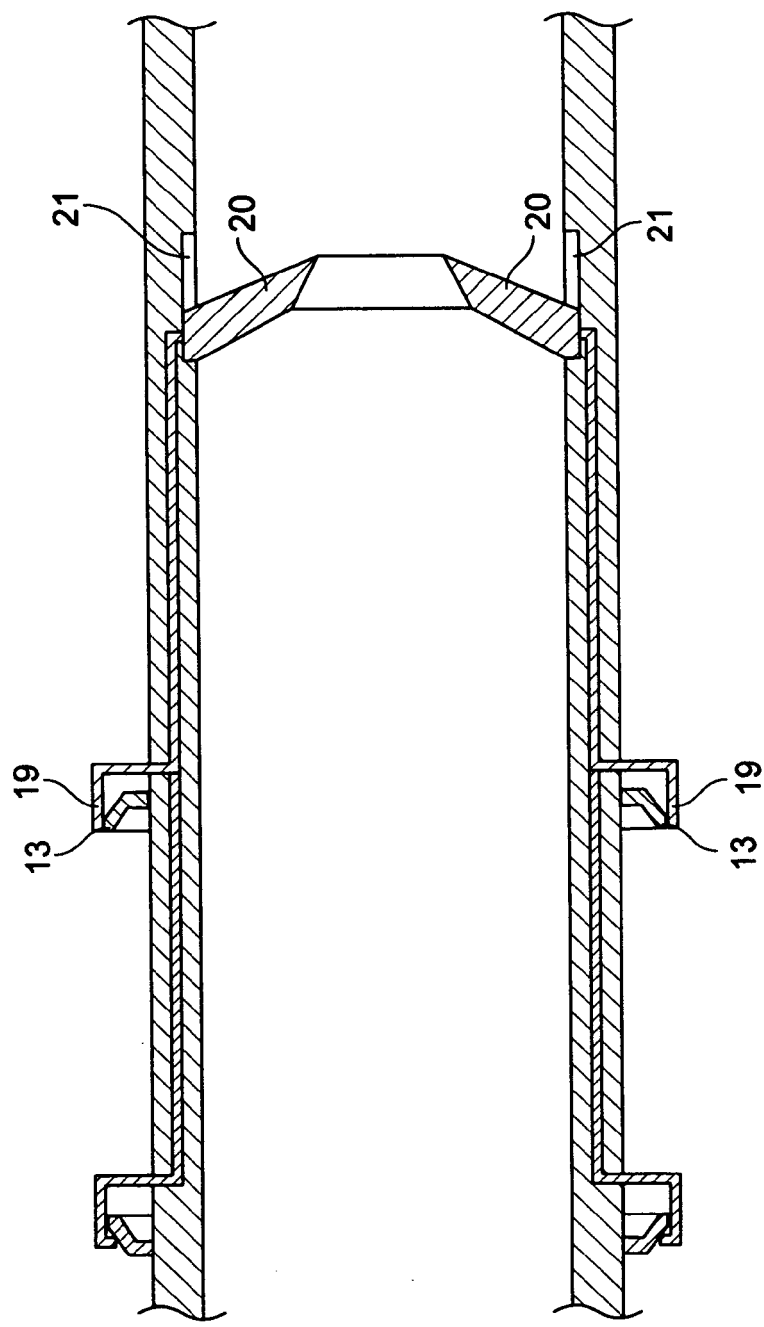


FIG. 10B

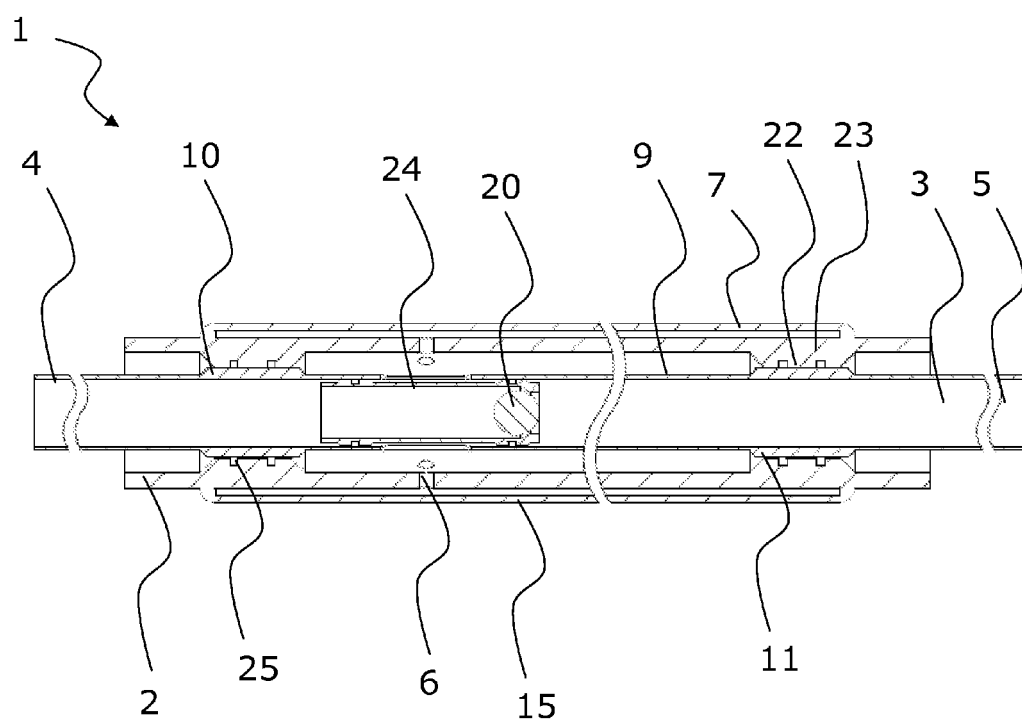


Fig. 11



EUROPEAN SEARCH REPORT

Application Number
EP 10 18 3095

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 206 879 A1 (WELLTEC AS [DK]) 14 July 2010 (2010-07-14) * column 7, line 28 - column 11, line 20; figure 1 *	1-18	INV. E21B43/10
A	US 2007/256841 A1 (GALLOWAY GREGORY G [US] GALLOWAY GREGORY GUY [US]) 8 November 2007 (2007-11-08) * page 4, paragraph 52; figure 12 *	1-18	
A	US 2007/029082 A1 (GIROUX RICHARD L [US] ET AL GIROUX RICHARD LEE [US] ET AL) 8 February 2007 (2007-02-08) * page 5 *	1-18	
A	US 2005/161232 A1 (PATEL DINESH R [US] ET AL) 28 July 2005 (2005-07-28) * the whole document *	1-18	
A	US 2005/098324 A1 (GANO JOHN C [US]) 12 May 2005 (2005-05-12) * the whole document *	1-18	TECHNICAL FIELDS SEARCHED (IPC)
A	US 6 640 893 B1 (RUMMEL FRITZ [DE] ET AL) 4 November 2003 (2003-11-04) * the whole document *	1-18	E21B
A	US 6 530 574 B1 (BAILEY GARY L [US] ET AL) 11 March 2003 (2003-03-11) * the whole document *	1-18	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 March 2011	Examiner Morrish, Susan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 18 3095

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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15-03-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2206879 A1	14-07-2010	WO 2010079237 A1	15-07-2010
US 2007256841 A1	08-11-2007	CA 2587163 A1 GB 2437847 A	05-11-2007 07-11-2007
US 2007029082 A1	08-02-2007	CA 2555563 A1 GB 2428715 A	05-02-2007 07-02-2007
US 2005161232 A1	28-07-2005	BR PI0501218 A CA 2494484 A1	27-09-2005 27-07-2005
US 2005098324 A1	12-05-2005	NONE	
US 6640893 B1	04-11-2003	AT 268429 T DE 60011254 D1 DE 60011254 T2 DK 1165933 T3 EP 1165933 A1 ES 2223487 T3 WO 0058601 A1 FR 2791732 A1 JP 2002540330 T PT 1165933 E	15-06-2004 08-07-2004 08-09-2005 11-10-2004 02-01-2002 01-03-2005 05-10-2000 06-10-2000 26-11-2002 29-10-2004
US 6530574 B1	11-03-2003	AU 9663401 A CA 2463052 A1 GB 2384202 A WO 0228560 A2	15-04-2002 11-04-2002 23-07-2003 11-04-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82