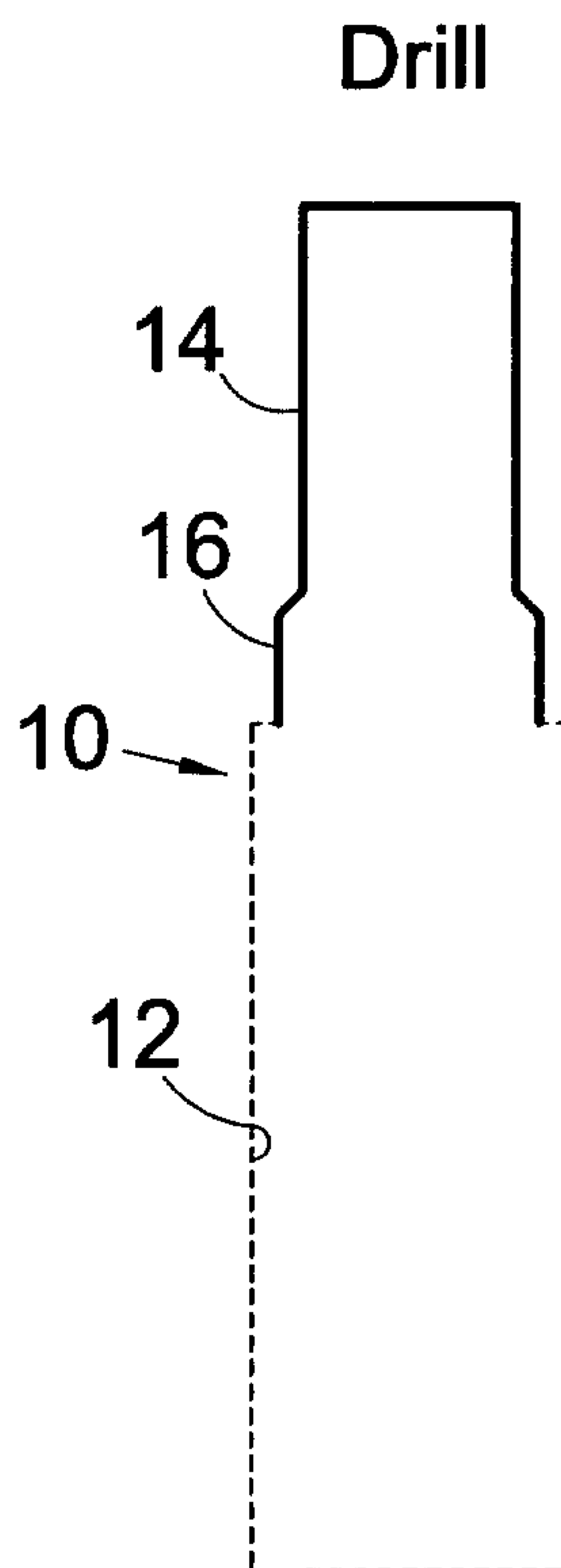




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(57) **Abrégé/Abstract:**

A method of lining a drilled bore comprises running an expandable first tubular (18) into a bore and locating part portion of the first tubular in an unlined section of the bore and another portion of the first tubular (14) overlapping a portion of an existing second tubular. The first tubular is secured (24) relative to the second tubular while retaining the provision of fluid outlets to permit displacement of fluid from an annulus between the first tubular and the bore wall. An expansion device (23) is then run through the first tubular to expand the first tubular to a larger diameter. Cement is then circulated into the annulus between the expanded first tubular and the bore wall. The fluid outlets are then closed.

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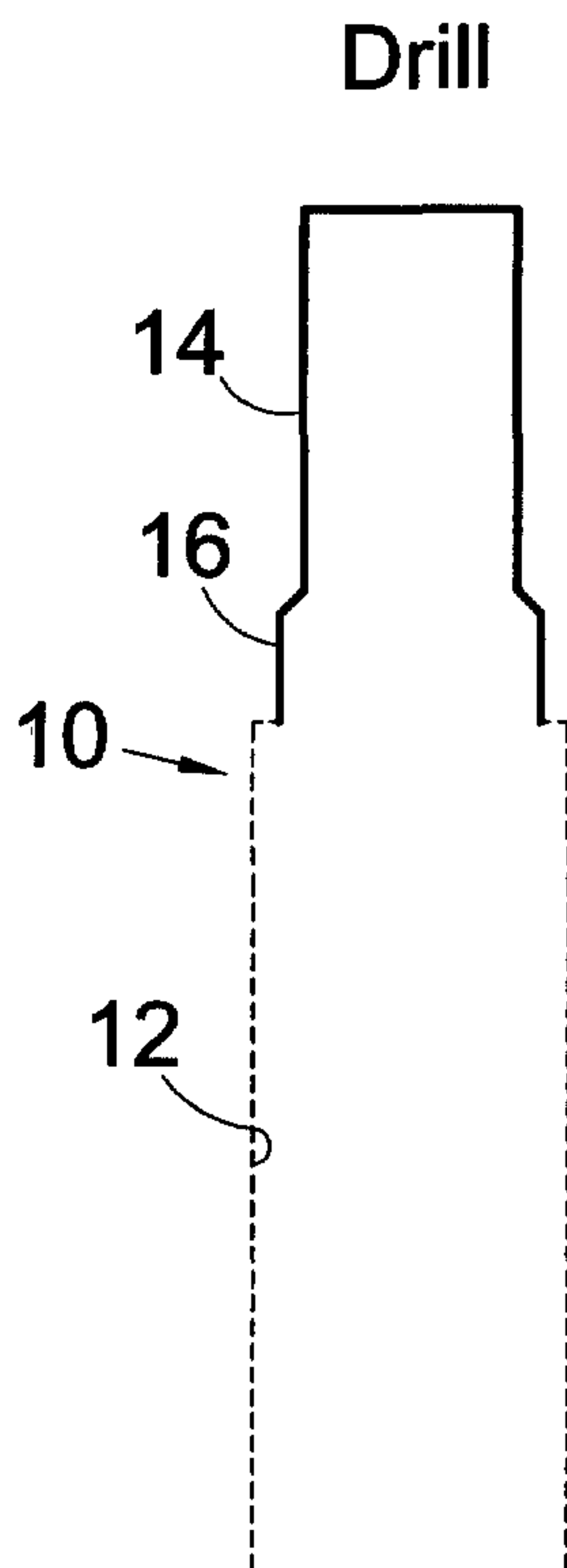
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(54) Title: BORE LINER



(57) **Abstract:** A method of lining a drilled bore comprises running an expandable first tubular (18) into a bore and locating part portion of the first tubular in an unlined section of the bore and another portion of the first tubular (14) overlapping a portion of an existing second tubular. The first tubular is secured (24) relative to the second tubular while retaining the provision of fluid outlets to permit displacement of fluid from an annulus between the first tubular and the bore wall. An expansion device (23) is then run through the first tubular to expand the first tubular to a larger diameter. Cement is then circulated into the annulus between the expanded first tubular and the bore wall. The fluid outlets are then closed.

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BORE LINER

FIELD OF THE INVENTION

This invention relates to bore liner, and in particular to expandable bore liner.

BACKGROUND OF THE INVENTION

Recent developments in the oil and gas exploration and
5 extraction industries have included the provision of
expandable bore-lining tubing. One such system proposes
expandable bore liner being run into a section of open
hole, below a cased section of bore, such that the upper
end of the liner overlaps with the lower end of the
10 existing casing, as described in GB 2 344 606 A. The lower
end of the liner is anchored in the bore, and cement slurry
is circulated into the annulus between the liner and the
bore wall, displaced fluid from the annulus passing through
the gap between the lower end of the casing and the upper
15 end of the unexpanded liner. The liner is run into the
bore with an expansion cone or swage located at the lower
end of the liner and, once the cement slurry is in place,
the expansion cone is urged upwardly through the liner, by
supplying hydraulic fluid at an elevated pressure behind
20 the cone. This expands the liner to a larger inner and
outer diameter, and brings the outer face of the upper end

of the liner into contact with the inner face of the lower end of the casing. The cement then cures, sealing and securing the expanded liner in the bore.

5 There are however a number of potential difficulties associated with this proposal. Firstly, as cementation takes place prior to expansion, there is a risk that the cement will set before expansion has been initiated or completed.

10 Further, the expansion cone moves upwardly from the lower end of the liner, such that any expansion problems may result in the cone becoming stuck part way through the liner. Access to remedy the problem is then restricted by the presence of the cone and the smaller diameter unexpanded liner above the cone.

15 Circumferential expansion of the liner using a cone results in axial shrinkage of the liner. Thus, difficulties may be experienced if the liner becomes differentially stuck in the bore, that is if there is a differential pressure between the bore and a formation
20 intersected by the bore, and this pressure differential acts on the liner to hold the liner against a portion of the bore wall. The axial shrinkage of the liner will thus be resisted between the differentially stuck portion of the liner and the anchor at the lower end of the liner. This
25 may result in the liner breaking, or in the expansion process being curtailed with the cone only part-way through.

the liner.

The use of pressure to urge the cone through the liner relies upon the maintenance of pressure integrity below the cone. Connections between liner sections will be subject to expansion, and should a connection leak following expansion, the expansion process may be hindered or halted. Furthermore, a sudden failure of a connection may expose the surrounding formation to undesirable elevated pressure, potentially damaging the formation and impacting on its production capabilities. Furthermore, if the formation is fractured, there may a loss of fluid into the formation, with the associated expense and inconvenience, and potential for damage to the formation.

Furthermore, the use of hydraulic pressure to urge the cone upwardly through the liner relies upon the provision of a pressure-tight seal between the cone and the liner, and thus requires the liner to conform to tight tolerances on the liner internal diameter, wall thickness and roundness. These tolerances are much tighter than standard API specifications, and consequently make manufacture of such liner relatively expensive.

Finally, when expanding a liner overlapping an existing casing utilising a cone or swage it is only possible to expand the liner to a diameter smaller than the casing, such that any further sections of liner must be of still smaller diameter.

It is among the objectives of embodiments of the present invention to obviate or mitigate these and other disadvantages of existing liner expansion proposals.

SUMMARY OF THE INVENTION

5 According to a first aspect of the present invention there is provided a method of lining a drilled bore, the method comprising:

running an expandable first tubular of an external first diameter into a bore;

10 locating the first tubular in an unlined section of the bore with an upper end of the first tubular overlapping a lower end of an existing second tubular of an internal second diameter larger than said first diameter;

securing the upper end of the first tubular relative to the lower end of the second tubular while retaining fluid outlets to permit displacement of fluid from an annulus between the first tubular and the bore wall;

running an expansion device down through the first tubular to expand the first tubular to a larger diameter;

20 circulating cement into the annulus between the expanded first tubular and the bore wall;

sealing the upper end of the first tubular to the lower end of the second tubular.

Expanding the first tubular prior to cementation avoids any problems relating to the cement setting prior to

expansion. Furthermore, as the expansion is carried out "top down", if any difficulties are experienced the expansion device is relatively easily accessed.

In other aspects of the invention it is not necessary
5 to cement the liner in place, for example the liner may be expanded to conform to the surrounding bore wall, or the liner may carry or be provided with a sleeve of deformable or expanding material, such as an elastomer which may be formulated to swell on exposure to selected fluids or
10 temperatures.

Preferably, the first tubular is expanded by rotary or rolling expansion, that is an expansion device featuring one or more rotatable expansion members, the device being rotated within the tubular as the device is axially
15 advanced there through. Examples of such rotary expansion devices are described in applicant's W000\37766 and US 09\469,690, the disclosures of which are incorporated herein by reference. Such expansion devices operate using a different expansion mechanism than cones and swages, that
20 is by reducing the wall thickness of the tubular and thus increasing the diameter of the tubular, rather than simple circumferential extension of the tubular wall. Such devices may be controlled to limit the degree of axial shrinkage or contraction of the tubular during expansion,
25 and thus the impact of any differential sticking is reduced, and the different yield mechanism of rotary

expansion is also better able to accommodate localised differential sticking. The rotary expansion device may be compliant, that is be capable of expanding a variable diameter, or of fixed diameter. However, in certain
5 embodiments of the invention, expansion cones or swages may still be utilised to expand the first tubular, or an axial compliant expander may be utilised, such as the tool sold under the ACE trade mark by the applicant, or the tool as described in the PCT and United States patent applications
10 filed on 30 November 2002, based on applicant's UK patent application 0128667.3.

The first tubular may be expanded by a combination of mechanical and hydraulic means, as described in applicant's PCT patent application W02\081863.

15 Preferably, the upper end of the first tubular is expanded to an internal diameter sufficient such that there is little or no reduction in internal diameter between the second tubular and the expanded first tubular. This may be achieved in a number of ways. The lower end portion of the
20 second tubular may describe a larger diameter than an upper portion of the tubular, to create a "bell-end" or the like, such that the first tubular may be expanded into the bell-end. Alternatively, the upper end of the first tubular may be expanded within the lower end of the second tubular and
25 induce expansion and deformation of the second tubular.

Preferably, the upper end of the first tubular is

expanded to secure the upper end of the first tubular relative to the lower end of the second tubular. Most preferably, the upper end of the first tubular is further extended to seal the upper end of the first tubular to the
5 lower end of the second tubular.

The lower end of the first tubular may be expanded to a larger internal diameter, to accommodate the upper end of a subsequent tubular.

Preferably, the first tubular is liner and the second
10 tubular is casing.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

15 Figures 1 to 7 are schematic illustrations of steps in the process of lining a bore in accordance with a preferred embodiment of the present invention;

Figure 8 shows a setting tool suitable for use in the process of Figures 1 to 7;

20 Figures 9 and 10 are schematic illustrations of steps in the process of lining a bore in accordance with a second embodiment of the present invention; and

Figures 11 and 12 are schematic illustrations of steps in the process of lining a bore in accordance with a third
25 embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Reference is first made to Figures 1 to 7 of the drawings, which are schematic illustrations of steps in the process of lining a drilled bore in accordance with a preferred embodiment of the present invention.

Figure 1 of the drawings illustrates the lower end of a bore 10 including an open or unlined bore section 12. Above the unlined section 12, the bore 10 has been lined with casing 14, which has been sealed relative to the adjacent bore wall using conventional cementation techniques. It will be noted that the lower end of the casing 14 features a larger diameter end section 16, or bell-end.

Figure 2 shows a section of expandable liner 18 which has been run into the bore 10 on an appropriate running string 20. The liner 18 is initially coupled to the running string 20 via a setting tool 22 (the tool 22 will be described in greater detail below, following the description of the process, with reference to Figure 8 of the drawings). The liner 18 is run into the bore 10 on the string 20 and located in the bore such that the upper end of the liner 18 overlaps the larger diameter casing end section 16.

The setting tool 22 includes a fluid pressure actuated compliant rolling expansion device 23 which is rotatably

coupled to the string 20 but which is rotatable relative to the setting tool 22 and liner 18. When actuated and rotated, the expansion device 23 extends at least a portion of the upper end of the liner 18 into contact with the casing end section 16, thus providing an anchor 24 for the liner 18. An axial push and pull is then applied to the tool 22 from surface to ensure that the liner 18 is firmly anchored to the casing 14. The setting tool 22 is then released from the now anchored liner 18 and the compliant rolling expansion device 23 utilised to expand the section of liner 18 above the anchor 24, to locate the liner 18 more securely relative to the casing 14. At this stage, an elastomeric seal sleeve 25 below the anchor 24 remains inactive, and a number of fluid ports 27 in the liner remain open to allow fluid to pass from the annulus 26 between the liner 18 and the bore wall between the overlapping ends of the casing 14 and liner 18.

Next, as illustrated in Figure 4, the setting tool 22 is moved downwardly through the liner 18 and a fixed diameter expansion device 25 is utilised to expand the liner 18 to a larger diameter, such that the expanded inner diameter of the liner 18 corresponds to the inner diameter of the casing 14. The expansion of the liner 18 is achieved using a rolling expansion device 25 but may equally feature one or both of fixed and compliant rolling elements. If compliant rolling elements are present, these

are actuated to extend radially outwardly of the tool body by hydraulic pressure supplied to the tool 22 via the running string 20.

5 The lower end of the liner 18 is provided with an expandable drillable float shoe 28, of a suitable material such a composite or aluminium alloy. The shoe 28 incorporates a float collar with a flapper valve, and the check valves normally found in a shoe. On the setting tool 10 22 encountering the float shoe 28, a sealed connection is formed with the float collar, the flapper valve is opened and a cement port in the setting tool 22 is opened, such that cement slurry may be pumped down the running string 20, through the setting tool 22, through the float shoe 28, and into the annulus 26, as illustrated in Figure 5. . The 15 fluid from the annulus displaced by the cement 30 passes through the flow ports 27 in the liner 18 below the anchor 24.

Once cementation is completed, the setting tool 22, with the compliant expansion device 23 retracted, is pulled 20 out of the lower end of the expanded liner 18 and the flapper valve in the float shoe closes. Cleaning fluid is then circulated through the liner 18 and casing 14, via the tool 22, to clean out any remaining cement residue. The compliant expansion device 23 is then pulled out until the 25 device 23 is located adjacent the liner seal 25. The expansion device 23 is then actuated to further expand the

upper end of the liner 18 into contact with the surrounding casing 14 to activate the seal 25 and close the liner flow ports 27, and thus form a fluid seal between the liner 18 and the casing 14. The setting tool 22 is then pulled out
5 of the bore 10.

As noted above, in this embodiment the casing 14 is provided with a larger diameter lower end section 16, into which the upper end of the liner 18 is expanded, such that the expanded liner 18 has the same internal diameter as the
10 casing 14. For example, $7\frac{5}{8}$ inch liner 18 may be run through a $9\frac{5}{8}$ inch casing 14. The $7\frac{5}{8}$ inch liner 18 may then be expanded to provide the same internal dimensions as the $9\frac{5}{8}$ inch liner.

Reference is now made to Figure 8 of the drawings, which illustrates details of a setting tool 22 as may be
15 utilised in the above-described method. The tool 22 will be described from the top down, starting with Figure 8a.

The upper end of the tool 22 extends above the upper end of the liner 18 and features a location device in the form of a spring-loaded latch 50 which is shaped to locate
20 in a profile (not shown) provided in the lower end of the casing 14. This serves to indicate when the tool 22, and thus the liner 18, has been correctly located relative to the casing 14; once the latch 50 has engaged the casing profile, an over-pull or additional weight is required to
25 dislodge the latch 50 from the profile. The correct

location of the tool 22 and the liner 18 in the casing 14 is important as, for example, if the overlap between the liner 18 and casing 14 is not as intended, it may not be possible to fully expand the liner 18, leaving a
5 restriction in the liner bore. Of course the location device may take other forms, and may utilise sensors relaying signals to surface rather than relying on mechanical engagement.

Below the latch 50 is the fixed diameter expansion
10 tool 25, which in this example features three rollers 52 mounted on inclined spindles. Mounted below the expansion tool 25 are a pair of torque anchors 56, 58, which are rotatably fixed relative to the arrangement for supporting the liner on the tool 22 (Figure 8c), in the form of liner-
15 supporting dogs 60, but which are mounted to the remainder of the tool 22 via a swivel. The anchors 56, 58 comprise rollers 62 which define circumferentially extending teeth. The rollers are mounted on pistons and are each rotatable about an axis which lies parallel to the axis of the tool
20 22 and the liner 18. The anchors 56, 58 may be hydraulically actuated to extend radially into contact with the inner surface of the casing 14.

The liner-supporting dogs 60 initially extend through windows 64 in the upper end of the liner 18, which will
25 form the liner hanger. The dogs 60 may be released by application of an over-pressure within the tool 22. In

this example such an over-pressure shears a disc which then creates an impulse pressure on a dog-supporting sleeve, to move the sleeve to a position in which the dogs may radially retract. However, in other embodiments the dogs
5 may be released by some other means, for example by rotating the tool 22 to the left relative to the anchored liner 18.

The liner-supporting dogs 60 and the torque anchors 56, 58 operate in concert when the compliant expansion
10 device 23 (Figure 8d) is first activated; the elevated pressure utilised to activate the expansion device 23 also serves to activate the anchors 56, 58 to engage with the casing 14, such that when the activated device 23 is rotated to expand the anchor C-ring 24, the liner 18 is
15 held stationary.

Following release of the dogs 60, by application of an over-pressure following activation of the anchor, the rollers 62 allow the actuated anchors 56, 58 to move upwardly relative to the casing 14 as the activated device
20 23 is utilised to expand the liner 18 above the anchor 24.

A cement stinger 70 (Figures 8d and 8e) is provided below the expansion device 23, and is mounted to the remainder of the lower end of the tool 22 via a swivel 72. Following expansion of the liner 18 the stinger 70 stabs
25 into an appropriate pack-off bushing at the liner shoe 28 ~~to allow cement to be pumped from surface into the annulus~~

26.

Following cementation and cleaning, as described above, the compliant expansion tool 23 is utilised to further expand the upper end of the liner, and in particular to activate the seal 25 and close the liner flow ports 27. This follows the tool 22 being accurately located relative the upper end of the liner 18 and the casing 14 by means of the latch 50.

Reference is now made to Figures 9 and 10 of the drawings, which illustrate an alternative arrangement, in which the casing 114 is initially of substantially constant diameter over its length. However, when the upper end of the liner 118 is expanded to provide a fluid-tight seal between the liner 118 and the casing 114, the lower end of the casing 116 is also subject to a degree of expansion, such that the upper end of the expanded liner 118 describes the same internal diameter as the unexpanded casing 114. To permit such expansion of the casing 114, it is of course necessary that the annulus around the lower end of the casing 114 is free of set cement or other incompressible materials. To this end, it is preferred that the casing has been provided with a shoe, such as described in applicant's PCT\GB01\04202, the disclosure of which is incorporated herein by reference, to retain the lower portion of the casing annulus free of cement.

~~In other embodiments, the lower end of the casing may~~

be subject to little if any expansion, such that there is a small loss of diameter at the liner top.

Reference is now made to Figures 11 and 12 of the drawings, Figure 11 showing liner 218 which has been expanded in a similar manner to the first described embodiment. However, the lower end of the liner 220 is then subject to further expansion, to facilitate accommodation of a further expanded liner, and such that the further expandable liner may be expanded to a similar internal diameter to the first expanded liner 218 and the existing casing 214. The expansion of the lower end of the liner may be achieved by means of a compliant expansion tool 23, as described above.

In other embodiments of the invention the cementation step may not be required, for example when the liner is provided with an elastomer on its outer face, which elastomer may be formulated to swell on contact with certain fluids to fill the annulus between the expanded liner and the bore wall. In still further embodiments, the cementation may be carried in stages, particularly when the liner is relatively long. In such a situation the expansion may also be carried out in stages, that is a section of liner is expanded and then cemented, and this process is then repeated as many times as is necessary for subsequent sections. Fluid circulation between the annulus and an intermediate section of the liner may be achieved by

providing flow ports at appropriate points in the liner, which ports are adapted to be closed on expansion of the liner to a predetermined degree. In one embodiment, an exterior sleeve is provided around the ports, allowing
5 fluid to flow through the ports. However, when the liner is expanded the liner is brought into contact with the sleeve and the sleeve closes the ports.

CLAIMS

1. A method of lining a drilled bore, the method comprising:

running an expandable first tubular into a bore;

5 locating a first portion of the first tubular in an unlined section of the bore and a second portion of the first tubular overlapping a portion of an existing second tubular;

10 securing the first tubular relative to the second tubular while retaining fluid outlets to permit displacement of fluid from an annulus between the first tubular and the bore wall;

running an expansion device through the first tubular to expand the first tubular to a larger diameter;

15 circulating cement into the annulus between the expanded first tubular and the bore wall; and

closing the fluid outlets.

2. The method of claim 1, comprising:

20 providing flow ports at a location in the first tubular to provide for fluid passage from the annulus into the tubular.

3. The method of claim 2, further comprising expanding the tubular at said location to close the flow ports.

4. The method of claim 3, comprising expanding the tubular at said location into contact with the surrounding
5 second tubular.

5. The method of any of claims 1 to 4, comprising running the expansion device down through the first tubular.

6. The method of any of the preceding claims, comprising locating a lower portion of the first tubular in an unlined
10 section of the bore and an upper portion of the first tubular overlapping a lower portion of the second tubular.

7. The method of any of the preceding claims, comprising expanding the first tubular by rotary expansion.

8. The method of any of the preceding claims, comprising
15 expanding the first tubular using an axial expander.

9. The method of any of the preceding claims, comprising expanding the first tubular utilising a compliant expander.

10. The method of any of the preceding claims, comprising
-20 expanding the first tubular utilising a fixed diameter

expander.

11. The method of any of the preceding claims, comprising:
expanding the second portion of the first tubular
using a variable diameter expansion device; and

5 expanding the first portion of the first tubular using
a fixed diameter expansion device.

12. The method of any of the preceding claims, wherein the
second portion of the first tubular is expanded to an
10 internal diameter corresponding to an internal diameter of
the second tubular.

13. The method of any of the preceding claims, wherein a
lower end of the second tubular describes a larger diameter
than an upper portion of the second tubular, and the first
15 tubular is expanded into said lower end of the second
portion.

14. The method of any of the preceding claims, wherein the
second portion of the first tubular is expanded within the
lower end of the second tubular to induce expansion and
20 deformation of the second tubular.

15. The method of any of the preceding claims, wherein the
second portion of the first tubular is at least partially-

expanded to secure the first tubular relative to the second tubular.

16. The method of claim 15, wherein the second portion of the first tubular is further expanded to seal the first
5 tubular to the second tubular.

17. The method of any of the preceding claims, wherein the lower end of the first tubular is expanded to a still larger internal diameter, to accommodate the upper end of a subsequent tubular.

10 18. The method of any of the preceding claims, wherein the first tubular is liner.

19. The method of any of the preceding claims, wherein the second tubular is casing.

15 20. The method of any of the preceding claims, wherein expansion of the first tubular is assisted by application of elevated fluid pressure.

21. The method of any of the preceding claims, further comprising positively locating the first tubular relative to the second portion before securing the first tubular
20 ~~relative to the second tubular.~~

22. The method of any of the preceding claims, further comprising expanding the first tubular in sections.

23. The method of any of the preceding claims, further comprising cementing the first tubular in sections.

5 24. The method of any of the preceding claims, further comprising:

running an expansion device through a first section of the first tubular to expand said first section to a larger diameter;

10 circulating cement into a first section of the annulus between the expanded first section and the bore wall.

25. The method of claim 24, further comprising:

15 running an expansion device through a second section of the first tubular to expand said second section to a larger diameter;

circulating cement into a second section of the annulus between the expanded second section and the bore wall.

20 26. A method of lining a drilled bore, the method comprising:

running an expandable first tubular into a bore;

~~running an expansion device through a first section of~~

the first tubular to expand the first section to a larger diameter;

circulating cement into the annulus between the first section and the bore wall; and

5 subsequently expanding and cementing further sections of the first tubular.

27. The method of claim 26, comprising expanding the first section prior to circulating cement into the annulus between the first section and the bore wall.

10 28. A method of lining a bore comprising:

running an expandable first tubular into a bore;

overlapping a portion of the first tubular with a second tubular located in the bore, the second tubular having a larger diameter portion for receiving said portion
15 of the first tubular; and

expanding the first tubular by a combination of compliant and fixed diameter rotary expansion.

29. A method of lining a bore in a single trip, the method comprising:

20 running an expandable first tubular into a bore;

overlapping a portion of the first tubular with a second tubular located in the bore, the second tubular having a larger diameter portion for receiving said portion

of the first tubular and the overlap permitting fluid
bypass;

expanding the first tubular to a larger diameter;

cementing the first tubular in the bore; and

5 closing said fluid bypass.

30. A method of lining a bore in a single trip, the method
comprising:

running an expandable first tubular into a bore;

10 overlapping a portion of the first tubular with a
second tubular located in the bore, the second tubular
having a larger diameter portion for receiving said portion
of the first tubular and the overlap permitting fluid
bypass;

expanding the first tubular to a larger diameter;

15 creating a still larger diameter portion at a lower
end of the first tubular;

cementing the first tubular in the bore; and

closing said fluid bypass.

20 31. A method of lining a bore in a single trip, the method
comprising:

running an expandable first tubular into a bore;

25 overlapping a portion of the first tubular with a
second tubular located in the bore, the second tubular
having a larger diameter portion for receiving said portion

24

of the first tubular and the overlap permitting fluid
bypass;

expanding the at least the first tubular to a larger
diameter such that the first tubular and the second tubular
5 define a substantially constant internal diameter;

cementing the first tubular in the bore; and
closing said fluid bypass.

32. A method of lining a bore in a single trip, the method
comprising:

10 running an expandable first tubular into a bore;

overlapping a portion of the first tubular with a
second tubular located in the bore, the second tubular
having a larger diameter portion for receiving said portion
of the first tubular and the overlap permitting fluid
15 bypass;

expanding the first tubular to a larger diameter such
that the first tubular and the second tubular define a
substantially constant internal diameter;

20 creating a still larger diameter portion at a lower
end of the first tubular;

cementing the first tubular in the bore; and
closing said fluid bypass.

33. A method of lining a drilled bore, the method
comprising:

25

running an expandable first tubular of an external first diameter into a bore;

5 locating the first tubular in an unlined section of the bore with an upper end of the first tubular overlapping a lower end of an existing second tubular of an internal second diameter larger than said first diameter;

10 securing the upper end of the first tubular relative to the lower end of the second tubular while retaining fluid outlets to permit displacement of fluid from an annulus between the first tubular and the bore wall;

running an expansion device down through the first tubular to expand the first tubular to a larger diameter; and

15 sealing the upper end of the first tubular to the lower end of the second tubular.

34. The method of claim 33, wherein the first tubular is expanded into close contact with the surrounding bore wall.

20 35. The method of claim 33 or 34, wherein the first tubular is provided in combination with a sleeve of deformable material for contacting the surrounding bore wall.

36. The method of claim 33 or 34, wherein the first tubular is provided in combination with a sleeve of

expanding material for contacting the surrounding bore wall.

37. The method of claim 36, wherein the sleeve of material comprises a swelling elastomer.

5 38. The method of claim 37, further comprising circulating fluid between the first tubular and the bore wall, the fluid being selected to interact with the elastomer and to induce swelling of the elastomer into sealing contact with the bore wall.

10 39. The method of any of the preceding claims, wherein expansion of the first tubular is assisted by application of elevated fluid pressure.

40. Apparatus for use in lining a drilled bore, the apparatus comprising:

15 a body;
a support for a bore-lining tubular; and
a rotary expander for expanding bore-lining tubular, the expander being rotatably mounted relative to the support.

20 41. The apparatus of claim 40, in combination with an expandable first tubular.

42. The apparatus of claim 41, in combination with an anchor on the tubular for engaging a surrounding second tubular.

43. The apparatus of claim 42, wherein the anchor
5 comprises a C-ring.

44. The apparatus of claim 42 or 43, wherein the anchor is initially located axially adjacent the expander.

45. The apparatus of any of claims 40 to 44, comprising a location device for locating the body relative to an
10 existing tubular.

46. The apparatus of claim 45, wherein the location device comprises a radially extending profile adapted for engaging a cooperating profile in the existing tubular.

47. The apparatus of claim 45 or 46, wherein the location
15 device comprises a sprung latch.

48. The apparatus of any of claims 40 to 47, comprising a fixed diameter rotary expander.

49. The apparatus of claim 48, wherein the fixed diameter rotary expander comprises at least one inclined axis-

roller.

50. The apparatus of any of claims 40 to 49, further comprising at least one torque anchor rotatably coupled to the support.

5 51. The apparatus of claim 50, wherein the torque anchor has at least one anchor member movable between a retracted configuration and an extended configuration.

52. The apparatus of claim 51, wherein the anchor member is pressure actuated.

10 53. The apparatus of claim 51 or 52, wherein the anchor member comprises a roller.

54. The apparatus of claim 53, wherein the roller is piston-mounted.

15 55. The apparatus of any of claims 50 to 54, wherein the torque anchor is adapted to permit axial movement between the anchor and a surrounding tubular.

56. The apparatus of any of claims 40 to 55, wherein the support comprises at least one member adapted for engaging a bore lining tubular.

57. The apparatus of claim 56, in combination with a tubular body defining a profile for cooperating with the member.

58. The apparatus of claim 57, wherein the profile is in
5 the form of a window.

59. The apparatus of any of claims 56 to 58, wherein the member is selectively movable between a tubular-engaging position and a tubular-release position.

60. The apparatus of any of claims 56 to 59, wherein the
10 member is selectively movable between an extended position and a retracted position.

61. The apparatus of any of claims 56 to 60, wherein the member is releasably lockable in a tubular-engaging position.

15 62. The apparatus of any of claims 56 to 61, wherein the member is releasable from a tubular-engaging position by application of fluid pressure.

63. The apparatus of any of claims 40 to 62, comprising a compliant expander.

64. The apparatus of any of claims 40 to 63, comprising a pressure actuated expander.

65. The apparatus of any of claims 40 to 64, further comprising a pressure-actuated torque anchor.

5 66. The apparatus of any of claims 40 to 65, comprising an expander having at least one expansion member movable between a retracted position and an extended position.

67. The apparatus of any of claims 40 to 66, further comprising a cement stinger.

0 68. The apparatus of claim 67, wherein the cement stinger is mounted to the body via a swivel.

69. A tubular hanger comprising an expandable body having a tubular wall, the body including an anchor portion adapted for engaging a surrounding tubular on expansion of the body, and at least one port in the body wall for providing a fluid flow path through the body.

70. The hanger of claim 69, wherein the body includes a seal portion adapted for forming a seal with a surrounding tubular on expansion of the body.

71. A tubing hanger assembly comprising:
an expandable first tubular;
a second tubular for receiving the first tubular;
an expandable body for coupling to the first tubular
5 in a drilled bore, the body having a tubular wall and
including an anchor portion adapted for engaging the second
tubular on expansion of the body, and at least one port in
the body wall for providing a fluid flow path through the
body.
- 10 72. A expandable tubular having a wall defining a
plurality of flow ports at axially spaced locations, the
flow ports being adapted to close on expansion of the
tubular at the port location.
- 15 73. The tubular of claim 72, further comprising a sleeve
at each of said locations.
74. A tubing hanger assembly comprising:
an expandable tubular body;
a first expansion device initially located within the
body for expanding at least a portion of the body to a
20 larger diameter; and
a second expansion device initially located externally
of the body and for translation through the body to expand
at least a portion of the body to a larger diameter.

75. The assembly of claim 74, wherein the first expansion device is a compliant expansion device.

76. The assembly of claim 74 or 75, wherein the first expansion device is a rotary expander.

5 77. The assembly of claim 74, 75 or 76, wherein the second expansion device is a fixed diameter device.

78. The assembly of claim 74, 75, 76 or 77, wherein the second expansion device is a rotary expander.

79. A tubular deployment tool for mounting to an elongate support member and for deploying an expandable tubular in a drilled bore, the system comprising:

a tool body;

a releasable tubular support for supporting a tubular from the body;

15 a tubular expander adapted for translation through a tubular to be expanded; and

a coupling for permitting passage of sealing material from the tool body into an annulus surrounding an expanded tubular.

20 80. The tool of claim 79, wherein the expander is a rotary expander.

81. The tool of claim 79 or 80, comprising a variable diameter expander.

82. The tool of claim 79, 80 or 81, comprising a fixed diameter expander.

5 83. The tool of any of claims 79 to 82, comprising a variable diameter expander and a fixed diameter expander.

84. An expandable tubular system comprising:
an expandable tubular;
an expandable hanger coupled to an upper end of the
10 tubular;
a coupling at a lower end of the tubular for cooperating with a sealing material supply member; and
a shoe.

15 85. The system of claim 84, wherein the coupling is drillable.

86. The system of claim 84 or 85, wherein the shoe is drillable.

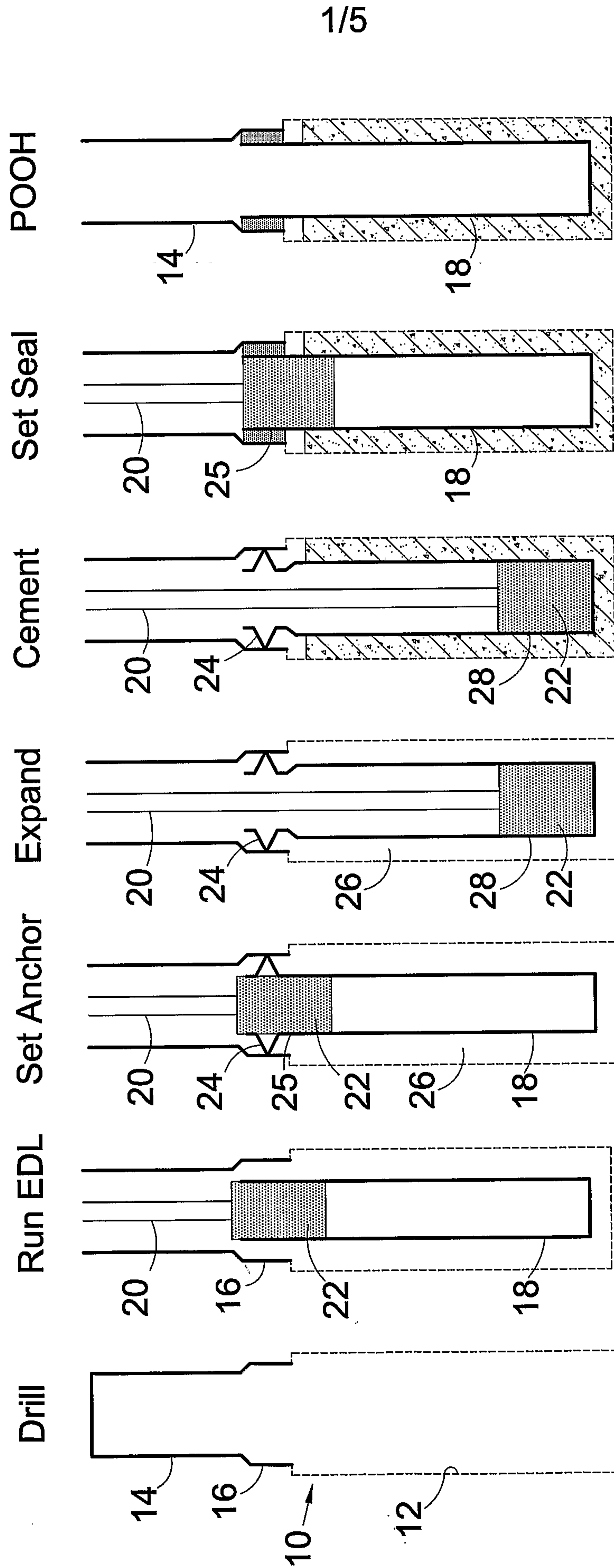


Fig.1 Fig.2 Fig.3 Fig.4 Fig.5 Fig.6 Fig.7

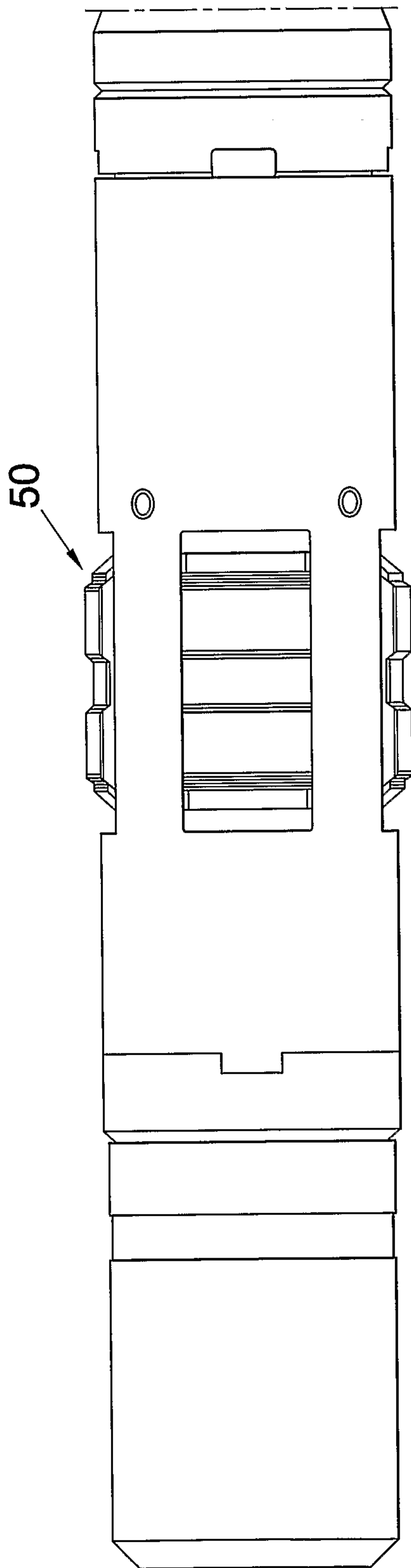


Fig. 8a

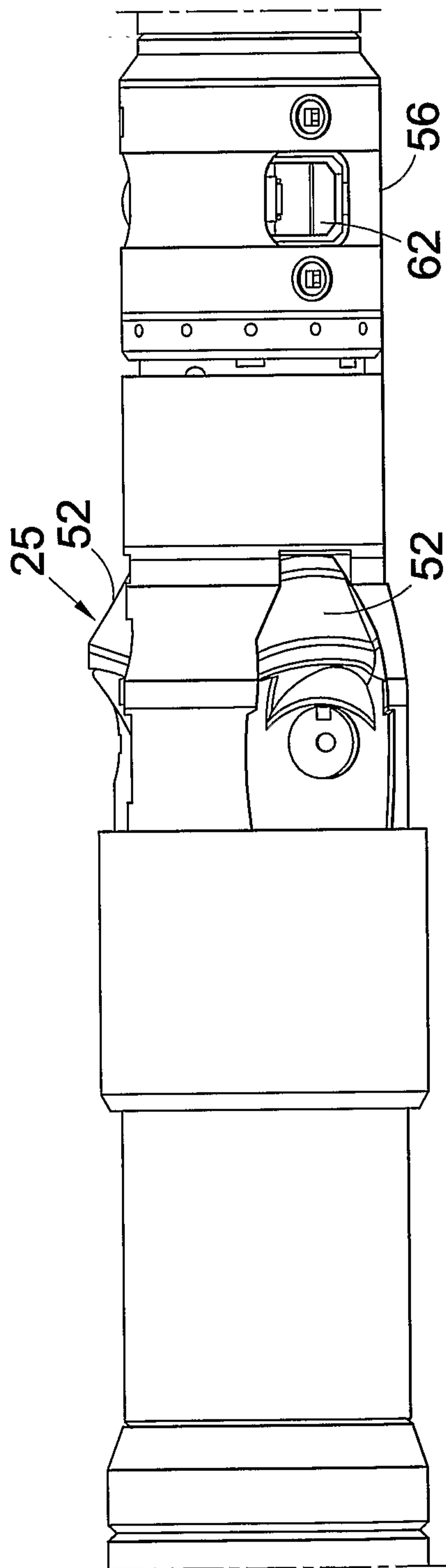


Fig. 8b

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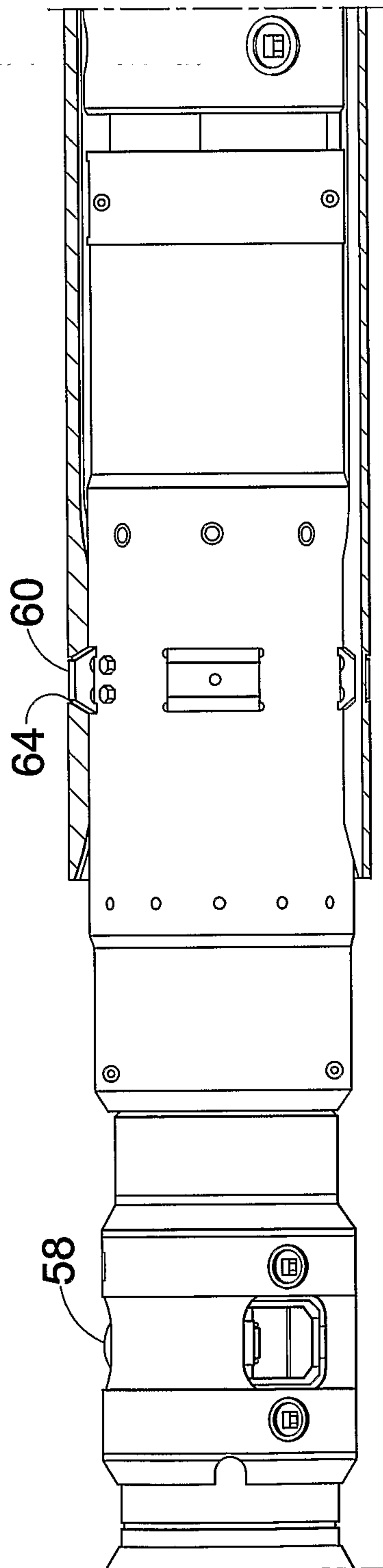


Fig.8c

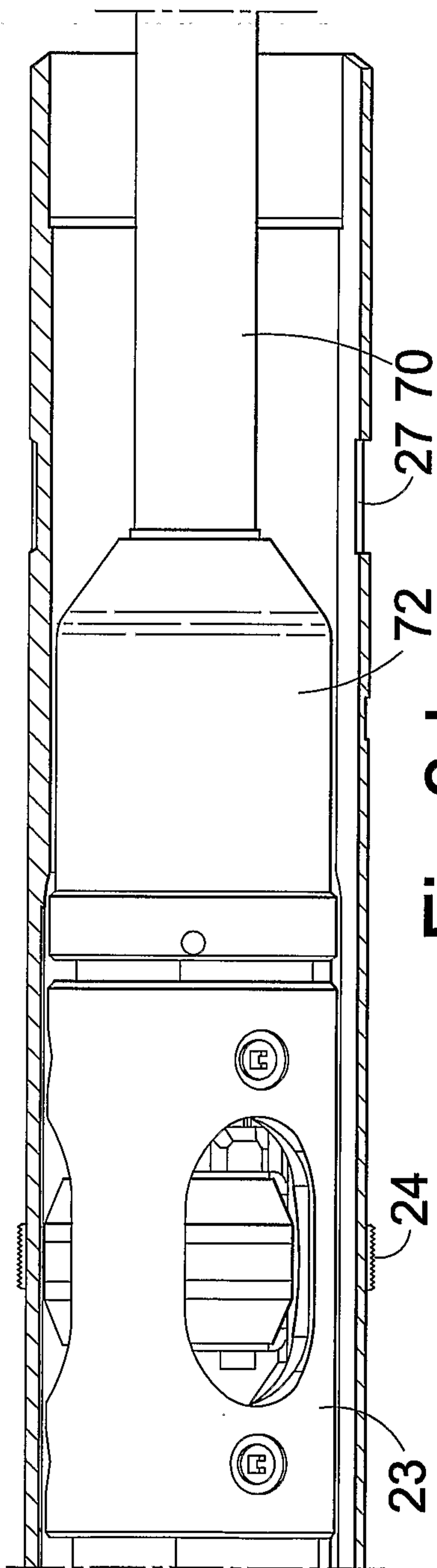


Fig. 8d

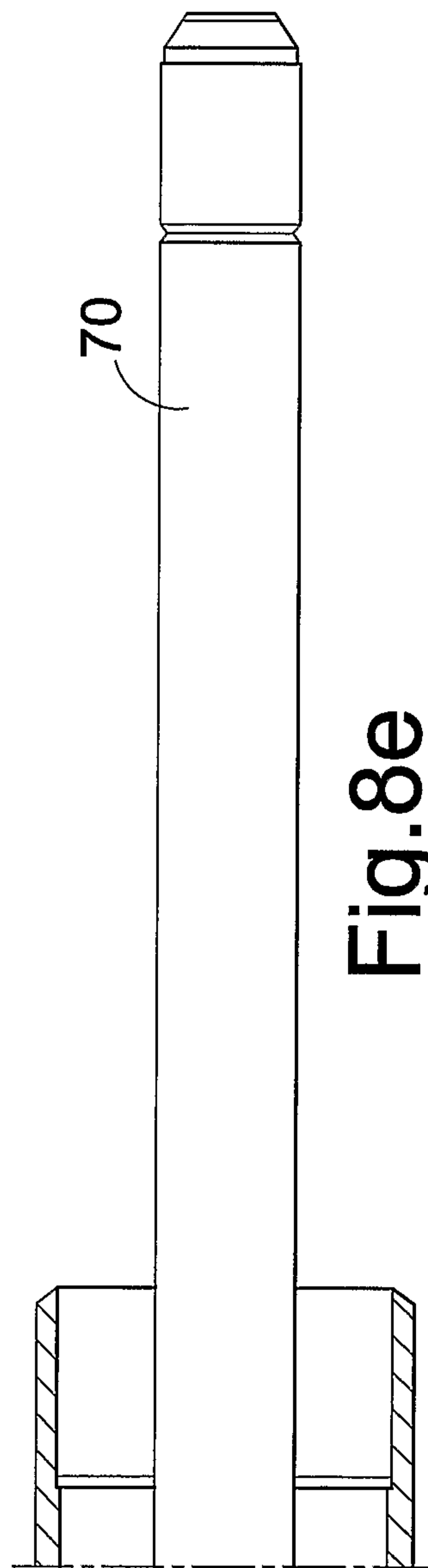


Fig. 8e

Embodiment 2

Embodiment 3

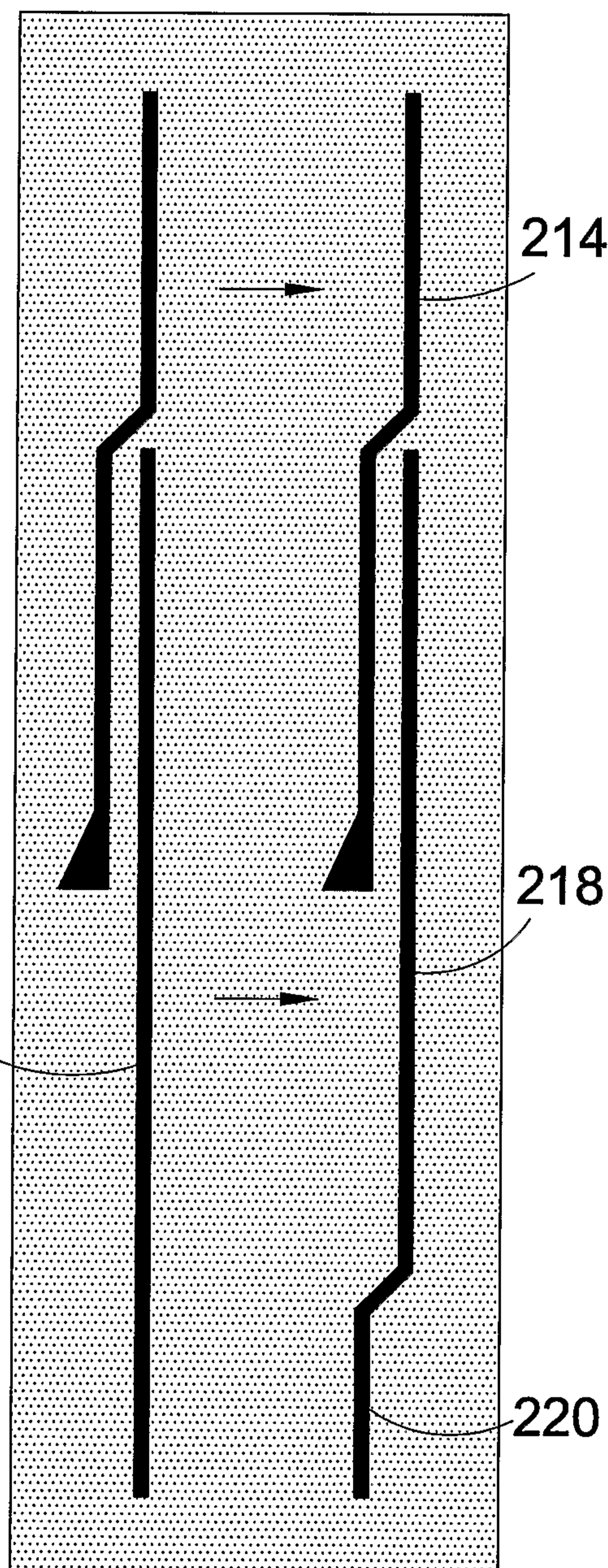
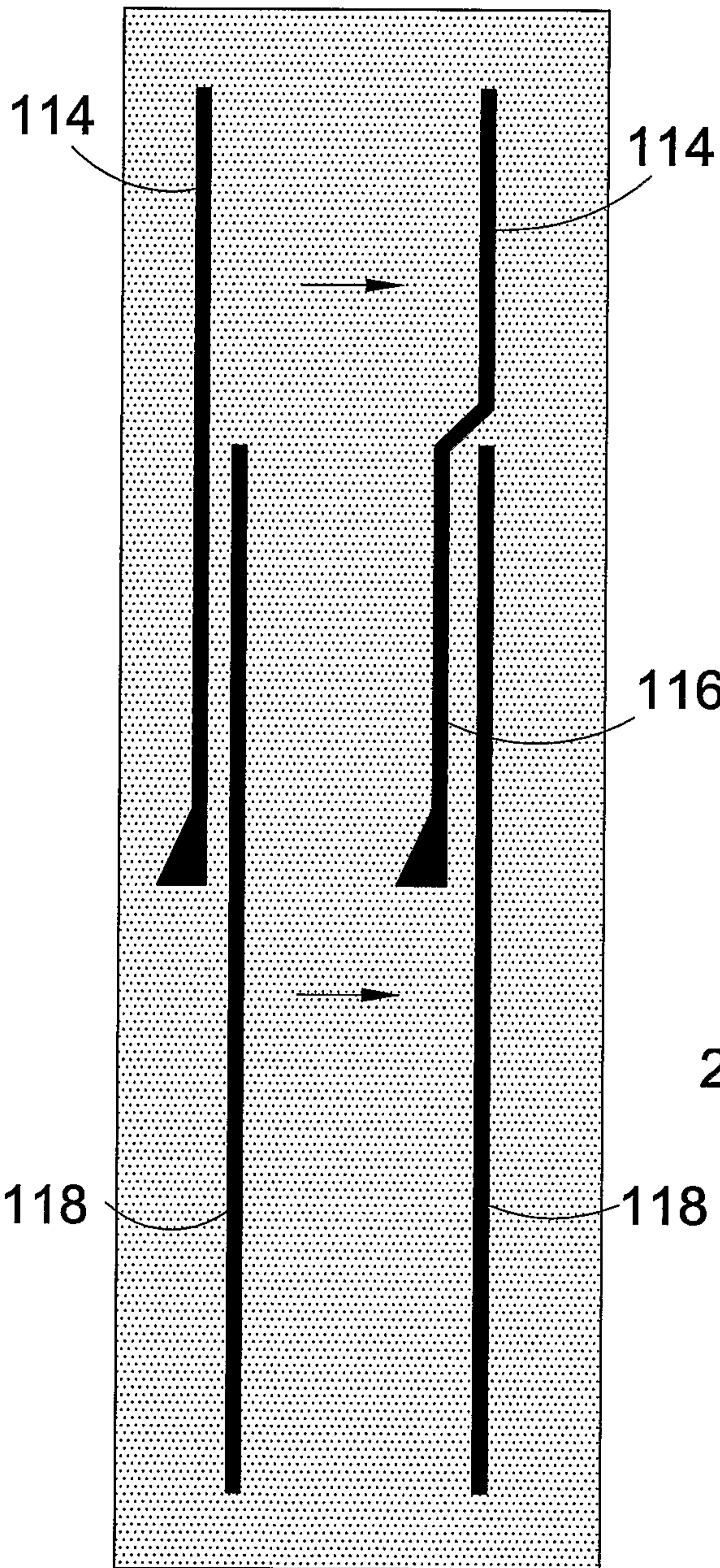


Fig.9 Fig.10

Fig.11 Fig.12

Drill

