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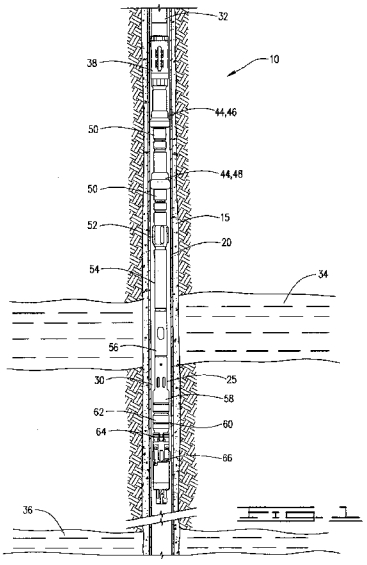
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(54) **Title**: APPARATUS AND METHOD FOR TREATING ZONES IN A WELLBORE



(57) **Abstract**: Apparatus and method for treating zones in a wellbore. The apparatus includes an expandable packer assembly and a sealing element positioned in the treatment assembly above the packer assembly. A communication port is positioned between the sealing element and the packer assembly. A plurality of slips will grippingly engage the well above the port through which treatment fluid is communicated to resist upward force caused by treatment pressure in the well acting on the sealing element. The sealing element may be a cup packer.

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APPARATUS AND METHOD FOR TREATING ZONES IN A WELLBORE

BACKGROUND

[0001] This disclosure relates to an assembly and method for treating a subterranean well formation, or zone, and more particularly to an apparatus and method for fracturing.

[0002] A number of techniques have been developed for treating formations to stimulate hydrocarbon production from formations intersected by a subterranean well. One such technique involves the hydraulic fracturing of a zone by isolating a zone and pumping a stimulation fluid into the isolated zone. The zone to be treated may be isolated with packers installed on a tubing lowered into the well, and the fracturing fluid may be pumped through the tubing so that it will exit one or more ports between the packers and move into the zone to be treated. Such arrangements work well, but in cases where cup-type packers are used, the pressure developed during pumping will try to lift the tubing in the well, which can damage the tubing.

[0003] In situations where large diameter casing is in use, for example, 5½ or 7 inch (14.0 or 17.8 cm), or where the treatment occurs in a horizontal well, the pressure may be such that the packers used to isolate the well, along with the weight of the tubing in the well, is not sufficient to keep the tool in place during fracturing. As such, there is a continuing need for fracturing assemblies in high pressure and/or large diameter casing applications that will resist upward movement due to the pressure applied by the fracturing fluid on the upper packer.

SUMMARY OF THE INVENTION

[0004] The current disclosure is directed to a treatment assembly for treating formations or zones intersected by the well. The treatment assembly has an expandable packer element mounted on a packer mandrel. The expandable packer element is movable between set positions in which the packer element seals against the well and an unset position in which the space is defined between the packer element and the well.

[0005] According to a first aspect of the present invention, there is provided a treatment assembly for treating formations intersected by a well, the assembly comprising: an expandable packer element mounted on a packer mandrel and movable between a set position in which the packer element seals against the well and an unset position in which the packer element is spaced from the well; at least one cup packer connected in the treatment assembly above the expandable packer element for engaging the well; and a ported sub connected in the treatment assembly between the at least one cup packer and the expandable packer element, the treatment assembly defining a flow passage for communicating fluid to the ported sub.

[0006] The well may be cased or uncased. The or each cup packer is connected in the treatment assembly above the expandable packer element and will engage the well as the treatment assembly is lowered into the well to the zone to be treated. The ported sub is connected in the treatment assembly between the at least one cup packer and the expandable packer element. Treatment fluid is communicated through the treatment assembly and through the ported sub into the zone to be treated.

[0007] The treatment assembly includes radially extendable slips for grippingly engaging the casing in the well to resist upward force that occurs when treatment pressure is increased in the well. The slips may be positioned above the ported sub and preferably above the at least one cup packer. The radially extendable slips may comprise a portion of a hold-down head which includes a top sub adapted to be connected to the tubing that lowers the treatment assembly in the well. The hold-down head may further include a hold-down body connected to the top sub and a bottom sub connected to the hold-down body. A plurality of radially extendable slips are mounted in the hold-down body that upon the application of hydraulic pressure will radially extend to grippingly engage the casing. The hydraulic pressure is generated by the treating fluid that is pumped through the treatment assembly and into the zone being treated. A radially directed force between the treatment assembly and the casing will resist the upward force that results from the pressure acting on the cup packer. Thus, additional holding or resisting force is applied by the treatment assembly.

[0008] When treatment of a particular zone is complete, the pumping will cease and the hydraulic pressure will be relieved so that the extendable slips will retract. The packer

element may likewise be released and moved to the unset position and the treatment system moved in the well to a second or more additional zones for treatment in the manner described herein. According to another aspect of the present invention, there is provided a tool for treating multiple zones in a wellbore comprising: at least one cup packer mounted on a mandrel connected in the tool slips; an expandable packer assembly connected in the tool below the cup packer, the tool including an injection port positioned between the at least one cup packer and the expandable packer assembly for communicating a treating fluid from the tool into a zone to be treated; and upwardly facing radially extendable slips positioned above the at least one cup packer for engaging the well and resisting the upward force resulting from the treatment pressure acting on the cup packer.

[0009] According to another aspect of the present invention, there is provided a method of treating a zone intersected by a well comprising the steps of: lowering a treatment assembly into the well, the treatment assembly comprising an expandable packer, a downwardly facing cup packer positioned above the expandable packer, and a ported sub positioned between the cup packer and the expandable packer; expanding the expandable packer in the well to engage the well; pumping a treating fluid into a selected zone in the well through the ported sub; applying a radially outwardly directed force to the casing in the well with the treatment assembly to resist movement of the treatment assembly upwardly in the well as the treating fluid is being pumped through the ported sub into the zone. The treatment assembly may be as described above. The treatment assembly may also be the tool as described above.

[00010] According to another aspect of the present invention, there is provided a method of treating multiple zones in a well comprising: lowering a treatment assembly into the well to a first position in the well to treat an initial selected zone; sealingly engaging the well with a sealing element during the lowering steps; expanding an expandable packer element to engage the well after the treatment assembly has reached the first position in the well; engaging the well with a plurality of downwardly facing slips below the packer element; injecting a treating fluid through the treatment assembly between the sealing element and the expandable packer element into the initial selected zone; grippingly engaging the well with the treatment assembly to resist an upward force applied to the sealing element during the injection step; and moving the treatment assembly in the well after the initial selected zone

has been treated to at least one additional position to treat at least one additional selected zone. The treatment assembly may be as described above. The treatment assembly may also be the tool as described above.

[00011] According to another aspect of the present invention, there is provided a method of anchoring a treatment tool in a well comprising: lowering the treatment tool into the well, the treatment tool defining a longitudinal central flow passage and at least one treatment port for communicating treatment fluid into a zone to be treated; radially expanding a packer element to contact the well below the treatment port; radially extending downward facing slips to resist downward movement of the tool; communicating treatment fluid through the treatment port into the zone to be treated; and grippingly engaging the well with upwardly facing slips to resist upward movement of the tool during the communicating step. The tool may be as described above. The tool may also be the treatment assembly as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[00012] FIG. 1 schematically shows a treatment assembly in a well.

[00013] FIG. 1A schematically shows the treatment assembly in a horizontal well.

[00014] FIG. 2 is a partial cross section of the lower portion of the treatment assembly in a run-in position.

[00015] FIG. 3 is a partial cross section of the lower portion of the treatment assembly in a set position.

[00016] FIG. 4 is a partial cross section of the lower portion of the treatment assembly in a retrievable position.

[00017] FIG. 5 is a cross-section view from line 5-5 of FIG. 6.

[00018] FIG. 6 is an end view of the hold-down assembly.

[00019] FIG. 7 is a cross-section view from line 7-7.

[00020] FIG. 8 shows the position of the lug in the J-slot.

[00021] FIGS. 9 and 10 are side and bottom views of a debris barrier.

DETAILED DESCRIPTION OF AN EMBODIMENT

[00022] While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts which can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention, and do not limit the scope of the present invention.

[00023] The present invention provides improved methods and tools for treating hydrocarbon zones in a single well. The methods can be performed in either vertical or horizontal wellbores. The term "vertical wellbore" is used herein to mean the portion of a wellbore in a producing zone to be completed which is substantially vertical, inclined or deviated. The term "horizontal wellbore" is used herein to mean the portion of a wellbore in a subterranean producing zone, which is substantially horizontal. Since the present invention is applicable in vertical, horizontal and inclined wellbores, the terms "upper and lower" and "top and bottom" as used herein are relative terms and are intended to apply to the respective positions within a particular wellbore while the term "levels" or "intervals" is meant to refer to respective spaced positions along the wellbore. The term "zone" is used herein to refer to separate parts of the well designated for treatment and includes an entire hydrocarbon formation or even separate portions of the same formation and horizontally and vertically spaced portions of the same formation. As used herein, "down," "downward" or "downhole" refer to the direction in or along the wellbore from the wellhead toward the producing zone regardless of whether the wellbore's orientation is horizontal, toward the surface or away from the surface. Accordingly, the upper zone would be the first zone encountered by the wellbore and the lower zone would be located further along the wellbore. Tubing, tubular, casing, pipe liner and conduit are interchangeable terms used herein to refer to walled fluid conductors.

[00024] Referring now to the drawings and more particularly to FIG. 1, a well 10 comprising a wellbore 15 and casing 20 cemented therein is shown. A treatment assembly 25

which may be referred to as a fracturing assembly 25 is shown lowered into well 10 on a tubing 32. Tubing 32 may be coiled or jointed tubing. An annulus 30 is defined by and between well 10, and more particularly between casing 20 and treatment assembly 25. Well 10 intersects an upper selected zone 34 and a lower selected zone 36 and may intersect any number of selected zones that may be treated as described herein. While zone 34 may be referred to as the first zone, since it is the first zone encountered during drilling, the treatment of zones will occur from the bottom of well 10 upwardly, so that the first zone encountered will be the last zone treated.

[00025] Treatment assembly 25 is shown disposed in a vertical wellbore or a vertical portion of a wellbore 15 in FIG. 1, but it is understood that treatment assembly 25 may be utilized in a horizontal or horizontal portion of a wellbore as shown in FIG. 1A. Numerical designations used in FIG. 1A include the subscript $_a$ for the well, wellbore, casing, annulus and first and second zones. Treatment assembly 25 may include a hold-down head or hold-down assembly 38 connected at its upper end 40 to tubing 32. It is understood that the hold-down head 38 and other components described herein may be connected together with fittings or adapters of types known in the art so that the hold-down head may be connected at its upper end 40 to tubing 32.

[00026] Treatment assembly 25 includes at least one and preferably a plurality of cup packers 44 that may be referred to as an upper cup packer 46 and a lower cup packer 48 both of which are downwardly faced cup packers. Cup packers 46 and 48 may be mounted on mandrels and connected in treatment assembly 25 with couplings or other adapters 50 known in the art. Cup packers 46 and 48 comprise sealing elements that will be in engagement with well 10, and in the embodiment shown with casing 20, as treatment assembly 25 is lowered into position adjacent selected zones to be treated.

[00027] A centralizer 52 is connected in treatment assembly 25 below cup packers 46 and 48 and may be connected at a lower end thereof to a blast or spacer joint 54. Treatment assembly 25 can include as many lengths of blast joint 54 as desired. A ported sub 56 is connected to spacer joint 54 and to an equalizing valve assembly 58. Treatment assembly 25 may further include a packer assembly 60 that includes expandable packer elements 62

connected to equalizing valve assembly 58. A slip assembly 64 and drag block assembly 66 are attached in treatment assembly 25 below expandable packer elements 62.

[00028] Referring now to FIG. 2, a portion of treatment assembly 25 is shown in partial cross section in run-in mode. Ported sub 56 has an upper end 70, a lower end 72 and has at least one and preferably a plurality of injection ports 74 defined therethrough. Injection ports 74, which may be referred to as treatment ports 74, are communicated with longitudinal central passage 76 which will receive a treating fluid therethrough. Equalizing valve assembly 58 includes a valve housing 78 having upper end 80 and lower end 82. In the run-in mode, upper end 80 will abut lower end 72 of ported sub 56. A plurality of slots 84 are defined through valve housing 78. A valve extension 86 having an upward facing shoulder 85 thereon, and having an upper threaded portion 88 is threadedly connected to ported sub 56 at the lower end 72 thereof. A seal retainer 87 having a seal 89 disposed thereabout is connected to a lower end of valve extension 86.

[00029] Upper end 90 of valve extension 86 may comprise a ball seat 92. A closing or plugging ball 94 is positioned between seat 92 and a plug portion 96 of ported sub 56. Longitudinal ports 98 communicate longitudinal central passageway 76 with a cage 100 defined by plug portion 96 and seat 92. Closing ball 94 is trapped in cage 100. Valve housing 78 is connected and preferably threadedly connected to a mandrel 102 which comprises a portion of packer assembly 60. Valve extension 86 extends into mandrel 102, so that seal 89 sealingly engages mandrel 102.

[00030] Packer mandrel 102 has upper end 104, lower end 106 and has a J-slot 108 defined therein. Expandable packer elements 110 are mounted on mandrel 102 and are movable between set and unset positions as will be explained in more detail herein.

[00031] Packer elements 110 have an upper end 112 which abuts lower end 82 of valve housing 78, and a lower end 114. A slip wedge 116 is mounted on mandrel 102 and abuts lower end 114 of packer elements 110. Slip assembly 64 may comprise a plurality of slips 118 mounted on mandrel 102. Drag block assembly 66 includes drag block housing 120 mounted on mandrel 102, a plurality of drag blocks 122 and a drag block retainer 124 mounted to mandrel 102. A plurality of drag block springs 126 will urge drag blocks 122 outwardly as is known in the art.

[00032] A lug rotator 128 which includes radially inwardly extending lug 130 is positioned in a lug rotator slot 132 defined by a shoulder 134 on drag block retainer 124 and an upper end 136 of a lug retainer 138 that is threadedly connected to drag block retainer 124. Lug rotator 128 will rotate in lug rotator slot 132 so that lug 130 will move in J-slot 108 as the treatment assembly 25 is moved between the run-in, set and retrieve modes.

[00033] Referring now to FIGS. 5-7, hydraulic hold-down assembly 38 comprises an upper or top sub 150 threadedly connected to a hold-down body 152 that is in turn threadedly connected to a bottom sub 154 which is adapted to be connected in treatment assembly 25 to cup packers 46 and 48 with connectors known in the art. Likewise, upper sub 150 is internally threaded so that it may be connected to tubing 32. A central passage 156 is defined through hydraulic hold-down assembly 38. Hydraulic slips 158 having teeth, or buttons 160 thereon are positioned in a bore 162 defined in hold-down body 152. Hydraulic slip 158 may comprise a cylindrical member 166 having an elongated slot 168 extending through a portion thereof, a plurality of recesses 170 therein, along with teeth 160. A plurality of hold-down straps 172 are attached to hold-down body 152. A plurality of slip retraction springs 174 bias the plurality of slips 158 in a retracted position within hold-down body 152.

[00034] Referring now to FIGS. 7 and 8, upper, or top sub 150 has a lower end 180. Hold-down body 152 has first inner diameter 182 and second inner diameter 184. A shoulder which is preferably an upward facing shoulder 186 is defined by and between first and second inner diameters 182 and 184. A space, or passage 188 is defined between lower end 180 of top sub 150 and shoulder 186. Space 188 allows communication of fluid and thus fluid pressure to a longitudinal port 190 defined in wall 191 of hold-down body 152. Longitudinal port 190 may be filled with grease in certain circumstances but in any case will allow fluid pressure to urge hydraulic slips 158 outwardly into engagement with the well 10. Fluid pressure from longitudinal port 190 acts upon cylindrical member 166 to urge hydraulic slip 158 outwardly. A sand barrier 192 may be positioned in space 188. Sand barrier 192 will act as an additional protective device to prevent blockage of longitudinal ports 190, and to prevent sand or other debris from inhibiting the proper operation and movement of slips 158. The sand barrier may be grooved as shown in FIGS. 9 and 10, to allow pressure to be communicated into ports 190. Sand barrier 192 may have radial inlet grooves 194 and 196, and a circular groove 198, to communicate pressure to longitudinal ports 190.

[00035] In operation, treatment assembly 25 is lowered into well 10. As it is lowered therein, cup packers 46 and 48 will engage casing 20. Treatment assembly 25 is lowered until the lower selected zone 36 to be treated is reached. The initial zone treated will in most cases be the lowermost zone. Lug 130 will be in region A as depicted in FIG. 8. Once this occurs, an upward pull is applied and then released. The upward pull will cause rotation of lug rotator 128. When the upward pull is released, downward motion will cause the lug rotator to continue to rotate so that lug 130 moves into region B as shown in FIG. 8 and allows the treatment assembly 25 to move to the set position shown in FIG. 3 in which the mandrel 102 along with the slip wedge 116 and valve housing 78 move downwardly to urge slips 118 outwardly into engagement with casing 20. When this occurs, continued compression will cause expandable packer elements 110 to expand outwardly to sealingly engage casing 20. The treatment fluid, such as fracturing fluid, may then be pumped through port 74 and into the zone to be treated. Hydraulic pressure inside treatment assembly 25 caused by fluid passing therethrough which passes through central passage 156 will urge hydraulic slips 158 outwardly. Hydraulic pressure is applied through port 190 and space 188. Engagement of the hydraulic slips 158 will help to hold treatment assembly 25 in well 10 and to prevent the assembly 25 from lifting upwardly, opening valve assembly 58 and potentially releasing packer elements 110 damaging the tubing 32.

[00036] Slips 118, positioned below packer elements 110 are downwardly facing slips designed to resist downward forces, but will not effectively resist the upward force caused by the pressure in the well acting on the downward facing cup packers 44. In the absence of slips 158, the primary force resisting the upward force is simply the weight of the tubing in the well. In some cases, a coiled tubing injector will apply an additional force to hold the tool in the well, but in many cases will not keep the treatment assembly 25 from lifting in the well. Hydraulic slips 158 will apply a radially outward directed force to casing 20, and will grip casing 20. Hydraulic hold-down assembly 38 will permit such a method to be utilized with higher pressure treatment and allow larger diameter tools such as 5½ and 7 inch (14.0 or 17.8 cm) cup-type packers, for which treatment assembly 25 with hold-down head 38, and the associated method of use has previously been unavailable.

[00037] Once lower zone 36 has been treated, it may be desired to treat additional zones in the well. When the pumping ceases, pressure will be equalized and the hydraulic slips 158

will retract from engagement with well 10. After a period of time, the pressure will equalize and an upward pull may be applied. Upward pull will cause seal retainer 87 to move upwardly so that seal 89 moves upwardly past the slots 84 in equalizer valve housing 78 so the pressure above and below packer elements 110 will equalize. Continued upward pull will cause shoulder 85 on valve extension 86 to engage equalizer valve housing 78 and pull equalizer valve housing 78 upwardly so that the compressive force applied to packer elements 110 will be relieved. Packer elements 110 will retract radially inwardly, and treatment assembly 25 can be moved in well 10 upwardly or downwardly as desired. If it is desired to treat another zone, the tool will be moved upwardly and the operation can be repeated as described herein, for example, in zone 34, or other selected zones.

[00038] While the embodiment herein discloses use of hydraulic slips 158, mechanical slips or other means to grippingly engage casing 20 may be used to prevent cup packer assemblies 44, including the cup-packer mandrel, from being moved upwardly, and pulling the entire treatment assembly 25 upwardly during the treatment procedure. Slips 158, or other slips, are preferably upward facing slips, to effectively resist upward movement as a result of pressure applied to the downward facing cup packers. Any type of slip used must be sufficient to apply an outwardly directed force to the casing so that the upward force resulting from treatment pressure is resisted. The gripping engagement of slips 158 with casing 20 will allow for greater treatment pressure, since it creates a holding force in addition to that resulting from the weight of the tubing in the well, and the force applied by slip assembly 64 and packer assembly 60. The embodiment described herein positions slips 158 above cup packers 44, but other arrangements are possible.

[00039] Thus, it is seen that the apparatus and methods of the present invention readily achieve the ends and advantages mentioned as well as those inherent therein. While certain preferred embodiments of the invention have been illustrated and described for purposes of the present disclosure, numerous changes in the arrangement and construction of parts and steps may be made by those skilled in the art, which changes are encompassed within the scope of the present invention as defined by the appended claims.

CLAIMS

1. A treatment assembly for treating formations intersected by a well, the assembly comprising: an expandable packer element mounted on a packer mandrel and movable between a set position in which the packer element seals against the well and an unset position in which the packer element is spaced from the well; at least one cup packer connected in the treatment assembly above the expandable packer element for engaging the well; a ported sub connected in the treatment assembly between the at least one cup packer and the expandable packer element, the treatment assembly defining a flow passage for communicating fluid to the ported sub; and radially extendable slips for grippingly engaging a casing in the well connected in the treatment assembly above the at least one cup packer.

2. A treatment assembly according to claim 1, the at least one cup packer comprising two cup packers connected in the treatment assembly above the ported sub.

3. A treatment assembly according to claim 1 or 2, the slips comprising hydraulically actuated slips.

4. A treatment assembly according to claim 1, 2 or 3, further comprising a hold-down head comprising: a top sub adapted to be threadedly connected to a tubing; a hold-down body connected to the top sub, the hydraulically actuated slips being mounted in the hold-down body; and a bottom sub connected to the hold-down body.

5. A treatment assembly according to claim 4, the hold-down body having an upper end and a lower end, and having a longitudinally extending communication port extending from the upper end of the hold-down body in a wall thereof for communicating hydraulic pressure to the radially extendable hold-down slips in the hold-down body.

6. A treatment assembly according to claim 5, the top sub having upper and lower ends, wherein the lower end of the top sub and the upper end of the hold-down body define a

passage therebetween, hydraulic pressure being communicated into the longitudinally extending communication port through the passage.

7. A treatment assembly according to claim 6, further comprising a debris barrier positioned in the passage.

8. A method of treating a zone intersected by a well comprising the steps of: lowering a treatment assembly into the well, the treatment assembly comprising an expandable packer, a downwardly facing cup packer positioned above the expandable packer, and a ported sub positioned between the cup packer and the expandable packer; expanding the expandable packer in the well to engage the well; pumping a treating fluid into a selected zone in the well through the ported sub; applying a radially outwardly directed force to the casing in the well with the treatment assembly to resist movement of the treatment assembly upwardly in the well as the treating fluid is being pumped through the ported sub into the zone.

9. A method according to claim 8, wherein the radially outwardly directed force is a result of increasing pressure in the treatment assembly.

10. A method according to claim 8 or 9, the treatment assembly further comprising a hydraulic hold-down head, the applying step comprising radially extending hold-down slips in the hold-down head to engage the casing in the well.

11. A method according to claim 8, 9 or 10, the applying step comprising radially expanding a hold-down tool positioned in the treatment assembly above the cup packer to engage the well.

12. A method according to claim 11, comprising increasing pressure in the treatment assembly to radially expand the hold-down tool to engage the well.

13. A method according to any one of claims 8 to 12, wherein the radially outwardly directed force is applied above the cup packer.

14. A method of treating multiple zones in a well comprising: lowering a treatment assembly into the well to a first position in the well to treat an initial selected zone; sealingly engaging the well with a sealing element during the lowering steps; expanding an expandable packer element to engage the well after the treatment assembly has reached the first position in the well; engaging the well with a plurality of downwardly facing slips below the packer element; injecting a treating fluid through the treatment assembly between the sealing element and the expandable packer element into the initial selected zone; grippingly engaging the well with the treatment assembly to resist an upward force applied to the sealing element during the injection step; and moving the treatment assembly in the well after the initial selected zone has been treated to at least one additional position to treat at least one additional selected zone.

15. A method according to claim 14, wherein the initial, and the at least one additional selected zone are in a horizontal portion of the wellbore.

16. A method according to claim 14 or 15, further comprising: releasing the gripping engagement; and retracting the expandable packer element prior to the moving step.

17. A method according to claim 14, 15 or 16, further comprising repeating the expanding, injecting, and grippingly engaging steps at the at least one additional selected zone.

18. A method according to any one of claims 14 to 17, wherein the sealing element comprises a downward facing cup-type packer.

19. A method according to any one of claims 14 to 18, the grippingly engaging step comprising radially expanding a portion of the treatment assembly to grippingly engage the well.

20. A method according to claim 19, the radially expanding step comprising communicating fluid pressure from a central passage in the treatment assembly to a

passageway defined in a wall of the treatment assembly, wherein the fluid pressure urges a portion of the treatment assembly radially outwardly into engagement with the well.

21. A method according to any one of claims 14 to 20, the treatment assembly further comprising a hold-down head, wherein the grippingly engaging step comprises radially extending hold-down slips in the hold-down head to engage the well.

22. A method according to any one of claims 14 to 21, the grippingly engaging step comprising radially extending upwardly facing slips to engage the well above the sealing element.

23. A tool for treating multiple zones in a wellbore comprising: at least one cup packer mounted on a mandrel connected in the tool slips; an expandable packer assembly connected in the tool below the cup packer, the tool including an injection port positioned between the at least one cup packer and the expandable packer assembly for communicating a treating fluid from the tool into a zone to be treated; and upwardly facing radially extendable slips positioned above the at least one cup packer for engaging the well and resisting the upward force resulting from the treatment pressure acting on the cup packer.

24. A tool according to claim 23, the at least one cup packer comprising a first downward facing cup packer and a second downward facing cup packer, the injection port being positioned between the second downward facing cup packer and the expandable packer assembly.

25. A tool according to claim 23 or 24, wherein the radially extendable slips comprise a portion of a hydraulic hold-down assembly.

26. A tool according to claim 25, the hydraulic hold-down assembly comprising: an upper sub; and a hold-down body connected to the upper sub, the hold-down body having an axial passage therein communicated with a central flow passage defined through the hold-down body, wherein hydraulic pressure communicated through the axial passage will urge the radially extendable slips outwardly into engagement with the well.

27. A tool according to claim 26, the upper sub and the hold-down body defining a space therebetween, wherein fluid pressure is communicated from the central flow passage in the hold-down body through the space and into the axial passage.

28. A tool according to any one of claims 23 to 27, the upwardly facing radially extendable slips being positioned in the tool above the at least one cup packer.

29. A method of anchoring a treatment tool in a well comprising: lowering the treatment tool into the well, the treatment tool defining a longitudinal central flow passage and at least one treatment port for communicating treatment fluid into a zone to be treated; radially expanding a packer element to contact the well below the treatment port; radially extending downward facing slips to resist downward movement of the tool; communicating treatment fluid through the treatment port into the zone to be treated; and grippingly engaging the well with upwardly facing slips to resist upward movement of the tool during the communicating step.

30. A method according to claim 29, the grippingly engaging step comprising radially extending a plurality of slips to engage the well above the treatment port.

31. A method according to claim 30, further comprising applying hydraulic pressure to the slips to radially extend the slips.

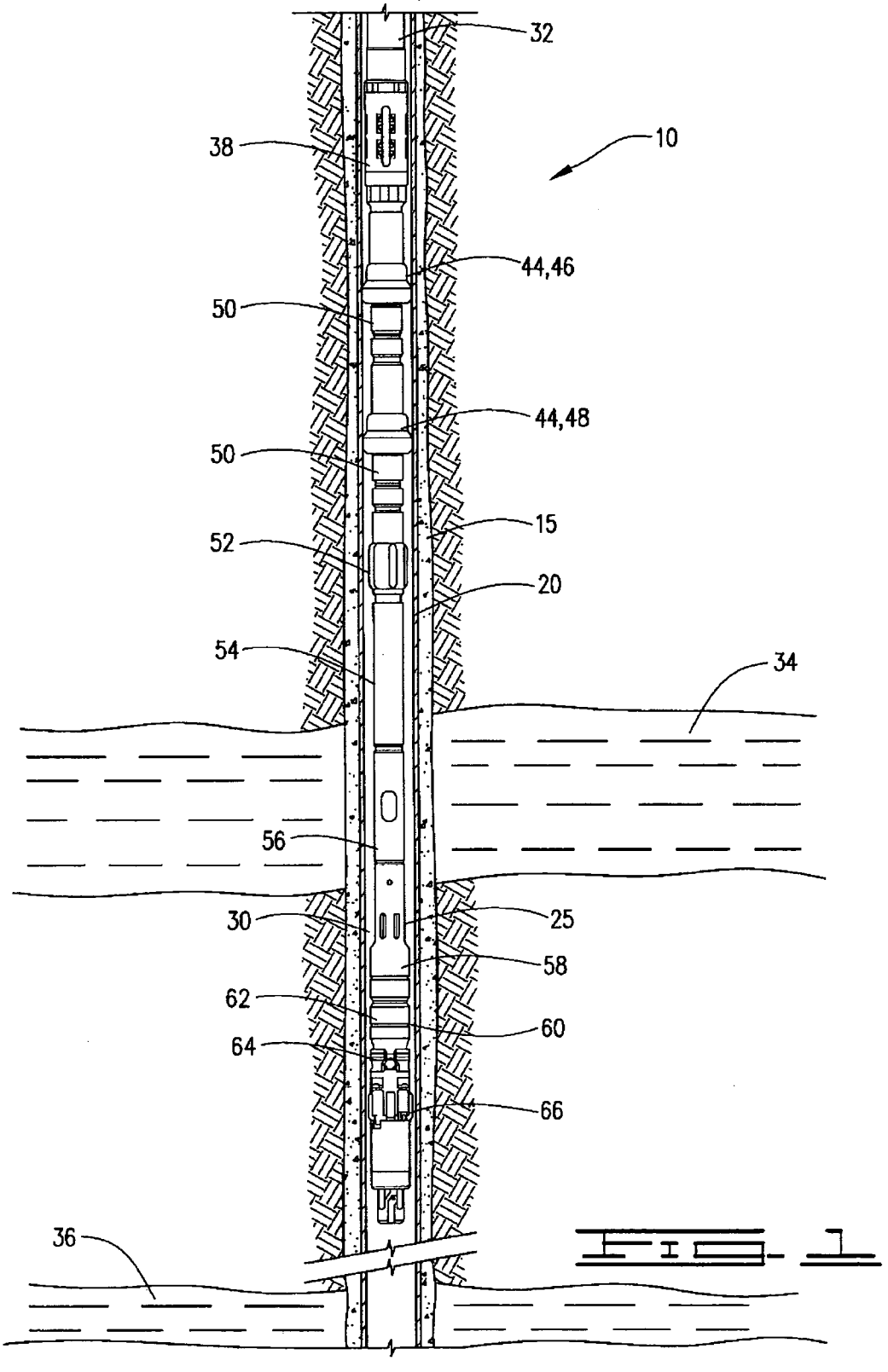
32. A method according to any one of claims 29 to 31, further comprising: retracting the packer element from contact with the well; releasing the gripping engagement; and moving the tool to at least one additional zone in the well to be treated.

33. A method according to any one of claims 29 to 32, further comprising sealingly engaging the well above the treatment port as the tool is lowered in the well.

34. A method according to claim 33, the sealingly engaging step comprising engaging the well with at least one cup packer.

35. A method according to claim 33, the grippingly engaging step comprising radially extending the upward facing slips to engage the well above the at least one cup packer.

36. A method according to any one of claims 29 to 35, wherein the tool includes a cup packer positioned above the treatment port and a hydraulic hold-down assembly positioned above the cup packer, and wherein the grippingly engaging step comprises increasing pressure to extend the upwardly facing extendable slips in the hold-down assembly to engage the well.


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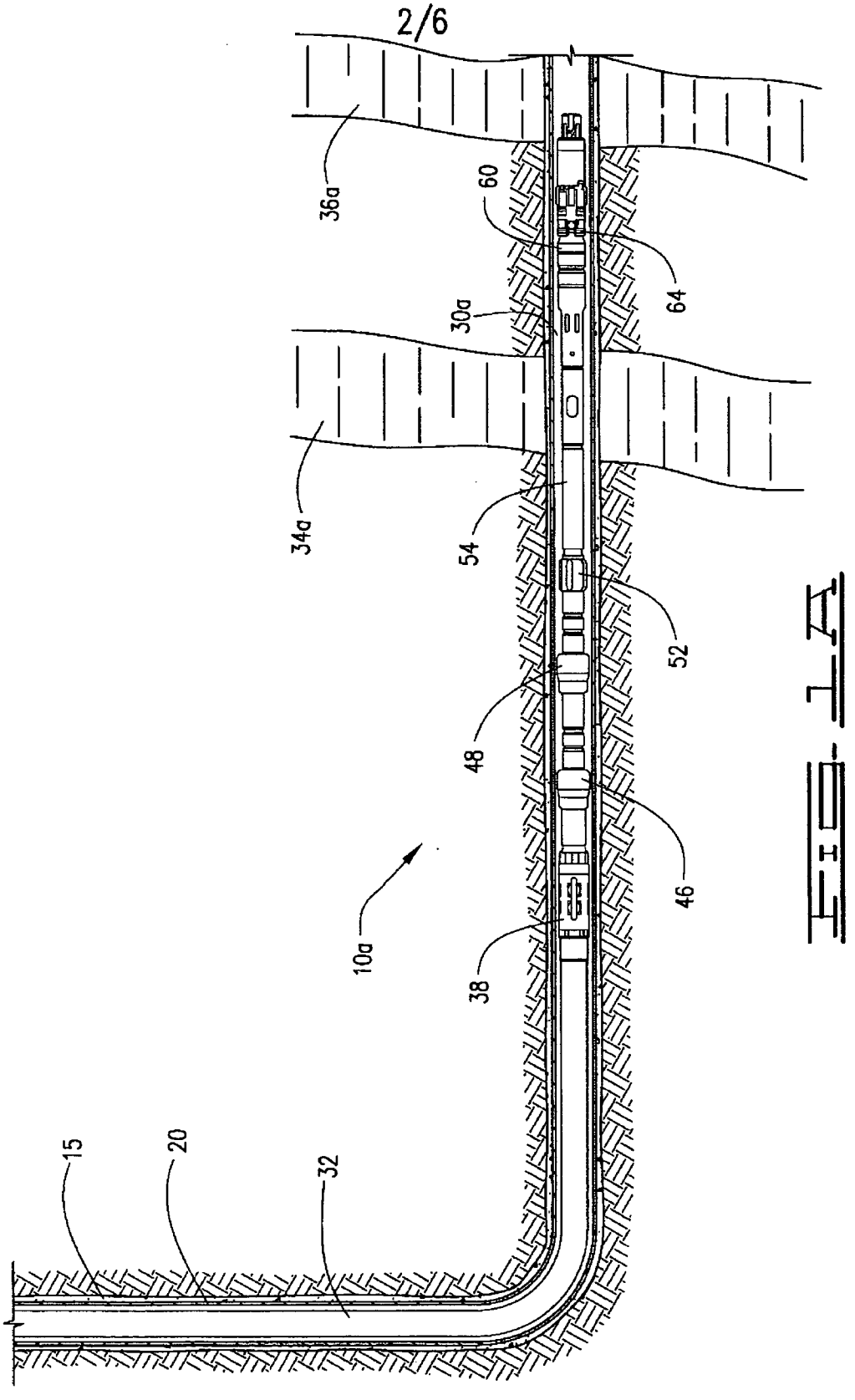
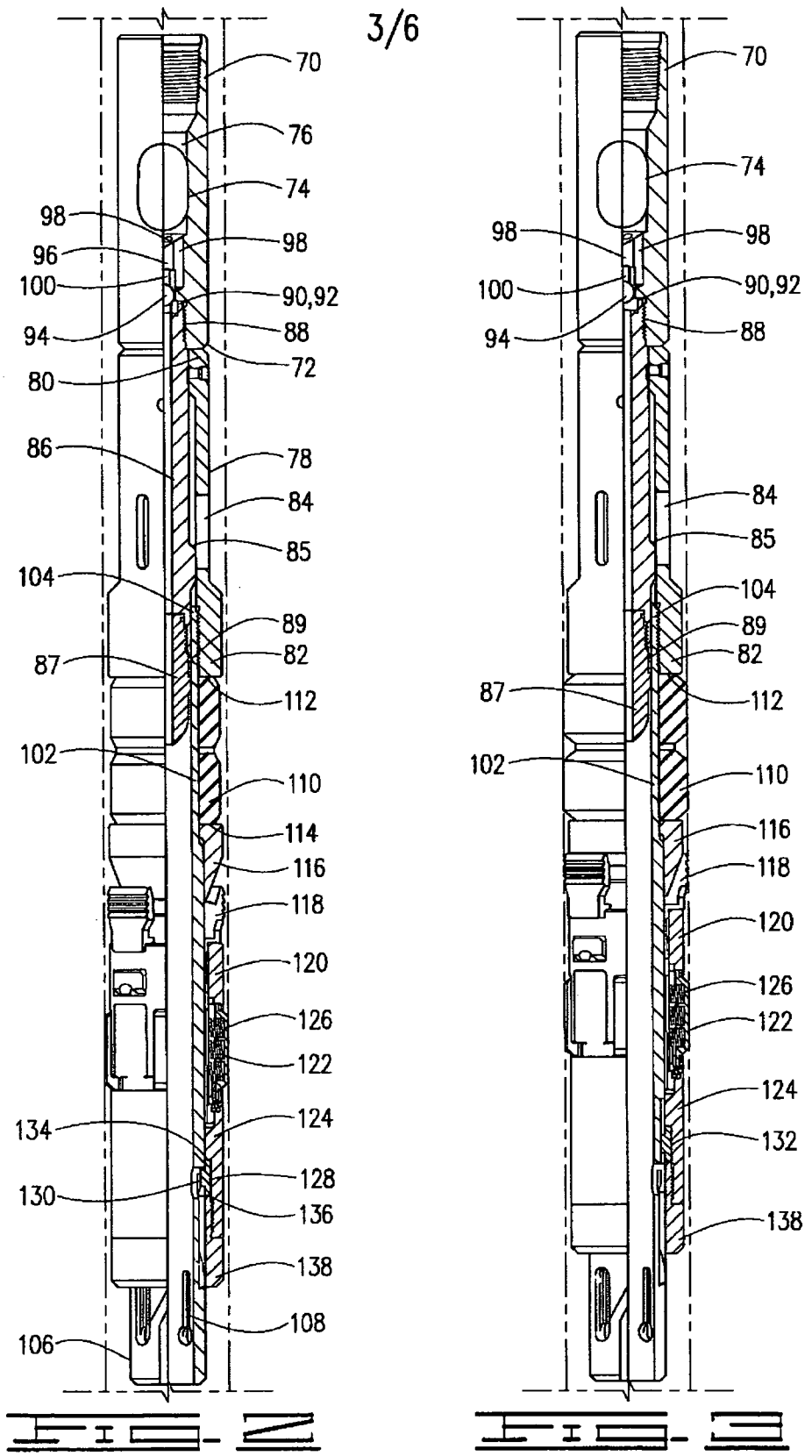


FIG. 1A


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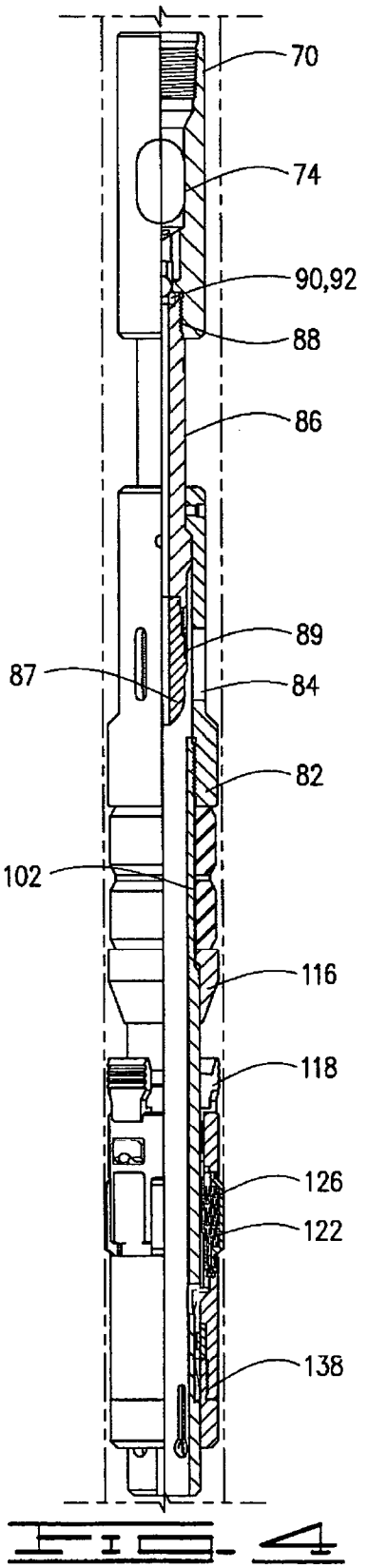

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FIG. 4

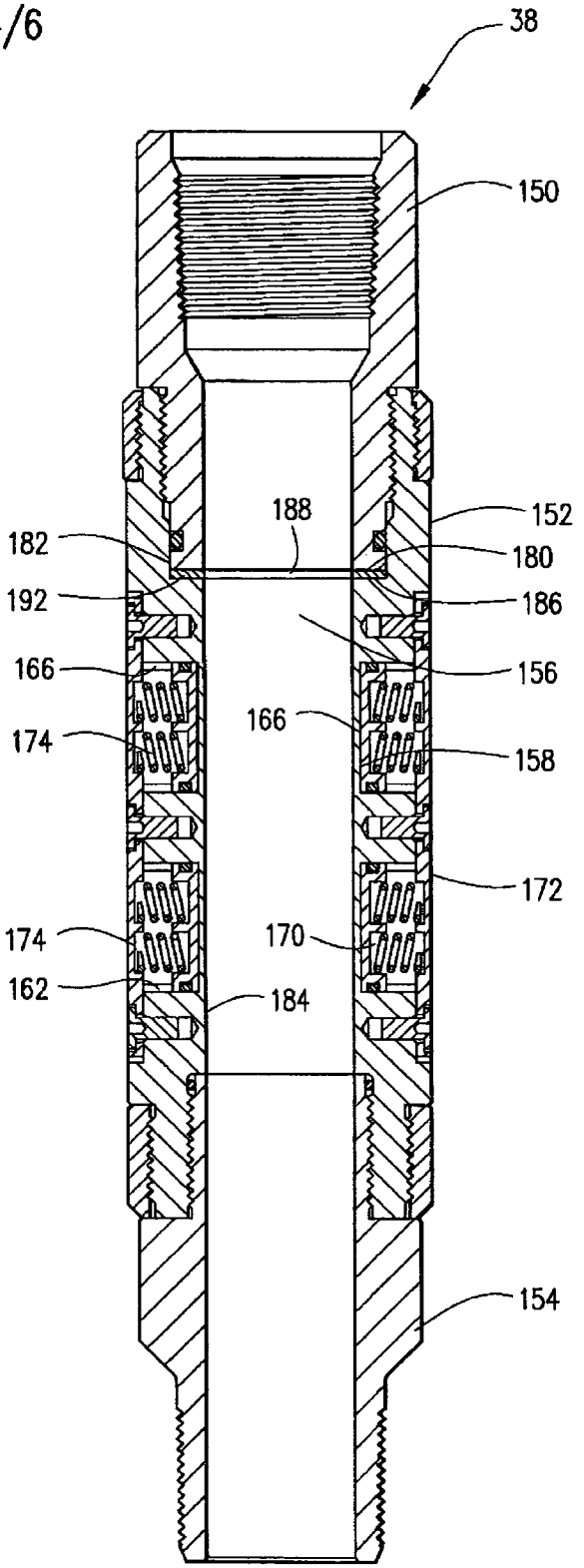
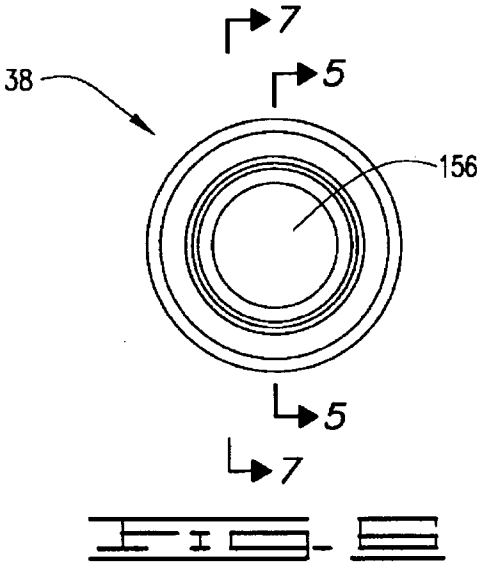
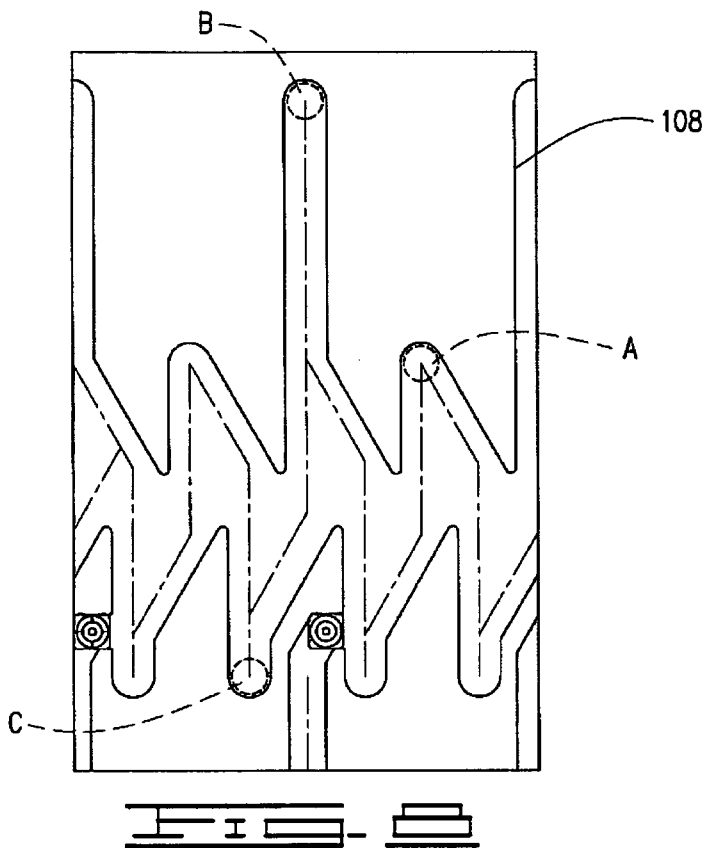
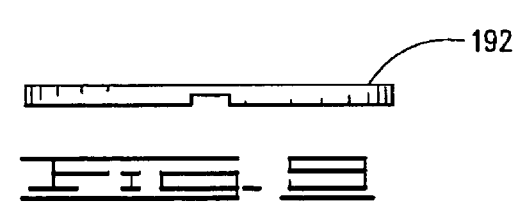

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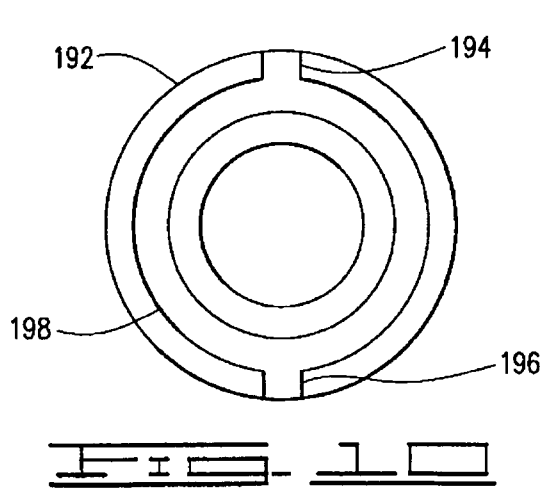
FIG. 5


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