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(54) Title: PRESSURE CONTROLLED TESTER AND COLLET THEREFOR

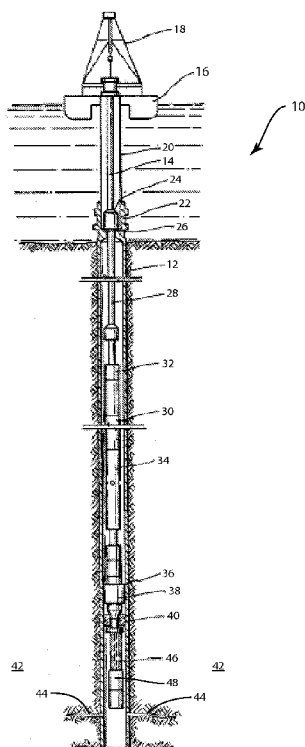


FIG. 1

(57) Abstract: A collet assembly for a pressure controlled well testing apparatus includes a cylindrical collet housing defining an open interior. A collet mandrel is disposed in the open interior. The collet mandrel is movable within the collet housing between a first position and a second position. A collet is disposed radially outwards from the collet mandrel and radially interior to the collet housing. The collet further includes a finger extending radially outwards from the collet. The finger engages a detent of the collet housing when the collet mandrel is in the first position and the finger deflects to move past the detent when the collet mandrel moves to the second position. A method of testing a well includes providing a pressure controlled tester within a wellbore. A first bias pressure is provided to a mandrel of the pressure controlled tester. A second bias pressure is provided to the mandrel. A pressure is applied to the wellbore. The location of the mandrel translates when the wellbore pressure is greater than the second bias pressure. The translation of the location of the mandrel moves the ball valve from the closed position to the open position.



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PRESSURE CONTROLLED TESTER AND COLLET THEREFOR

CROSS REFERENCE RELATED APPLICATIONS

5 This application is an International Application of U.S. Provisional
Application Serial No. 61/289,522 (Attorney's Docket No. 69.5766), entitled,
"Pressure Controlled Tester and Collet Therefor" which was filed on December 23,
2009 and incorporated by reference herein.

10 FIELD

[0001] The present disclosure relates to the field of subterranean hydrocarbon well testing. More specifically, the disclosure relates to a collet kit for a pressure controlled tester.

BACKGROUND

15 **[0002]** A drill stem test is conducted by lowering a packer and a test valve into
a well on a pipe string. The packer is set to isolate an interval of a hydrocarbon
formation to be tested from the hydrostatic pressure of the fluids above. The test
valve is then opened and closed to alternately flow and shut in the formation while
pressure recorders make a record of the pressures as a function of time. From the
20 pressure record, many useful parameters or characteristics of the hydrocarbon
formation can be determined. Usually, a sample of the produced hydrocarbon is also
recovered.

SUMMARY

25 **[0003]** A collet assembly for a pressure controlled well testing apparatus includes a cylindrical collet housing. The collet housing has a detent that extends radially inwards from the collet housing. A collet mandrel is disposed coaxially in the collet housing. The collet mandrel has a lip extending radially outward from the collet mandrel. The collet mandrel is movable within the collet housing between a
30 first position and a second position. A collet is disposed radially outwards from the collet mandrel and radially interior to the collet housing. The collet has a finger extending radially outwards from the collet. The finger engages the detent of the collet housing when the collet mandrel is in the first position and the finger deflects to move past the detent when the collet mandrel moves to the second position.

[0004] A pressure controlled well testing apparatus includes a ball is operable between a closed position and an open position. The ball valve is disposed in a ball valve housing. A collet housing is connected to the ball valve housing. The collet housing further includes a detent that extends radially inwards from the collet housing into the open interior. A collet is disposed radially interior to the collet housing. The collet includes a finger that extends radially outward from the collet. The finger of the collet engages the detent of the collet housing. A collet mandrel is disposed radially inwards of the collet housing and the collet. The collet mandrel is coupled to the ball valve such that movement of the collet mandrel between a first position and a second position moves the ball valve between the closed position and the open position. A hydrostatic bias system is operationally coupled to the collet housing and the collet mandrel. The hydrostatic bias system biases the collet mandrel in the first position and the ball valve in the closed position.

[0005] A method of testing a well includes providing a pressure controlled tester within a wellbore. The pressure controlled tester includes a ball valve, a mandrel, and a hydrostatic bias system. A first bias pressure is provided to the mandrel with the hydrostatic bias system. The first bias pressure maintains the ball valve in the closed position. A collet is provided that engages the mandrel. The engagement of the collet with the mandrel holds the ball valve in the closed position. A pressure is applied to the wellbore, the pressure being translated to the mandrel through a fluid port in the pressure controlled tester. When the applied pressure is greater than the second bias pressure, the collet disengages from the mandrel and the mandrel translates such that the ball valve moves from the closed position to the open position.

[0006] A collet assembly for a pressure controlled well testing apparatus includes a cylindrical collet housing. The collet housing has a detent that extends radially inwards from the collet housing. A collet mandrel is disposed coaxially in the collet housing. The collet mandrel has a lip extending radially outward from the collet mandrel. The collet mandrel is movable within the collet housing between a first position and a second position. A collet is disposed radially outwards from the collet mandrel and radially interior to the collet housing. The collet has a finger extending radially outwards from the collet. The finger engages the detent of the collet housing when the collet mandrel is in the first position and the finger deflects to move past the detent when the collet mandrel moves to the second position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The drawings illustrate the best mode presently contemplated of carrying out the invention. In the drawings:

[0008] Fig. 1 depicts the use of a disclosed embodiment in an offshore environment;

[0009] Fig. 2 depicts a pressure controlled tester including an embodiment of a disclosed collet kit;

[0010] Fig. 3 depicts an embodiment of the disclosed collet kit; and

[0011] Fig. 4 is a flow chart depicting the steps of an embodiment of a method of testing a well.

DETAILED DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is an environmental view showing an offshore well system 10 for the production of hydrocarbon. While Fig. 1 depicts an offshore well system 10, it is understood that similar embodiments of the apparatus and method disclosed herein may be implemented in other forms of hydrocarbon well systems, including terrestrial and subterranean wells.

[0013] A subterranean portion of the well 10 is often lined by a casing 12. When such a well is lined by a casing 12 it is referred to as a closed well system. Alternatively, if no casing is present, the well is referred to as an open well system. A pipe string 14 extends from a floating drilling vessel 16 that includes a derrick 18 for handling the pipe string 14. The pipe string 14 extends downwards from the drilling vessel 12 through a riser 20 that connects the vessel 12 to a subsea wellhead 22. The pipe string 14 further extends downward through the subterranean portion of the well.

[0014] The pipe string 14 may further include a control valve assembly 24 that includes a landing shoulder 26 that seats in the subsea wellhead 22 so that the pipe string 14 can be suspended from that fixed point and not subject to any of the motions that the vessel 16 experiences due to the action of waves and tides.

[0015] The pipe string 14 further includes a major section 28, such as a length of drill pipe, and a minor section 30 such as a predetermined length of drill collars having a known weight. The sections of the pipe string 14 are connected together by a slip joint-safety valve tool 32. The lower end of the minor pipe section 30 is connected to an upper end of a pressure controlled tester (PCT) 34, which will be described in greater detail herein. The pressure controlled tester (PCT) 34 is connected to a well packer 36 that includes packer elements 38 to seal off the

wellbore and slips 40 to anchor the packer 36 at the proper location above interval to be tested. The well interval to be tested is surrounded by a hydrocarbon formation 42 which has been perforated by one or more perforation tunnels 44.

[0016] Suspended below the packer 36 is a perforated nipple 46 that receives hydrocarbon flow during any production tests. Suitable pressure recorders 48 are provided to make a record of the pressures of the produced fluid versus time as the test proceeds.

[0017] Fig. 2 depicts a pressure controlled tester (PCT) 34, such as may be used in a pipe string 14 of Fig. 1. The pressure controlled tester 34 comprises a PCT valve 80, a collet kit 50 and a hydrostatic bias system 82. The PCT valve 80, the collet kit 50 and the hydrostatic bias system 82 are coupled to each other in that order. While the PCT valve 80, the collet kit 50 and the hydrostatic bias system 82 are depicted as being directly connected to each other, it is understood that these components may also be coupled by an indirect connection. The operation of the pressure controlled tester 34 will be described in greater detail herein, with particular reference to the collet kit 50.

[0018] The pressure controlled tester 34 is operated to selectively produce hydrocarbon from the hydrocarbon formation 42 surrounding the well interval sealed off by the packer 36, as described with respect to Fig. 1. The PCT valve 80 is biased in a closed position by the hydrostatic bias system 82. By adjusting the hydrostatic pressure in the well annulus 116 surrounding the pressure controlled tester 34, a well operator can operate the PCT valve 80 to open the valve and produce a sample of hydrocarbon. The PCT valve 80 opens when the hydrostatic pressure in the well annulus 116 exceeds the bias pressure established by the hydrostatic bias system 82. However, this operation creates a transition period wherein the well annulus pressure exceeds the bias pressure in a sufficient amount to begin to open the PCT valve 80, but greater annulus pressure is needed to fully open the PCT valve. The collet kit 50, inserted between the PCT valve 80 and the hydrostatic bias system 82 allows additional control of this transition period.

[0019] Fig. 3 depicts an embodiment of the collet kit 50 as disclosed in further detail herein. The collet kit 50 includes a collet housing 52. The collet housing 52 is cylindrical in shape and defines an open interior within the collet housing 52. A collet mandrel 54 is located radially interior to the collet housing 52. The collet mandrel 54 is slidably translatable within the collet housing 52. The collet mandrel 54 slidably

translates within the collet housing 52 between a first, uphole position and downhole position. The collet mandrel 54 further defines an open interior which functions as a flow passage 56 for the production of hydrocarbon samples through the collet kit 50.

5 [0020] A collet 58 is located radially interior to the collet housing 52 and radially exterior to the collet mandrel 54. The collet 58 is secured to the collet mandrel 54 with a collet nut 60. The collet nut 60 engages a lip 62 on the collet mandrel 54 to secure the collet 58 to the collet mandrel 54. In embodiments, the collet mandrel 54 may include one or more collet lips 62 and collet nuts 60 for
10 securing the collet 58 to the collet mandrel 54.

[0021] The collet housing 52 further includes a detent 64 that projects radially inwards from the collet housing 52 towards the open interior of the collet housing 52. A finger 66 extends radially outward from the collet 58 toward the collet housing 52. The finger 66 of the collet 58 engages the detent 64 of the collet housing 52.

15 [0022] The finger 66 is constructed of a deformable material, or is designed in a deformable construction or shape, such that when a specified force or pressure is applied to the collet mandrel 54, the finger 66 deforms and disengages from the detent 64, allowing the finger 66 and the collet mandrel 54 to translate downhole past the detent 64 to the second position.

20 [0023] The construction, size, and shape of the finger 66 of the collet 58 may be designed such as to achieve a particular required deformation pressure. In an embodiment, the collet 58 may be a unitary construction, including the finger 66; however, in an alternative embodiment, the finger 66 may be of a differing construction than the rest of the collet 58 and may be secured to the finger 66 by a
25 form of securing, such as welding. In an embodiment of the collet 58, a plurality of fingers 66 extend from the collet 58. This plurality of fingers 66 all engage mating detents 64 of the collet housing 52. Alternatively, the detent 64 of the collet housing 52 is an annular detent 64 that is engaged by the one or more fingers 66. It should be noted that in embodiments of the collet kit 50, elements such as the finger 66, detent
30 64, and lip 62 may be annular in construction, extending around the circumference of the respective collet housing 52, collet 58, or mandrel 54.

[0024] In some embodiments as will be disclosed in further detail herein, a plurality of collets 58 may be manufactured and made available to a well operator such that a collet 58 or an entire collet kit 50 may be selected based upon the

deformation pressure of the collet finger 66. Thus, a collet 58 or collet kit selected based upon a desired deformation pressure depending upon the well conditions within which the collet kit 50 will be used.

[0025] The collet kit 50 is adapted to be removably insertable into the pressure controlled tester 34 (Fig. 2). Therefore, the collet kit 50 includes a plurality of connectors such that the elements of the collet kit 50 may be operationally connected to the PCT valve 80 uphole of the collet kit 50 and operationally connected to the hydrostatic bias system downhole from the collet kit 50. The collet mandrel 54 includes an upper connector 68 and a lower connector 70. The upper connector 68 and the lower connector 70 are adapted to connect to mating connectors of respective upper and lower mandrels (not depicted) of the respective components above and below the collet kit 50. Similarly, the collet housing 52 includes an upper connector 72 and a lower connector 74. The upper connector 72 and the lower connector 74 of the collet housing 52 are adapted to connect to mating connectors of respective housings of the components above and below the collet kit 50.

[0026] The connectors 68, 70, 72, and 74 in one embodiment are threaded connectors; however, it is to be understood that other types of connectors for connecting cylindrical or tubular components may also be used. Such alternative connectors may include, but are not limited to, pressure or friction fit connectors, bayonet connectors, or keyed connectors.

[0027] Seal 76 and seal 78, which may be O-rings, are located on the collet housing 52 such as to make the connection of the upper connector 72 and lower connector 74 fluid tight.

[0028] Referring back to Fig. 2, the operation of the pressure controlled tester (PCT) 34 including the collet kit 50 will be described in greater detail herein. The pressure controlled tester 34 includes, from top to bottom, the PCT valve 80, the collet kit 50, and the hydrostatic bias system 82. It should be noted that like numerals with respect to the collet kit 50 as described in Fig. 3 identify similar structures in Fig. 2.

[0029] The PCT valve 80 includes a PCT valve housing 86. Within the PCT valve housing 86 is a ball valve 84 that is held in place with a ball cage 88 and the ball valve 84 engages a valve seat 90. The ball valve 84 is rotatable about an axis within the PCT valve housing 86 such that the ball valve 84 moves between opened and closed positions. In the open position, the ball valve 84 facilitates fluid

communication through the ball valve 84 from a flow passage 92 of the PC to the flow passage 56 of the collet kit 50.

[0030] The PCT valve 80 further includes a lock mandrel 94 that is coupled to the collet mandrel 54. An actuator tube 96, which may include a threaded connector 98, mates with the upper connector 68 of the collet mandrel 54. The actuator tube 96 retains the lock mandrel 94. The lock mandrel 94 further includes a drive pin 100 that slidably engages a circumferentially extending slot 102 within the ball valve 84.

Movement of the lock mandrel 94 causes the drive pin 100 to slide within the slot 102 thus moving the ball valve 84 from a closed position to an opened position. The PCT valve 80 is configured such that when the lock mandrel 94 is in a first, upmost position, the ball valve 84 is held in the closed position, and when the lock mandrel 94 is in a second lower position, the ball valve 84 is in an open position.

[0031] Downhole of the collet kit 50, the pressure controlled tester 34 includes a hydrostatic bias system 82. The hydrostatic bias system 82 includes a hold open mandrel 104 that is located coaxially interior to a bias system housing 106. The bias system housing 106 is coupled to the collet housing 52 with connector 108. As noted previously, the connection between connectors 74 and 108 may similarly be a threaded connection, or another type of connection as recognized by one of ordinary skill in the art. Seal 78 further makes the connection between the collet housing 52 and the bias system housing 106 water tight. The collet mandrel 54 is similarly coupled to the hold open mandrel 104 through the engagement of lower connector 70 of the collet housing 52 and a connector 110 of the hold open mandrel 104. The coupling of the collet mandrel 54 and the hold open mandrel 104 places the flow passage 106 of the collet mandrel 54 in fluid communication with a flow passage 112 of the hold open mandrel 104.

[0032] The hydrostatic bias system 82 includes a fluid port 114 that communicates fluid pressure from the well annulus 116 exterior of the pressure controlled tester 34. The annulus fluid pressure is provided through fluid port 114 into an interior region 118 of the hydrostatic bias system 82. In the interior region 118, the annulus fluid pressure acts upon a piston 120 of the hold open mandrel 104. A coil spring 122 acts between a lower face 124 of the bias system housing 104 and the piston 120. The coil spring 122 establishes a bias annulus pressure that must be achieved to overcome the force of the piston 120 on the mandrels (104, 54, 94) in

order for the mandrels (104, 54, 94) to move downhole within the pressure tester 34.

[0033] While the pressure controlled tester 34 is herein depicted in Fig. 2 as including direct connections between the PCT valve 80, the collet kit 50, and the hydrostatic bias system 82, it is to be understood that these components of the PCT 34 need only be operationally connected and therefore may be coupled to each other through intermediate structure. Just as the collet kit 50 is configured for removable insertion into the PCT 34, other components (not depicted) of the PCT 34 may similarly be removably constructed. So long as these other components include a housing and a mandrel, such that the PCT valve housing 86, collet housing 52, and bias system housing 106 may be coupled together. Similarly, the lock mandrel 94, collet mandrel 54, and hold open mandrel 104 are coupled together. Therefore, any arrangement of intermediate components that permit the functionality of the PCT 34 as described herein may also be included.

[0034] With reference to Figs. 1 and 2, the operation of the disclosed pressure controlled tester 34 will be herein disclosed in further detail. The pressure controlled tester 34 is included in the pipe string 14 that is positioned down a wellbore 10 in order to perform a drill stem test and/or to collect samples of hydrocarbon formation production. The pressure controlled tester 34 includes two bias or reference pressures provided by components for the operation of the pressure controlled tester 34. The first bias pressure is that which is provided by the coil spring 122 of the hydrostatic bias system 82. This first bias pressure holds the lock mandrel 94, collet mandrel 54, and hold open mandrel 104 in a first, uphole position that holds the ball valve 84 in the closed position.

[0035] The second bias or reference pressure is provided by the collet finger 66, which by the number of fingers, material, construction, size, shape, or a combination thereof, has a defined deflection pressure whereby the collet finger 66 will deflect such that the collet finger 66, collet 58, and collet mandrel 54 will move downhole past the detent 64 of the collet housing 52 to a second, downhole position. This translational movement of the lock mandrel 94, collet mandrel 54, and the hold open mandrel 104 rotates the ball valve 84 from the closed position to the open position, thereby opening fluid communication through the pressure controlled tester 34.

[0036] Pressure is applied to the interior of the pressure controlled through the fluid ports 114 of the hydrostatic bias system 82. The fluid ports 114 communicate the hydrostatic fluid pressure of the well annulus 116 to the interior of the pressure controlled tester 34. The wellhead assembly 22 allows for control of the pressure within the wellbore 10 outside of the pipe string 14. This is referred to as the well annulus 116, and results in a measured well annulus pressure. The well annulus pressure is controlled by the introduction or removal of fluids of varying weights, volumes, and compressibilities into the well annulus 116.

[0037] The bias pressure established by the collet finger 66 is greater than that of the bias pressure established by the coil spring 122. Therefore, as the annulus pressure is increased, the bias pressure of the coil spring is achieved first. However, the piston 120 does not begin to compress at this annulus pressure and the mandrels 94, 54, and 104 do not begin to translate downhole as the engagement of the collet finger 66 with the collet housing detent 64 holds the mandrels 94, 54, and 104 in their first, upper position. However, once the annulus pressure exceeds the collet finger bias pressure, the collet finger 66 deflects and moves past the detent 64 allowing the mandrels 94, 54, and 104 to translate downhole to the second lower position. At this point, the well annulus pressure is also much greater than the bias pressure of the coil spring 122, the piston 120 fully compresses and the ball valve 84 is moved completely from the closed position to the open position. Thus, the higher bias pressure established by the collet finger 66 stores sufficient potential energy such as to be able to completely overcome the piston 120 when this energy is finally released. This results in the ball valve 84 moving directly from the closed position to the open position with negligible time spent in transition between the fully closed position and the fully open position.

[0038] Additionally, the bias force of the coil spring 122 and the piston 120 acting on the mandrels 94, 54, and 104 is sufficient such that when the well annulus pressure drops below the coil spring bias pressure, the piston 120 moves the mandrels 94, 54, and 104 up from the lower position to the upper position. This achieves two effects. First, the translation of the mandrels 94, 54, and 104 from the lower position to the upper position moves the ball valve 84 from the open position to the closed position. This shuts off fluid communication through the pressure controlled tester 34. Secondly, the translation of the collet mandrel 54 from the lower position to the upper position moves the collet finger 66 back uphole past the collet housing detent

64. At this point, the collet finger 66 returns to its pre-deformation size, sl orientation and the collet finger 66 again engages the collet housing detent 64. This effectively resets the pressure controlled tester 34 for use in another operation.

[0039] In another aspect of the pressure controlled tester as disclosed herein, the collet kit 50 is a removable component of the pressure controlled tester 34. Based upon the conditions of the well system 10, the additional pressure regulation and ball valve 84 control may or may not be required. In such testing applications wherein the additional control is not needed, the collet kit 50, may be removed, by disengagement of the connections between the housings and mandrels and the reconnection of the pressure controlled tester 34 by connecting the PCT valve 80 directly to the hydrostatic bias system 82.

[0040] However, when condition in the well system 10 make a well operator desire the additional pressure controlled operation provided by the collet kit 50, the well operator may disconnect the engagement between the PCT valve 80 and the hydrostatic bias system 82 and insert a collet kit 50.

[0041] In a still further aspect of this embodiment, a plurality of collet kits 50 may be available to a well operator. Each of the available plurality of collet kits 50 may include a collet finger 66 of varying composition, size, shape, or construction such that each of the collet kits 50 of the plurality has a different collet finger bias pressure. Therefore, based upon data collected from the same or similar well systems or data obtained from computer simulations, the well operator may select a collet kit 50 with a particular collet finger bias pressure such that operation of the pressure controlled tester 34 may be optimized to the downhole conditions of the well system 10.

[0042] Fig. 4 is a flow chart depicting an embodiment of a method of testing a well 200 as disclosed herein.

[0043] A pressure controlled tester is provided within a wellbore at 202. The pressure controlled tester includes a ball valve that controls fluid flow through the pressure controlled tester, a mandrel coupled to the ball valve, and a hydrostatic bias system coupled to the mandrel. Translational movement of the mandrel moves the ball valve between a closed position and an open position.

[0044] At step 204, a first bias pressure is provided to the mandrel with the hydrostatic bias system. The hydrostatic bias system may use a piston with a coil spring in order to place a bias pressure against the mandrel to hold the mandrel in a

first position. The mandrel, when in the first position, holds the ball valve closed position. Next, at 206, a second bias pressure is provided to the mandrel. The second bias pressure is provided to the mandrel through a collet that engages the mandrel and engages a detent of a mandrel housing. The second bias pressure is higher than the first bias pressure and holds the ball valve in the closed position.

5 [0045] Then, at 208, pressure is applied to the wellbore. The pressure may be applied to the wellbore by pumping fluid of various volumes, weights, or compressibility into the wellbore. The wellbore pressure is communicated to the mandrel through a fluid port in the pressure controlled tester.

10 [0046] If the wellbore pressure is greater than the second bias pressure, then at 212 the collet is disengaged from the detent, the wellbore pressure further overcomes the first bias pressure. Therefore, at 214, the location of the mandrel is translated such that the ball valve moves from the closed position to the open position.

[0047] In additional embodiments, after the ball valve is moved to the open position, a well test is performed at 216. The well test may include pressure measurement, or a collection of one or more hydrocarbon samples from the wellbore. After the well test is performed, the wellbore pressure is reduced at 218. The hydrostatic bias system monitors the wellbore pressure to determine if the wellbore pressure is less than the first bias pressure established by the hydrostatic bias system at 220. At 222, if the wellbore pressure is less than the first bias pressure, the hydrostatic bias system translates the location of the mandrel moving the ball valve from the open position to the closed position. Finally, at 224, once the ball valve is moved to the closed position, the collet once again engages the detent. This reestablishes the second bias pressure acting on the mandrel.

25 [0048] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to make and use the invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include
30 equivalent structural elements with insubstantial differences from the literal languages of the claims.

[0049] Various alternatives and embodiments are contemplated as in the scope of the following claims, particularly pointing out and distinctly claiming the subject matter regarded as the invention.

CLAIMS

What is claimed is:

1. A collet assembly for a pressure controlled tester, the collet assembly comprising:
 - a cylindrical collet housing defining an open interior, the collet housing having a detent extending radially inwards from the collet housing towards the open interior;
 - a collet mandrel disposed in the open interior of the collet housing, the collet mandrel having a lip extending radially outwards from the collet mandrel, the collet mandrel being movable axially within the collet housing between a first position and a second position; and
 - a collet disposed radially outwards from the collet mandrel and radially interior to the collet housing, the collet having at least one finger extending radially outwards from the collet, the at least one finger engages the detent of the collet housing when the collet mandrel is in the first position and the finger deflects to move past the detent when the collet mandrel moves to the second position;wherein the collet housing is configured to couple between a pressure controlled test valve and a hydrostatic bias system in a pressure controlled tester.
2. The collet assembly of claim 1 further comprising a collet nut that secures the collet to the collet mandrel by engaging the lip of the collet mandrel.
3. A pressure controlled tester, the tester comprising:
 - a ball valve operable between a closed position and an open position;
 - a ball valve housing, the ball valve disposed in the ball valve housing;
 - a collet housing connected to the ball valve housing, the collet housing being cylindrical and defining an open interior, the collet housing further comprising a detent that extends radially inwards from the collet housing into the open interior;
 - a collet disposed radially inwards from the collet housing, the collet including a finger extending radially outwards from the collet, and the finger engages the detent of the collet housing;

a collet mandrel disposed radially inwards of the collet housing and the collet, the collet mandrel coupled to the ball valve such that movement of the collet mandrel between a first position and a second position moves the ball valve between the closed position and the open position; and

a hydrostatic bias system operationally coupled to the collet housing and the collet mandrel, the hydrostatic bias system biasing the collet mandrel in the first position and the ball valve in the closed position;

wherein when a force is applied to the hydrostatic bias system sufficient to disengage the finger of the collet from the detent of the collet housing, the collet mandrel moves from the first position to the second position and the ball valve moves from the closed position to the open position.

4. The pressure controlled tester of claim 3, wherein the mandrel is secured to the collet with a collet nut that engages a lip extending from the collet mandrel

5. The pressure controlled tester of claim 3, wherein the finger of the collet disengages the detent of the collet housing when the force applied to the hydrostatic bias system deforms the finger of the collet.

6. The pressure controlled tester of claim 5, wherein the finger mechanically deforms.

7. The pressure controlled tester of claim 5, wherein the finger structurally deforms.

8. The pressure controlled tester of claim 3 further comprising a biasing spring in the hydrostatic bias system, the biasing spring applying a first bias pressure on the collet mandrel which maintains the collet mandrel in the first position.

9. The pressure controlled tester of claim 8, wherein the force sufficient to disengage the finger from the detent is also greater than the first bias pressure from the biasing spring.

10. The pressure controlled tester of claim 9, wherein the force sufficient to disengage the finger from the detent is further sufficient to fully compress the biasing spring, such that when the finger disengages the detent, the hydrostatic bias system fully compresses the biasing spring.

11. The pressure controlled tester of claim 9, wherein when the force applied to the hydrostatic bias system is less than the first bias pressure of the biasing spring, the hydrostatic bias system moves the collet mandrel from the second position to the first position.

12. The pressure controlled tester of claim 11, wherein when collet mandrel returns to the first position the finger engages the detent.

13. The pressure controlled tester of claim 3, further comprising a collet nut that secures the collet to the mandrel.

14. The pressure controlled tester of claim 3, wherein the hydrostatic bias system further comprises a bias system housing and a hold open mandrel, the bias system housing being threadedly connected to the collet housing and the hold open mandrel being coupled to the collet mandrel.

15. The pressure controlled tester of claim 14, wherein the collet housing and collet mandrel are removably coupled to the hydrostatic bias system and the ball valve housing.

16. A method of testing a well, the method comprising:
providing a pressure controlled tester within a wellbore, the pressure controlled tester comprises a ball valve that controls fluid flow through the pressure controlled tester, a mandrel coupled to the ball valve, wherein translational movement of the mandrel moves the ball

valve between a closed position and an open position, and a hydrostatic bias system coupled to the mandrel;

providing a first bias pressure to the mandrel with the hydrostatic bias system, the first bias pressure maintaining the ball valve in the closed position;

providing a second bias pressure to the mandrel through a collet coupled to the mandrel and engaging a detent of the pressure controlled tester with a finger of the collet, the second bias pressure being higher than the first bias pressure, and holding the ball valve in the closed position;

raising a hydrostatic pressure in the wellbore, the hydrostatic pressure being communicated to the mandrel through a fluid port in the pressure controlled tester;

disengaging the finger of the collet from the detent when the pressure is greater than the second bias pressure, and the mandrel overcomes the first bias pressure of the hydrostatic bias system; and

translating the location of the mandrel such that the ball valve moves from the closed position to the open position.

17. The method of claim 16 further comprising selecting the collet from a plurality of collets, each of the plurality of collets having a different second bias pressure.

18. The method of claim 16, wherein the first bias pressure is provided to the mandrel by a biasing spring in the hydrostatic bias system.

19. The method of claim 16 further comprising producing a flow of hydrocarbon through the ball valve in the open position.

20. The method of claim 16 further comprising lowering the hydrostatic pressure in the wellbore to a hydrostatic pressure below the first bias pressure;

translating the location of the mandrel such that the ball valve moves from the open position to the closed position; and

engaging the detent with the finger to provide the second bias pressure.

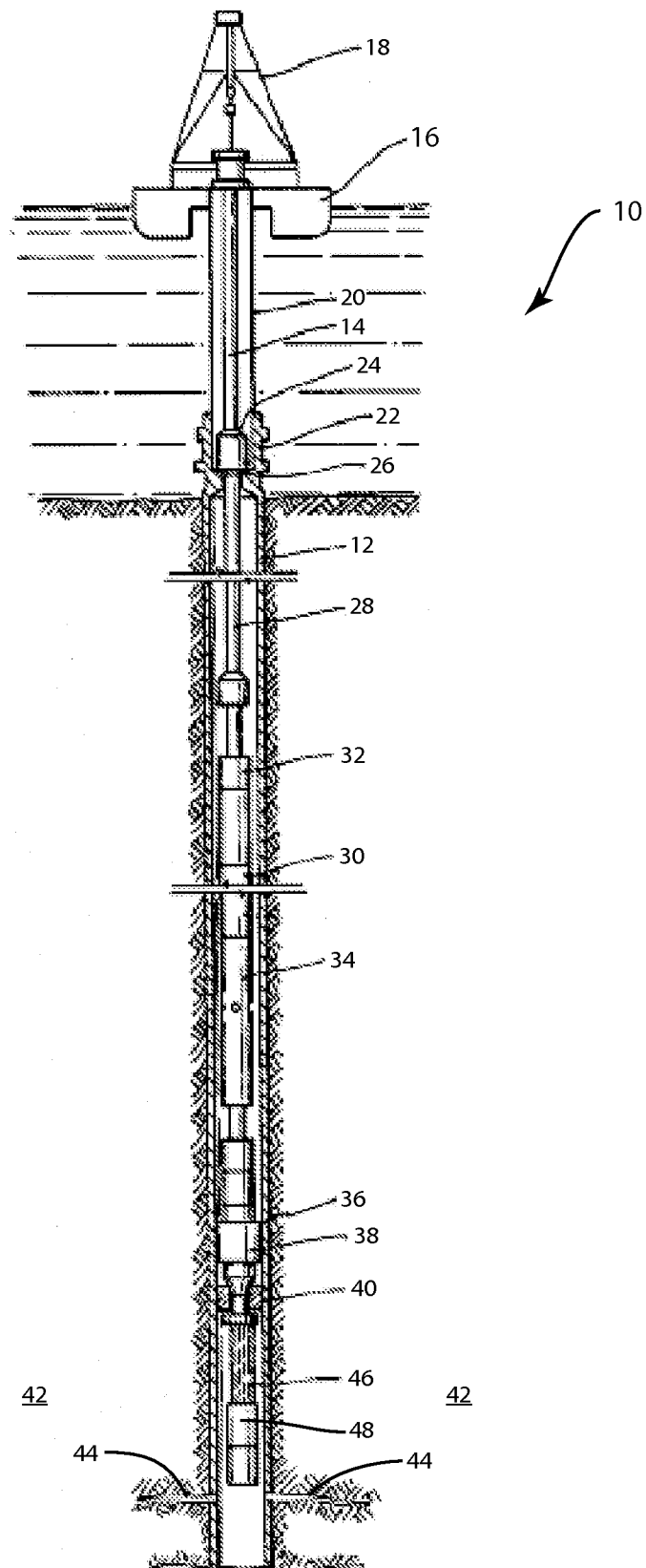
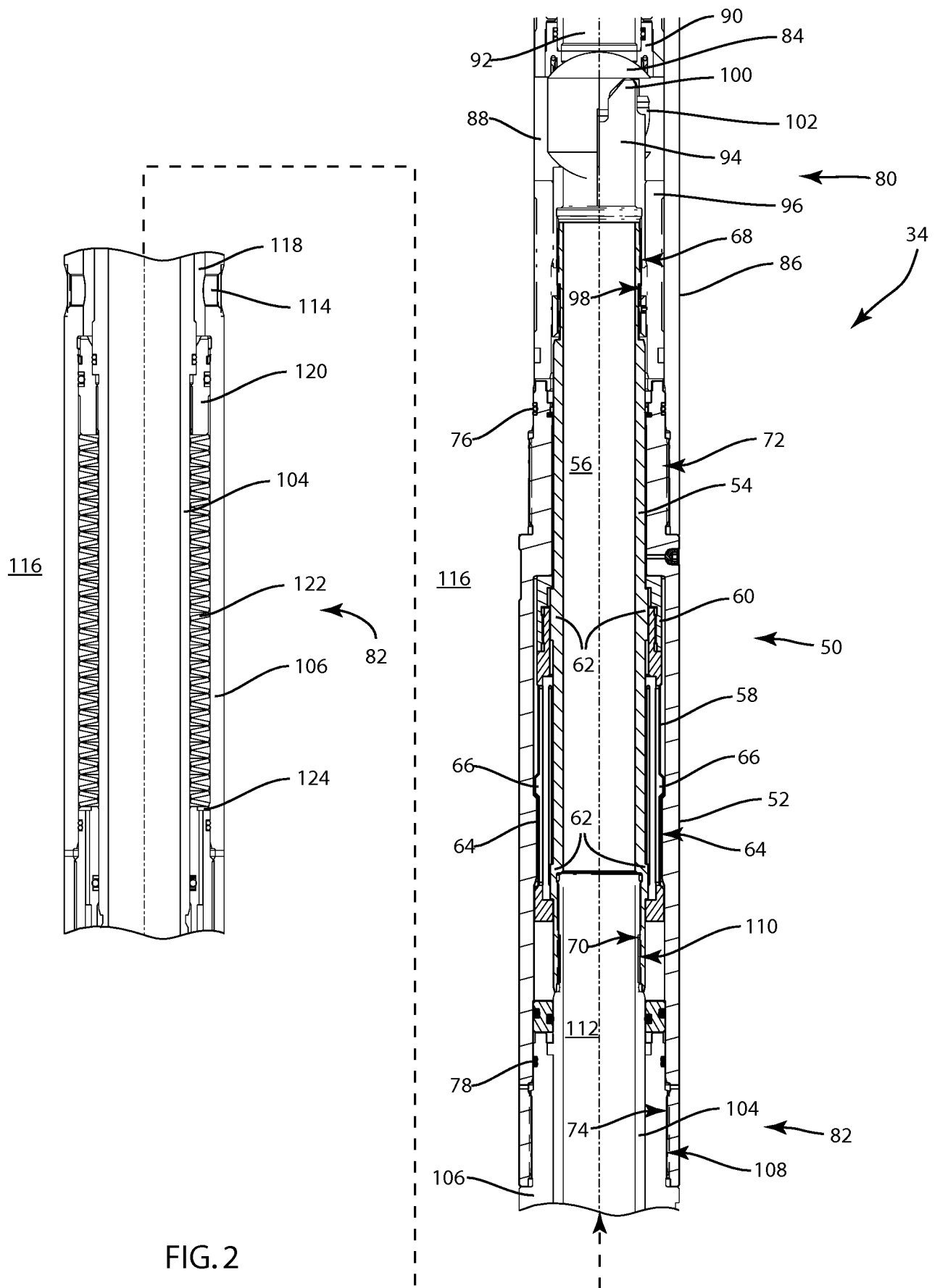


FIG. 1



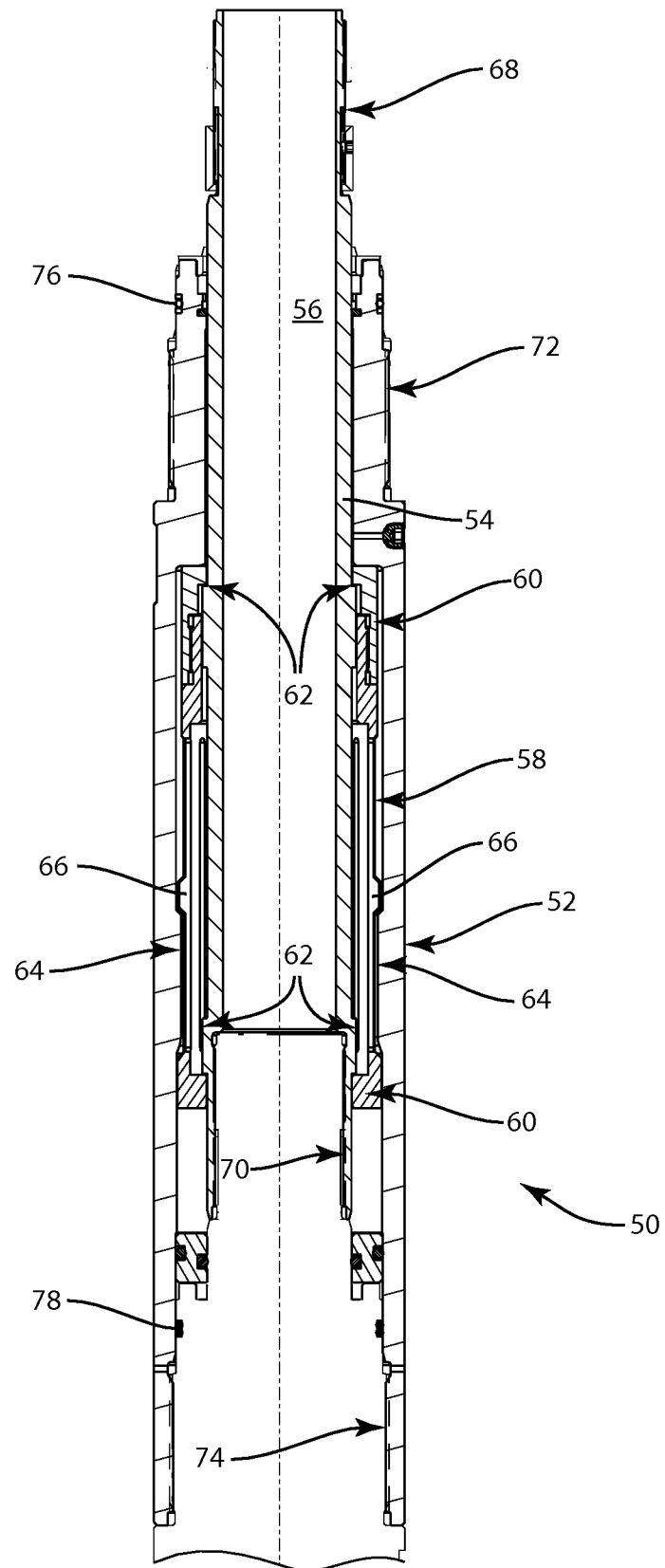
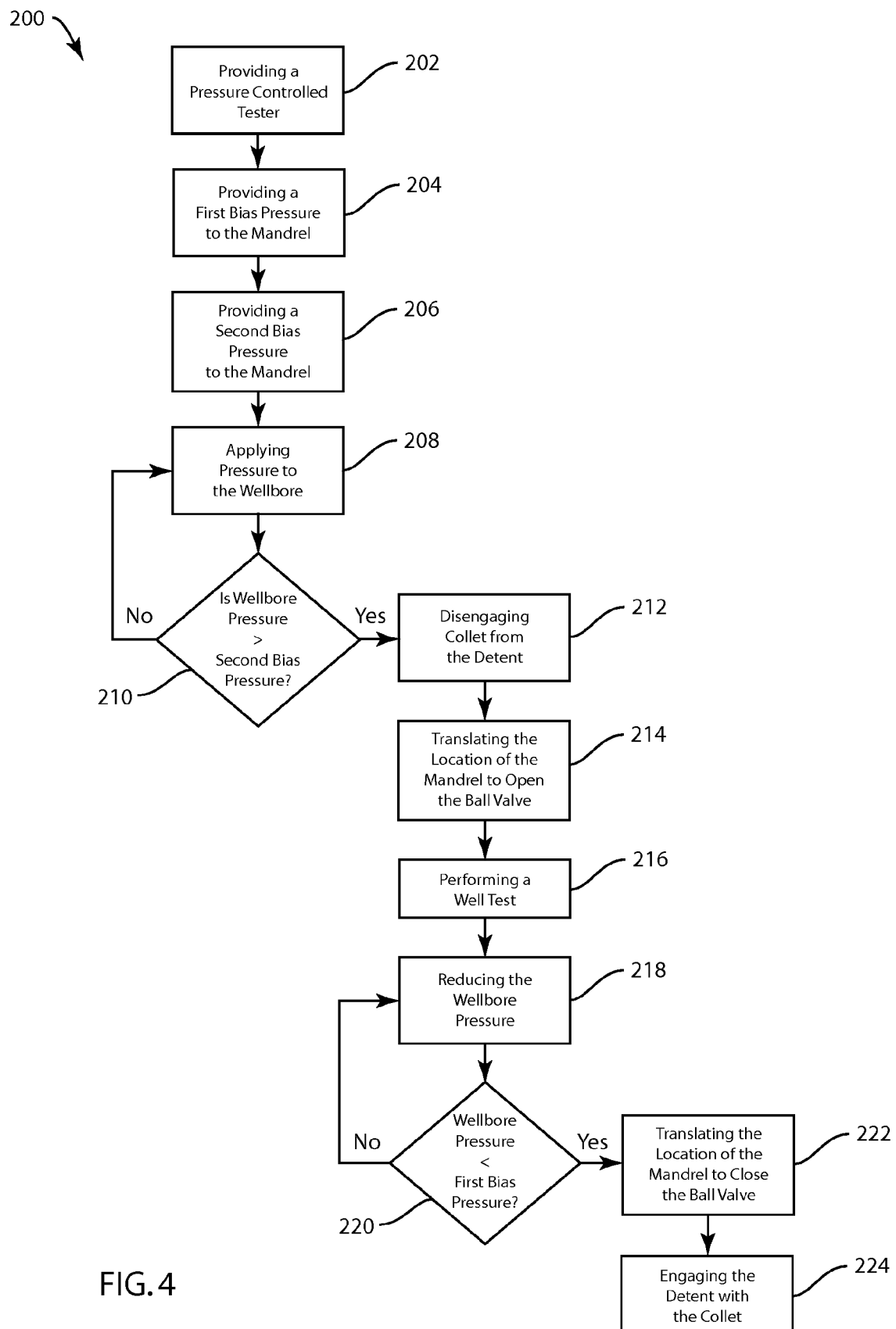


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/058685**A. CLASSIFICATION OF SUBJECT MATTER*****E21B 49/08(2006.01)i, E21B 47/00(2006.01)i, E21B 34/10(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E21B 49/08; E21B 43/12; E21B 34/06; E21B 47/00; [E21 B4312

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords:cylindrical collet housing, pressure controlled valve, hydrostatic bias system

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 04440230A A (MCGILL; HOWARD L.) 03 April 1984 See abstract, column 5 and figure 2.	1-20
A	US 04125165A A (HELMUS; SYDNEY S.) 14 November 1978 See abstract, column 9 and figure 2.	1-20
A	US 04144937A A (JACKSON; GERALD [D. et al.]) 20 March 1979 See abstract and figure 2.	1-20
A	US 04064937A A (BARRINGTON; BURCHUS Q.) 27 December 1977 See abstract and figure 2.	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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