

⁽¹²⁾ UK Patent Application ⁽¹⁹⁾ GB ⁽¹¹⁾ 2 291 905 ⁽¹³⁾ A

(43) Date of A Publication 07.02.1996

(21) Application No **9514477.0**

(22) Date of Filing **14.07.1995**

(31) 08281954 (32) 28.07.1994 (33) US

Schlumberger Limited

(Incorporated in the Netherlands Antilles)

**277 Park Avenue, New York, NY 10172,
United States of America**

Michael Griffith

B D Stooile

**Schlumberger plc, 1st Floor 1 Kingsway, LONDON,
WC2B 6XH, United Kingdom**

E21B 49/08 17/20

E1F FAC FAC2 FAC9 FHB

US 5275038 A US 5178223 A US 4921057 A

UK CL (Edition N) E1F FAC FHB

INT CL⁶ E21B

Online: WPI

(54) Testing wells

(57) A new drill stem test apparatus and corresponding method includes a dual coaxial coiled tubing adapted to be disposed in the wellbore. The dual coaxial coiled tubing includes an inner coiled tubing 10a, and an outer coiled tubing 10b surrounding and enclosing the inner coiled tubing and forming an annular space 10c which is located between the inner coiled tubing and the outer coiled tubing. The annular space is adapted to contain a pressurized kill fluid. A first end of the outer coiled tubing is sealed by a sealing element 10d to a first end of the inner coiled tubing, the end of the inner coiled tubing extending beyond the sealing element and adapted to receive a formation fluid. The first ends of the inner and outer coiled tubing are disposed in a wellbore. A second end of the inner and outer coiled tubing is wound onto a coiled tubing reel and is connected to a kill fluid valve 22 and a formation fluid valve 26. When the kill fluid valve opens while the formation fluid valve is closed, a pressurized kill fluid fills and pressurizes the annular space between the inner and outer coiled tubing. While the kill fluid valve is still open, the formation fluid valve is opened. A formation fluid begins to flow from the formation through the inner coiled tubing and through the formation fluid valve. If the inner coiled tubing forms a hole and begins to leak formation fluid, the pressurized kill fluid in the annular space will prevent the formation fluid in the inner coiled tubing from leaking out of the interior of the inner coiled tubing and into the annular space.

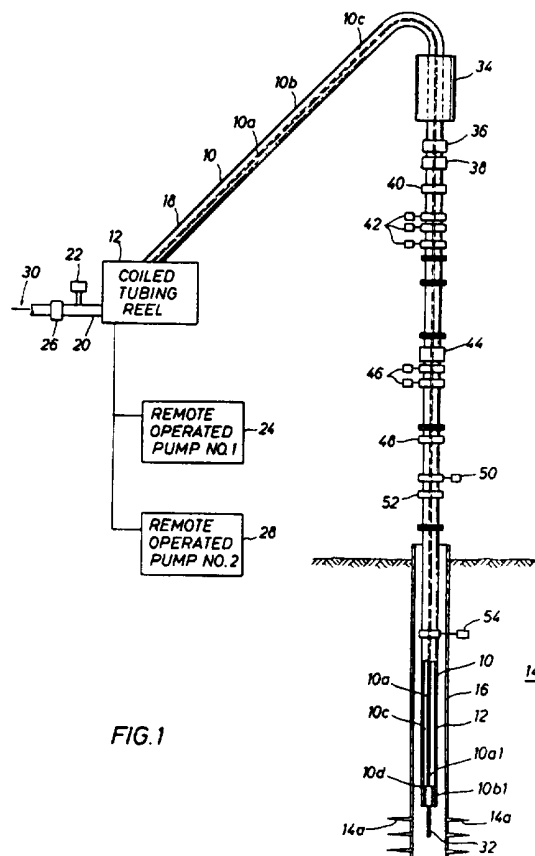


FIG. 1

GB 2 291 905 A



FIG. 1

FIG. 2

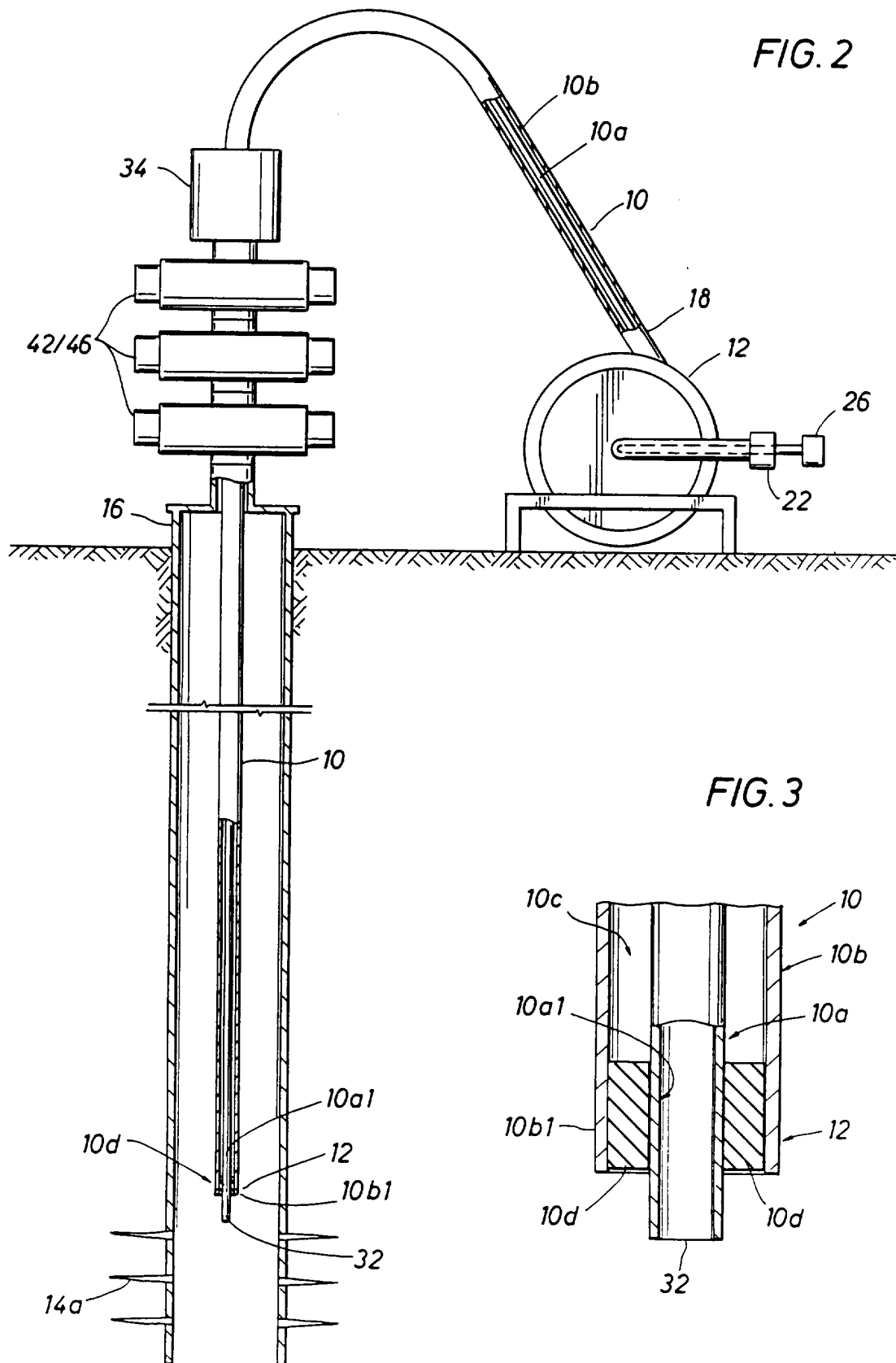


FIG. 3

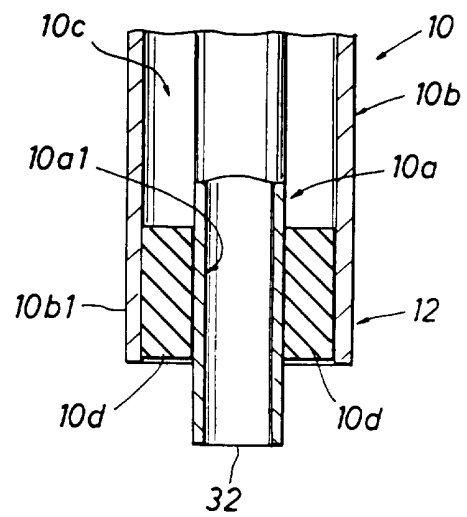


FIG. 4

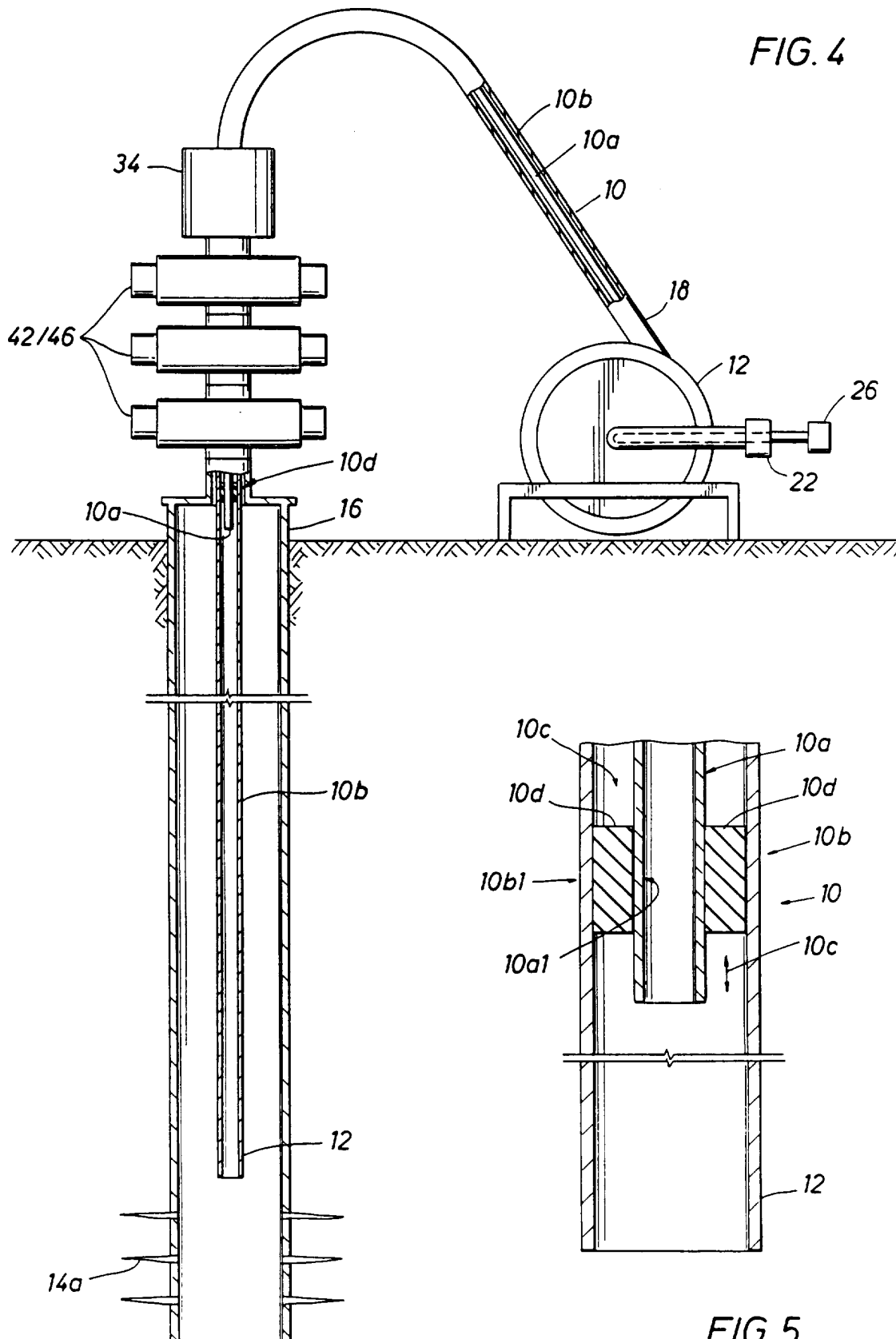


FIG. 5

METHOD AND APPARATUS FOR TESTING WELLS

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for testing wells, and provides a method and apparatus for running a dual coiled tubing test string into a wellbore, pumping a kill fluid into an annular space located between the two coiled tubing strings, and performing a drill stem test.

Coiled tubing is increasing in popularity in connection with wellbore operations simply because it is easier and less expensive to lower a coiled tubing into a wellbore instead of a production tubing. For example, U.S. Patent 5,287,741 to Schultz et al discloses a method for performing a drill stem test by lowering a coiled tubing and an attached drill stem test tool string into a production tubing string in a wellbore. The disclosure of U.S Patent 5,287,741 to Schultz et al is incorporated by reference into the specification of this application. Although the Schultz et al patent indicates (in column 8, line 15) that the coiled tubing has no connections to leak, the coiled tubing may, nevertheless, separate or split, thereby forming a hole. When the coiled tubing is carrying a formation fluid, the formation fluid may begin to leak through the hole in the coiled tubing. The Schultz et al patent fails to disclose any method or apparatus for protecting the coiled tubing and containing the leak of the formation fluid which is leaking through the hole in the coiled tubing.

Consequently, a new drill stem test apparatus is needed which utilizes a coiled tubing instead of a production tubing to lower a drill stem test tool string into a wellbore, and which alleviates the problem of the apparatus of the Schultz et al patent.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a new drill stem test (DST) apparatus adapted to be disposed in a wellbore for performing a drill stem test, and in which the leakage problem is alleviated.

It is a further object of the present invention to provide a new method for performing a drill stem test.

According to a first aspect of the present invention, there is provided a new drill stem test (DST) apparatus adapted to be disposed in a wellbore for performing a drill stem test, the new DST apparatus including a first coiled tubing and a second coiled tubing enclosing the first coiled tubing and forming an annular space between the first coiled tubing and the second coiled tubing.

A further aspect of the present invention provides a new drill stem test (DST) apparatus adapted to be disposed in a wellbore for performing a drill stem test, the new DST apparatus including a first coiled tubing and a second coiled tubing sealed at its end to an end of the first coiled tubing and enclosing the first coiled tubing thereby forming an annular space between the first coiled tubing and the second coiled tubing, the ends of the first and second coiled tubings being adapted to be disposed in the wellbore, the first coiled tubing receiving the formation fluid.

Yet another aspect of the present invention provides a new drill stem test (DST) apparatus adapted to be disposed in a wellbore for performing a drill stem test, the new DST apparatus including a first coiled tubing and a second coiled tubing sealed at its end to an end of the first coiled tubing and enclosing the first coiled tubing thereby forming an annular space between the first coiled tubing and the second coiled tubing, and a kill fluid disposed within the annular space between the first and second coiled tubings, the ends of the first and second coiled tubings adapted to be disposed in the wellbore, the first coiled tubing receiving the formation fluid.

A further aspect of the present invention provides a new method for performing a drill stem test, the new drill stem test method including the steps of lowering a dual coaxial coiled tubing into a wellbore and performing a drill stem test.

A still further aspect of the present invention provides a new method for performing a drill stem test, the new drill stem test method including the steps of lowering a first coiled tubing and a second coaxially disposed coiled tubing into a wellbore and performing a drill stem test.

A further aspect of the present invention provides a new method for performing a drill stem test, the new drill stem test method including the steps of lowering a first coiled tubing and a second coaxially disposed coiled tubing into a wellbore, an annular space existing between the first coiled tubing and the second coiled tubing, filling the annular space with a kill fluid, and performing a drill stem test.

Yet another aspect of the present invention provides a new method for performing a drill stem test, the new drill stem test method including the steps of lowering a first coiled tubing and a second coaxially disposed coiled tubing into a wellbore, the second coiled tubing being sealed at one end to an end of the first coiled tubing and enclosing the first coiled tubing thereby forming an annular space between the first and second coiled tubing, the ends of the first and second coiled tubings being lowered into the wellbore; filling the annular space between the first and second coiled tubings with a kill fluid; and receiving a formation fluid into the end of the first coiled tubing.

A preferred embodiment of the new drill stem test apparatus includes a dual coaxial coiled tubing adapted to be disposed in the wellbore. The dual coaxial coiled tubing includes a first coiled tubing, and a second coiled tubing surrounding and enclosing the first coiled tubing and forming an annular space between the first coiled tubing and the second coiled tubing. A first end of the second coiled tubing is sealed to a first end of the first coiled tubing. Although the first ends of the first and second coiled tubing are adapted to be disposed in a wellbore, the first end of the first coiled tubing is the only tubing which receives a formation fluid from a formation penetrated by the wellbore. A second end of the first coiled tubing is connected to a formation fluid valve via a coiled tubing reel, and a second end of the second coiled tubing is connected to a kill fluid valve via the coiled tubing reel.

A preferred implementation of the new method for performing a drill stem test includes the steps of lowering the first end of the aforementioned dual coaxial coiled tubing into a wellbore, the first end of the first coiled tubing being adapted to receive the formation fluid from the formation. The kill fluid valve is opened. When the kill fluid valve is opened, a kill fluid begins to flow into the annular space between the first coiled tubing and the second coiled tubing. The kill fluid

cannot leak out of the first end of the first and second coiled tubing because the first end of the second coiled tubing is sealed to the first end of the first coiled tubing. When the kill fluid fills the annular space and is pressurized to a predetermined pressure, the formation fluid valve, connected to the second end of the first coiled tubing, is opened. As a result, the formation fluid which is flowing into the first end of the first coiled tubing begins to flow uphole through the first coiled tubing and through the formation fluid valve. If the first coiled tubing separates and forms a hole, the formation fluid in the first coiled tubing will attempt to leak out of the hole in the first coiled tubing and into the annular space. However, the pressurized kill fluid which is present in the annular space between the first and second coiled tubing will prevent the formation fluid from leaking out of the hole from the interior of the first coiled tubing into the annular space. Consequently, the formation fluid will continue to flow uphole uninterrupted through the first coiled tubing and through the formation fluid valve.

Further scope of applicability of the present invention will become apparent from the detailed description presented hereinafter. It should be understood, however, that the detailed description and the specific examples, while representing a preferred embodiment of the present invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become obvious to one skilled in the art from a reading of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

A full understanding of the present invention will be obtained from the detailed description of the preferred embodiment presented hereinbelow, and the accompanying drawings, which are given by way of illustration only and are not intended to be limitative of the present invention, and wherein:

figure 1 illustrates a first embodiment of the new drill stem test method and apparatus of the present invention including the new dual coaxial coiled tubing string disposed in a wellbore;

figure 2 illustrates a second embodiment of the new drill stem test method and apparatus of the present invention;

figure 3 illustrates an exploded section of a portion of the dual coaxial coiled tubing of figure 2 illustrating the inner coiled tubing, the outer coiled tubing, a sealing element, and the annular space between the inner and outer coiled tubing;

figure 4 illustrates a third embodiment of the new drill stem test method and apparatus of the present invention; and

figure 5 illustrates an exploded section of a portion of the dual coaxial coiled tubing of figure 4 illustrating the inner coiled tubing, the outer coiled tubing, a sealing element, and the annular space between the inner and outer coiled tubing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to figure 1, a new drill stem test apparatus in accordance with a first embodiment of the present invention is illustrated.

In figure 1, a dual coaxial coiled tubing 10 is wound upon a coiled tubing reel 12. The dual coaxial coiled tubing 10 includes an inner coiled tubing 10a and an outer coiled tubing 10b which encloses the inner coiled tubing 10a thereby forming an annular space 10c between the inner coiled tubing 10a and the outer coiled tubing 10b. When the dual coaxial coiled tubing 10 is rolled off the coiled tubing reel 12, a first end 12 of the dual coaxial coiled tubing 10 is disposed in a wellbore which is lined with a casing 16. The casing 16 penetrates an earth formation 14 traversed by the wellbore. A second end 18 of the dual coaxial coiled tubing 10 is wound upon the coiled tubing reel 12. The second end 18 is connected to a pipe 20. The pipe 20 is connected to a 3-1/2 inch kill fluid valve 22 which is associated with a kill pump 24 and a 2 inch formation fluid valve 26 which is associated with a formation fluid pump 28. The kill fluid valve 22 is adapted to open a flow line between the pipe 20 and the annular space 10c which is disposed between the inner and outer coiled tubings 10a and 10b. However, the formation fluid valve 26 is adapted to open a flow line between an interior of the inner coiled tubing 10a and the pipe 20. When the kill fluid valve 22 is opened, the kill pump 24 will pump a kill fluid into the annular space 10c

disposed between the inner coiled tubing 10a and the outer coiled tubing 10b. The kill fluid is heavier than the expected formation fluid which will flow from the formation 14 through the interior of the inner coiled tubing 10a. As a result, if a hole is formed in the inner coiled tubing 10a, the kill fluid, being heavier than the formation fluid, will prevent the formation fluid from leaking out of the hole from the interior of the inner coiled tubing 10a into the annular space 10c. However, when the formation fluid valve 26 is opened, a formation fluid flowing within the interior of the inner coiled tubing 10a will flow out of the inner coiled tubing 10a and through the pipe 20 in the direction of the arrow 30. The first end 12 of the dual coaxial coiled tubing 10 includes an end 10b1 of the outer coiled tubing 10b, an end 10a1 of the inner coiled tubing 10a, and a sealing element 10d which seals the end 10b1 of the outer coiled tubing 10b to the end 10a1 of the inner coiled tubing 10a. The sealing element 10d may comprise either a polished rod or a sealing slip joint. When the sealing element 10d seals the end 10b1 to the end 10a1 of the outer and inner coiled tubings, if a formation fluid begins to flow from a plurality of perforations 14a in the formation 14, the formation fluid cannot enter the annular space 10c disposed between the inner and outer coiled tubings 10a and 10b. In figure 1, a drill stem test string 32 protrudes from an end of the sealing element 10d. In our example shown in figure 1, the drill stem test string 32 actually forms a part of the inner coiled tubing 10a. However, the inner coiled tubing 10a which comprises the drill stem test string 32 of figure 1 could easily be connected to a number of other drill stem test tools, such as the tools shown in figure 1B of U.S. Patent 5,287,741 to Schultz et al. These other tools would include a reverse circulating valve, a tester valve, a sampler, a gauge carrier, and/or a straddle packer. In figure 1, the dual coaxial coiled tubing 10 also includes an injector head 34, an upper stripper 36, a lower stripper 38, a quick connector 40, an upper coiled tubing blowout preventer 42, a coiled tubing annular blowout preventer 44, a lower coiled tubing blowout preventer 46, a swab valve 48, a hydraulic master valve 50, a manual master valve 52, and a hydraulic subsurface safety valve 54. When the kill fluid valve 22 is opened, the kill fluid will be pumped by kill pump 24 into the entire length of the annular space 10c, disposed between the inner and outer coiled tubings 10a and 10b of figure 1.

Referring to figures 2 and 3, the new drill stem test apparatus in accordance with a second embodiment of the present invention is illustrated. Figure 2 illustrates a

dual coaxial coiled tubing string, in accordance with a second embodiment of the present invention, disposed in a wellbore for use during the practice of a new method, also in accordance with the present invention, for performing drill stem test. Figure 3 illustrates an exploded section of a portion of the dual coaxial coiled tubing of figure 2 illustrating the inner coiled tubing, the outer coiled tubing, a sealing element, and the annular space between the inner and outer coiled tubing. In figures 2 and 3, the element numerals used in figure 1 will be used in figures 2 and 3 wherever possible.

In figures 2 and 3, the second embodiment of the new drill stem test apparatus of the present invention is basically the same as the first embodiment shown in figure 1. The second end 18 of the dual coaxial coiled tubing 10 is wound upon the coiled tubing reel 12 as shown in figure 1 and the first end 12 of the dual coiled tubing 10 is situated in the casing string 16 of the wellbore. The drill stem test apparatus of figure 2 also includes the injector head 34 and the coiled tubing blowout preventors 42/46. As best shown in figure 3, the outer coiled tubing 10b encloses the inner coiled tubing 10a and forms an annular space 10c between the outer and inner coiled tubing. In figure 2, the annular space 10c is connected to the kill fluid valve 22. When the kill fluid valve 22 is opened, a pressurized kill fluid begins to flow into the annular space 10c between the outer and inner coiled tubing 10b and 10a, respectively. However, in figure 3, the first end 12 of the dual coaxial coiled tubing 10 includes an outer coiled tubing end 10b1 and an inner coiled tubing end 10a1, the two ends 10b1 and 10a1 being sealed together by the sealing element 10d. The sealing element 10d can be either a sliding seal assembly, polished rod, or a welded joint. Therefore, when the kill fluid valve 22 is opened and the kill fluid begins to flow into the annular space 10c, in view of the sealing element 10d of figure 3, the kill fluid will not flow out of the first end 12 of the dual coiled tubing 10. The kill fluid between the inner and outer coiled tubing 10a and 10b can be used in the following manner: (1) fill the annular space 10c with the kill fluid and remove all air; monitor the kill fluid with a pressure readout at the surface of the wellbore to determine if there is any indication of a leak in the inner coiled tubing 10a, or (2) fill the annular space 10c with the kill fluid and pressurize the kill fluid to a desired, predetermined pressure to reduce the burst stress on the inner coiled tubing 10a; continue to monitor the kill fluid to determine if a hole in the inner coiled tubing 10a produces a leak from the inner coiled tubing; if a leak from the inner coiled

tubing 10a occurs, increase the pressure of the kill fluid in the annular space 10c to control the leak. When formation fluid is produced from the perforations 14a in the formation, the formation fluid will be forced to enter the drill stem test string 32 of figure 3, which in the example of figures 2-3, consists of the first end 12 of the inner coiled tubing 10a. However, recall again that the end of the inner coiled tubing 10a of the drill stem test string 32 of figure 3 could easily be connected to other drill stem test tools, such as a reverse circulating valve, a tester valve, a sampler, a gauge carrier, and/or a straddle packer.

Referring to figures 4 and 5, the new drill stem test apparatus in accordance with a third embodiment of the present invention is illustrated. Figure 4 illustrates a dual coaxial coiled tubing string, in accordance with a third embodiment of the present invention, disposed in a wellbore for use during the practice of a new method, also in accordance with the present invention, for performing drill stem test. Figure 5 illustrates an exploded section of a portion of the dual coaxial coiled tubing of figure 4 illustrating the inner coiled tubing, the outer coiled tubing, a sealing element, and the annular space between the inner and outer coiled tubing. In figures 4 and 5, the element numerals used in figure 1 will be used in figures 4 and 5 wherever possible.

In figures 4 and 5, the drill stem test apparatus of figure 4 is basically the same as the drill stem test apparatus of figures 2 and 3. However, the major difference between the drill stem test apparatus of figures 2 and 4 relates to the location of the sealing element 10d. In figure 2, the sealing element 10d was located adjacent to the drill stem test string 32 (the end of the inner coiled tubing 10a) and adjacent to the perforations 14a in the formation. However, in figure 4, the sealing element 10d is located adjacent the first end of the inner coiled tubing 10a which is located just below the blow out preventors 42/46; however, in figure 4, the first end 12 of the outer coiled tubing 10b extends far beyond the first end of the inner coiled tubing 10a.

In figure 4, the new drill stem test apparatus includes the dual coaxial coiled tubing 10 disposed in a wellbore for performing a new drill stem test. As shown in figure 5, the dual coaxial coiled tubing 10 includes the inner coiled tubing 10a which is enclosed by the outer coiled tubing 10b, and the annular space 10c disposed between the inner and outer coiled tubing. The second end 18 of the

dual coaxial coiled tubing 10 is wound on the coiled tubing reel 12 and the first end 12 of the dual coiled tubing 10 is disposed in the wellbore. As mentioned earlier, the drill stem test apparatus also includes the injector head 34 and the blowout preventors 42/46. When the kill fluid valve 22 is opened, a pressurized kill fluid enters the annular space 10c, which is best shown in figure 5. However, the sealing element 10d of figure 5 will prevent the kill fluid in the annular space 10c from spilling out the annular space 10c and out of the end of the outer coiled tubing. When the formation fluid from the perforations 14a enter the outer coiled tubing 10b, and when the formation fluid valve 26 is opened, the formation fluid in the inner coiled tubing 10a will flow uphole within the inner coiled tubing 10a and through the formation fluid valve 26. If a hole forms in the inner coiled tubing 10a, the formation fluid will not leak from the interior of the inner coiled tubing 10a and through the hole into the annular space 10c because the pressurized kill fluid, which is located in the annular space 10c, will prevent the formation fluid from leaking through the hole. The formation fluid will continue to flow through inner coiled tubing 10a and through the formation fluid valve 26.

The new drill stem test method of the present invention will be described below in the following paragraphs with reference to the new drill stem test apparatus of the present invention which is shown in figures 1 through 5 of the drawings.

The new drill stem test apparatus of the present invention is set up in the wellbore in the manner shown, for example, in figure 1. The dual coaxial coiled tubing string, consisting of two concentrically disposed coiled tubing strings separated by an annular space 10c, is wound off the coiled tubing reel 12 and a first end is disposed in a wellbore lined by a casing 16. The kill fluid valve 22 is opened, but the formation fluid valve 26 remains closed. A kill fluid, which is heavier than the expected formation fluid, begins to flow from the kill fluid valve 22 and into the annular space 10c between the outer coiled tubing 10b and the inner coiled tubing 10a. The sealing element 10d will prevent the kill fluid in the annular space 10c from spilling out the other end of the annular space 10c and out of the dual coaxial coiled tubing 10 and into the wellbore. The kill fluid is pressurized to a predetermined pressure. Then, the formation fluid valve 26 is opened. Formation fluid from the perforations 14a in the formation begins to flow into the first end 12 of the inner coiled tubing 10a. Since the formation fluid valve 26 is

opened, the formation fluid will flow through the inner coiled tubing 10a and through the formation fluid valve 26 at the surface of the wellbore. Assume that a hole forms in the wall of the inner coiled tubing 10a. The formation fluid inside the inner coiled tubing 10a will attempt to leak out of the hole and into the annular space 10c. However, since the pressurized kill fluid is located in the annular space 10c and since it is heavier than the formation fluid, the kill fluid in the annular space 10c will prevent the formation fluid in the inner coiled tubing 10a from leaking out from the interior of the inner coiled tubing 10a, through the hole, and into the annular space 10c. The flow of the formation fluid in the inner coiled tubing 10a will not be interrupted; rather, the formation fluid will continue to flow out of the formation fluid valve 26.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

CLAIMS

1. A method of performing a drill stem test, comprising the steps of:

lowering an end of a dual coiled tubing into a wellbore, the dual coiled tubing including an inner coiled tubing and an outer coiled tubing enclosing said inner coiled tubing and forming an annular space between said outer coiled tubing and said inner coiled tubing; and

receiving a formation fluid into the end of said inner coiled tubing.

2. The method of claim 1, further including the step of filling said annular space with a kill fluid.

3. The method of claim 2, wherein said dual coiled tubing further includes a sealing element disposed between and sealing the end of said outer coiled tubing to the end of said inner coiled tubing, and wherein the filling step comprises the steps of:

filling said annular space bounded on one side by said sealing element with said kill fluid; and

pressurizing said kill fluid in said annular space.

4. A drill stem test apparatus adapted to be disposed in a wellbore, comprising:

a first coiled tubing; and

a second coiled tubing disposed around and enclosing the first coiled tubing and forming an annular space between the first coiled tubing and the second coiled tubing.

5. The drill stem test apparatus of claim 4, further comprising:

a kill fluid disposed in said annular space between said first coiled tubing and said second coiled tubing.

6. The drill stem test apparatus of claim 4, wherein the first and second coiled tubing have an end, the ends of the first and second coiled tubing being adapted to be disposed in said wellbore, further comprising:

a sealing element disposed between and sealing the end of the first coiled tubing to the end of the second coiled tubing.

7. The drill stem test apparatus of claim 6, wherein a formation fluid flows from a formation traversed by said wellbore, and wherein the end of said first coiled tubing extends beyond said sealing element, said formation fluid flowing into said end of said first coiled tubing.

8. The drill stem test apparatus of claim 7, further comprising:

a kill fluid disposed in said annular space between said first coiled tubing and said second coiled tubing.

9. A method of performing a wellbore operation in a wellbore, comprising the steps of:

lowering a dual coaxial coiled tubing into the wellbore; and

performing the wellbore operation using said dual coaxial coiled tubing.

10. The method of claim 9, wherein the performing step comprises the step of performing a drill stem test in said wellbore using said dual coaxial coiled tubing.

11. The method of claim 9, wherein said dual coaxial coiled tubing includes an inner coiled tubing and an outer coiled tubing enclosing said inner coiled tubing and forming an annular space between the inner and outer coiled tubing, and wherein the lowering step comprises the step of:

lowering said inner and outer coiled tubing into said wellbore.

12. The method of claim 14, further comprising:

filling said annular space with a kill fluid under pressure.

13. The method of claim 12, wherein the performing step comprises the step of performing a drill stem test in said wellbore using said dual coaxial coiled tubing.

14. An apparatus adapted to be disposed in a wellbore, comprising:

a first coiled tubing; and

a second coiled tubing enclosing said first coiled tubing and forming an annular space between the first and second coiled tubing.

15. The apparatus of claim 14, wherein the first and second coiled tubing each have an end adapted to be disposed in said wellbore, further comprising:

a sealing element disposed between and sealing the end of said second coiled tubing to the end of said first coiled tubing, the end of said first coiled tubing extending beyond said sealing element and being adapted to receive a formation fluid from a formation penetrated by said wellbore.

16. The apparatus of claim 15, further comprising:

a kill fluid disposed within said annular space.

17. The apparatus of claim 16, further comprising:

a first valve connected to said annular space and adapted for opening and filling said annular space with said kill fluid; and

a second valve connected to said first coiled tubing and adapted for opening and flowing said formation fluid received in said end of said first coiled tubing through said second valve.

18. A drill stem test apparatus adapted to be disposed in a wellbore, comprising:

an inner coiled tubing adapted to flow a formation fluid through an interior thereof and adapted to form a hole disposed through a wall of said inner coiled tubing;

an outer coiled tubing enclosing the inner coiled tubing and forming an annular space between the inner coiled tubing and the outer coiled tubing; and

a pressurized kill fluid disposed within said annular space, the pressure of said kill fluid preventing said formation fluid in said inner coiled tubing from flowing from said interior into said annular space via said hole.

19. The drill stem test apparatus of claim 18, wherein the inner coiled tubing and the outer coiled tubing have an end, further comprising:

a sealing element disposed between the ends of the inner coiled tubing and the outer coiled tubing and sealing the end of the outer coiled tubing to the end of the inner coiled tubing, a first end of said annular space being closed when said sealing element seals the end of the outer coiled tubing to the end of the inner coiled tubing.

20. The drill stem test apparatus of claim 19, further comprising:

a first valve adapted for opening and flowing said kill fluid therethrough and closing, the pressurized kill fluid flowing into said annular space through said first valve when said first valve is open, a second end of said annular space being closed when said first valve is closed; and

a second valve adapted for opening and closing, a second end of said inner coiled tubing being closed when said second valve is closed.



Application No: GB 9514477.0
Claims searched: 1 to 20

Examiner: D.B.Pepper
Date of search: 14 September 1995

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.N): E1F FAC, FHB.

Int CI (Ed.6): E21B

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	US 5275038 A (Sizer et al) - See figure 5	4,6,9-11, 13,14
X	US 5178223 A (Smet) - See figure 2	9,11,14
X	US 4921057 A (Smet) - See figure 1	9,11,14

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.