

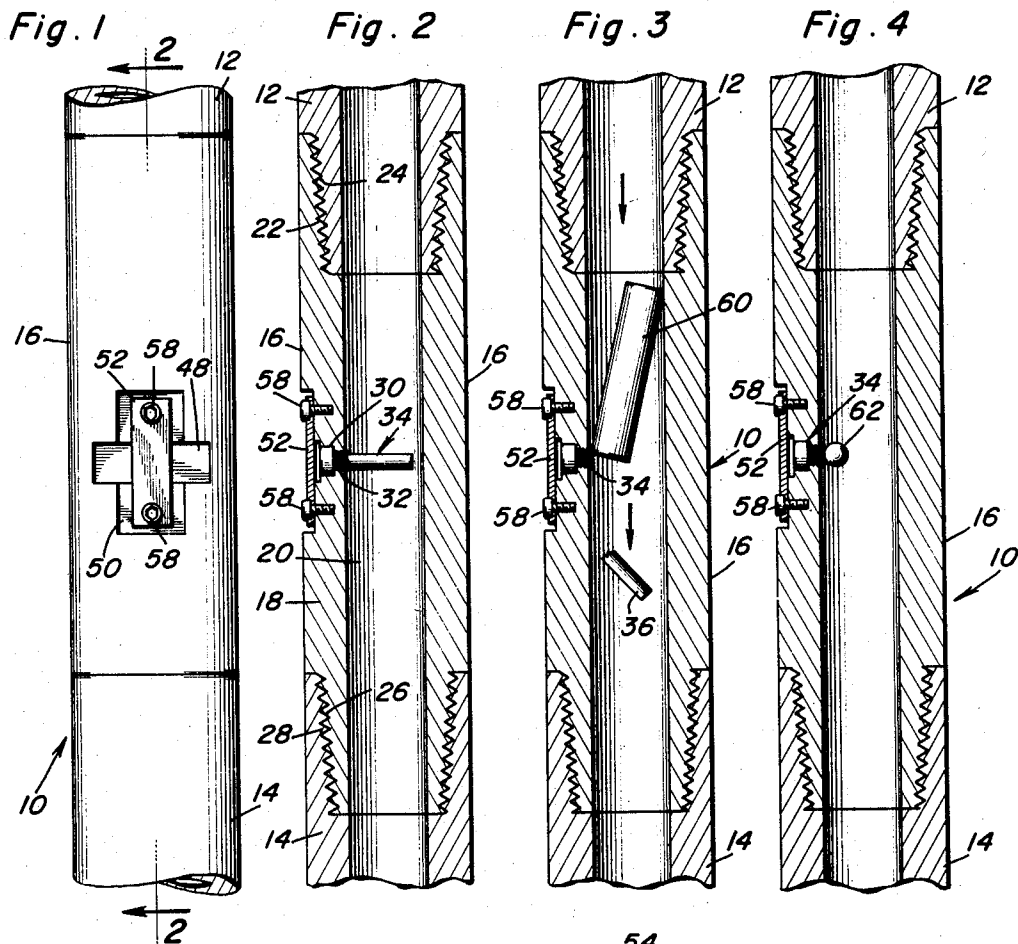
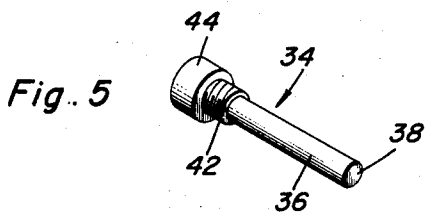
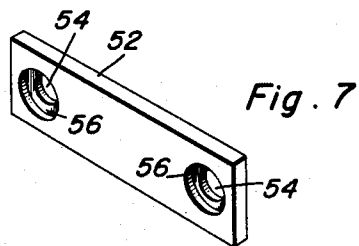
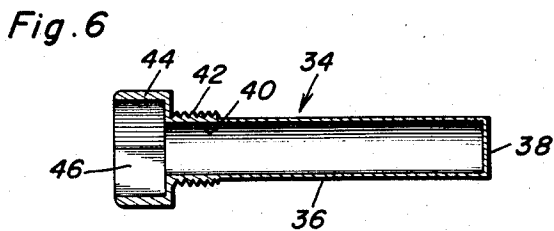
Sept. 8, 1959

G. E. LAYTON ET AL

2,903,074

CHOKED REVERSE CIRCULATING SUB

Filed Sept. 25, 1956



Gerald E. Layton
Walter K. Arbuckle
INVENTORS.

BY *James A. O'Brien*
and *Harvey B. Jacobson*
Attorneys

1

2,903,074

CHOKED REVERSE CIRCULATING SUB

Gerald E. Layton, Denver, and Walter K. Arbuckle,
Englewood, Colo.

Application September 25, 1956, Serial No. 611,863

1 Claim. (Cl. 166—224)

This invention relates in general to new and useful improvements in oil well testing apparatus, and more specifically to an improved choked reverse circulating sub.

After tests have been taken in an oil well at different horizons with the oil flowing in the drill stem, it is highly desirable to flow the oil upwardly and through the drill stem both to salvage the oil and to assure the accuracy of the test by obtaining a proper measurement of the oil.

It is therefore the primary object of this invention to provide a drill stem sub which is provided with a tubular plug extending through the drill stem sub, the tubular plug being formed of a frangible material whereby the plug may be selectively broken to communicate the exterior of the drill stem with the interior thereof.

Another object of this invention is to provide a drill stem sub which has a tubular plug extending therethrough, the plug being normally closed and projecting into the interior of the drill stem, the plug being formed of a frangible material so that the portion thereof extending into the interior of the drill stem sub may be broken off and thereby communicate the interior of the drill stem with the exterior thereof to permit reverse circulation of drilling mud and other fluids within a well hole about the drill stem.

Still another object of this invention is to provide an improved drill stem sub to permit reverse circulation through the drill stem, the sub having a transverse bore in which there is positioned a tubular plug, the plug normally having a closed inner end, there being disposed at the outer end of the plug in overlying relation a baffle plate so as to prevent both the plugging of the tubular plug and to decrease the tendency of washing of the wall of the well hole by the drilling mud as it drains back out of the drill stem at the time the drill stem is being pulled from the oil well hole.

A further object of this invention is to provide an improved drill stem sub for use in drilling in reverse circulation process, the drill stem sub having a transverse bore therethrough in which there is positioned a tubular plug, the tubular plug normally having a closed inner end and having an open outer end, there being positioned over the outer end in closely spaced relation thereto a baffle plate, all of the tubular plug and the baffle plate being disposed within the confines of the drill stem sub whereby the drill stem sub offers no greater resistance to the downward movement of the drill stem and to the circulation of fluids thereby than normal sections of the drill stem.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a fragmentary elevational view of a drill

2

stem including the drill stem sub which is the subject of this invention;

Figure 2 is a vertical sectional view taken substantially upon the plane indicated by the section line 2—2 of Figure 1 and shows the condition of the drill stem sub when it is lowered into the oil well hole;

Figure 3 is a sectional view similar to Figure 2 and shows the tubular plug of the drill stem sub being broken by a section of pipe dropped down through the drill stem;

Figure 4 is another sectional view similar to Figure 2 and shows a rubber ball closing the inner end of the tubular plug after a reverse circulating operation;

Figure 5 is an enlarged perspective view of the tubular plug and shows the specific details thereof;

Figure 6 is an enlarged sectional view taken through the tubular plug and further shows the construction thereof; and

Figure 7 is an enlarged perspective view of the baffle plate used in conjunction with the tubular plug.

Referring now to the drawings in detail, it will be seen that there is illustrated a portion of a drill stem which is referred to in general by the reference numeral 10. The drill stem 10 includes sections 12 and 14 which are connected together by intermediate drill stem sub 16. The drill stem sub 16 is of a tubular construction and includes a wall 18 and longitudinal bore 20. The upper end of the wall 18 is provided with internal threads 22 which have meshed therewith threads 24 at the lower end of the section 12. The lower end of the wall 18 is provided with external threads 26 which are meshed with internal threads 28 at the upper end of the section 14.

The drill stem sub 16 is provided intermediate the upper and lower ends thereof with a transverse bore 30. The bore 30 extends entirely through the wall 18 so as to communicate the longitudinal bore 20 with the exterior of the drill stem sub 16. It is to be noted that the bore 30 is of the stepped type and includes an innermost threaded portion 32.

Referring now to Figures 5 and 6 in particular, it will be seen that there is illustrated a tubular plug which is referred to in general by the reference numeral 34. The tubular plug 34 includes an elongated tubular body portion 36 which has the inner end thereof closed by an end wall 38. The tubular body portion 36 is provided at its outer end with a thickened wall portion 40 which is externally threaded as at 42. The outer end of the tubular plug 34 is in the form of an enlarged hollow head 44 which communicates with the interior of the tubular body portion 36, the head 44 having a non-circular socket 46 to facilitate the engagement of the tubular plug 34 by a suitable wrench to facilitate the positioning thereof.

Referring once again to Figure 2 in particular, it will be seen that initially the tubular plug 34 is positioned within the bore 30 with a major part of the tubular body portion 36 extending within the bore 20. In fact, the tubular body portion 36 extends substantially entirely across the bore 20. The external threads 42 of the tubular plug 34 are meshed with the threaded portion 32 of the bore 30 so as to position the tubular plug 34. It is to be noted that the tubular plug 34 is recessed within the wall 18 so that the head 44 is disposed a considerable distance from the exterior surface of the wall 18.

The exterior part of the wall 18 is provided with a transverse recess 48 which is of a depth so that the bottom thereof is coplanar with the upper end of the tubular plug 34, as is best illustrated in Figure 2. The exterior part of the wall 18 is also provided with a longitudinal recess 50 which is wider than the recess 48 and shallower, as is best illustrated in Figure 2. The recesses 48 and 50 intersect

3

in alignment with the open end of the tubular plug 34 and positioned within the recess 50 is a baffle plate 52.

Referring now to Figure 7 in particular, it will be seen that the baffle plate 52 is in the form of an elongated plate which has bores 54 extending therethrough adjacent opposite ends thereof. The outer portions of the bores 54 are countersunk as at 56.

The baffle plate 52 is secured in place by a pair of fasteners 58 of the headed type. The heads of the fasteners 58 seat within the counterbores 56 so as to firmly and rigidly position the baffle plate 52. Inasmuch as the recess 50 is shallower than the recess 48, the baffle plate 52 is spaced from the open end of the tubular plug 30 for a slight distance.

The spacing of the baffle plate 52 slightly from the open end of the tubular plug 34 serves several purposes. In the first place, it prevents the plugging of the tubular plug by foreign matter, secondly, it decreases the washing tendency of the drilling mud as it drains back out of the drill stem 10 back into the oil well hole. It is to be understood that the recess 48 serves as a passage for the fluid draining from the drill stem 10.

In the operation of the present invention, the drill stem 10 is used for test purposes within the oil well. After the test is taken, the drill stem is full of oil which should be salvaged because of its value and also so that it may be measured to accurately obtain the results of the test. Because of the difference in hydrostatic pressure between the drilling mud on the outside of the drill stem 10 and the lighter oil and water on the inside of the drill stem 10, if an opening were made in the drill stem 10, the drilling mud would enter into the drill stem 10 and force the oil and water upwardly thereout of.

After the desired test has been run with the drill stem, a short length of pipe 60 is dopped into the drill stem 10. Inasmuch as the tubular plug 34 extends across the bore 20, the length of pipe 60 will strike the projecting portion of the tubular plug 34. The tubular plug 34 is formed of a frangible material and the projecting portion thereof is broken off by the pipe section 60. This immediately communicates the interior of the drill stem 10 with the exterior thereof so that the drilling mud within the oil well hole may force a reverse circulation of the oil in the drill stem 10.

If, for any reason, it is desired to again circulate oil or other fluids down through the drill stem 10, escape thereof may be prevented by means of a small rubber ball 62. It is merely necessary to drop the rubber ball 62 down into the drill stem 10 during a direct circulating operation and the ball 62 will be urged by the movement

4

of the fluids into the position illustrated in Figure 4 for closing the tubular plug 34.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

A testing device for oil wells comprising a drill stem sub having threaded fittings at opposite ends for connection to drill stem section and a longitudinal bore therethrough, a shallow longitudinal recess in the exterior of said sub, a deeper fragmentary circumferential recess in the exterior of said sub, said longitudinal recess and said circumferential recess being disposed in crossed relation, a small transverse bore through said sub generally at the intersections of said longitudinal recess and said circumferential recess, said transverse bore opening into said longitudinal bore and having an internally threaded inner portion and a counterbored outer portion, a tubular plug disposed in said transverse bore and projecting a substantial distance across said longitudinal bore, said tubular plug having an outer portion in the form of an enlarged head seated in said counterbored outer portion of said transverse bore and an externally threaded adjacent portion threadedly engaged with said internally threaded portion of said transverse bore, said tubular plug also having an inner closure wall whereby circulation of fluids through said tubular plug is normally prevented, said tubular plug being formed of a frangible material to facilitate the breaking thereof, the outer end of said tubular plug being open, and a baffle plate secured to said sub and seated in said longitudinal recess in spaced overlying relation to said tubular plug opening whereby fluids may flow through said tubular plug when broken and the entrance of foreign matter is excluded.

References Cited in the file of this patent

UNITED STATES PATENTS

1,732,791	Crowell	Oct. 22, 1929
1,873,741	Crowell	Aug. 23, 1932
1,980,942	Manning	Nov. 13, 1934
2,287,076	Zachry	June 23, 1942
2,368,419	McGivern et al.	Jan. 30, 1945
2,754,910	Derrick et al.	July 17, 1956