Aug. 2, 1960 W. E. HYDE 2,947,361

RETRIEVABLE TESTER FOR OIL WELLS

Filed July 25, 1958

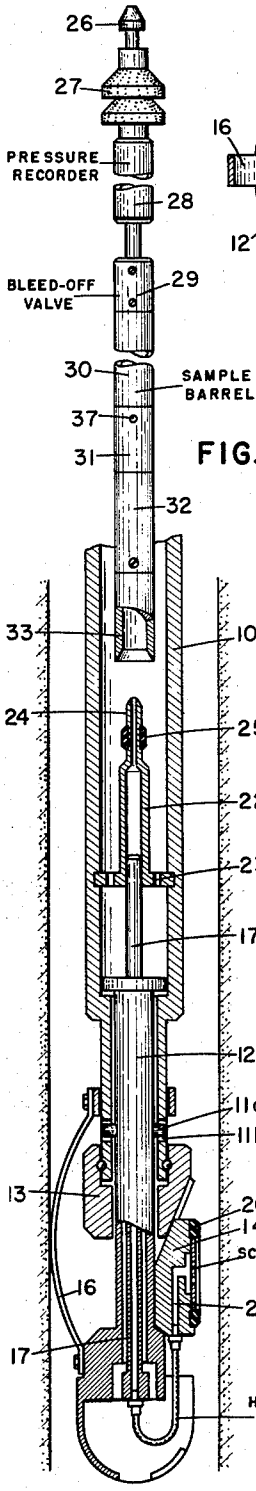


FIG. 1.

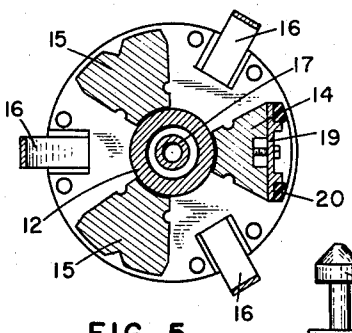


FIG. 5.

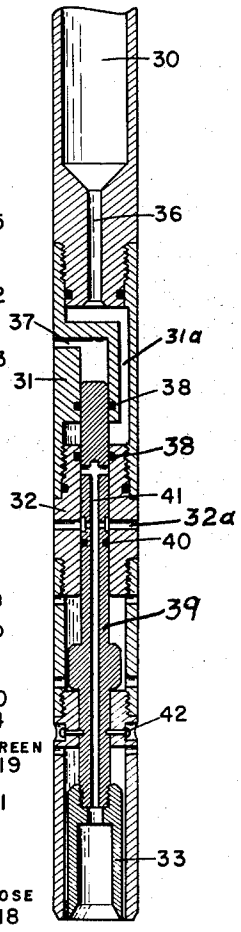


FIG. 3.

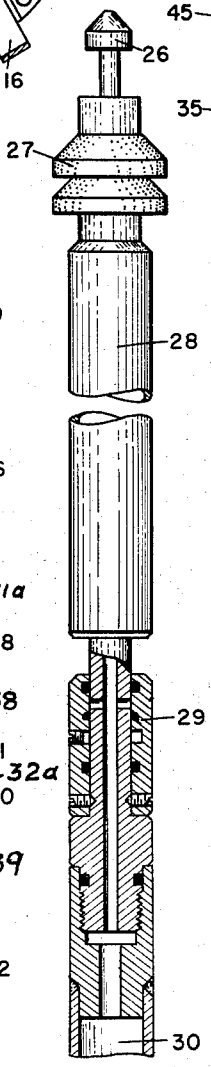


FIG. 2.

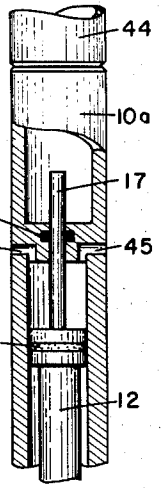


FIG. 6.

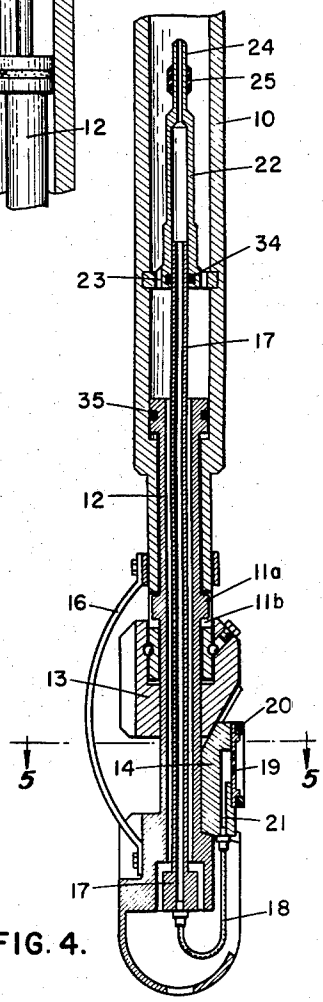


FIG. 4.

INVENTOR.
WALTER E. HYDE,
BY Earl Babcock.
ATTORNEY.

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RETRIEVABLE TESTER FOR OIL WELLS

Walter E. Hyde, Duncan, Okla., assignor to Halliburton Oil Well Cementing Company, Duncan, Okla.

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2 Claims. (Cl. 166—100)

This invention relates to testing devices for use in oil wells or the like and more particularly to an arrangement by which drill pipe may be used to selectively seal off a section of an earth formation from the well bore and then make a test of that section to determine its fluid content by the use of apparatus run down through the drill pipe and retrieved on a wire line.

The formation testing of oil wells to determine their fluid content is now a well developed art. In general, a "drill stem formation tester" must seal off a selected zone in the well bore from mud or other fluids therein and then cause flow of the fluid from that zone into the drill pipe, a valve of some kind being incorporated in the drill pipe and somehow manipulated to control the flow.

In accordance with the present invention only a small section of a selected earth formation is sealed off from the well bore. This operation of sealing off is accomplished by running a special side wall packing assembly into the well bore on the bottom of the drill pipe or operating string. After the section of the formation is sealed off, a retrievable sample barrel unit is dropped into the drill pipe, or lowered therein on a suitable wire line. The sample barrel unit is equipped with a tester valve and with means for making a connection to the sealed off section of the earth formation, so that fluid can flow from that section into the sample barrel. The arrangement is such that by fishing out the sample barrel unit, re-setting the side wall packer at different locations in the well, and again running retrievable sample barrel units, a number of tests can be made with only one round trip of the drill pipe and packer assembly.

The objects of the invention will be apparent to those skilled in the art from what has been said above and upon consideration of the following detailed description of the invention when considered in connection with the accompanying drawing, in which:

Figure 1 is a fragmentary and somewhat diagrammatic view in vertical cross section of the lower end of a drill pipe in a well bore with the elements of the present invention associated therewith;

Figure 2 is a view partly in side elevation and partly in vertical cross section of the upper portion of the retrievable sample barrel unit;

Figure 3 is a vertical cross-sectional view of the lower portion of the sample barrel unit and showing the tester valve, Figures 2 and 3 being contiguous views of this unit;

Figure 4 is a view in vertical cross section of the side wall packing assembly of Figure 1, and illustrating the construction thereof somewhat more accurately than the diagrammatic showing of Figure 1;

Figure 5 is a transverse cross-sectional view of the assembly of Figure 4, the view being taken on the line 5—5 thereof; and

Figure 6 is a fragmentary view, partly in vertical cross section, of a modified arrangement of coupling which

may be used in connection with the assembly of Figures 4 and 5.

Referring to the drawing in detail, and first to the apparatus of Figure 1, it will be seen that lower section **10** of a drill pipe is there illustrated as located in a well bore. The lower section **10** of the drill pipe is provided with a conventional J-slot **11***b* for making connection, by means of conventional pins **11***a*, to a mandrel **12** of a side wall packing device. The mandrel **12** is vertically and telescopically movable in the section **10**.

A spreader block **13** is swiveled upon the lower section **10** of the drill pipe. This spreader block has one special slip **14** and two conventional, open-hole slips **15** dovetailed to it in the conventional manner.

Drag springs **16** are secured to the mandrel **12** and to a ring slidable upon the drill pipe **10**. These drag springs are spaced in between the slips **14** and **15**, as shown in Figure 5. They serve to center the assembly, and also to prevent rotation of the mandrel **12** so that the J-slot coupling **11***a* and **11***b* can be manipulated. The mandrel **12** is hollow, and extending down through it, and some distance above it, there is a tube **17**. The lower end of this tube **17** is connected to a hose **18**. The hose **18** serves as a flexible connection between the lower end of the tube **17** and a chamber in the special slip **14**.

A screen **19** is mounted on the exposed face of the chamber **21** in the slip **14** and this is surrounded by a rubber pad or gasket **20**.

There is a slip joint coupling provided in the drill pipe **10** at the top of the tube **17**. As shown in Figures 1 and 4, this may consist of a telescoping cylinder **22** mounted on a spider **23** in the drill pipe. Since there are holes in the spider **23**, fluid can flow from the well bore up through the mandrel **12** and into the drill pipe **10** at all times.

The tip **24** of the cylinder **22** is provided with a packing **25** for making a fluid tight seal with the retrievable sample barrel unit.

As shown generally in Figure 1, and in detail in Figures 2 and 3, the sample barrel unit may be provided with a projecting fishing neck **26**. It may also be provided with flanged rubber cups **27**, such as are used on swabs, so that it may be pumped into and out of the drill pipe, if desired.

A housing **28** for a pressure recorder may be incorporated in the unit. Since the pressure recorder may be of the type generally used in connection with a drill stem tester, it will not be described here.

A bleed-off valve **29** may be provided at the top of the sample barrel **30**. The bleed-off valve may be of conventional design and is used to relieve the pressure in the barrel **30** when the barrel is disassembled after the test is completed. In the form of bleed-off valve shown in Figure 2, set screws are used to hold a sleeve in a closed position.

There may, of course, be a number of barrels **30** screwed together to form a rather long receptacle for fluid, but in the arrangement illustrated, only one has been shown.

Beneath the barrel **30**, there is a tester valve. This may be made up of two coupling members, **31** and **32**, and a socket **33**.

The socket **33** is designed to slide down over the tip **24** of the slip joint **22** and make a fluid tight connection with the packing **25**.

As shown in Figure 4, a suitable O-ring **34** may be provided in the packing assembly, so that there can be no leakage in the slip joint.

An O-ring **35** is also preferably provided between the top of the mandrel **12** and the inside of the drill pipe.

The tester valve is of the type which opens upon telescoping movement of its parts. It has a vertically ex-

tending stem 39, integral with and extending upwardly from the socket 33. There is a passage 36 from the bottom of the sample barrel 30 into a passage 31*a* in the coupling 31.

A suitable outlet 37 is provided in the coupling 31 above the top of the stem 39, so that there is no fluid lock tending to prevent movement of the stem 39 in the coupling 31.

O-rings 38 may be employed to prevent leakage around the top of the stem 39.

The stem 39 has a passageway 41 extending upwardly from its lower end and out laterally at two points near its upper end. When the parts are telescoped together, the upper lateral portion of the passageway 41 is in between the two O-rings 38 and thus makes connection with the passage 31*a*, so that fluid can then flow from the tube 17 of the packer assembly up through the slip joint 22, the socket 33, and the passage 41 into the passage 36 and the sample barrel 30. Upon the parts being returned to the position shown in Figure 3, the tester valve is closed.

When the parts are in the position of Figure 3, the lower lateral portion of the passageway 41 matches with lateral passageways 32*a* in the coupling 32 so that the socket 33 is then exposed to fluid in the drill pipe 10. Thus the socket 33 can be forced on or removed from the tip 24 of the slip joint without a fluid lock interfering.

An O-ring 40 is provided around the stem 39 to prevent fluid from entering the passage 41 through the passageway 32*a* when the tester valve is open.

To hold the parts in the position shown in Figure 3, while the sample barrel unit is being lowered into the well, shear pins 42 are provided. When the unit strikes the packer assembly, the socket 33 is first forced down over the tip 24. The pins 42 then shear, and the tester valve automatically opens. Upon lifting the fishing neck 26, the tester valve automatically closes, entrapping a sample of fluid in the barrel 30.

The manner of operation of the arrangement of Figures 1 to 5, the drill pipe 10 is run into the well bore and the slips 14 and 15 set at the desired location to pack off the chamber 21 in the slip 14. The slips are set by rotating the drill pipe to the right as it is set down. This motion of the drill pipe uncouples the J-slot connector 11*a* and 11*b* and permits the mandrel 12 to telescope up into the section 10.

The chamber 21 being thus sealed off from the fluids in the well bore by the pad 20, the taking of a sample of fluid from the packed off section of the earth formation may now be accomplished. This is done by running the sample barrel unit down through the drill pipe, either by dropping it in, or running it in on a flexible line, or pumping it down.

After the socket 33 engages the tip 24, the tester valve automatically opens, as described above. Fluid flows from the packed off section of the formation through the screen 19, the chamber 21, the hose 18, the tube 17, slip joint 22, socket 33, the tester valve and into the sample barrel 30, the latter being empty when run into the well, and sealed against the entry of well fluid by the tester valve.

The sample barrel unit may then be retrieved, and the drill pipe picked up. Upward movement of the drill pipe will automatically bring the packer assembly back into the position illustrated in Figure 4, and the whole apparatus is ready for the making of a second test.

The structure shown in Figure 6 illustrates how the packing assembly of Figures 4 and 5 might be used in connection with a conventional tester valve, i.e. one which is incorporated directly in the drill pipe and not retrievable.

Instead of causing the top of the tube 17 to make connection with a slip joint 22, as shown in Figure 4, it may extend up through the bottom of a closed coupling 10*a* which is provided with an O-ring 43, as shown in Figure 6.

The coupling 10*a* is made up with the lower end of a conventional tester valve 44 which is in turn connected with the bottom of the drill pipe (not shown in Figure 6).

Beneath the bottom of the coupling 10*a*, there are outlet passages 45 so that fluid can flow up through the mandrel 12 at all times, whether the slips 14 and 15 are set or not.

The manner of operation of the packer assembly when the arrangement of Figure 6 is incorporated with it is the same as described above, except that the tester valve will then not be opened automatically.

While only two embodiments are shown and described herein, it will be obvious that various changes may be made without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. A side wall packer assembly for use in testing oil wells or the like comprising a section of drill pipe or the like, a mandrel vertically and telescopically movable in said section of pipe, a J-slot connector coupling said mandrel to said section of pipe and adapted to hold the mandrel in fixed position in the section of pipe while the assembly is being lowered into the wells, drag means on said mandrel for preventing rotation of the mandrel in the well so that the J-slot connector can be uncoupled upon rotation of the section of drill pipe, a spreader block mounted to swivel on the section of pipe, a plurality of slips mounted on the spreader block and adapted to engage the wall of the well upon relative telescopic movement of said mandrel in said section of drill pipe, one of said slips being a special slip and provided with a chamber, a pad for sealing against the wall of the well bore to prevent well fluid from flowing into said chamber, a tube extending up through the mandrel, a flexible hose connecting the lower end of the tube to the chamber in said special slip, a cylinder fixed in said lower section of pipe, the upper end of said tube and lower end of said cylinder providing a slip joint coupling, the arrangement thus providing for the flow of fluid from the chamber into the cylinder.

2. The side wall packer assembly defined in claim 1 in combination with a retrievable sample barrel unit consisting of a sample barrel, a tester valve and a socket adapted to make fluid-tight connection with the top of said cylinder, whereby a sample of fluid flowing from the chamber into the cylinder may be entrapped in said barrel and brought out of the well.

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