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3,020,957

APPARATUS FOR REMOVING SAND FROM WELLS

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2 Sheets-Sheet 1

FIG. 1.

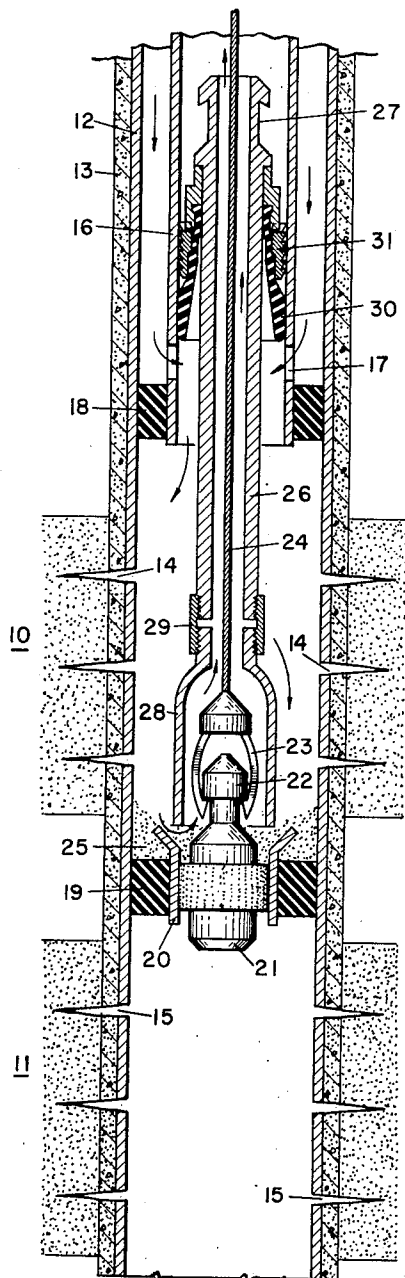


FIG. 2.

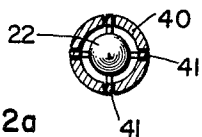
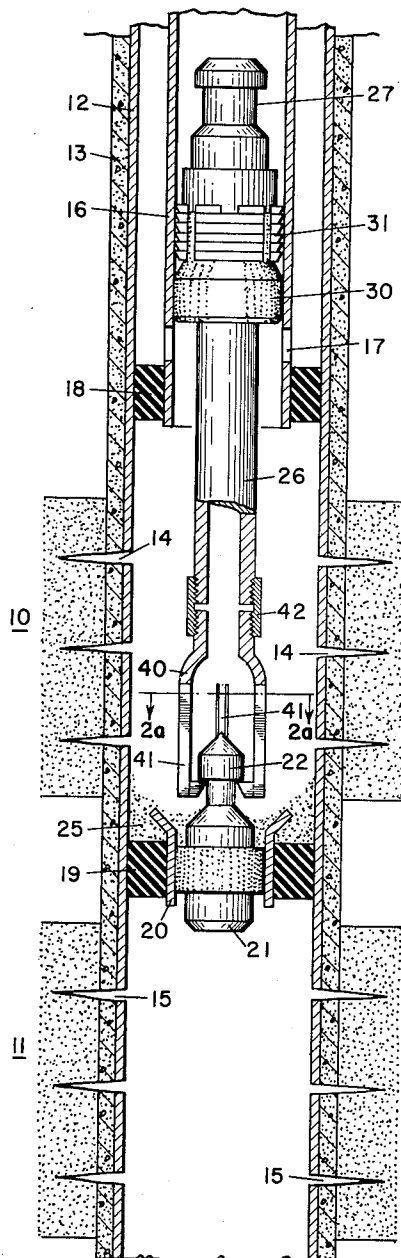


FIG. 2a

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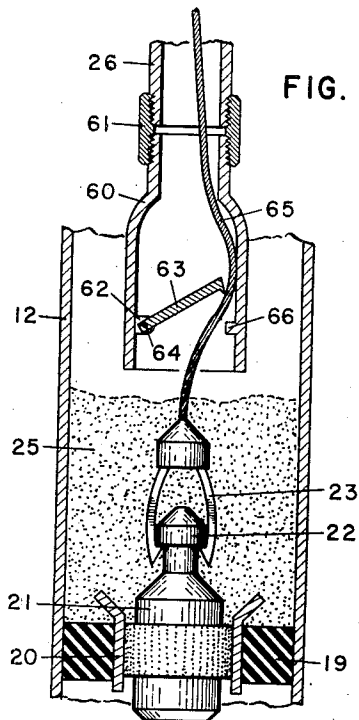
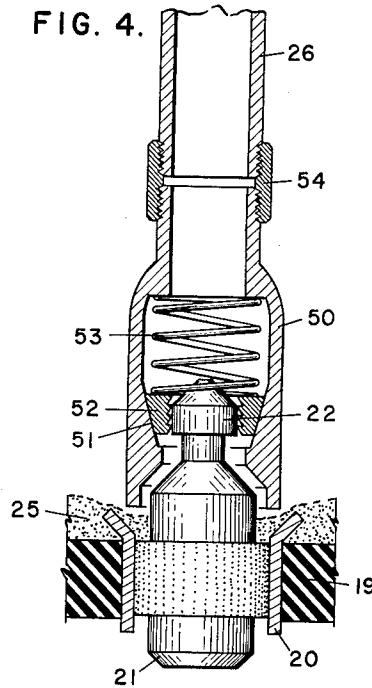
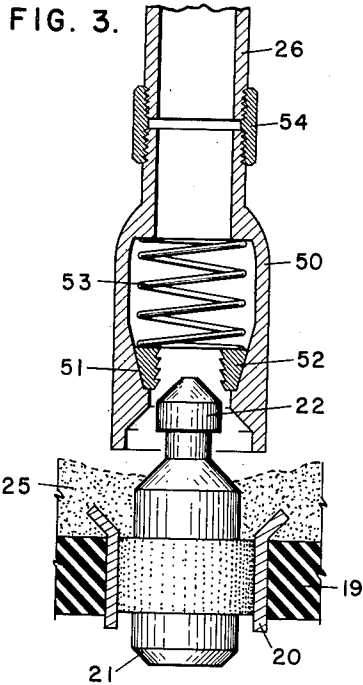
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2 Sheets-Sheet 2



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1

3,020,957 APPARATUS FOR REMOVING SAND FROM WELLS

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5 Claims. (Cl. 166-99)

This invention relates to oil and gas wells. More particularly, this invention relates to an apparatus for removing sand from oil and gas wells.

In carrying out operations in wells, it is common practice to lower and raise many different kinds of instruments into and from the wells by means of equipment operated by wireline. Often, however, the well and the tubing used for production of oil and gas becomes filled or partially filled with sand which penetrates the well and tubing from the formations traversed by the well. The penetrating sand is often so extensive as to completely cover wireline removable instruments which have been placed in the hole. Often the sand covers a portion of the wireline. When this occurs, the various instruments, including the wireline often become stuck within the well or tubing, and it is necessary to remove the sand before these instruments can be removed to the surface.

The apparatus to be described herein provides a means for removing stuck wireline operated objects and stuck wire line from wells. A tubular member is lowered down the production tubing until it rests on the sand. Circulation is then started; that is, fluid is directed down the well to remove the sand to the surface. If desired, means may be provided within the bottom portion of the tubular member to catch or latch on to the stuck wire line operated object after the sand has been removed therefrom so that the object can be removed to the surface by pulling up the tubular member.

In one embodiment of the invention, means are provided for removing as much as possible of the wire line if it is anticipated that fishing operations for the removal of the wire line and stuck object will be necessary.

Examples of wire line operated objects which may be sand-washed and removed by the present apparatus are:

- (1) Chokes used to control the rate of flow of fluids from the well,
- (2) Plugs used to cut off the flow of fluids and/or gases from a particular formation within the well,
- (3) The wire line operated hooks use to remove the plugs and chokes from the well during normal operations, and
- (4) Wire line.

The invention, as well as its many advantages, may be further understood by reference to the following detailed description and drawings, in which:

FIG. 1 is a sectional elevational view showing a method for washing sand from around a stuck plug and from around a tool which is operated by wire line;

FIG. 2 is a sectional elevational view showing an apparatus for sand-washing a plug with means provided at the lower end of the tubular member for latching onto the fishing neck of the plug so that it may be removed to the surface after the sand-washing operations;

FIG. 2a is a horizontal cross-sectional view taken along lines 2a-2a of FIG. 2;

FIGS. 3 and 4 illustrate a second apparatus for washing sand from the plug and removing it from the well after the sand has been washed; and

FIG. 5 is a sectional elevational view showing an apparatus for removing stuck wire line from the well bore.

Referring particularly to FIG. 1, a permanent-type dual completion well is shown penetrating producing formations 10 and 11. A casing 12 is shown cemented to the

2

sides of the borehole by means of cement 13. Producing formations 10 and 11 have had perforations 14 and 15 formed in the casing 12 and cement 13 to allow production of fluids and gases from the producing formations 10 and 11, respectively.

Production tubing 16 has been permanently arranged within the well with its lower end above the bottom of the well. Production tubing 16 includes therein circulation ports 17 formed at a point above a packer 18. Other spaced circulation ports may be provided in the tubing. For example, if it is anticipated that sand may extend above ports 17, a plurality of vertically spaced sets of ports may be provided in tubing 16. Thus, fluid can be circulated through the unobstructed ports. These ports are opened to permit circulation above the sand level.

A lower packer 19 is shown schematically as being expanded against the side wall of the well to separate producing formation 10 from producing formation 11. The lower packer 19 includes a plug guide means 20. A plug 21 having a fishing neck 22 is shown positioned within the plug guide means 20 and lower packer 19. Plug 21 has been placed in the lower packer 19 to permit the production of fluids from the upper formation 10 without producing from the lower formation 11.

Wire line operated devices such as plug 21 are conventionally removed from the well by means of a pulling tool 23 lowered into the well by means of a wire line 24 to hook onto the plug 21 so that it can be removed to the surface. However, it often occurs that the wire line removed objects such as plug 21 and even the pulling tools and wire lines, such as the tool 23 and wire line 24, become stuck within the well because of the penetration into the well of sand 25.

To remove the sand from the fishing neck 22 of plug 21, pulling tool 23, and the wire line 24, a tubular extension member 26 having a fishing neck 27 is shown lowered into the well until its lower end has rested upon the sand 25. Notice that the tubular member 26 is unobstructed throughout its length. This permits the tubular member 26 to be lowered down the well about the wireline 24. The inside diameter of the tubular member 26 is sufficiently large to fit around the various wireline operated devices which may be within the well. The outside diameter of the tubular member 26 is sufficiently small to be lowered down the well through the permanently-arranged tubing 16.

A bottom member 28 is connected to the lower extremity of the member 26 by means of threaded coupling 29. The bottom member 28 may be of larger inside diameter than the inside diameter of the remaining length of the tubular member 26. The lower member 28 is illustrated in the figures as being bowl shaped.

The sand is shown as being removed from around the wireline operated objects by reverse circulation. Fluid is flowed down the tubing-casing annulus, through circulation ports 17, along the outside of tubular member 26, around the bowl shaped portion 28, and up the unobstructed inside of tubular member 26 to the earth's surface. To direct the fluid along the desired path, a cup packer 30 is provided about the tubular member 26 at a point above circulation ports 17. During reverse circulation, the cup packer expands to cause slips 31 to grip the inside wall of tubing 16, thus preventing upward movement of tubular member 26. After a portion of the sand has been removed, if necessary, tubular member 26 may be lowered by stopping reverse circulation and/or applying direct circulation down tubing 16.

FIG. 2 illustrates an apparatus for not only sand washing the stuck plug 21, but also hooking on to the fishing neck 22 of plug 21 after the sand has been sufficiently removed from about the fishing neck 22. Like

3

numerals in FIG. 2 refer to like elements of FIG. 1. The bowl shaped member 40 has included at its lower extremity a plurality of flexible dogs 41. Bowl shaped member 40 is coupled to the lower portion of the tubular member 26 by means of threaded coupling 42. As the sand is removed, bowl shaped member 40 covers the neck of plug 21. After the bowl shaped member 40 has fallen sufficiently low to permit the dogs 41 to grasp the fishing neck 22 of plug 21, the tubular member 26 can be removed to the surface of the well, thus removing the plug 21 from plug guide 20 in lower packer 19.

FIGS. 3 and 4 show schematically a second embodiment for sand washing and removing wire line operated objects. The bowl shaped lower member 50 includes therein a circular protrusion 51. The upper portion of protrusion 51 tapers upwardly and outwardly. Slips 52 have outside tapering portions which mate with the tapered portions of the protrusion 51 in the bowl shaped lower member 50. Slips 52 are spring biased against the tapered portion of protrusion 51 by a coil spring 53 provided within the lower bowl shaped member 50. The lower member 50 is coupled to the tubular extension 26 by means of threaded coupling 54.

In the embodiments described in FIGS. 3 and 4, the sand is washed from about the plug 21 by reverse circulation as in the embodiments of FIGS. 1 and 2. As the sand is washed, the tubular member 26 is lowered until the fishing neck 22 of plug 21 is at a point adjacent to or above the slips 52, as shown in FIG. 4. Tubular member 26 is then raised upwardly. The raising of tubular member 26 moves the tapered portion of protrusion 51 upwardly to move the slips 52 inwardly into gripping contact with the fishing neck 22 of plug 21. The plug 21 may then be removed to the surface of the well, along with the tubular member 26.

If it is anticipated that the stuck wire line operated objects such as the pulling tool 23 cannot be removed and fishing operations will be necessary, it is possible to remove as much of the wire line as possible by means of the method and embodiment shown in FIG. 5. The bowl shaped lower member 60 is coupled to the tubular extension member 26 by means of threaded coupling 61. Bowl shaped lower member 60 has included along its inside diameter a protrusion 62. A trap door 63 is pivotally mounted to protrusion 62 by means of pivot 64. The outer extremity of trap door 63 may be sharpened.

The washing of sand from about the wire line 65 is done in a manner similar to the sand washing using the embodiments of FIGS. 1 through 4. As the tubular member 26 is lowered as the sand is removed, the wire line 65 is permitted to be encompassed by tubular member 26 because the trap door 63 pivots about pivot pin 64. The tubular member 26 may then be moved upwardly so that the sharpened point of trap door 63 is moved against a second protrusion 66 to cut the wire line at that point. The tubular member 26 may then be removed to the surface, with the wire line 65 held within the bottom portion 60 of the tubular member by the trap door 63.

Although the illustrations described herein show apparatus for sand washing or sand washing and removing a plug, the apparatus may be used to remove other wire line operated objects, such as chokes.

4

Also, although the illustrations described herein show the removal of sand from about objects located in a lower packer, it is to be understood that the apparatus may be equally as well used in sand washing and removing objects from the production tubing.

Various modifications of the apparatus described herein may be made without departing from the scope of the appended claims.

I claim:

1. An apparatus for sand washing stuck wire line operated objects from a well having a production tubing arranged in the well comprising: a tubular member of less outside diameter than the production tubing adapted to be lowered down the production tubing to rest upon the sand, said tubular member having a bottom portion of increased inside diameter to encompass the stuck object; and fluid pressure operated locking means mounted on the tubular member adapted to lockingly engage the inside of the production tubing upon application of fluid pressure whereby fluid pressure may be applied down the well and outside the production tubing and upwardly in the production tubing to operate the locking means, and also up through the tubular member and out the production tubing above the locking means whereby the sand is washed from around the stuck object.

2. An apparatus in accordance with claim 1 wherein engaging means are provided on the lower portion of said tubular member and adapted to remove the stuck object upon upward movement of the tubular member after the sand has been washed from around the stuck object.

3. An apparatus in accordance with claim 2 wherein said engaging means are flexible dogs.

4. An apparatus in accordance with claim 2 wherein said engaging means is a slip arrangement within the tubular member.

5. An apparatus in accordance with claim 1 wherein a wire line cutting and trapping member having a sharp edge is pivotally mounted to the inside of said bottom portion and a stop member is also mounted to the inside of said bottom portion to limit the downward movement of the sharp edge of the cutting and trapping member, said cutting and trapping member being of sufficient length to span said bottom portion to engage the wire line with the inside of said bottom portion so that the tubular member can be lowered down the well and about the wire line and then moved upward whereby the sharp edge of the cutting and trapping member will cut the wire line at the stop member and trap the wire line above said stop member within the tubular member.

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