United States Patent [19]

McArthur et al.

[11] **3,825,285**

[45] **July 23, 1974**

[54] **TUBING STINGER WITH HOLD DOWN RING**

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[22] Filed: **July 17, 1972**

[21] Appl. No.: **272,386**

[52] **U.S. Cl.** ..... **285/27**, 166/315, 285/137 A

[51] **Int. Cl.** **F16l 39/00**

[58] **Field of Search** ..... 166/313, 54.1, 189, 315; 285/137 A, 339, 382.7, 421, 321, 27, 334.4, 342; 403/368, 367, 409

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[57] **ABSTRACT**

Two parallel tubing strings are suspended in a well and respectively carry at their lower ends a bottom hole assembly and a stinger adapted to be stabbed into a socket in the bottom hole assembly. A hold down ring on the stinger and engageable with the wall of the socket resists withdrawal of the stinger from the socket with a force which is large compared to that required to insert the stinger into the socket. If resistance to further movement is encountered when running the stinger-equipped tubing string in, it can be readily determined whether such resistance is due to insertion of the stinger into its socket, or is due to some other obstruction. In other words, if the pull out force is high compared to the run in force experienced just before termination of tubing string movement, stabbing of the stinger into its socket was achieved, in which case the stinger is reinserted. However, if the pull out force is small, then the termination of tubing string movement was due to some other obstruction.

2 Claims, 5 Drawing Figures

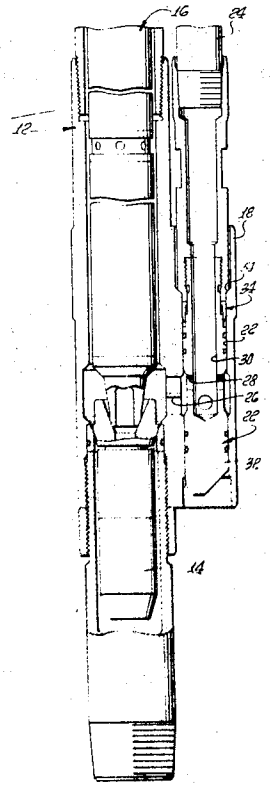


FIG. 1.

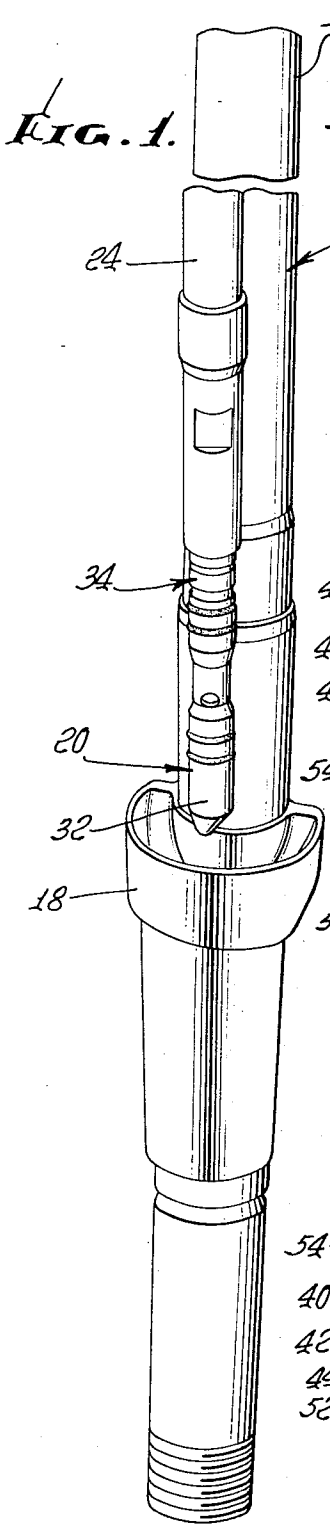


FIG. 5.

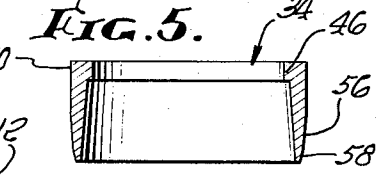


FIG. 4.

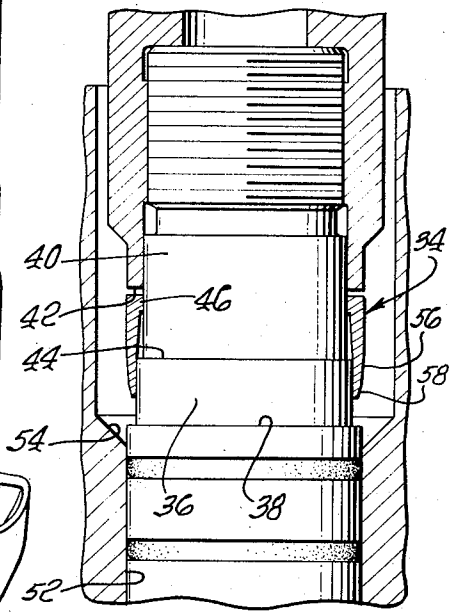


FIG. 3.

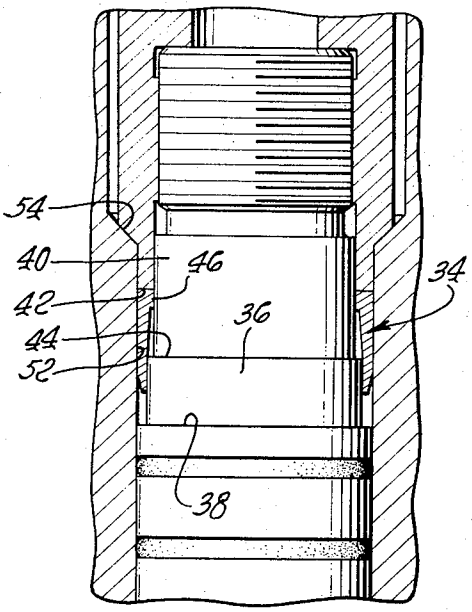
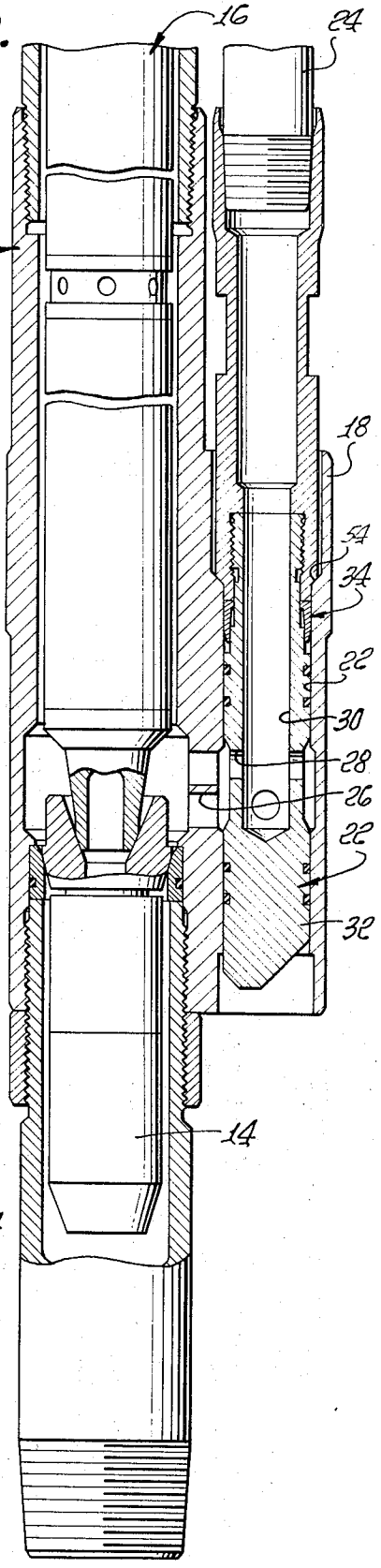


FIG. 2.



TUBING STINGER WITH HOLD DOWN RING

BACKGROUND OF INVENTION

In some fluid operated oil well pumping systems, at least two tubing strings are required, one to conduct power fluid downwardly to the fluid operated pump and the other to conduct production fluid upwardly to the surface. In the case of a closed system, wherein the power fluid and the well fluid are kept separate, a separate tubing string is required to conduct the spent power fluid upwardly to the surface.

Conventionally, a bottom hole assembly, which houses the pump, is connected to the lower end of a relatively large tubing string which is run into the well first for convenience. The bottom hole assembly is provided with an upwardly facing socket for each additional tubing string to be run in subsequently, and each additional tubing string is provided at its lower end with a stinger adapted to be stabbed into the corresponding socket to make the required fluid connection. Normally, the tubing strings are in parallel or side by side relation.

When running in such a stinger-equipped tubing string, it is frequently difficult to determine when, or whether, the stinger has been stabbed into its socket, especially in the case of a slant drilled well far enough from the vertical that the stinger may be difficult to insert into the socket with the force available from the weight of the tubing string, resisted by friction forces against both tubing and casing. More particularly, when such a tubing string cannot be displaced into the hole any further, it is difficult to determine whether this is due to bottoming of the stinger in its socket, or due to some other obstruction, such as entangled couplings on the two tubing strings, or friction, as mentioned above.

OBJECTS AND SUMMARY OF INVENTION

With the foregoing background in mind, the primary object of the present invention is to provide a way of ascertaining quickly and easily whether the stinger has been stabbed into its socket properly, or whether movement of the tubing string has been stopped by some extraneous obstruction.

More particularly, an important object of the invention is to provide means for resisting withdrawal of the stinger from its socket with a force which is large compared to that required to stab the stinger into its socket. With this construction, when further movement of the tubing string is impossible, the tubing string is pulled back a short distance, e.g., a few feet, and the force required to pull the tubing string back is compared to the run in force encountered just before stoppage of movement of the tubing string. If the pull back force is large compared to the final run in force, this is evidence that the stinger had been stabbed in properly. On the other hand, if the pull back force is not substantially larger than the run in force encountered just before stoppage, then the stoppage was due to some other obstruction, such as a coupling on the tubing string being run in hanging up on a coupling of the initially installed tubing string, or friction between the tubing string being run in and the previously installed tubing string or casing. In this event, the tubing string being run in is manipulated as required to clear the extraneous obstruction.

The invention may be summarized as including, and another important object of the invention is to provide a well tubing system which includes: a first tubing string suspended in a well; a bottom hole assembly connected to the lower end of the first tubing string; the bottom hole assembly providing an upwardly facing socket; a second tubing string suspended in the well; a stinger connected to the lower end of the second tubing string and having a free end insertable into the socket; a ring mounted on the stinger for limited axial sliding movement relative thereto and engageable with the wall of the socket; and means embodied in the ring and responsive to axial movement of the ring relative to the stinger, for resisting withdrawal of the stinger from the socket with a force which is large compared to that required to insert the stinger into the socket.

Another object is to provide a structure of the foregoing nature wherein the ring diverges internally and converges externally toward the free end of the stinger, and wherein the stinger is provided thereon with axially spaced external annular shoulders engageable by the ring to limit axial sliding movement of the ring relative to the stinger. With such a tapered ring, the force required to pull the stinger out of its socket may be several times the force required to stab the stinger in. For example, the stab in force may be of the order of 500 to 1,000 pounds, while the pull out force may be of the order of 5,000 to 10,000 pounds. Such differentials provide a clear indication of whether the stinger was properly stabbed in, or whether cessation of tubing string movement was due to some other obstruction.

The foregoing objects, advantages, features and results of the invention, together with various other objects, advantages, features and results which will be evident to those skilled in the art in the light of this disclosure, may be achieved with the exemplary embodiment of the invention illustrated in the accompanying drawing and described in detail hereinafter.

DESCRIPTION OF DRAWING

In the drawing:

FIG. 1 is a fragmentary perspective view showing a stinger of the invention about to be stabbed into its socket in a bottom hole assembly;

FIG. 2 is a vertical sectional view of the bottom hole assembly shown in FIG. 1, with the stinger stabbed into its socket;

FIG. 3 is a sectional view duplicating a portion of FIG. 2 on a larger scale and showing the stinger hold down ring of the invention in its fully inserted position;

FIG. 4 is a view similar to FIG. 3, but showing the hold down ring in its position prior to complete stabbing in of the stinger; and

FIG. 5 is a sectional view of the hold down ring alone.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF INVENTION

Referring to the drawing, shown fragmentarily therein is a main tubing string 10 which is suitably suspended in an oil well, not shown, and which has a bottom hole assembly 12 connected to its lower end. Disposed within the bottom hole assembly 12 is a standing valve 14 on which is seated a fluid operated pump 16 of the type which is capable of being circulated hydrau-

lically between its operating position in the bottom hole assembly and the surface.

The bottom hole assembly **12** is provided on one side thereof with a bowl **18** for guiding a tubing stinger **20** into an upwardly facing receptacle or socket **22.** The stinger **20** is connected to the lower end of an auxiliary tubing string **24** alongside the main tubing string **10.**

In the particular exemplary construction shown for purposes of illustration, power fluid under pressure for operating the pump **16** is delivered thereto through the main tubing string **10.** Well fluid and spent power fluid discharged by the pump **16** flow through ports **26** and **28** into an axial passage **30** in the stinger **20,** and thence upwardly to the surface through the auxiliary tubing string **24.**

As is well known, the pump **16** is circulated in by introducing power fluid into the tubing string **10** thereabove. The pump **16** is circulated out by introducing power fluid under pressure into the auxiliary tubing string **24,** such fluid flowing through the passage **30** and the ports **28** and **26** to displace the pump upwardly through the tubing string **10** to the surface.

It will be understood that the foregoing is an exemplary installation only to illustrate the present invention as embodied in the stinger **20.** Obviously, the invention may be embodied in stingers in other tubing systems than the one specifically illustrated.

Carried by and encircling the stinger **20** above its lower or free end **32** is a stinger hold down ring **34** of the invention. The ring **34** is slidable on a reduced diameter portion **36** of the stinger **20,** which reduced diameter portion terminates at its lower end in an upwardly facing, external annular shoulder **38.** Above the reduced diameter portion **36** is a further reduced diameter portion **40** bounded at its upper and lower ends by external annular shoulders **42** and **44** on the stinger **20.** The ring **34** is provided at its upper end with an internal annular flange **46** slidable on the reduced diameter portion **40.**

The ring **34** is provided adjacent its upper end with an external cylindrical surface **50** which makes an interference fit with the cylindrical wall **52** of the socket **22** below an annular stinger seat **54** within the socket.

The ring **34** is provided below the cylindrical external surface **50** with a tapered external surface **56** converging downwardly toward the free end **32** of the stinger **20.** The angle of this taper is of the order of ½°.

The tapered external surface **56** terminates in a beveled surface **58** also converging downwardly toward the free end of the stinger **20.** This bevel angle may be of the order of 15°.

Internally, the ring **34** diverges downwardly toward the free end of the stinger **20.** The included angle of the tapered internal surface of the ring **34** may be of the order of 1½° and is exaggerated in the drawing.

It will be noted that insertion of the ring **34** results from engagement of the annular shoulder **42** with the upper end thereof, as shown in FIG. **3.** In the construction illustrated, withdrawal results from engagement of the annular shoulder **44** with the lower end of the ring **34.**

With the foregoing construction, the force required to insert the ring **34** into the cylindrical portion **52** of the socket **22,** which inserted condition is shown in FIGS. **2** and **3,** is much less than the force required for withdrawal, this result being due to the hereinbefore-described configurations of the internal and external surfaces of the ring. For example, the stab in force may be of the order of 500 to 1,000 pounds, while the force required to pull the stinger **20** out may range from 5,000 to 10,000 pounds, or more.

Consequently, when running the auxiliary tubing **24** in, it is a simple matter to determine whether cessation of downward movement of the tubing string means that the stinger **20** has been stabbed in, or whether some other obstruction has been encountered. All that is necessary is to pull the tubing string **24** upwardly a short distance and measure the force required to do this. If this upward force is large compared to the downward force just before termination of downward movement of the tubing string **24,** then stabbing in of the stinger was achieved, and the stinger can be reinserted. Otherwise, some other obstruction was responsible for the termination of downward movement of the tubing string **24,** and manipulation of the tubing string is necessary to clear such other obstruction.

Thus, the present invention provides a very simple way of determining whether stabbing in of the stinger has been achieved, which is an important feature of the invention.

Another important feature is that the hold down ring **34** resists stinger pull out when the tubing string **10** stretches due to a head of fluid therein, or due to a head of fluid plus pressurization.

For convenience, the invetnion has been disclosed herein in connection with a hydraulic oil well pumping system, but is not limited thereto. Also, the invention is not limited to a parallel tubing system, but may be used in a concentric one as well.

Although an exemplary embodiment of the invention has been disclosed for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the claims appearing hereinafter.

We claim as our invention:

1. In a well tubing sytem, or the like, the combination of:

a. a first tubing string suspended in a well;

b. a bottom hole assembly connected to the lower end of said first tubing string;

c. said bottom hole assembly providing an upwardly facing socket having an internal cylindrical wall;

d. a second tubing string suspended in the well;

e. a stinger connected to the lower end of said second tubing string and having a free end insertable into said socket, said stinger having an external cylindrical wall portion of less diameter than said internal cylindrical wall;

f. a circumferentially continuous ring mounted on said stinger for limited axial sliding movement relative thereto and engageable with the wall of said socket said ring diverges internally and converges externally toward said free end of said stinger, said stinger is provided thereon with axially spaced external annular shoulders engageable by said ring to limit axial sliding movement of said ring relative to said stinger, said ring in the assembled position being pressed into the space between said internal cylindrical wall and the external cylindrical wall portion; and

g. means embodied in said ring and responsive to axial movement of said ring relative to said stinger, for resisting withdrawal of said stinger from said socket with a force which is large compared to that required to insert said stinger into said socket.

2. A system as set forth in claim **1** wherein said tubing strings are side by side.

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