

[54] **OVERSIZE SUBSURFACE TUBING PUMP
INSTALLATION AND METHOD OF
RETRIEVING THE PUMP**

3,461,958 8/1969 Brown..... 166/315 X

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[57] **ABSTRACT**

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An oversize subsurface tubing pump installation and method of retrieving the pump from a well. Both the pump barrel and plunger are too large to pass through the tubing. When the pump is to be retrieved, the sucker rods are raised and lift the seating assembly to expose a drain hole in the seating nipple. Fluid drains from the tubing through the exposed drain hole. Continued raising of the sucker rods breaks the connection between the sucker rods and pump plunger. The sucker rods and then the tubing and pump are pulled from the well. Draining the tubing prevents spillage at the top of the well.

[52] U.S. Cl. **166/315**

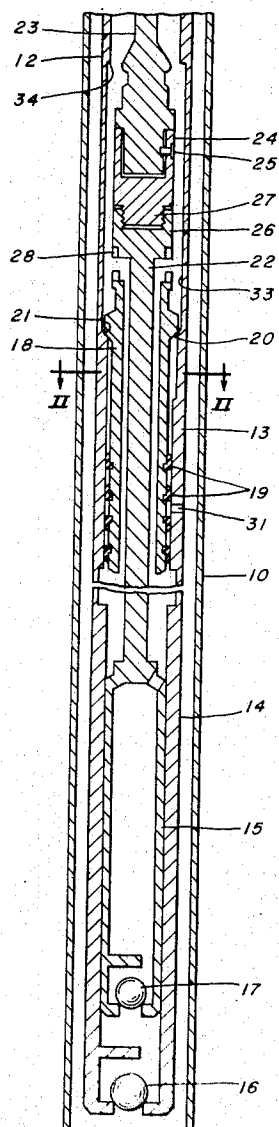
[51] Int. Cl. **E21b 33/00**

[58] Field of Search 166/315, 117.7, 297, 298

[56] **References Cited**
UNITED STATES PATENTS

3,712,376 1/1973 Owen et al..... 166/315 X

8 Claims, 5 Drawing Figures



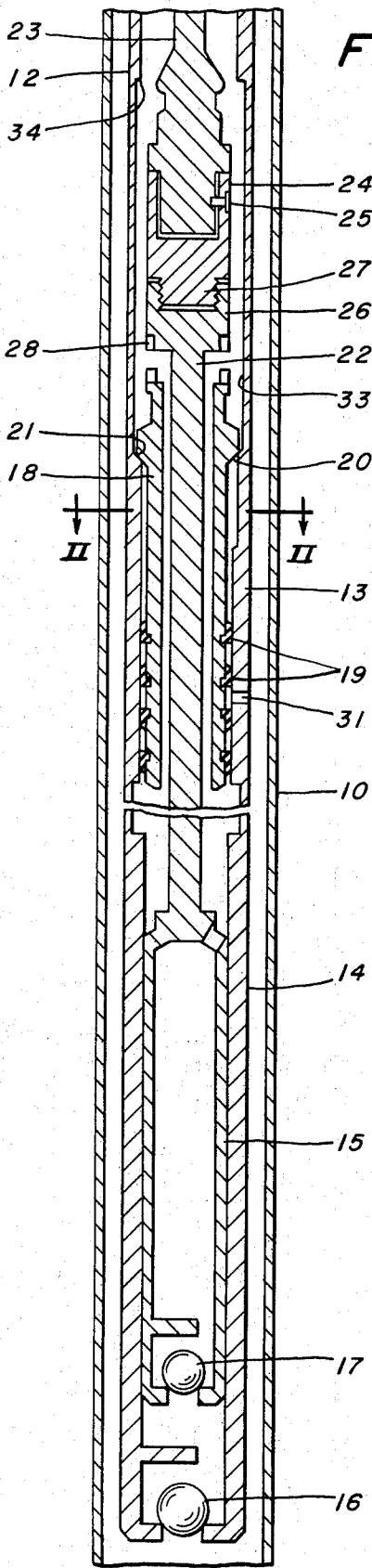


FIG. 1.

FIG. 5.

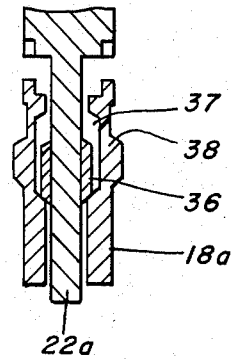


FIG. 2.

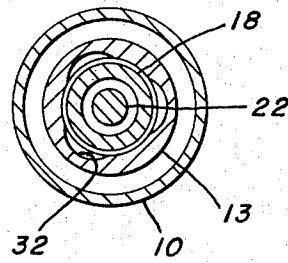


FIG. 4.

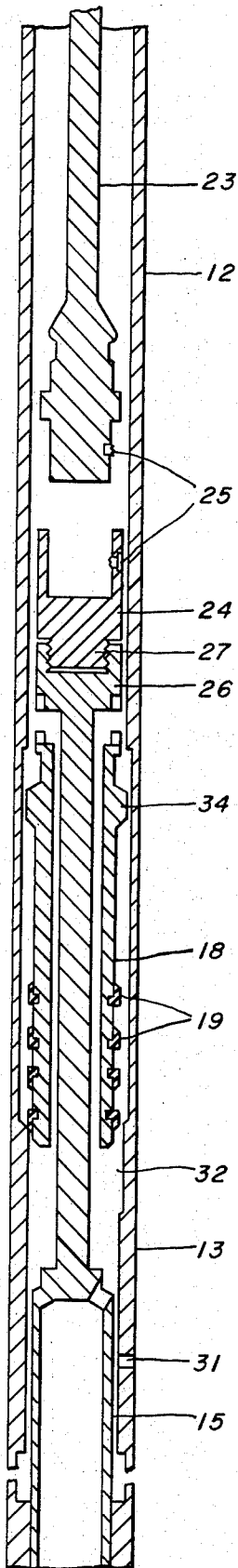
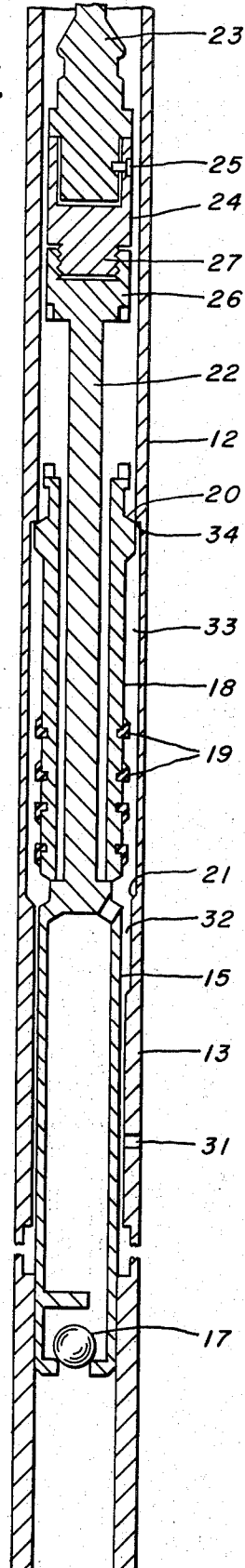


FIG. 3.



OVERSIZE SUBSURFACE TUBING PUMP INSTALLATION AND METHOD OF RETRIEVING THE PUMP

This invention relates to an improved oversize subsurface tubing pump installation and to a method of retrieving an oversize pump from a well.

An oversize subsurface pump is a pump of a diameter too large for either its barrel or its plunger to pass through the tubing as it is retrieved from a well. Such pumps are popular in some oil fields, particularly in Canada, for obtaining large capacity. To retrieve the pump from the well, it is necessary first to disconnect the sucker rods from the pump plunger and pull the sucker rods, and subsequently to pull the tubing. Heretofore such pumps have lacked any way of draining the tubing of fluid prior to pulling it from the well, with the result that a considerable spillage of fluid occurs at the top of the well whenever the tubing is pulled. Another difficulty is that the traveling assembly is located as close as possible to the bottom for best efficiency, but because of friction or changing loads, the sucker rods occasionally stroke too far and the plunger damages parts at the bottom of the pump.

An object of my invention is to provide an improved oversize pump installation and method of retrieving the pump in which I overcome the foregoing difficulties, that is, in which the tubing drains automatically before it is pulled.

A further object is to provide an improved oversize pump, the parts of which are proportioned so that less vulnerable parts at the top of the pump receive the blow whenever the sucker rods stroke too far.

A more specific object is to provide an improved oversize pump which is proportioned to avoid damage to parts at the bottom and in which the seating nipple has at least one normally closed drain hole automatically opened whenever the sucker rods are pulled.

In the drawing:

FIG. 1 is a diagrammatic vertical sectional view of my improved pump installation with the parts seated for normal operation;

FIG. 2 is a horizontal section on line II—II of FIG. 1;

FIG. 3 is a view similar to FIG. 1, but showing the seating assembly of the pump unseated as the sucker rods are being pulled;

FIG. 4 is another similar view, but showing the pump dropping back after the sucker rods are disconnected from the pump plunger; and

FIG. 5 is a fragmentary vertical sectional view showing a modification.

FIG. 1 shows the lower portion of a well which contains a conventional casing 10 and tubing 12 inside the casing. A seating nipple 13 is connected at its upper end to the lower end of the tubing. A pump barrel 14, which contains a reciprocable plunger 15, is connected at its upper end to the lower end of the seating nipple. The barrel and plunger have conventional standing and traveling valves 16 and 17 respectively. In the interest of simplicity, the various couplings used to join these parts are omitted from the diagrammatic showing. The barrel and plunger are oversize and both are too large to pass through the tubing. The seating nipple 13 contains a relatively short tubular seating assembly 18, which includes a series of vertically spaced elastomer sealing rings 19 around its outer circumference. These rings contact the inside face of the seating nipple and

normally prevent leakage of fluid between the seating assembly and seating nipple. The seating assembly also has an external shoulder 20 which is located near its upper end and seats on an external shoulder 21 of the seating nipple.

The upper end of the plunger 15 has a stem 22 which extends through the seating assembly 18 into the lower portion of tubing 12, where it is connected to a string of conventional sucker rods 23. The connection includes an adapter 24 attached to the lower end of the sucker rod string with a shear pin 25. The upper end of stem 22 carries an enlarged cup 26, and the lower end of the adapter 24 has a projection 27 received in the cup with a quarter-turn interrupted thread connection. The upper end of the seating assembly 18 and the bottom of cup 26 have interengageable clutch elements 28. When the pump is installed in the well, the tubing 12 is lowered with the seating nipple 13, pump barrel 14, pump plunger 15 and seating assembly 18 all in place, as shown in FIG. 1, but with the clutch elements 28 engaged. Subsequently the sucker rods 23 are lowered with the adapter 24 attached. The projection 27 enters cup 26. The sucker rods are rotated a quarter turn to effect a connection between the adapter and cup, while the clutch elements 28 prevent the cup and parts attached thereto from rotating.

An important feature of my invention is that the seating nipple 13 has one or more drain holes 31 and one or more by-pass slots 32 (FIG. 2) which extend downwardly from its shoulder 21 but terminate a substantial distance above the drain holes. As FIG. 1 shows, when the pump is seated for normal operation, the seating assembly 18 is located with various of its elastomer rings 19 contacting the inside face of the seating nipple 13 both above and below the drain holes 31. There is no communication between the by-pass slots 32 and the drain holes. Consequently well fluid cannot escape from the pump through the drain holes.

When I retrieve the pump from the well, I first raise the sucker rod string 23 above the upper limit which it reaches during an upstroke. The plunger 15 abuts the seating assembly 18 and lifts the seating assembly into a chamber 33 formed in the tubing 12 above the seating nipple 13 into an abutting relation with an internal shoulder 34 at the top of the chamber 33, as FIG. 3 shows. The drain holes 31 are now exposed and well fluid commences to drain from the tubing. I continue to pull the sucker rods, whereupon the shear pin 25 breaks, as FIG. 4 shows. The pump plunger 15 and seating assembly 18 drop back to the bottom of chamber 33, where the lowermost elastomer ring 19 abuts the shoulder 21 of the seating nipple 13 and prevents the seating assembly from re-entering the seating nipple. Well fluid continues to drain from the tubing via the by-pass slots 32 and drain holes 31. Thereafter I pull the sucker rod string completely from the well and subsequently pull the tubing and thus retrieve the pump.

The parts are proportioned so that the clutch elements 28 collide if the sucker rods 23 stroke too far. These clutch elements are used only when the pump is installed. Consequently, if they are damaged during operation of the pump, no harm is done and they are readily replaced when the pump is retrieved from the well. If the plunger and standing valve collide, either or both the traveling and standing valves can be damaged.

FIG. 5 shows a modification in which the stem 22a carries a poppet valve 36, and the upper end of the seating assembly 18a has a valve chamber 37 and discharge port 38. This arrangement takes the fluid load off the traveling valve in the plunger during the downstroke and improves efficiency.

From the foregoing description it is seen that my invention affords a simple oversize pump construction and retrieving method which facilitate the retrieving operation by assuring that the tubing is drained of well fluid before the pump is retrieved. I am aware that it is known to drain tubing before retrieving smaller diameter pumps, the plungers of which can be pulled through the tubing, as shown for example in Bloudoff U.S. Pat. No. 3,267,872. Nevertheless I believe it is novel and unobvious to drain the tubing of an oversize pump, the plunger of which is too large to pass through the tubing.

I claim:

1. In an oversize subsurface pump installation which comprises a tubing, a seating nipple connected to the lower end of said tubing, a pump barrel connected to the lower end of said seating nipple, a plunger within said barrel, a seating assembly within said seating nipple and including a series of vertically spaced sealing rings around its circumference, a stem carried by said plunger and extending through said seating assembly, and a sucker rod string connected to said stem, both said barrel and said plunger being too large to pass through said tubing, the improvement in which said seating nipple has at least one drain hole, said sealing rings normally contact the inside face of said seating nipple both above and below said drain hole and prevent discharge of fluid therethrough, said seating assembly is movable to expose said drain hole and thereby drain the tubing when said pump barrel and plunger are to be retrieved.

2. An installation as defined in claim 1 in which said plunger is engageable with said seating assembly when

raised above its normal stroke level to lift said seating assembly above said drain hole and expose said drain hole.

3. An installation as defined in claim 2 including means for disconnecting said sucker rod string from said stem when said sucker rod string is raised.

4. An installation as defined in claim 3 including a cup on the upper end of said stem, an adapter on the lower end of said sucker rod string to be received in said cup and attached thereto on relative rotation, and a clutch connection between said cup and said seating assembly.

5. An installation as defined in claim 4 in which the means for disconnecting said sucker rod string from said stem includes a shear pin between said sucker rod string and said adapter.

6. An installation as defined in claim 1 in which the dimensions are proportioned so that said stem and said seating assembly collide whenever said sucker rods travel too far on a downstroke.

7. An installation as defined in claim 1 in which said seating nipple has at least one by-pass slot, at least one of said sealing rings normally contacting said seating nipple between said slot and said drain hole, but permitting communication therebetween when said seating assembly is moved to expose said drain hole.

8. In the operation of an oversize subsurface tubing pump, which has a barrel and plunger of a size too large to pass through the tubing, a method of retrieving said pump from a well, said method comprising exposing a drain hole located between said pump and said tubing when the sucker rods which operate the pump are raised above the upper limit which they reach during an upstroke and thereby draining the tubing through said drain hole, breaking the connection between the sucker rods and pump on continued raising of said sucker rods, and thereafter pulling said tubing and pump.

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