June 24, 1941. C. D. WAGNER 2,247,325

CASING PUMP ASSEMBLY

Filed Aug. 5, 1940

Fig. 1.

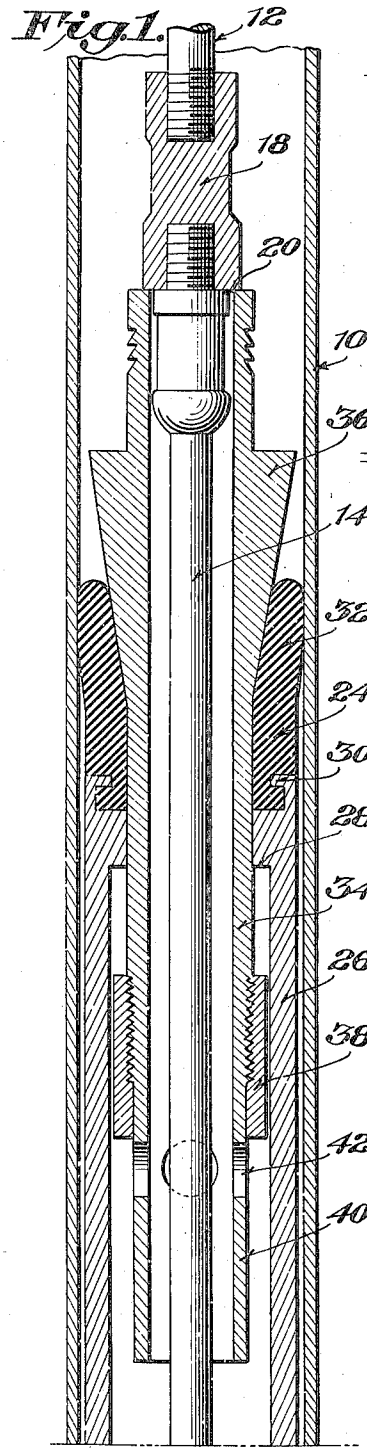


Fig. 1a.

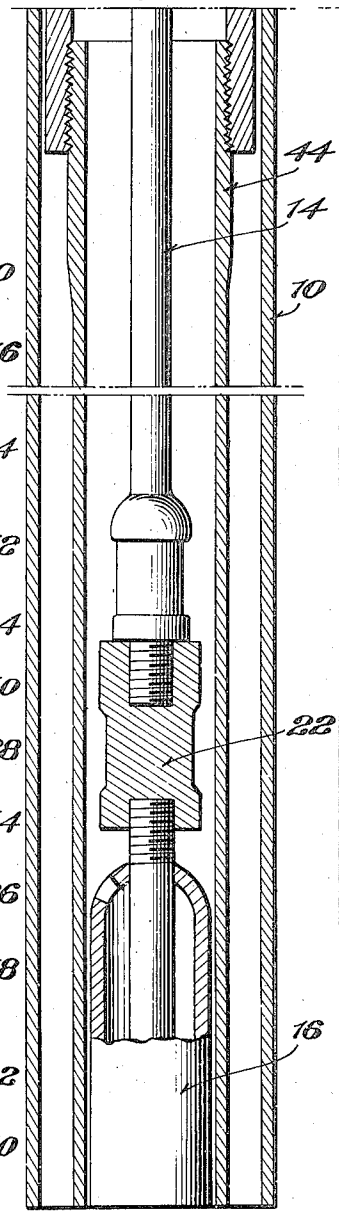
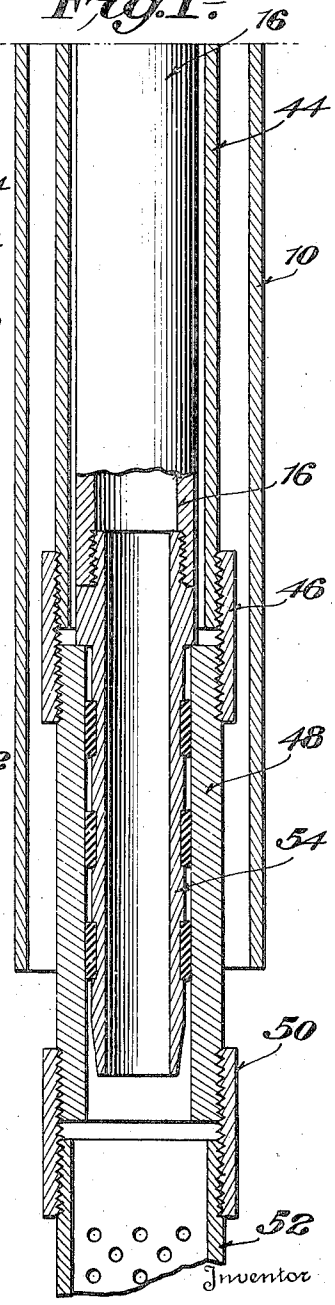


Fig. 1b.



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CASING PUMP ASSEMBLY

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5 Claims. (Cl. 103—219)

The present invention relates to the operation of pumping equipment in deep wells and is particularly concerned with unitary pumping assembly construction adapted to be lowered to position within the well and there operated to lift fluid to a higher elevation.

The present invention more particularly contemplates the provision of a pump assembly of the type adapted to interengage with the walls of the well casing to fixedly locate the pump therein. I have found that in constructions of this class with which I am familiar the pumping elements have been hitherto combined in a unitary specialized combination with the necessary casing engaging parts forming a rather complex, costly construction, and one which becomes unserviceable as a unit when any of the parts thereof require replacement or repair.

It is accordingly an important object of the present invention to provide an improved casing pump assembly capable of use with conventional insert pumps and the invention is of particular advantage in that it substitutes for the prior costly replacement assemblies a relatively inexpensive and simple construction which converts the insert pump with a minimum investment.

A further object of the present invention contemplates the provision of a casing pump assembly adapted to locate the pump in a casing so that conventional insert pumps may be substituted if necessary or desirable.

The present invention contemplates the provision of a casing pump assembly as above constructed to facilitate insertion and removal within the pump casing in accordance with improved principles. The substantial fluid pressures sometimes existing in deep wells and the accumulation of sediment frequently contribute difficulties inherent in releasing devices of the present class from their interengagement with the casing walls. Thus, as understood by those skilled in the art, where a high fluid pressure is exerted against the upper portion of the pump construction due to the elevated column of fluid standing in the well, great difficulty has frequently been heretofore experienced in releasing and raising the device for withdrawal, the resulting forces in some instances creating a resistance beyond the lifting ability of the lifting equipment. I am aware that it has been attempted to obviate this difficulty by the provision of selectively actuable valves of various construction and located at various points for releasing the foregoing pressure. Such valve constructions, however, are subject to failure, particularly under the severe conditions of service prevailing in an oil well, for example and in view of the accumulation of sand, sediment, and other solid material. In the relatively complex constructions heretofore available, the foregoing sediment accumulations may tend to clog and pack about the assembly and in many instances, the release of the pressure head in accordance with the foregoing actually contributes to this undesirable tendency. In other words, the initial release of the standing column of fluid occurs in such a manner as to stir sediment and convey it directly into the pump assembly.

It is accordingly an important object of the present invention to obviate the foregoing by providing a casing pump assembly for cooperation with an insert pump as above wherein the assembly is subject to the fluid pressure of the standing oil only when the insert pump is disposed within its seating nipple and wherein sepation of the pump results in release of the fluid. In other words, the present invention contemplates a construction as above wherein the insert pump is adapted to function in its conventional manner to create and release fluid pressure while the casing pump support construction cooperates therewith merely to provide an anchor for the pump.

It is accordingly an important object of the present invention to provide a cooperating casing pump support construction as above which is per se free from any means capable of maintaining standing pressure within the well casing and accordingly capable of cooperation with the well casing independent of any forces resulting from such pressures.

Another important object of the present invention comprises the provision of a cooperating casing pump assembly as above adapted, upon release of the insert pump, to direct fluid downwardly about the pump valves to wash sediment and solid material reversely into the well bed to the end that the parts are cleansed and freed from solid matter prior to removal.

Other and further objects of the invention will be apparent from a consideration of the following drawing, wherein:

Figures 1, 1*a* and 1*b* are vertical sectional views taken centrally through a well casing containing a casing pump assembly embodying the principles of the present invention. It will be seen that the three views comprise successively underlying sections which, when arranged in continuous longitudinal disposition, exemplify the arrangement

of the parts within the casing just during arrangement in final operative position.

Referring now more particularly to the figures of the drawing, wherein the one illustrative embodiment of the invention is shown for the purpose of exemplifying the details of the invention, the numeral 10 represents a well casing which, in the present instanace may be considered as forming a part of an oil well extending into oil bearing strata. A sucker or pump rod 12 is disposed centrally of the casing 10 and bears at its lower end an extension or auxiliary sucker rod 14 extending downwardly for actuation of an insert pump 16. Since the insert pump is of conventional construction, the details thereof will not be described in the present specification and it will be understood that various conventional equivalent pumps may be substituted in the present relationship. The pump 16 illustrated more or less diagrammatically is of the conventional type adapted to receive oil at its lower portion from the vicinity of the hold-down and eject it adjacent the top to the space about the rod 14. It will be seen that in the present embodiment the pump is of a type wherein the barrel is rigid with the hold-down and therefore fully anchored or seated when the hold-down is received by a seating nipple. On the other hand, it will be appreciated that conventional insert pumps include variations wherein other portions of the pump are adapted to be anchored or seated by a seating nipple for permitting relative reciprocation of associated parts to produce a pumping action. It should be particularly noted that the main sucker rod 12 and the auxiliary sucker rod 14 are joined by a nipple or coupling 18 providing radially or laterally projecting annular shoulder portions 20 for a purpose which will hereinafter appear more in detail. A second nipple or coupling 22 rigidly joins the auxiliary sucker rod 14 to the insert pump.

In accordance with the present invention, the pump is operatively located or anchored within the casing by virtue of a cooperating casing pump supporting construction or assembly illustrated generally by the reference numeral 24 and comprising an outer sleeve 26 of cylindrical worm adapted to fit within the casing with substantial clearance as illustrated in Figure 1. The upper portion of the sleeve is internally shouldered as at 28 and bears at its upper extremity an interlocking configuration 30 for axial interengagement with an annular resilient packing collar 32. The packing collar may be formed of rubber, although it is preferred to employ some equivalent oil resistant product such as neoprene in the case of petroleum wells.

Internally and coaxially of the sleeve 26 is disposed a cylindrical seating mandrel 34 outwardly tapered at its upper portion 36 and accordingly adapted to expand the resilient collar 32 forcefully against the well casing when shifted axially thereto as will be apparent from a consideration of Figure 1. An annular collar or lock nut 38 threadedly engaged with a lower portion of the sleeve 34 coacts with the shoulder 38 to prevent separation of the sleeve of the mandrel while permitting limited relative axial movement to facilitate expansion or retraction of the resilient packing 32. Particular attention is directed to the fact that the mandrel sleeve 34 terminates in a free lower extremity. In short, it is important to note that the mandrel is free from rigid connection with the pump or any portion thereof. It is further of important significance to note that the mandrel is centrally apertured to accommodate the sucker rod and leave a longitudinal passage of adequate proportions therealong. In other words, the pump supporting assembly provides at all times a free passage for the fluid standing in the casing, and thus does not of itself tend to create and maintain fluid heads tending to resist its manipulation within the casing. To this end, it should be further noted that the lower portion of the mandrel sleeve 34 extends downwardly below the lock nut as at 40 and is apertured in a plurality of points 42 to maintain the foregoing function even though the lower end of the sleeve might become closed as will hereinafter more fully appear.

Referring to Figures 1*a* and 1*b*, it will be seen that the lower extremity of the sleeve 26 threadedly engages a length of tubing 44 extending downwardly about the insert pump 16 and coupled at its lower extremity by means of a coupling 46 to a seating nipple 48. The lower end of the seating nipple terminates in an anchor comprising a coupling 50 receiving fluid from the appropriate fluid bearing strata.

Attention is particularly directed to the fact that the insert pump comprises a cup hold-down construction at its lower extremity as shown in detail in Figure 1*b* and represented by the reference numeral 54. While the cup hold-down, as shown in the figure, is disposed just above the seating nipple prior to interassociation, it will be readily understood by those skilled in the art that further downward movement will result in operative interassociation of these parts, as represented in the figure.

From the foregoing it will be seen that the parts, when assembled as shown, are axially interengaged in such a manner that they may be suspended from the sucker rod 12. That is to say, when so suspended, the mandrel sleeve 34 may rest upon the upper extremity of the coupling 22 and be supported thereby, the outer sleeve 26 gravitating downwardlly so that its shoulder rests upon and is supported by the collar or nut 38. Accordingly, therefore, the pump enclosing tube 44 and the associated seating nipple and other anchor portions are similarly suspended. Thus arranged, the entire assembly may be lowered downwardly into a well of any desired depth. At completion of descent, the anchor portions and, accordingly, the tube 44 and the sleeve 26 rest upon the floor of the well, while the internal parts of the assembly continue to shift relatively downwardly. During this movement, it will be apparent that the tapered portion 36 of the mandrel gravitates into the collar 32 to expand the collar against the casing wall. Further downward movement of the sucker rod permits the cup hold-down 54 to enter the seating nipple 48 for operative interengagement therewith. When so engaged, a portion of the pump is anchored, seated and held immovable by virtue of its rigid connection with the cup hold-down 48 thus permitting associated parts of the pump to be reciprocated by action of the pump rod 14 for resulting in a pumping action.

It is preferred that the auxiliary sucker rod 14 be of such length as to permit the upper coupling 18 to approach into engagement with the upper extremity of the mandrel so that a

slight bump or other suitable application of force along the pump rod 12 will suffice to additionally drive the mandrel into the resilient collar 32, assuring the desired forceful frictional compression against the casing wall.

It will be apparent from the foregoing that with the parts thus arranged the pump supporting assembly is rigidly associated with the well casing and serves to anchor the insert pump in operative position. Accordingly, reciprocation of the sucker rod 32 will serve to actuate the pump piston through a predetermined reciprocatory path to force the fluid entering the perforated nipple upwardly through the tubing 48, the mandrel 34, and thence to the surface. When it becomes desirable to remove the pump and associated construction from the well, the sucker rod 14 is merely drawn upwardly beyond its normal path of reciprocation, ultimately withdrawing the cup hold-down from the seating nipple and bringing the upper extremity of the lower coupling 22 into engagement with the lower extremity of the mandrel. It is of particular importance to note that, with the removal of the cup hold-down from the seating nipple, any column of fluid standing in the well is released and from this point on the pump supporting and mounting assembly is completely free from any fluid pressure tending to resist manipulation thereof. In other words, adequate passages immediately provide communication throughout the full length of the well, wherefore the mandrel remains in interengagement with the resilient packing collar solely by virtue of its frictional engagement therewith. So also it will be evident that the release of the foregoing column of fluid results in a downward or reverse flow of liquid through these passages, which cleanses and flushes the entire construction including the pump and valves.

As the pump rod is progressively moved upwardly, therefore, the lower coupling 22 when coming into engagement with the lower extremity of the mandrel, readily shifts the mandrel upwardly, releasing the collar 32 from engagement with the casing wall, and permitting the outer sleeve and the associated anchoring parts to be brought to the surface.

The present invention provides a simplified construction contributing to economical large scale well operation and which, by virtue of its simplified construction, is practically incapable of failure or improper operation. In short, the present invention, in obviating the use of remotely operable pressure relief valves, in this respect, eliminates parts inherently susceptible to failure. The present invention, moreover, requires no special pumping equipment other than conventional insert pumps and the operative assembly of the pump may be readily and expeditiously effected by anyone skilled in the art. It is to be noted, moreover, that the fluid pressure differential is maintained solely by virtue of the insert pump construction and its association with the seating nipple, wherefore the pump anchoring and supporting assembly per se is not adapted to maintain fluid pressures resisting its operation. On the other hand, it must be remembered that with the insert pump in operative relationship, the fluid pressure head existing in the well is rendered available to effectively maintain the seating mandrel in operative position and the resilient collar 32 in locking engagement with the well casing. As the result, therefore, the present invention takes full advantage of the pressure head during pumping, while obviating this factor as an influence which heretofore has seriously limited the use of the present type of construction.

Obviously, the invention is not limited to the specific structural arrangement disclosed herein but is capable of other modifications and changes without departing from the spirit and scope of the present invention.

I claim:

1. A casing pump assembly for mounting an insert pump of the type having hold-down portions adapted to be operatively and releasably received by a seating means, a tubular member forming a closed casing adapted to receive said insert pump freely therein, said tubular member having disposed therewithin a seating means adapted to receive said hold-down portions of the insert pump to seat and to hold said insert pump operatively within said tubular casing during pumping, resilient means mounted on said tubular casing and adapted to expand into sealing and gripping engagement with the walls of a well, an actuating means disposed for longitudinal movement interiorly of said resilient means and operative to expand said resilient means into said gripping engagement, said actuating means having a central passage adapted to accommodate a pump actuating rod and being disposed substantially above the pump receiving region of said tubular casing and adapted to operate independently and separately from the pump inserted within the said section.

2. A casing pump assembly for mounting an insert pump construction of the type having hold-down portions adapted to be operatively and releasably received by a seating means, said casing pump assembly including means forming a casing adapted to be disposed within a well and operative to receive said insert pump construction, said casing having associated therewith a seating means adapted to receive said portion of the insert pump to seat and to hold said insert pump portion operatively within said casing during pumping, resilient means mounted on said tubular casing and adapted to expand into sealing and gripping engagement with the walls of a well, and actuating means disposed for movement interiorly of said resilient means and operative to expand said resilient means into said gripping engagement, said actuating means having a central passage adapted to accommodate a pump actuating member and being adapted to operate independently and separately from the pump inserted within said section.

3. A casing pump assembly for mounting an insert pump construction of the type having hold-down portions adapted to be operatively and releasably received by a seating means, said casing pump assembly including means forming a casing adapted to be disposed within a well and operative to receive said insert pump construction, said casing having associated therewith a seating means complementary to said hold-down portion of the insert pump and adapted to receive said hold-down portion of the insert pump to seat and to hold said insert pump portion operatively within said casing during pumping, said pump portion being shiftable to and from engagement with said seating means within the casing, resilient means mounted on said tubular casing and adapted to expand into sealing and gripping engagement with the walls of a well, and actuating means disposed for movement interiorly of said resilient means and operative

to expand said resilient means into said gripping engagement, said actuating means having a central passage adapted to accommodate a pump actuating member and being adapted to operate independently and separately from the pump inserted within said section.

4. A casing pump assembly for mounting an insert pump construction of the type having hold-down portions adapted to be operatively and releasably received by a seating means, said casing pump assembly including means forming a casing adapted to be disposed within a well and operative to receive said insert pump construction, said casing having associated therewith a seating means complementary to said hold-down portion of the insert pump and adapted to receive said hold-down portion of the insert pump to seat and to hold said insert pump portion operatively within said casing during pumping, resilient means mounted on said tubular casing and adapted to expand into sealing and gripping engagement with the walls of a well, and an actuating means shiftable downwardly interiorly of said resilient means for expanding the resilient means into said gripping engagement independently of operation of the pump, said actuating means having lower portions interengageable with said casing in supporting relationship when the actuating means is disposed in a relatively upper position, wherein said gripping means is released, said actuating means having a central passage adapted to freely accommodate a pump actuating member and having portions adapted to be engaged by means associated with the insert pump assembly whereby the casing pump assembly is adapted to be operatively suspended upon and carried by the pump actuating member when the pump is shifted from operative position within the casing and into supporting engagement with the actuating means.

5. A casing pump assembly as defined in claim 4 wherein said actuating member is provided with fluid passages effecting communication between the central passage therein and said casing at all times.

CARL D. WAGNER.

CERTIFICATE OF CORRECTION.

nt No. 2,247,325. June 24, 1941.

CARL D. WAGNER.

is hereby certified that error appears in the printed specification
ıe above numbered patent requiring correction as follows: Page 2, first
mn, line 8, for "instanace" read --instance--; line 50, for "worm"
--form--; and that the said Letters Patent should be read with this
ection therein that the same may conform to the record of the case in
Patent Office.

gned and sealed this 16th day of September, A. D. 1941.

Henry Van Arsdale,

l) Acting Commissioner of Patents.