May 25, 1937. C. J. COBERLY 2,081,225

DEEP WELL PUMPING MEANS AND INLET MEMBER THEREFOR

Filed March 5, 1935

Fig. 1a.

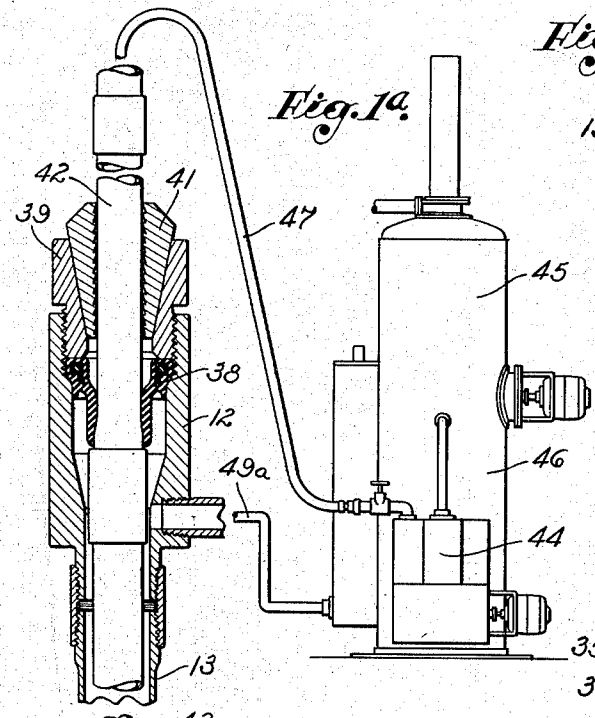


Fig. 1b.

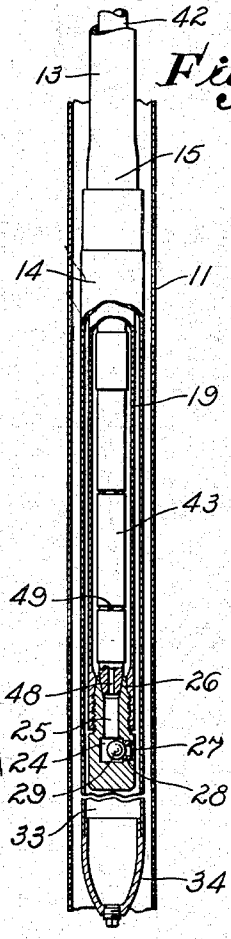


Fig. 2.

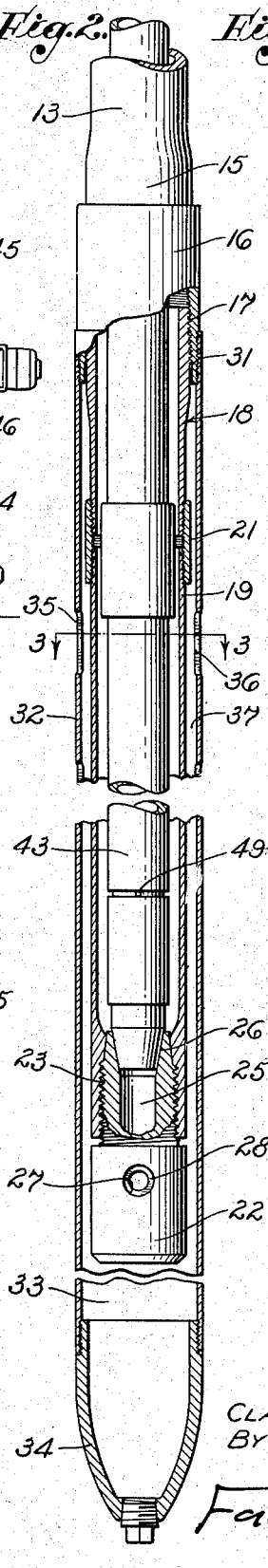


Fig. 3.

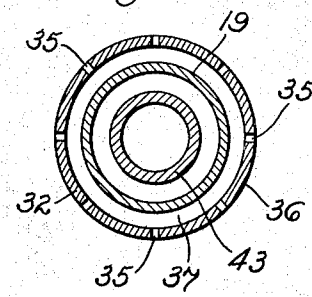
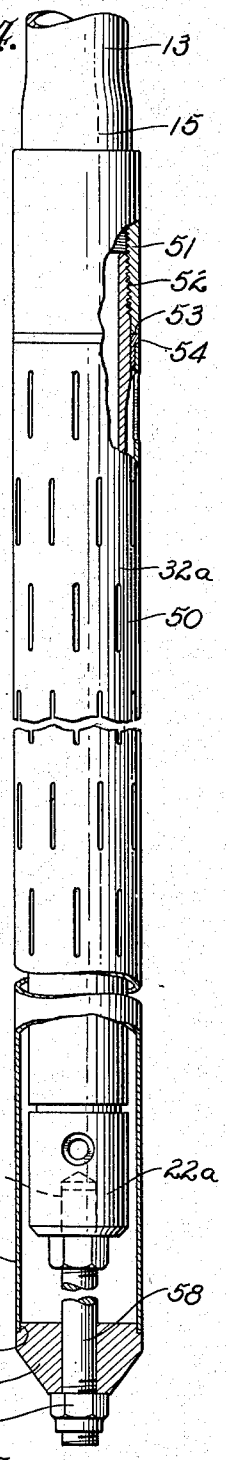


Fig. 4.



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DEEP WELL PUMPING MEANS AND INLET MEMBER THEREFOR

Clarence J. Coberly, Los Angeles, Calif., assignor to RoKo Corporation, Reno, Nev., a corporation of Nevada

Application March 5, 1935, Serial No. 9,413

13 Claims. (Cl. 103—46)

My invention relates to equipment especially useful in the pumping of oil from deep wells.

For many years the practice of pumping oil wells employed chiefly what is known as the sucker rod type of pump, such pump having a pump piston disposed in a pump barrel at the lower end of the well, and a string of sucker rods extending upwardly to a suitable reciprocating or actuating means disposed above the upper end of the well. Pumps of this character were found satisfactory for shallow wells, but with the increase in the depth of wells many difficulties and disadvantages have arisen, among which are loss of power due to elongation and contraction of the string of sucker rods and losses due to breakage of the sucker rods. As a solution for the problem in general I have produced a deep well pump, as disclosed in my copending application, Serial No. 720,061, filed April 11, 1934, entitled Fluid operated deep well pump, having a pump unit comprising a pump proper and a fluid operated motor therefor, adapted to be placed in the oil producing zone at or near the bottom of a well and having a high pressure fluid delivery pipe extending downwardly thereto from a suitable source of fluid under pressure at the top of the well. Actual use of this pump in the oil fields shows that it is capable of long periods of use without replacement. Also, it is found that the pump may be operated at relatively high speeds, for example, two hundred to three hundred strokes per minute as compared with the fifty to one hundred strokes customary in sucker rod pumps. Some of the structure of the present application is disclosed in my copending application, Serial No. 740,452, filed August 18, 1934, entitled "Method and apparatus for installing pumps in wells" patented October 6, 1936, No. 2,056,418.

It is an object of my invention to provide for a pump of the character described above a means for reducing to a minimum the tendency for the pump to cause emulsification, and for reducing to a minimum losses occurring due to the formation of gas pockets in or gas locking of the pump.

It is accordingly an object of my invention to provide a pumping device having an oil inlet means of such character that the oil will be delivered to the pump under such static pressure that the gas content of the oil will be held in solution, so that during the operation of the pump the fluid drawn into the pumping cylinder thereof will consist of a liquid and not a combination of liquid and free gas.

It is an object of my invention to provide a pump adapted to be lowered through a tube to the lower end of a well, this tube having an external shell around the outer part thereof for conducting oil downwardly to the pump inlet. This shell extends upwardly around the lower end of the tube to a height materially above the position of the pump so that the oil must travel downwardly through a relatively long distance before it reaches the pump inlet.

It is an object of the invention to provide a simple and effective combination of parts forming the oil inlet member of the pumping device, and an additional object of the invention is to provide an inlet member of the above character which will serve not only as a gas anchor but also as a sand trap for the small quantities of sand permitted to enter through the screen forming the upper part of the inlet member, and which may be raised to the surface of the ground with the tubing for the purpose of cleaning.

Further objects and advantages of the invention will be made evident throughout the following part of the specification.

Referring to the drawing, which is for illustrative purposes only,

Fig. 1*a* is a schematic sectional view showing the upper portion of a preferred embodiment of my invention in use in a well.

Fig. 1*b* is a reduced schematic sectional view of the lower portion of the embodiment shown in Fig. 1*a*.

Fig. 2 is an enlarged sectional view of the inlet member shown in Fig. 1*b*.

Fig. 3 is a cross section on a plane represented by the line 3—3 of Fig. 2.

Fig. 4 is a sectional view similar in character to Fig. 2, showing an alternative method of construction for the inlet member.

In Figs. 1*a* and 1*b* I show a casing 11 extending downwardly in a well to an oil production zone. By means of a suitable casing head 12 an oil tube 13 is suspended in the well. At the lower end of the tube 13 an inlet member 14 is secured, this inlet member being connected to the piping 15 of which the oil tube 13 is formed by means of an internally threaded sleeve 16. In the internal threads 17 formed in the lower end of the sleeve 16 a tube member 18 is secured, and at the lower end of the tube 18 a pump receptacle 19 of tubular form is placed. This pump receptacle 19 may be a downward continuation of the tube 18 or may consist of a separate tube secured to the tube 18 by means of a coupling 21. At the lower end of the receptacle 19 a valve body 22 is placed, this valve body being prefer-

ably threaded into the lower end of the pump receptacle 19 as shown at 23. The valve body 22 has a chamber 24 in the lower part thereof which is connected to the interior of the pump receptacle by a vertical passage 25, the upper end of which is flared to form a seat 26. A lateral opening 27 in the wall of the body 22 connects the chamber 24 with the exterior of the valve body 22. In the lateral opening 27 a valve seat 28 is placed which is adapted to be engaged by a closure member consisting preferably of a metal ball 29 disposed in the chamber 24. Connected to the coupling 16 by means of external threads 31 thereon is a shell 32 which extends downwardly around the pump receptacle 19 and extends a distance below the valve body 22 so as to form a sand trap 33 which may be closed by a plug 34 threaded into the lower end of the outer shell 32. The shell 32 may be ordinarily forty to fifty feet in length, and the lower end of the pump receptacle 19 may be disposed a few feet above the plug 34 so that the pump receptacle 19 actually is suspended in the lower end of the outer shell 32 and is spaced from the plug 34 only a sufficient distance to leave the space 33, the size of which may be varied to suit conditions. The upper portion of the shell 32 is provided with slots 35 so as to form a screen or strainer 36 for permitting the entrance of oil into the upper end of the space 37 between the shell 32 and the pipe 18 and pump receptacle 19.

The head 12 shown in Fig. 1*a* has a sealing means 38 of expansible character mounted at the upper end thereof. This sealing means is held in place by a threaded member 39 tapered so as to receive slips 41 for holding a string of high pressure tubing 42 which is extended downwardly through the oil tube 13 into the piping 18, and has a fluid operated pump 43 secured to its lower end so as to rest within the pump receptacle 19 and engage the tapered seat 26. Adjacent the head 12 a high pressure pump 44 is placed, this pump being adapted for drawing clean fluid such, for example, as filtered oil from a clean fluid storage chamber 45 of a filtering device 46 and for pumping this clean fluid through piping 47 into the upper end of the high pressure tubing 42 through which the fluid under pressure is conducted to the fluid operated pump 43 which may be constructed as disclosed in my copending application Serial No. 720,061, hereinbefore referred to. The operation of the pump 43 draws oil through the inlet opening 27, the passage 25, and the inlet passage 48 of the pump, such oil being discharged through openings 49 into the pump receptacle 19 through which it is delivered to the production tube 13 which carries it to discharge piping 49*a* connecting with the filter device 46.

The distance from the inlet opening 27 to the oil inlet slots 35 at the upper end of the shell 32 is such that a definite static head of oil is placed on the oil in the lower part of the shell 32 which is drawn into the pump 43 through the inlet opening 27. The openings 35 are disposed near the upper level of the oil in the well. The oil entering the well from the formation, in order to pass into the shell 32, must move into fairly close proximity to the upper level of the oil in the well. Accordingly, free gases in such oil may be released from the oil into the casing 11. Fine bubbles of gas of soluble character may be carried into the shell 32 with the oil, but as the oil passes downwardly through the space 37, a pressure is exerted due to the static head of the oil so that when the oil enters the pump 43, these small bubbles of gas will be re-absorbed into the oil, and gas locking of the pump will not occur.

In Fig. 4 I show an alternative form of inlet member 50 for the production tube 13, such inlet member 50 consisting of a collar 51 which is threaded onto the lower end of the tube 13 and has internal threads 52 in the lower end thereof for holding the inner tubular member represented by the pipe 18 and the pump receptacle 19 carrying a valve body 22*a* at the lower end thereof. Instead of the collar 51 being externally threaded, as is the collar 16 at 31, a shoulder 53 is provided against which a shouldered ring 54 may rest. The upper end of an outer shell 32*a* engages this ring 54 and is centralized thereby, the upper end of the shell 32*a* being thus positioned without the use of threads. A plug 55 engages the lower end 56 of the shell 32*a* and is shouldered at 57 so as to make a tight seal with and to centralize the lower end 56 of the shell 32*a*. Through the plug 55 a bolt 58 extends into threaded engagement at 59 with the lower end of the valve body 22*a*. A nut 61 is threaded onto the lower end of the bolt 58 and is tightened up so as to force the plug 55 upwardly against the lower end 56 of the shell 32*a* and in turn cause the upper end of the shell to force the ring 54 tightly against the shoulder at the lower end of the collar 51. In this form of inlet member the shell may be placed and removed with ease.

Although I have herein shown and described my invention in simple and practical form, it is recognized that certain parts or elements thereof are representative of other parts, elements, or mechanisms which may be used in substantially the same manner to accomplish substantially the same results; therefore, it is to be understood that the invention is not to be limited to the details disclosed herein but is to be accorded the full scope of the following claims.

I claim as my invention:

1. A deep well pumping device of the character described, including: an oil tube adapted to be extended down into a well to the oil producing zone thereof for carrying the oil to the surface of the ground; an outer shell extending downwardly from the lower end of said tube, said shell having an oil inlet opening in the upper end thereof; a pump receptacle in the lower part of said shell; tubular means connecting the upper end of said pump receptacle to the oil tube; pumping means, comprising a pump barrel with a pumping piston in said pump barrel and means for reciprocating said pumping piston, adapted to be lowered through said oil tube into said pump receptacle; means forming a seal between the exterior of said pumping means and said receptacle; and inlet means at the lower end of said receptacle connecting the inlet of said pumping means with the space within the lower part of said shell.

2. A deep well pumping device of the character described, including: an oil tube adapted to be extended down into a well to the oil producing zone thereof for carrying the oil to the surface of the ground; an outer shell extending downwardly from the lower end of said tube, said shell having an oil inlet opening in the upper end thereof; a pump receptacle suspended from the lower end of said oil tube within said shell, the lower end of said pump receptacle being spaced from the lower end of said shell so as to

provide a space in the lower end of said shell below the lower end of said receptacle; pumping means, comprising a pump barrel with a pumping piston in said pump barrel and means for reciprocating said pumping piston, adapted to be lowered through said oil tube into said pump receptacle; means forming a seal between the exterior of said pumping means and said receptacle; and inlet means at the lower end of said receptacle connecting the inlet of said pumping means with the space within the lower part of said shell.

3. A deep well pumping device of the character described, including: an oil tube adapted to be extended down into a well to the oil producing zone thereof for carrying the oil to the surface of the ground; an outer shell extending downwardly from the lower end of said tube, said shell having an oil inlet opening in the upper end thereof; a pump receptacle suspended from the lower end of said oil tube within said shell; pumping means, comprising a pump barrel with a pumping piston in said pump barrel and means for reciprocating said pumping piston, adapted to be lowered through said oil tube into said pump receptacle; means forming a seal between the exterior of said pumping means and said receptacle; and inlet means at the lower end of said receptacle connecting the inlet of said pumping means with the space within the lower part of said shell.

4. A deep well pumping device of the character described, including: an oil tube adapted to be extended down into a well to the oil producing zone thereof for carrying the oil to the surface of the ground; an outer shell suspended from the lower end of said tube, said shell having an oil inlet opening in the upper end thereof; piping extending downwardly within said shell; a pump receptacle connected to the lower end of said piping within said shell; pumping means, comprising a pump barrel with a pumping piston in said pump barrel and means for reciprocating said pumping piston, adapted to be lowered through said oil tube into said pump receptacle; means forming a seal between the exterior of said pumping means and said receptacle; and inlet means at the lower end of said receptacle connecting the inlet of said pumping means with the space within the lower part of said shell.

5. In well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; an outer shell having its upper end connected to the lower end of said tube, said shell having the lower end thereof closed and the upper end thereof with a fluid inlet opening; a pump receptacle suspended within said shell from a point above said fluid inlet opening so that the space between said pump receptacle and said shell will communicate with said inlet opening; means for supporting said pump within said pump receptacle; a seal for sealing between said pump and said pump receptacle; and an inlet member at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

6. In well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; an annular fitting connected to the lower end of said tube, said fitting having an internal thread and an external thread at the lower end thereof; an outer shell having its upper end connected to said external thread of said fitting, said shell having the lower end thereof closed and the upper end thereof with a fluid inlet opening; a pump receptacle suspended from said internal thread within said shell; a seal for sealing between said pump and said pump receptacle; and an inlet member at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

7. In well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; an outer shell having its upper end connected to the lower end of said tube, said shell having the lower end thereof closed and the upper end thereof with a fluid inlet opening; a pump receptacle suspended within said shell from a point above said fluid inlet opening so that the space between said pump receptacle and said shell will communicate with said inlet opening; means for supporting said pump within said pump receptacle; a seal for sealing between said pump and said pump receptacle; and an inlet check valve at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

8. In well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; an annular fitting connected to the lower end of said tube, said fitting having an internal thread and an external thread at the lower end thereof; an outer shell having its upper end connected to said external thread of said fitting, said shell having the lower end thereof closed and the upper end thereof with a fluid inlet opening; a pump receptacle suspended from said internal thread within said shell; a seal for sealing between said pump and said pump receptacle; and an inlet check valve at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

9. In a well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; a pump receptacle extending downwardly from said tube, the upper end of said pump receptacle being connected to said tube so as to be suspended therefrom; means forming a collar at the lower end of said tube, said collar being of larger diameter than said pump receptacle; an outer shell around said pump receptacle, the upper end of said shell engaging said collar, and said shell having an opening therein through which fluid may enter the shell; means for closing the lower end of said shell; means

connecting the lower end of said pump receptacle to said shell and forcing said shell upwardly against said collar; a seal for sealing between said pump and said pump receptacle; and an inlet member at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

10. In well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; a pump receptacle extending downwardly from said tube, the upper end of said pump receptacle being connecting to said tube so as to be suspended therefrom; means forming a collar at the lower end of said tube, said collar being of larger diameter than said pump receptacle; an outer shell around said pump receptacle, the upper end of said shell engaging said collar, and said shell having an opening therein through which fluid may enter the shell; means for closing the lower end of said shell; means connecting the lower end of said pump receptacle to said shell and forcing said shell upwardly against said collar; a seal for sealing between said pump and said pump receptacle; and an inlet check valve at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

11. In well pumping means having a pump adapted to be lowered into a well and means for operating said pump, the combination of: a tube of such size that said pump may pass therethrough extending down into the well to the production zone thereof for carrying the oil to the surface of the ground; a pump receptacle extending downwardly from said tube, the upper end of said pump receptacle being connected to said tube so as to be suspended therefrom; means forming a collar at the lower end of said tube, said collar being of larger diameter than said pump receptacle; an outer shell around said pump receptacle, the upper end of said shell engaging said collar, and said shell having an opening therein through which fluid may enter the shell; means for closing the lower end of said shell; means connecting the lower end of said pump receptacle to said shell and forcing said shell upwardly against said collar; a tapered seat in the lower end of said pump receptacle in which said pump may rest, said seat forming a seal between said pump and said pump receptacle; and an inlet member at the lower end of said pump receptacle having an inlet passage connecting the inlet of said pump with the space in said shell around said pump receptacle.

12. A deep well pumping device of the character described, including: an oil tube adapted to be extended down into a well to the oil producing zone thereof for carrying oil to the surface of the ground; an outer shell extending downwardly from the lower end of said oil tube, said shell having an oil inlet in the upper end thereof; a pump receptacle in the lower part of said shell; means connecting said pump receptacle to said oil tube; pumping means comprising a pump barrel with a pumping piston in said pump barrel and means for reciprocating said pumping piston, said pumping means being adapted to be lowered through said oil tube into said pump receptacle; inlet means in said receptacle and positioned below said oil inlet, connecting the inlet of said pumping means with the space within the lower part of said shell; and means associated with said receptacle for securing said shell relative thereto.

13. A deep well pumping device of the character described, including: an oil tube adapted to be extended down into a well to the oil producing zone thereof for carrying oil to the surface of the ground; an outer shell extending downwardly from the lower end of said oil tube, said shell making a slip joint with said oil tube, said shell having an oil inlet in the upper end thereof; a pump receptacle in the lower part of said shell; means connecting said pump receptacle to said oil tube; pumping means comprising a pump barrel with a pumping piston in said pump barrel and means for reciprocating said pumping piston, said pumping means being adapted to be lowered through said oil tube into said pump receptacle; inlet means in said receptacle and positioned below said oil inlet, connecting the inlet of said pumping means with the space within the lower part of said shell; and means associated with said receptacle for securing said shell relative to said oil tube.

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