Sept. 13, 1932. J. A. YERKES ET AL 1,877,112

TRAVELING TUBE PUMP

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Fig. 1

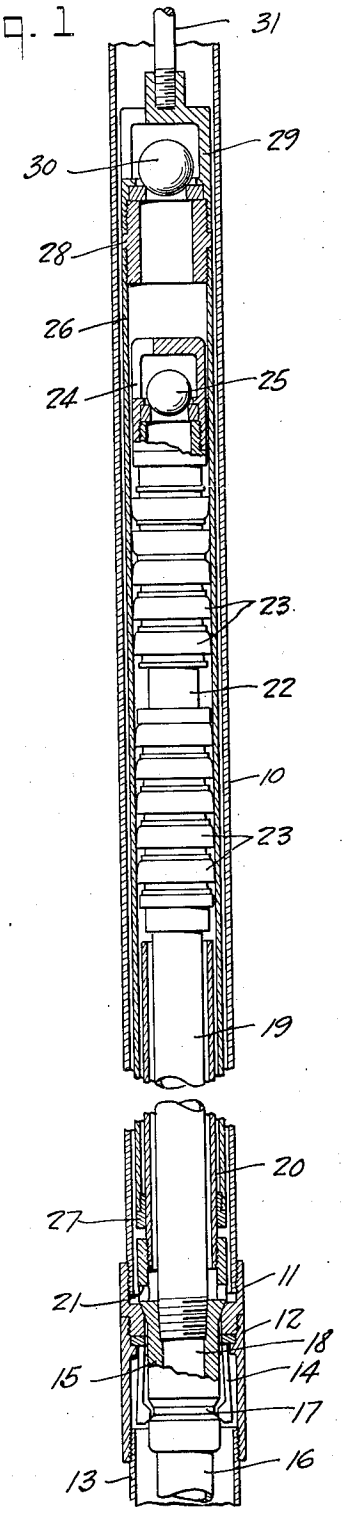


Fig 2

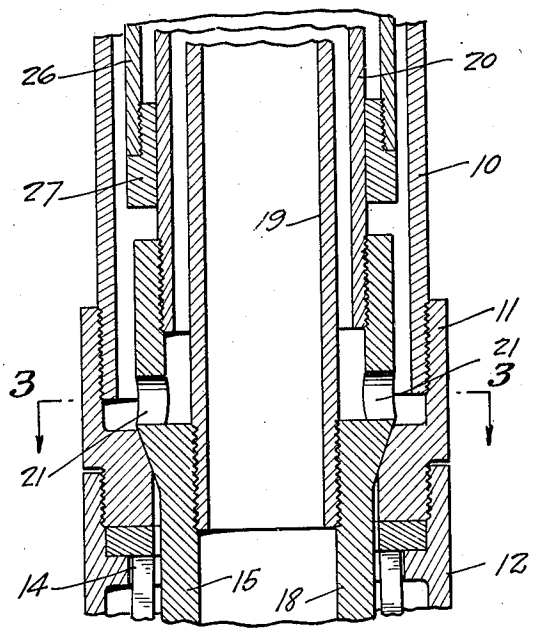
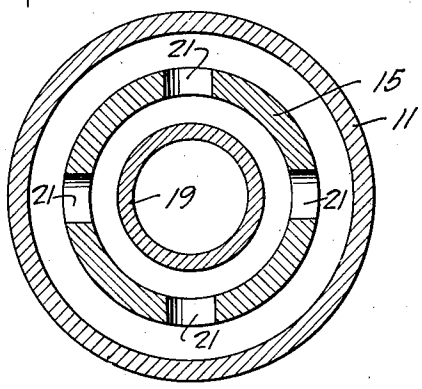


Fig. 3



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Fig. 4

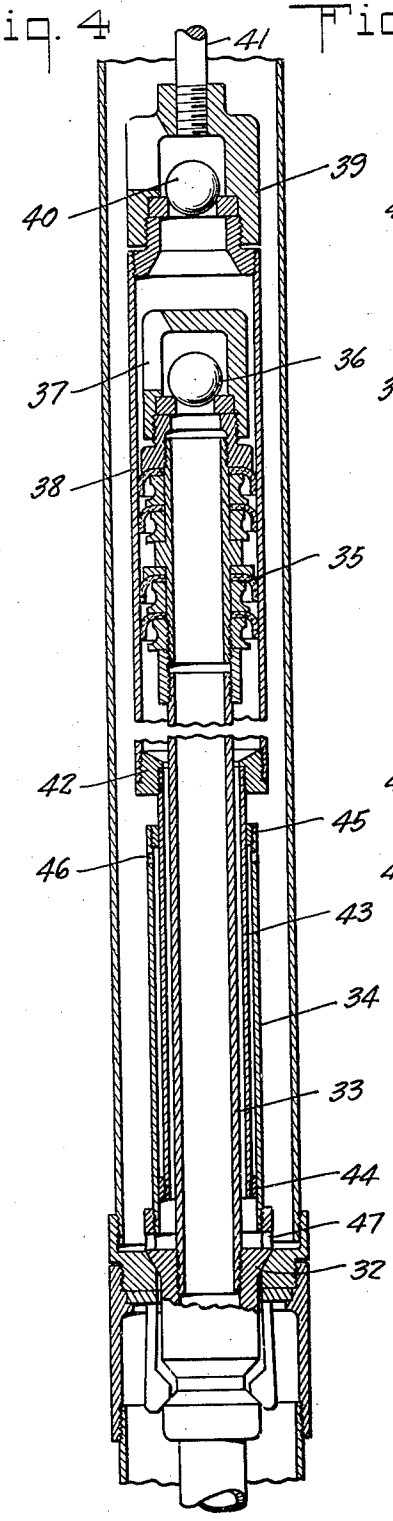
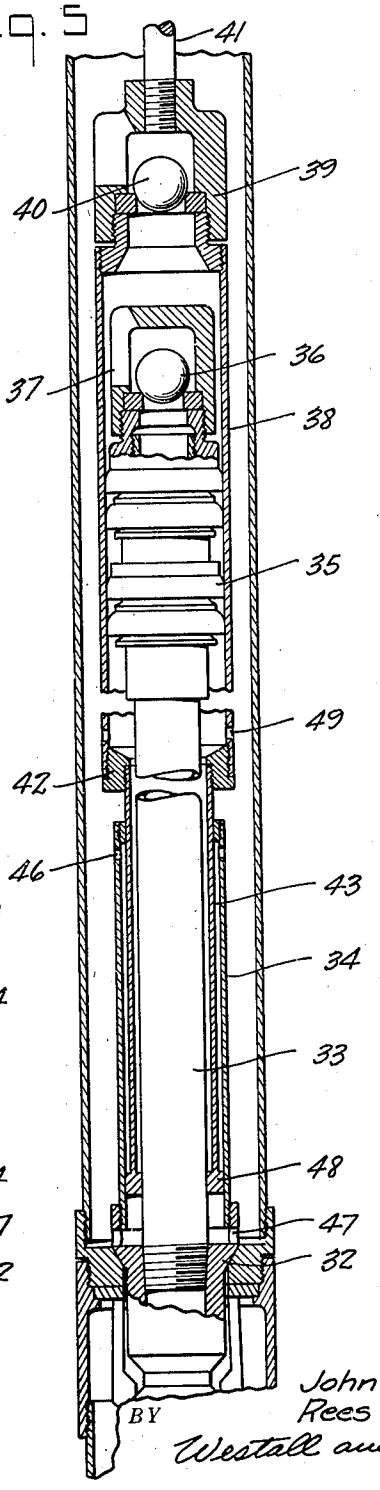


Fig. 5



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Patented Sept. 13, 1932 1,877,112

UNITED STATES PATENT OFFICE

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TRAVELING TUBE PUMP

Application filed January 3, 1930. Serial No. 418,264.

This invention relates to a deep well pump having a relatively stationary piston and a reciprocating working barrel nested over the piston. The invention pertains especially to features of construction whereby fluid between the pump and the well tube or shell surrounding the pump is operated upon to cause turbulence and prevent settling of sand and sediment.

The objects of this invention are to provide a traveling tube pump in which sand or sediment settling out of the liquid in the well tubing is prevented from lodging between the well tubing and the pump thereby obviating the usual difficulties encountered by such pump, namely, "freezing" or sticking as well as ultimately resulting in shortening the pump stroke. Another object of this invention is to provide greater strength and simplicity as well as inexpensive construction. A further object of this invention is to provide a deep well pump having nested tubular stand pipes, one of which is provided with a working piston, a working barrel surrounding the piston and forming therewith a working space, said working barrel coacting with the stand pipes to cause surging of liquid back and forth in the space between the pump and well tube, the surging in said space being substantially coextensive therewith.

These objects are accomplished by means of the embodiments of our invention illustrated in the accompanying drawings, in which:—

Fig. 1 is an axial section through a well tube showing one form of pump inserted therein, portions of the pump being shown in elevation; Fig. 2 is an enlarged longitudinal section through the lower end of the pump and well tubing string shown in Fig. 1; Fig. 3 is a section as seen on the line 3—3 of Fig. 2; Fig. 4 is a longitudinal section through a fragment of well tubing showing another form of pump embodying our invention; Fig. 5 is a view similar to Fig. 4, showing still another form of pump embodying our invention.

Referring more particularly to Figs. 1, 2 and 3, the usual well tubing is marked 10. The section of well tubing is that near the bottom of the well and carries at its lower end a shoe 11, to which is attached a collar 12. A gas anchor pipe marked 13 is threadedly attached to collar 12. The shoe 11 has a tapered bore to receive an extension, later described.

Clamped between the shoe 11 and collar 12 is a resilient anchoring member 14 including spring fingers which depend below the shoe 11 and into the collar.

The pump proper comprises an anchoring extension 15 also serving as a seat for the pump and coacting with the tapered bore of the shoe. The tail pipe 16 is attached to the anchoring extension. A bevelled annular recess 17 serves for the mounds on the fingers to engage therewith and hold the anchoring extension in place. A bore 18 is formed in the extension and is threaded to receive an inner stand pipe 19. The upper end of the extension is enlarged in diameter and threaded to receive an outer stand pipe 20. Below the lower end of stand pipe 20 and in the wall of the anchoring extension are lateral ports 21 which serve for communication of the space between the stand pipes 19 and 20 with the space between the well tube 10 and the pump.

A piston body 22 is secured to the upper end of the inner stand pipe 19 and mounted thereon are plunger cups 23 secured in any suitable manner as by lock nuts and followers. It will be noted that the upper two cups shown in Fig. 1 are reversed in position with respect to the remaining cups, the upper cups serving as wipers to wipe sand or sediment from the reciprocating barrel. Secured to the upper end of the piston by a suitable lock bushing is a valve cage 24 housing a ball valve 25.

Reciprocatingly mounted over the piston is a working barrel 26. This barrel extends over the outer standing tube 20 and is spaced therefrom, there being a guide nut 27 at the lower end of the barrel engaging the outer standing tube 20 and forming an annular piston. The guide nut need not form a leak tight fit with the outer standing tube, it being sufficient that when the barrel is reciprocated, the annular space between the outer

standing tube 20 and the barrel 26 will be longitudinally contracted and expanded. At the upper end of the working barrel is a bushing 28 to which a valve cage 29 is attached. A ball valve 30 is mounted in cage 29. There is a sucker rod 31 attached to the valve cage 29.

It will be understood, that in actual practice, the tubing 10, shoe 11, resilient anchoring device 14, collar 12 and the anchor pipe 13 are assembled and lowered into the well hole in position. Thereupon, the assembled pump elements as a unit are secured to the sucker rod 31 and lowered into the well tubing until the anchoring extension 15 seats in the shoe 11 and is securely locked in position by the resilient anchoring device, but in such a manner that an upward pull upon the sucker rods will cause the spring fingers on the anchoring device to release the pump assembly. With the pump inserted in position in the well tubing, it is now ready for operation. The sucker rods 31 are reciprocated as usual which causes the traveling tube 26 or working barrel to reciprocate over the piston. On the up-stroke of the pump, liquid is drawn through the tail pipe 16 up through the standing tube 19, through the piston and past the valve 25. It enters the pump working space, being elevated by the upward movement of the working barrel 26. The valve 30 in cage 29 will have remained seated upon the up-stroke of the pump. On the down-stroke of the pump, the ball valve 25 seats and the ball valve 30 lifts to permit discharge of the fluid into the well tubing 10.

The pumping action just described is the usual action common to this type of pump. However, the working barrel causes an additional and novel action. In Fig. 1, the working barrel is shown near the bottom of the down-stroke. On the following up-stroke, the liquid which is contained in the annular space between the traveling tube 26 and the outer standing tube 20 is forced upwardly out of said annular space and downwardly through the annular space between the standing tubes 19 and 20. The annular spaces just referred to constitute a play chamber for liquid contained therein, and the play chamber is contracted and expanded with reciprocation of the working barrel thereby forming a pulsator. Contraction of the play chamber causes liquid to be forced therefrom out through the holes 21 and upwardly in the annular space between the pump unit and the well tube 10. On the following down-stroke, it is obvious that liquid will be drawn into the play chamber through the holes 21 and will enter the play chamber. It will be seen that the guide nut 27, fitting closely over the outer standing tube 20, acts as a seal and thus standing tube 20 also acts as a stationary piston, the skirt or lower end of the working barrel or traveling tube 26 acting as a traveling cylinder. Thus, a surging device or pulsator in the nature of a simple auxiliary pump is provided which alternately draws in and discharges liquid through the holes 21 at the bottom of the space around the pump and close to the shoe 11.

Under operating conditions, the liquid contained in the tubing generally carries quantities of sediment and sand in varying amounts. The largest portion of this sand or sediment is usually carried out with the liquid due to the velocity of the liquid moving upwardly. Some sand and sediment, however, will settle and tend to lodge in the annular space between the well tubing and the working barrel. It will often, if permitted, settle around the anchoring extension 15 at the pump seat or shoe, rendering it difficult and often impossible to remove the pump by pulling upon the sucker rods and requiring pulling of the tubing string 10, causing an expensive and laborious job. So long as the working barrel 26, in the ordinary type of such traveling tube pump, is kept in motion, it is unlikely that sand or sediment will clog the space between the tubing 10 and the traveling tube 26 due to the agitation. Likewise, fluid above the valve cage 29 moving upwardly tends to prevent settling of sand and sediment, but some sand usually finds it way down to the lowermost portion of the tubing and tends to build up at this point, often to such an extent that the traveling tube "pounds" or strikes the sand packed at the bottom of the space. This is highly detrimental to the operation of the pump, as it is necessary to respace the traveling tube to prevent it from striking the packed sand or sediment in this space. In many cases, this must be repeatedly done and often involves shortening the stroke to avoid "pounding". This shortening decreases the capacity of the pump. Such "pounding" also tends to tamp the sand, "freezing" the inserted assembly and making removal thereof practically impossible without pulling the well tubing. Furthermore, there is danger of causing parting of the tubing string. Heretofore, numerous attempts have been made to avoid the above described conditions, but with the devices heretofore used, sufficient surge of the fluid in the space around the pump is not obtained to adequately agitate the fluid. In the structure just described, the turbulence is coextensive with the space and the surge is inaugurated at the extreme lower point, where it is most effective. The lock nut or annular piston 27 may be slightly loose with relation to standing tube 20, but the action just described will take place even though the guide nut fits loosely, because of the rapidity of movement during operation.

Referring to the species of pumps shown in Fig. 4 the well tubing its shown as before

with a shoe, collar and resilient anchoring device to engage an anchoring extension 32. Mounted on the anchoring extension 32 are nested standing tubes 33 and 34. At the upper end of the inner standing tube 33 is a piston 35 equipped with a valve 36 and valve cage 37 at its upper end. Over the piston is slidably mounted a working barrel or traveling tube 38 having a valve cage 39 and valve 40 at the top for connection to a sucker rod string 41. An adaptor bushing 42 is threaded into the lower end of the traveling tube 38 and secured thereto is a skirt tube 43 which in effect is a continuation of the working barrel. A bushing of ring form and marked 44 is shown in Fig. 4 as engaging the outer standing tube 34 so as to define an annular space between the skirt tube 43 and the outer standing tube 34. A bushing 45 is mounted upon the outer standing tube 34 and slidably engages the skirt tube. The space between tubes 33 and 43 is placed in communication with the space about the pump by ports 46. The shoe 32 has openings 47 also communicating with the space about the pump and adjacent the shoe. Upon reciprocation of the working barrel, the skirt causes a play of the liquid between the outer tube 34 and the skirt tube 43 so as to create a surge back and forth through openings 46 adjacent the top of the outer traveling tube. At the same time, there will be a surge created in the play space between the skirt tube and the inner standing tube 33 due to the pulsator formed by the piston 35, tubes 33 and 43. The liquid from the last mentioned space surges through the opening 47 at the lower portion of the pump.

Referring particularly to Fig. 5, a variation of the structure shown in Fig. 4 is disclosed. In Fig. 5, the bushing 48 at the lower end of the skirt tube is made of such size as to slidingly fit both the inner standing tube 33 and the outer standing tube 34. In this instance, there is a triple action, due to the space below the bushing 47, the space between the skirt tube 43 and the outer standing tube 34 and the space between the inner standing tube 33 and the skirt tube 43. The fluid from the last mentioned space surges through openings 49 in the working barrel.

What we claim is:—

1. In combination with a well tube having a support, an inserted well pump, mounted in said tube and on said support to seal the space above said support from that below, said pump comprising nested tubular stand pipes, one of said stand pipes being provided with a piston, said stand pipes being spaced from one another to provide an annular non-working space therebetween, openings terminating in stationary ports placing said annular space in communication with the space surrounding said stand pipes, a working barrel surrounding said piston and forming therewith a working pump space, said working barrel reciprocating with respect to said stand pipes to cause play of liquid contained in said annular non-working space and surging of such liquid back and forth through said openings.

2. In combination with a tube having a support, an inserted well pump, mounted in said tube and on said support to seal the space above said support from that below, said pump comprising a tubular stand pipe provided with a piston at its upper end, a second stand pipe disposed about and spaced from said first mentioned stand pipe to provide an annular space, a working barrel surrounding said piston and forming therewith a working pump space above said piston, said working barrel having its lower end reciprocatingly engaging one of said stand pipes in telescopic relation and providing with said annular space a closed contractible and expandable play chamber, and passages terminating in stationary ports connecting said play chamber with the space around said pump at its lower end whereby liquid may be caused to surge back and forth through said passages by reciprocation of said barrel.

3. In combination with a well tube, an inserted pump, retaining means at the lower end of said pump to hold said pump in said well tube and seal the space above said means from that below; said pump comprising the combination of a tubular stand pipe provided with a piston at its upper end, a second stand pipe disposed about and spaced from said first mentioned stand pipe to provide an annular space, a working barrel surrounding said piston and forming therewith a working pump space above said piston, said working barrel having its lower end reciprocatingly engaging a stand pipe in telescopic relation with said stand pipes and providing with said annular space a closed contractible and expandable play chamber, and passages terminating in stationary ports connecting said play chamber with the space around said pump at its lower end whereby liquid may be caused to surge back and forth through said passages by reciprocating of said barrel.

4. In combination with a well tube having a support, an inserted well pump, mounted in said tube and on said support to seal the space above said support from that below, said pump comprising a tubular stand pipe provided with a piston, a second stand pipe nested about and spaced from said first mentioned stand pipe, a working barrel surrounding said piston and forming therewith a working pump space above said piston, said working barrel being slidably nested over one of said stand pipes in telescopic relation therewith, a ring piston on said working barrel coacting with one of said stand pipes

to limit a play chamber and to cause play of liquid contained in said play chamber, openings terminating in stationary ports at the lower end of said pump placing said play chamber in communication with the space about said pump whereby liquid may surge back and forth through said openings.

5. In combination with a well tube having a support, an inserted well pump, mounted in said tube and on said support to seal the space above said support from that below, said pump comprising an inner tubular stand pipe provided with a piston, an outer stand pipe nested about and spaced from said inner stand pipe to provide an annular space, openings terminating in stationary ports placing said annular space in communication with the space surrounding said outer stand pipe at the lower end of the latter, a working barrel surrounding said piston and forming therewith a working pump space, said working barrel being slidably nested over, spaced from and coacting with the outer stand pipe and having a ring piston coacting with said outer stand pipe to form a closed expansible play chamber and cause play of liquid in the space between said barrel, outer stand pipe and annular space and surging of such liquid back and forth through said openings.

6. In combination with a well tube, an inserted pump, retention means at the lower end of said pump to releasably hold said pump in said well tube; said pump comprising the combination of a tubular stand pipe provided with a piston, a second stand pipe nested about and spaced from said first mentioned stand pipe, a working barrel surrounding said piston and forming therewith a working pump space, said working barrel being slidably nested over one of said stand pipes, a ring piston on said working barrel coacting with one of said stand pipes to limit and form a closed expansible play chamber and to cause play of liquid contained in said play chamber, openings terminating in stationary ports at the lower end of said pump placing said play chamber in communication with the space about said pump whereby liquid may surge back and forth through said openings.

In witness that we claim the foregoing we have hereunto subscribed our names this 26th day of December, 1929.

JOHN A. YERKES.
REES H. LEMMON.