May 8, 1934. J. PENROD 1,958,016

WELL PUMP

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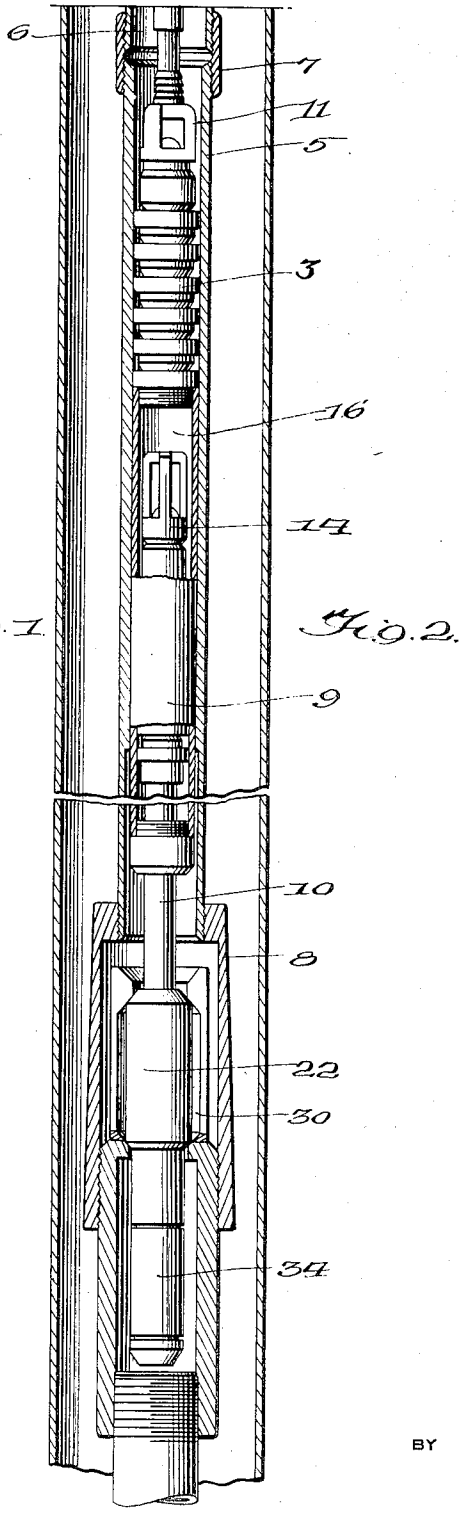


Fig. 1

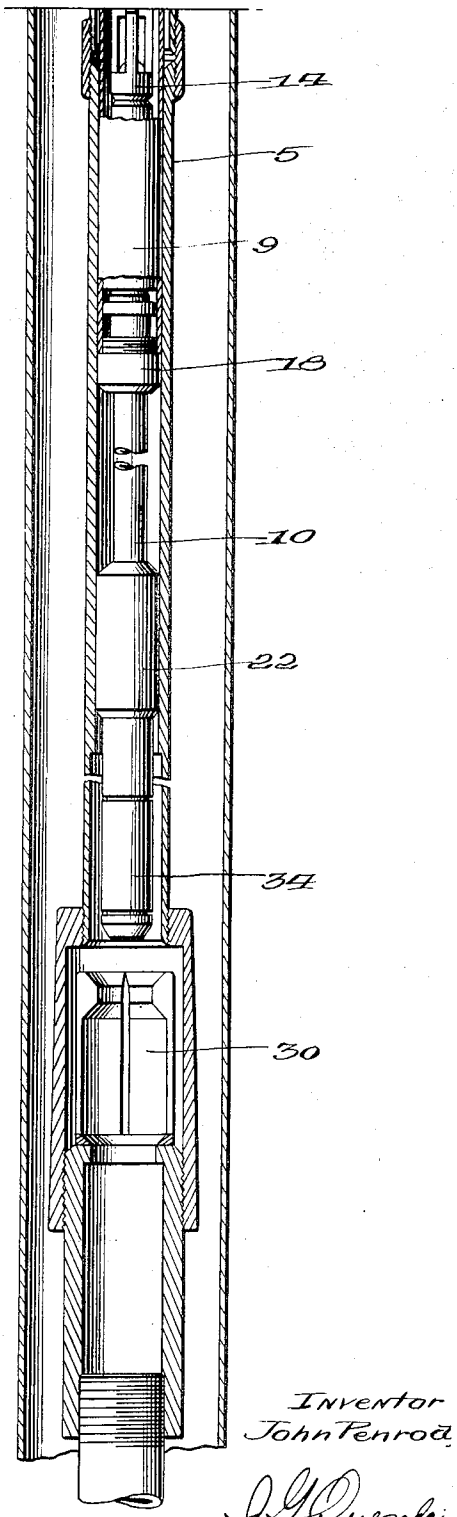


Fig. 2.

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Fig. 3.

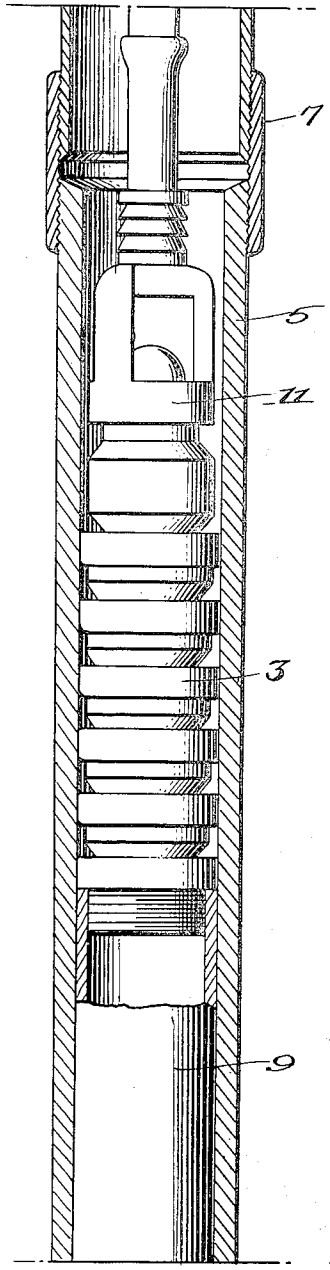


Fig. 4

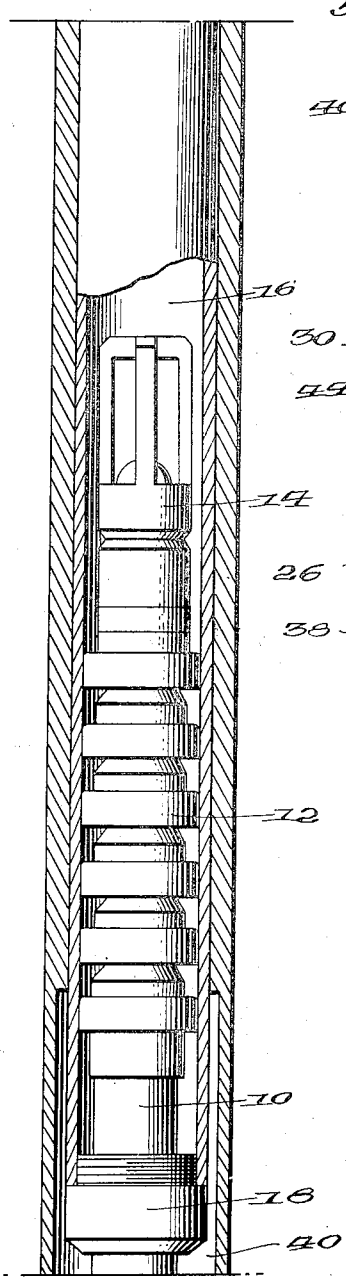
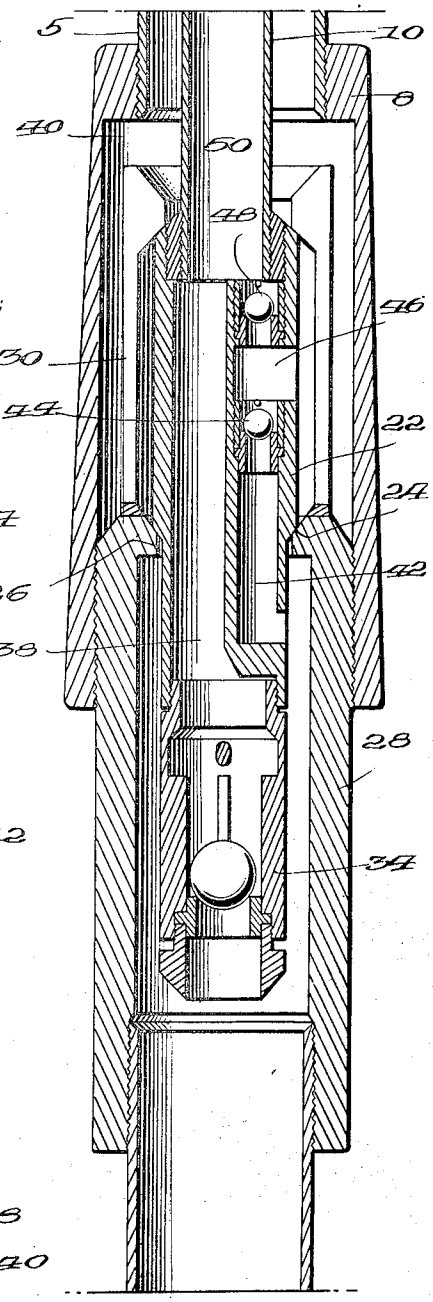


Fig. 5.



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WELL PUMP

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11 Claims. (Cl. 103—187)

This invention relates to pumps especially adapted for use in pumping oil.

Briefly stated, an important object of this invention is to provide a well pump having automatic means by which the same is prevented from becoming gas bound as the result of the presence of a relatively large volume of gas in the fluid.

Another object is to provide a pump having a combination pumping and protecting chamber in the line of pressure between the tubing and the sealing devices of the main pumping chamber so that the combined pumping and protecting chamber and more particularly the sealing devices thereof bear the brunt of the wear incident to the tubing pressure, especially during the up strokes of the pump.

Another and equally important object of the invention is to provide a well pump in which the clutching on mechanism therefor is positioned in the path of circulation of the fluid through the aforesaid pumping and protecting chamber and is cleansed thereby of settling sand so that unseating of the pump is simplified and rendered more certain.

Another object is to provide a well pump in which the protection for the main pumping chamber is increased substantially without sacrificing the diameter of the pumping element which, in this case, is in the nature of a combination working barrel and plunger limited in diameter only by the internal diameter of the tubing.

The invention will also be found to be provided with means by which all the balls and seats thereof and other parts subject to wear may be withdrawn to the surface in an expeditious manner for inspection and repair.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a fragmentary vertical sectional view through the improved pump in seated position,

Figure 2 is a similar view through the pump in unseated position,

Figure 3 is a sectional view through the upper portion of the pump,

Figure 4 is a sectional view through the intermediate portion of the pump,

Figure 5 is a sectional view through the lower portion of the pump.

In the drawings wherein for the purpose of illustration is shown a preferred embodiment of the invention, the numeral 5 designates a working barrel incorporated in a tubing 6 through the medium of a coupling 7 and having connection at the lower portion thereof with the housing 8 of a clutching on mechanism to be described.

The fixed working barrel 5 receives what might be said to be a combination working barrel-plunger 9, the upper portion of which is provided with suitable sealing devices 3 and with a traveling valve 11. The traveling valve 11 is connected in any suitable manner with the sucker rod. The combination working barrel-plunger 9 embodies a tubular body having a close working fit within the fixed barrel 9 and receives a relatively fixed plunger 10.

Referring now to Figure 4, it will be seen that the upper portion of the relatively fixed plunger 10 is provided with a plurality of inverted cups 12 or other sealing devices having fluid tight contact with the interior wall of the movable working barrel-plunger 9. The upper portion of the plunger 10 also is provided with a standing valve 14 by which fluid is admitted into the main pumping chamber 16. Of course, during the up stroke of the combination working barrel-plunger 9, the main pumping chamber 16 is increased in volume and receives fluid by way of the passage through the fixed plunger 10. On the down stroke of the combination working barrel-plunger 9, the main pumping chamber is decreased in volume and the fluid previously admitted thereto is discharged into the tubing. The lower portion of the combination working barrel-plunger 9 has a sleeve nut 18 threaded thereon and forming a means by which the relatively fixed plunger 10 may be unseated to withdraw the pumping unit to the surface. Figure 4 illustrates that the follower of the lowermost cup 12 is in the path of travel of and is adapted for pressure engagement by the sleeve nut 18 when the normal up stroke of the pump is exceeded whereby the pump may be unseated.

The lower portion of the relatively fixed plunger 10 has connection with a foot valve 22 annularly shouldered as indicated at 24 for engagement with the ground seat 26 of the foot valve shoe 28. The foot valve 22 is held in fluid tight contact with the seat 26 thereof by a clutching member embodying an annular series of leaf spring members 30, the upper portions of which are provided with dogs overhanging and having pressure engagement with the upper terminal portion of the valve body 22. The opposed contacting surfaces of the valve 22 and

the dogs of the leaf spring members 30 are oppositely bevelled so that the leaf springs are caused to exert constant pressure on the valve 22 to hold the same on its seat and at the same time to permit of the unseating of the valve and the pump by the means described previously.

A lower standing valve 34 has connection with the lower end of the foot valve 22 and provides a means by which the well fluid may enter the plunger 10 and the main pumping chamber 16. The longitudinal passage 38 through the foot valve 22 provides for the free movement of fluid from the valve 34 to the plunger 10 by way of the chamber 50.

Attention is now invited to Figures 4 and 5 which illustrate that the lower portion of the working barrel 5 and the major portion of the housing 3 cooperate with the plunger 9 and the foot valve 22 in the formation of a combination pumping and protecting chamber 40. The movement of the combination working barrel-plunger 9 in and out of the chamber 40 brings about a variation in the volume of this chamber so that fluid is alternately admitted to and discharged from the chamber 40 to augment action of the chamber 16.

Figure 5 illustrates that the inlet to the combined pumping and protecting chamber 40 is by way of a passage 42 controlled by a valve 44. The passage 42 establishes communication between the interior of the foot valve shoe 28 and a radial port or passage 46, the latter constantly communicating with the chamber 40. The outlet from the combined pumping and protecting chamber 40 is by way of a valve 48.

In the operation of the pump in connection with a relatively noncompressible fluid, the up stroke of the member 9 will bring about the opening of the valves 34, 44 and 14. On the down stroke of the pump when used in connection with a relatively noncompressible fluid, the valves 11, 14 and 48 will be opened to allow of the discharge of liquid from the chambers 40 and 16.

In tracing the flow of liquid that passes through the lower pumping chamber 40, it will be seen that on the up stroke of the combination working barrel-plunger 9, the volume of such chamber is increased so that a vacuum is created therein and the ball valve 44 is unseated to allow of the admission of fluid by way of the passage 42. On the subsequent down stroke of the combination working barrel-plunger 9, the ball valve 44 is seated and the ball valve 48 is unseated so that a portion of the fluid in the chamber 40 is discharged into the intermediate passage 50 and directed into the main pumping chamber 16. Of course, during the descent of the combination working barrel-plunger 9 when pumping a noncompressible fluid, the valve 14 is unseated to allow of the discharge of fluid from the passage 50 into the chamber 16.

The pumping action of the main chamber 16 in connection with a noncompressible fluid is obvious but it might be added that during the descent of the member 9, the valve 14 is unseated along with the unseating of the valve 11 so that the fluid pumped by the two chambers is discharged into the tubing for elevation to the surface.

Now, should the main pumping chamber 16 become gas bound as a result of the presence of a relatively high proportion of gas in the fluid being recovered, the valve 11 and the valve 14 will remain seated on the down stroke of the member 9. The valve 34 will also remain seated. The continued reciprocation of the member 9 in the chamber 40 will result in the building up of fluid pressure within the intermediate chamber 50. That is to say, repeated down strokes of the member 9 in the chamber 40 will build up the pressure in the intermediate chamber 50 to a point superior to the diminished pressure in the chamber 16 on the up stroke. As is well known, the up stroke of the member 9 enlarges the pumping chamber 16 and the pressure of the gas trapped therein is diminished so that the pressure accumulated in the intermediate chamber 50 will be superior thereto and bring about the unseating of the valve 14. In other words, the pressure in the pumping chamber 16 will be stepped up by the flow of fluid from the intermediate chamber 50 to a point where a subsequent down stroke of the member 9 will be accompanied by the opening of the valve 11 against the tubing pressure.

Referring now to the means by which the main pumping chamber 16 and more particularly the sealing devices thereof, such as the cups 3 are protected against the tubing pressure and sand that may be present in the fluid, it is pointed out that coincident with the up stroke of the member 9, the area of contact of the same with the fixed working barrel 5 is increased and in this manner the barrier to the descent of tubing fluid is strengthened. Attention is especially directed to the fact that the combined pumping and protecting chamber 40 is closed at the upper portion thereof by the close contact of the members 9 and 5 and is located in the line of pressure between the tubing fluid and the sealing devices 3 for the main pumping chamber 16. Consequently, the combination pumping and protecting chamber 40 and the sealing devices therefor are caused to bear the brunt of the wear incident to the use of the pump and in this manner the pumping chamber 16 and the sealing devices therefor are relieved of such wear.

Also, it will be seen that the circulation of fluid through the combination pumping and protecting chamber will prevent the accumulation of sand about the clutching on devices 30 so that by no chance, can the foot valve 22 be frozen in place.

A pump constructed in accordance with this invention is limited in its pumping capacity only by the diameter of the tubing and the increased protection to the working parts of the pump is attained at no sacrifice of pumping capacity. The pumping element need be of an external diameter only slightly less than the internal diameter of the tubing to allow of the insertion and removal of the pumping element by way of the tubing.

With reference to the foregoing description taken in connection with the accompanying drawings it will be seen that the member 9 in addition to performing the usual functions, cooperates with the fixed working barrel 5 in increasing the protection to the working parts of the pump and at the same time acts as a plunger within the chamber 40 to increase the capacity of the pump.

It will be seen that the combined pumping capacity of the chambers 16 and 40 is equal to the volume of fluid capable of being displaced by a plunger having the same external diameter as the external diameter of the member 9.

Having thus described the invention, what is claimed is:

1. In a pump, a relatively fixed plunger, a mov-

able working barrel receiving said plunger and having a pumping chamber, and a fixed working barrel closely embracing said movable working barrel, there being a pumping chamber below the point of contact of said movable and fixed barrels and being substantially closed thereby, separate inlet and outlet control devices for said first and second named pumping chambers, there being means directing the discharge from said second named pumping chamber into said first named pumping chamber.

2. In a pump for use in wells, a fixed working barrel, a relatively fixed plunger having sealing devices, a movable working barrel receiving said plunger and having a pumping chamber, there being a fluid pumping chamber receiving one end portion of said movable working barrel and protecting said sealing devices of the plunger, valve controlled means directing the discharge from said second named pumping chamber to said first named pumping chamber, and a valve controlled inlet to said second named chamber independent of said first named chamber.

3. In a pump for use in pumping compressible and relatively non-compressible fluids from wells, a tubing, a fixed working barrel attached to the tubing, a relatively fixed plunger having sealing devices, a working barrel receiving said plunger and the sealing devices thereof and being provided with a pumping chamber, there being means cooperating with said plunger and said fixed working barrel in the formation of a protecting and pumping chamber communicating with the interior of said movable working barrel, said plunger being provided with an intermediate chamber establishing communication between said first and second named chambers and functioning as a pressure accumulating chamber when the pump is gas bound, and a valve controlling communication between said second named pumping chamber and said pressure accumulating chamber.

4. In a pump for use in pumping compressible and relatively non-compressible fluids from wells, a fixed working barrel, a relatively fixed plunger, a working barrel receiving said plunger and being provided with a pumping chamber, there being means cooperating with said plunger and said fixed working barrel in the formation of a protecting and pumping chamber communicating with the interior of said movable working barrel, said plunger being provided with an intermediate chamber establishing communication between said first and second named chambers and functioning as a pressure accumulating chamber when a compressible fluid is encountered, a valve controlling communication between said protecting and pumping chamber and said intermediate chamber, and valves located adjacent to the ends of said intermediate chamber.

5. In a pump for use in pumping compressible and relatively non-compressible fluids from wells, a fixed working barrel, a fixed plunger, a movable barrel embraced closely by said fixed barrel and having fluid tight con'act with said plunger, there being means cooperating with said plunger in the formation of a combination protecting and pumping chamber receiving said movable working barrel, standing valves adjacent to the ends of said plunger, means to admit fluid to said combination protecting and pumping chamber independently of said standing valves, said plunger being provided with a passage between said first and second named chambers and functioning as a pressure accumulating chamber when a compressible fluid is encountered.

6. In a pump for use in pumping compressible and relatively non-compressible fluids from oil wells, a fixed working barrel, a plunger within said fixed working barrel and having a fluid conduit provided with an inlet thereto, a movable working barrel receiving said plunger and provided with a pumping chamber, there being means cooperating with said plunger in the formation of a combination protecting and pumping chamber receiving said movable working barrel and having the volume varied thereby, there being means independent of said fluid conduit and the inlet thereto for supplying well fluid to said pumping and protecting chamber, and means establishing communication between said first and second named chambers, and embodying a chamber for the accumulation of pressure when in pumping, a compressible fluid is encountered.

7. In a pump for use in oil wells, a fixed working barrel, a plunger having a fluid conduit, a movable working barrel receiving said plunger and being provided with a pumping chamber, there being means cooperating with said plunger in the formation of a combination protecting and pumping chamber receiving said movable working barrel and having its volume varied thereby, there being means independent of said fluid conduit for supplying well fluid to said pumping and protecting chamber, said conduit constituting a means establishing communication between said chambers whereby fluid discharged from the pumping and protecting chamber is directed through said conduit into the pumping chamber of the movable working barrel, upper and lower valves for said conduit, a foot valve carried by said fixed plunger, and an anchoring device engaging said foot valve and positioned in the path of and maintained relatively free of accumulations of sand by the fluid being recovered.

8. In a pump for use in oil wells, a fixed working barrel, a plunger having a fluid conduit, a movable working barrel receiving said plunger and being provided with a pumping chamber, there being means cooperating with said plunger in the formation of a combination protecting and pumping chamber receiving said movable working barrel and varied in volume thereby, there being means independent of said fluid conduit for supplying well fluid to said pumping and protecting chamber, there being means establishing communication between said pumping and protecting chamber and said conduit whereby fluid discharged from the pumping and protecting chamber is directed through said conduit into the pumping chamber of the movable working barrel, upper and lower valves for said conduit, a foot valve carried by said fixed plunger, and an anchoring device engaging said foot valve, said foot valve and the anchoring device thereof being located in said pumping and protecting chamber whereby the movement of fluid therein is caused to cleanse the foot valve and the anchoring device.

9. In a pump for use in pumping compressible and relatively non-compressible fluids from wells, a working barrel having a pumping chamber, there being inlet and outlet means to said pumping chamber, a member having a second pumping chamber, there being a fluid passage between said first and second named chambers for the flow of fluid from the second chamber to the first chamber, and forming a pressure accumulating chamber when a compressible fluid is encountered during pumping, and separate set of inlet and

outlet valves for each of said pumping chambers.

10. In a fluid lift for pumping compressible and relatively non-compressible fluids from wells, a working barrel having a pumping chamber, a plunger within the working barrel and having a passage opening into said chamber and forming a pressure accumulating chamber when in pumping a relatively compressible fluid is encountered, a member having a second pumping chamber in communication with said fluid passage whereby fluid is directed from the first to the second named chamber, means controlling the flow of fluid through said passage, said passage in the plunger being provided with a valve controlled inlet separate from said chamber.

11. In a fluid lift for use in wells, a combination working barrel and plunger having a pumping chamber, a plunger in said barrel and alternately enlarging and diminishing the volume of the chamber, a second pumping chamber receiving said combination working barrel and plunger and having the volume thereof enlarged thereby concurrently with the enlargement of the volume of the first named chamber, there being means conducting the fluid discharged from the second chamber into the first chamber during the enlargement of the first chamber and consequent diminution of the pressure therein, separate sets of inlet and outlet valves for each of said first and second named chambers.

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