March 3, 1953 L. DAVIS 2,630,070

WELL PUMP

Original Filed May 13, 1949 2 SHEETS—SHEET 1

Fig. 1.

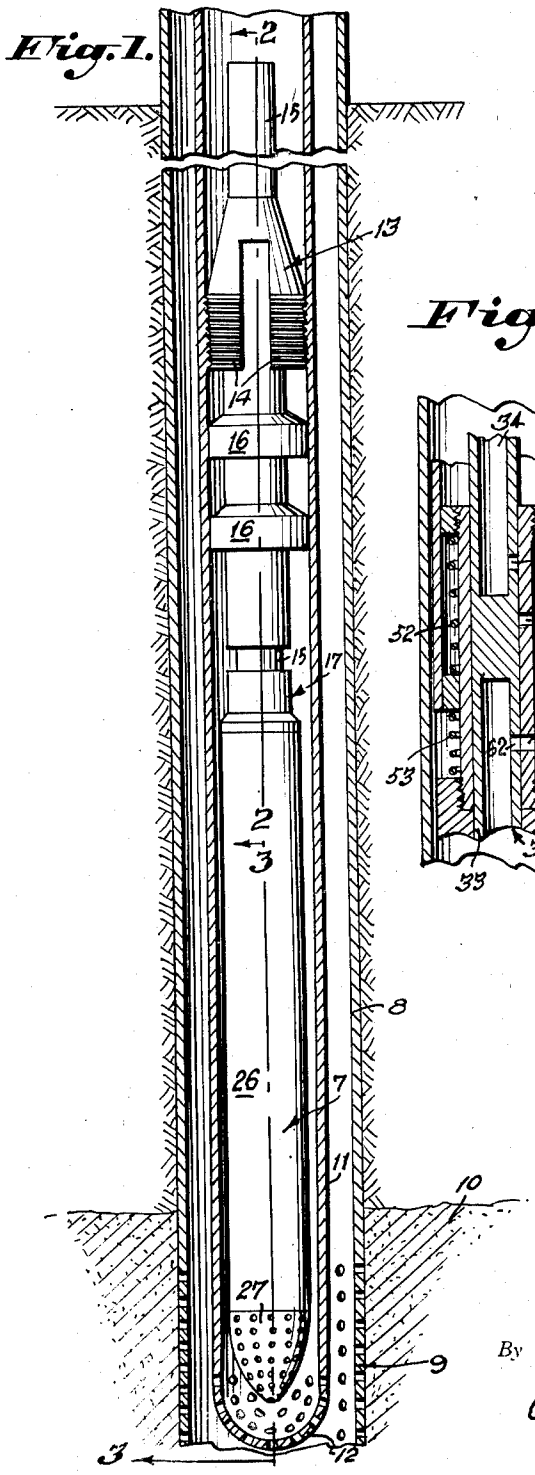
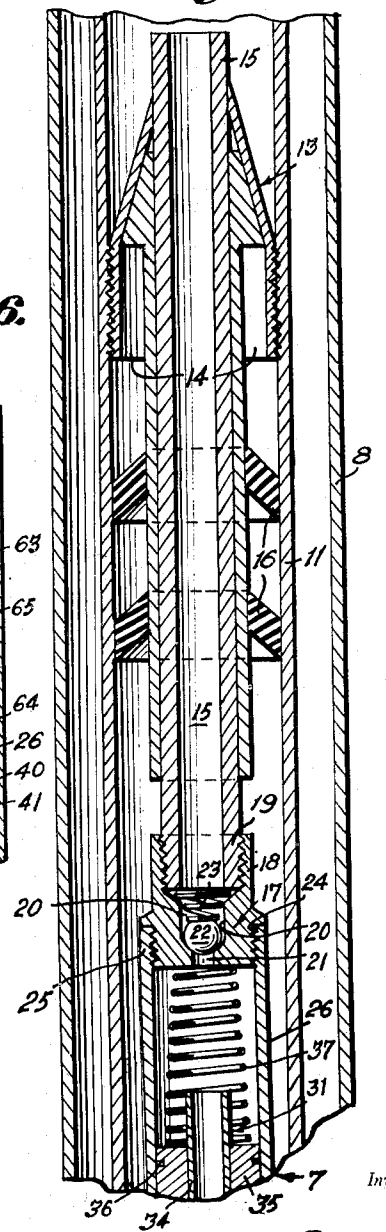


Fig. 6.

Fig. 2.



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Fig. 3.

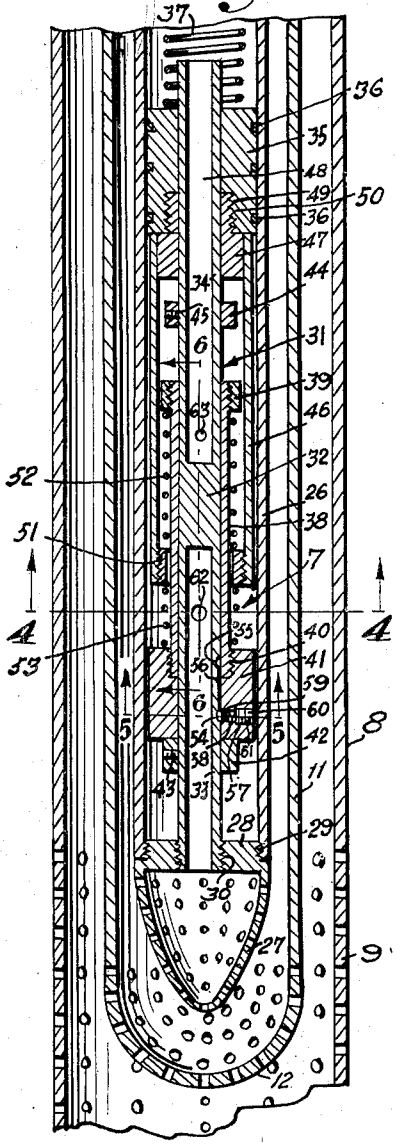


Fig. 4.

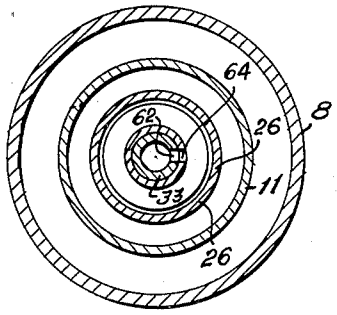
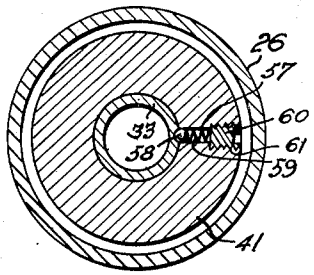


Fig. 5.



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2,630,070

WELL PUMP

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Continuation of application Serial No. 92,989, May 13, 1949. This application August 3, 1950, Serial No. 177,467

9 Claims. (Cl. 103—46)

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This application is a continuation of my prior application No. 92,989, now abandoned.

This invention relates to a novel construction of well pump, power for the operation of which is provided by the pressure in the bottom of a well.

More particularly, it is an aim of the present invention to provide a reciprocating type well pump wherein the pump structure is moved in one direction by the pressure in the bottom of a well or below the pump for loading, expansion spring means for forcing the pump structure to move in the opposite direction.

Another object of the invention is to provide a novel pump structure having a reciprocating valve means for permitting the medium being pumped from the bottom of a well or from beneath the pump to pass longitudinally through the pump in an upward direction.

A further object of the invention is to provide a pump having a snap action for quickly reversing the position of the valve as the pump approaches the extremity of its movement and for causing the pump to quickly reverse its direction of travel.

Another object of the invention is to provide a pump capable of being applied to a pump tubing without killing the well and which is equally well adapted for use with wells having jet valves and to prevent the gas from by-passing the oil or other liquid being raised and to thereby minimize the waste of gas from a well and to prevent the liquid from being blown out of the well by the gas pressure therein.

A further object of the invention is to provide a pump which will reduce the amount of gas required for pumping any given quantity of oil or other liquid mediums from a well by preventing the gas from passing the liquid in its upward travel through the pump tubing.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

Figure 1 is a fragmentary, central sectional view, partly in side elevation showing a well casing containing a well tubing in which the pump is detachably mounted;

Figure 2 is a fragmentary vertical sectional view on an enlarged scale taken substantially along a plane as indicated by the line 2—2 of Figure 1;

Figure 3 is a similar view taken substantially

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along a plane as indicated by the line 3—3 of Figure 1;

Figure 4 is a cross sectional view taken substantially along a plane as indicated by the line 4—4 of Figure 3;

Figure 5 is an enlarged cross sectional view taken substantially along a plane as indicated by the line 5—5 of Figure 3, and

Figure 6 is a vertical sectional view taken substantially along a plane as indicated by the line 6—6 of Figure 3.

Referring more specifically to the drawings, for the purpose of illustrating a preferred application and use of the pump, designated generally 7 and comprising the invention, the numeral 8 designates a well casing having a perforated lower portion 9 which is submerged in the oil and sand 10 forming a subsurface stratum. Disposed within the well casing 8 is a conventional well tubing 11 having a lower perforated end 12 which is disposed in the perforated casing 9. The numeral 13 designates generally a conventional setting tool or anchoring device which is adapted to be lowered into the well tubing 11 and detachably anchored therein at any desired level by means of its expansible clamping element 14. The anchoring device 13 includes a length of tube or pipe 15 having packing members 16 of annular form which engage and seal the pump casing 11 around the anchoring unit 13 to prevent liquid from the bottom of the well passing upwardly through the pump tubing 11 except by passing through the pipe or tube 15 from beneath the anchoring unit 13 to thereabove.

The pump 7, comprising the invention, includes an adaptor or coupling 17 having an internally threaded upper end 18 which engages the externally threaded lower end 19 of the pipe 15 for detachably connecting the pump 7 to the lower end of the anchoring unit 13 and so that said pump will be supported thereby in the lower portion of the well tubing 11, as illustrated in Figure 1. The coupling 17 has a bore extending longitudinally therethrough as seen at 20 which opens outwardly of the lower end thereof and which communicates with the tube 15; said bore 20 being restricted adjacent its lower end to provide an upwardly facing valve seat 21 for an upwardly opening ball valve 22 which is normally urged downwardly to a closed position by an expansion valve spring 23 which bears on the upper part thereof and which seats against the lower end of the tube 15. The lower end of the coupling or adaptor 17 is restricted and externally

threaded as seen at 24 to receive the internally threaded upper end 25 of a pump barrel 26 which extends downwardly therefrom to adjacent the lower perforated end 12 of the pump tubing 11.

The pump barrel 26 is provided with a screen 27 at its lower end which extends into the perforated lower end 12 of the well tubing 11 and which has a disk 28 at its upper end which is externally threaded to detachably engage the internally threaded lower end 29 of the pump barrel 26 for detachably mounting the screen 27 thereon.

The disk 28 is provided with a threaded opening 30 in which is detachably mounted the threaded lower end of a conduit, designated generally 31 which extends upwardly therefrom through the pump barrel 26 to beneath and adjacent the adaptor 17. The conduit 31 has a solid intermediate portion 32 and tubular end portions forming a lower pipe or conduit 33 which opens into the screen 27 and an upper pipe or conduit 34 which opens into the pump barrel 26 beneath and adjacent the adaptor 17.

A piston 35 is reciprocally mounted on the upper pipe portion 34 and is reciprocally disposed in the pump barrel 26 and is provided with a plurality of piston rings 36 for engagement with the internal wall of the pump barrel 26 to prevent the medium being pumped from passing around the piston 35. An expansion coiled spring 37 bears against the underside of the adaptor 17 and against the upper end of the piston 35 for urging said piston downwardly in the pump barrel 26 and on the tube or conduit 34.

A sleeve valve 38 is reciprocally mounted on the intermediate portion of the conduit 31 and is provided with an externally threaded upper end to receive a nut 39 and an externally threaded lower end which engages a threaded recess 40 in a collar 41 which is reciprocally mounted on the tube portion 33. A stop collar 42 is adjustably secured to the tube portion 33 by a setscrew 43 below the collar 41 to be engaged thereby for limiting the downward sliding movement of said collar and the sleeve valve 38 on the conduit member 31 and a similar stop collar 44 is adjustably secured to the tube portion 34, above the nut 39 by a setscrew 45 to limit the upward movement of the sleeve valve 38.

A sleeve 46 has an adaptor 47 secured in the upper end thereof and which is provided with a bore 48 extending therethrough for reciprocally engaging the tube portion 34 and which is provided with a restricted externally threaded upper end 49 which threadedly engages a downwardly opening threaded recess 50 of the piston 35 for detachably connecting the sleeve 46 thereto. The sleeve 46 is loosely disposed in the pump barrel 26 and loosely disposed around the upper portion of the conduit member 31 and has an annular spring stop 51 threaded into its lower end to provide a seat for an upper expansion coiled spring 52 which is disposed on the conduit member 31 above the spring stop 51 and the upper end of which seats against the nut 39. The spring stop 51 also provides a seat for the upper end of a lower expansion spring 53 which is likewise mounted on the conduit member 31 and the lower end of which seats against the collar 41.

The tube portion 33 is provided with externally disposed longitudinally spaced recesses including a lower recess 54 and an upper recess 55 connected by a groove 56. The collar 41 is provided with a radial bore 57 containing at its inner end a ball latch 58 which is spring urged inwardly by an expansion coiled spring 59 which seats against the ball 58 and against a screw stop 60 which engages in the outer internally threaded end 61 of the bore 57. The spring latch 58 is adapted to selectively engage the recesses 54 and 55 and to travel therebetween in the groove 56.

As best seen in Figure 6, the tube portion 33 adjacent the solid portion 32 is provided with a port 62 and the tube portion 34, adjacent the solid portion 32 is likewise provided with a port 63. The sleeve valve 38 has a lower port 64 which registers with the port 62 only when the spring latch 58 is in engagement with the lower recess 54 and an upper port 65 which registers with the port 63 only when the spring latch 58 is in engagement with the upper recess 55.

Assuming the parts are in the positions as illustrated in Figures 3 and 6, the pressure in the bottom of the well in which the pump 7 is disposed will cause the oil or other liquid being pumped to enter the well casing through the perforated portion 9 and to enter the lower end of the pump tube through its perforated portion 12. The oil will then enter the pump 7 through the screen 27 and pass upwardly through the tube portion 33 and will be released through the registering ports 62 and 64 into the pump barrel 26. The oil can pass upwardly between the sleeve 46 and pump barrel 26 to impinge against the lower end of the piston 35 and sufficient space is provided between the spring stop 51 and sleeve valve 38 to permit the oil to pass upwardly into the sleeve 46 and impinge against its coupling or adaptor 47. When a sufficient amount of oil has thus entered the pump barrel 26 so as to exert sufficient pressure against the piston 35 to overcome the pressure of the spring 37 and spring 52, the spring latch 58 will be cammed out of engagement with the recess 54 and the piston 35 will slide upwardly in the pump barrel 26 carrying with it the sleeve 46, sleeve valve 38 and collar 41. This upward movement of the piston 35 and sleeve 46 will initially occur relatively to the sleeve valve 38, nut 39 and collar 41 during which time the spring 52 will be compressed and the spring 53 expanded until the pressure of the spring 52 is sufficient to unseat the spring latch 58 so that thereafter the sleeve valve 38 will move rapidly to the upper extremity of its movement and in which the spring latch 58 will seat in the upper recess 55, thereby moving the port 64 out of registry with the port 62 and the port 65 into registry with the port 63. When this occurs the oil within the pump barrel 26 will be released through the registering ports 62 and 65 and pass upwardly through the tube portion 34 to above the piston 35 and the oil which has passed to above the piston 35 on its previous upstroke will have been forced upwardly into the pipe 15 by the pressure in the pump barrel chamber above the piston 35 and which causes the valve 22 to be unseated to permit the oil to pass into the pipe 15. After sufficient of this oil has escaped the then loaded spring 37 will force the piston 35 downwardly and the spring 23 will cause the valve 22 to resume a closed position to prevent the oil from escaping from the pipe 15 back into the pump barrel 26. As the piston 35 moves downwardly the spring 52 is initially permitted to expand to assist in forcing said piston and sleeve 46 downwardly and at the same time the spring 53 is compressed until the pressure thereof is

sufficient to unseat the ball latch 58 from the recess 55. When this occurs the collar 41 and sleeve valve 39 will move rapidly downwardly until the ball latch 58 seats in the bottom recess 54 to thereby close the port 63 and reopen the port 62 so that the operation can be repeated. The ball latch 58 will engage the groove 56 in its movement between the recesses 54 and 55 to insure its proper seating in said recesses and to prevent the sleeve valve 39 from turning relatively to the conduit member 31 so that the ports 64 and 65 will properly align with the ports 62 and 63, respectively.

From the preceding it will be readily apparent that a well pump of extremely simple construction has been provided which may be readily mounted in a well tubing and which will be reciprocally operated by the pressure in the bottom of the well for moving the reciprocating parts in one direction and for loading the spring to move the parts in the opposite direction. The pump 7 may also be utilized with wells which are jetted by locating the pump above the jet valve and if desired a number of pumps may be employed, one above each of the jet valves of a well to prevent the gas from bypassing the oil, thereby eliminating the waste of gas. The pump 7 will also prevent oil from being blown out of a well and may be utilized in a well having a considerable bottom pressure.

Various other modifications and changes are contemplated and may obviously be resorted, without departing from the spirit or scope of the invention as hereinafter defined by the appended claims.

I claim as my invention:

1. A reciprocating pump for pumping pressure fluid up the tubing of a well in which said tubing is installed, said pump being adapted to be lowered into a well tubing and detachably anchored adjacent the lower end thereof and comprising a pump barrel assembly adapted to be disposed in the well tubing in a submerged position and including a pump barrel and a conduit extending thereabove, means for sealing off the annular space between the well tubing the pump barrel assembly below the upper end of the conduit, an upwardly opening valve interposed between said conduit and the pump barrel, a piston reciprocally mounted in the pump barrel, spring means for urging the piston downwardly, a closure for the lower end of said pump barrel, a conduit member having one end secured in and extending through said closure and extending upwardly therefrom through a substantial portion of the pump barrel and reciprocally through said piston, said conduit member having a solid intermediate portion and upper and lower tubular end portions, said lower tubular end portion opening through the closure and communicating with the well tubing to form the inlet passage of the pump, said upper tubular portion opening at its upper end above the piston and beneath said check valve, said tubular portions each being provided with a port, adjacent said solid intermediate portion, communicating with the pump barrel, a sleeve valve slidably mounted on said conduit member and having a port to register with the lower tubular portion only when the piston is at the lower extremity of its movement and a port to register with the port of said upper tubular portion only when the piston is at the upper extremity of its movement, and means forming a connection between the piston and sleeve valve whereby said sleeve valve will be reciprocated on said conduit member by the reciprocating movement of the piston, said piston being urged upwardly by the pressure of the oil within the pump barrel and beneath the piston.

2. A well pump as in claim 1, and adjustable stop means mounted on said conduit member for limiting the reciprocating movement of the sleeve valve.

3. A well pump as in claim 1, and cushioning springs interposed between the means connecting the piston and sleeve valve for cushioning the movement of the piston and for causing the sleeve valve to rapidly move from a position to expose one of the ports of the conduit member to a position to expose the other port thereof.

4. A well pump as in claim 1, and cushioning springs interposed between the means connecting the piston and sleeve valve for cushioning the movement of the piston and for causing the sleeve valve to rapidly move from a position to expose one of the ports of the conduit member to a position to expose the other port thereof, and spring latch means carried by the sleeve valve, said conduit member having spaced recesses to be engaged by said spring latch means at each extremity of the movement of the sleeve valve for releasably holding the sleeve valve in one or the other of the extremities of its movement and for cooperation with said cushioning spring for causing a rapid movement of the sleeve valve in each direction.

5. A well pump as in claim 1, said means for connecting the piston and sleeve valve including a sleeve member connected to and depending from the piston and disposed around a portion of the sleeve valve, a spring stop at the lower end of said sleeve member, expansion springs bearing against the upper and lower sides of the spring stop and disposed on the sleeve valve, and collar members at the remote ends of the sleeve valve forming seats for the remote ends of said last mentioned springs.

6. A well pump as in claim 1, said means for connecting the piston and sleeve valve including a sleeve member connected to and depending from the piston and disposed around a portion of the sleeve valve, a spring stop at the lower end of said sleeve member, expansion springs bearing against the upper and lower sides of the spring stop and disposed on the sleeve valve, and collar members at the remote ends of the sleeve valve forming seats for the remote ends of said last mentioned springs, and spring latch means carried by the sleeve valve for releasably latching the sleeve valve at each extremity of its movement and for cooperation with said last mentioned springs to cause a rapid action of the sleeve valve as the piston approaches each extremity of its reciprocating movement.

7. A reciprocating pump for pumping pressure fluid up the tubing of a well in which said tubing is installed, said pump being adapted to be detachably anchored in the lower end of said tubing and comprising, a barrel, means connected therearound for sealing off the annular space between said barrel and said tubing, said barrel opening into said tubing above said sealing means, said barrel having a bottom closure, a conduit member having one end secured in and extending through said closure and extending upwardly within said barrel, a piston operable within said barrel and around said conduit, a check valve in said barrel above said piston, resilient means between said check valve and piston for urging said piston downwardly, a sleeve valve slidably mounted on said conduit member and having an

upper and lower port therethrough, a wall across said conduit, ports through said conduit above and below said wall, connection means between said sleeve valve and said piston to reciprocate said sleeve valve as said piston is urged upwardly by said pressure fluid and downwardly by said resilient means, and guide and stop means on said conduit and said sleeve valve to bring said upper and lower ports in engagement respectively at the upper and lower stroke ends.

8. A reciprocating well pump for a well having a tubing therein and a pressure fluid in communication with the lower end of the tubing, said pump comprising, a barrel adapted to be positioned in the lower end of said tubing, means around said barrel for sealing off the annular space between said barrel and said tubing, said barrel opening into said tubing above said sealing means and having a bottom closure below said sealing means, a conduit communicating with said pressure fluid below said bottom closure and upstanding within said barrel above said bottom closure, a piston operable within said barrel and around said conduit, a check valve in the portion of said barrel above said conduit, means between said barrel portion and said piston to yieldably urge said piston downwardly, a valve member in movable contact with said conduit, said conduit and said valve member being adapted in lower position of said valve member to admit said pressure fluid from said conduit into said barrel below said piston to act upwardly thereon while closing off fluid pressure flow out said conduit above said piston, said conduit and said valve member being also adapted in upper position of said valve member to admit said pressure fluid from said barrel to flow out said conduit above said piston while closing off fluid pressure flow from said conduit into said barrel below said piston, and means between said valve and said piston to alternately yieldably urge said valve downwardly to said lower position, and upwardly to said upper position.

9. A reciprocating pump for a well having a tubing therein and a pressure fluid in communication with the lower end of the tubing, said pump comprising, a barrel having a conduit upstanding therewithin from the lower end thereof to communicate with said pressure fluid, means to seal between said barrel and said tubing, a piston operable to slidably seal between said barrel and said conduit, a check valve in said barrel above said piston, means in said barrel and around said conduit to yieldably urge said piston downwardly, a valve means around said conduit, said conduit and said valve means being adapted to permit relative motion therebetween between two pre-determined positions to admit pressure fluid to urge said piston upwardly when in one position and to discharge fluid from said conduit above said piston in the other position when said piston is urged downwardly.

LOUIS DAVIS.

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