

Feb. 5, 1957

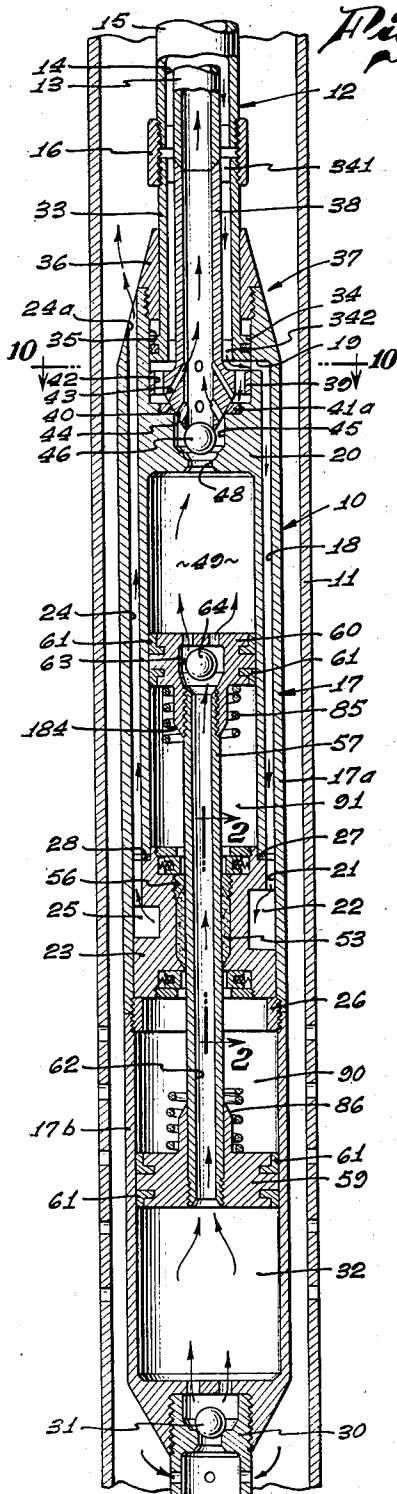
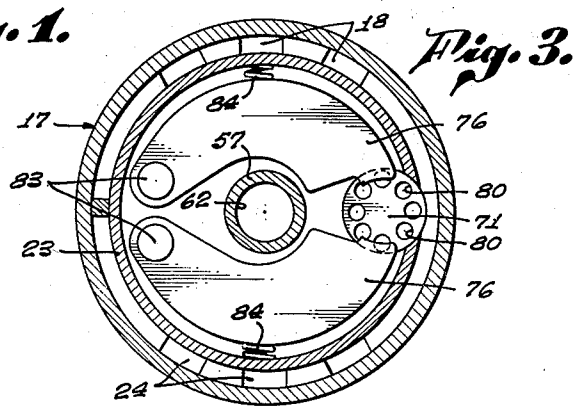
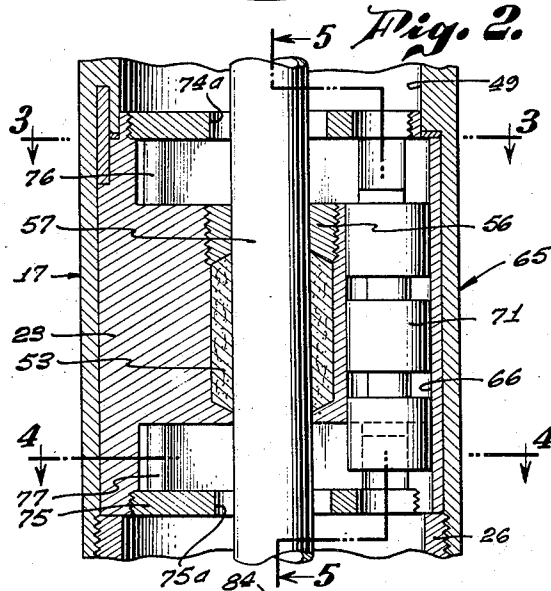
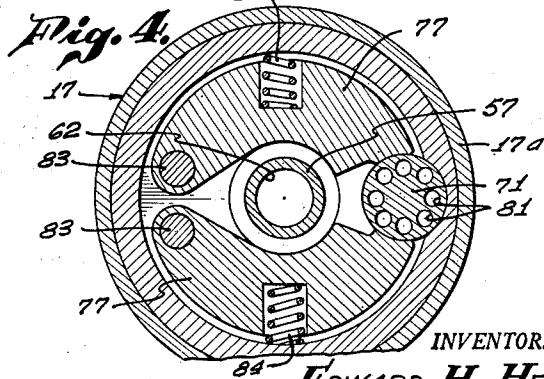
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2,780,171

PNEUMATICALLY ACTIVATED WELL PUMP

Filed May 20, 1954

3 Sheets-Sheet 1



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Feb. 5, 1957

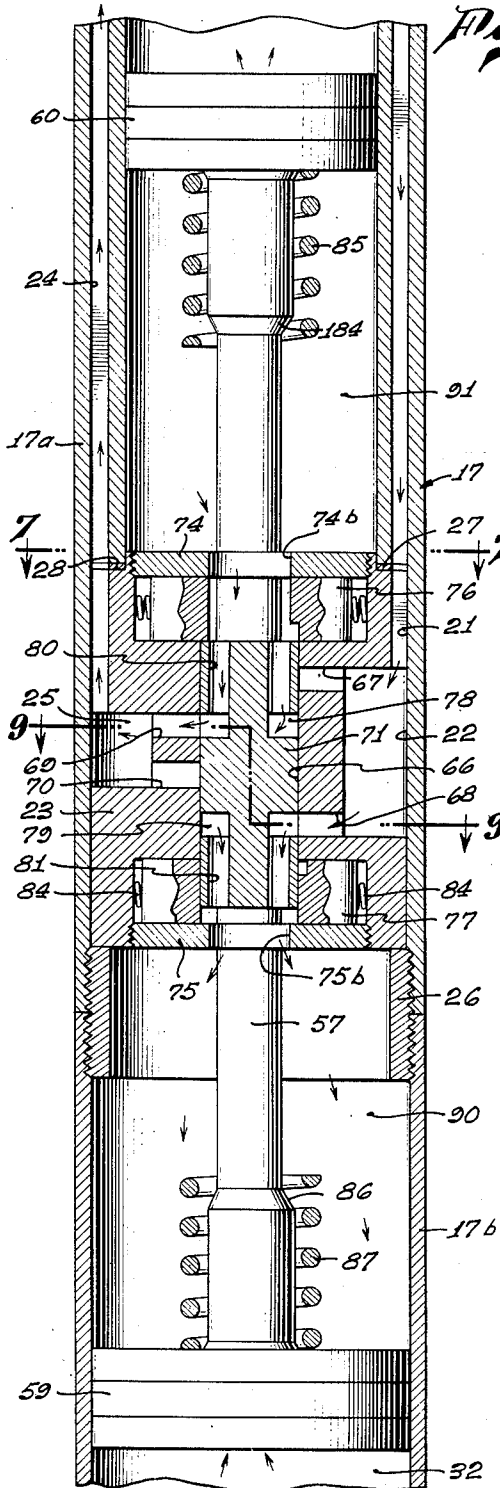
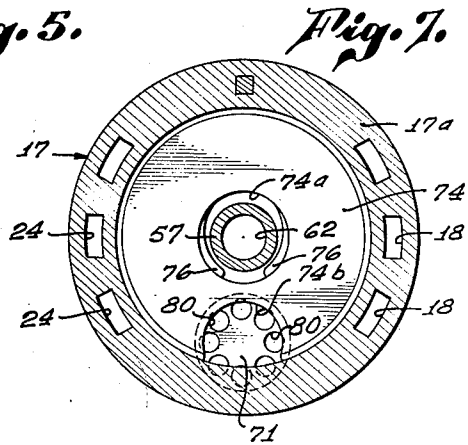
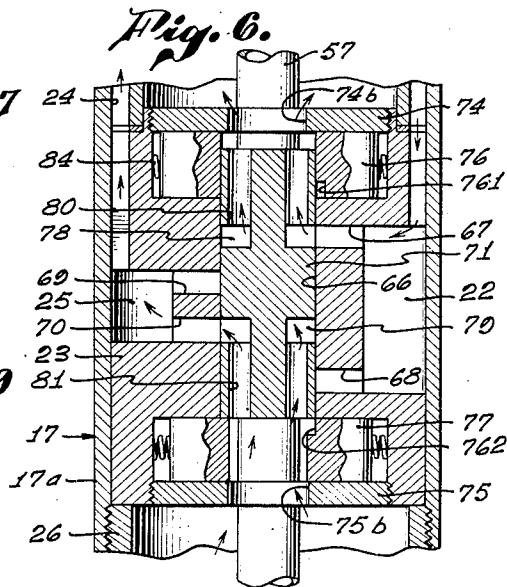
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PNEUMATICALLY ACTIVATED WELL PUMP

Filed May 20, 1954

3 Sheets-Sheet 2



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PNEUMATICALLY ACTIVATED WELL PUMP

Filed May 20, 1954

3 Sheets-Sheet 3

Fig. 8.

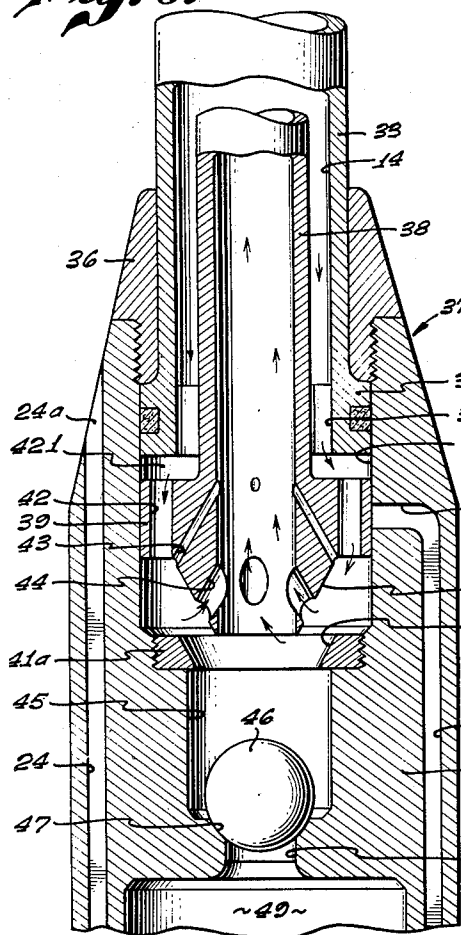


Fig. 11.

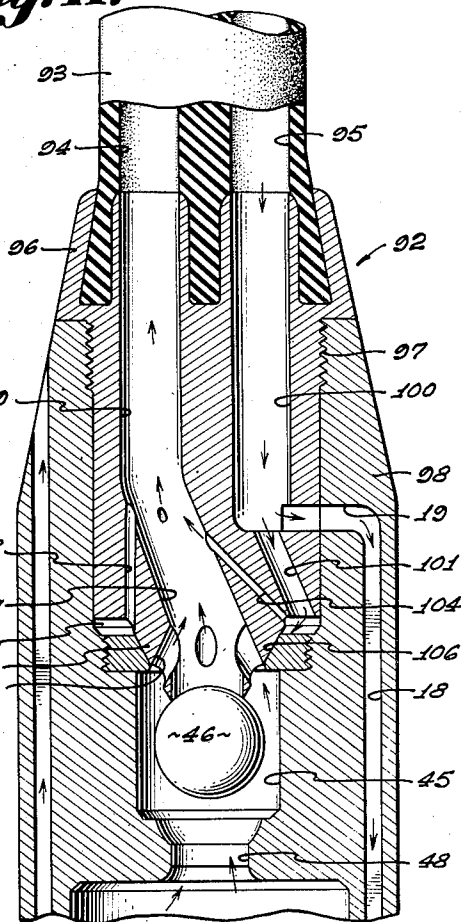


Fig. 9.

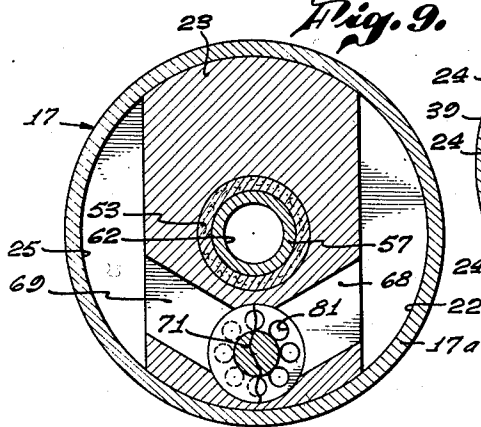
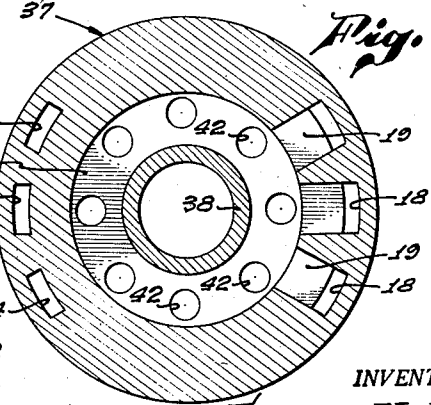


Fig. 10.



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PNEUMATICALLY ACTIVATED WELL PUMP

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Application May 20, 1954, Serial No. 431,064

20 Claims. (Cl. 103—5)

This invention has to do generally with fluid pressure actuated equipment to be operated in deep wells for the displacement of production liquid to the ground surface. More particularly, the invention is directed to pneumatically operated liquid-displacing mechanisms designed for use in modern oil wells under conditions of well-bore or casing diameters under six inches, pressures in excess of 1000 p. s. i., depths that may be as great as 20,000 feet, and offsets presently ranging over a mile from the perpendicular.

Structurally, and in one of its aspects, the invention is concerned with improvements in piston type well pumps wherein the displacement of production liquid results from reversing application of the pressure of a gaseous operating fluid to oppositely facing areas of a piston or piston assembly. One feature of major importance concerns an improved valve means, itself pneumatically actuated, for so applying the operating gas pressures to the piston assembly.

Further in connection with the valve means, the invention contemplates in its preferred form, a relatively simple form of single reciprocating control valve operable at the limits of its stroke to cause the application of reversing gas pressures to the piston assembly. The invention is particularly concerned with the novel aspects of positively controlling automatically and in accordance with or response to the piston assembly travel, the retention of the valve in its two operative or pressure fluid transmitting positions. In this connection, and as will later appear in full detail, the invention provides a novel arrangement of valve blocking means, preferably in the nature of latch elements, which positively position the valve in the function positions between which it is displaced by the operating gas pressure, and which are releasable by the piston assembly to permit instantaneous throw of the valve between those positions under the influence of the operating gas pressure.

Other objects of the invention have to do with the provision of novel liquid displacing means operable in conjunction with the pump proper to utilize the pump actuating pressurized gas to aid in the ejection or displacement to the ground surface of the production fluids displaced upwardly from and by the pump.

Additional features, structurally and functionally related to the gas ejection mechanism, provide means for immobilizing the pump piston assembly and permit the circulation of solvents through the pressurized gas feed and production fluid discharge conduits, generally to flush out these lines and particularly for the removal of paraffinic or asphaltic accumulations in the discharge conduit.

The invention has various additional features and objects, all of which together with the details of certain typical and preferred embodiments of the invention, will be understood more fully and to best advantage from the following description of the accompanying drawings, in which:

Fig. 1 is an axial section illustrating the apparatus as used in a well;

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Fig. 2 is an enlarged fragmentary vertical sectional view taken on line 2—2 of Fig. 1, particularly showing the control valve and piston;

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 2;

Fig. 5 is an enlarged sectional view taken on line 5—5 of Fig. 2, showing the valve tripping elements located at the piston heads;

Fig. 6 is a fragmentary view of the central section of Fig. 5, showing the control valve in its upper position;

Fig. 7 is a cross-sectional view taken on line 7—7 of Fig. 5;

Fig. 8 is an enlarged view of the manifold section located in the upper end of Fig. 1, particularly showing this unit in its open position;

Fig. 9 is a section taken on broken line 9—9 of Fig. 5;

Fig. 10 is a cross-sectional view taken on line 10—10 of Fig. 1; and

Fig. 11 is a vertical sectional view through a modification of the manifold unit illustrated in Fig. 8, particularly showing this unit's adaptation to flexible operational conduits.

Referring particularly to Fig. 1 in the drawings, the fluid displacing mechanism generally indicated at 10, is shown to be run down within the usual perforated casing or line 11 on the lower end of a double conduit string 12 which may comprise an inner fluid delivery pipe 13 contained within and concentrically spaced at 14 from an outer pressure fluid pipe 15. The sections or stands of the outer pipe 15 are joined, as by couplings 16, which may comprise suitable means for interconnecting corresponding length stands of the inner pipe so that the two pipe strings are rigidly associated.

The fluid displacement mechanism 10 includes a tubular pump body 17, the side wall of which contains a plurality of pressure fluid delivery passages 18, see Fig. 10, leading from ports 19 in the head 20 down to registering passages 21 and the intake chest 22 in a block 23 which accommodates certain fluid passages, valve ports and the piston rod, all as will hereinafter appear. The side of the pump body 17 opposite the passages 18 contains a plurality of circularly spaced exhaust passages 24 leading from the block-contained exhaust chest 25 through head 20 to the outside of the pump. The block 23 is held in confinement between coupling 26 (interconnecting the body or barrel sections 17a and 17b) and gasket 27 seated against shoulder 28. Well fluid enters the bottom of the pump barrel through an intake pipe or gas pilot 30 past check valve 31, which prevents return flow from the lower displacement chamber 32. Pipe 30 may be sufficiently extended to locate the exhaust ports 24a above the normal liquid levels in the well so as to avoid agitation of the liquid before it is taken into the pump.

Referring to Figs. 1 and 8, the lower end of pipe 15 is provided with an extension 33 and head 34 slideable within a cylindrical bore 35 in the pump body head 20, and retained in the bore by threaded sleeve collar 36. This head 34, along with its accommodation in the cylindrical bore and association with the later described appurtenant parts, are included in what generally may be designated as the manifold unit 37. The bottom extension 38 of pipe 13 similarly carries a head 39 vertically reciprocable within bore 35 and having a lower tapered surface 40 engageable with the corresponding taper 41 of seat 41a threaded into the pump body. Extensions 33 and 38 are rigidly joined, as by circularly arranged spacers at 341 and 342, and terminate in a single head for simultaneous movement. Head 39 contains circularly spaced passages 42 which may transmit pressure fluid from passage 14 and annular recess 421,

into the pump-displaced liquid column in pipe 13, through circularly arranged passages 43 and 44. When the head 39 is in a raised position such as appears in Fig. 8, the gas flow from passages 42 into the liquid production column may occur through both passages 43 and 44, as well as between the head and its seat 41. When head 39 is lowered to seating position on the taper 41, see Fig. 1, a relatively restricted flow of the gas into the production column then occurs only through passages 43.

Below the seat 41, the pump body head 20 contains a counterbore 45 within which is accommodated a ball check 46 which seats at 47 to prevent return flow of fluids displaced through bore 48 upwardly from chamber 49.

Block 23 is centrally bored to contain a packing 53 and packing gland 56 (see Fig. 2) which surround in sealing relationship a hollow piston rod 57 extending between the chamber 32 and an upper displacement chamber 49. Rod 57 connects the piston heads 59 and 60, each of which is exteriorly channeled to carry self-sealing cups 61. Bore 62 extends through rod 57 and the lower piston head 59 to open into the chamber 32 therebelow. At its upper end and within the piston head 60, bore 62 opens into a valve chamber 63 which contains a check valve 64.

A control or stroke reversing unit generally indicated at 65 (see Fig. 2) and located in the head 23, comprises a cylindrical bore 66 parallel to the rod 57, communicating with pressure ports 67 and 68 which extend to the pressure intake or distributing chest 22, and with the exhaust ports 69 and 70, which extend to the exhaust chest 25. A piston-like valve 71 is positioned within bore 66 and retained therein by plate 74 at its upper end and plate 75 at its lower end, the valve being shorter than the bore 66 and freely slidable between the plates 74 and 75, except as restricted by the trigger elements 76 at its upper end and the trigger elements 77 at its lower end.

Valve 71 is provided with annular channels 78 and 79 from which the passages 80 and 81 extend to the respective ends of the valve, as most clearly illustrated in Figs. 5 and 6.

When valve 71 is held in its lower position, Fig. 5, by the trigger elements 76, groove 79 is aligned with the pressure port 68 and the groove 78 is aligned with the exhaust port 69. And at the same time the pressure port 67 is blocked off by the upper portion of the valve and the exhaust port 70 is blocked off by the central portion of the valve. When the valve is in its upper position, being held there by the triggers 77, as in Fig. 6, the respective grooves in the valve become reversely aligned with the respective pressure and exhaust ports.

Trigger elements 76 and 77 are individually pivoted at 83 and their respective free ends are constantly urged towards the valve 71 by the individual springs 84 as most clearly illustrated in Figs. 3 and 4, so that when the valve is in its lower position, it is held there by the triggers 76, which overlap the upper end of the valve as in Fig. 3 and the free ends of the lower triggers 77 merely exert a minor friction on the outer walls of the lower end of the valve. When the position of the valve is reversed, the positions of the triggers also become reversed. The triggers preferably are formed to present shoulders 761 and 762 in the nature of safety catch projections to assure proper retention of the valve and reversal of the fluid porting, if the edges of the triggers should become worn and fail to properly engage the valve ends.

Piston head 60 is provided with a tripping element presenting an annular cam 184 located a suitable distance below the head 60, and is provided with a compression spring 85. The lower piston head 59 is similarly provided with a cam 86, associated with a surrounding compression spring 87.

In considering the operation of the invention, assume

that the pump unit is rested on the bottom of the well and the tubing is rested sufficiently to cause the head 34, 39 assembly to assume its lower position, indicated in Fig. 1, thereby aligning the annular recess 421 with the ports 19, and causing the male terminal surface 40 of the inner pipe to engage the seat 41.

The discharge conduit 13 may be connected to conventional gas separators or suitable reservoirs to receive the displaced fluids. The pressure conduit 15 may connect with a source of gas under pressure, preferably natural gas.

Gas fed under pressure into the conduit 15 at the ground surface flows into the annular groove 421 in the head 39, a portion of the gas continuing on through the ports 42 into the chamber of bore 35 and thence into conduit 38 through the impregnating or jetting ports 43. The balance of the gas continues through the multiple ports 19, passages 18 and 21 into the pressure distributing chest 22. From this point, when the valve 71 is in its lower position as illustrated in Fig. 5, the gas pressure will be communicated through the port 68, groove 79 and the passages 81 into chamber 90 above the piston head 59.

Continued application of the gas pressure in chamber 90 forces the head 59 downwardly, displacing any fluid in chamber 32 below the head upwardly through the hollow piston rod 57 and past the ball check 64 into the upper chamber 49 above the piston head 60. During this downward movement of the piston assembly, channel 78 in valve 71 being aligned with the exhaust port 69, permits the used pressure gas in the upper chamber 91 below the piston head 60 to escape through port 74b in plate 74, passages 80 in the upper end of valve 71, the valve groove 78, exhaust port 69 and chest 25, thence through passages 24 to the exterior of the pump and eventually to the ground surface where the gas is recoverable for re-use.

Just before the downward stroke of the piston assembly is completed, the lower end of compression spring 85 contacts the plate 74 and offers resistance to further downward movement of the piston assembly, until a desired minimum of gas pressure develops in the lower chamber 90. Continued compression of spring 85 permits the beveled cam 184 to pass through the bore 74a in plate 74 (see Figs. 2 and 7) and contact the upper edges of the triggers 76. Up to this time these triggers have assumed the position shown in Fig. 3, their free ends overlapping the upper end of valve 71 and preventing this valve's upward movement by the pressure exerted against its lower end.

Further downward movement of cam 184 forces the triggers 76 to spread outwardly away from the valve until the ends of the triggers become disengaged from the valve, at which time the pressures accumulated in chamber 90 cause the valve to be thrust upwardly and instantaneously to its upper position illustrated in Fig. 6. Thereupon the lower triggers 77 close in beneath the lower end of the valve and hold it in its upper position. The triggers 76 then assume open positions.

The shifting of the valve 71 to its upper position, simultaneously causes the pressure port 68 to be blocked off by the lower section of the valve and the exhaust port 69 to be blocked off by the central section of the valve, at the same time causing the channel 78 in the valve to become aligned with the pressure port 67 while the valve channel 79 aligns with the exhaust port 70. In this position the valve permits the operating gas to enter the upper chamber 91 through passages 80 while permitting the used exhausts of gas from chamber 90 to escape through passages 81, groove 79, port 70, and into the exhaust chest 25 from which the gas is conducted to the exterior of the pump through the passages 24.

The pressure gas entering chamber 91 forces the piston assembly upwardly to displace all fluids previously trapped in upper chamber 49 above the ball valve 64,

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upwardly past the ball check 46 and through the ports 44 and into the fluid conduit 13.

The piston displaced fluids are forced past the impregnating and jetting ports 43 which are constantly emitting an amount of the pressurized gas into the fluid conduit 13, sufficient to reduce to such degree as may be desired, the fluids' weight in the discharge conduit and thereby reduce or minimize the constant work loads imposed upon the piston means by the weights of the vertically pumped fluid columns. To acquire any desired degree of gas impregnation, ranging up to a full jetting blast, the size and number of the jetting ports 43 is predetermined prior to the pump's installation.

As will be understood, the upward movement of the piston assembly causes fresh well fluids to be drawn into the lower chamber 32 past the check valve 31. Before the completion of the upward stroke, the upper end of compression spring 87 contacts the plate 75 and offers sufficient resistance to further upward movement of the piston assembly until a desired minimum of expandable or elastic pressures have accumulated in chamber 91. Continued compression of the spring permits the cam to pass through the center bore 75a in plate 75 and contact the lower edges of triggers 77 which are in a closed position and holding the valve 71 in its upper position. Continued upward movement of cam 86 causes the ends of triggers 77 to spread away from the lower end of the valve, at which time the pressure accumulated in chamber 91 causes the valve to be thrust downwardly and instantaneously to its lower position, as illustrated in Fig. 5. The triggers 76 then again assume their closed position, as illustrated in Fig. 3, and hold the valve in its lower position until the completion of the down stroke in the aforescribed manner. In the Fig. 5 position of valve 71, pressure fluid passes from port 68 through groove 79, passages 81 and the plate port 75b into chamber 90 to drive the piston assembly in its down stroke.

A repetition of these functions occurs so long as amply pressurized gas is supplied to the pump from the ground surface.

As observed, the fluids in upper chamber 49 are ejected through passage 48 on the upstroke of the piston head 60. Also, during the downward movement of piston head 59, fluid is forced upwardly through passage 48 by virtue of the fact that the fluid is forced into chamber 49 from the lower chamber 32 at a rate which exceeds the displacement of the piston 60, the lower chamber 32 being greater in cross-sectional area than the upper chamber.

The speed of reciprocation of the piston unit will be a variable determined by the characteristics of the well being pumped, and governed generally by the pressure of the gas introduced into the conduit 15.

In this embodiment of the invention, when it is desired to pull the pump from the well, lifting of the conduit sections and the pump unit proper is made easier by the gas ejection to the well surface of production liquid that would otherwise remain in the tubing. To effect the ejection of the trapped fluids from the fluid conduit to the surface, it is merely necessary to apply a sufficient volume of the operating gas pressures into the pressure conduit 15. Then upon slight initial lifting of the conduits, heads 34 and 39 slide upwardly within the cylinder 35 until arrested by the lower end of the collar 36. This upward movement of the head assembly blocks off the pressure ports 19, as most clearly illustrated in Fig. 8, and thereby immobilizes the piston unit while the valve 46 assumes a closed position and prevents the gas pressures from entering the chamber 49. Simultaneously, the male seat 40 becomes disengaged from the female seat 41 to expose the full base of the trapped fluid column to the full volume of the gas pressures. Continued application of gas pressures in this manner forces the fluids to the surface ahead of the gases. Upon completion of the ejection operation, the gas pressures are shut off and the tubing and pump are pulled.

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Should it be desirable to remove paraffin accumulations in the fluid conduit 13, the ejecting operation is performed, but upon its completion the pump is allowed to remain in suspension, maintaining the manifold assembly 37 in the open condition illustrated in Fig. 8, and the ejecting pressures are completely shut off. In their place and in a similar manner, paraffin solvents are introduced into the pressure conduit 15. Once the tubes become full of the solvent, the latter is circulated in the tubes until all paraffin accumulations are dissolved. The gas pressures then are reapplied and the solvents ejected to the surface in the manner of the entrapped displaced fluids. Upon completion of this ejection, the pump is allowed to assume its normal pumping position as in Fig. 1, and pumping operations are re-established.

Should the well be of extreme depth or of extreme sanding conditions, then the ports 43 are opened sufficiently to obtain a full jetting blast, which further reduces the work loads and prevents the formation of a sand block in the fluid conduit.

Referring now to Fig. 11 in particular, a modified connecting conduit unit 92 may be used to replace certain of the parts in the first described embodiment of the invention. It is to be understood that the general construction and operation of the pump remains the same. Conduit 93 extending to the top of the well, may be made of rubber or the like, so as to contain a displaced fluid passage 94 and a pressure passage 95. The lowermost end of conduit 93 is conventionally attached to a head 96 having features similar to the head assembly of the first described embodiment, except the means for gas-lifting the entrapped fluids are omitted. In conduit 93 the displaced fluid passage, being of relatively small diameter, presents no serious weight problem.

The head 96, threaded at 97 into the upper end of the pump body 98, contains passages 99 and 100 communicating respectively with passages 94 and 95 in the conduit 93. A major portion of the pressurized operating gas goes to the pump through ports 19 and passages 18, as in the first described embodiment. The remainder of the gas may be taken through passage 101 into the annular channel 102 to be jetted upwardly through ports 103 and 104 discharging into the lower angular portion 99a of passage 99. Fig. 11 shows the tapered lower end 105 of the head 96 to be closed upon the seat 106 with ports 107 in communication with chamber 45 containing, as in the first described embodiment, the ball check 46 above the discharge passage 48.

Assume that a pump embodying the construction shown in Fig. 11 is to be positioned and operated in a well. A conventional mobile hoist unit carrying the necessary length of conduit 93 wound upon its pulling drum in a cable-like manner, is positioned at the well head, the head 96 is attached to the pump proper, and the latter is lowered into the well. Once the pump rests on the bottom, the upper end of conduit 93 is suspended at the well head and detached from the hoisting unit. Pressurized gas delivered through passage 95 actuates the pump and jets into the production column through the ports 103 and 104, all in a manner essentially similar to the previously described jetting of gas through ports 43.

It will be understood that the drawings are to be regarded merely as illustrative of the invention in certain typical embodiments, and that various changes and modifications may be made without departure from the intended spirit and scope of the invention as defined in the claims.

I claim:

1. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertically elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge

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of production fluid through the other conduit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, a valve in communication with oppositely facing piston surfaces to control alternate application of supplied gas pressure thereto and at the same time to receive the force of said alternate pressure, means guiding the valve to reciprocate independently of actuation by the piston means and in response to said alternate pressure reception for controlling said alternate pressure application to the piston surfaces, separate movable valve blocking means engageable by opposite end portions of the valve to arrest the valve travel against the force of the actuating gas pressure, and means operated by said piston means to release said blocking means from blocking relation to the valve.

2. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertically elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge of production fluid through the other conduit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, a valve in communication with oppositely facing piston surfaces to control alternate application of supplied gas pressure thereto and at the same time to receive the force of said alternate pressure, means guiding the valve to reciprocate independently of actuation by the piston means and in response to said alternate pressure reception for controlling said alternate pressure application to the piston surfaces, separate movable valve blocking means engageable by opposite end portions of the valve to arrest the valve travel against the force of the actuating gas pressure, yielding means urging said blocking means into valve arresting positions, and means operated by said piston means to release said blocking means from blocking relation to the valve.

3. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertically elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge of production fluid through the other conduit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, a valve in communication with oppositely facing piston surfaces to control alternate application of supplied gas pressure thereto and at the same time to receive the force of said alternate pressure, means guiding the valve to reciprocate independently of actuation by the piston means and in response to said alternate pressure reception for controlling said alternate pressure application to the piston surfaces, separate movable valve blocking means engageable by opposite end portions of the valve to arrest the valve travel against the force of the actuating gas pressure, and spaced cam means carried by the piston means and operable to release said blocking means from blocking relation to the valve.

4. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertical elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge of production fluid through the other con-

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duit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, a valve in communication with oppositely facing piston surfaces to control alternate application of supplied gas pressure thereto and at the same time to receive the force of said alternate pressure, means guiding the valve to reciprocate independently of actuation by the piston means and in response to said alternate pressure reception for controlling said alternate pressure application to the piston surfaces, separate movable valve blocking means each comprising a spring-urged element, said elements being engageable by opposite end portions of the valve to arrest the valve travel against the force of the actuating gas pressure, and cam means operated by said piston means to release said blocking means element from blocking relation to the valve.

5. Apparatus as defined in claim 1, in which said valve is of generally cylindrical form containing an annular groove for receiving gas pressure from said gas conduit and longitudinal gas passages within end extents of the valve and communicating with said groove and at least one of said piston surfaces.

6. Apparatus as defined in claim 1, in which said piston means is elongated axially of the body and said valve is contained in the body at one side of the piston means.

7. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertically elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge of the production fluid through the other conduit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, said piston means comprising upper and lower piston heads reciprocable respectively within upper and lower cylindrical bores in the body, a transverse wall in the body, a tubular piston rod interconnecting said heads and extending axially within said bores and through said wall, well fluid being taken into said lower bore and axially displaced upwardly through said rod into the upper bore above the upper head and thence into said discharge conduit, said bores forming an upper chamber directly below said upper head and a lower chamber directly above said lower head, said chambers being communicable with an exhaust passage in the body leading into the well at the exterior of the pump body, a valve in said wall in communication with said chambers to control alternate application of supplied gas pressure to said piston heads and at the same time to receive said alternate pressure, said valve being guided to reciprocate independently of actuation by the piston rod and in response to said alternate pressure reception for controlling said alternate pressure application to the piston heads, valve blocking means in the body engageable by opposite end portions of the valve to arrest the valve travel against the force of the actuating gas pressure, and means operated by said piston means to release said blocking means from blocking relation to the valve.

8. Apparatus as defined in claim 7, including also springs in the body urging said blocking means into valve arresting positions.

9. Apparatus as defined in claim 8, including also spaced cams carried by the piston means and operable to engage and release said blocking means from blocking relation to the valve.

10. Apparatus as defined in claim 7, in which said blocking means includes two spaced pairs of spring-urged elements engageable by the end of the valve and spreadable to receive the valve between them, and spaced

cams carried by said piston means and operable upon piston reciprocation to so spread the elements.

11. Apparatus as defined in claim 1, including means in the body for jetting gas from the supply conduit into the discharge conduit at a location above said piston means.

12. Apparatus as defined in claim 1, including also means directly associated with said pump for shutting off an operational feed of gas from said supply conduit to the pump, and for by-passing the gas into said discharge conduit for elevation of the production liquid therein.

13. Apparatus as defined in claim 1, in which said blocking means are released in response to movement of the piston means near its stroke limits, and comprising also yielding means in the body resisting movement of the piston means as it approaches its stroke limits.

14. Apparatus as defined in claim 3 in which said blocking elements each has stepped surfaces individually engageable by the end of the valve.

15. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertically elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge of production fluid through the other conduit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, a valve in communication with oppositely facing piston surfaces to control alternate application of supplied gas pressure thereto and at the same time to receive the force of said alternate pressure, means guiding the valve to reciprocate independently of actuation by the piston means and in response to said alternate pressure reception for controlling said alternate pressure application to the piston surfaces, said conduits comprising spaced inner and outer pipe strings having between them a first fluid passage and a second fluid passage inside the inner string, the pressurized operating gas being supplied to the pump through one of said fluid passages, a portion of the gas being conducted through passages in the pump to actuate the piston and valve, and the production liquid being taken to the well surface through the other of said fluid passage, and means in the body for jetting another portion of the pressurized gas from said one of the fluid passages into the liquid column in the other fluid passage.

16. Apparatus as defined in claim 15, in which said pipe strings are interconnected and together are movable vertically relative to the pump body.

17. Apparatus as defined in claim 5, in which the last mentioned means includes means directly associated with said pump for shutting off an operational feed of gas to the piston means and for by-passing the gas into the production liquid column.

18. Apparatus as defined in claim 17, in which said gas shut-off means is controllable by vertical movement of said pipe strings relative to the pump.

19. Apparatus of the character described comprising a pump adapted to be lowered in a well in connection with a pressurized gas supply conduit and a production discharge conduit both inside a well casing, said pump comprising a vertically elongated body, means for connecting the body with said conduits for delivery of the pressurized gas to the pump through one of the conduits and discharge of production fluid through the other conduit, piston means in the body operable by the pressurized gas to draw production liquid from the well into said body and displace production liquid upwardly from the body into the discharge conduit, passage means in said body for conducting gas from said supply conduit to said discharge conduit, a valve in communication with oppositely facing piston surfaces to control alternate application of supplied gas pressure thereto and at the same time to receive said alternate pressure, means guiding the valve to reciprocate independently of the piston means and in response to said alternate pressure reception for controlling said alternate pressure application to the piston surfaces, said conduits comprising spaced inner and outer pipe strings having between them a first fluid passage and a second fluid passage inside the inner string, the pressurized operating gas being supplied to the pump through one of said passages and the production liquid being taken to the well surface through the other passage, and means directly associated with said pump for shutting off communication between the gas supply passage and the pump to permit solvent circulation through said passages independently of the pump.

20. Apparatus as defined in claim 19 in which said shut-off means is controllable by vertical movement of said pipe strings.

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