

Nov. 24, 1953

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2,660,119

WELL PUMP

Filed Oct. 19, 1950

3 Sheets-Sheet 1

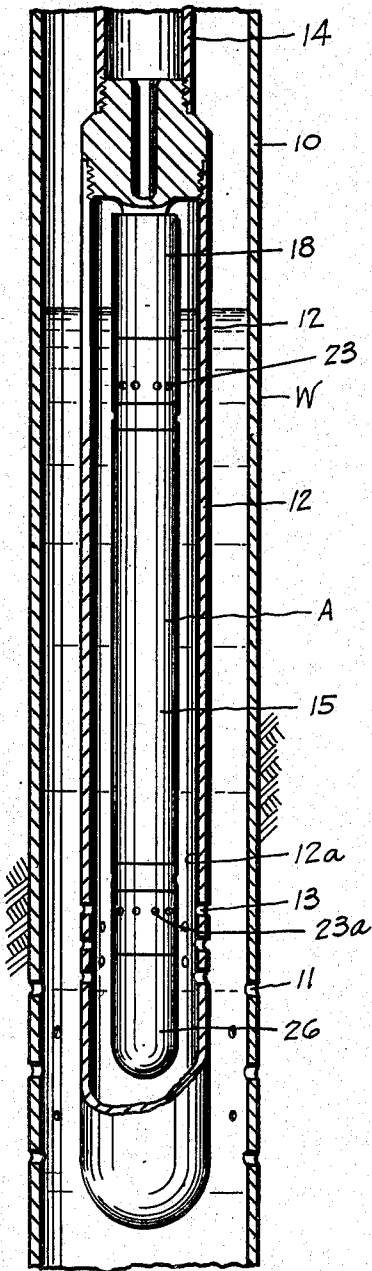


Fig. 1

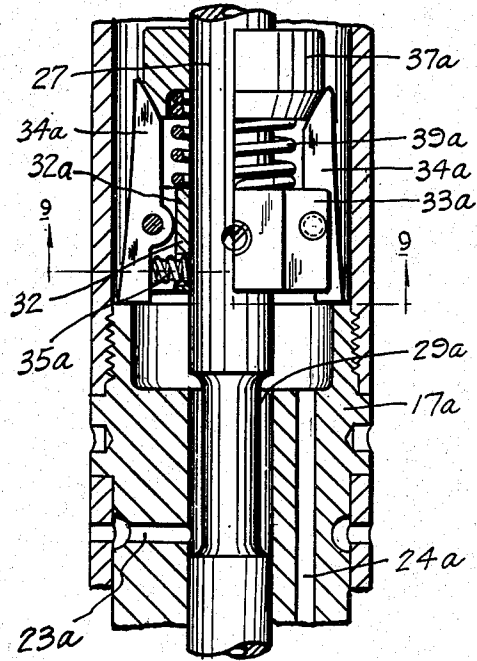


Fig. 8

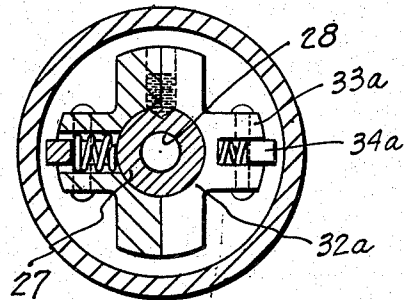


Fig. 9

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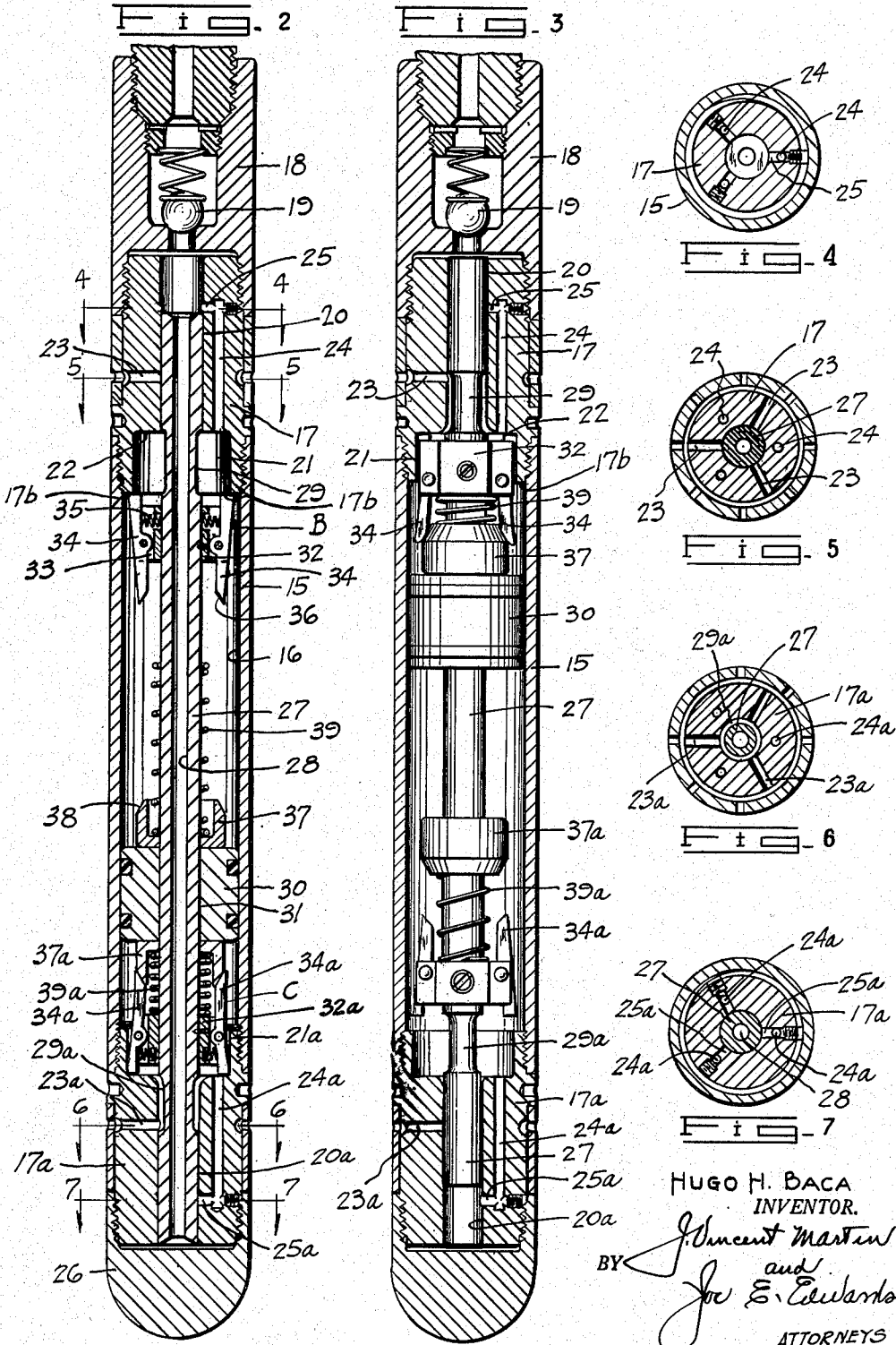
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2,660,119

WELL PUMP

Filed Oct. 19, 1950

3 Sheets-Sheet 2



Nov. 24, 1953

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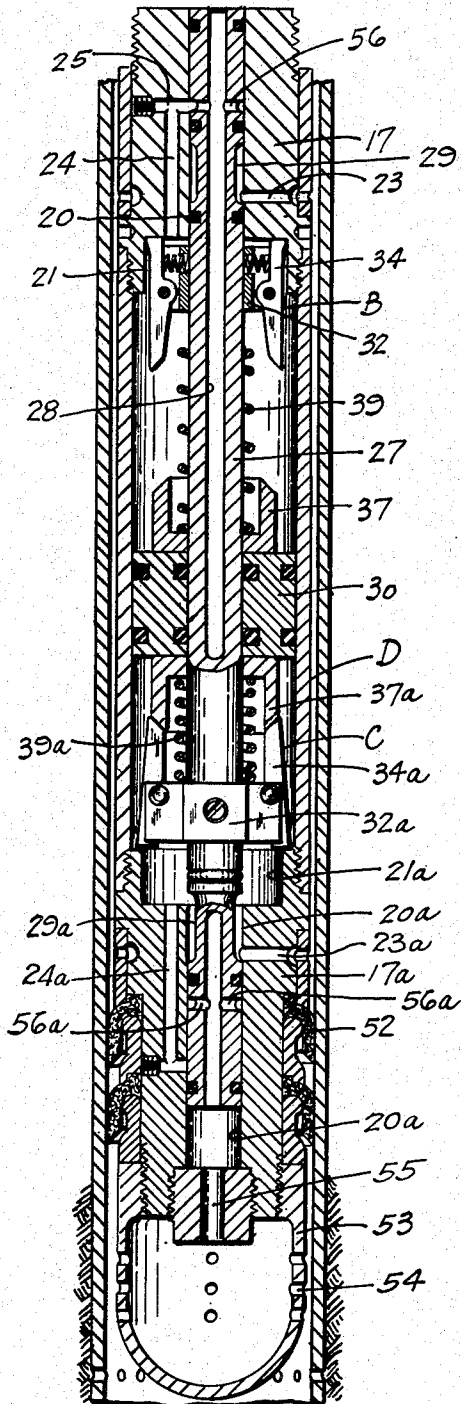


Fig. 10

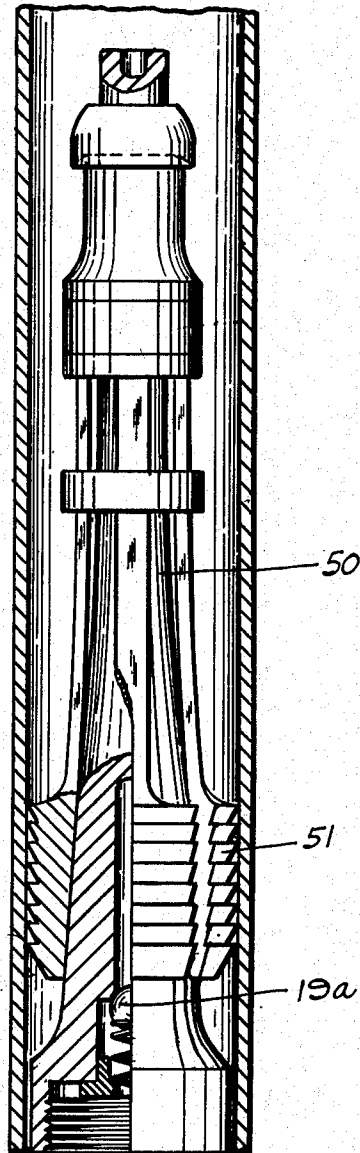


Fig. 11

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2,660,119

WELL PUMP

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Application October 19, 1950, Serial No. 191,069

15 Claims. (Cl. 103—46)

1

This invention relates to new and useful improvements in well pumps.

One object of the invention is to provide an improved pump which is particularly adapted for use in pumping oil wells and which is constructed so as to be actuated solely by the natural pressure within the well, whereby the usual pump rods and pump plunger, together with the inherent disadvantages thereof, are eliminated.

An important object of the invention is to provide a well pump which is operated by the natural pressure present in the well bore and which has its power piston double acting to perform a pumping operation on both the upstroke and the downstroke of said piston, whereby increased capacity and pumping efficiency is obtained.

Another object is to provide a pump, of the character described, wherein pressure is applied directly to the power piston on both strokes thereof to assure positive movement of the piston in both directions of its travel.

A further object is to provide a well pump, of the character described, which may be directly connected to a flow pipe in a more or less permanent installation or which may be removably mounted within the bore of a well pipe; the removable arrangement permitting the pump to be lowered, locked in position and raised within said pipe which facilitates removal and replacement of the pump in a minimum time and with minimum labor.

A particular object is to provide a well pump which operates a relatively low differential of pressure whereby said pump may be efficiently actuated by the natural formation pressure normally present in the lower end of the well bore.

Still another object is to provide a double acting well pump wherein the application of the pressure fluid to the power piston, as well as the flow of the fluid being lifted, is controlled by a single control element which is shifted by the power piston when the latter completes its stroke, whereby positive operation is assured; the single control element simplifying manufacture and minimizing cost of the apparatus.

A further object is to provide an improved pump wherein the single control element is positively locked against actuation during the travel of the piston and is arranged to be operated with a snap action when the piston completes its stroke; operation of the control element functioning to shift the application of pressure to the piston to reverse the movement of said piston to continue the pumping operation.

2

Still another object of the invention is to provide a pump, of the character described, wherein the pressure of the fluid being pumped is utilized to operate the pump and also wherein said fluid is directed through numerous relatively small passages which function to break up the fluid into numerous streams to release and liberate the gas from the fluid, whereby said gas tends to aerate the fluid column to assist the pumping operation in moving the fluid to the surface.

Another object is to provide a well pump of simplified construction and having the parts thereof readily interchangeable with each other to facilitate replacement in the field.

Other objects will hereinafter appear.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

Figure 1 is an elevation of a pump constructed in accordance with the invention and illustrating the same disposed within a well bore,

Figure 2 is a longitudinal sectional view showing the pump mounted on the lower end of a fluid conductor and illustrating the position of the power piston as it is moving through its upstroke,

Figure 3 is a similar view with the power piston at the limit of its upstroke,

Figure 4 is a horizontal cross-sectional view taken on the line 4—4 of Figure 2,

Figure 5 is a horizontal cross-sectional view taken on the line 5—5 of Figure 2,

Figure 6 is a horizontal cross-sectional view taken on the line 6—6 of Figure 2,

Figure 7 is a horizontal cross-sectional view taken on the line 7—7 of Figure 2,

Figure 8 is an enlarged sectional detail of the latch assembly,

Figure 9 is a horizontal cross-sectional view taken on the line 9—9 of Figure 8,

Figure 10 is a longitudinal sectional view of the lower portion of a modification of the invention wherein the pump is removably mounted within a fluid conductor, the power piston being shown in its position moving downwardly within the cylinder, and

Figure 11 is a continuation of Figure 10 showing the upper portion of the device.

In the drawings the numeral 10 designates a

3

well casing or pipe which extends downwardly within a well bore W and which is formed with perforations 11 opposite a producing formation or strata, whereby the well fluids under pressure may flow into said well pipe or casing. An inner casing string or well pipe 12 extends axially through the casing or pipe 10 and has its lower portion formed with a plurality of perforations 13 so that the well fluids under pressure may enter the bore 12a of said inner string.

The improved well pump generally indicated at A is adapted to be disposed within the inner pipe string 12 and as illustrated in Figures 1 to 9 the pump may be supported by and attached to the lower end of a fluid conductor 14. As will be explained, the pump A is arranged to be actuated by the pressure of the well fluids and functions to lift the well fluids to the surface through the fluid conductor. Although the pump A is illustrated as attached to and supported by the fluid conductor 14, said pump may, if desired, be removably supported by any suitable slip assembly within the inner pipe string 12, in which event the inner string 12 will function as the fluid conductor.

The pump A comprises a main cylinder 15 having an axial bore 16. The upper end of the cylinder is closed by a block or head member 17 and the upper portion of the head member is connected with a check valve assembly 18 which assembly is in turn connected to the fluid conductor 14. The check valve assembly 18 includes a downwardly closing ball check valve 19. The block 17 is formed with an axial bore 20 which extends entirely therethrough and which is of a diameter less than the diameter of the cylinder. The lower portion of the bore 20 is enlarged to provide a recess 21 in the lower end of the block, the upper wall of said recess providing an internal annular shoulder 22 within the block.

A plurality of radial inlet ports 23 are formed within the block above the internal shoulder 22, and each port establishes communication between the area exteriorly of the block and the bore 20 of said block, whereby the pressure well fluid within the inner string 12 may flow into the ports. It is desirable that the ports be relatively small so that the fluid upon flowing through said ports is broken up into a plurality of small streams. Vertical passages 24 extend through the block and are located between the ports 23, as is clearly shown in Figure 5; the lower end of each passage 24 communicates with the recess 21 in the lower end of the block and therefore with the upper end of the cylinder 15, while the upper end of each passage has communication through an offset 25 with the upper portion of the bore of the block 17. Thus, the passages 24 establish communication between the upper end of the cylinder and the bore of the block at a point above the radial ports 23 which establish communication between the area exteriorly of the block and the bore thereof.

The lower end of the cylinder 15 is closed by a lower block 17a which is identical in construction to the upper block 17. Being on the lower end of the cylinder, the block 17a is of course inverted with respect to the block 17. The lower block 17a includes an axial bore 20a having its inner end enlarged to provide a recess 21a. The block also includes radial ports 23a establishing communication between the exterior of the block and the bore thereof. Passages 24a provided in the lower block and each having offsets 25a establish communication between the lower end of

4

the cylinder and the bore 20a of said block. A bull plug 26 is threaded onto the lower end of the lower block and functions to close the lower end of the bore of said block.

For controlling the flow through the ports and passages of the upper and lower blocks 17 and 17a, an elongate tubular control or valve element 27 is provided. The valve element has an axial bore 28 extending entirely therethrough and the element extends axially within the cylinder with its upper end slidable within the bore 20 of the upper block and its lower end slidable within the bore 20a of the lower block. The length of the control or valve element 27 is such that when said element is in its lowered position as shown in Figure 2, its upper end is below the offsets 25 of the passages 24 in the upper block so that at this time communication between the upper end of the cylinder 15 and the upper end of the bore 20 of the block 17 is established. At the same time the lower end of the control or valve element is lowered below the offsets 25a of the passages 24a of the lower block 17a so that communication between the lower end of the cylinder and the bore 20a of the lower block is shut off.

For controlling the flow through the radial ports 23 in the upper block the control or valve element 27 is formed with a recessed portion 29 and with the control element in its lowered position this recessed portion is spaced below the ports 23 so that flow through said ports is shut off. The lower portion of the control element is formed with a similar recessed portion 29a which is adapted to coact with the radial ports 23a of the lower block and with the control element in its lower position said recessed portions 29a is opposite the ports 23a. The upper end of the recessed portion 29a is within the lower end of the cylinder 15 and thus the recessed portion provides an annular flow space which establishes communication between the lower end of the cylinder and the radial ports 23a. It is thus evident that when the control element is in its lowered position, as shown in Figure 2, the ports 23a of the lower block are open, while the ports 23 of the upper block are closed; at the same time the passages 24a of the lower block are closed while the passages 24 of the upper block are open.

Upon shifting of the control or valve element 27 to its upper position as indicated in Figure 3, the control element functions to open the passages 24a of the lower block and to close the radial ports 23a of such lower block. At the same time, the shifting of the control element upwardly opens the ports 23 of the upper block to establish communication with the upper end of the cylinder through the annular recess 29 and also closes the passages 24 of said upper block.

A power piston 30 is reciprocable within the bore of the cylinder 15 and has an axial bore 31 through which the tubular control or valve element 27 extends, whereby the piston is guided on said control element. The power piston 30, as will be explained, functions to lift the well fluids upwardly through the fluid conductor 14 and also functions to control the shifting movement of the control element, whereby flow through the various ports and passages is controlled. Referring to Figure 2, the parts are illustrated in a position with the power piston 30 moving upwardly. At this time the natural pressure of the well fluids is acting through the ports 23a of the lower block, annular recess 29a on the control element 27 and its entering beneath

the power piston to move said piston upwardly. The upward movement of the piston is lifting the fluid present in the upper portion of the cylinder upwardly through the open passages 24 into the upper end of the bore 20 of the upper block 17, past the check valve 19 and into the fluid conductor 14.

Upward shifting of the control or valve element 27 during the upward movement of the power piston is prevented by means of a latch assembly B which is secured to the control element. As clearly shown in Figures 2 and 3, the latch assembly includes a collar 32 which surrounds and is secured to the control element at a point just below the annular recess 25. The collar is bifurcated at diametrically opposed points thereon to form two pairs of supporting lugs 33 and pivotally mounted between each pair of lugs is a latching member 34. A coil spring 35 confined between the upper end of each latching member and the control element functions to urge the upper ends of the latch members radially outwardly. When in such outward position the upper ends of the latch members 34 are adapted to engage the lower end 17b of the upper block 17 and thus lock the control element against upward movement relative to said block.

For swinging the latch arms so as to move the upper ends thereof inwardly so that said upper ends may enter the recess 21 of the upper block, the lower end of each latch arm or member is beveled at 36. A floating collar 37 is slidable on the control element 17 below the latch members 34 and has its upper end beveled or inclined at 38 to coact with the inclined lower ends of the latch member. It will be evident that as the collar 37 is moved upwardly between the lower ends of the latch members said latch members are swung on their pivots to move their upper ends radially inwardly against tension of the springs 35 whereby the latch members may move laterally inwardly into the recess 21. Since the latch members are in fact attached to the control element 27 it will be obvious that when said latch members clear the lower end 17b of the upper block an upward movement of the control element may occur.

In order to effect a snap action in shifting the control element a coil spring 39 surrounds the control element and is confined between the floating collar 37 and the fixed collar 32 of the latching assembly B. Thus, with the parts in the position shown in Figure 2 and with the power piston 30 moving upwardly within the cylinder said cylinder will engage the floating collar 37 and will compress the spring a predetermined amount before the collar contacts the lower ends of the latch arms to swing the upper ends of said latch arms clear of the lower end of the upper block. As the piston continues its upward movement and the latch arms clear the lower end of the block 17, the coil spring 39 will function to snap the control element upwardly, moving the latching assembly B into the recess 21 as illustrated in Figure 3. When the control element is shifted to the position shown in Figure 3, the passages 24 in the upper block which have been conducting fluid to the fluid conductor 14 are closed, and simultaneously therewith communication is established through the ports 23 and recess 29 between the pressure exteriorly of the pump and the upper end of the cylinder. This applies the natural formation pressure to the upper end of the power piston and moves said piston downwardly within the cylinder.

It is noted that when the control element was shifted to its upper position, as shown in Figure 3, the radial ports 23a in the lower block are closed while the angular passages 24a in said lower block are opened. Thus, upon downward movement of the piston the fluid which previously entered the lower portion of the cylinder is discharged from the lower end of the cylinder through passages 24a and then upwardly through the bore 28 of the control element, past the check valve 19 and into the fluid conductor.

For effecting a shifting of the control element upon a completion of the downstroke, a second latching assembly C (Fig. 8) is secured to the control element adjacent the lower recess 29a. This assembly is identical in construction to the assembly B and includes pivoted latch arms 34a which coact with the inner end of the lower block 17a to lock the control element against downward shifting during the downward travel of the piston 30. A floating collar 37a similar to the collar 37 coacts with the latch arms 34a to swing said arms and allow a snap action shifting of the control element by a coil spring 39a.

As the piston completes its downstroke and the latching assembly C is actuated to allow entry thereof into the recess 21a of the lower block, the control element is again shifted back to the position shown in Figure 2 to again apply the natural formation pressure to the under side of the power piston 30.

It is believed that the operation of the pump is obvious from the foregoing. The natural formation pressure is utilized to apply pressure to the power piston 30 upon both strokes of said piston. During the upstroke of the piston, pressure is applied through the ports 23a of the lower block, and said piston is thereby moved upwardly in its cylinder. At this time the passages 24 of the upper block are open and fluid within the upper portion of the cylinder is displaced upwardly in the fluid conductor 14. The control element is locked against any upward shifting by the upper latching assembly B, and shifting of the control element cannot occur until the piston has completed its upstroke. Upon completion of the upstroke of the piston the floating collar 37 engaged by the piston coacts with the latching assembly to actuate the same and permit said assembly to move into the recess 21 of the upper block. When this occurs the single control element 27 is shifted upwardly to the position shown in Figure 3 to apply the external operating pressure to the upper side of the piston. It is pointed out that when the control element 27 was shifted upwardly the lower latching assembly C was moved out of the recess 21a of the lower block and automatically reset to lock the valve element against downward shifting until the power piston 30 completes its downstroke. The operation of the device is entirely automatic and the natural formation pressure is utilized to impart positive movement to the power piston on both strokes thereof. It is evident that the piston is double acting in that it actually lifts fluid upon both its upstroke and its downstroke.

As has been noted the pump A is illustrated in Figures 1 to 9 as mounted on the fluid conductor 14, but if desired said pump may be connected with a suitable supporting assembly so that it is removably mounted within the inner pipe string 12. In Figures 10 and 11, a modified form of the invention is illustrated wherein the pump D

7

has its upper end secured to a suitable slip supporting assembly 50. The particular assembly 50 which is shown includes gripping slips 51 which are adapted to be set and released by wire line operation whereby the pump D may be mounted in the inner well pipe 12 at any desired point therein. The lower end of the pump D is modified to the extent that annular packing cups 52 surround the lower block 17a. Instead of the bull plug 26 the lower end of the pump D has a perforated plug 53 secured to its lower end. The natural formation pressure may enter the perforations 54 in the plug 53 and may flow upwardly through a bore 55 into the lower end of the bore 20a of the lower block 17a.

The internal construction of the pump D is identical to the construction of the pump A except for additional radial ports 56 and 56a in the control element 27 and includes the upper block 17 having the ports 23 and passages 24, the lower block 17a having ports 23a and passages 24a and the power piston 30. The pump D also includes the latching assemblies B and C as well as the floating collars 37 and 37a which have the springs 39 and 39a associated therewith.

In the operation of the form shown in Figures 10 and 11, the pump D is lowered into position and set within the inner pipe string 12 by means of a wire line. In this case the inner string 12 is utilized as the fluid conductor with the conductor 14 of the first form being eliminated. On the downstroke of the power piston the natural formation or operating pressure enters the perforations 54 of the lower plug and flows upwardly through the bore 28 of the control element 27. As shown in Figure 10 the control element is in its upper position and the operating pressure passing upwardly through the control element is directed to the passages 24 through radial ports 56 provided in the control element and aligned with the offsets 25 of the passages 24. An upwardly closing check valve 19a in the lower portion of the slip assembly 50 prevents upward flow from the bore 23. The operating pressure is thus applied through passages 24 to the upper end of the power piston to move the same downwardly within its cylinder. Fluid is discharged from the lower end of the cylinder through the annular recess 29a around the control element and then outwardly through the ports 23a into the inner string 12 above the packing cups 52 and the fluid is thus lifted through the inner string.

Upon completion of the downstroke and shifting of the control element to the limit of its lower position, radial ports 56a in the control element are aligned with the passages 24a in the lower block 17a. At the same time, the upper radial ports 56 are misaligned with the passages 24 of the upper block. This directs the operating pressure which is entering through the perforated plug 53 upwardly through the passages 24a of the lower block and causes an upward movement of the power piston. The downward shifting of the control element which changed the application of operating pressure to the piston also moved the recess 29 in the control element 27 downwardly to set up a communication between the upper end of the cylinder and the ports 23 in the upper block. It is, therefore, evident that upon the upstroke fluid is discharged from the upper end of the cylinder through ports 23 and into the inner string 12.

It will be evident that in the form shown in Figures 10 and 11, the operation will be substan-

8

tially identical except that the passages 24 and 24a are utilized to conduct the operating pressure to the cylinder, while the ports 23 are utilized as discharge ports. In the form shown in Figures 1 to 9 the ports 23 and 23a conduct the operating pressure to the cylinder, while the passages 24 and 24a function as discharge passages. Either form of the invention may be connected to a fluid conductor pipe in the manner shown in Figure 1 or, if desired, either form may be combined with a removable slip assembly which is operable by a wire line. Where the pump is combined with a wire line slip assembly, it is evident that said pump may be lowered, set, released and removed all by wire line operation. In both forms the power piston is actuated by the natural formation pressure and positive pressure is applied to the piston upon both strokes so that lifting of fluid is accomplished on both the upstroke and the downstroke of the piston. The single control valve or element 27 efficiently controls all ports and passages which enter into the operation and the latching assemblies provide for positive locking of the control element against accidental shifting until the power piston has reached the limit of its travel in each direction.

During operation of the pump, the fluid is broken up into numerous small streams which function to liberate the gas and tends to separate the gas to some extent from the liquids and the liberated gas more or less aerates the column to assist in lifting said column. It will be evident that the speed of the pumping operation is controlled from the surface by the choking effect at the surface controls (not shown) of the well. By providing a positive lift of the fluid column, slippage is prevented and more efficient operation obtained. In the forms wherein the pump is run in on a wire line, the lowering of the pump and setting thereof may be accomplished under pressure and without the necessity of "killing" the well.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

Having described the invention, I claim:

1. A well pump including, a cylinder having an upper end and a lower end, said cylinder having an inlet port and an exhaust port at its upper end and also having a second inlet port and a second exhaust port at its lower end, a downwardly closing valve means in the cylinder above said inlet port and exhaust port at the upper end of the cylinder, a shiftable control element extending axially within the cylinder and co-acting with both inlet ports and both outlet ports for controlling flow therethrough, said control element having a longitudinal passage therethrough which communicates with said second exhaust port when said control element is shifted to open said second exhaust port, a power piston reciprocable within the cylinder and slidable on said control element, and means actuated by the power piston for shifting the control element upon the piston reaching its limit of movement in each direction, whereby the flow of fluid through the inlet and exhaust ports is changed to reverse the direction of travel of said piston.

2. A well pump including, a cylinder having an upper end and a lower end, said cylinder having

an inlet port and an exhaust port at its upper end and also having a second inlet port and a second exhaust port at its lower end, a downwardly closing valve means in the cylinder above said inlet port and exhaust port at the upper end of the cylinder, a shiftable control element extending axially within the cylinder and co-acting with both inlet ports and both outlet ports for controlling flow therethrough, said control element having a longitudinal passage therethrough which communicates with said second exhaust port when said control element is shifted to open said second exhaust port, a power piston reciprocable within the cylinder and slidable on said control element, means actuated by the power piston for shifting the control element upon the piston reaching its limit of movement in each direction, whereby the flow of fluid through the inlet and exhaust ports is changed to reverse the direction of travel of said piston, and a latch means for locking the control element against movement when the piston is moving through the intermediate portion of its travel within the cylinder.

3. A well pump including, a fluid conductor extending to the well surface, a cylinder having an upper end and a lower end, a power piston reciprocable within the cylinder between the upper and lower ends thereof, the upper end of the cylinder having a passage establishing communication between said upper end of the cylinder and the well bore and also having a second passage establishing communication between the upper end of the cylinder and the fluid conductor, a downwardly closing valve means in the cylinder above said passages at the upper end of the cylinder, the lower end of said cylinder also having a pair of similar passages one of which communicates with the well bore while the other passage communicates with the fluid conductor, a single shiftable control element extending axially through the cylinder and having the piston slidable thereon, said control element having a longitudinal passage therethrough which communicates with said other passage when said control element is shifted to open said other passage, said element co-acting with the passages in the upper and lower ends of the cylinder to direct pressure fluid from the well bore to one side of the piston and to simultaneously direct the fluid from the other side of the piston to the fluid conductor, whereby the pressure fluid from the well bore imparts movement to the piston, and means engageable by the piston as it reaches the limit of its travel in each direction for shifting the control element to change the application of pressure to the piston and the direction of flow from the cylinder to the fluid conductor to reverse the travel of the piston.

4. A well pump as set forth in claim 3, together with latch means associated with the shifting means for the control element for locking the control element against movement during movement of the piston through the intermediate portion of its travel.

5. A well pump as set forth in claim 3, together with latch means associated with the shifting means for the control element for locking the control element against movement, said latch means being operated by the piston reaching its limit of travel in each direction within the cylinder.

6. A well pump including, a fluid conductor extending to the well surface, a cylinder having an upper end and a lower end, a power piston

reciprocable within the cylinder between the upper and lower ends thereof, the upper end of the cylinder having a passage establishing communication between said upper end of the cylinder and the well bore and also having a second passage establishing communication between the upper end of the cylinder and the fluid conductor, a downwardly closing valve means in the cylinder above said passages at the upper end of the cylinder, the lower end of said cylinder also having a pair of similar passages one of which communicates with the well bore while the other passage communicates with the fluid conductor, a single shiftable control element extending axially through the cylinder and having the piston slidable thereon, said control element having a longitudinal passage therethrough which communicates with said other passage when said control element is shifted to open said other passage, said element co-acting with the passages in the upper and lower ends of the cylinder to direct pressure fluid from the well bore to one side of the piston and to simultaneously direct the fluid from the other side of the piston to the fluid conductor, whereby the pressure fluid from the well bore imparts movement to the piston, a latch means connected to the control element adjacent each end of the cylinder, each latch functioning to lock the control element against shifting movement during travel of the piston toward said latch means, and means on the control element engageable by the piston as it completes its travel in one direction for releasing the adjacent latch means to allow shifting of the control element to change the application of pressure to the piston and the direction of flow from the cylinder to the fluid conductor to thereby reverse the travel of the piston within its cylinder.

7. A well pump as set forth in claim 6, together with means for imparting a snap action movement to the control element each time the element is shifted.

8. A well pump as set forth in claim 1, wherein the cylinder is connected to a fluid conductor by which said pump may be lowered into the well.

9. A well pump as set forth in claim 1, wherein the pump cylinder has connection with a supporting assembly whereby the cylinder may be removably supported within the bore of a fluid conductor, said supporting assembly being actuated by means of a wire line.

10. A well pump as set forth in claim 3, wherein the pump cylinder has connection with a supporting assembly whereby the cylinder may be removably supported within the bore of a fluid conductor, said supporting assembly being actuated by means of a wire line.

11. A well pump including, a cylinder having an upper end and a lower end, an upper block closing the upper end of the cylinder and having an axial bore, a port in the block establishing communication between the area exteriorly of the block and its bore, and also having a passage in the block establishing communication between the upper end of cylinder and the bore of said block, a downwardly closing valve means in the cylinder above said passage and said port at the upper end of the cylinder, a lower block closing the upper end of the cylinder and having an axial bore, a port in said lower block establishing communication between the area exteriorly of the block and the bore thereof, said second block also having a passage establishing communication between the lower end of the cylinder

11

der and the bore of said second block, an elongate tubular valve element extending axially through the cylinder and having its ends slidable within the bores of the upper and lower blocks and shiftable to two positions therein, said element having means co-acting with the ports and passages of said block and arranged when in one position to open the port in the upper block, close the passage in said upper block, close the port in the lower block and open the passage in the lower block, the other position of said valve element closing the port and opening the passage in the upper block and opening the port and closing the passage in the lower block, a piston reciprocable in the cylinder between the upper and lower blocks, and means connected with the tubular valve element and engageable by the piston for shifting said valve element when the piston reaches its limit of travel in each direction.

12. A well pump as set forth in claim 11, together with means for connecting the ports of said blocks to a pressure source and the passages of said blocks to a fluid conductor.

13. A well pump as set forth in claim 11, together with means for connecting the passages of said blocks to a pressure source and the ports of said blocks to a fluid conductor.

12

14. A well pump as set forth in claim 11, together with means for connecting the passages of said blocks to a pressure source and the ports of said blocks to a fluid conductor, a slip assembly secured to the upper end of the cylinder for removably supporting the cylinder within a well pipe, and an annular packing means on the lower portion of the cylinder for sealing off between said cylinder and the pipe in which it is supported.

15. A well pump as set forth in claim 11, together with a latch means associated with the valve element adjacent each block, each latch means locking the element against shifting movement until the piston reaches the limit of its travel in each direction.

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