

Sept. 8, 1936.

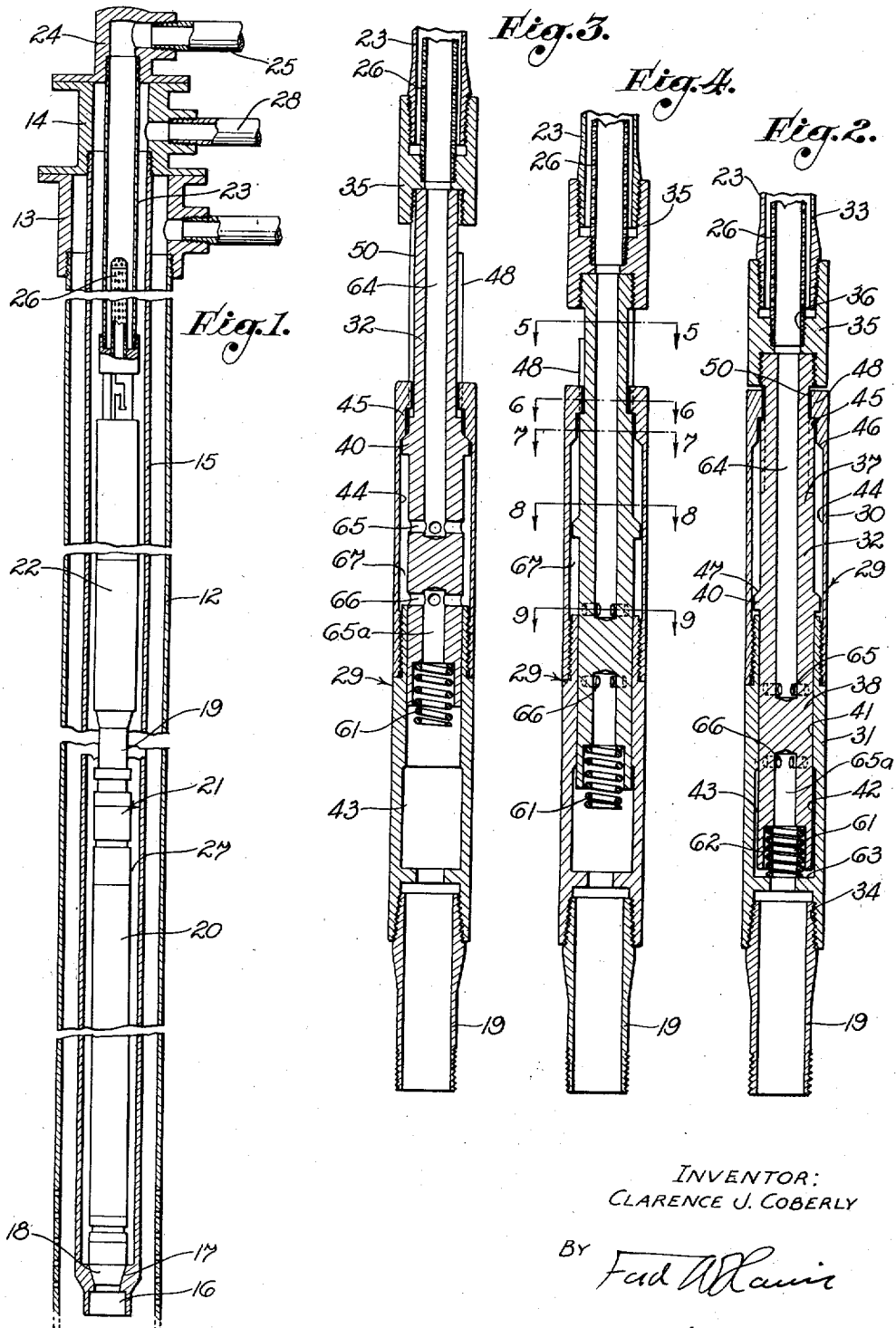
C. J. COBERLY

2,053,602

BLEEDER FOR DEEP WELL PUMPS

Filed April 13, 1934

2 Sheets-Sheet 1



Sept. 8, 1936.

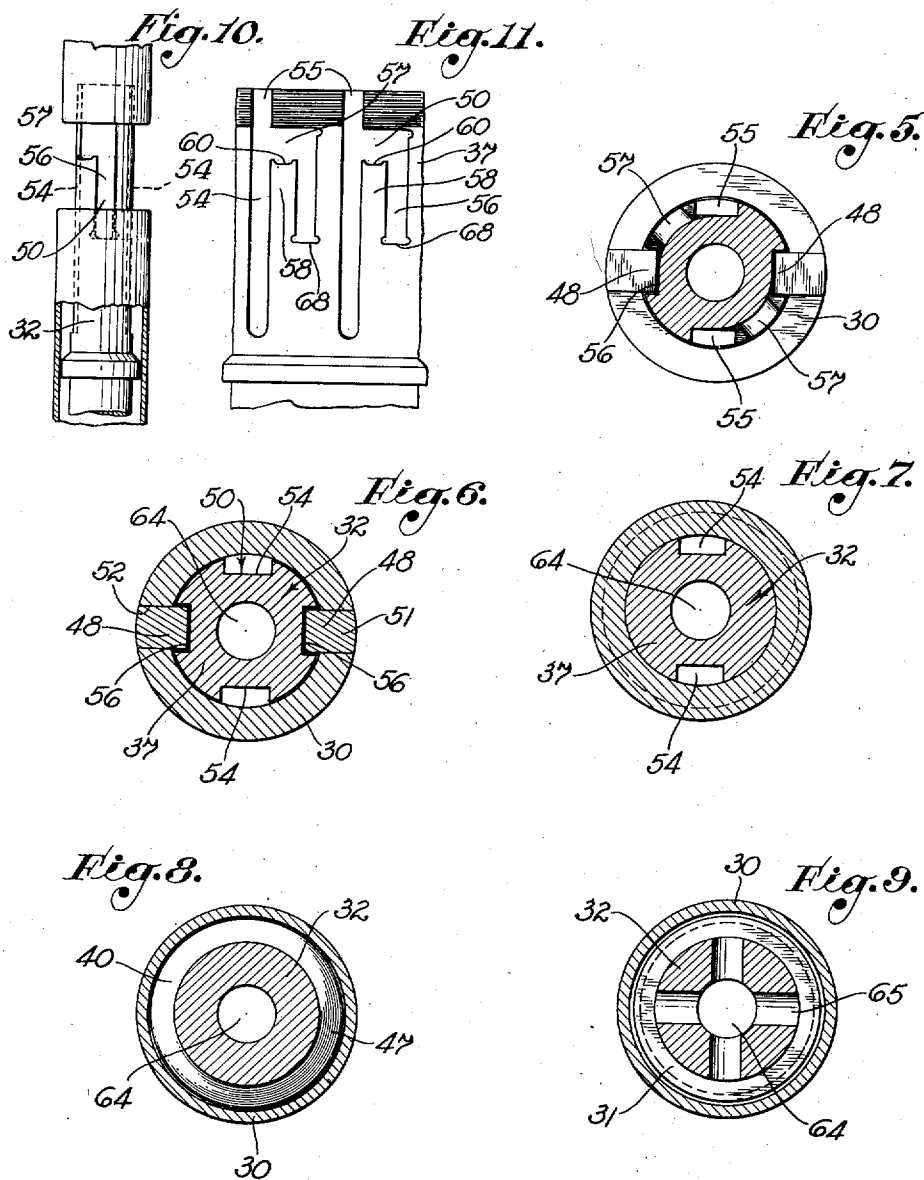
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,053,602

BLEEDER FOR DEEP WELL PUMPS

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of Nevada

Application April 13, 1934, Serial No. 720,414

22 Claims. (Cl. 103-46)

My invention relates to deep well pumps and relates in particular to deep well pumps of fluid operated type.

It is an object of the invention to provide a pump structure adapted to be lowered to the bottom of a well, such pump structure having a means for controlling the flow of fluids therethrough during the lowering of the same, for controlling the flow of fluids therethrough after the pump structure has been brought into operative position at the bottom of the well, and for controlling the flow of fluids preliminary to and during the lifting of the pump from the well.

Although the invention may have valuable utility with various types of deep well pumps, it constitutes an improvement in the pumping mechanism disclosed in the copending application of Clarence J. Coberly, Serial No. 623,171, filed July 18, 1932, and entitled Liquid operated pump. Pumping mechanisms of this general character employ a pump unit to which an actuating fluid is delivered through a pipe which extends downwardly through the well to the pump unit situated in the oil producing zone of the well. The pump unit comprises a motor section and a pumping section, the discharge of which is generally delivered into an oil delivery pipe which carries the oil to the top of the well and which in many instances is placed in a position to surround the pump unit and the pressure piping through which the actuating fluid is delivered to the pump unit. During the lowering of the pump unit into the well, a reverse pressure of fluid is exerted through the discharge ports of the motor mechanism, and accordingly dirty oil from the well enters the mechanism and may also flow some distance up within the lower end of the pressure fluid delivery piping. This often results in entrance of abrasive substances into the operating parts of the pump mechanism.

An object of my invention is to provide a device susceptible to control from the top of the well for preventing a reverse flow of fluid through the pump during the operation of lowering it into position at the bottom of the well. The method of installation of this device and the pump unit with which it is used is covered in my co-pending application Serial No. 740,452, filed August 18, 1934, which is a continuation-in-part of this application, and to which reference is hereby made.

During the operation of the pumping device the pressure fluid delivery tube is filled with oil. It is desirable to provide a means which may be open during the pulling of the pump from the well so that the oil in the pressure fluid delivery

tube may drain out, thereby avoiding what is known as a wet pulling job, or, in other words, avoiding the often encountered experience of having oil from the tubing spilled over the floor and surrounding equipment of a derrick as the result of a pulling job.

It is accordingly an object of the invention to provide a pumping device having a pressure fluid delivery tube equipped with means for draining the same during the pulling of the pump device from the well.

It is also an object of the invention to provide a means for testing the supply tube for tightness without removing it from the well.

A further object is to provide a means for circulating fluid from the inner tube to the outer tube without operating the pump in order to clean the system. It is further possible to circulate in this manner and determine the friction loss under operating conditions.

Further objects and advantages of the invention will be made evident throughout the following part of the specification.

Referring to the drawings, which are for illustrative purposes only,

Fig. 1 is a sectional view showing a pumping device embodying my invention in position for operation in a deep well.

Fig. 2 is a sectional view showing the control valve mechanism with the parts thereof in position for lowering the pump device into the well.

Fig. 3 shows the control valve with the parts thereof in pumping position.

Fig. 4 is a sectional view showing the control valve with the parts thereof in position for pulling the pump device from the well.

Fig. 5 is a cross section to enlarged scale on a plane represented by the line 5-5 of Fig. 4.

Fig. 6 is an enlarged cross section on a plane represented by the line 6-6 of Fig. 4.

Fig. 7 is an enlarged cross section on a plane represented by the line 7-7 of Fig. 4.

Fig. 8 is an enlarged cross section on a plane represented by the line 8-8 of Fig. 4.

Fig. 9 is an enlarged cross section on a plane represented by the line 9-9 of Fig. 4.

Fig. 10 is a fragmentary view showing the latch mechanism of the control device.

Fig. 11 is a projection of the inner tubular member of Fig. 10 to show the cooperating channels in the face thereof.

In Fig. 1 I show a string of pipe or casing extending down into a well from a casing-head. From an intermediate fitting of the casing-head an oil production pipe extends down

within the piping 12 into the oil producing zone of the well. This oil production pipe has an opening 16 at its lower end which extends through a conical seat 17 adapted to receive the lower end 5 18 of a pump unit 20 forming a part of a pumping mechanism 21 which includes a control valve 22 connected to the upper end of the pump unit by means of a short nipple 19, and fluid pressure delivery piping 23 which extends through the piping 15 to the top of the well and is connected to a cap fitting 24 through which fluid under pressure is conducted from a pipe 25 into the upper end of the delivery piping 23. A strainer or screen 26 of tubular form may be connected 15 to the upper end of the control valve 22 so that the actuating pressure fluid, which is generally clean oil, will have to pass through the screen 26 before it enters the operating parts of the pumping mechanism. When the respective parts of the pumping mechanism 21 are in operating position, as shown in Fig. 1, the clean pressure fluid is conducted down through the fluid pressure delivery piping 23, the control valve 22, and the nipple 19 into the pump unit 20, where such 25 fluid operates in the motor mechanism of the pump unit 20 to reciprocate the pumping mechanism, which generally consists of a pumping piston operating within a pumping cylinder, as known to the art and as disclosed in the copending application hereinabove set forth.

The clean fluid discharged from the power mechanism of the pump unit and the oil pumped from the well are both delivered into the space 27 existing around the pumping mechanism 21 35 within the discharge piping 15, and accordingly the two fluids are carried to the top of the well as a combined or single flow, from whence they are delivered through the fitting 14 to piping 28 leading to a suitable means for disposal of the 40 production from the well.

My present improvement concerns the inclusion in the pump mechanism 21 of the means, represented by the control valve 22, for controlling the flow of fluid through the pressure fluid 45 delivery piping 23 and other parts of the pumping mechanism at different times. The preferred form of the control device, as shown in Figs. 2 to 11 of the drawings, includes a shell 29 which comprises an upper tubular member 30 and a 50 lower tubular member 31, and further includes an inner vertically slidable member 32. One of the parts of the control valve 22 is connected to the pump unit 20, and the other of the parts is connected to the lower end 33 of the pressure fluid delivery piping 23. The preferred construction includes internal threads 34 at the lower end of the shell 29 for connecting the same to the nipple 19 which extends upwardly from the pump unit 20, and a fitting 35 threaded onto the 60 upper end of the inner member 32 and onto the lower end 33 of the piping 23. The fitting 35 has an inner bore 36 into which the screen 26 is threaded so as to project upwardly within the lower portion of the piping 23.

The inner member 32 is of cylindrical form and is divided into upper and lower sections 37 and 38 by a circular rib or collar 40. The lower section 38 of the inner member 32 is slidable within the bore 41 of the lower tubular member 31 above a slightly enlarged bore 42 which provides an annular space 43 around the lower extremity of the section 38 when the inner member is in lowered position, as shown in Fig. 2. The upper section 30 of the shell 29 has a large lower 75 bore 44, in which the collar 40 of the inner mem-

ber 32 is slidable and an upper bore 45 of smaller diameter which is separated from the lower bore 44 by an annular concentric seat 46 adapted to receive a conical face 47 formed on the upper part of the collar 40 when the inner member 32 5 is in raised position relative to the shell 29, as shown in Fig. 3.

In the upper part of the upper bore 45 diametrically opposing lugs 48 project inwardly into engagement with a depression 50 formed in the 10 upper part of the upper section 37 of the inner member 32 below the fitting 35. As shown in Figs. 5 and 6, the inwardly projecting lugs 48 may be formed from bodies of metal 51 welded into notches 52 in the upper part of the upper tubular member 30. The depression 50 is clearly shown in Fig. 10 and Fig. 11 which constitutes a development of the upper portion of the inner member 32 shown adjacent thereto. The depression 50 is milled in the upper portion of the upper section 37 of the member 32 so as to form a pair of 20 diametrically opposed longitudinal or coaxial major channels 54, such major channels 54 extending entirely to the top of the section 37 so that entrances 55 are provided for entry of the lugs 48 into the depression 50 in assembling the respective parts of the control valve 22. Adjacent and parallel to each of the major channels 54 are minor channels 56 which are diametrically 25 disposed and are each connected to a major channel through an arcuate passage or channel 57 which extends across the upper end of each wall 58 separating a major channel 54 from a minor channel 56. A depression or pocket 60 is formed in the upper end of each dividing wall 58 in which the lugs 48 rest when the shell 29 and the inner member 32 are in collapsed relation, as shown in Fig. 2. A spring 61 is set into a counterbore 62 in the lower end of the inner member 32 in such position that the spring will bear against a shoulder 63 formed near the lower end of the lower tubular member 31 when the parts 29 and 32 are in collapsed relation, as shown in Fig. 2, such spring 61 at this time exerting a force tending to move the parts 29 and 32 thereof outwardly, and 45 thereby providing a force tending to hold the lugs 48 in seated engagement with the pockets 60 at the upper ends of the dividing walls 58.

In the preceding paragraph I have described a means for holding the shell 29 and the inner 50 member 32 in such position that a flow of fluid from the member 19 to the piping 23, or from the exterior of the control valve 22 to the nipple 19 or the piping 23, cannot occur. It will be perceived that the inner member 32 has an axial 55 passage 64 extending downwardly from the upper end thereof to radial ports 65 which are at this time positioned intermediate the ends of the bore 41 of the shell 29. The passage 64 connects through the fitting 35 and the screen 26 with the 60 piping 23, and in view of the fact that the ports 65 are closed by the closely fitting bore 41, fluid cannot flow through the passage 64 into the passage 23. Accordingly, the relation of the shell 29 and the inner member 32 shown in Fig. 2 is 65 employed during the lowering of the pumping mechanism 21 into the well, since the setting of the parts 29 and 32 in the positions shown in Fig. 2, prior to the lowering of the device into the well assures that no dirty fluid will pass from 70 the well into the lower part of the pressure fluid piping 23, and further assures that a reverse flow of dirty fluid through the operating mechanism of the pump unit 20 cannot occur. This reverse flow is prevented by the control valve 22 by rea- 75

son of the fact that no communication is provided between the lower end of the upper axial passage 64 of the inner member 32 and the axial passage 65a having radial ports 66.

5 When the pumping mechanism 21 is lowered into the piping 15 to such position that the lower end 18 engages the seat 17, as shown in Fig. 1, the weight of the superimposed piping 23 will force the inner member 32 downwardly against
10 the action of the spring 61 so as to lower the pockets 60 from engagement with the lower ends of the lugs 48. By turning the piping 23, the inner member 32 may be rotated in anti-clockwise direction so as to bring the upper ends of the major channels 54 into alignment with the lugs
15 48, as shown in Fig. 3, whereupon the inner member 32 may be lifted until the face 47 of the collar 49 comes into engagement with the seat 46 formed near the upper end of the shell 29, thereby sealing off between the large bore 44 within the upper tubular member 30 and the small bore 45 which communicates with the body of dirty oil existing within the lower portion of the piping 15. The movement of the inner member 32 into this fully
20 raised position relative to the shell 29 moves the radial ports 65 and 66 both into a position above the upper end of the bore 41 so that they are in open communication through the space 67 within the large bore 44 in the upper portion of the shell 29. The control valve 22 is now in condition for the delivery of pressure fluid from the piping 23 to the pump unit 20. As soon as the space 43 in the lower part of the shell 29 is filled with fluid under high pressure, the pressure of
25 such fluid will act downwardly against the pump unit 26 and will at the same time act upwardly against the inner member 32 so as to force the face 47 into pressural engagement with the seat 46, thereby assuring a positive seal between the shell 29 and the inner member 32 during the operation of the pumping mechanism 21.

When it is desired to pull the pumping mechanism 21, the pressure fluid delivery piping 23 is lowered to an extent bringing the arcuate passages 57 down to the lugs 58, whereupon rotation of the piping 23 may be employed to turn the inner member 32 in clockwise direction so as to bring the upper ends of the relatively short minor channels 56 into alignment with the lugs. Then,
30 by raising the piping 23, the inner member 32 may be raised to an intermediate position determined by the engagement of the lugs 58 with the lower end walls 68 of the channels 56, as shown in Fig. 10. This movement of the inner member 32 into an intermediate position relative to the shell 29 brings the ports 65 into a position above the upper end of the bore 41 but leaves the ports 66 intermediate the ends of the bore 41. The axial passage 64 of the inner member 32 now provides communication of the pressure fluid delivery piping 23 with the exterior of the control valve 22 and the interior of the piping
35 15, through the ports 65, the space 67 within the bore 44, the bore 45, together with the lower portions of the major channels 54. Accordingly, during the pulling of the pumping device 21, the parts 29 and 32 are retained in the respective positions thereof shown in Fig. 4, and the oil drains readily from the piping 23 through the openings now provided therefor in the upper portion of the control valve 22.

The device, with the parts thereof disposed as shown in Fig. 4, has two additional utilities, namely; to permit circulation of oil down through
40 the pressure pipe 23 and upwardly through the

discharge pipe 15 without operating the pump, and to determine the friction head of the discharge space between the pipes 15 and 23. The value of this friction head may be employed during various periods of operation for determining
45 the level from which oil is being pumped.

To circulate oil through the discharge pipe 15, the member 37 is moved into the position in which it is shown in Fig. 4 wherein the radial openings 68 are closed, but the radial openings
50 65 are in such position as to provide a communication of the axial passage 64 with the space 67, so that the oil pumped downwardly through the pressure pipe 23 will be diverted through the openings 65, the space 67, and the upper end of
55 the member 30 into the space within the pipe 15 outside the pump mechanism and the pressure pipe 23, such oil passing upwardly through the pipe 15 and being finally discharged through the pipe 28. The power required to circulate the oil
60 in this manner provides a means for determining the friction head with which the annular space between the members 15 and 23 will resist a flow of oil therethrough, and with the friction head of this passage known it is possible to compute
65 the level of oil in the well from the power required to pump oil from the well.

It will be recognized that the device provides a simple means for testing the supply tube 23 for tightness. After the pump is first lowered into the well substantially to its operating position, and with the ports 65 and 66 thereof entirely closed as shown in Fig. 2, fluid under pressure may be applied to the upper end of the piping 23 to determine whether or not there are
70 any leaks therein.

Although I have herein shown and described my invention in simple and practical form, it is recognized that certain parts or elements thereof are representative of other parts, elements, or mechanisms which may be used in substantially the same manner to accomplish substantially the same results; therefore, it is to be understood that the invention is not to be limited to the details disclosed herein but is to be accorded the
75 full scope of the following claims.

I claim as my invention:

1. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well,
80 said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end
85 of said piping having a plurality of passages therein and means for connecting said passages so as to connect the interior of said piping with said power mechanism of said pump unit, to connect the interior of said piping with the exterior
90 of said control valve, or to entirely close the fluid passage formed by the lower end of said piping.

2. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump
95 unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of
100 said piping having a plurality of passages therein and means operative by movement applied through said piping to relatively arrange said passages so as to connect the interior of said piping with said power mechanism of said pump
105

unit, to connect the interior of said piping with the exterior of said control valve, or to entirely close the fluid passage formed by the lower end of said piping.

3. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping having upper and lower relatively movable parts, said upper part being connected to the lower end of said piping and said lower part being connected to said pump unit, there being passage means in said control valve, said passage means being controlled by the change of said upper and lower parts of said control valve between three different positions, through movement of said piping relative to said pump unit, to connect the interior of said piping with said power mechanism of said pump unit, to connect the interior of said piping with the exterior of said control valve, or to entirely close the fluid passage formed by the lower end of said piping.

4. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping having upper and lower relatively movable parts, said upper part being connected to the lower end of said piping and said lower part being connected to said pump unit, there being passage means in said control valve, said passage means being controlled by the change of said upper and lower parts of said control valve between three different positions, through movement of said piping relative to said pump unit, to connect the interior of said piping with said power mechanism of said pump unit when said upper part is in raised position relative to said lower part, to connect the interior of said piping with the exterior of said control valve when said upper part is in an intermediate position relative to said lower part, or to entirely close the fluid passage formed by the lower end of said piping when said upper part is in lowered position relative to said lower part, there being means for holding said parts in said relative positions.

5. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of the well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping having upper and lower relatively movable parts, said upper part being connected to the lower end of said piping and said lower part being connected to said pump unit, there being passage means in said control valve, said passage means being controlled by the change of said upper and lower parts of said control valve between three different positions, through movement of said piping relative to said pump unit, to connect the interior of said piping with said power mechanism of said pump unit, to connect

the interior of said piping with the exterior of said control valve, or to entirely close the fluid passage formed by the lower end of said piping, there being latch means operative between said upper and lower parts to retain said parts in said three positions.

6. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping having upper and lower relatively movable parts, said upper part being connected to the lower end of said piping and said lower part being connected to said pump unit, there being passage means in said control valve, said passage means being controlled by the change of said upper and lower parts of said control valve between three different positions, through movement of said piping relative to said pump unit, to connect the interior of said piping with said power mechanism of said pump unit when said upper part is in raised position relative to said lower part, to connect the interior of said piping with the exterior of said control valve when said upper part is in an intermediate position relative to said lower part, or to entirely close the fluid passage formed by the lower end of said piping when said upper part is in lowered position relative to said lower part, there being latch means operative between said upper and lower parts to retain said parts in said raised, intermediate, and lowered positions, said latch means comprising a lug on one of said parts and three shoulders spaced upon the other of said parts so as to be engaged by said lug in said three relative positions of said parts.

7. A control valve of the character described, for use at the lower end of a pump tube, including: an upper member and a lower member relatively movable between three positions of engagement, said upper member being adapted for attachment to the lower end of said pump tube and said lower member being adapted for attachment to a tube extending downwardly therefrom, each of said members having a passage communicating with the tube to which it is connected, one of said members having a port communicating with the exterior of said control valve, said passages being so placed in their respective members that they will be connected together in open communication when said members are in one of said three relative positions, that the passage in said upper member will be connected to said port when said members are in a second of said three relative positions, and that at least one of said passages will be closed when said members are in a third of said three relative positions; and means controllable from a remote point for holding said members selectively in said three relative positions.

8. A control valve of the character described, for use at the lower end of a pump tube, including: an upper member and a lower member relatively movable between three positions of engagement, said upper member being adapted for attachment to the lower end of said pump tube and said lower member being adapted for attachment to a tube extending downwardly therefrom, each of said members having a passage communicating with the tube to which it is connected, one of said members having a port communicating with the exterior of said control valve, said passages being so placed in their re-

spective members that they will be connected together in open communication when said members are in one of said three relative positions, that the passage in said upper member will be connected to said port when said members are in a second of said three relative positions, and that at least one of said passages will be closed when said members are in a third of said three relative positions; and means controllable by movement of said pump tube and said upper member relative to said lower member for holding said members selectively in said three relative positions.

9. A control valve of the character described, for use at the lower end of a pump tube, including: an upper member and a lower member relatively movable between three positions of engagement, said upper member being adapted for attachment to the lower end of said pump tube and said lower member being adapted for attachment to a tube extending downwardly therefrom, each of said members having a passage communicating with the tube to which it is connected, one of said members having a port communicating with the exterior of said control valve, said passages being so placed in their respective members that they will be connected together in open communication when said members are in one of said three relative positions, that the passage in said upper member will be connected to said port when said members are in a second of said three relative positions, and that at least one of said passages will be closed when said members are in a third of said three relative positions; and means operative to selectively maintain said members in said three relative positions in accordance with the utility desired from said control valve.

10. A control valve of the character described, for use at the lower end of a pump tube, including: an upper member and a lower member relatively movable between three positions of engagement, said upper member being adapted for attachment to the lower end of said pump tube and said lower member being adapted for attachment to a tube extending downwardly therefrom, each of said members having a passage communicating with the tube to which it is connected, one of said members having a port communicating with the exterior of said control valve, said passages being so placed in their respective members that they will be connected together in open communication when said members are in one of said three relative positions, that the passage in said upper member will be connected to said port when said members are in a second of said three relative positions, and that said passages will be closed when said members are in a third of said three relative positions; and means operative to selectively maintain said members in said three relative positions in accordance with the utility desired from said control valve.

11. A control valve of the character described, for use at the lower end of a pump tube, including: a lower member having means at its lower end for connecting it to a downwardly projecting tubular member, said lower member having a bore with a restricted portion therein; an upper member slidable into the upper end of said lower member, said upper member having means at its upper end for connecting it to said pump tube and having a passage leading downwardly from its upper end to an upper lateral port and a passage leading upwardly from its lower end to a lower lateral port below said upper lateral port; and means for holding said members in three relative positions

comprising collapsed position, intermediate position, and extended position, said ports being so placed relative to said positions that said ports will be in said restricted bore portion of said lower member when said members are in relatively collapsed position, and that said upper port will be open to the exterior when said members are in said intermediate relative position, there being means for sealing between said members when they are in said extended relative position.

12. A device as defined in claim 11, in which said holding means comprises a lug projecting from one of said members and a channel in the other of said members in a position to receive said lug, said channel being so formed as to provide three shoulders spaced longitudinally with respect to the axes of said members for receiving said lug.

13. A control valve of the character described, for use at the lower end of a pump tube, including: a lower member having means at its lower end for connecting it to a downwardly projecting tubular member, said lower member having a bore with a restricted portion and an internal seat near its upper end; an upper member slidable into the upper end of said lower member, said upper member having means at its upper end for connecting it to said pump tube, an external seat intermediate the ends thereof, a passage leading downwardly from its upper end to an upper lateral port, and a passage leading upwardly from its lower end to a lower lateral port below said upper lateral port; and means for holding said members in three relative positions comprising collapsed position, intermediate position, and extended position, said ports being so placed relative to said positions that said ports will be in said restricted bore portion of said lower member when said members are in relatively collapsed position, that said upper port will be open to the exterior when said members are in said intermediate relative position, and that said seats will engage when said members are in said extended relative position so as to seal between said members.

14. A device as defined in claim 13, in which said holding means comprises a lug projecting from one of said members and a channel in the other of said members in a position to receive said lug, said channel being so formed as to provide three shoulders spaced longitudinally with respect to the axes of said members for receiving said lug.

15. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve to close the lower end of said piping, said valve being so formed as to be operated by movement of said piping relative to said pump unit.

16. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping operated by movement of said fluid piping to close the lower end of said passage so that no fluid will flow through the same.

17. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping having a plurality of passages therein and means for connecting said passages so as to connect the interior of said piping with said power mechanism of said pump unit, or to connect the interior of said piping with a space external to said control valve.

18. A method of determining the friction head of the discharge tube of a fluid operated deep well pump, comprising: placing in the well a pump and a fluid supply tube; connecting the lower end of the fluid supply tube with the lower portion of the discharge tube for delivering an actuating fluid under pressure to the pump; and circulating fluid through the supply tube and the discharge tube without operating said pump.

19. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping operative to close the lower end of said passage so that no fluid will flow through the same, and to open the lower end of said passage so that fluid may flow therefrom to said pump unit.

20. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and means disposed near said pump unit operative to prevent a flow of fluid through said power mechanism of said pump unit.

21. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping operative to close the lower end of said passage so that no fluid will flow through the same.

22. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism with a pressure fluid inlet passage, and a pumping mechanism actuated by said power mechanism; pressure fluid piping carrying actuating fluid down through the well to said inlet passage of said power mechanism; and valve means operative to close said inlet passage and to connect the lower end of said pressure fluid piping to the exterior of said valve means.

CLARENCE J. COBERLY.

CERTIFICATE OF CORRECTION.

Patent No. 2,053,602,

September 8, 1936.

CLARENCE J. COBERLY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, first column, line 20-21, claim 18, strike out the words "for delivering an actuating fluid under pressure to the pump" and insert the same after the word "tube" and before the semicolon in line 18, same claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of November, A. D. 1936.

(Seal)

Henry Van Arsdale
Acting Commissioner of Patents.

17. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping having a plurality of passages therein and means for connecting said passages so as to connect the interior of said piping with said power mechanism of said pump unit, or to connect the interior of said piping with a space external to said control valve.

18. A method of determining the friction head of the discharge tube of a fluid operated deep well pump, comprising: placing in the well a pump and a fluid supply tube; connecting the lower end of the fluid supply tube with the lower portion of the discharge tube for delivering an actuating fluid under pressure to the pump; and circulating fluid through the supply tube and the discharge tube without operating said pump.

19. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping operative to close the lower end of said passage so that no fluid will flow through the same, and to open the lower end of said passage so that fluid may flow therefrom to said pump unit.

20. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and means disposed near said pump unit operative to prevent a flow of fluid through said power mechanism of said pump unit.

21. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism and a pumping mechanism actuated thereby; pressure fluid piping having a passage therethrough for carrying actuating fluid down through the well to said pump unit therein; and a control valve near the lower end of said piping operative to close the lower end of said passage so that no fluid will flow through the same.

22. A fluid operated deep well pump of the character described, including: a pump unit adapted for placement in the bottom of a well, said pump unit having a fluid operated power mechanism with a pressure fluid inlet passage, and a pumping mechanism actuated by said power mechanism; pressure fluid piping carrying actuating fluid down through the well to said inlet passage of said power mechanism; and valve means operative to close said inlet passage and to connect the lower end of said pressure fluid piping to the exterior of said valve means.

CLARENCE J. COBERLY.

CERTIFICATE OF CORRECTION.

Patent No. 2,053,602,

September 8, 1936.

CLARENCE J. COBERLY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, first column, line 20-21, claim 18, strike out the words "for delivering an actuating fluid under pressure to the pump" and insert the same after the word "tube" and before the semicolon in line 18, same claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of November, A. D. 1936.

(Seal)

Henry Van Arsdale
Acting Commissioner of Patents.