

Jan. 30, 1945.

H. C. FRENCH

2,368,131

SUBMERSIBLE DEEP WELL PUMP

Filed Dec. 27, 1943

2 Sheets-Sheet 1

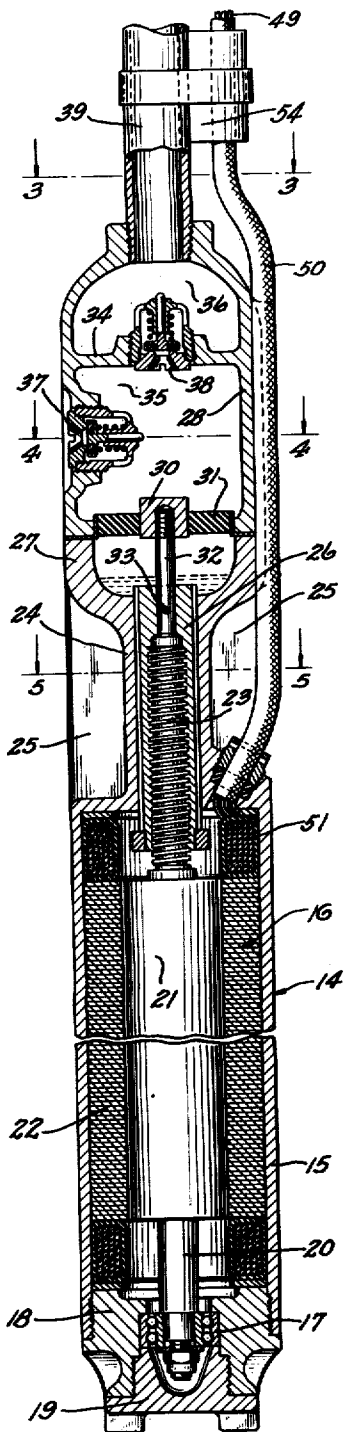


Fig. 2.

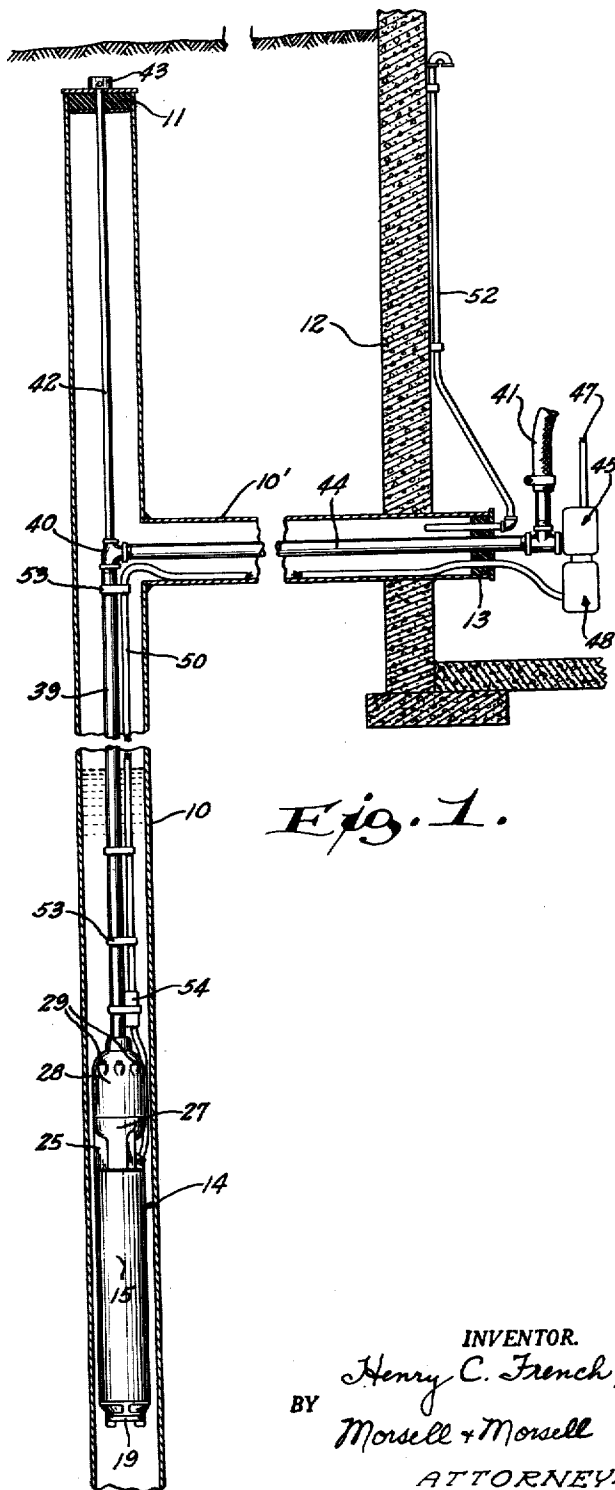


Fig. 1.

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Fig. 3.

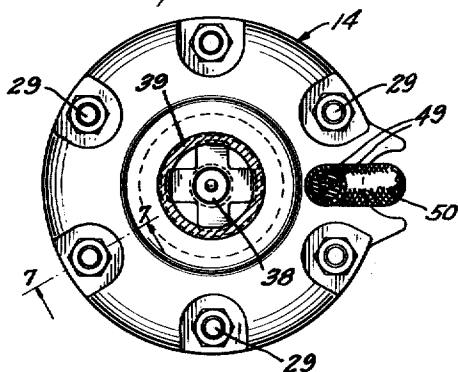


Fig. 4.

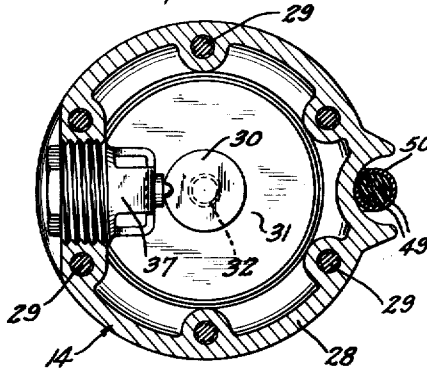


Fig. 5.

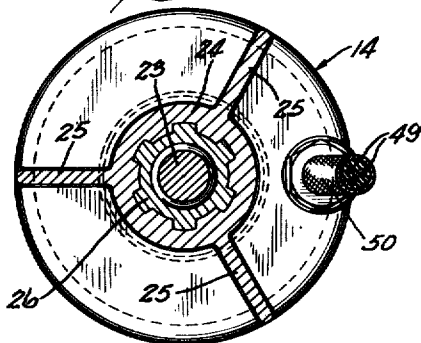


Fig. 6.

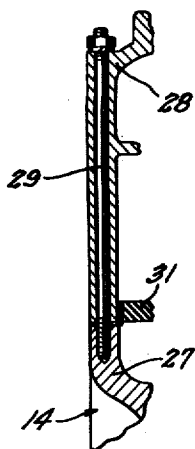
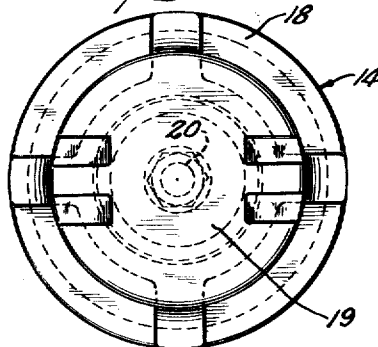


Fig. 7.

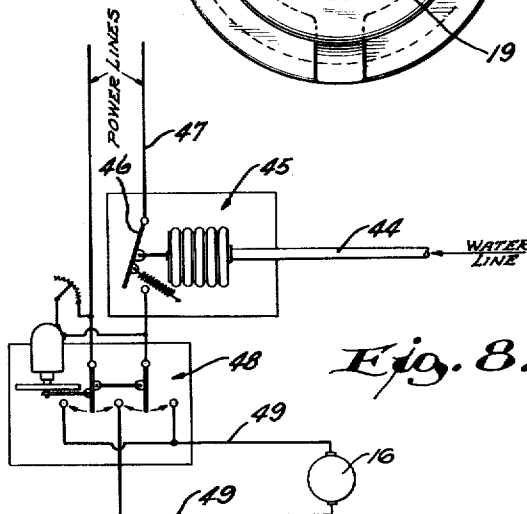


Fig. 8.

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UNITED STATES PATENT OFFICE

2,368,131

SUBMERSIBLE DEEP WELL PUMP

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Application December 27, 1943, Serial No. 515,681

4 Claims. (Cl. 103—46)

This invention relates to improvements in submersible deep well pumps.

A general object of the invention is to provide for use in a deep well, a novel submersible pumping unit which includes a torque motor actuating a diaphragm with pulsations of the latter being effective to draw charges of water into and to force a confined stream out of a chamber in the pumping unit.

A further object of the invention is to provide a deep well pump having a submersible lower unit which is water-tight and houses a torque motor, said unit including a pulsating diaphragm which also serves to seal that portion of the submerged lower unit in which said motor is housed.

A further object of the invention is to provide a deep well pump wherein the submerged pumping unit, housing a torque motor and sealed by a pulsating diaphragm, is initially filled with a body of oil for lubricating purposes which, because of the sealed arrangement, will never require replenishment.

A further object of the invention is to provide a submersible deep well pump having a minimum of moving parts including but a single bearing which is oil covered and water sealed.

A further object of the invention is to provide a torque motor actuated, submersible deep well pump wherein heat generated by the motor is transmitted by oil surrounding the motor to the metallic walls of the unit chamber and from thence it is dissipated by the water in the well in which the pump is submerged.

A further object of the invention is to provide a deep well pump including a diaphragm actuated by a torque motor, the rapidity of pulsation of the diaphragm being regulated by a reversing switch with the result that a simple adjustment or setting of the switch is effective to govern the amount of water delivered by the pump.

A further object of the invention is to provide a submersible deep well pump which is of simple and inexpensive construction, which is easy to install and service, which is strong and durable, which is highly efficient in operation, and which is well adapted for the purposes described.

With the above and other objects in view the invention consists of the improved submersible deep well pump and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings in which the

same reference characters indicate the same parts in all of the views:

Fig. 1 is a fragmentary vertical sectional view of a deep well showing the improved submersible pump installed therein and in association with a portion of a building to be supplied with water from the well;

Fig. 2 is an enlarged vertical sectional view of the submersible pumping unit;

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 2, and on a larger scale;

Fig. 4 is a transverse sectional view taken on line 4—4 of Fig. 2, and on a larger scale;

Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 2, and on a larger scale;

Fig. 6 is an enlarged bottom view of the pumping unit;

Fig. 7 is a fragmentary, detail sectional view taken on line 7—7 of Fig. 3, and on a smaller scale; and

Fig. 8 is a diagrammatic view of the pressure and reversing switches which control the pumping mechanism, and the wiring arrangement for said switches.

Referring now more particularly to Fig. 1 of the drawings it will appear that a casing for a deep well is indicated generally by the numeral 10, said casing having its upper end closed by a standard well seal 11. Intermediate its ends, said well casing has a lateral extension 10' projecting through a wall 12 of a building or other structure to be supplied with water by the well. The inner end of said extension also carries a standard well seal 13.

The improved deep well pump is adapted to be installed within the well casing 10 with its pumping unit 14 submerged in the water of the well, the pumping unit additionally having various extensions and conduits connected thereto and projecting into portions of the well casing and lateral extension 10', as will appear more fully hereinafter.

The pumping unit 14, shown in detail in Fig. 2, comprises an elongated metallic casing whose lower portion 15 is substantially cylindrical in cross-section and houses a torque motor 16, the latter having the lower end of its rotor shaft 20 mounted in a bearing 17 disposed in removable screw threaded base caps 18 and 19 which close the lower end of the unit 14. The rotor 21 of the torque motor revolves in reverse directions within a stator 22 and the upper end of said rotor has an integral upwardly projecting reduced screw 23.

Above the lower cylindrical casing portion 15

the unit casing is formed with a reduced, vertical, bored neck 24 from which project spaced radial fins or webs 25. An elongated internally threaded nut 26, engaged by said rotor screw 23, is in splined engagement with the neck 24.

The unit casing above the neck 24 is widened and has the form of a barrel, comprising a lower cup-shaped portion 27 and an upper complementary cap portion 28, the portions 27 and 28 having engaging peripheral lugs and being removably held together by elongated bolts 29, as best shown in Figs. 3, 4 and 7. A flexible rubber diaphragm 31 has its peripheral portions clamped between the casing sections 27 and 28. The medial portion of said diaphragm carries a block 30 which is engaged by the upper end of a rotor screw extension 32 whereby vertical reciprocations of the nut 26 are transmitted to the diaphragm 31 to pulsate the same. A pin 33 attaches the screw extension 32 to the nut 26.

A horizontal partition 34 divides the interior of the casing 27—28 into an inlet chamber 35 and an exhaust chamber 36. An automatic pressure actuated inlet valve 37 installed in a side wall of the casing portion 28 controls the suction of water from the well into the inlet chamber 35, and an automatic pressure actuated outlet valve 38 positioned in the partition 34 controls the discharge of water from said inlet chamber to the exhaust chamber 36. Extending from the latter which is in the extreme upper end of the pumping unit casing is a riser pipe 39. Said riser pipe extends upwardly within the well casing and at the junction of the same with its lateral extension 10' there is an elbow 40 from which a main water pipe 44 extends through said extension 10' into the building or structure wherein it is equipped with a hose 41, piping, or other suitable connections to convey pumped water to desired locations. From the riser pipe elbow 40 there also extends a smaller pipe 42 upwardly through the vertical extent of the well casing, with its upper end being suitably capped, as at 43.

Attached to and in communication with an inner end portion of the water pipe 44, conveniently located within the building or structure, is a pressure switch 45. The latter is shown diagrammatically in Fig. 8 and a pressure or bellows element, influenced by water pressure from the pipe 44, is effective to open and close a switch element 46 in the power line 47. The power line extends to a source of electrical energy (not shown). There is associated with the pressure switch 45 and in the same electrical circuit therewith, an automatic reversing switch, shown schematically in Fig. 8 and indicated generally by the numeral 48. Circuit wires 49, housed in a lead cable 50, connect with the stator windings 51 of the torque motor 16. The reversing switch, according to its setting and when the pressure switch has the element 46 in the circuit closed, functions to reverse the flow of electricity through the stator windings and thus causes the rotor 21 to first turn in one direction and then in the reverse direction.

A vent pipe 52 is extended through the well seal 13 into the well casing extension 10'. The lead cable 50, which carries the circuit wires 49, adequately protects the same against water in the well casing and the cable is held compactly against the riser pipe 39 by straps 53, passing through a water-proof junction box 54 and then into the casing enclosing the torque motor. It should also be observed that the pumping unit

casing is filled with oil up to about the level shown in Fig. 2. Hence all of the working parts are submerged and run in the confined oil. As the interior of the entire casing below the diaphragm 31 is sealed by the latter the body of oil never requires replenishing. Heat generated by the motor is carried by said oil to the metal walls of the casing and as the latter is submerged in the water of the well, the motor is maintained in a cool condition at all times.

In the operation of the improved deep well pump when the main power line circuit is closed the reversing switch 48 is put into operation whereby the torque motor 16 is energized. The reversing switch causes the rotor 21 of the torque motor to rotate first in one direction and to then rotate in a reverse direction, and so on. The speed and extent of the rotor's movements in said reverse directions will govern the rapidity of pulsations of the diaphragm 31 and this regulates the amount of water delivered by the pump. The movements of the rotor mentioned, through its screw extension 23, cause vertical reciprocations of the splined nut 26, and the screw extension 32 pinned thereto, pulsates the diaphragm, creating suction and pressures within the pump casing inlet chamber 35. By means of the valves 37 and 38 previously described, water from the well casing 10 is drawn into the inlet chamber and discharged therefrom and is forced through the riser pipe and connections thereto to supply the building or structure. This cycle of operation continues as long as the pressure switch remains in a circuit closing position.

The improved submersible deep well pump is very novel in the utilization of a submersible pumping unit which includes a torque motor controlled by a reversing switch with the torque motor serving to pulsate a diaphragm. The construction is such that the interior of the pumping unit is water-tight, with the diaphragm serving as a seal for the same, permitting the initial introduction of a large body of oil for lubricating purposes which will never require replenishment. The pump has a minimum of movable parts and requires but a single bearing. All of the moving parts are oil-covered and water-sealed. The submersible deep well pump is extremely simple and inexpensive in its construction and may be installed and serviced with a minimum of effort. The improved submersible deep well pump is, additionally, extremely efficient in operation and well adapted for the purposes described.

What is claimed as the invention is:

1. A submersible pump for wells, comprising a submersible casing divided into a fluid pumping chamber having inlet and exhaust ports therein and a motor chamber, the latter containing a body of oil for lubricating and cooling purposes, valves controlling said ports, a flexible partition between the fluid pumping and motor chambers and hermetically sealing the latter and forming a variable enclosing wall for the former, an electric motor within the motor chamber and covered by the oil therein, and a connection between the motor and partition for flexing the latter.

2. A submersible pump for wells, comprising a submersible casing divided into a pressure pumping chamber having inlet and exhaust ports therein and a motor chamber, valves controlling said ports, a flexible partition forming an imperforate wall between the pumping and motor chambers and sealing the latter and movable to vary the capacity of the former, said motor chamber containing a body of oil for lubricating and

cooling purposes, an electric motor within the motor chamber and covered with the oil therein, and a mechanical connection between the motor and partition for flexing the latter and varying the pressure within the pumping chamber while the partition is serving as a seal for the motor chamber.

3. A submersible pump for wells, comprising an elongated submersible casing having an upper liquid chamber and a lower motor chamber, the latter being filled with a body of oil for lubricating and cooling purposes, the upper chamber having inlet and exhaust ports therein, pressure actuated valves controlling said ports, a flexible, imperforate partition separating said chambers and sealing the motor chamber from the other chamber, an electric torque motor within said lower chamber and having a screw extension, a nut engaged by said screw extension and splined in a portion of said casing, an operating extension fixed to said nut and engaging said partition

for flexing it in reverse directions to vary the pressure within the fluid chamber while it is sealing the motor chamber, an electrical circuit extending to the torque motor for energizing it, a reversing switch in said circuit remote from the casing to control operation of the motor, and means in said circuit remote from the casing for controlling said circuit.

4. In a pump for wells including a submersible casing having a pumping chamber and a motor chamber, the latter containing a body of oil for lubricating and cooling purposes, an electric motor within the motor chamber submerged in the oil therein, a flexible partition separating the pumping and motor chambers and hermetically sealing the latter, and means between the motor and partition whereby the partition is flexed for pumping purposes while it is serving as a seal for said motor chamber, and as a variable wall for the pumping chamber.

HENRY C. FRENCH.

CERTIFICATE OF CORRECTION.

Patent No. 2,368,801.

February 6, 1945.

HAROLD E. CARNAGUA, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 18, strike out "other establishes a reverse drive. Obviously, it is"; 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 22nd day of May, A. D. 1945.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.

cooling purposes, an electric motor within the motor chamber and covered with the oil therein, and a mechanical connection between the motor and partition for flexing the latter and varying the pressure within the pumping chamber while the partition is serving as a seal for the motor chamber.

3. A submersible pump for wells, comprising an elongated submersible casing having an upper liquid chamber and a lower motor chamber, the latter being filled with a body of oil for lubricating and cooling purposes, the upper chamber having inlet and exhaust ports therein, pressure actuated valves controlling said ports, a flexible, imperforate partition separating said chambers and sealing the motor chamber from the other chamber, an electric torque motor within said lower chamber and having a screw extension, a nut engaged by said screw extension and splined in a portion of said casing, an operating extension fixed to said nut and engaging said partition

for flexing it in reverse directions to vary the pressure within the fluid chamber while it is sealing the motor chamber, an electrical circuit extending to the torque motor for energizing it, a reversing switch in said circuit remote from the casing to control operation of the motor, and means in said circuit remote from the casing for controlling said circuit.

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