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1,929,754

ROTARY WELL PUMP

Filed Oct. 27, 1930

2 Sheets-Sheet 1

Fig. 1.

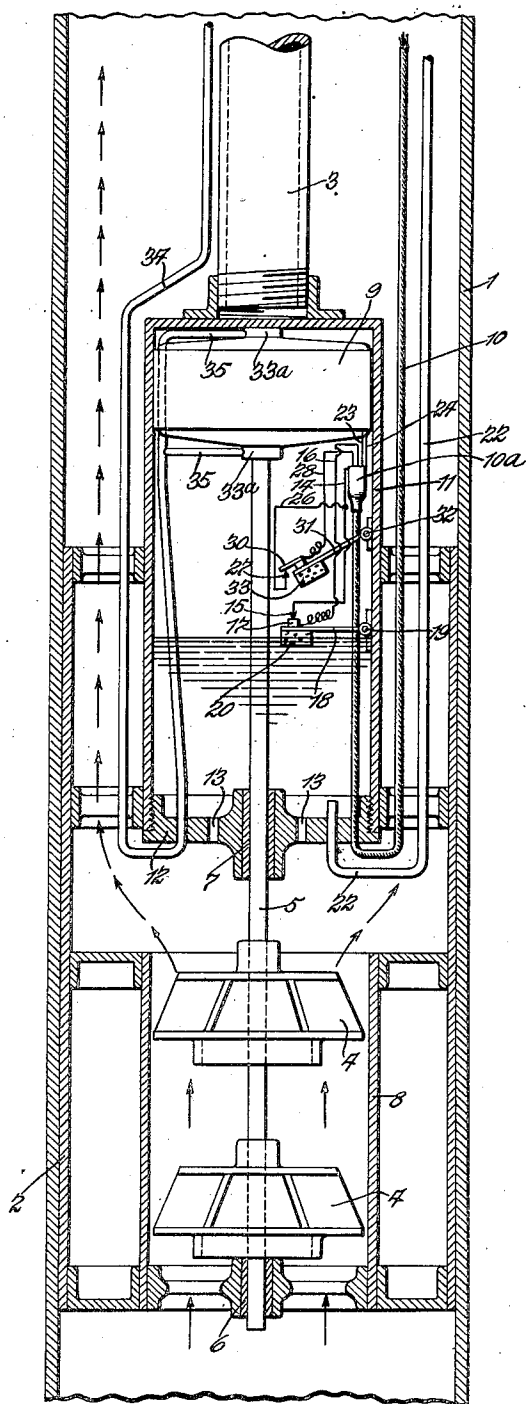


Fig. 4.

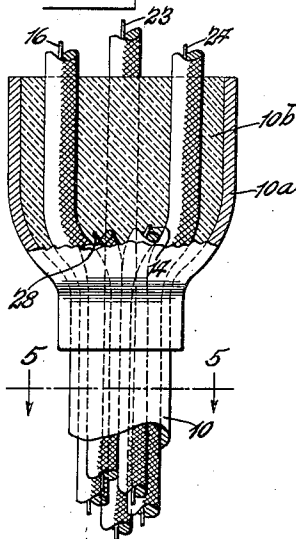
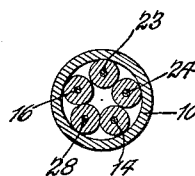


Fig. 5.



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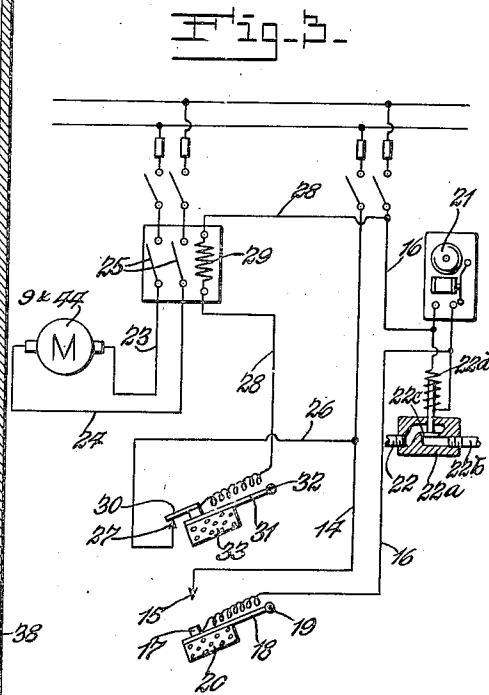
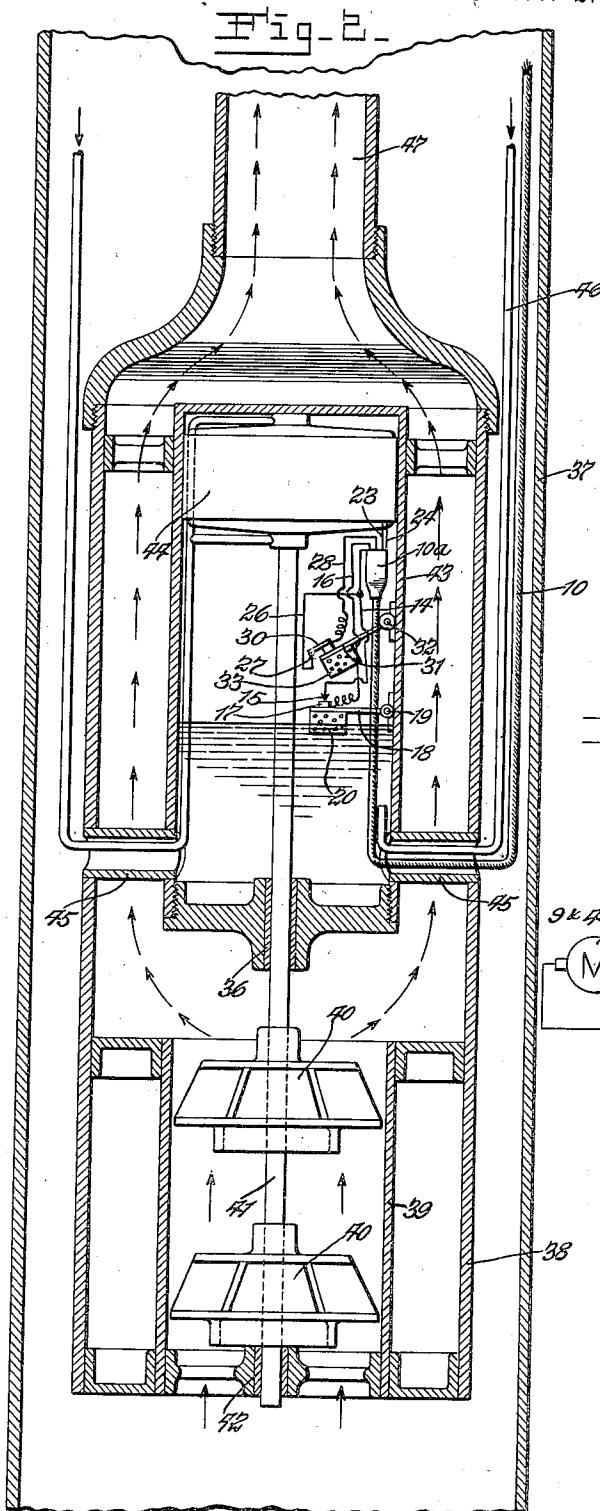
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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ROTARY WELL PUMP

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2 Claims. (Cl. 103—87)

This invention relates to rotary well pumps, and an object is to provide improved mechanism arranged and constructed to drive a rotary well pump by means of a directly connected motor that is essentially located below the static head of the well and is submerged in the well.

It is a general practice to operate these pumps by a motor located at the surface. This requires a connecting shaft from the motor to the pump and a tube enclosing the shaft, both the tube and the shaft often extending several hundred feet below the motor. These devices are heavy and expensive and another object of my invention is to provide a construction and arrangement which will eliminate the long heavy shaft arrangement mentioned.

The location of the motor under the water in the well requires that some provision be made to keep the water out of contact with the motor. This is essential for both electrical and mechanical reasons, because water coming in contact with the insulation on the coils will break down the insulation and cause shorts and the motor will fail; and because the motor loads itself when operated in any liquid. The motor operating in a liquid becomes loaded because the liquid fills the air gap between the rotor and the stator and creates a frictional resistance that loads the motor and makes the motor useless for other purposes. Therefore, an additional object of the invention is to provide a construction and arrangement which overcomes and eliminates these objections.

Other objects will appear from the following description, reference being made to the accompanying drawings, in which—

Fig. 1 is a vertical sectional view showing one embodiment of the invention that is satisfactorily operative under certain conditions.

Fig. 2 is a similar sectional view showing a variation of the invention to meet other requirements.

Fig. 3 is a diagrammatic view of the electric circuit controlling the motor of either embodiment of my invention.

Fig. 4 is an enlarged vertical sectional view of the seal that seals the end of the cable from which the electric circuit wires extend.

Fig. 5 is a cross sectional view on the line 5—5 of Fig. 4.

According to the invention shown in Fig. 1, the well casing 1 encloses a tubular support 2 in connection with which the pump and the motor for operating the pump are supported by the pipe 3 extending downwardly into the casing 1.

The pipe 3 functions as a support for the pump mechanism and also acts as a torque tube.

The pump or pumps 4 are attached to and operated by a rotary shaft 5 having its lower end rotative in a bearing 6 and its intermediate portion journaled in a bearing 7. The pump or pumps 4 are within a tube 8 and the bearing 6 is supported at the lower end of said tube. It is now apparent that when the pump or pumps 4 are operated, the water in the well will be pumped upwardly in the direction of the arrows.

The electric motor 9 is arranged to rotate the pump shaft 5 by the usual familiar connections utilized to rotate shafts by electric motors.

The electric wires for the motor are enclosed in an impervious cable 10 that extends downwardly into the well casing. The electric circuit for operating the motor is controlled by switch and contact members constituting an important feature of the invention.

The motor 9 is enclosed within a chamber 11 attached to the lower end of the pipe 3. The chamber 11 is impervious and is open only in its lower end to which the bearing 7 is attached. The bearing 7 is supported by a plate 12 detachably secured in the lower end of the chamber 11 and having therethrough a number of holes 13 for the admission and discharge of water into and from the chamber 11.

The electric wires lead from the cable 10 through a seal device comprising a ferrule 10^a having a reduced end forming an impervious joint with the cable 10 and having its other end enlarged and filled with a sealing substance 10^b, such as wax, asphaltum, or other appropriate sealing material. One wire of the electric circuit leads to a stationary contact 15, and the other wire 16 of said circuit leads to a movable contact 17 mounted on an insulation support 18. The support 18 is mounted on a pivot 19 for operation to move the contact 17 into and out of contact with the contact 15 so as to close and to open the electric circuit through the wires 14 and 16. A float 20 is attached to the support 18 and is arranged to be operated by water entering the chamber 11 to close the circuit. Normally, the circuit through the wires 14 and 16 is open because the contact 17 is down and out of engagement with the contact 15. When water enters the chamber 11 through the ports 13 to a sufficient height, the contact 17 will be moved against the contact 15 and the circuit through the wires 14 and 16 thereby closed. An appropriate signal 21 is in connection with the wire 16 and is operated when the circuit is closed to

indicate that fact. A tube 22 extends downwardly in the well casing 1 and opens through the plate 12 into the chamber 11 and constitutes means for forcing air into said chamber to eject water from said chamber as an incident to which ejection of water the circuit 14—16 is opened by movement of the contact 17 away from the contact 15. Thus, the operator at the surface or elsewhere is automatically informed when the circuit 14—16 is closed by the admission of an excessive amount of water into the chamber 11; or, expressed differently, the operator is informed when an excessive amount of water enters the chamber 11.

If desired, the pipe 22 may be equipped with a magnetically operated valve, as conventionally shown in Fig. 3 of the drawings. As there shown, a valve housing 22^a opens at one end into the pipe 22 and at the other end into a pipe 22^b communicating with any compressed air tank or pump so as to discharge air into the pipe 22 through the valve housing 22^a. A valve 22^c is mounted in the housing 22^a and is operative by a magnetic device 22^d to open the passage through the valve housing 22^a simultaneously with the operation of the signal 21. It will be understood that the illustration in Fig. 3 is conventional, specific illustration of the magnetically operated valve being entirely unnecessary because valves of this type are well known and their application to the present invention will be clearly understood by those skilled in the art from the showing in Fig. 3 of the drawings.

The circuit for operating the motor comprises wires 23 and 24 having in connection therewith an automatic circuit breaker 25 (Fig. 3). A wire 26 from the wire 14 leads to a stationary contact 27; and a wire 28 from the wire 16 leads through a "non-voltage release" device 29 to a movable contact member 30 actuated by float 33. The movable contact member 30 is carried by a support 31 mounted on a pivot 32 and is normally in contact with the stationary contact member 27. Thus, when the circuit 26—28 is closed by the switch 27—30, the "non-voltage release" device 29 is energized and the circuit breaker 25 can be used to close the circuit through the wires 23 and 24 and cause the motor to operate. When the circuit 26—28 is open, the device 29 is de-energized and the circuit breaker 25 operates automatically to open the circuit 23—24 to the motor and cause the motor to stop. The equipment 25—29 is of known and standard construction and is not illustrated in detail but is clearly shown diagrammatically in Fig. 3 of the drawings. The present invention makes use of these standard devices 25—29 so as to open the circuit 23—24 automatically when the circuit 26—28 is open. A float 33 is in connection with the support 31 and will be operated when the water in the chamber 11 rises to an excessive height in said chamber. Thus, the motor will be automatically stopped when an excessive amount of water enters the chamber 11. Moreover, a signal will be given by the closing of the circuit 14—16 in the manner previously described before the water rises to a height sufficient to stop the motor. This enables the operator to force air into the chamber 11 through the air conduit 22 and thus eject the water from said chamber so as to keep closed the circuit that operates the motor and to open the circuit that gives the signal and thus stop the operation of the signal. Or, if the invention is equipped with the magnetically operated valve conventionally shown

in Fig. 3 of the drawings, said valve will open automatically to permit air to pass through the air conduit 22 and into the chamber 11 and thus eject the water from said chamber for the purposes indicated.

In the manner described, the motor is operated and the water is forced through the pump or pumps and between the chamber 11 and the well casing and up through the well casing to the surface. While I have shown a single motor, it will be clearly apparent to those who have skill in this art that any number of motors may be assembled simply by increasing the dimensions of the part to provide room therefor.

Oil may be conducted to the motor bearings 33^a through a pipe 34 having branches 35 leading to said bearings.

The construction shown in Fig. 1 is intended for use when the difference between the static head in the well and the total head pumped against is not great. The arrangement shown in Fig. 2 is designed and adapted for use when the difference between the static head in the well and the total head pumped against is great. In Fig. 2, the water under high pressure that is passing from the pumps does not enter the motor chamber excepting the comparatively insignificant amount of water that may leak through the bearing 36.

In the arrangement shown in Fig. 2, the well casing is indicated by 37. The pump frame 38 has supports therein, a pump outlet 39 enclosing pump or pumps 40 attached to the shaft 41 having its intermediate portion journaled in the bearing 36 and its lower end journaled in a bearing 42 supported by the pump outlet 39. The chamber 43 that encloses the motor 44 is completely closed excepting for the pipe sections 45 that open into said chamber and extend across the space between said chamber 43 and the member 38 and open to the outside of said member 38 into the well casing. Thus, the water that is under high pressure passing from the pump cannot enter the chamber 43 except for an insignificant amount of water that may leak through the bearing 36. Only the water in the well casing under pressure of the static head may enter the chamber 43.

The wiring and electrical equipment, including the switches and the circuit opening and closing devices for the invention as illustrated in Fig. 2, are exactly the same as that already described in connection with Fig. 1 and as clearly shown in Fig. 3 of the drawings. Accordingly, the same reference numbers are applied to the same parts of the wiring system that are applied in Figs. 1 and 3.

It is now clear that in the construction shown in Fig. 2, the water pressure in the chamber 43 will be the pressure given by the static head of the well and not the pressure of the water under the impulse of the pump. When the water rises in the air chamber 43 to a height to close the circuit 14—16 and operate the signal 21, the operator may force air through the air inlet 46 so as to eject the water from the air chamber 43 against the pressure of the static head to an extent sufficient to permit the circuit 14—16 to open. When the water rises in the chamber 43 to a height sufficient to open the circuit controlling the motor, the motor will be automatically stopped, as before described in the description of the construction shown in Fig. 1.

The pump mechanism in the construction shown in Fig. 2 is supported by a pipe 47 which

constitutes the passage for conducting the water from the well. Thus, the well casing 37 is not utilized as a conduit for conducting the water to the surface but the supporting pipe 47 constitutes such a conduit.

Illustrations of the differences between the operation of the mechanism of Fig. 1 and the mechanism of Fig. 2 is as follows: Assume that water is to be pumped 100 feet above the mouth of the well and the static head or level of the water in the well is 200 feet below the surface and that the pump in the well is 300 feet below the surface. In this example, the head pressure on the motor chamber would be 400 feet, because the motor chamber is 400 feet below the point to which the water is to be pumped and such pressure is about 200 pounds to the square inch. Accordingly, it would require 200 pounds of air in the chamber 11 to hold the water from the motor. When the pump of Fig. 1 is not running, the pressure on the motor would be reduced to 100 feet head or about 50 pounds. Accordingly, when the motor is stopped, the 200 pounds of air will bubble out until it is reduced to about 50 pounds. When the pump is again started up, it would be necessary again to increase the air pressure in the chamber 11 to 200 pounds.

In the use of the mechanism shown in Fig. 2, however, there is no such variation of the pressure in the chamber 43, which corresponds to the chamber 11. This is because the air in the chamber 43 is subjected only to the pressure of the static head of the water in the well casing 37, which pressure is reduced when the motor is started because the motor removes some of the water from the casing. When the pump of the Fig. 2 construction is stopped, the static head resumes its original pressure under 100 feet of water, which pressure is about 50 pounds. That is to say, in the illustration the maximum pressure in the air chamber 43 is about 50 pounds, whereas in the casing of Fig. 1 in the same illustration the maximum pressure in said chamber is about 200 pounds.

It is now clear that all of the objects of my invention are obtained in a highly efficient and satisfactory way. The construction, arrangement and relationship of the mechanism may be varied otherwise than as specifically indicated without departure from the nature and principle of the invention. I do not restrict myself in any

unessential respects, but what I claim and desire to secure by Letters Patent is:

1. A well pump adapted to be submerged in the water in a well from which the water is to be pumped comprising a bell chamber in communication with the water at its lower end, a motor enclosed in said chamber, a shaft driven by said motor and extending outside of said chamber, an impeller on the outer end of the shaft, a power circuit for the motor, a switch in the chamber adapted to open the power circuit, a float adapted to operate said switch, an air conduit leading from the top of the well to the chamber, an auxiliary circuit, a switch in the chamber for the auxiliary circuit, a float positioned below the first named float adapted to operate the auxiliary circuit switch, means at the top of the well under the influence of said auxiliary circuit adapted to inject air through the conduit into the chamber, and a cable enclosing the wires of the power circuit and the auxiliary circuit extending from the top of the well to the chamber.

2. A well pump adapted to be submerged in the water in a well from which the water is to be pumped comprising a bell chamber in communication with the water at its lower end, a motor enclosed in said chamber, a shaft driven by said motor and extending outside of said chamber, an impeller on the outer end of the shaft, an air injecting tube for the chamber extending from the top of the well, an electrically operable valve at the top of the well, a first wire extending from the chamber to the top of the well, a second wire extending from the chamber to the top of the well and with the first wire comprising an auxiliary circuit for operating said valve, a float operated switch in the chamber for connecting said first and second wires, a power circuit for the motor, a circuit breaker at the top of the well for opening said power circuit, a second auxiliary circuit for operating said circuit breaker, said second auxiliary circuit including said first wire and a third wire leading from the top of the well to the chamber, a second float operated switch above the first mentioned switch adapted to connect said first and third wires, and a cable enclosing the wires of the power circuit and the said first, second and third wires of the auxiliary circuits, said cable extending from the chamber to the top of the well.

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