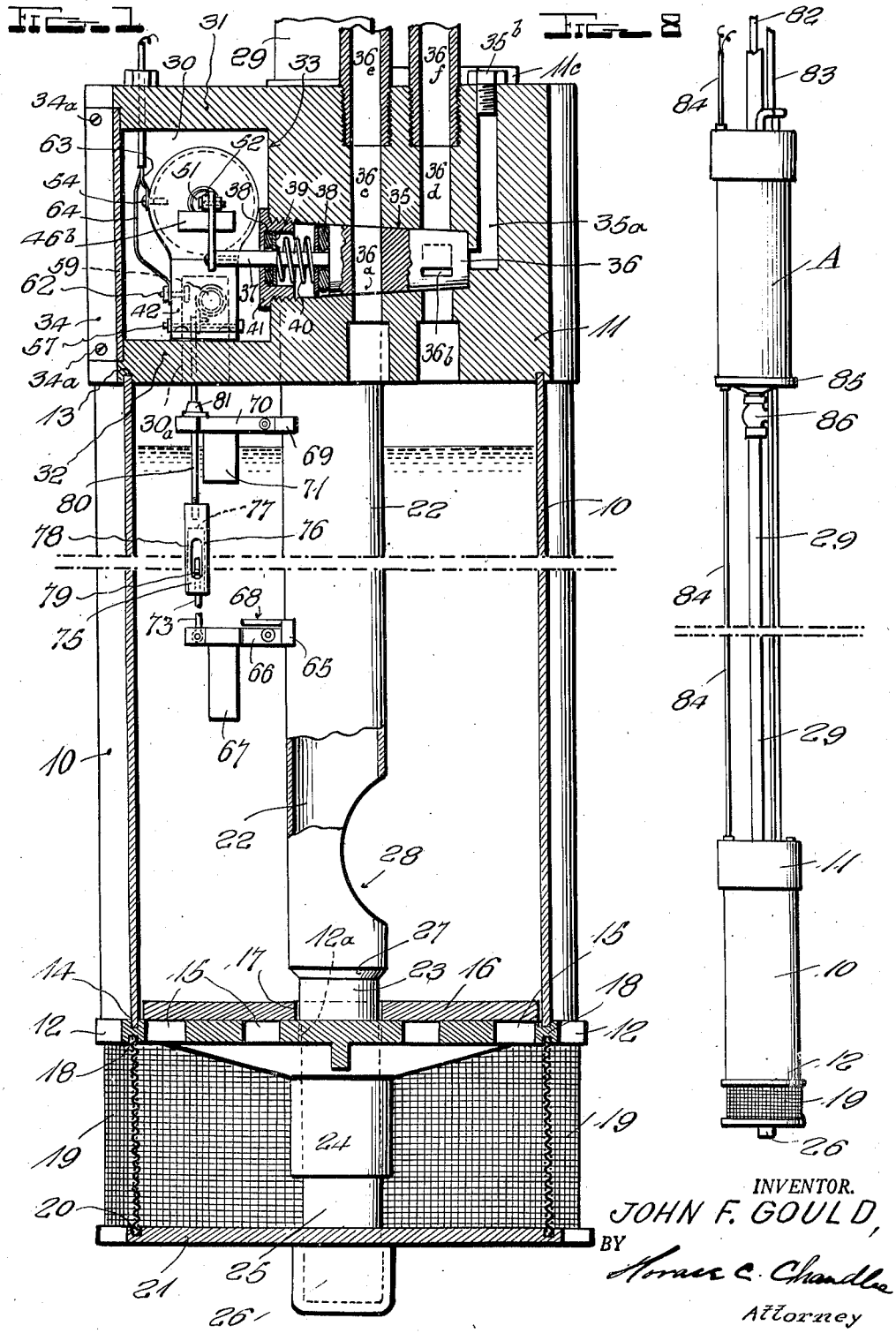
Jan. 20, 1942. J. F. GOULD 2,270,434

PUMP

Filed Oct. 12, 1940 4 Sheets-Sheet 1



INVENTOR.
JOHN F. GOULD,
BY
Horace C. Chandlee
Attorney

Jan. 20, 1942. J. F. GOULD 2,270,434

PUMP

Filed Oct. 12, 1940 4 Sheets-Sheet 2

FIG. 2

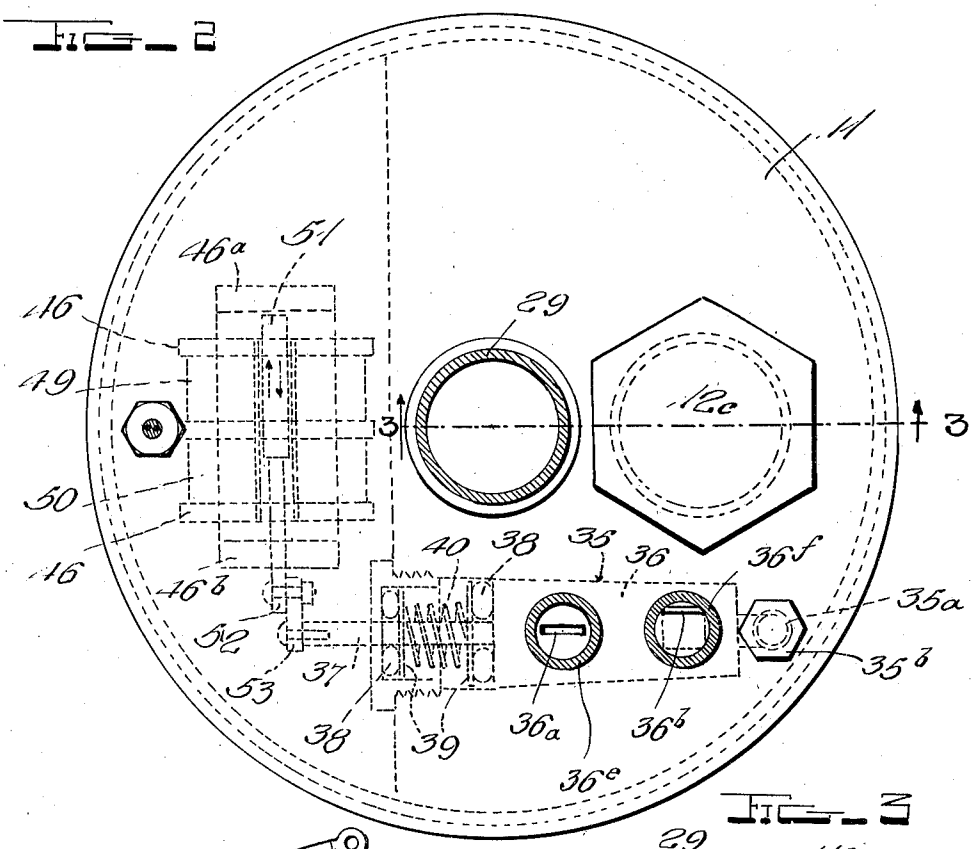
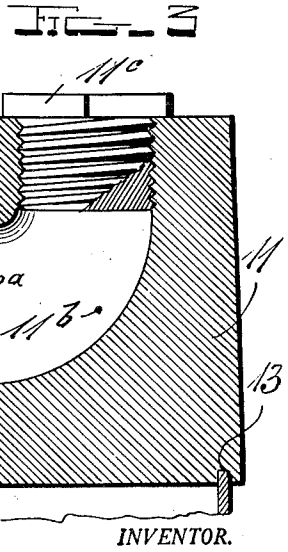


FIG. 3



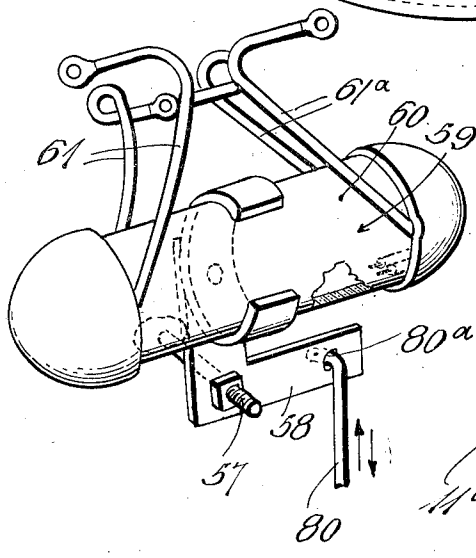


FIG. 7

INVENTOR.
JOHN F. GOULD,
BY
Horace C. Chandlee
Attorney

Jan. 20, 1942. J. F. GOULD 2,270,434

PUMP

Filed Oct. 12, 1940 4 Sheets-Sheet 3

FIG. 6

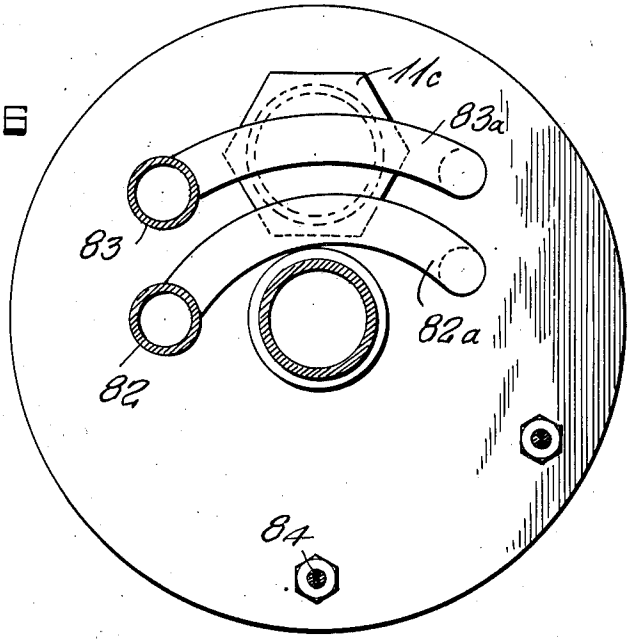
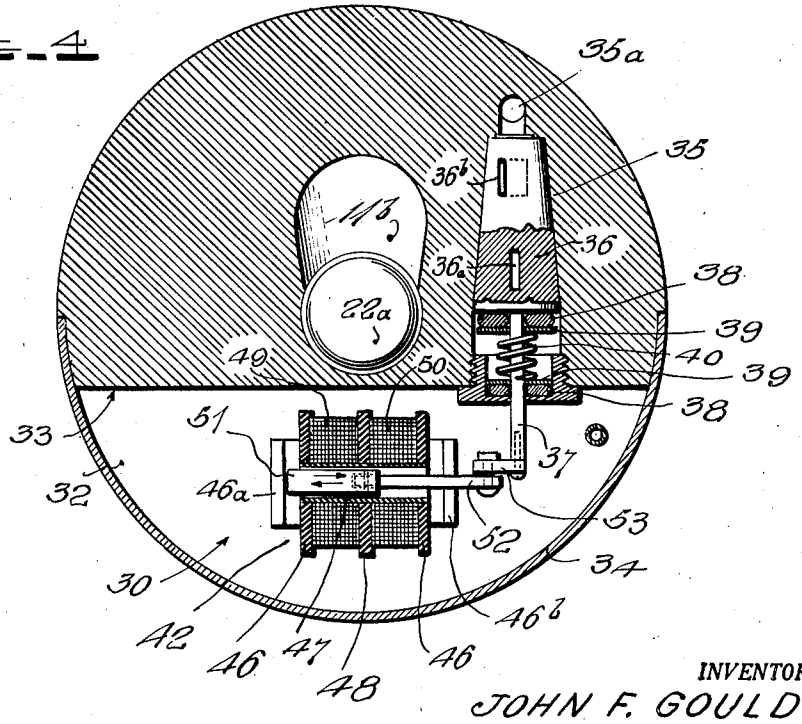


FIG. 4



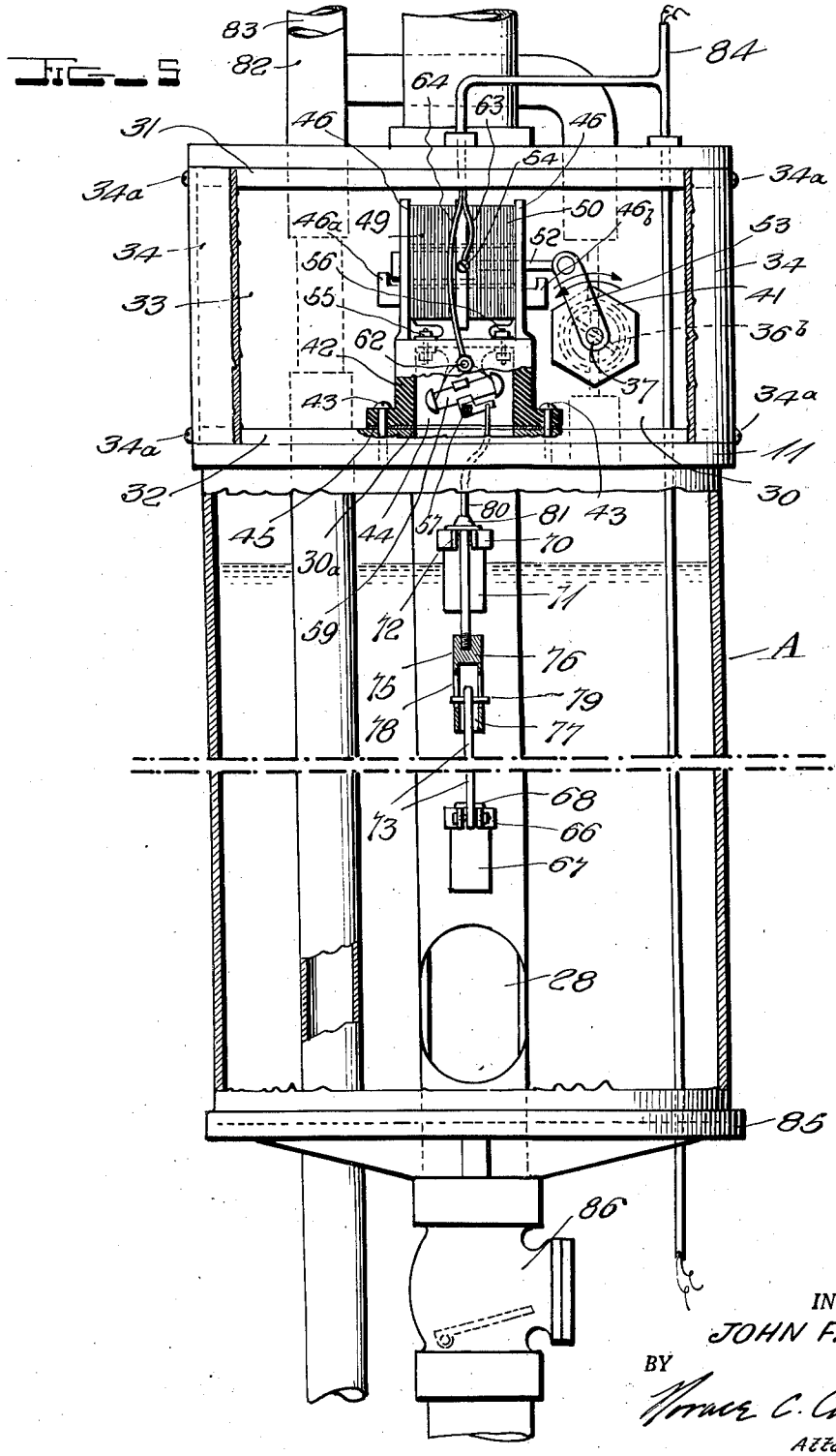
INVENTOR.
JOHN F. GOULD,
BY
Horace C. Chandler
Attorney

Jan. 20, 1942. J. F. GOULD 2,270,434

PUMP

Filed Oct. 12, 1940 4 Sheets-Sheet 4

FIG. 5



INVENTOR.
JOHN F. GOULD,
BY
Horace C. Chandler
Attorney

Patented Jan. 20, 1942

2,270,434

UNITED STATES PATENT OFFICE

2,270,434

PUMP

John F. Gould, Little Rock, Ark.

Application October 12, 1940, Serial No. 360,982

12 Claims. (Cl. 103—241)

This invention relates generally to pumps, and more particularly to pumps for elevating water by means of compressed air instead of with the use of the usual reciprocating pistons.

The principal object of the invention is to provide a pressure-operated pump including a cylinder adapted to receive a charge of water to be pumped and from which the water will be raised to the place of utilization by the admission of compressed air to the cylinder, said cylinder having electrically operated means for admitting the compressed air thereinto, to discharge the water therefrom, and for releasing the compressed air in order that the cylinder may become re-charged with water, the electrically operated means being controlled by the level of the water in the cylinder.

Another object is to provide an arrangement whereby a plurality of the said cylinders may be arranged one above another for use in deep wells with air at a relatively low pressure, the water being forced from the lowermost cylinder, or terminal unit, to the first auxiliary unit thereabove and continuing in a step-by-step manner from one cylinder to the next until it reaches the point of utilization.

While this invention can be used for pumping liquid of any kind with the use of any fluid under pressure as a lifting force, it will be described herein as used for pumping water with the use of compressed air.

With the foregoing and other objects in view, which will appear as this description proceeds, the invention resides in the combination and arrangement of parts and in the detail of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein set forth can be made within the scope of the appended claims without departing from the spirit of the invention.

In the drawings:

Fig. 1 is a vertical sectional view of the terminal unit included in the invention, parts thereof being shown in side elevation,

Fig. 2 is a plan view of the terminal unit,

Fig. 3 is fragmentary sectional view on the line 3—3 of Fig. 2,

Fig. 4 is a horizontal sectional view through the head of the terminal unit,

Fig. 5 is a view similar to Fig. 1, but showing an auxiliary unit with parts in front elevation,

Fig. 6 is a plan view of an auxiliary unit,

Fig. 7 is a detail view showing the type of mercury switch used in connection with the invention, together with its mounting, and

Fig. 8 illustrates the manner in which auxiliary units are used in connection with the terminal unit.

Referring to the drawings, 10 designates a hollow cylinder to the upper end of which there is fitted a circular head 11 and to the lower end of which is fitted a circular foot plate 12 which has an opening 12*a* through its center. In the under face of the head 11 is an annular groove 13 in which the upper end of the cylinder 10 is seated, a corresponding groove 14 being formed in the upper face of the foot plate 12 to receive the lower end of the cylinder 10. If found necessary in order to provide water-tight joints, gaskets may be fitted in these grooves. The foot plate 12 is provided with a number of perforations as indicated at 15, and resting loosely upon its upper face is a circular foot valve 16 having a central circular opening 17 therethrough. The under face of the foot plate 12 is provided with an annular groove 18 corresponding with the groove 14, and seated therein is the upper end of a cylindrical screen 19, the lower end of which is seated in a groove 20 formed in the upper face of a closure plate 21 and also corresponding with the groove 18. The head 11 has a central bore 11*a* therethrough, and into its lower end is threaded the upper end of a discharge pipe section 22 having its lower end terminating a short distance above the foot valve 16. Welded, or otherwise suitably secured, within the lower end of the pipe section 22 is an end of a relatively short pipe section 23 of less diameter than the section 22. The section 23 extends downwardly through the openings 17 and 12*a* of the foot valve and foot plate, respectively, and has its lower end threaded. A pipe coupling 24 is screwed onto this threaded end so that its upper end engages and binds tightly against the under face of the foot plate 12. The coupling 24 thus forces the foot plate 12 towards the head 11 so that the cylinder 10 is clamped tightly therebetween. A pipe nipple 25 is screwed into the lower end of the coupling 24 and protrudes through a central opening in the closure plate 21. Screwed onto the protruding end of this nipple and into tight engagement with the under face of the plate 21 is a cap 26 which serves to close the nipple and also to force the closure plate 21 towards the foot plate 12 and thus clamp the screen 19 firmly between the said plates.

As the pipe section 23 is of less diameter than that of the section 22, and is fitted therein, the

lower end of the section 22 presents a shoulder 27 which serves as a stop to limit the upward movement of the foot valve 16. In the side of the pipe section 22, adjacent its lower end, is an opening 28 to permit admission of water to be pumped. Threaded into the upper end of the bore 11*a* of the head 11 is the discharge pipe 29 for conveying water from the cylinder 10 to the point of utilization. Extending downwardly into the head 11 from its upper face is an arcuate passage 11*b*, as shown in Fig. 3, the lower end of which communicates with the bore 11*a* between the upper and lower ends of the pipes 22 and 29 respectively, the upper or outer end of which arcuate passage is normally closed by a screw plug 11*c*. The passage 11*b* serves as means for admission to the bore 11*a* of a ball check valve 22*a* which is normally seated upon the upper end of the pipe 22.

Formed in the peripheral face of the cylindrical head 11 is a recess 30 having a top wall 31, a bottom wall 32, and a rear wall 33. The edge faces of the walls 31 and 32 are rabbeted to receive an arcuate closure plate 34 which is preferably held to said walls by screws 34*a*. The plate 34 thus serves as a removable closure for the recess 30.

Extending into the head 11 through the rear wall 33 of the recess 30 is a tapered bore or valve seat 35 in which is seated a rotary valve 36 having an axial stem 37 which protrudes into the recess 30. Surrounding this stem are spaced packing rings 38 upon the opposing faces of which are washers 39 seated against which washers are the ends of a coil spring 40 which surrounds the stem 37 Threaded into the outer end of the bore 35 is a packing gland 41 which serves to compress the spring 40 and thereby not only compresses the packing rings 38 through the medium of the washers 39 but also holds the valve 36 snugly in its seat as will be clearly understood by reference to the drawings. To provide means for lubricating the valve 36, a passage 35*a* extends downwardly through the head 11 to the valve seat 35 and has a closure plug 35*b*. Passing through the valve 36 and spaced axially thereof are slots 36*a* and 36*b* which are at an angle to each other and are adapted to register alternately with air inlet and exhaust passages designated respectively at 36*c* and 36*d*, upon partial rotation of the valve 36 The air passages 36*c* and 36*d* extend downwardly through the head 11 and intersect the valve seat 35 Threaded into the outer end of the inlet passage 36*c* is a pipe 36*e* which leads from a source of compressed air not shown, and threaded into the exhaust passage 36*d* is an exhaust pipe 36*f*.

Extending through the bottom wall 33 of the recess 30, approximately at its center, is a passage 30a, and positioned within the recess 30 directly over the upper end of this passage is a supporting member designated generally at 42 formed of hard rubber or other nonconductor of electricity. The member 42 is secured to the bottom wall 32 by screws 43, and has a recess 44 in its under side which communicates with the interior of the cylinder 10 through the passage 30*a*. Between the supporting member 42 and the wall 32 on which it rests is a gasket 45 to provide a water-tight joint. As shown in Fig. 4, extending upwardly from the ends of the supporting member 42 are flanges 46 which support the ends of a tube 47 formed of non-magnetic material such as fibre or a non-magnetic metal. Surrounding the tube 47 and spaced apart by an insulator 48 are solenoids 49 and 50. Slidably mounted in the tube 47 is a core 51 which is adapted to reciprocate between the ends of the tube and pass into the solenoids 49 and 50 when these solenoids are alternately energized in a manner to be described later herein. The movement of the core 51 is limited by stops 46*a* and 46*b* mounted on the flanges 46. These stops overlie the ends of the tube and are engaged by the ends of the core when an opening through the valve 36 is in alinement with an air passage. The length of the core is such that when an end thereof engages a stop overlying one extremity of the tube 47, its other end will extend slightly within the solenoid at the opposite end of the tube. Pivoted to one end of the core 51 is an end of a connecting rod 52. The other end of the rod 52 is pivoted to one end of a crank 53 which has its other end fixed to the stem 37 of the valve 36.

The solenoids 49 and 50 each have one end of their windings connected together by a screw 54 mounted in the insulator 48 and have the other end of their windings respectively connected to the upper ends of binding posts 55 and 56 which pass through the upper wall of the recess 44.

Rockably mounted on a pin 57 supported in a wall of the recess 44 is an angle bracket 58, one arm of which supports a mercury switch indicated in general at 59 and having a pair of contacts at each end of its mercury tube 60, the contacts of each pair being adapted to be electrically connected in the manner common to mercury switches One of each pair of contacts is connected by a wire 61 to the inner end of a binding post 62 mounted upon the supporting member 42 and extending into the recess 44, while the other contacts of each pair are respectively connected to the binding posts 55 and 56 by wires 61*a*. Leading from a suitable source of electricity and extending into the recess 30 through its upper wall 31 are electrical conductors 63 and 64, the former being connected to the screw 54 and thus to an end of the windings of the solenoids 49 and 50, while the conductor 64 is connected to the binding post 62. It will thus be seen that when the mercury tube 60 is rocked in one direction, the terminals at one end thereof will become electrically connected so as to energize the solenoid 49, and when rocked in the opposite direction, the terminals at the opposite end will become electrically connected so as to energize the solenoid 50.

Secured to the discharge pipe section 22 slightly above its opening 28 is a bracket 65 to which is pivoted a frame 66 which supports a float 67. The bracket 65 is provided with a laterally projecting stop 68 which serves to prevent the frame 66 from rising above a horizontal position. Also secured to the pipe section 22, but adjacent its upper end is a bracket 69 to which is pivoted a frame 70 which supports a float 71, the outer end of the frame being forked as at 72. Pivoted to the free end of the frame 66 is the lower end of a rod 73 the upper end of which is slidably connected to the lower end of a rod 80 by means of a slip joint 75. This slip joint consists of an elongated body 76 having an axial bore 77 extending into its lower end and having a transverse slot 78 intersecting said bore. The upper end of the rod 73 extends loosely into the bore 77, and secured in a perforation through the upper end of the rod is a pin 79 the ends of which protrude into and are adapted to slide within the slot 78. The pin 79 thus serves to limit the movement of the

rod 73 within the body 76. Secured to the upper end of the body 76 is the lower end of the rod 80 the upper end of which is pivotally connected to one arm of the angle bracket 58, as at 80a, (see Fig. 7). The rod 80 passes through the fork 72, and secured to said rod above the fork so as to be engaged by the latter when the float 71 is raised is an abutment 81. The raising of the float 71 thus lifts the rod 80 which, being pivoted to the angle bracket 58, causes the same to rock, carrying with it the mercury switch 59.

The operation of the parts heretofore described is as follows: The cylinder 10 is placed below the surface of the water to be pumped, the air inlet passage 36c being connected to a source of compressed air and the exhaust pipe 36d extending above the water line, the electrical conductors 63 and 64 being connected to a source of electricity, and the water discharge pipe 29 leading to the point of utilization. Assuming that the cylinder 10 contains no water, the floats 67 and 71 will be in their lowermost positions because of which the rods 73 and 80 will also be in lowered position. The mercury switch 59 will therefore have been rocked so as to energize the solenoid 50, thus causing the rotary valve 36 to have closed the air inlet passage 36c and opened the air exhaust passage 36d. Hydrostatic pressure will then lift the foot valve 16 and cause the cylinder 10 to fill with water. As the water rises in the cylinder 10, the float 67 will be raised until its supporting frame 66 engages the stop 68 and is thereby held against upward movement beyond horizontal position. As the water continues to rise, it raises the float 71 which lifts the rod 80 because of engagement of the fork 72 with the abutment 81, lifting of the rod 80 after the frame 66 has been stopped in a horizontal position being permitted by the slip joint 75. This will rock the bracket 58 and cause the mercury switch to so operate as to energize the solenoid 49, and cause the core 51 to move thereinto. This will cause the valve 36 to rotate so as to open the air inlet passage 36c and close the exhaust passage 36d. The compressed air which will then flow into the cylinder 10 will produce sufficient pressure therein to cause the water within the cylinder to flow into the pipe 22 through the opening 28 and thence through the discharge pipe 29 to the point of utilization. As the water recedes from the cylinder 10 the upper float 71 falls, also the rod and the slip joint 75 attached thereto, until the ends of the pin 79 engage the upper wall of the slot 78. This causes the mercury tube 60 to assume a horizontal position so that the mercury therein does not engage and electrically connect either pair of contacts. No current is then flowing through either solenoid, thus giving them an opportunity to cool, and also permitting the water to be discharged to a level below the float 67 before the exhaust passage 36d is again opened. When the water recedes below the float 67 permitting the same to fall, the mercury switch is so rocked as to assume the position described at the outset which permits the compressed air to escape from the cylinder 10 and allows it to again fill with water. These operations then continue so long as electricity is supplied to the conductors 63 and 64. It will be understood that if one charge of water forced from the cylinder 10 is not sufficient to reach the point of utilization it will be held in the discharge pipe, above the cylinder, by the ball check valve 22a and will be forced out by a subsequent pumping operation. Under some conditions it may be considered advisable to employ auxiliary units indicated generally at A, in addition to the terminal unit just described. These auxiliary units will be arranged one above another in the discharge pipe line in the manner shown in Fig. 8. The construction and operation of each auxiliary unit will be identical with that of the terminal unit excepting that air inlet and exhaust pipes 82 and 83, respectively, will extend downwardly from above the surface of the ground and will pass completely through each auxiliary unit and into the terminal or lowermost unit. Each auxiliary unit will then be served by branch pipes 82a and 83a leading respectively from these main pipes. In a similar manner, the electrical conductors 63 and 64 will be arranged in conduits 84 passing through each auxiliary unit to the terminal unit. Each auxiliary unit will also differ from the terminal unit in that its lower end will be closed by a cover plate 85 which is unperforated except for a central opening to receive the discharge pipe 29, and an upwardly opening check valve 86 will take the place of the coupling 24 in the terminal unit. The screen 19 and closure plate 21 of the terminal unit will also be omitted from the auxiliary units. When auxiliary units are used the terminal unit discharges to the auxiliary unit next thereabove, which unit raises the liquid to the next auxiliary unit, and so on until the water is discharged at the point of utilization.

What is claimed, is:

1. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, solenoids in the recess, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the core, means operable by water in the tank for actuating the current controlling means, and means for supplying compressed air to the air inlet passage.

2. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, solenoids disposed within the recess, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the armature, means operated by water in the tank adapted to cause energizing of one of said solenoids, like operated means adapted to cause energizing of the other of said solenoids, and means for supplying compressed air to the air inlet passage.

3. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening

through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, a supporting member mounted in the recess, a tube carried by said member, solenoids surrounding the tube, a core mounted for reciprocation within the tube, said core being operatively connected to said valve, stops carried by the supporting member for limiting the movement of the core, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the core, means operable by water in the tank for actuating the current controlling means, and means for supplying compressed air to the air inlet passage.

4. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank and having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, a supporting member mounted in the recess, a tube carried by said member, a pair of solenoids surrounding the tube, a core mounted for reciprocation within the tube, said core being operatively connected to said valve, stops carried by the supporting member for limiting the movement of the core, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the core, means operated by water in the tank adapted to cause energizing of one of said solenoids, like operated means adapted to cause energizing of the other of said solenoids, and means for supplying compressed air to the air inlet passage.

5. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, a supporting member mounted in the recess, a tube carried by said member, a pair of solenoids surrounding the tube, a core mounted for reciprocation with in the tube, said core being operatively connected to said valve, stops carried by the supporting member for limiting the movement of the core, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the core, means operated by water in the tank for actuating the current controlling means to energize one of said solenoids, like operated means adapted to actuate the current controlling means for energizing the other of said solenoids, and means for supplying compressed air to the air inlet passage.

6. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, solenoids disposed within the recess, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the core, means operated by water in the tank for actuating the current controlling means to energize one of said solenoids, like operated means adapted to actuate the current controlling means for energizing the other of said solenoids, and means for supplying compressed air to the air inlet passage.

7. A pump of the character described comprising a tank having a valve controlled water inlet at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, solenoids mounted within the recess, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, a switch for controlling said current to alternately energize the solenoids whereby to reciprocate the core, an operating rod having an end connected to the switch and an end extending into the tank, a float mounted within the tank and adapted to engage and operate said rod for moving the switch to cause energizing of one of the solenoids, a float within the tank connected to said rod and adapted to operate the same for moving the switch to cause energizing of the other of the solenoids, and means for supplying compressed air to the air inlet passage.

8. A pump of the character described comprising a tank having a valve-controlled water inlet at its lower end, a head on the upper end of the tank, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, solenoids associated with the head, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, a switch for controlling said current to alternately energize the solenoids whereby to reciprocate the core, an operating rod having an end connected to the switch and an end extending into the tank, a float mounted within the tank and adapted to engage and operate said rod for moving the switch to cause energizing of one of the solenoids, a second float within the tank, an operating rod connected to the second float, a joint connecting said rods adapted to permit limited longitudinal movement of each with respect to the other, said second-named float being adapted to move said switch to cause energizing of the other solenoid, and means for supplying compressed air to the air inlet passage.

9. A pump of the character described comprising a tank having a valve controlled water inlet at its lower end, a head on the upper end of the tank and having a recess therein, a water discharge pipe opening through the head and hav-

ing an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, a supporting member mounted in the recess, a tube carried by said member, solenoids surrounding the tube, a core mounted for reciprocation within the tube, said core being operatively connected to said valve, stops carried by the supporting member for limiting the movement of the core, means for supplying a current of electricity to the solenoids, a switch for controlling said current to alternately energize the solenoids whereby to reciprocate the core, an operating rod having an end connected to the switch and an end extending into the tank, a float adapted to engage and operate said rod for moving the switch to cause energizing of one of the solenoids, a float connected to said rod adapted to operate the same for moving the switch to cause energizing of the other of the solenoids, and means for supplying compressed air to the air inlet passage.

10. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, a pair of solenoids associated with the head, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, a switch for controlling said current to alternately energize the solenoids whereby to reciprocate the core, an operating rod having an end connected to the switch and an end extending into the tank, a float mounted within the tank and adapted to engage and operate said rod for moving the switch to cause energizing of one of the solenoids, a second float within the tank, an operating rod connected to the second float, a joint connecting said rods adapted to permit limited longitudinal movement of each with respect to the other, said second-named float being adapted to move said switch to cause energizing of the other solenoid, and means for supplying compressed air to the air inlet passage.

11. A pump of the character described comprising a tank having a water inlet at its lower end, a head on the upper end of the tank having a recess therein and a bore therethrough, a water discharge pipe having an end supported in the lower end of the bore and an end positioned within the tank, a water inlet in said pipe, a water discharge pipe supported in the upper end of the bore, a check valve within said bore adapted to close the first-named discharge pipe against receding water, a passage leading from said bore through the head, a closure for the passage, air inlet and outlet passages communicating with the interior of the tank, a valve for controlling said air passages, solenoids in the recess, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, means for controlling said current to alternately energize the solenoids whereby to reciprocate the core, means operable by water in the tank for actuating the current-controlling means, and means for supplying compressed air to the inlet passage.

12. A pump of the character described comprising a tank having a water inlet valve at its lower end, a head on the upper end of the tank having a recess therein, a water discharge pipe opening through the head and having an end positioned within the tank, said discharge pipe having a water inlet therein, air inlet and outlet passages communicating with the interior of the tank through said head, a valve for controlling said air passages, solenoids in the recess, a core mounted for reciprocation within the solenoids and operatively connected to said valve, means for supplying a current of electricity to the solenoids, rockable means for controlling said current whereby to alternately energize the solenoids, a rod connected to said rockable means, a float mounted within the tank adapted to raise the rod, a float mounted within the tank beneath the first-named float, a slip-joint connecting said rod and second-named float, and means for supplying compressed air to the air inlet passages.

JOHN F. GOULD.