(No Model.) 4 Sheets—Sheet 1.

C. C. PECK & W. H. CHAPMAN.

ELECTRIC PUMPING APPARATUS.

No. 260,408. Patented July 4, 1882.

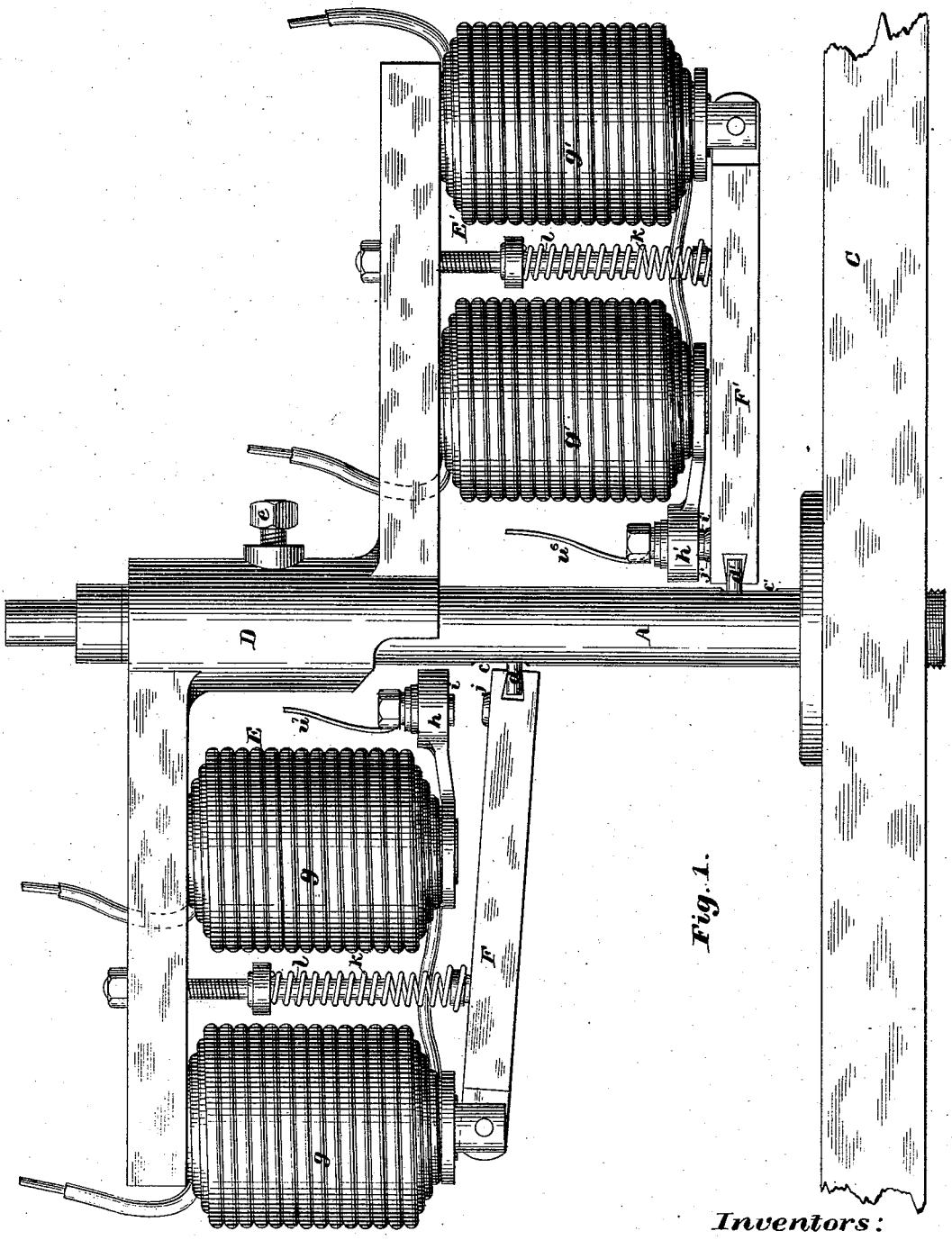

Fig. 1.

Witnesses:
Thomas Hibbard
Walter E. Lombard.

Inventors:
Charles C. Peck,
William H. Chapman.
by N. C. Lombard
Attorney.

(No Model.) 4 Sheets—Sheet 2.

C. C. PECK & W. H. CHAPMAN.

ELECTRIC PUMPING APPARATUS.

No. 260,408. Patented July 4, 1882.

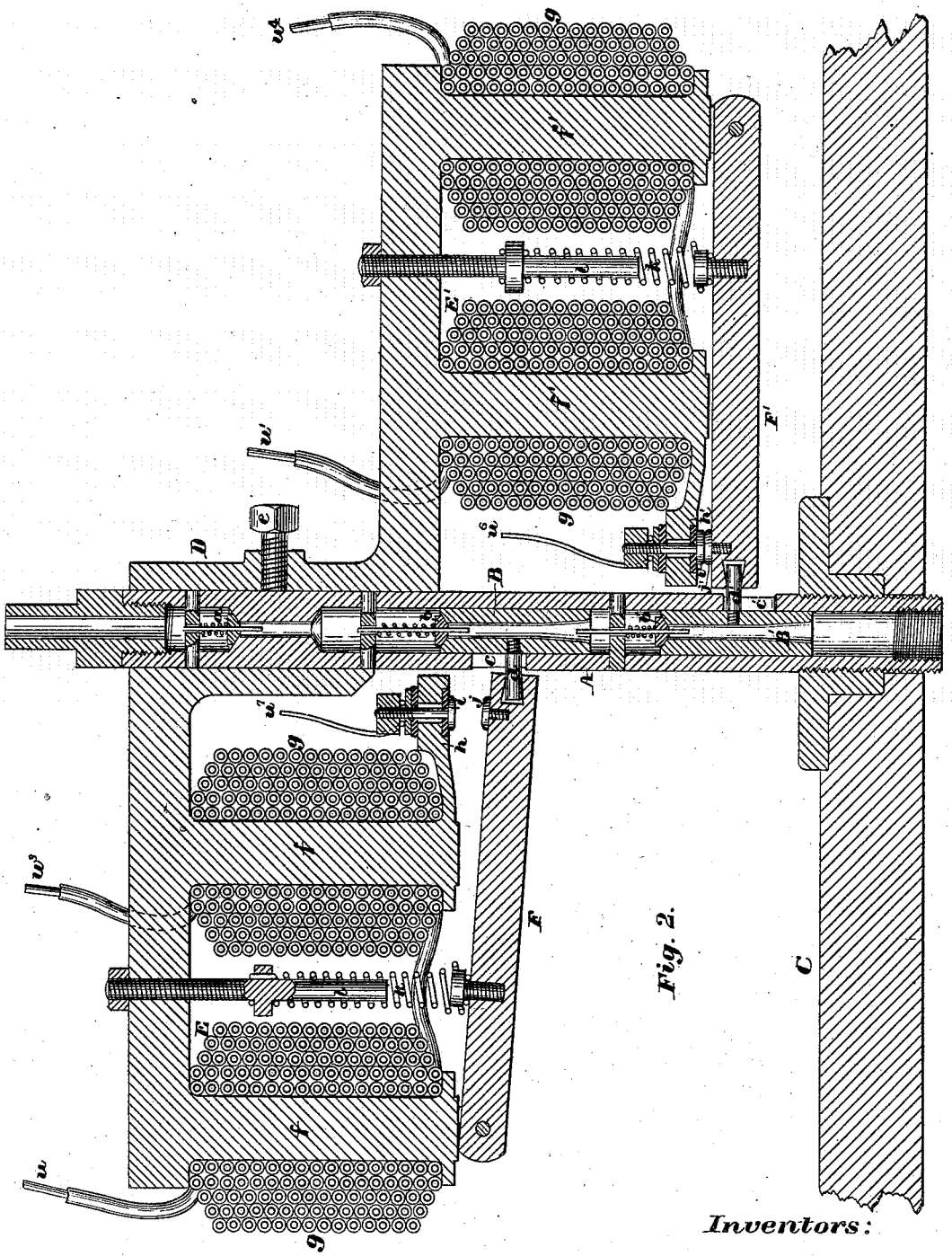

Fig. 2.

Witnesses:
Thomas Hibbard
Walter E. Lombard.

Inventors:
Charles C. Peck,
William H. Chapman
by N. E. Lombard
Attorney.

(No Model.) 4 Sheets—Sheet 3.

C. C. PECK & W. H. CHAPMAN.

ELECTRIC PUMPING APPARATUS.

No. 260,408. Patented July 4, 1882.

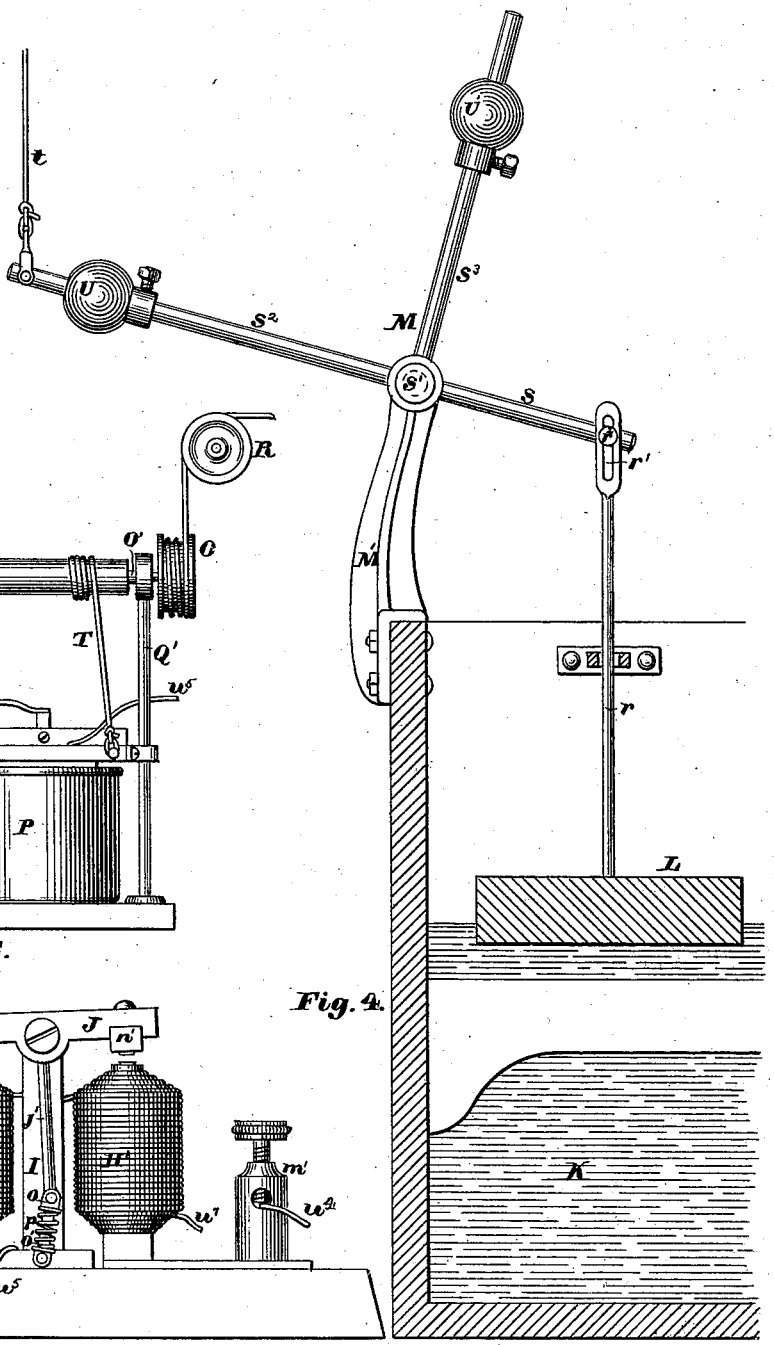

Fig. 4.

Fig. 3.

Fig. 5.

Witnesses:
Thomas Hibbard
Walter G. Lombard.

Inventors:
Charles C. Peck,
William H. Chapman,
by N. G. Lombard
Attorney.

(No Model.) 4 Sheets—Sheet 4.

C. C. PECK & W. H. CHAPMAN.

ELECTRIC PUMPING APPARATUS.

No. 260,408. Patented July 4, 1882.

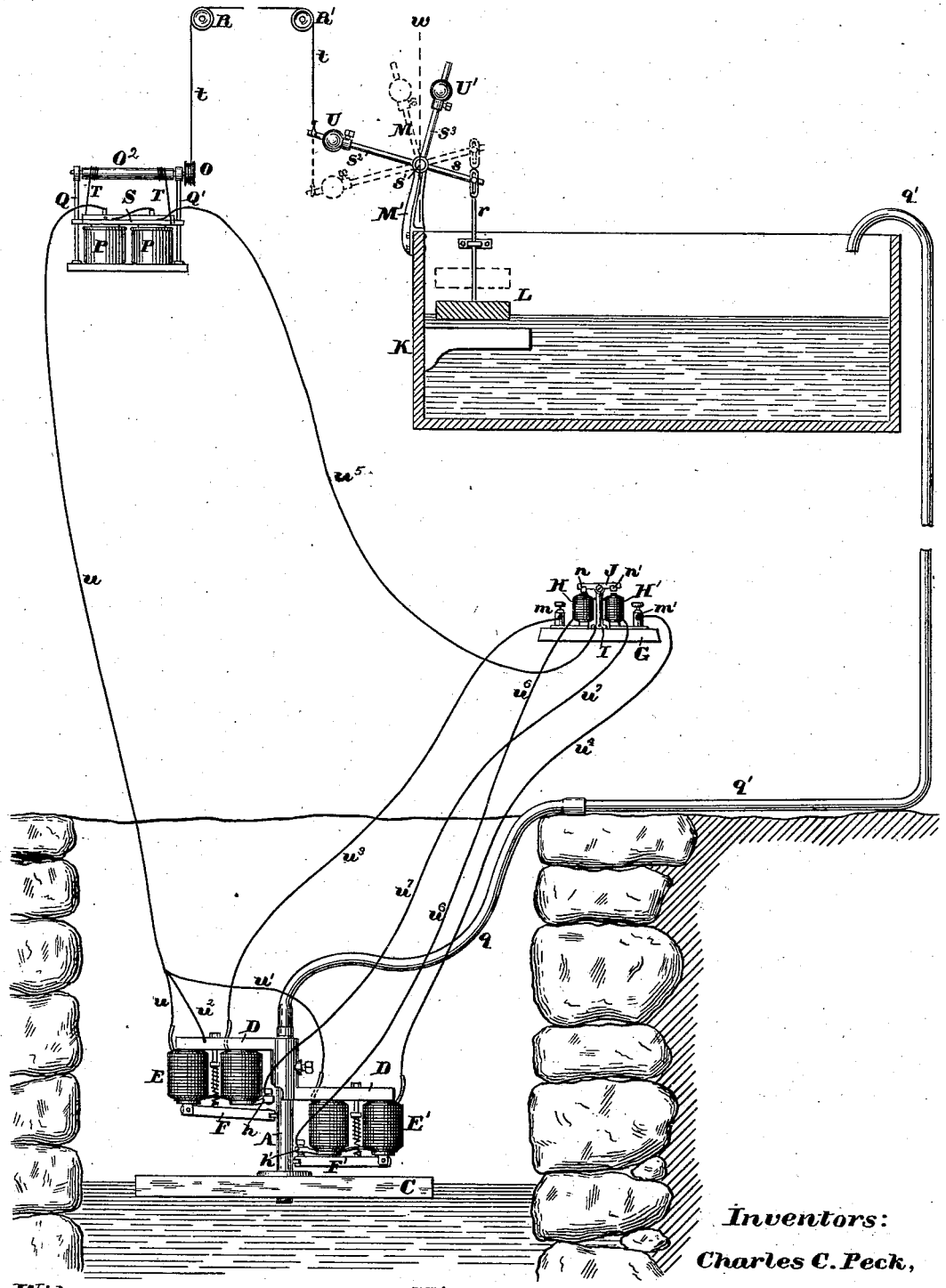

Fig. 6.

Witnesses:
Thomas Hubbard
Walter E. Lombard.

Inventors:
Charles C. Peck,
William H. Chapman,
by N. A. Lombard
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES C. PECK AND WILLIAM H. CHAPMAN, OF MIDDLEBURY, VT.

ELECTRIC PUMPING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 260,408, dated July 4, 1882.

Application filed August 29, 1881. (No model.)

To all whom it may concern:

Be it known that we, CHAS. C. PECK and WILLIAM H. CHAPMAN, both of Middlebury, in the county of Addison and State of Vermont, have invented a new and useful System of Pumping Liquids by Electricity, and Apparatus Therefor, of which the following, taken in connection with the accompanying drawings, is a specification.

Our invention relates to a new system of and apparatus for pumping water or other liquids by electricity; and it consists, first, in the system of pumping by electricity in which the action or non-action of the electric apparatus is automatically controlled by the excess of supply of the liquid pumped over the demand for the same.

It further consists of an electric pump composed of a cylinder provided with a valve near its upper end arranged to open upward, and two tubular pistons, each provided with a valve arranged to open upward, two electro-magnets, each provided with a pivoted armature, the free or movable end of which is connected to one of said pistons in such a manner that the vibrations of said armatures will cause said pistons to reciprocate in the pump-cylinder.

It further consists of a pump-cylinder provided with pistons and valves, two electro-magnets, and two pivoted armatures, constructed and arranged as above described, all mounted upon a float in such a manner that said pump may rest upon the surface of the water or liquid to be pumped.

It further consists in the combination of the pump-cylinder provided with two pistons and suitable valves, two electro-magnets, two pivoted armatures connected by their free or movable ends with said pistons, and means of shunting a portion of the electric current when said armatures are moved upward by their magnets.

It further consists in the combination of a pump-cylinder provided with a piston and suitable valves, an electro-magnet composed of two coils and two soft-metal cores, and an armature pivoted at one end to one of said cores and connected at its other end with said piston.

It further consists in the combination of a pump-cylinder provided with two pistons and suitable valves, two electro-magnets, two pivoted armatures connected to and adapted to work said pistons, two shunting devices connecting with said armatures when closed, and a commutator arranged to be operated by said shunted current and control the passage of the main current alternately through one and then the other of said electro-magnets or the coils thereof.

It further consists in the combination of a battery, an electrically-operated pump, a reservoir to receive the liquid pumped, a float in said reservoir arranged to rise and fall with the surface of the liquid contained therein, and intermediate mechanism between said float and the zincs of the battery, so arranged and connected therewith that a rise of the surface of the liquid in the reservoir to a given height will cause the zincs to be removed from the acid in the battery, and a fall of the surface of said liquid to a certain lower level will cause the zincs to be replaced in the acid.

Figure 1 of the drawings is a side elevation of our pump, drawn full size. Fig. 2 is a central vertical section of the same. Fig. 3 is a side elevation of the commutator, drawn to the same scale as the pump. Fig. 4 is a sectional elevation of the reservoir and float and the lever operated thereby, drawn to a reduced scale. Fig. 5 is a side elevation of the battery, drawn to the same scale as the reservoir; and Fig. 6 is a diagram showing the manner of connecting the several parts of the apparatus to make up a complete automatically-regulated pumping-machine.

A is the pump-cylinder, provided near its upper end with the upwardly-opening valve *a* and with the two hollow or tubular plungers or pistons, B and B′, each having fitted to its upper end an upwardly-opening valve, *b* or *b′*, respectively. The cylinder A is firmly set in an upright position in the float C, which is designed to rest upon the surface of the water in the well or other source of supply, as shown in Fig. 6. The valves *a*, *b*, and *b′* are pressed to their seats by spiral springs, as shown in Fig. 2.

Two slots, *c* and *c′*, are cut through the wall of the cylinder A, upon opposite sides thereof and at different levels—that is, at or near the centers of the lengths of the pistons B and B′, respectively, said pistons being made of such

lengths relative to the lengths of said slots that said slots will always be covered by said pistons.

The pistons B and B′ have set in their sides the studs *d* and *d′*, respectively, which studs project horizontally therefrom through the slots *c* and *c′*, to serve as a medium through which movement may be imparted to said pistons.

D is a two-armed bar provided with a socket at the center of its length, which embraces the cylinder A, to which it is secured in a fixed position by the set-screw *e*, the two arms of said bar being located at different levels, and each having cast therewith and pendent therefrom two round pins or studs, *f* or *f′*, to serve as cores to receive and support the coils *g g* and *g′ g′*, of insulated wire of large size, as shown. These coils *g g* and *g′ g′*, with the cores *f* and *f′*, constitute two electro-magnets, E and E′, respectively placed upon opposite sides of the cylinder A in positions shown in Figs. 1 and 2.

The cores *f* and *f′* that are farthest from the cylinder A are made somewhat longer than their mates, and have pivoted thereto the armatures F and F′, respectively, the inner or free ends of said armatures being forked and engaging respectively with the studs *d* and *d′* of the pistons B and B′.

The inner poles or cores *f* and *f′* of the magnets E and E′ have formed upon or secured to their lower ends the arms *h* and *h′*, which project inward toward the cylinder A directly over and in line with the armatures F and F′, respectively, and have secured thereto, but insulated therefrom, the brass contact-pieces *i* and *i′*, respectively, with which the contact-pieces *j* and *j′* respectively come in contact when said armatures are moved upward by the attraction of the electro-magnets E and E′.

Between the two coils of each magnet is arranged a spiral spring, *k*, the lower end of which is attached to the armature, and its upper end to the rod *l*, adjustably attached to the horizontal arm D, said spring *k* being so adjusted that it will tend to hold the armature in about the center of its vibratory movement when the pump is not in operation, and of such power or tension as to permit the armature to be moved upward by the attraction of the electro-magnet when the circuit is closed, while at the same time the reaction of said spring and the momentum of the descending armature will cause said armature to descend below the normal position, which it will finally assume if the circuit remains broken.

The commutator shown in Fig. 3 consists of the base G, of wood or other non-conducting material, upon which are mounted the two electro-magnets H and H′, insulated from each other, but in metallic connection with the screw-cups *m* and *m′*, respectively.

Centrally located between the two magnets H and H′ is the metallic post or standard I, to the upper end of which is pivoted the brass rocking lever J, to the opposite ends of which are secured, in positions at right angle thereto, the soft-iron armatures *n* and *n′* directly above the cores of the magnets H and H′, respectively.

The rocking lever J is provided with a third arm, J′, arranged at right angles to the main lever and projecting downward therefrom, to the lower end of which is pivoted the short stud *o*, around which the upper end of the spring *p* is coiled, the lower end of said spring being in like manner coiled around a similar stud, *o′*, which is pivoted to the standard I.

The office of the arm J′ and the pivoted spring-connection *o p o′* is to hold the rocking beam or lever J in a tilted position, with the armature at its lowest end in contact with its magnet till said lever is tilted in the opposite direction by magnetizing the cores of the opposite magnet and the demagnetizing of the cores with which the armature is then in contact. This is an important feature of our invention.

The upper end of the pump-cylinder A is connected by the flexible pipe *q* to the fixed pipe *q′*, which leads to and discharges into the reservoir-tank K, in which is placed a float, L, from the upper side of which rises the rod *r*, the upper end of which is connected, through the medium of the slot *r′* and the pin r^2, with the short arm *s* of the lever M, pivoted at *s′* to the stand M′, and having secured to the free or movable end of the arm s^2 the cord *t*, the opposite end of which is made fast to the periphery of the pulley O on the drum-shaft O′, located above the battery cells or cups P P, and having its bearings in the upper ends of the uprights Q Q′.

R R′ are guiding-pulleys for directing the cord *t* in the right path.

The zincs and carbons of the battery are suspended from a suitable frame, S, which extends across and rests upon the tops of the cups P P, and is provided at its ends with eyes which embrace the rods Q and Q′.

T T are two cords secured by one end to the drum O^2, and wound several times around said drum, and secured at their other ends to the frame S in such a manner that by rotating the drum O^2 said frame and the zincs and carbons attached thereto may be raised, so as to remove the zincs and carbons out of the acid, or lowered to insert them again in the acid. The cord *t* is wound several times around the pulley O, so that a draft upon said cord to unwind it from said pulley will cause the drum O^2 to be rotated so as to wind up the cords T T upon said drum, and thus raise the frame S.

The lever M is provided with a third arm, s^3, arranged at right angles to the arms *s* and s^2 and radial to the axis of vibration of said lever, and the arms s^2 and s^3 have mounted thereon the adjustable weights U and U′, respectively, the weight U being so adjusted on the arm s^2 as to just counterbalance the weight of the frame S, with the zincs and carbons attached thereto.

The method of connecting the several parts of the apparatus is clearly shown in Fig. 6,

where it will be seen that one terminal of each pump-magnet is connected with one pole—say negative—of the battery by the wires u and u', and the same pole is also connected with the frame of the pump by the wire u^2.

The other terminals of the pump-magnets are connected one to the screw-cup m and the other to the screw-cup m' of the commutator by the wires u^3 and u^4 respectively.

The positive pole of the battery is connected by the wire u^5 to the standard I of the commutator, and one terminal of each of the commutator-magnets H and H′ is in like manner connected to the standard I, and the other terminals of said magnets are connected respectively, by the wires u^6 and u^7, to the contact-pieces i' and i, or the nuts by which said contact-pieces are secured in place.

The operation of our invention is as follows: The several parts of the apparatus being connected and placed in position, as shown in Fig. 6, and the battery being properly charged, the electric current will pass from the battery, through wire u, coils g g of magnet E, wire u^3, to screw-cup m, thence to the cores of magnet H, through said cores, through the armature n, lever J, standard I, and wire u^5 to the battery. The magnetized cores of the magnet E attract the armature, causing its inner or free end to move upward, carrying with it the piston B, which causes the valve a to be raised to permit the discharge of a portion of water or air that may be above said piston. When the armature F comes in contact with the contact-piece i a shunt or branch circuit is completed, so that a portion of the electricity will pass through wire u^2, the frame of the pump-armature F, contact-piece i, wire u^7, through the coils of the magnet H′, to the standard I, where it unites again with the main circuit. The induced magnetism of the magnet H′ attracts its armature n' with sufficient force to overcome the tension of the spring p and tilt the lever J to the opposite angle from that shown in the drawings, thus breaking the circuit through the magnet and closing a new circuit, in which is included the magnet E, the armature F′ having previously fallen away from said magnet to a position corresponding to that of armature F in the drawings. The magnetism induced in the cores of the magnet E′ by the passage of the current of electricity through the coils g' g' of said magnet attracts the armature F′, causing its inner or free end to move upward, carrying with it the piston B′, at the same time that the armature F and piston B descend, which movements of the pistons B and B′ cause the valve b to open upward and a given quantity of water to pass through it to the chamber above, and at the same time the valve a is opened upward and a quantity of water equal to one-half that delivered through the valve b is discharged through the valve a into the pipe q. The completion of the upward stroke of the armature F′ closes the shunt or branch circuit through wire u^2, pump-frame, armature F′, contact-point i', wire u^6, the coils of the magnet H to the standard I, where it unites again with the main circuit. The circuit through the magnet H′ having been previously broken by the falling away of the armature F, caused by the breaking of the circuit through the magnet E, the lever J will be again tilted to the position shown in the drawings by the attraction of the armature n by the magnet H, thus causing a breaking of the circuit through the magnet E′ and closing that through the magnet E. These operations will continue so long as the battery remains operative, the main circuits being alternately changed from the magnet E to magnet E′, and vice versa, and the shunt-circuit being alternately changed from magnet H′ to magnet H, and vice versa, and as a consequence thereof the pistons B and B′ making alternate reciprocations. The water is discharged through the pipes q and q' into the reservoir K, from which the supply for use is drawn. When the water has risen in the reservoir to the level shown in Fig. 6 the float L will have been lifted from its seat and moved upward, and will continue to so move upward, if the water continues to rise in the reservoir, till the lower end of the slot r' has engaged with the pin r^2 and moved the lever M around its axis of motion a distance sufficient to throw the center of gravity of the weight U′ to the opposite side of a line drawn perpendicularly through the pivotal axis of the lever M, when the preponderance of weight upon that side will cause the lever M to tilt to the position shown in dotted lines, the pin r^2 moving in the slot r' and the cord t being drawn over the pulleys R R′ and unwound from the pulley O, thus causing the drum O^2 to be revolved in such a manner as to wind upon it the cords T T and raise the frame S sufficiently to lift the zincs and carbons out of the acid, and thus stop the pump by checking the production of the motive power. As the water is drawn from the reservoir the float will descend with the fall of the water therein, and, overcoming the gravity of the weights U and U′, moves the lever M around its pivot till the weight U′ has passed to the right of the perpendicular line w, when the preponderance of weight upon that side will cause the lever M to be suddenly tilted to the position shown in full lines, and thus cause the zincs and carbons to descend into the acids contained in the battery-cups P P, when the pump will be again set in operation.

The battery used is a zinc-carbon one worked by a solution of bichromate of potash and sulphuric acid, said battery being of low resistance, and the wire of the pump magnet-coils will be large to correspond, and we prefer to use for said coils Finley's patent rubber-coated wire.

The wire of the commutator magnet-coils will be quite fine, so that but a very small part of the current will be shunted through the commutator, as only a slight force is needed to tilt the commutator-lever.

What we claim as new, and desire to secure by Letters Patent of the United States, is—

1. An electric pump composed of a cylinder provided with a valve near its upper end arranged to open upward, two tubular pistons, arranged one above the other in said cylinder and each provided with a valve arranged to open upward, and two electro-magnets, each provided with a pivoted armature, the free or movable end of which is connected to one of said pistons, substantially as and for the purposes described.

2. The combination of the cylinder A, pistons B and B′, valves *a*, *b*, and *b′*, electro-magnets E and E′, armatures F and F′, and the float C, all constructed, arranged, and adapted to operate substantially as and for the purposes described.

3. The combination of a pump-cylinder, two pistons arranged in said cylinder, one above the other, two electro-magnets, each provided with an independent pivoted armature connected at its free or movable end with one of said pistons, and two electrically-connected contact points or surfaces located outside of the magnets and with which said armatures engage to shunt a portion of the current when they are attracted into contact with the cores of said magnets, substantially as described.

4. The combination of a pump-cylinder provided with a piston and suitable valves, an electro-magnet composed of two coils of insulated wire wound upon two magnetic metal cores, and an armature, pivoted at one end to one of said cores and connected at its other end, which extends beyond the other core, with said piston, substantially as and for the purposes described.

5. The combination of a pump-cylinder provided with two pistons and suitable valves, two electro-magnets, two pivoted armatures connected to and adapted to work said pistons, two shunting devices connecting with said armatures when closed, and a commutator constructed, as set forth, to be operated by said shunted current and control the passage of the main current alternately through one and then the other of the pump-magnets, substantially as and for the purposes described.

6. The combination of a battery, an electric pump, a reservoir to receive the liquid pumped, a float arranged in said reservoir to rise and fall with liquid contained therein, and mechanism connecting said float with the zincs and carbons of the battery, whereby an excess of liquid discharged into the reservoir will cause the zincs and carbons to be raised out of the acid, and a deficiency of liquid in said reservoir will cause said zincs and carbons to be redeposited in the acid, substantially as described.

7. In combination with an electric pump, a battery for operating the same, provided with the frame S, carrying the zincs and carbons, the reservoir K, the float L, provided with the slotted rod *r*, the three-armed lever M, connected by one arm to the rod *r*, and provided with the weights U and U′, the cord *t*, the pulley O, the drum O^2, and the cords T T, all arranged and adapted to operate substantially as and for the purposes described.

8. The combination, with an electric pump and a battery for operating the same, of a commutator composed of two electro-magnets, H and H′, the standard I, the three-armed lever J J′, carrying the armatures *n* and *n′*, and the spring *p*, pivoted at one end to the movable end of the arm J′ of said lever and at its other end to a fixed pivot, substantially as described.

9. The combination of a pump-cylinder provided with a piston and suitable valves, an electro-magnet composed of two coils wound upon separate cores, an armature pivoted at one end to one of said cores and extending beyond the other core and connected to said piston, and the spring *k*, arranged to act upon said armature to move it from either extreme of its movement toward the center of said movement, substantially as and for the purposes described.

Executed at Middlebury, Vermont, this 26th day of August, 1881.

CHARLES C. PECK.
WILLIAM H. CHAPMAN.

Witnesses:
LOYAL D. ELDREDGE,
JOSEPH M. BURKE.