(No Model.) 2 Sheets—Sheet 1.

C. J. VAN DEPOELE.

COMBINED ELECTRIC ENGINE AND PUMP.

No. 458,873. Patented Sept. 1, 1891.

Fig. 1.

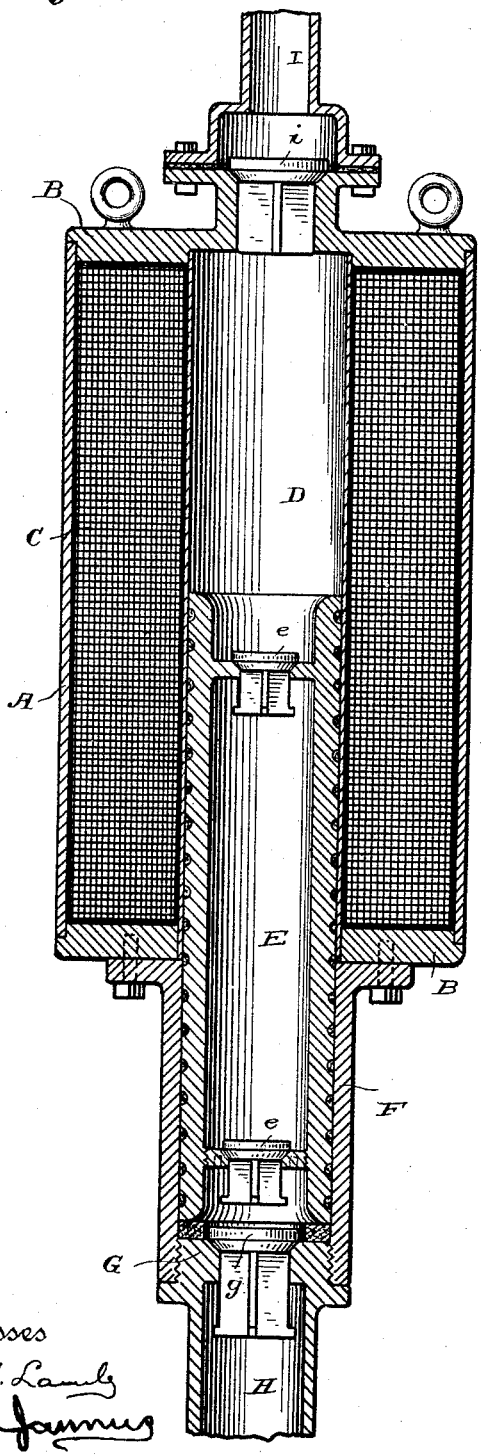
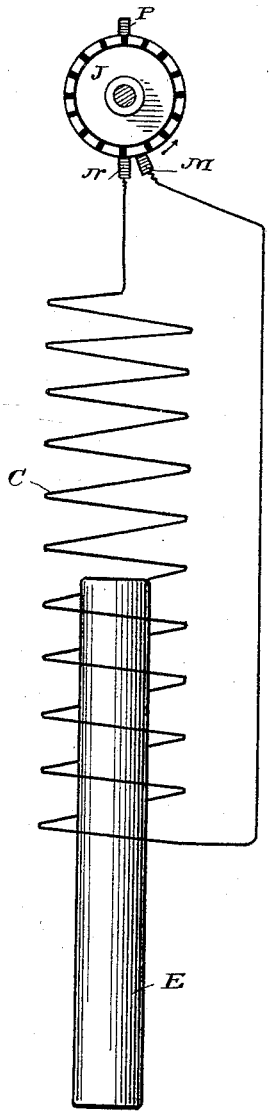


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

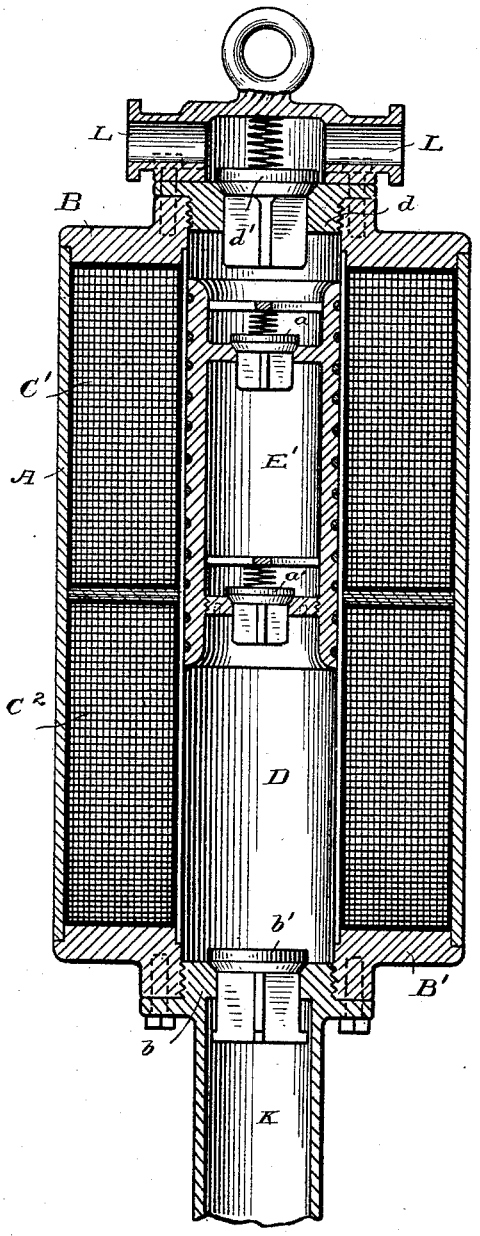
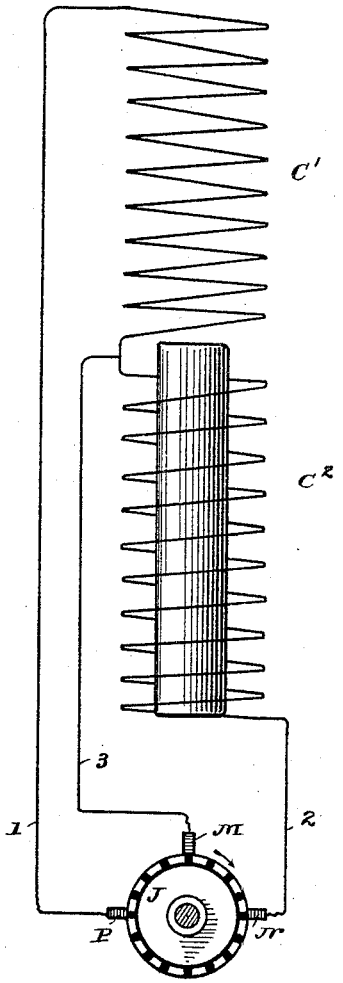


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN, MASSACHUSETTS.

COMBINED ELECTRIC ENGINE AND PUMP.

SPECIFICATION forming part of Letters Patent No. 458,873, dated September 1, 1891.

Application filed March 27, 1891. Serial No. 386,607. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in a Combined Electric Engine and Pump, of which the following is a description, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

My invention relates to improvements in reciprocating electric engines; and it consists more particularly in an electrically-actuated pump, this designation being applied for the reason that the necessary parts of a reciprocating electric engine have been reconstructed and changed so that they are rendered capable of performing a double purpose, producing the combination of reciprocating electric engine and pump which I have termed an "electrically-actuated pump," since the pump and the electric engine are embodied in the same structure.

According to this invention a magnetic piston is reciprocated within a pump-cylinder placed inside a motor coil or coils, and the piston itself is so constructed as to constitute the piston of a pumping-engine, while the cylinder within which it is contained serves as the protective casing interposed between the piston and the interior of the motor-coils, the cylinder in this instance being, however, of diamagnetic metal and of correct bore without slits or other openings communicating with the coils, and serving, therefore, as a cylinder, through which pass the liquids to be moved. The engine may be double-acting, and therefore capable of operation in any position, or it may be single-acting for vertical work. In either event the reciprocations of the magnetic piston are caused by the shifting of the field of force of the motor coil or coils, which is produced by successive waves or impulses of defined rising and falling currents—for example, as set forth in my prior Patent, No. 422,856, dated March 4, 1890, and the various divisions thereof.

The construction and operation of the device will be hereinafter set forth, and referred to in the appended claims.

Figure 1 is a vertical sectional elevation of an electrically-actuated pump embodying the invention. Fig. 2 is a diagrammatic representation of the circuits thereof. Fig. 3 is a vertical sectional elevation of an electrically-actuated pump also embodying the invention, but differing from Fig. 1 in its electrical structure. Fig. 4 is a diagrammatic view of the circuits of the machine seen in Fig. 3.

In said drawings, A indicates an exterior casing or shell of iron, which shell is provided with iron ends or heads B B′.

Within the casing formed by the shell and heads are located the motor-coils, of which there may be one or more, according to the method of operation and the result sought. As indicated in Fig. 1, but a single motor-coil C is employed, this representing the simplest form of the machine. Within the motor-coil C is fitted a tube or cylinder D of diamagnetic metal. This tube is fitted to the heads B B′, so that the coil C is contained within a casing formed by the outer shell A and the inner tube D, within which it can be absolutely protected. A plunger E, of magnetic material, is fitted to move within the tube D, and whenever current is supplied to the coil C said plunger will be drawn into it with a force depending upon the strength of current. According to my invention the reciprocating magnetic plunger is not only the translating device responding to the flow of current in the motor coil or coils, but by direct contact with the liquid to be moved it serves also as the piston of the pump. The piston E is tubular and is provided at its ends with valves *e e′*.

F is an extension of the tube D, which is attached to the lower end of the machine and for convenience may be made separately and suitably secured to the head B′. The lower end of the extension F is provided with a valve-seat G and valve *g*, from which extends downwardly the inlet-pipe H. The upper head B is provided with an outlet-pipe I and a valve *i*. With this construction upon the upward movement of the plunger E its valves *e e′* will be closed, and it will act as a piston to force liquid from the upper part of the tube D through the valve *i* and outlet-pipe I.

The apparatus of Fig. 1 is operated by intermittent current of constant direction, as indicated in the diagram, Fig. 2, where J represents a sectional commutator of a continu-

ous-current machine. P N are the main positive and negative commutator-brushes, and M an auxiliary commutator-brush, which is arranged to be rotated about the commutator toward and away from the said main brushes, and this may be accomplished in any convenient manner. One end of the coil C is connected to one of the stationary commutator-brushes, (as seen to brush N,) while the other end of the said coil is connected to the moving brush M. As the brush M moves about the commutator, alternately approaching and receding from the main brushes, defined rising and falling currents will be caused to flow through the coil C, the frequency thereof depending upon the speed at which the brush M is moved.

In operation the plunger E will be attracted into the coil C by each succeeding impulse of current and will be free to drop down through said coil between each phase. The plunger E may of course be provided with a spring for retracting it; but when used in a vertical position its weight will ordinarily be sufficient to secure the return movement.

In a single-coil machine the plunger should be of such length and its range of motion such that it cannot drop out of its magnetic field—as, for instance, as here shown, the length of the pump-cylinder, comprising tube D and extension F, is such that when at its lowest point the upper part of the plunger E is well within the field of force of the coil, and its length is such that when drawn into said coil it will entirely fill the tube D and expel its contents through the discharge-pipe.

Aside from the electrical features I believe the particular form of pump to be novel, as I am not aware that a valve-piston has ever before been actuated without some form of direct mechanical connection.

As indicated in Figs. 3 and 4, a double coil, and therefore double-acting engine, is shown.

This machine may be operated in any position.

Within the casing are placed two motor-coils C′ C^2, and within the tube D is a plunger E′, made tubular and of magnetic metal, with suitable packing between its exterior surface and the interior of the tube D. The plunger E′ is also provided with valves *a a′* at one of its ends, which in this instance are spring-actuated. The head B′ is provided with a valve-seat *b* and valve *b′*, the head B being similarly provided with valve-seats *d* and valve *d′*, which may be spring-actuated or controlled by gravity, according to the position in which the engine is to be operated.

K is an inlet-pipe, and L L are outlets.

As shown in Fig. 4, a sectional commutator J is provided with brushes, as seen in Fig. 2, with this difference, however, that the outer terminals of one coil, as C′, are connected by conductor 1 with the positive commutator-brush and the outer terminal of coil C^2 by conductor 2 with the negative commutator-brush, while both the inner terminals of said coils are connected to the moving brush M by an intermediate conductor 3. The result of this arrangement is that while the brush M is moved about the commutator toward and away from the stationary brushes defined phases of current are alternately supplied to the said motor-coils, the current rising in one coil while falling in the other, substantially as set forth in Letters Patent No. 431,494, granted to me July 1, 1890. The plunger E is reciprocated within the tube D under the influence of the shifting field of force, and, being arranged and constructed as described, will operate as a pump to transfer liquid from the inlet to the outlet pipe.

While I have described a very desirable arrangement of motor-coils, it will be understood that many other arrangements are not only possible but contemplated. Some of these are shown and described in patents already granted to me, while others are the subject of pending applications. I do not, therefore, limit myself to the particular arrangement shown.

Various changes and modifications may be made in the mechanical structure of the parts without departing from the invention in view of the principles disclosed.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An electric pumping-engine comprising a diamagnetic pump-cylinder, a tubular piston therefor of magnetic material and through which the liquid acted upon passes, a motor coil or coils upon the exterior of the pump-cylinder for acting upon and imparting movement to the piston, and means for supplying current to the coil or coils.

2. An electric pumping-engine comprising a diamagnetic pump-cylinder, a tubular piston therefor of magnetic material and provided with valves, a motor coil or coils upon the exterior of the cylinder for acting upon and imparting movement to the piston, and means for supplying currents to the coil or coils.

3. An electric pumping-engine comprising a diamagnetic pump-cylinder provided with suitable inlet and outlet valves, a tubular piston therefor of magnetic material and also provided with valves, a motor coil or coils upon the exterior of the pump-cylinder for acting upon and imparting movement to the piston within the cylinder, and means for supplying defined rising and falling currents to the coil or coils.

4. An electric pumping-engine comprising an iron shell or casing, a motor coil or coils within the shell, a diamagnetic pump-cylinder within the coil or coils, a tubular valved piston therefor of magnetic material, and inlet and outlet valves connected with the ends of the pump-cylinder.

5. An electric pumping-engine comprising a diamagnetic pump-cylinder, a tubular piston therefor of magnetic material and through

which the liquid acted upon passes, a motor coil or coils upon the exterior of the pump-cylinder for acting upon and imparting movement to the piston within the cylinder, suitable inlet and outlet valves for the pump-cylinder, an exterior iron envelope for containing and sustaining the pump-cylinder, and means for supplying defined rising and falling currents to the motor coil or coils.

6. A combined electric engine and pump comprising an exterior iron envelope, a motor coil or coils therein contained, a diamagnetic lining or tube passing actually through the coil or coils and contained within and sustained by the envelope, a magnetic plunger suitably packed and adapted to be reciprocated within the diamagnetic tube and to constitute the magnetic plunger and the piston of the pump, said piston being tubular and provided with valves for the passage of liquid therethrough, and suitable inlet and outlet valves arranged at the ends of the pump-cylinder and sustained by the envelope.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES J. VAN DEPOELE.

Witnesses:
JOHN W. GIBBONEY,
HENRY J. GUY.