(No Model.)

C. J. VAN DEPOELE, Dec'd.

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ELECTROMAGNETIC RECIPROCATING PUMP.

No. 496,331. Patented Apr. 25, 1893.

Fig. 1.

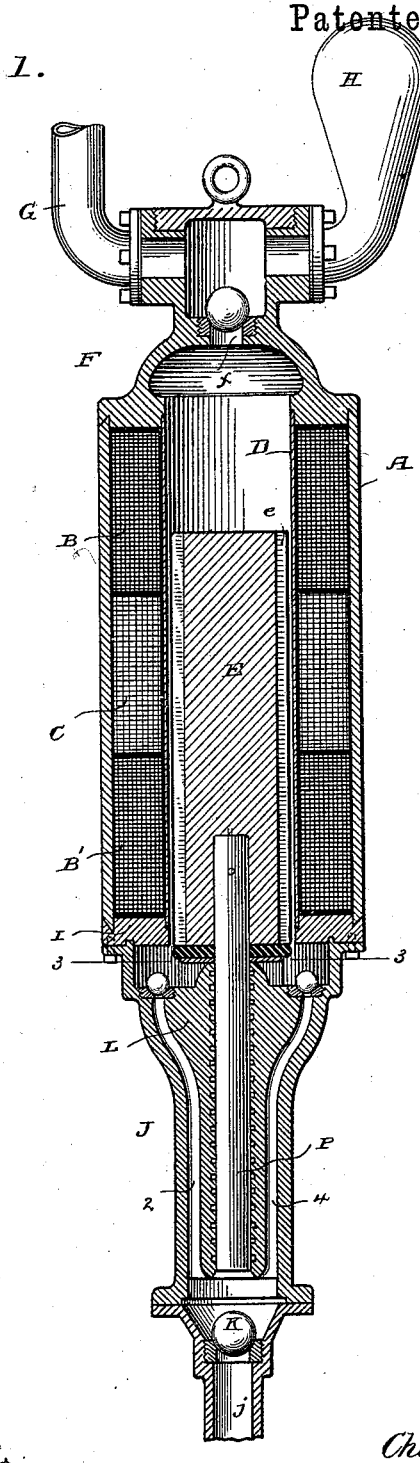


Fig. 2.

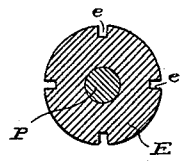
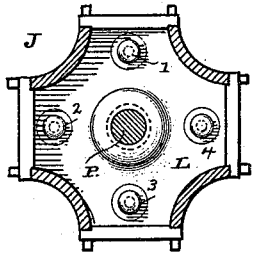


Fig. 3.



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UNITED STATES PATENT OFFICE.

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ELECTRO-MAGNETIC RECIPROCATING PUMP.

SPECIFICATION forming part of Letters Patent No. 496,331, dated April 25, 1893.

Application filed December 12, 1891. Serial No. 414,883. (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 Electro-Magnetic Reciprocating Pumps, 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 present invention relates to improvements in reciprocating pumping apparatus actuated by electrical power.

Several patents have already been granted to me for electrically actuated pumping apparatus, but the present invention is believed to be entirely novel in that the liquid to be moved is passed directly through an electro-magnetic engine in a manner differing from any heretofore disclosed by me.

The reciprocating electro-magnetic engine which forms the basis of my said invention comprises motor coils inclosed within a magnetic envelope and provided with an interior non-magnetic metallic lining within which a magnetic body or plunger is reciprocated under the influence of currents which are caused to flow in the motor coils in any appropriate manner. A pumping apparatus is secured to one end of the electric engine and a pump piston is fitted thereto and secured directly to the magnetic plunger. The magnetic plunger far outweighs the pump piston so that its mass may preponderate to such an extent as to be capable of developing a very high pressure upon the pump piston it being understood that the pressure capable of being developed by a mass of iron is limited by the point of magnetic saturation thereof. The other end of the electric engine is provided with a delivery pipe and may also have an air chamber of the usual type. The magnetic plunger is either longitudinally slitted or made smaller than the tube within which it moves and in operation said plunger in its upward stroke raises water. In its downward stroke the water is forced out of the pump cylinder by the descent of the piston and passes upward through passages formed in the pump proper said passages communicating with the central opening of the electric engine through which it passes upward either around the body of the piston, where it is made smaller, or through ordinary slots or ducts formed therein, passing out through the valved pipe in the top of the engine.

With an ordinary double-acting pump, practically the same amount of power is required to be exerted in each stroke, but by means of the arrangement I have now devised or its substantial equivalent, I am enabled to effect a very great economy in the application of electric power since the pump must be placed within the range of lift, about twenty-eight feet from the liquid, which will be referred to as water. The plunger being proportionately heavy, a considerable part of the power of the motor coils will be absorbed in raising it, but on the other hand, having the smallest amount of work to perform, the additional power required to raise the water twenty-eight feet into the pump barrel, will be comparatively small and easily performed. The pump being now charged with water we have an extra heavy plunger in position to exert the force of gravity thereon. The plunger is also of large mass capable of receiving the impression of a very strong magnetic field and the motor coils being now free to exert their maximum power upon the plunger, aided by its own weight, are capable of developing a high pressure upon the pump piston and of thereby forcing the water to a very great height. The water passing up through the pump under the influence of the descending piston, avoids the introduction of any additional piping and also keeps the motor coils cool under all circumstances and permits the use of much heavier currents in said motor coils than would otherwise be possible, thereby, by preventing overheating, adding very greatly to the possible capacity and general efficiency of the machine.

The construction and arrangement of the several parts of the machine embodying the invention will now be described, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of a reciprocating electro-magnetic pumping engine embodying the invention. Fig. 2 is a transverse sectional view of the plunger. Fig. 3 is a transverse sectional view on the line 3—3— of Fig. 1.

A, is a magnetic envelope within which are placed the motor coils B, B′, and C, the coils B, B′, being at the extremities of the coil C. An interior non-magnetic lining is provided for the motor coils within which lining is adapted to be reciprocated the plunger E. The upper part of the cylinder A, is closed by an iron head F, which is provided with a valved opening *f*, upon which is fitted an eduction pipe G, and which is, or may be, provided with an air chamber H. The lower portion of the cylinder A, is provided with an iron head I, to which is attached a metallic, preferably iron, extension J, which constitutes the pump proper and is provided at its lower end with a tubular extension *j*, carrying the foot valve K.

The pump J, may be constructed in a variety of ways without in any way affecting this invention so long as the movement of the water is substantially in accordance herewith. In the present instance I have shown a construction in which a central pump cylinder L, is surrounded by four eduction ports 1, 2, 3, 4, as indicated in Fig. 3, each of said ports being provided, as here indicated, at its upper end, with a valve, said valves being in small chambers each opening into the lower end of the tube D, of the electric engine.

To the lower end of the plunger E, is secured the pump piston P, which said piston is fitted to move within the pump cylinder L, and may be packed or not, as desired. The piston P, is considerably smaller than the plunger E, for technical reasons, as will appear.

The plunger E, may be accurately fitted within the tube D, and lubricated if preferred, but I find that with electro-magnetic engines it is wholly unnecessary to encounter the friction resulting from close packing and that a loose fit is all that is required. In the present instance a loose fit will secure a thin sheet of water between the plunger and the interior of the tube D, thereby providing all necessary lubrication.

The plunger E, is provided with recesses or ways *e*, of any preferred shape, size, and number, although said recesses may be arranged as shown in Fig. 2. With this construction each complete reciprocation will cause the plunger to raise water sufficient to fill the pump cylinder L, which water on the return stroke, will be expelled and driven upward through the passages 1, 2, 3, 4, and into and through the cylinder D, passing from there through the valve *f*, and to the delivery pipe G, being in no wise impeded by the presence of the plunger E, which is passed by way of the recesses formed therein. The water, furthermore, serves to keep the entire surface cool.

The coils are desirably energized differently, that is to say, I secure good results from passing a continuous current through the central coil thereby continuously magnetizing the plunger E, and maintaining therein constant poles. The end coils B, B′, are desirably energized by currents which are changed in direction with each desired reciprocation of the plunger, and they may be arranged to be shifted automatically or by hand. A means of accomplishing this result is pointed out in a contemporaneous application, although the broad idea of shifting the current at the generator or source by means controlled by the movement of the pump plunger, is covered by Patent No. 461,294, granted to me October 13, 1891.

Although I have only shown one complete structure in connection with the foregoing description, it must be understood that the invention may be embodied in a variety of forms, in which the liquid being pumped is forced through passages provided in the electro-magnetic engine, so that, while I have illustrated what I believe to be the best and most practical form, I wish it to be understood that the invention is not limited thereto.

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

1. A reciprocating electro-magnetic pumping engine comprising motor coils, a magnetic plunger adapted to be reciprocated therethrough, a pump actuated by said plunger, and passages extending from the pump and through the electric engine and in proximity to the motor coils.

2. A reciprocating electro-magnetic pumping engine comprising electric motor coils, a magnetic plunger adapted to be reciprocated therethrough, a pump actuated by said plunger, and connections between the pump and the electric engine whereby the pumped liquid is passed through the engine.

3. A reciprocating electro-magnetic pumping engine comprising electric motor coils, a magnetic plunger adapted to be reciprocated therethrough, and a pump piston actuated directly thereby, the mass or weight of the magnetic plunger being greater than that of the pump piston.

4. A reciprocating electro-magnetic pumping engine comprising electric motor coils, a magnetic plunger adapted to be reciprocated therethrough, a pump actuated by said plunger, and connections between the pump and the interior of the motor coils whereby the pumped liquid is passed therethrough before reaching the eduction pipe.

5. A reciprocating electro-magnetic pumping engine comprising motor coils, a magnetic plunger adapted to be reciprocated therethrough under variations of current in the coils, a pump and mechanical connections

between the piston thereof and the plunger of the reciprocating engine, and ports and passages connecting the pump with the interior of the engine.

6. A reciprocating electro-magnetic pumping engine comprising electric motor coils, a magnetic plunger adapted to be reciprocated therethrough, said plunger being formed with longitudinal passages, a pump actuated by said plunger, and passages extending between the pump and the interior of the motor coils whereby the pumped liquid is passed therethrough and through the passages in the plunger before reaching the eduction pipe.

7. An electro-magnetic pumping engine comprising electric motor coils, having an interior non-magnetic lining, a magnetic plunger adapted to be reciprocated therethrough, an exterior iron envelope for the coils, a valve chamber at one end of said envelope and a pump at the other end the valve chamber and the pump closing the magnetic circuit of the envelope, and direct connections between the magnetic plunger and the pump piston.

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

CHARLES J. VAN DEPOELE.

Witnesses:

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STEPHEN JANNUS.