(No Model.) 2 Sheets—Sheet 1.

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ELECTROMAGNETIC RECIPROCATING PUMP.

No. 523,822. Patented July 31, 1894.

Fig. 1.

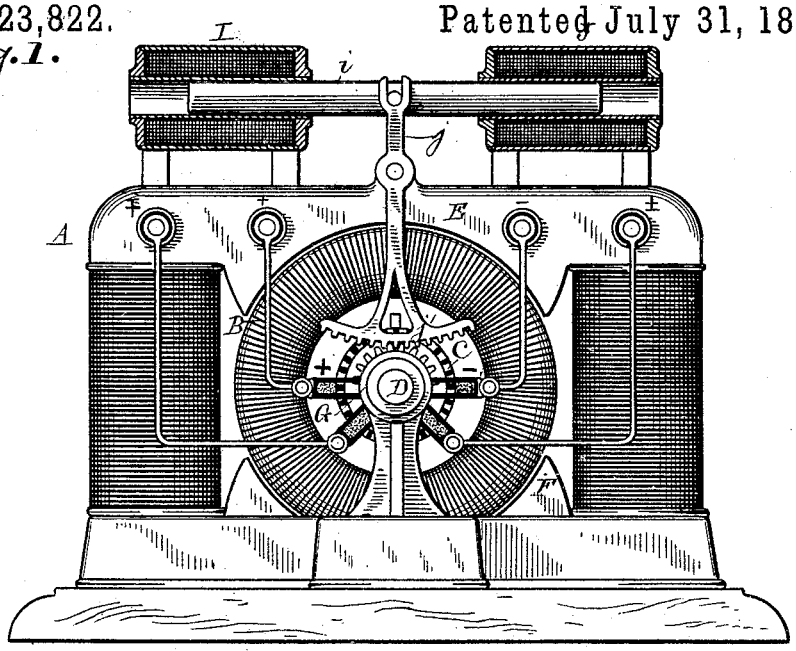

Fig. 2.

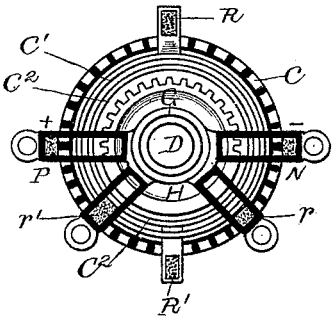

Fig. 3.

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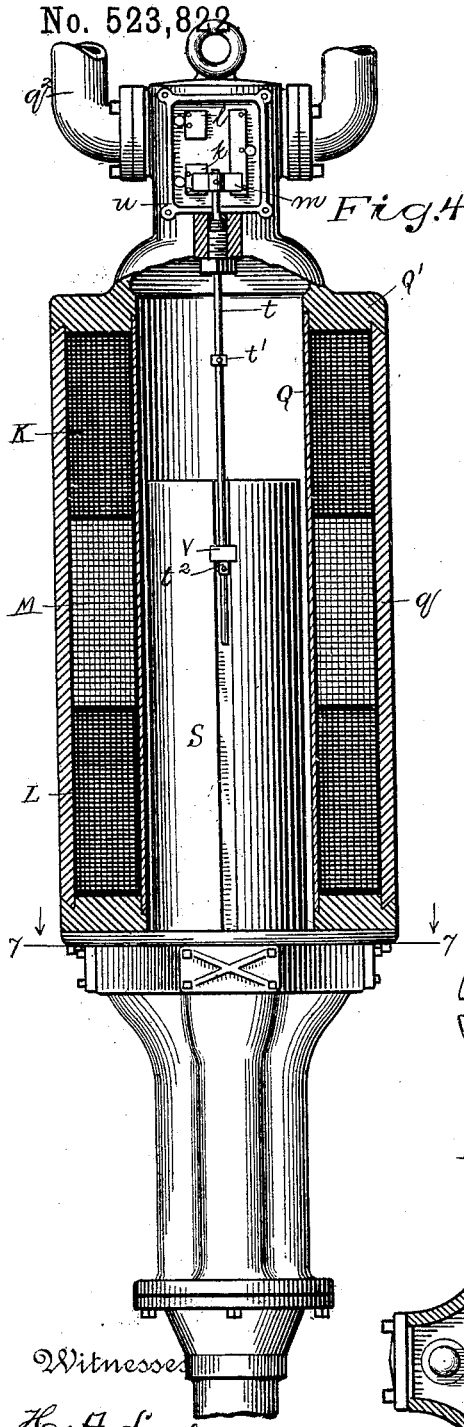


Fig. 4.

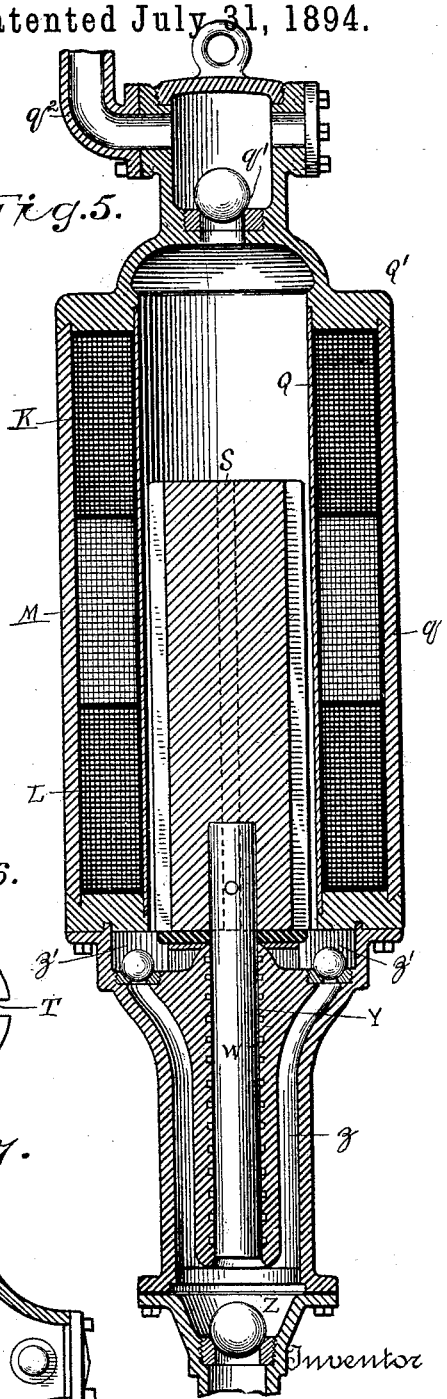


Fig. 5.

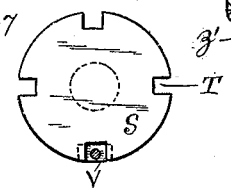
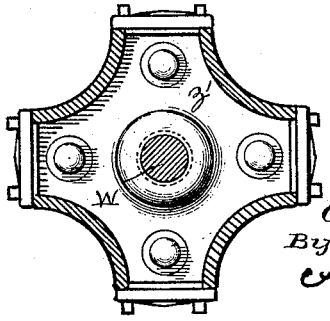


Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC RECIPROCATING PUMP.

SPECIFICATION forming part of Letters Patent No. 523,822, dated July 31, 1894.

Application filed December 12, 1891. Serial No. 414,882. (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 Electromagnetic 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 electro-magnetic reciprocating pumping engines and includes an improved method of supplying the current to the motor coils of such an engine as well as an improved structure of machine.

The engine comprises a reciprocating electro-magnetic engine having motor coils and a magnetic plunger adapted to be reciprocated therethrough, the motor coils and plunger being arranged relatively in a manner adapted to many uses. The plunger, however, is different from that ordinarily used. To the lower end of the engine is secured a pump the piston of which is attached directly to the plunger of the reciprocating engine. The pump is made of smaller diameter as compared to the mass of the said plunger so that high pressure may be imparted to the pump piston by the said plunger. In steam engineering an almost unlimited power may be imparted to the driving piston by a proportionate increase of steam pressure. With an electrically impelled plunger, however, there is a limit beyond which increase in the strength of the field of force ceases to affect its armature, and therefore, in order to provide for high service work the magnetic plunger by which the pump piston is driven must be of relatively large mass the proportions, of course, depending upon the conditions to be met.

In my Patent No. 461,294, dated October 13, 1891, an automatic electric reciprocating engine system is described and claimed in which the change of the motive current in the motor coils necessary to produce the reciprocations of the plunger, is produced at the generator or source of current by means controlled by the movements of the plunger so that the stroke of the machine will depend upon the work to be done and be fast or slow according to the capacity of the engine, in other words, the motive current will continue to impart its force in one direction until that stroke is completed, no matter whether the time required be a fraction of a second or of an hour. In the present application I have shown another specific means for accomplishing the same purpose, the construction of which I desire to claim.

The pump here shown is pre-eminently adapted for a sinking pump but it will be apparent to persons skilled in the art that an apparatus constructed according to the principles herein laid down will be extremely useful in many positions, and further, that the co-acting elements may be combined in a variety of forms and shapes to produce the results herein claimed and that these modifications may be made without in any manner departing from the spirit of or varying or enlarging the invention.

The novel features of the pump *per se* are broadly claimed in a contemporaneous application, Serial No. 414,883, filed December 12, 1891.

The various details of construction and arrangement of an apparatus embodying the invention will now be described, reference being had to the accompanying drawings, in which—

Figure 1 is a view in elevation partly in section, showing a dynamo electric generator or distributer embodying the invention. Fig. 2 is a view of the commutator and collecting rings and contact brushes of the generator seen in Fig. 1. Fig. 3 is a diagrammatic view illustrating the system. Fig. 4 is a view in elevation partly in section, showing an electric pumping engine constructed according to the invention. Fig. 5 is a view resembling Fig. 4 in its electrical details but differing therefrom slightly in mechanical construction. Fig. 6 is a top plan view of the plunger in Fig. 4. Fig. 7 is a view on the line 7—7 of Fig. 4.

As indicated in Fig. 1, A, is a dynamo elec-

tric generator or it may be a dynamo electric machine to which current is supplied and which acts as a distributer. In either event it is a machine of the continuous current type.

B, is the armature.

C, is the commutator; and D, is the commutator shaft.

E, F, are the field magnet poles between which the commutator revolves.

The commutator C, is shown in Figs. 2 and 3.

P, N, are the main positive and negative brushes upon the commutator C.

R, R′, are a pair of movable brushes arranged at opposite points upon the commutator and adapted to be rotated thereabout or to be rocked back and forth between the stationary main commutator brushes P, N. Concentric with the commutator C, are two insulated contact rings C′, C². The moving brush R, is at all times in contact with the ring C′, as well the commutator C, and the moving brush R′, is similarly in contact with the other ring C², and a commutator, so that the said rings represent the moving commutator brushes, which, in their oscillations or rotation, collect current first from one side of the commutator and then from the other, and then, of course, deliver currents of alternating direction each phase having a defined rise and fall corresponding with the rate and character of the movement of the said moving brushes about the commutator C.

As indicated in Figs. 1 and 2, the contacts may all be arranged to be supported by a stationary four-armed yoke carrying four insulated contacts the main commutator brushes P, N, and the contacts r, r', bearing upon the rings C′, C² with which the moving brushes R, R′ are also in contact. To the insulated extremities of this yoke the terminal leads of the machine may be attached, substantially as indicated in Fig. 1. Various means for imparting motion to the moving brushes has been heretofore shown and described by me, notably in my Patent No. 422,855, of March 4, 1890, and later in Patent No. 435,261, of August 26, 1890; No. 461,294, of October 13, 1891, and No. 461,297, of October 13, 1891. In the present instance the brushes are oscillated about the commutator that is to say, are moved back and forth toward and away from the main stationary brushes. This is accomplished in the present instance by an electro-magnetic reciprocating device placed upon the form A, or machine constituting the source of supply. The action of this apparatus, however, depends entirely upon the movement of the pump and it must be understood in this connection that the best results are secured by shifting the current only at the extremities of the movements of the plunger and doing so with the least loss of time in order that the available power of the machine may be applied to the plunger through the longest portion of its stroke.

As indicated in Figs. 1 and 2, a pinion H, or a pulley having teeth h, upon part of its surface, is mounted movably upon the armature shaft D. The moving commutator brushes R, R′, are each carried by an arm which is fixed to the pinion H, but omitted for convenience of illustration. Two small reciprocating engines I, J, are located at opposite ends of the dynamo A, and an iron plunger i, is placed within the said engines and arranged to be reciprocated back and forth thereby.

The engines I, J, are each single coil machines capable of attracting the plunger in one direction and they are arranged as here shown as matter of convenience although they may be differently disposed and still produce the same result.

To the plunger i, is secured a lever j, which carries a toothed sector j', at its lower end, said sector engaging the teeth h, upon the wheel H. The lever j, is pivoted to some fixed point upon the machine A, and its upper end is bifurcated to engage a pin or like device upon the plunger i, so that, as said plunger is reciprocated, the lever j, will be caused to swing and in so doing it will impart rotary movement to the wheel H, first in one direction and then in the other, thereby moving the brush R, R′, about the commutator in a corresponding manner. The electrical connections of the engines or coils I, J, and the operation of that part of the device is indicated in the diagram, Fig. 3, in which K, L, M, are three motor coils, K, L, being at the ends and M, in the center. These coils are arranged to act upon a magnetic plunger which is reciprocated back and forth under their action. The coils L, K, are energized by defined phases of current of alternating direction, said currents being supplied to them through the moving brushes, R, R′, and the rings C′, C², and conductors 1, 2, 3. The said coils K, L, are wound or connected in the proper direction and are connected by the conductor 2. The middle coil M, is supplied with continuous current through conductors 4, 5, extending from the main positive and negative commutator brushes. The coils I, J, by which the brush moving mechanism is actuated are connected at their respective extremities through the conductors 4, 5, and their inner ends are joined and connected by conductor 6, to a movable contact m. Two stationary contacts k, l, are so located with respect to the contact m, that when moved in one direction, as up or sidewise, they will be brought into engagement with one of the stationary contacts and when moved in the opposite direction will engage the other one. The moving contact is connected with the inner terminals of both the coils I, J, while the stationary contacts are connected respectively with the opposite sides of the constant current circuit, represented by conductors 4, 5. The movements of the contact m, from one to the other of the stationary contacts will, therefore, serve to close

the circuit of one of the coils I, or J, thereby energizing the same and causing it to at once attract the plunger *i*, in its direction, thereby swinging the lever *j*, and moving the commutator brush.

Fig. 4 indicates a pumping engine embodying the invention and arranged in operative form. K, L, are the motor coils which are inclosed between an interior non-magnetic metallic lining Q, and an exterior magnetic envelope *q*. Within the lining Q, is arranged the plunger S, seen in top plan view in Fig. 6, and there shown as provided with vertical grooves or slots T. The upper end of the machine is closed by an iron head Q', which is formed with valved passages q', q^2, through which the liquid is ejected. A practical form of the switching device shown in Fig. 3 is indicated in Fig. 4. U, is a switch box containing the movable contact *m*, and the stationary contacts *k*, *l*. The moving contact is actuated by a rod *t*, said rod passing up into the switch box through suitable packing. Tappets t', t^2, are adjustably placed upon the rod *t*, in desired position and said rod passes through a nut or similar device V, which is secured to one of the slots T, of the plunger, so that as the plunger moves up and down the rod *t*, will be contained in said slot without interfering with the operation of the device or being in danger of injury. As the plunger S, moves upward the nut V, encounters the tappet t', when said plunger is near the end of its stroke and the distances are so adjusted that there will be sufficient movement left to move the contact *m*, from the stationary terminal *k*, to the other terminal *l*. This, as will be seen by reference to diagram, Fig. 3, will shift the current from one of the coils or engines I, J, to the other one, the result being a rapid movement of the plunger *i*, and connected parts, resulting in a shifting of the direction of current flowing in the motor coils K, L. It will be obvious that the return movement of the plunger S, reverses the conditions.

Fig. 5 shows those parts of the engine seen in Fig. 4, which are not there fully illustrated, and shows how the pumped liquid may pass from the foot valve through the machine to the eduction pipe. The plunger S, is connected to the pump piston W, which works in the pump secured to the lower end of the reciprocating electric engine and is composed mainly of iron in order to act as a lower head for said engine and complete the magnetic circuit. The piston W, is reciprocated within a pump cylinder Y, and communicates at its lower end with a valve chamber Z. As the piston is raised water is drawn into said pump cylinder and when forced down said water is ejected therefrom and forced upward through parallel lateral passages *z*, which terminate in valved chamber *z'*, connecting with the lower part of the interior lining of the magnetic engine. The force of the descending plunger and piston will force the water upward through the passages *z*, into the valve chamber *z'*, up through the tube Q, of the engine, either between the piston and said tube or through the slots in the piston, or both, the liquid eventually being forced out of the top of the machine through the valved opening q', into the chamber containing said valve and from thence out through the eduction pipe q^2.

While I have described the structure in minute detail it will be understood that various mechanical changes may be made without departing from the spirit or nature of the invention.

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

1. The combination with a continuous current generator having stationary main positive and negative brushes, of a pair of auxiliary brushes, adapted to be moved upon said commutator, a double-acting electro-magnetic brush shifting engine electrically connected in the circuit of the main positive and negative conductors, and mechanical connections between said engine and the movable brushes, a reciprocating electro-magnetic engine having alternate current coils in circuit with the moving brushes, and a continuous current coil or coils in circuit with the main stationary brushes, and a switch controlling the circuits of the brush shifting engine and arranged and adapted to be thrown by the movement of the plunger of the pumping engine to open and close the circuits of the said brush shifting engine in alternation.

2. The combination with a continuous current generator having stationary main positive and negative commutator brushes, of a pair of auxiliary brushes adapted to be moved upon the commutator toward and away from the stationary brushes, a reciprocating electro-magnetic pumping engine having part of its coils in circuit with the stationary brushes and the remainder thereof in circuit with the moving brushes, a double solenoid brush shifting engine having the outer terminals of its motor coil connected respectively to the main positive and negative commutator brushes, and mechanical connections between the brush shifting engine and the movable brushes, and means actuated by the plunger of the pumping engine comprising a switch arranged and adapted to shift the circuit connections of the brush shifting engine to open and close the circuits thereof in alternation.

3. The combination with a continuous current generator having stationary main positive and negative commutator brushes of a pair of auxiliary brushes adapted to be moved upon said commutator toward and away from the stationary brushes, a double-acting electro-magnetic brush shifting engine and mechanical connections between the engine and the movable brushes, an electro-magnetic reciprocating pumping engine having a continuous current coil or coils in circuit with the stationary commutator brushes of the generator and alternating current coils in circuit

with the moving commutator brushes, and a switch mechanism actuated by the moving part of the pumping engine and connecting the switch to the brush shifting motor, whereby the reciprocations of the pumping engine alternately open and close the circuits of the brush shifting motor.

4. The combination with a continuous current generator having stationary main positive and negative commutator brushes, of a pair of auxiliary brushes adapted to be rotated about the commutator toward and away from the stationary brushes, a reciprocating brush-shifting motor, an electro-magnetic reciprocating pumping engine having a continuous current coil or coils in circuit with the stationary commutator brushes of the generator, and alternating current coils in circuit with the moving commutator brushes thereof, a switch mechanism actuated by the moving part of said pumping engine, and circuits and connections between said switch and the brush-shifting motor whereby the reciprocations of the pumping engine control the movements of the moving brushes and the reversals of current in the alternating current coils.

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

CHARLES J. VAN DEPOELE.

Witnesses:
JOHN W. GIBBONEY,
STEPHEN JANNUS.