

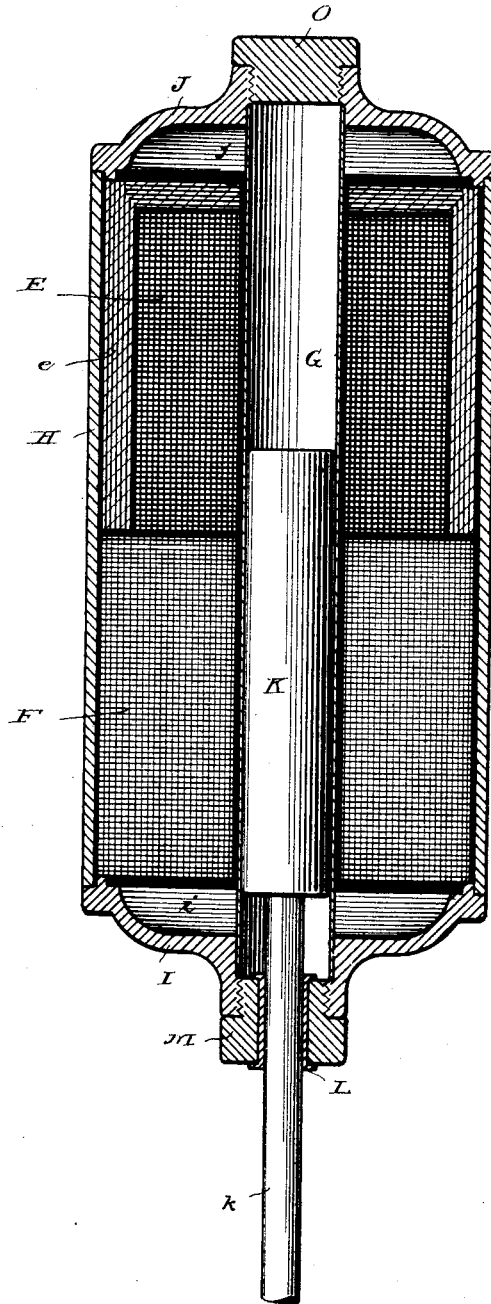
(No Model.)

C. J. VAN DEPOELE.
RECIPROCATING ELECTRIC ENGINE.

No. 458,874.

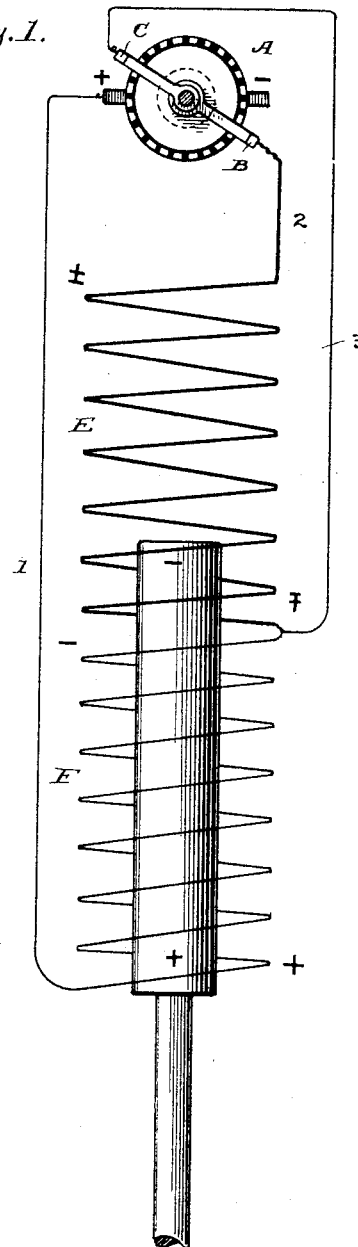
Patented Sept. 1, 1891.

Fig. 2.



Witnesses
H. A. Lamb
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Fig. 1.



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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN, MASSACHUSETTS.

RECIPROCATING ELECTRIC ENGINE.

SPECIFICATION forming part of Letters Patent No. 458,874, dated September 1, 1891.

Application filed April 7, 1891. Serial No. 387,923. (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 Reciprocating Electric Engines, 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 electro-magnetic reciprocating engines, and comprises improvements upon the invention set forth and claimed in my prior application, Serial No. 376,610, filed January 3, 1891. As set forth in said application, the invention comprises a reciprocating electric engine having one set of coils adapted to be energized by an intermittent continuous current, another set of coils energized by alternating currents having a defined rise and fall, and an iron plunger placed under the influence of both sets of coils. I find in practice that a construction embodying two coils only—that is, one energized by an intermittent continuous current and the other one energized by an alternating current—produces very good results, and although such form comes generically within the claims of my said prior application, in the present instance I specifically show and describe such a form of engine, hereby specifically disclaiming the construction shown and described in my said prior application.

In the drawings, Figure 1 is a diagrammatic view of the circuits and connections of an electro-magnetic reciprocating engine embodying the invention. Fig. 2 is a vertical sectional elevation of a reciprocating electro-magnetic engine.

In the drawings, A is the sectional commutator of an electro-dynamic machine of the continuous-current type, which, as set forth in my patents, Nos. 422,855 and 422,858, dated March 4, 1890, may be either a generator producing continuous current or a motor run by a continuous current operating as a counter-electro-motive-force device, and said commutator is provided with the main stationary positive and negative commutator-brushes indicated by the signs. In addition to the main brushes are two moving brushes B C,

arranged to be rotated about the commutator in any desired manner.

The reciprocating engine comprises, as here shown, two motor-coils E F, which are arranged endwise and placed upon a diamagnetic tube G, which may be a slitted brass tube or, when the plunger is otherwise guided, of vulcanized fiber or some comparatively strong non-metallic substance. The coils E F and tube G are inclosed within an exterior iron envelope composed of a cylindrical shell H, provided with iron heads I J, said heads being desirably formed so as to leave spaces *i j* between them and the ends of the motor-coils.

K is an iron plunger adapted to be reciprocated within the tube G under the influence of the coils E F, and said plunger is provided with a piston-rod or tool-holding extension *k*, which is suitably guided through one of the heads, as shown, through the head I, in which it is guided by a brass bushing L, fitted into a removable iron gland M. An iron stopper O is provided for the opening in the head J and also serves to complete its magnetic circuit. The coil F is energized by intermittent currents of continuous direction and the coil E with alternating currents having a defined rise and fall.

Referring to the diagram, the outer terminal of the continuous-current coil F is connected by conductor 1 with the main positive brush upon the commutator A. The outer terminal of the coil E is connected with the moving commutator-brush B by conductor 2, while the inner terminals of the two coils are connected together, and by conductor 3 connected with the other moving brush C upon the commutator A. The brushes B and C being moved to and fro or around upon the commutator A will transmit defined rising and falling currents, first in one direction and then in the other, the frequency of which will depend altogether upon the rate at which said brushes are moved. The coil F will magnetize the plunger K, and, although the current in said coil is intermittent in character, the sluggishness of magnetization of the exterior envelope and of the plunger will serve to continually maintain the polarities in said plunger, which will always be of the same sign. In order to secure the best effects from the alternating-current coil E, I inclose the same

within a magnetic shell comprising a number of layers of thin sheet-iron *e*, which are interposed between said coil and the exterior magnetic envelope. This feature, however, is referred to in an application, Serial No. 385,690, filed March 19, 1891.

I find in practice that where the resistances of the motor-coils are properly proportioned an element of self-regulation exists, which is extremely valuable, and this is owing to the employment of pulsating currents—as, for example, where the electro-motive force is high the moving brushes may be operated at a correspondingly high speed and the action of the machine will be rapid and effective. Where, however, the electro-motive force is low, the movement of the brushes should be slower, in order to permit the desired current to pass through the respective coils for each stroke. This being the case, the effective blow will be the same under either set of conditions, although the number of strokes per minute would then vary according to the electro-motive force of the current supplied. Where the current for this machine is taken from a distributor or counter-electro-motive-force device—as, for instance, that shown in Patent No. 422,857, dated March 4, 1890, where the moving brushes are shown as being actuated by connections from the armature-shaft—if the electro-motive force of the supply-current drops the speed of the distributor will be reduced and with it the rate of movement of its brushes. In such a case the action of the reciprocating engine automatically regulates itself, because, although the strokes are not so frequent, the time between each will permit of the flow of a sufficient quantity of current to energize the coils up to the point of maximum duty.

Various minor modifications and changes may be made in accordance with the principles hereinbefore set forth without departing from the invention.

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

1. A reciprocating electric engine having one motor-coil energized by an intermittent continuous current, another coil energized by alternating currents having a defined rise and

fall, an iron envelope inclosing both coils and magnetized by the intermittent continuous current, and an iron plunger placed under the influence of both coils, substantially as described.

2. A reciprocating electric engine comprising two sets of motor-coils arranged upon a diamagnetic tube, a magnetic plunger reciprocating within the tube, means for supplying one set of motor-coils with intermittent currents of continuous direction and for supplying the other one with defined rising and falling currents of alternating direction, an iron envelope inclosing both coils, and magnetic shields between the iron envelope and the coil energized by the alternating current, substantially as described.

3. A reciprocating electric engine having a motor-coil of relatively high resistance and energized by intermittent currents of continuous direction and another coil of relatively low resistance and energized by defined rising and falling currents of alternating direction, and an iron plunger placed under the influence of all of said coils, substantially as described.

4. A reciprocating electric engine having a motor-coil of relatively high resistance energized by an intermittent continuous current and a coil of relatively low resistance energized by alternating currents having a defined rise and fall, and an iron plunger placed under the influence of both motor-coils, substantially as described.

5. A reciprocating electric engine comprising a coil energized by an intermittent current of continuous direction and a coil energized by defined rising and falling currents of alternating direction, an iron plunger placed under the influence of and reciprocating through both sets of coils and continuously magnetized by the constant-polarity coil, and an iron envelope inclosing both coils and magnetized by the constant-polarity coil, substantially as described.

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

CHARLES J. VAN DEPOELE.

Witnesses:

JOHN W. GIBBONEY,

CHAS. H. OLIN.