(No Model.)

C. J. VAN DEPOELE.

PULSATING CURRENT RECIPROCATING ELECTRIC ENGINE SYSTEM.

No. 455,520. Patented July 7, 1891.

Fig. 1.

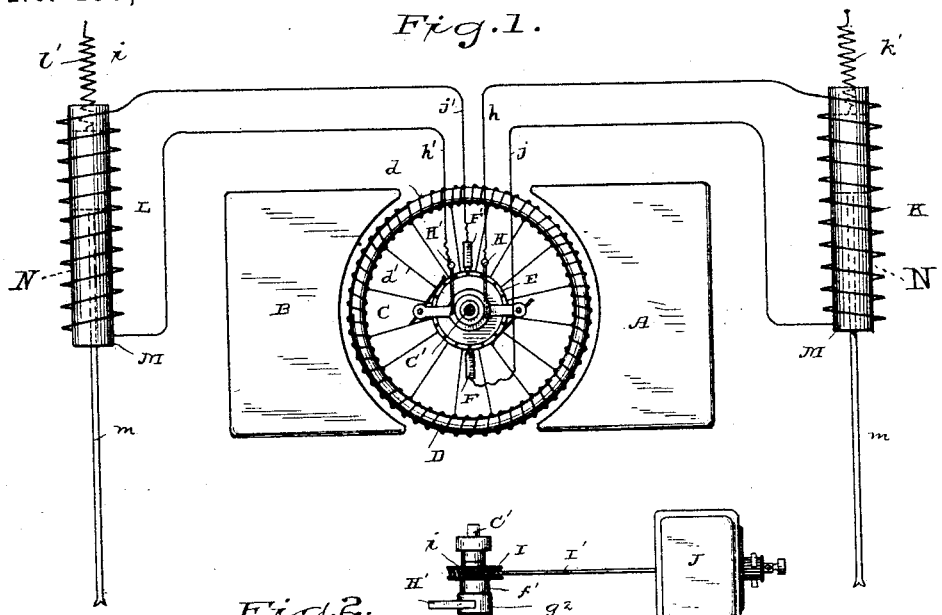


Fig. 2.

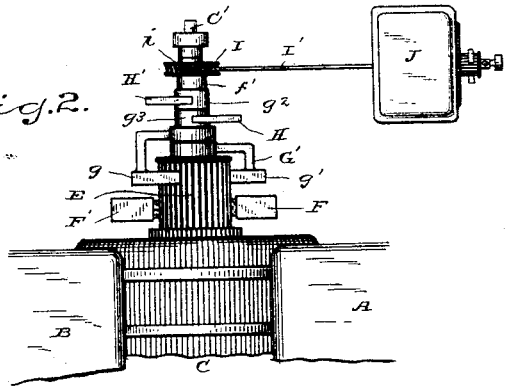
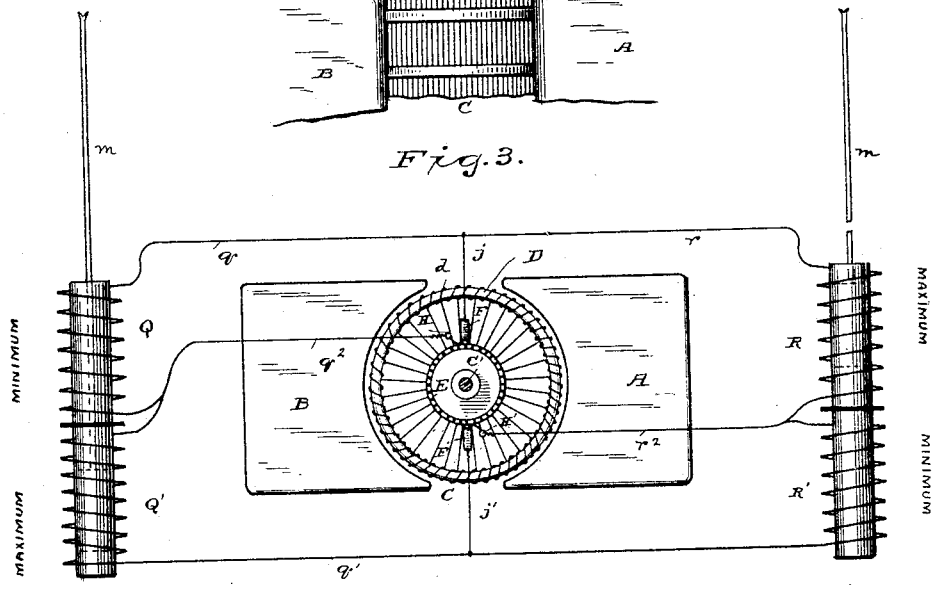


Fig. 3.



Witnesses
H. A. Lamb
C. L. Sturtevant.

Inventor
Charles J. VanDepoele
By his Attorney
Frankland James

UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN, MASSACHUSETTS.

PULSATING-CURRENT RECIPROCATING ELECTRIC-ENGINE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 455,520, dated July 7, 1891.

Original application filed March 23, 1889, Serial No. 304,544. Divided and this application filed June 26, 1889. Serial No. 315,579. (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 Pulsating-Current Reciprocating Electric-Engine Systems, of which the following is a description, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

This application is a division of my application filed March 23, 1889, Serial No. 304,544.

My invention relates to improvements in electric generators, more especially with reference to the production of currents having a defined rise and fall—that is to say, intermittent or pulsating currents—for example, such as are referred to in my patents, Nos. 400,809, dated April 2, 1889, and 401,231, dated April 9, 1889, and especially adapted for operating electro-magnetic reciprocating engines.

As set forth in my said patents, my improved electro-magnetic reciprocating engines are operated synchronously with a generator or source of defined currents, each current energizing a coil in the engine for the purpose of producing the movements of the reciprocating portion thereof. Since the rapidity of alternation in what are known as "alternate currents" in electric-lighting machines is altogether too great and beyond the speed at which the piston of a direct-acting engine of any size is required to be employed, and since it is impracticable to operate known forms of electric-lighting engines at a speed low enough to accomplish my purpose, I have provided means whereby I am enabled to convert the current-energy of an ordinary continuous-current armature rotating at its most efficient speed into undulating or pulsating currents having any desired rapidity of succession.

My invention is embodied in an electric machine having an armature of any desired type and a commutator for straightening the currents therein, stationary commutator-brushes upon the normal line of commutation and in electrical connection with the exterior working-circuit, and an additional traveling commutator brush or brushes in circuit with the return terminal or terminals of the working-circuit, and arranged to be moved around the commutator with a degree of rapidity corresponding to the number of current-waves required to be delivered to the working-circuit, which may vary from several hundred per minute to zero. The motor-coils of the reciprocating engines are connected in circuit with the stationary and moving brushes, and the rise and fall of potential in said working-circuits caused by the movement of the traveling brush or brushes toward and away from the points of maximum and zero electro-motive force upon the commutator cause a corresponding rise and fall of energy in the working-circuits of reciprocating engines, resulting in the movement of their reciprocating parts in synchronism with the movements of the traveling commutator-brushes.

The mode of operation and arrangement of parts will be fully hereinafter described, and referred to in the appended claims.

In the drawings, Figure 1 is an elevation, partly in diagram, showing a generator embodying my invention and two working-circuits therefor, including two reciprocating electro-magnetic engines. Fig. 2 is a top plan view of a portion of the generator seen in Fig. 1 and showing also the motor and connections for operating the rotating brushes at any desired speed. Fig. 3 is a diagrammatic view, partly in elevation, showing a generator with working-circuits therefor and indicating the rise and fall of potential in the respective circuits.

As indicated, A B are the polar extensions of the field-magnet system of the generator, and between which an armature C of the Gramme or any other suitable type is rotatively mounted. The core D of the armature is wound with continuous conductor *d*, connected by terminals *d'* with the segments of a sectional commutator E, as in the well-known Gramme armature. The face of the commutator E is made long enough to receive two sets of brushes, one (the main) being stationary and the other movable, and by "stationary" is meant remaining in the desired position upon the line of commutation, al-

though they will of course be adjustably sustained, and said brushes can be single or double.

F F′ are the stationary brushes, desirably of carbon. The brushes F F′ are placed upon the line of commutation and occupy that part of the commutator nearest the armature. Upon the armature-shaft C′ is placed a rotating sleeve f', insulated from the shaft and provided with a pair of metallic arms G G′, extending rearward to opposite points below and above the commutator, and at the extremities of said arms a second set of commutator-brushes $g\ g'$ are secured. The brush-holders G G′ are carefully insulated each from the others upon their common bearing f, and adjacent to the axis of each is located a collector-ring $g^2\ g^3$, one of said rings being in electrical connection with the brush g and the other with the brush g'. Collector-brushes H H′ bear upon the collector-rings $g^2\ g^3$, and from said brushes extend working-conductors $h\ h'$, as will appear.

The sleeve f, together with the brush-holders and collector-rings attached thereto, is mechanically rotated, thereby causing the commutator-brushes $g\ g'$ to travel around the commutator toward and away from points of maximum to zero electro-motive force, and to collect or convey currents of a duration dependent upon the speed with which the said brushes are moved about the commutator. The sleeve f' may be rotated in any convenient manner, the specific means being immaterial; but in Fig. 2 it is shown as provided with a worm-wheel I, which is engaged by a worm i upon a driving-shaft I′. The shaft I′ may be an extension of the armature-shaft of an electric motor J, by which the shaft, worm-wheel, sleeve, and commutator-brushes may be rotated at any desired speed, suitable means being provided for regulating the motor.

The working-circuits in Fig. 1 are from main brush F of the generator by conductor j, extending therefrom to the motor-coil K of a reciprocating engine, returning by conductor h, connected to moving brush H. The second working-circuit from the said generator is from brush F′ by conductor j' to motor-coil L of a second reciprocating engine, returning through conductor h' to moving brush H′.

The reciprocating engines here shown may be of a type seen in my patent, No. 400,809, referred to—that is to say, each having a single motor-coil for moving the piston in one direction—the reverse movement being effected by a suitable spring $k'\ k'$, as indictated, or vice versa. Within the said coils K L are arranged non-magnetic casings M and magnetic pistons N, adapted to be reciprocated within the casings M under the influence of the motor-coils and the compression of their spring $k'\ k'$.

As here indicated, the motor-coils constitute two working-circuits for the generator; but the said circuits might be extended and include a plurality of reciprocating engines or other motors, according to the capacity of the generator, two only being shown by way of illustration. Assuming that the armature C is capable of furnishing current of the desired constant potential, the intensity of which may vary with the circuits and connections arranged as shown in Fig. 1, if the potential between F F′ is, for example, one hundred volts, the voltage between F and H and F′ H′ will depend upon the relative positions of the moving brushes H H′ with regard to the main brushes F F′, and currents will rise and fall simultaneously in the respective circuits and motor-coils K L, the maximum currents being given when the largest number of sections are between the brushes F H F′ H′, the said currents rising and falling in the solenoids K L with the rotation of the moving brushes.

The foregoing refers to two separate working-circuits each supplied by one-half of the armature, the currents rising and falling in the corresponding parts of the said circuits at the same time. I have shown a single-coil engine in each circuit; but by dividing the circuits, as shown in Fig. 3, double-coil engines can be used. In said Fig. 3 the conductor j, extending from the main brush F, is bifurcated, one part q leading to one motor-coil Q, and the other r to motor-coil R of separate double-coil engines comprising motor-coils Q Q′ and R R′. The conductor j' from main brush F′ likewise divides and extends by conductor q' to motor-coil Q′, and by conductor r' to motor-coil R′, returning from said coils to the moving brushes by conductors $q^2\ r^2$, connected, respectively, to brushes H H′. With the positions shown the currents are maximum in coils Q′ R, the succeeding half-rotation of the brushes H H′ reversing the conditions. With this construction and arrangement it will be understood that the rise and fall of potential in the working-circuits will, with proper circuits and connections, result in alternately reducing the power in the motor-coils of reciprocating engines, which will thereby be caused to operate in synchronism with the source of supply-current and perform useful work.

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

1. The combination, with a source of pulsating or rising and falling currents, of an electro-magnetic reciprocating engine having a motor coil or coils and a magnetic piston moved within the coil or coils in synchronism with the rise and fall of energy therein, substantially as described.

2. The combination, with a source of pulsating or rising and falling currents, of two working-circuits connected therewith, an electro-dynamic reciprocating engine having two motor-coils, one in each working-circuit, and means for directing the flow of current in the respective coils, substantially as described.

3. The combination, with a source of pulsating or rising and falling currents, of one or more electro-magnetic reciprocating engines, each comprising a motor coil or coils and a reciprocating magnetic piston moving within the coil or coils, circuits extending from the generator to the said coil or coils, and means for alternately raising and lowering the potential of the current in the coils of the said reciprocating engine to cause reciprocation of the moving part, substantially as described.

4. The combination, with a source of pulsating or rising and falling currents, of two working-circuits connected therewith, an electro-dynamic reciprocating engine having two motor-coils, one in each working-circuit, and means for regulating the flow of currents in the respective coils, substantially as described.

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

CHARLES J. VAN DEPOELE.

Witnesses:
FRANK L. STAGG,
EDW. D. FLOYD.