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C. J. VAN DEPOELE.

PULSATING ELECTRIC GENERATOR.

No. 422,855. Patented Mar. 4, 1890.

Fig. 1.

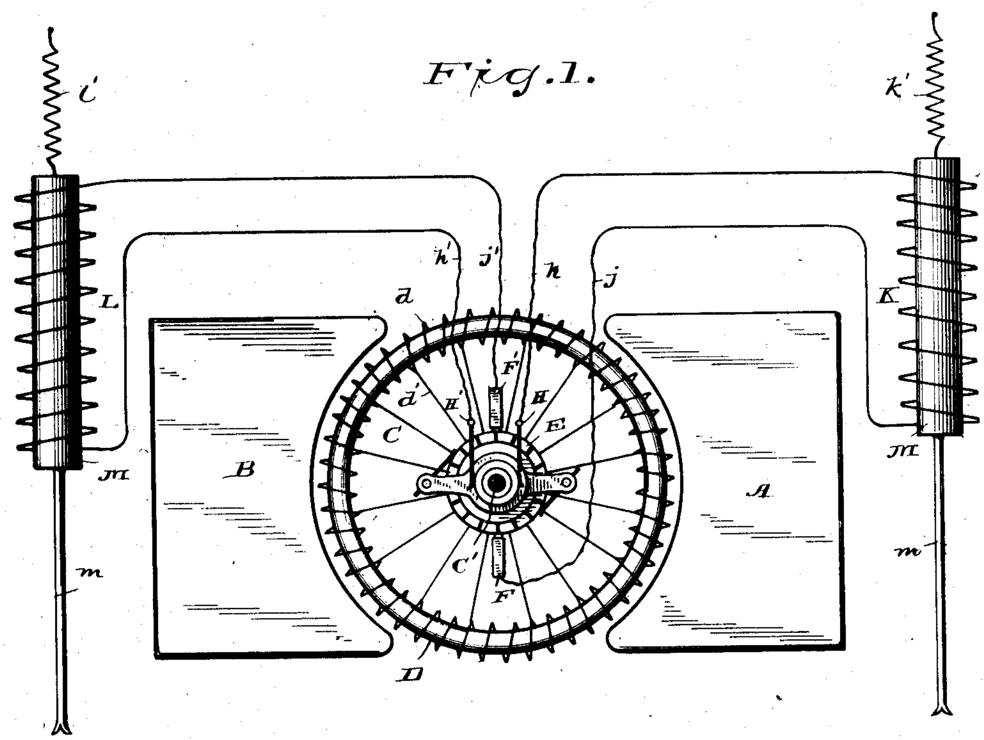

Fig. 2.

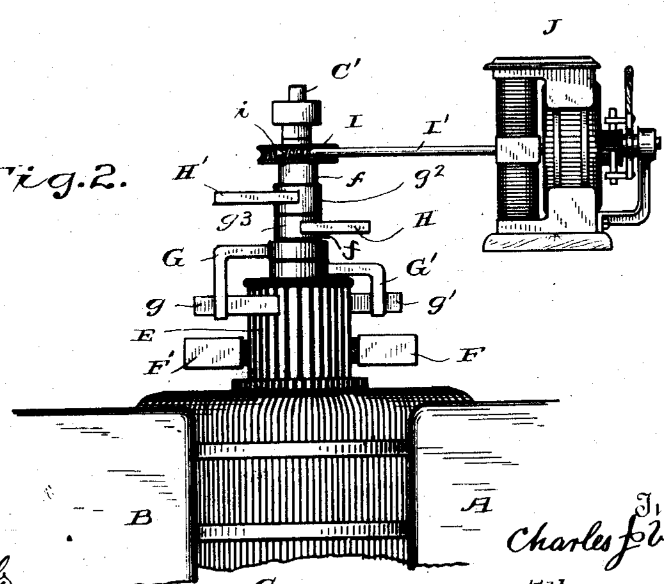

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Fig. 3.

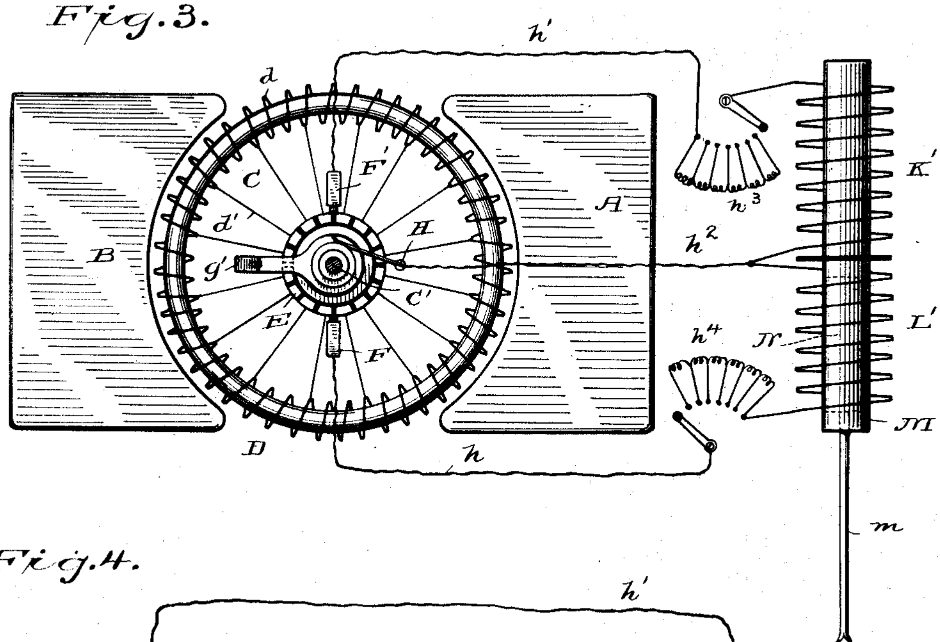
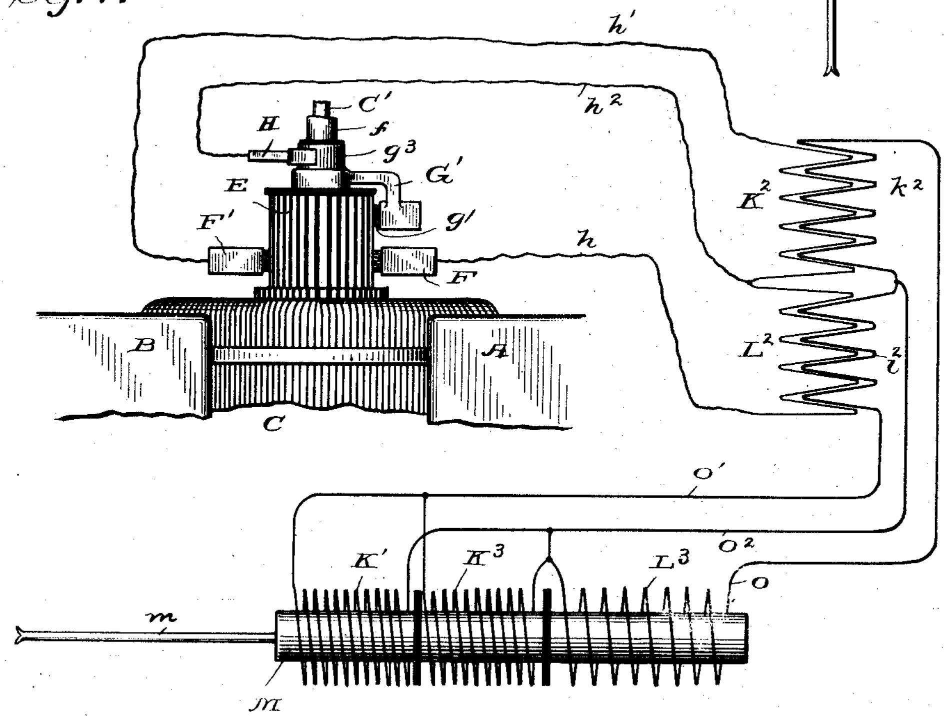


Fig. 4.



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(No Model.) 6 Sheets—Sheet 3.

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PULSATING ELECTRIC GENERATOR.

No. 422,855. Patented Mar. 4, 90.

Fig. 5.

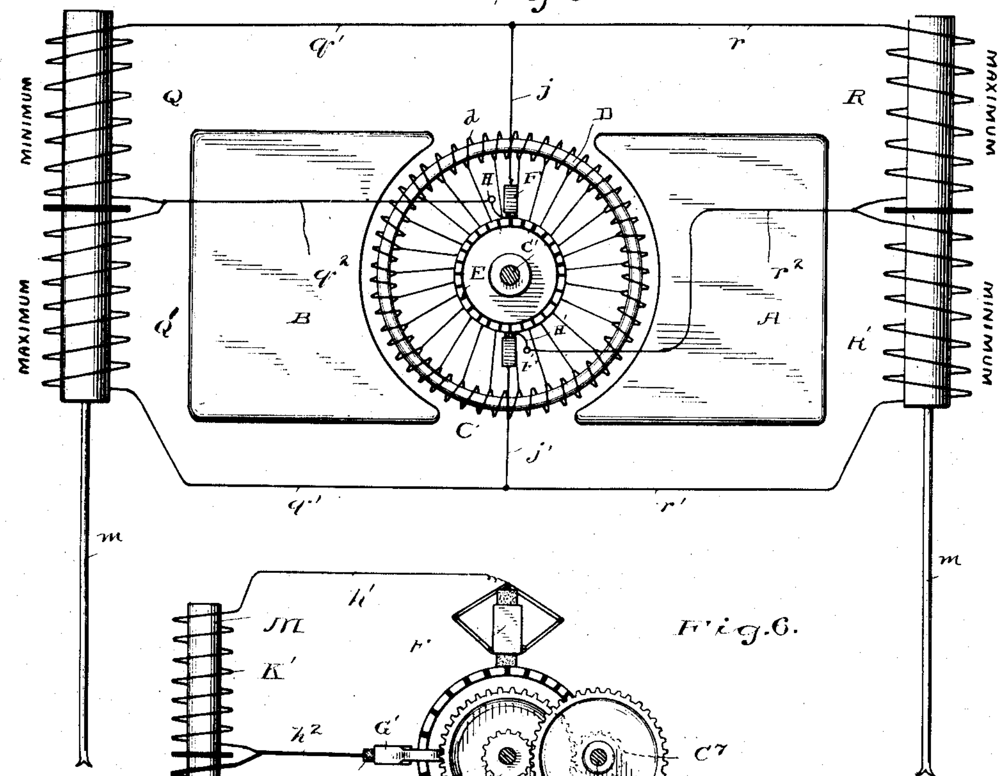


Fig. 6.

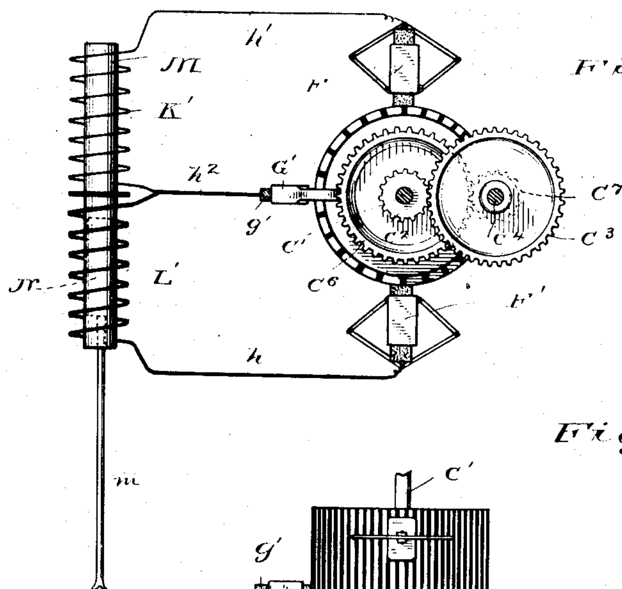
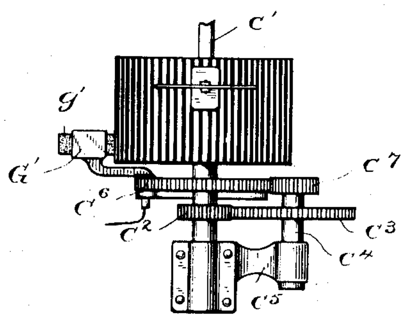


Fig. 7.



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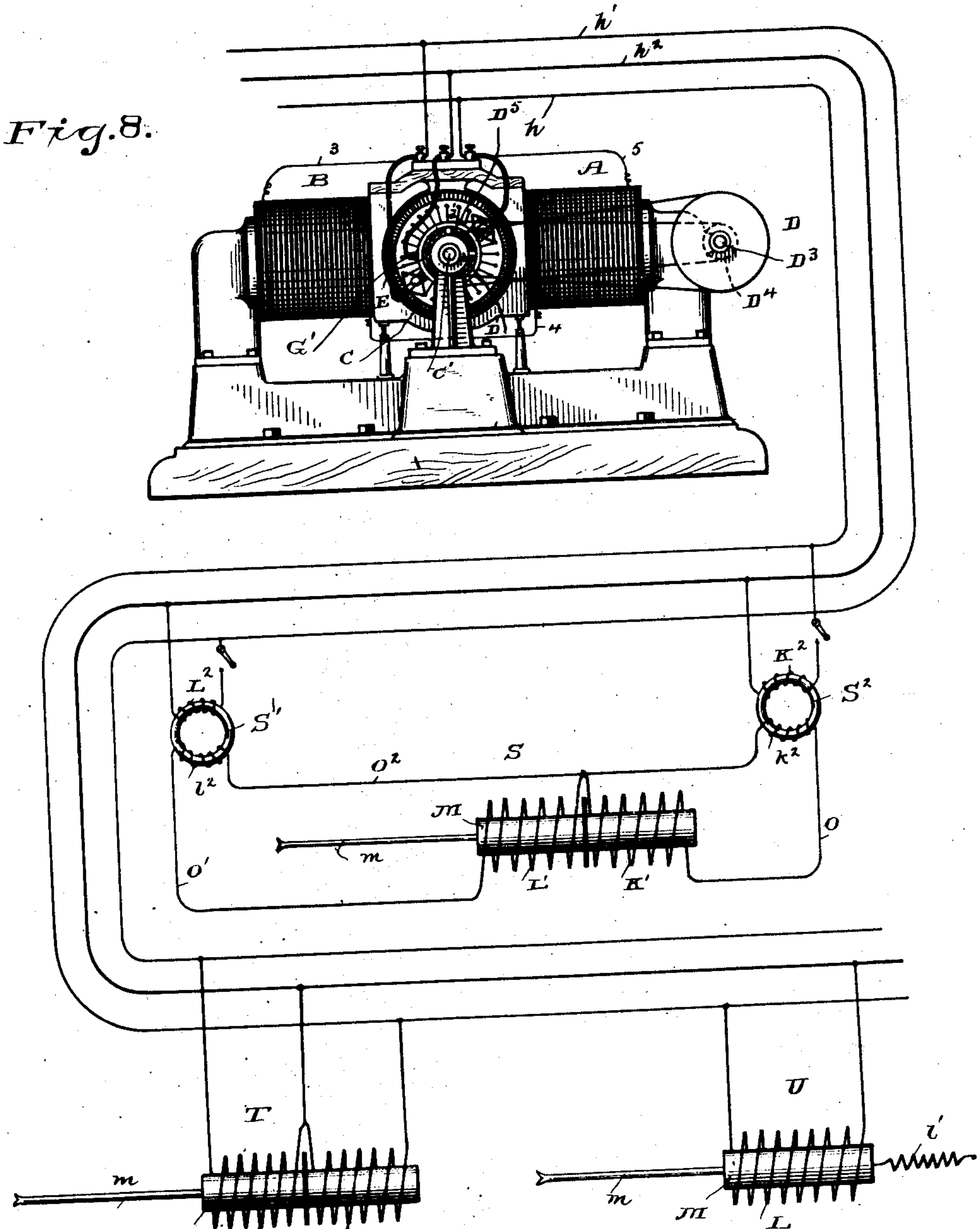
C. J. VAN DEPOELE.

PULSATING ELECTRIC GENERATOR.

No. 422,855.

Patented Mar. 4, 1890.

Fig. 8.



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PULSATING ELECTRIC GENERATOR.

No. 422,855. Patented Mar. 4, 1890.

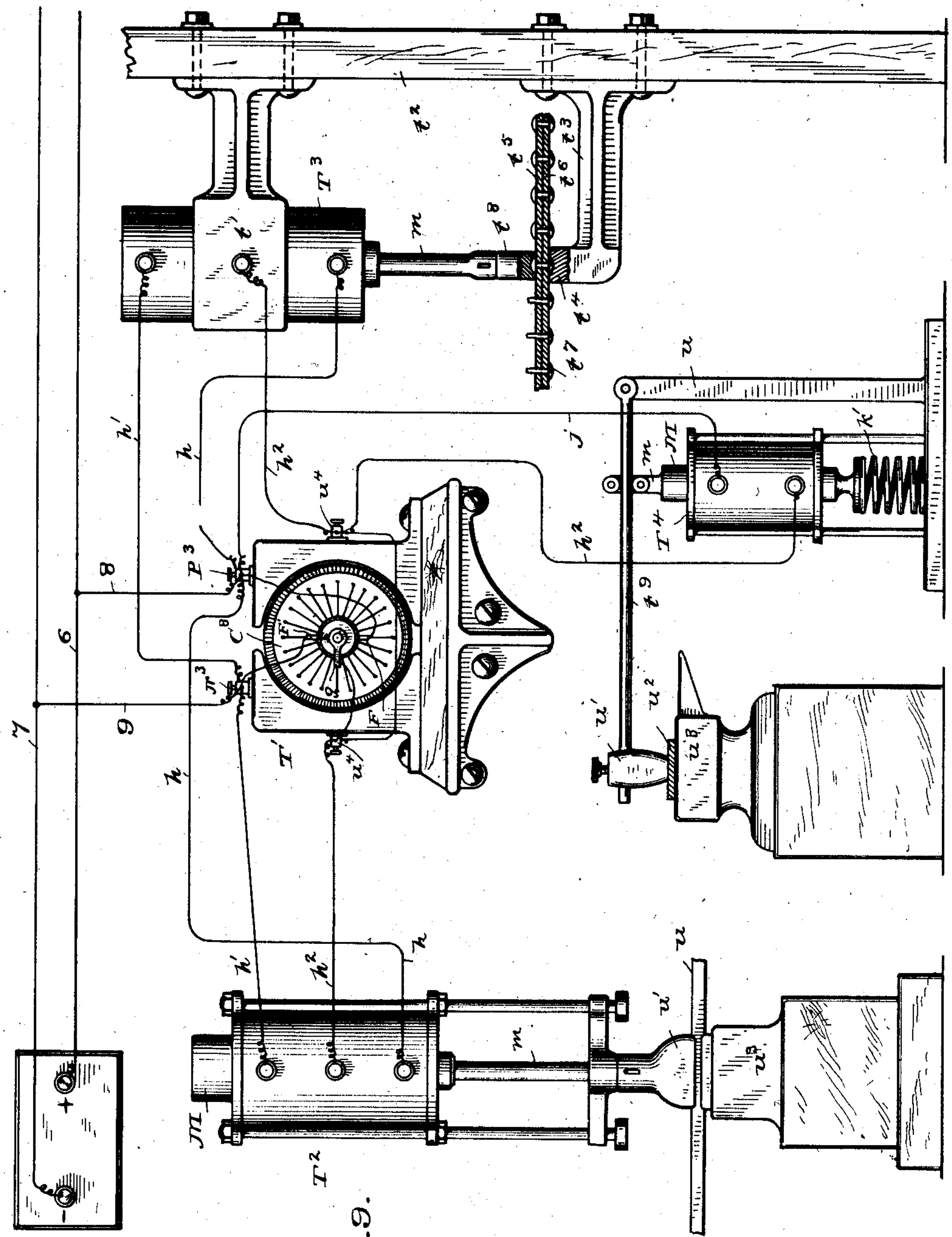

Fig. 9.

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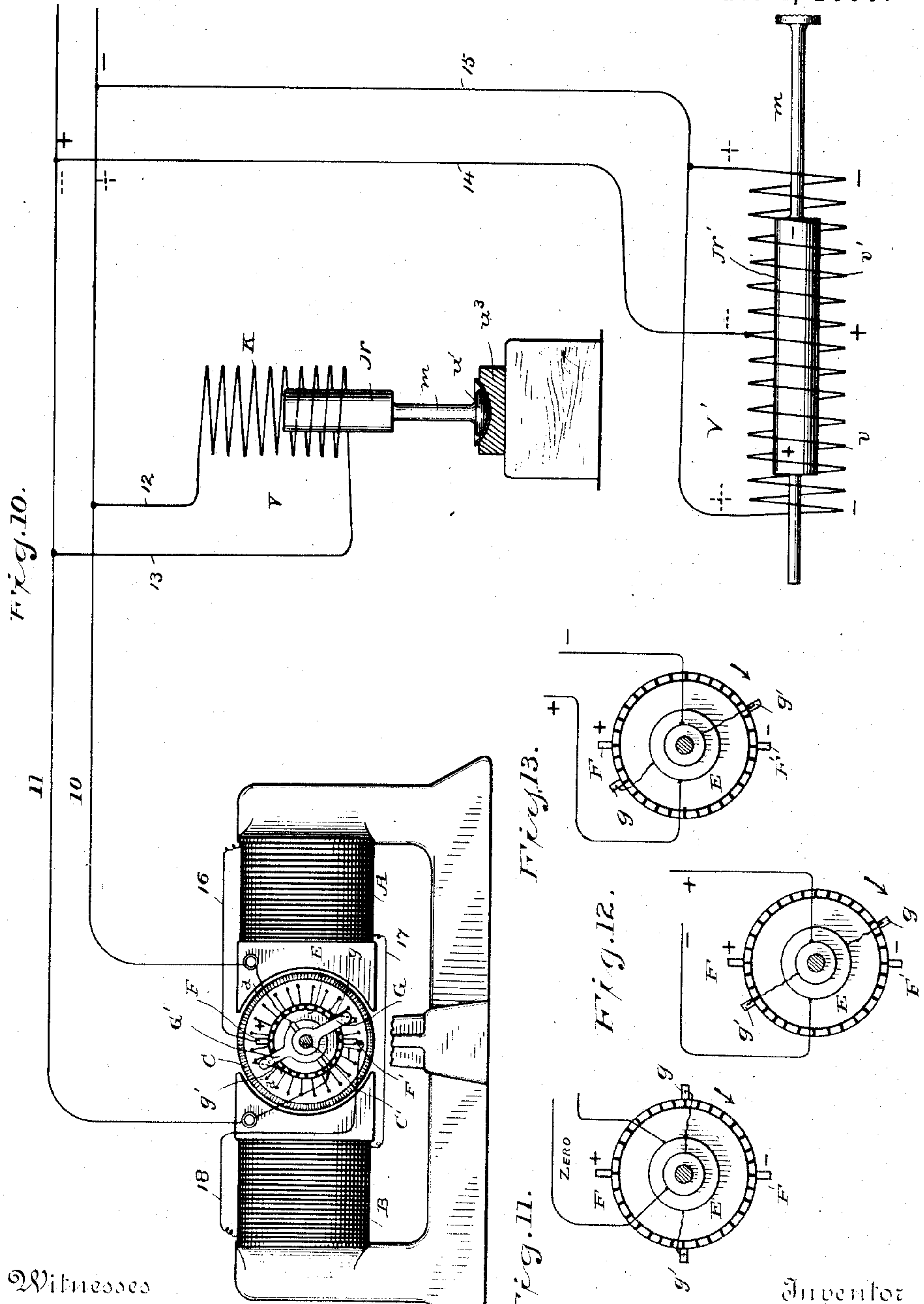

Witnesses

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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN, MASSACHUSETTS.

PULSATING ELECTRIC GENERATOR.

SPECIFICATION forming part of Letters Patent No. 422,855, dated March 4, 1890.

Application filed March 23, 1889. Serial No. 304,544. (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 Electric Generators, 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 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 applications, Serial Nos. 285,294, filed September 13, 1888, and 296,981, filed January 21, 1889, and specially adapted for operating reciprocating engines.

As set forth in my said prior applications, 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 imparting a stroke thereto.

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 moved, and since it is impracticable to operate known forms of alternate-current electric-light generators 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 a dynamo-electric machine having an armature of any desired type and having a commutator for straightening the currents therein, stationary commutator-brushes upon the normal line of commutation and in electric 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 down to zero.

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-dynamic engines. Fig. 2 is a top plan view of a portion of the generator seen in Fig. 1, showing also the motor and connections for operating the rotating brushes at any desired speed. Fig. 3 is an elevation, partly in diagram, showing a generator and a working-circuit therefor embodying a slightly-different form of the invention, only one traveling brush being used. Fig. 4 is a plan view of part of the generator seen in Fig. 3, with a working-circuit therefor shown in diagram. Fig. 5 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. Fig. 6 is a detail view of one form of commutator-brush-rotating mechanism, together with a working-circuit therefor. Fig. 7 is a plan view of the mechanism seen in Fig. 6. Fig. 8 is a view showing a generator in elevation and a working-circuit in diagram. Fig. 9 is a diagrammatic view of an organization of apparatus supplied with pulsating currents according to my said invention, and differing from the system seen in Fig. 8 in that a rotating motor supplied with continuous current is used instead of the generator to produce the rise and fall of potential in the several working-circuits. Fig. 10 is a view showing a generator with rotating brushes, the working-circuits, and apparatus in diagram, said generator being arranged to supply pulsating currents of alternating polarity. Figs. 11, 12, and 13 are detail views showing the commutator and brushes of the generator in Fig. 10 in different positions.

As indicated, A B are the polar extensions of the field-magnet system of the generator seen in complete form in Fig. 8, between the extensions of which an armature C of the Gramme or any other type is rotatively mounted. The core D of the armature is wound with continuous conductor d, connected by terminals d' with 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, although they will of course be adjustably sustained, and they can be single or double brushes.

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 in the extremities of the said arms a second set of commutator-brushes g g' are secured. The brush-holders G G' are carefully insulated each from the other upon their common bearing f', and adjacent to the axis of each is located a collector-ring g^2 g^3. Upon the collector-rings g^2 g^3 are placed contact-brushes H H', from which 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 and to collect currents therefrom of a duration depending upon the speed with which the said moving brushes are moved. 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', which may be an extension of the armature-shaft of an electric motor J, and by which the shaft I', worm-wheel i, sleeve f, and commutator-brushes g g' may be rotated at any desired speed, suitable means being provided for regulating the motor. In many instances it is, however, preferable to rotate the moving brushes by connections extending and receiving power from the armature-shaft. Such an arrangement is shown in Figs. 6 and 7, where, as indicated, the armature-shaft C' is provided with a driving-pinion C^2, meshing with a toothed gear C^3 upon a counter-shaft C^4, mounted in suitable bearings in brackets C^5 or other support attached to the frame of the machine. The moving brush g' is carried by holder G', which is secured to a gear C^6, sleeved upon the armature-shaft. The gear C^6 is in mesh with a pinion C^7 upon the counter-shaft C^4, which, being rotated by gear C^3 and armature-pinion C^2, communicates rotary motion to the brush-carrying wheel C^6, to move the brush g' around the commutator E at a fixed rate relative to the armature speed, which may be arranged as desired by suitably proportioning the gears C^2 C^3 C^6 C^7.

Another form of brush-rotating gear is shown in Fig. 8, in which a relatively small pulley D' is mounted upon the armature-shaft C'. The counter-shaft D^3 carries also a smaller pulley D^4, which is belted to a brush-carrying pulley D^5, sleeved upon the armature-shaft C', the arrangement being substantially the same as shown in Figs. 6 and 7, except that the connections are of a flexible instead of a rigid type. With either of these arrangements the relative speed of the armature and of the moving brush or brushes can be determined, and will thereafter vary with the speed of the armature. The working-circuits in Fig. 1 are from main brush F of generator by conductor j, extending therefrom to the motor-coil K of a reciprocating engine, and 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 said prior application—that is to say, having a single motor-coil for moving the piston in one direction, the reverse movement being effected by a suitable spring k' l', as indicated, 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 a compression or other spring k' l'. 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 one hundred volts, the voltage between F and H and F' H' will depend upon the relative positions of the moving brushes g g' 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 g F' g', the said currents rising and falling in the two 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 said circuits at the same time, and I have shown a single-coil engine in each circuit; but by dividing the circuits, as shown in Fig. 5, double-coil engines can be used. In said Fig. 5 the conductor j, extending from 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 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 and H′. With the positions shown the currents are maximum in coils Q′ and R and minimum in coils Q and R′, the succeeding half-rotation of the brushes H H′ reversing the conditions. The current energy of the armature can, however, as readily be directed alternately in the separate circuits whether the same be supply-circuits including a number of motor-coils suitably connected, or whether the two circuits comprise the motor-coils of a single reciprocating engine. Such an arrangement is indicated in Figs. 3 and 4, where, as will be seen, the commutator is provided with stationary brushes, as described; but in connection therewith I employ a single rotating collector-brush with connections. Upon the sleeve f is mounted an arm G′, provided with commutator-brush g', upon the collector-ring g^3 of which bears a collector-brush H. The motor-coils K′ L′ are, as indicated, placed over a non-magnetic casing M, within which a magnetic piston N (indicated in dotted lines) is free to be reciprocated, and which is provided with a pick m or other suitable tool. Stationary brush F is connected to the terminal of coil L′ by conductor h, the other stationary brush F′ being similarly connected to the exterior terminal of the coil K′ by conductor h'. Where, however, the currents are to be alternately directed to different circuits, the collector-brush H is connected, as by conductor h^2, with the inner terminals of both the coils K′ L′, or other working-circuits. With this arrangement, as the sleeve f is rotated and the traveling collector-brush g' carried around the commutator E, it will alternately close the circuit upon first one and then the other of the stationary commutator-brushes, the brush H and conductor h^2 constituting the return-circuit for the coils K′ L′ alternately. It will thus be apparent that intermittent currents of any desired rapidity can be taken in succession from the commutator of an armature of any type running at its most efficient speed, whatever that might be; also, that the said currents can be supplied direct to a number of motors suitably connected therewith, or to a plurality of supply-circuits between which the motors are connected; and, furthermore, the said currents, rising and falling in intensity, can be taken off by rotating commutator-brushes without the destructive sparking accompanying the sudden rupture of a fully-charged circuit.

In many instances where it is desired to convey the current over long distances to the point of consumption it is desirable to use current of relatively high potential, and to provide the translating devices with tension-reducing devices or converters. Since the rate of production of intermittent or defined currents according to my invention is not in any way dependent upon the potential of the main supply-current, I may use a machine producing current of any desired voltage, the current being sent to line through the phasing devices described, and transformed into currents of lower potential at or near the point or points of consumption and without the use of any circuit shifting, changing, or breaking devices. Such arrangements are indicated in Figs. 4 and 8.

The apparatus seen in Fig. 1 comprises a form of reciprocating engine shown in my said prior application, and including a single coil for producing the power-stroke and a spring for retracting the piston.

In Fig. 3 a form of engine is shown comprising two motor-coils—one producing the forward and the other the backward strokes. A desirable means for regulating the flow of current in the respective coils is indicated in Fig. 3 in the form of an adjustable resistance h^3, included in the supply-circuit of coil K′, a similar resistance h^4 being included in the supply-circuit of coil L′. By adjusting the resistances h^3 h^4, I can vary the effective power of said coils so as to produce a greater force on the forward or power stroke and weakening the effect of the coil K′, by which the piston is retracted, thereby preventing or diminishing the wear and tear on the machine due to the shock of the return-stroke.

Another means for accomplishing the same result, but which I prefer, since no artificial resistances are used, and consequently no current lost thereby, is indicated in Fig. 6. Assuming the forward stroke should have twice the power of the return-stroke, I wind or connect the motor-coils in three sections or divisions, each of substantially the same resistance. The two front coils are connected in multiple arc with their supply-conductors and the back coil singly. The resistance of the two front coils, taken together, will only be one-half that of the back coil, and consequently twice as much current will flow in the front coils as in the back one, thereby giving the preponderance of power to the forward movement of the piston. This arrangement is indicated in Fig. 4, in which is seen a three-wire circuit similar to those seen in Fig. 3, but also including tension-reducing devices in connection with reciprocating engines, as well as other forms of apparatus, as will appear. The outer terminals of coils K^2 L^2, acting as primaries, are in circuit with the conductors h h' and the stationary commutator-brushes, and their inner terminals are both connected to the return-conductor h^2, leading to the moving brush g'. Secondary coils k^2 l^2 are arranged in inductive relation to the coils K^2 L^2, said secondary coils being connected by conductors O O′ O^2 with the coils K′, K^3, and L^3 of a reciprocating engine. Secondary currents generated in the coils k^2 l^2 by the intermittent currents flowing in the main circuit and primary coils K^2 L^2 will be led to the motor-coils K′ K^3 L^3, substantially in the same manner as if said motor-coils were supplied direct from the generator and phasing device seen in Fig. 3. The front coils K′ K^3 are connected in multiple arc between conductors O′ O^2 and the back coil L′ between conductors O O^2. The same results will be produced by using two coils, the sectional area of one being greater than that of the other. With a current of constant potential, current will flow into the working-circuits in proportion to the respective resistance thereof, and therefore, when it is desired that the front coil shall develop, for instance, twice the power of the back coil, by making the conductors of the front coil of twice the sectional area of those of the back coil the desired results will be produced. Such an arrangement is indicated in Fig. 6, where it will be seen that the conductors comprising the motor-coil L′ are larger in size than those of the coil K′, the current dividing between the said coils in proportion to their respective resistances.

The intermittent continuous currents produced according to my invention may be formed or created by means differing from those already described, and the invention is not limited to the means already referred to.

Another method of accomplishing the described results would be to supply continuous current to a rotating commutator through stationary brushes and collect and distribute currents of rising and falling potential from moving brushes arranged substantially as in Fig. 2. Such an organization is seen in Fig. 9, in which T′ is an electric motor having a continuously-connected armature C^8 of the Gramme or other type and a sectional commutator E, upon which bear stationary brushes F F′, and which is further provided with a moving brush g, rotated about the said commutator E by any suitable means, as previously described. The motor T′ is supplied with continuous current from conductors 6 7, extending from any suitable source of continuous currents and connected to the said motor by conductors 8 9, attached to binding-posts P^3 N^3. The field-magnets of the motor are connected in any suitable manner with respect to the armature, which is supplied with current through the stationary brushes F F′, which are connected to the binding-posts P^3 N^3, and the armature of said motor should be arranged to rotate at a substantially constant speed. Several pieces of apparatus actuated by my improved electromagnetic reciprocating engines are shown in connection with the pulsator T′. At T^2 is indicated a hammer, which may be actuated by a double-coil motor, such as shown in Fig. 3, the circuit-connections h h' h^2 being led to separate binding-posts connected with coils upon the interior of the casing, (seen in the drawings,) substantially as indicated in said Fig. 3.

T^3 indicates a reciprocating engine similar to that in Fig. 2, but shown as applied to a somewhat different form of work. As indicated, the engine T^3 is supported by a bracket t', extending from an upright t^2, which is also provided with a second bracket t^3, carrying an anvil or die t^4, upon which, as shown, are placed two pieces of metal t^5 t^6 to be united by rivets t^7, which when placed upon the anvil t^4 are set up by blows of a suitable hammer t^8, attached to the extremity of the piston-rod m.

T^4 indicates a form of apparatus shown diagrammatically in Fig. 1—that is to say, the engine T^4 is provided with a single actuating coil, the return-stroke being effected by a spring k'. The piston-rod m of the engine T^4 may be connected, as shown, to an arm T^9, pivoted at one end to an upright u and carrying at its free extremity a hammer or other tool u', adapted when oscillated by reciprocations of the piston-rod m to act upon work u^2 upon a suitable anvil u^3. No work is connected to the armature-shaft of the motor T′ unless it be desired to apply a brake thereto for purposes of regulating the speed, and the said armature being rotated by the continuous currents from the line will serve to distribute pulsating currents in a manner similar to the machine shown in Fig. 2, with this difference, however, that the current sent to the various working-circuits is received from the continuous-current supply-conductors 6 and 7. The supply-conductor is connected to the binding-post P^3 of the motor, to which are connected the stationary brush F and the outgoing circuits h j of the various engines, which said circuits correspond to the circuits similarly indicated and previously described. The opposing circuits h' are all similarly connected to binding-post N^3, which is connected to the line-conductor 7 and to the stationary brush F′. The moving brush g is electrically connected with a binding post or posts u^4, to which the return-circuit of the various engines are connected by conductors h^2. With this or equivalent construction it will be understood that as the brush g travels around the current from the supply-conductors 6 and 7 will flow through the several circuits as the rotating brush approaches and recedes from the stationary brushes F F′, thus producing rising and falling currents in the said circuits. This arrangement will be very convenient in many instances—as, for example, where a source of continuous current is available and the circumstances do not require or justify the installation of a separate generator arranged as herein set forth.

In Fig. 8 is seen a completely-organized circuit including a generator having field-magnets A B and armature C, the commutator and brush-rotating mechanism having been previously described. The generator may be of any desired continuous-current type. The field-magnets of the generator may be energized from a separate exciter or by a shunt-circuit, (indicated by conductors 3, 4, and 5.) As shown, the working-circuit of said generator is on the three-wire distribution principle, previously referred to in connection with Fig. 3, conductors $h\ h'$ representing the stationary or main commutator-brushes and the conductor h^2, and moving brush by which potential is caused to rise and fall in the said circuit. The various species of reciprocating electro-magnetic engines hereinbefore referred to may be operated in one circuit, as indicated in said Fig. 8. At S is seen a two-coil reciprocating engine operated by secondary currents from converters S′ S², the circuits and mode of operation of said converters being similar to the apparatus seen in Fig. 4. The reciprocating engine, however, differs from that seen in Fig. 4 in having two instead of three coils, although it will be apparent that one of the coils may be subdivided and connected as described. The engine shown at T is similar to that seen in Fig. 3 and already described. The single-coil engine seen at U is similar to those illustrated in connection with Fig. 1. The apparatus shown in circuit with the generator in Fig. 8 may be provided with any of the regulating devices hereinbefore referred to, and, being all connected in multiple arc, they can be operated without interference each with the other and will take current according to their several resistances or the resistances of their several portions.

Although of rising and falling potential, the currents flowing in the circuits $h\ h'\ h^2$ are always of the same polarity, and therefore it will be understood that I may operate any kind of continuous-current translating devices thereby. The invention is not, however, limited to the production of rising and falling currents of constant polarity, since by simply connecting the working-circuit to the rotating brushes $g\ g'$, without including the stationary brushes, the currents sent to line will be of the same character as those hereinbefore referred to, but of alternating polarity. Such an arrangement is indicated in Fig. 10, in which the generator does not differ materially from that shown and described with reference to Fig. 8, except in having two rotating brushes, as shown in Fig. 1. The working-circuit connections are, however, differently disposed, the main supply-conductors 10 11 being connected to moving brushes $g\ g'$.

V indicates a single-coil reciprocating engine similar to those shown (K and L) in connection with Fig. 1, the motor-coil K being connected to the working-circuit 10 11 by conductors 12 13. The engine V is provided with a piston N of magnetic material, as iron, and is provided with a piston-rod m, which may carry a hammer u at its extremity. When a current-wave of one polarity flows through the coil K, the piston N will be attracted and raised thereby. On the fall of this phase and before the succeeding phase has acquired any strength the piston will be released. The succeeding phase, which will be of opposite polarity, will in turn attract and raise the plunger or piston, which, as before, will fall and perform work during the interval between the succeeding phases. As here indicated, the hammer will perform work by striking upon whatever is placed between the hammer u' and anvil u^3. The effective blow of the hammer u' can of course be increased by the addition of a spring, but, as indicated, the blow is effected by the weight of the piston N.

V′ indicates a double-acting electro-magnetic engine operated by alternating currents. The engine V′ is provided with two motor-coils $v\ v'$, connected in multiple arc by conductors 14 15, extending to the line-conductors 10 11, and the flow of currents therethrough of alternating polarity will produce, for example, positive poles at each end of said coils and a negative pole in the center, the succeeding phase reversing the polarities, as indicated by the signs in full and dotted lines. The engine V′ is provided with a polarized or permanently-magnetized steel piston N′, and since the magnetism of the piston does not change the shifting of polarity in the coils $v\ v'$ under the influence of the currents of alternating polarity flowing therethrough the said piston will be reciprocated in synchronism therewith.

In Fig. 11 the moving brushes $g\ g'$ are at zero, being in positions equidistant from the stationary brushes F F′, in which positions, the circuits being balanced, no currents will flow, except, of course, through the circuits of the generator proper, the field-magnets being shown as connected by conductors 16 17 with the stationary brushes F F′. As the brush g approaches the brush F′ and the brush g' the brush F, a constantly-increasing current will flow through said brushes, the maximum currents passing when said rotating brushes are nearest to the stationary brushes toward which they are moving, the said currents diminishing as the moving brushes travel away from the stationary brushes until the zero-point is reached and the brushes $g\ g'$ are upon the opposite sides of the commutator in the positions the reverse of those indicated in Fig. 11. In Fig. 12 the brushes are seen as having moved from the zero-point toward the stationary brushes, when currents, as indicated by the signs, flow through the main conductors. In Fig. 13 the relative positions are the same as those seen in Fig. 12, the lettering indicating that the brushes $g\ g'$ have passed the zero-point and are now approaching the opposite set of stationary brushes from those indicated in Fig. 12, under which conditions currents of opposite sign are flowing in the main conductors, as indicated. With this arrangement, therefore, there will be two reversals of the current during each complete rotation of the collecting-brushes, and it will be apparent that the reversals may be made more or less rapid as desired by regulating the speed at which the collecting-brushes are moved.

Various changes and modifications may be made in the structure and arrangement of the hereinbefore-described apparatus without departing from the invention, and I therefore do not limit myself to the precise details described and shown by way of illustration.

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

1. The combination, with a sectional commutator and a source of electric currents, of a set or sets of brushes constantly moved about said commutator toward and away from the points of maximum and zero electro-motive force, and suitable working-circuits supplied from said brushes and in which the potential is caused to constantly rise and fall by the action of the moving brushes.

2. The combination, with a sectional commutator and a source of electric currents, of a set or sets of stationary brushes upon the commutator, a set or sets of brushes constantly moved about said commutator to and from the stationary brushes, and suitable working-circuits supplied from said commutator-brushes, and in which the potential is caused to constantly rise and fall by the action of the moving brushes, substantially as described.

3. The combination of an electric machine of the continuous-current type having collecting and distributing commutator-brushes upon the commutator thereof, working-circuits connected to said brushes, and means for constantly moving one of the sets of brushes toward and away from the other, thereby varying the potential between the said collecting and distributing brushes and changing the continuous into a pulsating or intermittent current in the working-circuits.

4. An electric generator having a sectional armature and commutator, and a set of stationary brushes therefor, and an additional brush or brushes constantly moving upon said commutator to raise and lower the potential in the working-circuits of the machine, substantially as described.

5. An electric generator having a sectional armature and a sectional commutator, a set or sets of stationary brushes upon said commutator, and a set or sets of brushes capable of constantly being moved upon the sectional commutator toward and away from the points of maximum and zero electro-motive force, substantially as described.

6. A system of generating and distributing currents of rising and falling potential, consisting of a dynamo-electric generator having one or more sets of stationary brushes upon the commutator thereof, one or more brushes constantly moving about the commutator to and from the stationary brushes, and connections between the working circuit or circuits and the stationary and moving brushes, substantially as described.

7. An electric generator of the continuous-current type, having an armature and commutator, two or more main brushes upon the commutator, and one or more brushes capable of constantly revolving upon the commutator, in order to produce constantly-recurring changes of potential between the main and revolving brushes, and connections from main and revolving brushes to working-circuits, substantially as described.

8. An electric generator having an armature and commutator therefor, two main stationary brushes, one or more brushes capable of constantly moving around the commutator, and working-circuits and translating devices between said brushes and actuated by the recurring rise and fall of current in said working-circuits, substantially as described.

9. The combination, with a generator or armature of the continuous-current type, of working-circuits therefor, and connections between one side of each circuit and the commutator-brushes, and an additional commutator brush or brushes connected to the other sides of said working-circuit, and means for constantly moving the auxiliary brush or brushes upon the commutator to produce a rising and falling of potential in the working-circuit, substantially as described.

10. The combination, with a generator or armature of the continuous-current type, of working-circuits therefor and connections between one side of each circuit and the main commutator-brushes, and an additional commutator brush or brushes connected to the other sides of said working-circuit, and means for constantly rotating the auxiliary brush or brushes continuously around the commutator to raise and lower the potential successively in the several circuits, substantially as described.

11. A pulsating-current generator having an armature with sectional winding and a sectional commutator therefor, one or more sets of stationary brushes upon the revolving commutator and one or more constantly-moving brushes upon said commutator, in order to vary the potential between the stationary and the moving brushes and proper circuits from said brushes to the working circuit or circuits, substantially as described.

12. A system of producing electric currents of succeeding rising and falling waves, consisting of an electric machine capable of producing a potential between its stationary brushes or collectors, and a traveling constantly-moving brush or brushes adapted to be moved between the main brushes of the machine upon the sectional commutators of the same, so as to produce a difference in potential between the stationary and the mov-

ing brushes, and proper connections between the stationary and moving brushes and the working-circuit, substantially as described.

13. The combination, with a sectional commutator and source of continuous currents, of a set or sets of stationary brushes upon the commutator, a set or sets of brushes moved about said commutator to and from the stationary brushes to produce pulsating or rising and falling currents in suitable working-circuits, an electro-magnetic reciprocating engine having a motor coil or coils connected to said working-circuits, and a magnetic piston moving within the coil or coils in synchronism with the rise and fall of energy therein.

14. The combination, with a source of pulsating or rising and falling currents, of a reciprocating electro-magnetic engine having at opposite ends thereof motor-coils of different capacities energized in alternation, and two circuits extending between the source of current and said motor-coils.

15. The combination, with a sectional commutator and a source of continuous currents, of a set or sets of stationary brushes upon the commutator, a set or sets of brushes moved about said commutator to and from the stationary brushes, two working-circuits connected to said commutator-brushes and including the motor-coils of an electro-magnetic reciprocating engine, said coils being of different conductive capacity, and in which the potential is caused to rise and fall by the action of the moving brushes, substantially as described.

16. The combination, with a rotating sectional commutator and a source of continuous currents, of a set or sets of brushes arranged to be constantly moved about the commutator, and driving-gear connected to a suitable source of power for continuously moving said brushes about said commutator, and thereby varying the potential of currents transmitted therethrough to suitable working-conductors.

17. The combination, with a revolving sectional commutator and a source of electric currents, of a set or sets of brushes arranged to be moved about the commutator, a controllable motor, and connections between the motor and the moving brushes for moving said brushes about said commutator with a controllable speed.

18. The combination, with a sectional commutator and a source of electric currents, of a set or sets of brushes arranged to be constantly moved about the commutator, an independent controllable motor, and connections between the moving part of said motor and the moving brushes for continuously moving said brushes about said commutator with a controllable speed, and thereby varying the potential of currents transmitted therethrough to suitable working-conductors.

19. The combination, with a source of pulsating or rising and falling currents of relatively high potential, 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, and tension-reducing devices in circuit with the said motor-coils and the supply-circuit.

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

CHARLES J. VAN DEPOELE.

Witnesses:

J. W. GIBBONEY,

GUSTAVE HELLEBUCK.