(No Model.)

# C. J. VAN DEPOELE.

## RECIPROCATING ELECTRIC ENGINE.

No. 431,495. Patented July 1, 1890.

*Fig. 1.*

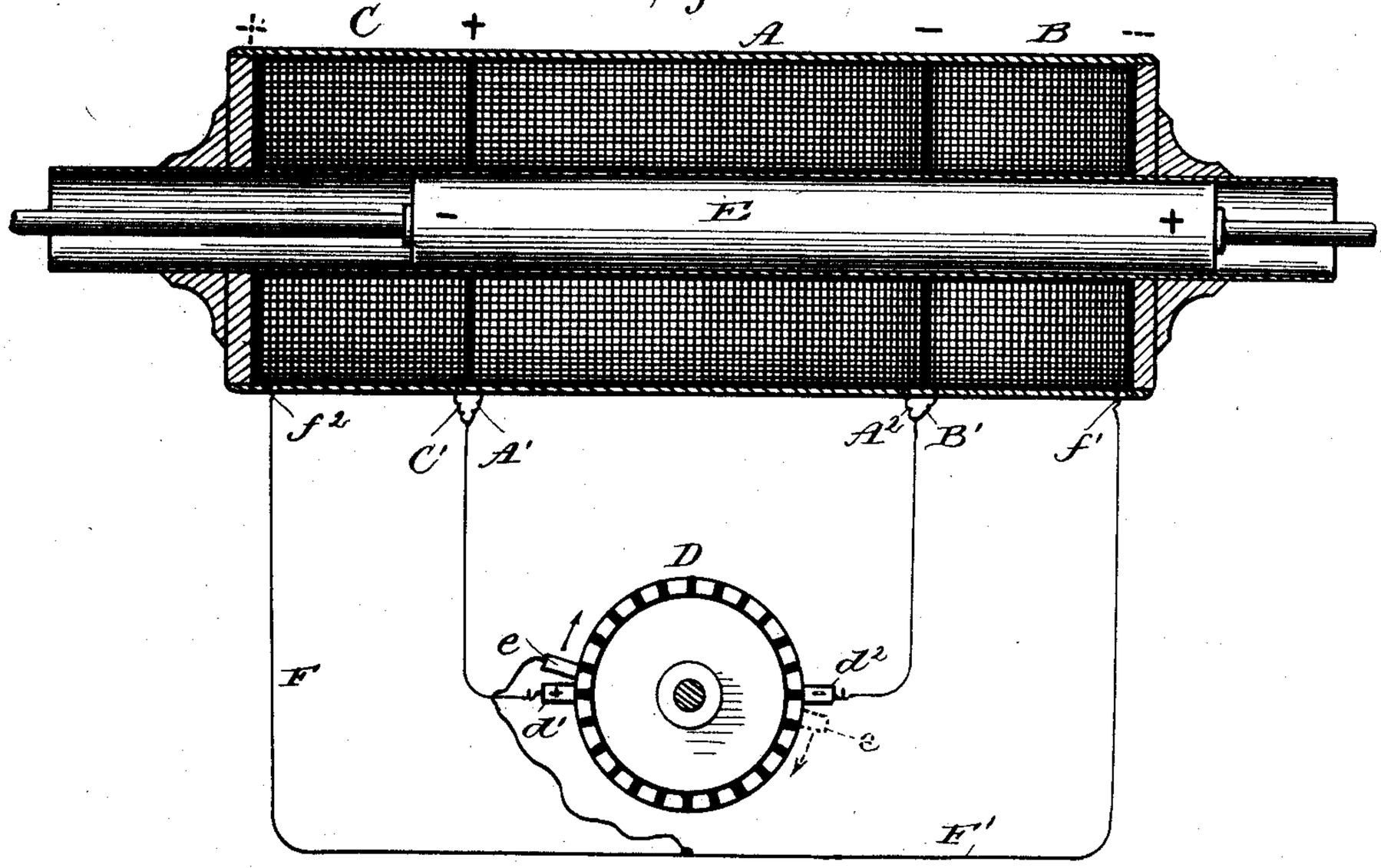
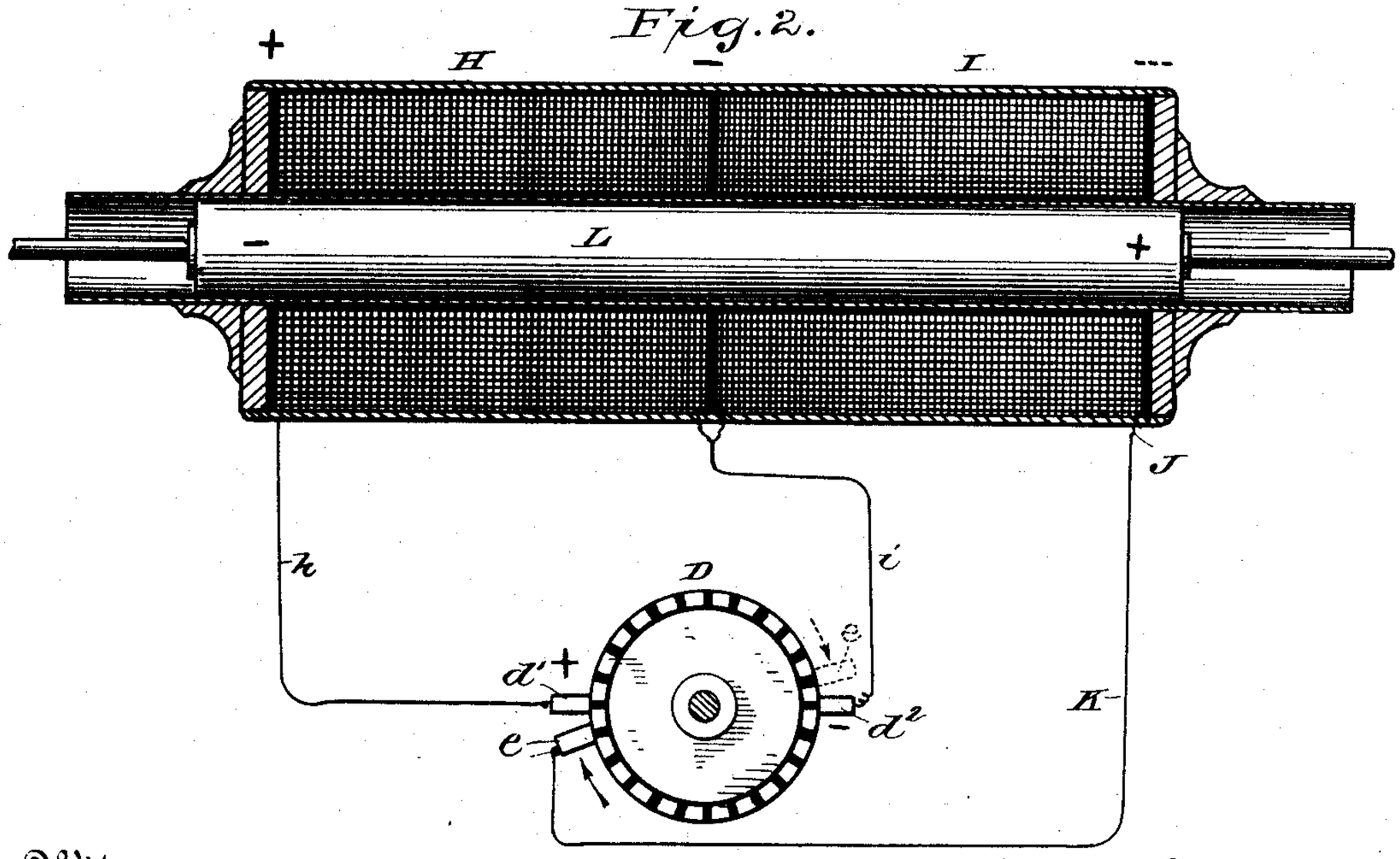



*Fig. 2.*

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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. 431,495, dated July 1, 1890.

Application filed April 18, 1890. Serial No. 348,545. (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 of reference marked thereon.

My invention relates to improvements in reciprocating electric engines of the type in which two or more motor-coils are provided, said coils being adapted to act upon and reciprocate a magnetic piston which is propelled therethrough by the shifting of the current from coil to coil. The supply-current should be continuous in direction, and is shifted in the respective coils so as to change the position of the field of force therein and thereby impart motion to the magnetic piston, which, as will appear, is constantly magnetized and therefore responds without delay to the changes in the supply-current.

The following detailed description will explain the construction and operation of the apparatus, the novel features of which will be referred to in the appended claims.

In the drawings, Figure 1 is a diagrammatic representation of an organization of apparatus embodying the invention. Fig. 2 is a similar view, differing from Fig. 1 in certain electrical details.

In Fig. 1 of the drawings, A B C represent motor-coils, the coils B C being arranged at opposite ends of coil A, and the coil A being desirably, but not necessarily, considerably larger than either of the coils B C. The sectional commutator of a continuous-current armature is represented at D, and said commutator is provided with main positive and negative commutator-brushes $d' d^2$. The adjacent terminals C′ A′ of the coils A and C are united and connected to the commutator-brush $d'$. The corresponding adjacent terminals $A^2$ B′ of the coils A B are similarly connected to the opposite commutator-brush $d^2$, so that current will constantly flow through the coil A and powerfully magnetize a magnetic piston E, which is arranged to be reciprocated within the coils A B C, and to which drilling or other tools may be connected for the purpose of performing useful work.

An additional commutator contact or brush *e* is provided, said brush *e* being adapted to be moved around the commutator or back and forth between the fixed brushes in any convenient manner—as, for example, in any of the ways set forth in my patent, No. 422,855, dated March 4, 1890, or any of the divisions thereof. The moving brush *e* is connected, as by conductors F F′, with the outer terminals $f' f^2$ of the coils B C. With this arrangement, assuming the brush *e* to be constantly moved around the commutator at the desired rate of speed, current will flow continuously in the coil A and alternately in the coils B C. Movement of the brush *e* is indicated by the arrows and by the dotted positions.

With the positions shown in Fig. 1 some current will be flowing in the coil A, the same being permanently connected between the main commutator-brushes. A portion of the current, however, will be diverted through the connection $f'$ into the coil B, returning therefrom through terminal B′ to the negative brush $d^2$. The moving brush *e* being at this moment adjacent to the main positive commutator-brush $d^2$, the coil C is short-circuited and the coil B has attained its maximum power and forms practically a continuation of the magnetic field of the coil A. Under these circumstances, the coil C being dead, the coils B and A will coact upon the plunger E to impel it forcibly toward and partly through the coil B. It will be understood that the coils A B C can be made of any relative size to meet the requirements of different lengths of stroke. As the brush *e* moves away from the positive commutator-brush the current will be gradually shifted from the coil B to the coil C, falling in coil B while rising in coil C. This will, of course, have the effect of transferring the field of force to the opposite end of the machine, the coil C coacting with the coil A to draw the plunger E toward and partly through the coil C. Current will therefore rise and fall in the coils B and C alternately during and in accordance with the movement of the brush *e*.

As before stated, the coil A is always in circuit between the main commutator-brushes,

and the proportion of current flowing through said coils as well as that flowing through the coils B and C will depend upon their several resistances.

As seen in Fig. 2, the engine is provided with two substantially similar motor-coils H I. The inner terminals of said coils are connected by conductor *i* with the negative commutator-brush $d^2$, while the outer terminal only of the coil H is connected by conductor *h* with the positive commutator-brush *d'*. The remaining terminal J, being the outer terminal of coil I, is connected by conductor K with the moving commutator-brush *e*. With this arrangement the main supply-current will constantly traverse the coil II, powerfully magnetizing the plunger L, which, as indicated, is a heavy rod of iron about as long as or—in some cases where weight would be of advantage—even longer than the combined coils H I.

When the traveling brush *e* is in the position seen in Fig. 2, both of the coils H and I will be receiving current, since the main current at the positive commutator-brush will be divided, part of it passing out through the said main brush and conductor *h* into and through the coil H, returning to the negative commutator-brush through conductor *i*. The other portion of said current will pass through the moving brush *e*, conductor K, into coil I at J, thence through coils I, also returning to the commutator through the negative conductor *i*. As the brush *e* moves away from the positive brush *d'*, the current diverted thereby to the coil I will decrease the current flowing through the coil H, remaining practically constant. The current in the coil I will continue to decrease until the brush *e* is near to or opposite the negative commutator-brush $d^2$, when the said coil I will be practically short-circuited. With this arrangement the coil H will be always alive, whereas the current in the coil I will, with each rotation of the moving brush, pass from zero to maximum and from maximum to zero. When the current in the coil I is at the maximum, the plunger L will be drawn in into a position of magnetic equilibrium between said coils, as shown, and as the current falls in the coil I the plunger will seek a position of magnetic equilibrium in the constantly-energized coil H and be forcibly projected, and if provided with tools or mechanical connections can be arranged to perform useful work.

In describing my improved electro-magnetic reciprocating engine I have set forth but one specific means of producing the current-changes necessary to secure the desired movement of the magnetic piston. It must be understood, however, that similar electromagnetic effects can be otherwise secured. For example, the current might be supplied to the coil H constantly from an unvarying source, and the current in the coil I be caused to rise and fall as by means of the herein-described mechanism interposed between the source of continuous current feeding the coil H and a circuit derived therefrom and including the coil I. Good results might also be secured by sending a constant current through the coil H and an alternating current through the coil I. The same principle applies to a three-coil machine, as shown in Fig. 1. These modifications will, however, form the subject of a separate application for Letters Patent.

The particular arrangement of the parts, as well as the proportions shown by way of illustration, may of course be modified without departing from the invention.

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

1. A reciprocating electro-magnetic engine having constantly-energized motor-coils and a supplementary coil or coils in which the current alternately rises and falls, the combined coils reacting upon and imparting reciprocating motion to a magnetic piston movable therein, substantially as described.

2. An electro-magnetic reciprocating engine comprising a magnetic piston and a constantly-energized coil or coils reacting thereon, and an additional intermittently-energized coil or coils disturbing the field of force of the main coil or coils to produce a reciprocating movement of the magnetic piston, substantially as described.

3. A reciprocating electro-magnetic engine having a magnetic piston, a motor coil or coils reacting thereon and constantly in circuit with a source of continuous current, an additional coil or coils arranged to shift the field of force of the main coil or coils, and means for intermittently energizing the additional coils and thereby reciprocating the magnetic piston, substantially as described.

4. A reciprocating engine comprising a plurality of motor-coils and a magnetic piston, one of said coils being constantly energized to magnetize the piston, a source of continuous current, and means for causing the supply-current to rise and fall in part of the motor-coils to produce reciprocations of the magnetic piston, substantially as described.

5. In a reciprocating engine, a plurality of motor-coils, a sectional commutator, and source of continuous current, connections between the free terminals of part of said coils and the main commutator-brushes, a movable commutator-brush, and connections between said moving brush and the other terminals of the motor-coils, whereby the current is raised and lowered from maximum to zero in part of the said motor-coils, substantially as described.

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

CHARLES J. VAN DEPOELE.

Witnesses:

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FRANKLAND JANNUS.