

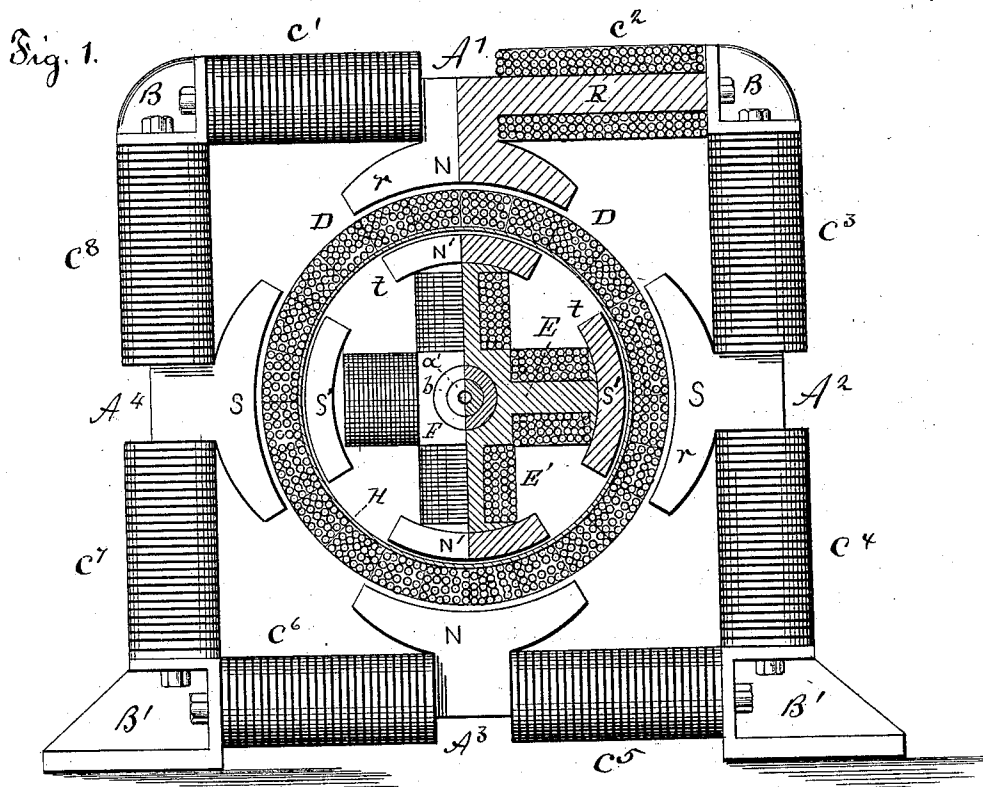
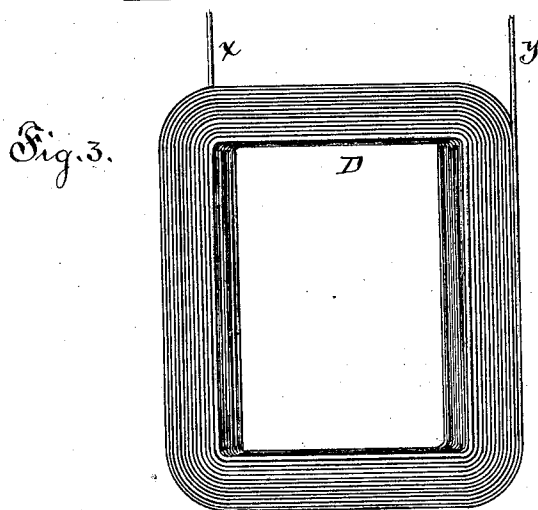
(No Model.)

4 Sheets—Sheet 1.

T. L. DENNIS.
DYNAMO ELECTRIC MACHINE.

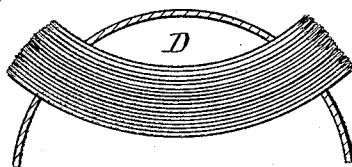
No. 295,368.

Patented Mar. 18, 1884.



WITNESSES: Fig. 4.

D. D. Mott
P. B. Miller



INVENTOR:

T. L. Dennis

BY

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(No Model.)

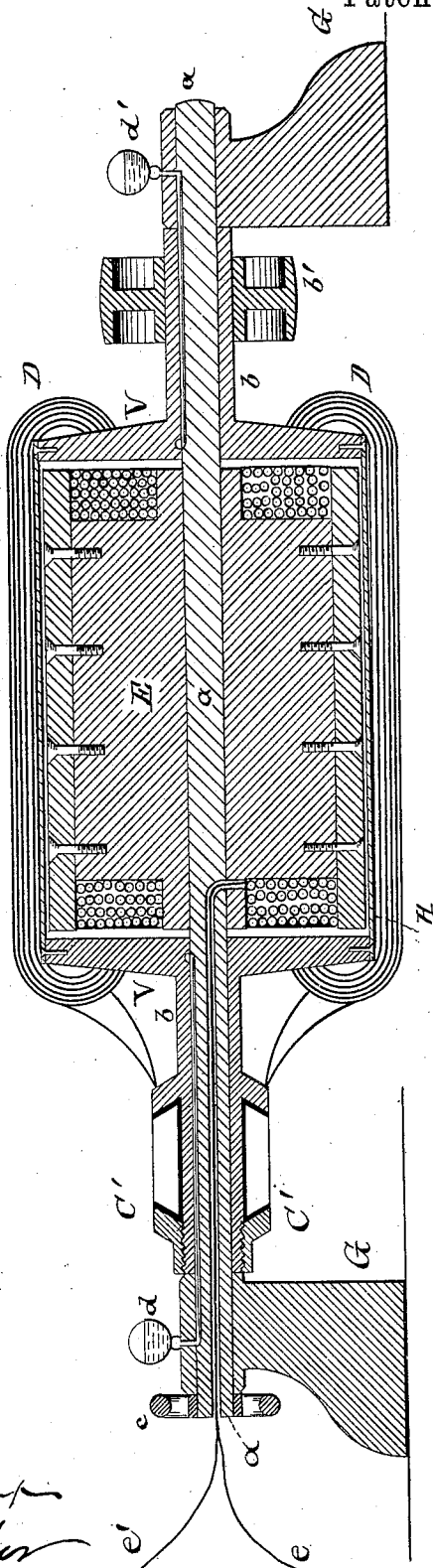
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Fig. 2.



WITNESSES:

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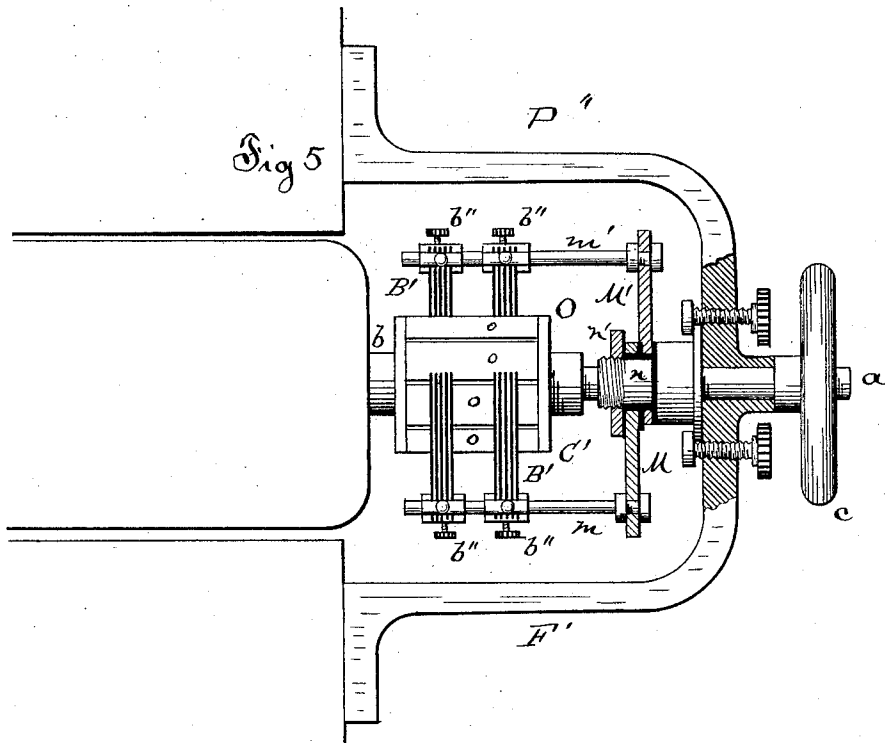
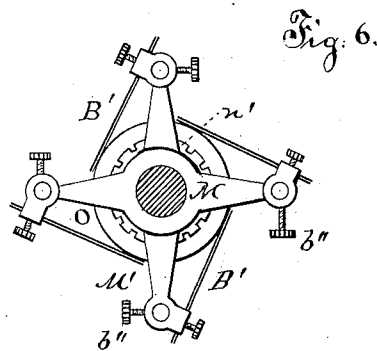
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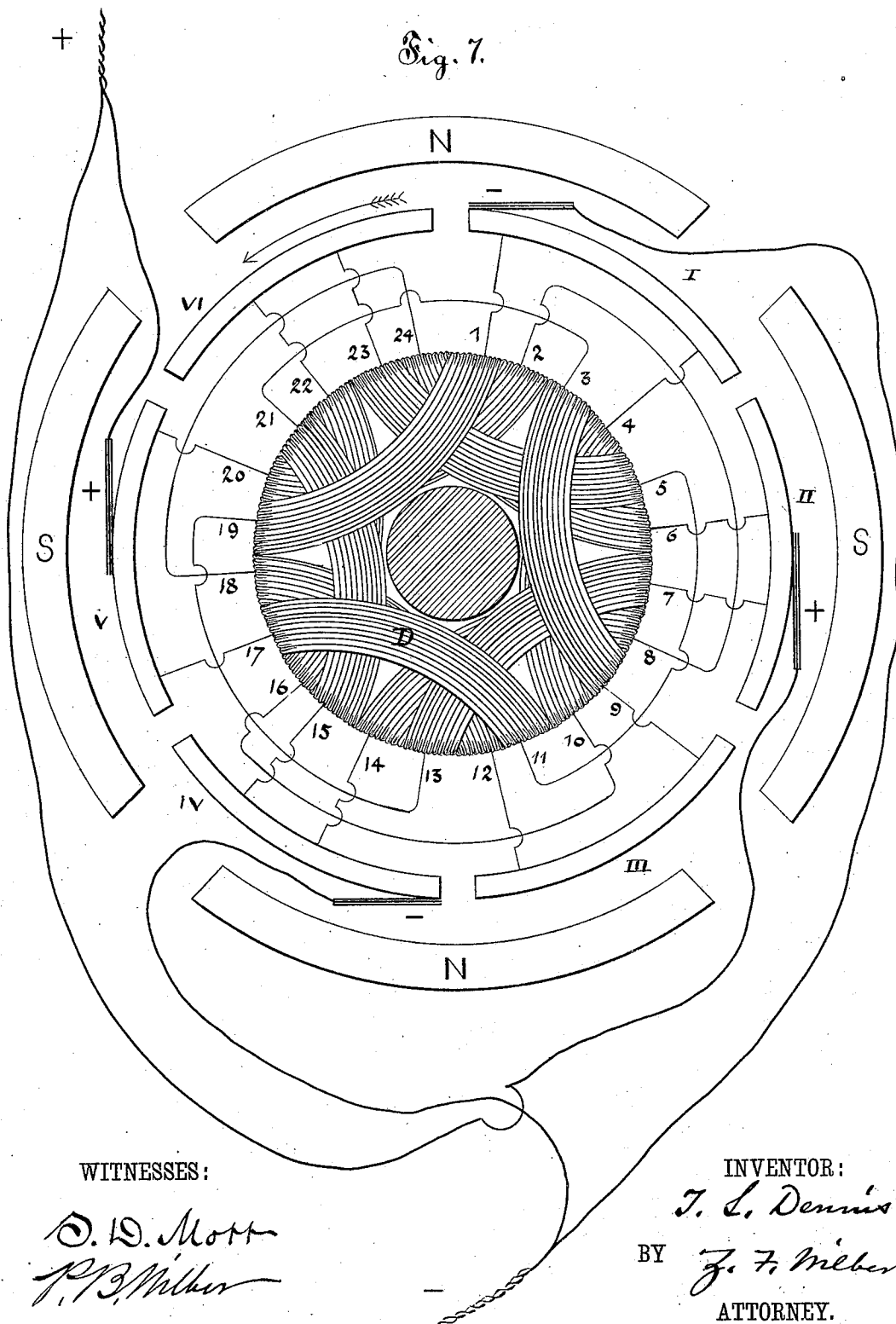
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Patented Mar. 18, 1884.



UNITED STATES PATENT OFFICE.

THOMAS L. DENNIS, OF NEW YORK, N. Y.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 295,368, dated March 18, 1884.

Application filed November 9, 1882. (No model.)

To all whom it may concern:

Be it known that I, THOMAS L. DENNIS, residing in the city, county, and State of New York, have invented certain Improvements in
5 Dynamo-Electric Engines or Generators, of which the following is a specification.

The object of my invention is to produce a magneto-electric machine easy of and economical in construction, durable, efficient in operation, and of wide range of adjustability, so far
10 as its generative capacity is concerned.

To the accomplishment of these ends my invention consists in the features more particularly hereinafter described and claimed.

15 The revolving armature in which the currents are generated or induced has its helices or coils wound longitudinally of the axis of the machine, and revolves in a magnetic field formed between the partly circular poles of
20 fixed interior and exterior field-magnets. In constructing this armature no core is used, but the coils are placed over a supporting-shell of any sufficiently rigid non-magnetic material. The coils are made as entire paral-
25 lelograms, and then placed upon the supporting-shell, and in such manner that the armature may be taken to pieces to get at any defect or defective coil without unwinding or destroying any coil. The exterior field-
30 magnets are four in number, each formed of an iron core having at its center a projecting piece concave on its interior, forming part of the field. Each is so wound upon the portions
35 upon either side of the field projection that the coils mutually coact to produce the same polarity in the field-pole. The four are united together into a parallelogram by corner angle-
40 irons, to which they are bolted, all the coils being so arranged as to give a regular alternation in polarity, N S N S, to the four exterior field-magnets. The interior field-magnet consists of four arms radiating from a hub, each arm terminating in a polar extension of convex face concentric to the concavity of the
45 polar extension of the exterior fields. Upon the arms are wound the magnetizing-coils and in such manner as to give a regular alternation in polarity. There being four exterior and four interior projecting polar extensions, four
50 fields of force are formed. The interior field-

magnet is rigidly fixed to a supporting-shaft, which normally is always at rest, but is provided with means by which it may be turned slightly, carrying with it the interior field system, and varying the relation between the
55 interior and exterior polar projections, also thereby varying the magnetic force of the field, and hence eventually the generative capacity of the machine. The revolving armature is attached by suitable heads to sleeves, one at
60 each end, which rotate upon the fixed shaft of the interior field system. The sleeve upon one end carries a pulley, the one on the other end the commutator or collector, although both may be on one sleeve. The commutator or
65 collector is mounted on one of the sleeves, and four sets of brushes, with several in each set, are used, two sets being connected together for the + and two for the - currents. The connection for the sets of one polarity is a rigid
70 arm, at each end of which is supported by a projecting arm one of the sets. The rigid arms cross, but are insulated from each other and from the fixed sleeve on which they are supported. This sleeve is provided with a
75 jam-nut, holding the arms in any desired position and permitting their adjustment relatively to each other. The wires forming the connection to the interior field-coils pass there-
80 through a longitudinal bore in the fixed shaft, and the interior and exterior field-coils may be connected directly in series with the induction armature-coils, or in multiple are thereto, either singly or jointly. These and other matters embodied in my invention may
85 be better understood by reference to the drawings, in which—

Figure 1 is a front view, partly in section, showing the relation of the induction-armature, the interior and exterior field systems;
90 Fig. 2, a longitudinal section of the machine, omitting the exterior field system. Figs. 3 and 4 are top and end views, respectively, of a single bobbin or coil of the revolving armature. Fig. 5 is a top view, showing the
95 arrangement of the commutator or collector, while Fig. 6 is an end view of a detail thereof. Fig. 7 is a diagram showing the circuit-connections of the armature-coils and the commutator or collector.

A' A² A³ A⁴ is the exterior field system. Each side consists of a core, R, having at its center an interior polar extension, *r*, with a concave face. Upon this core, on each side of *r*, is wound a coil. These coils are noted at C' C², &c. Their winding is such that both C' and C² coact in giving one polarity to *r* of A²—say S—that is, the system is one of four fields, A' to A⁴ being one magnet, while all the magnets mutually coact and assist in the work of those adjacent. These sides are joined together by angle-irons B B', so as to form a rigid structure. Of these angle-irons, B' B' may be formed also as bases for the machine.

The interior field consists of four arms, E, radiating from a hub, F, each arm ending in a polar projection, *t*, of convex exterior and concentric to the concave faces of *r*. Upon the arms E are wound the coils E', whereby interior field-magnets, N' S', are formed. This system of interior field-magnets is rigidly secured to a shaft, *a*, supported in bearings G G, the shaft *a* being normally at rest therein, but being provided with means—as, for instance, a hand-wheel, *c*—by which it may be turned in its bearings, so as to alter the relation of the inner and exterior fields. As shown in Fig. 1, inner N' and exterior N are seen as opposed to each other. By giving *a* a one-quarter turn in its bearings, N and S would be opposed to each other, and between these two limits—N opposite N and N opposite S—there is a wide range of adjustment for varying the amount or character of work done by the machine.

In the space between the inner and exterior field systems rotates the induction-armature. By means of heads or arms V, attached to sleeves *b b*, it is attached to such sleeves, they rotating upon the shaft *a*. Upon one sleeve is a pulley, *b'*, for communicating motion to the revolving armature, while upon the other is the commutator or collector C'. The wires *c c'*, leading to the coils of the interior field, are passed thereto through a hole bored longitudinally in the shaft *a*.

As is customary, means should be provided for the lubrication of the bearings or journals, for which purpose ordinary oil-cups, *d d'*, are provided, but which form no part of the invention herein claimed.

The revolving armature is composed of a number of helices or coils, D, supported upon a light but rigid cylinder, H, which is secured to the heads or arms V. Each coil is made in any suitable method or by any suitable means, as an entirety and as a parallelogram, as shown, the coils being of various lengths, a number (three) of the shortest length being taken for, say, the first set. The next set is of equal number, but of a length equal to the first plus the thickness of the first, so that the second may be placed over the first at the inactive ends. The surface of the armature is covered by coils by first taking three of the shortest coils, which are placed upon the shell H at intervals from each other equal to the width of

a coil. For instance, in Fig. 7 these three coils would be 6 24, 8 14, and 16 22. In the intervals between the two convolutions of each of these three coils, and at a distance equal to the width of a coil therefrom, three more are placed in position, their ends lying over the ends of the first three—as, for instance, 2 20, 4 10, and 12 18. Three more—say 5 23, 15 21, and 7 13—are now put in position, and then the last three—1 19, 3 9, and 11 17—are fixed in position, the latter acting as keystones to arches and aiding in binding all firmly in position. The contiguous coils are not connected, nor are the diametrically-opposite windings of a coil connected, as in the so-called "Gramme ring" and "Siemens armature," but the coils are connected as shown in Fig. 7, in which figure the six plates of the commutator are designated as I, II, III, IV, V, and VI. In this figure each longitudinal convolution of a coil is marked as a coil, and they are numbered 1 to 24. It will be seen that the opposite convolutions of each coil, or that the convolutions forming two connected numbered coils, are separated by five others. Each complete coil, as in Fig. 3, forming two of the numbered coils in Fig. 7, has two free ends, one of which is connected to a plate of the commutator or collector, the other to the sixth coil in order therefrom. For instance, the free ends of 2 and 8, 3 and 21, 5 and 11, 10 and 16, 13 and 19, 18 and 24, are united, the other free end being connected to a plate of the commutator or collector, as 1 4 6 7 9 12 14 15 17 20 22 23. The collector or commutator has six plates, shown as spread out diagrammatically in Fig. 7. These plates are insulated from each other, and are fixed to an insulating-base and secured to one of the sleeves *b*, the coils being connected to the various plates, as shown in Fig. 7.

Two sets of brushes or springs are used for each polarity. Two arms, M M', are borne upon a sleeve, *n*, and insulated therefrom and from each other. Each arm carries at each end and in front of the commutator or collector an arm, *m* or *m'*, upon which are adjustably secured the brushes B'. The end of the sleeve *n* is screw-threaded at its inner end, and carries thereon a clamping-nut, *n'*, which may be clogged at its periphery, as shown in Fig. 6, to permit its easy manipulation. Upon loosening it the arms M M' may be placed in relative position to each, and then clamped firmly in such position.

As seen in Fig. 7, two brushes of the same polarity are always in contact with opposite plates of the commutator or collector. When the parts are in the position there shown, the paths of the generated currents—the exterior circuit between + and — of course being always understood—are in one set of coils + II 7 13 19 1 I —; in a second set, + V 20 2 8 14 IV —; in third set, + II 6 24 18 12 III 9 3 21 15 IV —; and in the fourth set, + V 17 11 5 23 VI 22 16 10 4 I —, all the coils being in cir-

cuit; but the third and fourth sets include eight coils each, instead of four, as in the first and second sets; but of these eight in the third and fourth sets, 9 3 21 18 22 16 10 4 are in the neutral spaces and inactive; hence each set has four active coils and the machine the electro-motive force of four active coils in each set—that is, the quantity of the machine is that of four four-coil machines and the electro-motive force that of four coils.

Both strength of current and the electro-motive force of the machine may be varied or regulated by changing the field in which the armature revolves by altering the positions relatively to each other of the inner and outer field systems, as before noted, or by changing the positions of the + and — brushes relatively to each other on the commutator or collector.

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

1. In a dynamo or magneto electric machine, the combination of interior and exterior field-magnet systems and a hollow cylindrical armature revolving between the two, the interior field system being adjustable relatively to the exterior field system, substantially as set forth.

2. In a dynamo or magneto electric machine, a system of interior field-magnets, consisting of a hub, radial arms carrying coils, and enlarged polar extremities, all mounted upon a movable shaft and adapted to be adjusted relatively to the exterior field-magnet system, substantially as set forth.

3. The combination, in a dynamo or magneto electric machine, of an exterior system of field-magnets, an interior system of field-magnets, and means for changing or varying the relative position of the two systems, substantially as set forth.

4. The combination, with a collector or commutator, of two sets of brushes or springs for each polarity, electrically connected, and means for adjusting the sets of different polarity relatively to each other, substantially as set forth.

5. In a dynamo or magneto electric machine, the combination of a fixed system of exterior field-magnets, an adjustable system of interior field-magnets rigidly attached to or mounted upon a movable shaft, and a revolving hollow cylindrical armature supported by sleeves upon the shaft and capable of rotation thereon, substantially as set forth.

6. In a dynamo or magneto electric machine, a system of interior field-magnets, consisting of a hub, radial arms carrying coils, and polar extensions therefor, all mounted upon a movable shaft and adapted to be adjusted relatively to the exterior system of field-magnets, the movable shaft being perforated longitudinally to permit the passage therethrough to the inner field system of the requisite electrical conductors, substantially as set forth.

THOMAS L. DENNIS. [L. s.]

Witnesses:

EUGENE N. ELIOT,
HARRY EDWARDS.