(No Model.) 4 Sheets—Sheet 1.

W. M. MORDEY.

ELECTRIC GENERATOR.

No. 437,501. Patented Sept. 30, 1890.

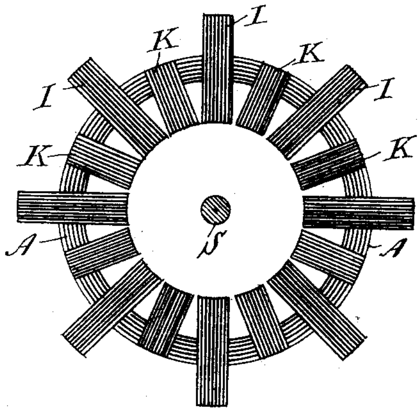


Fig.1.

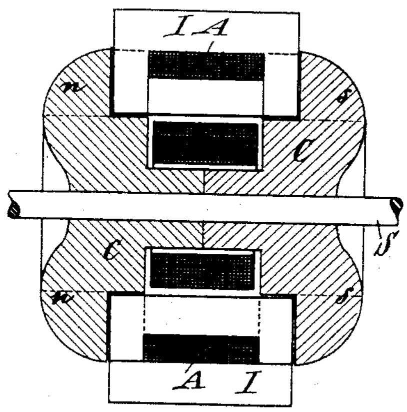


Fig.2.

Witnesses

F. H. Birmingham

W. Gross

Inventor

W. M. Mordey

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

4 Sheets—Sheet 2.

W. M. MORDEY.

ELECTRIC GENERATOR.

No. 437,501. Patented Sept. 30, 1890.

Fig. 4.

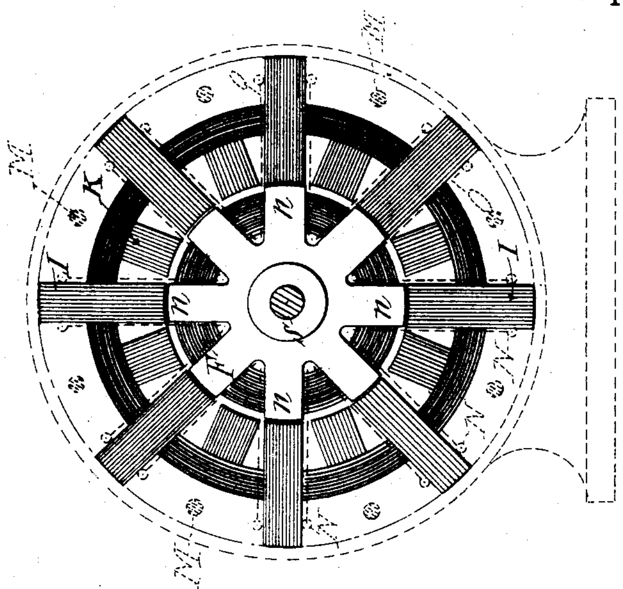
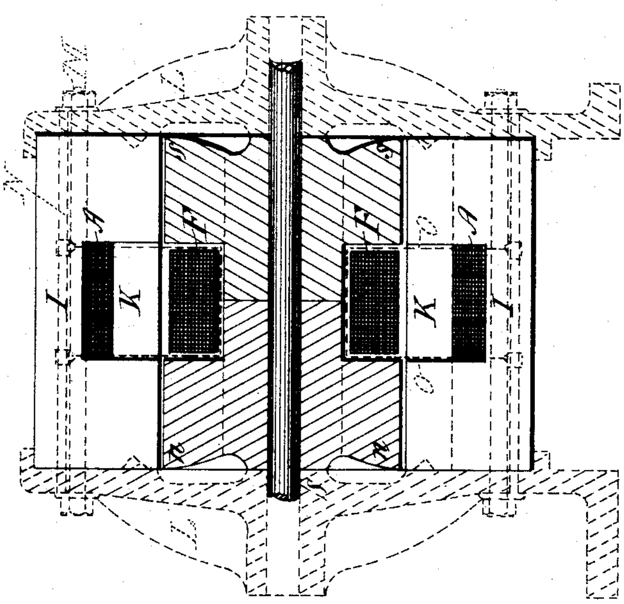


Fig. 3.



Witnesses.
Jos H Blackwood
W. G. Doolittle.

Inventor.
Wm M. Mordey
by Wm H. Doolittle
Atty

(No Model.) 4 Sheets—Sheet 3.

W. M. MORDEY.

ELECTRIC GENERATOR.

No. 437,501. Patented Sept. 30, 1890.

Fig. 4A

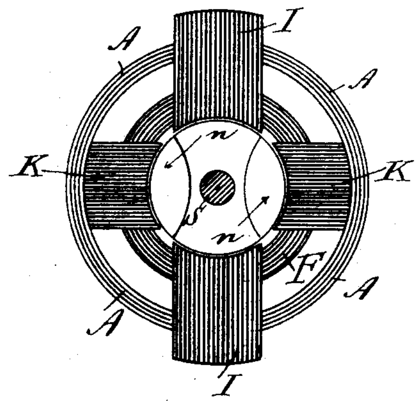


Fig. 4B

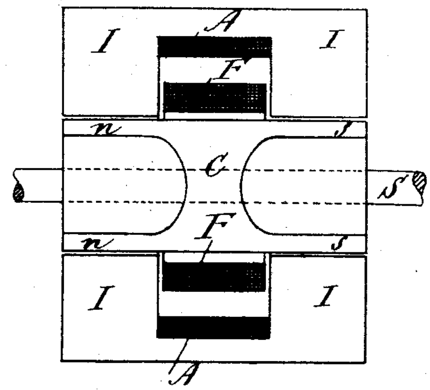


Fig. 10.

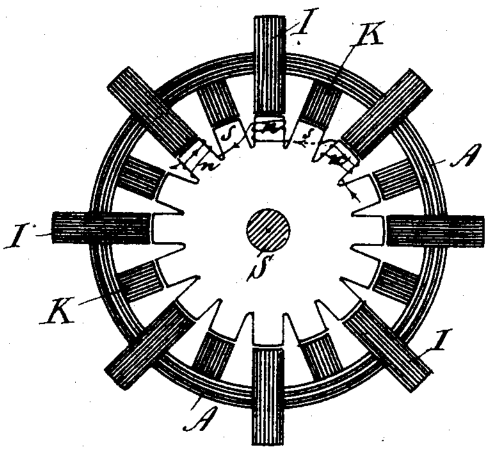
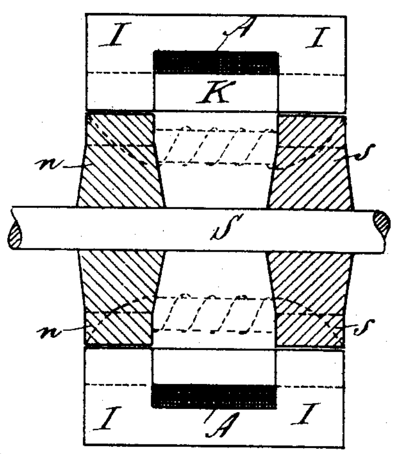


Fig. 11.



Witnesses
[illegible]
W. Cross

Inventor.
W. M. Mordey

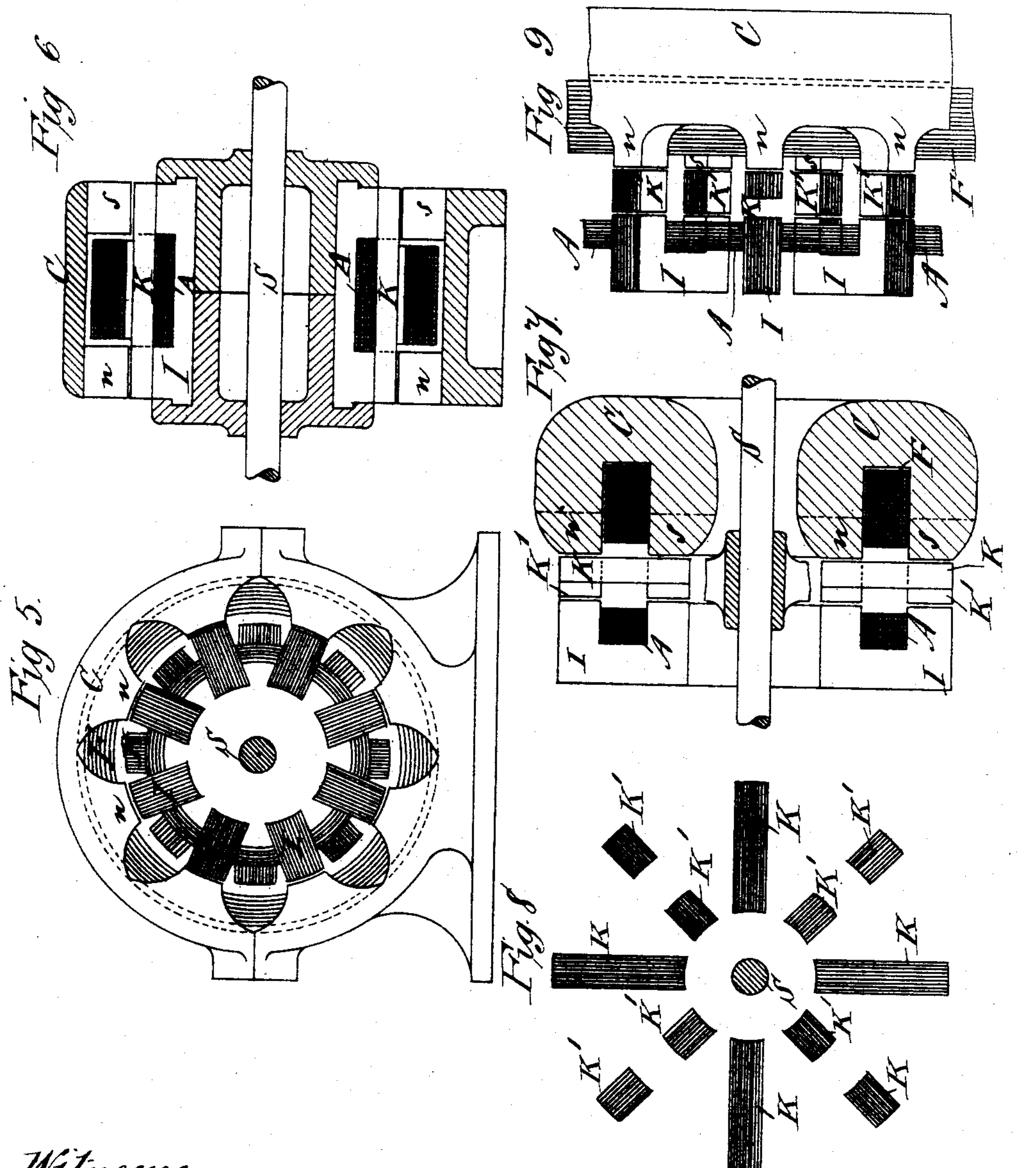
(No Model.)

4 Sheets—Sheet 4.

W. M. MORDEY.

ELECTRIC GENERATOR.

No. 437,501. **Patented Sept. 30, 1890.**



Witnesses

Inventor:

W. M. Mordey.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM MORRIS MORDEY, OF LAMBETH, ENGLAND.

ELECTRIC GENERATOR.

SPECIFICATION forming part of Letters Patent No. 437,501, dated September 30, 1890.

Application filed March 25, 1889. Serial No. 304,696. (No model.) Patented in England April 7, 1888, No. 5,162; in France March 18, 1889, No. 196,784; in Belgium March 19, 1889, No. 85,446; in Italy March 31, 1889, No. 32; in Switzerland June 25, 1889, No. 1,126, and in Austria-Hungary August 31, 1889, No. 13,369.

To all whom it may concern:

Be it known that I, WILLIAM MORRIS MORDEY, a subject of the Queen of Great Britain, residing at Lambeth, in the county of Surrey, England, have invented Improvements in Electric Generators, of which the following is a specification.

Foreign patents have been obtained for this invention as follows: in Great Britain, No. 5,162, dated April 7, 1888; in France, No. 196,784, dated March 18, 1889; in Belgium, No. 85,446, dated March 19, 1889; in Italy, No. 32, dated March 31, 1889; in Austria-Hungary, No. 13,369, dated August 31, 1889, and in Switzerland, No. 1,126, dated June 25, 1889.

The present invention has for its object a method of constructing an alternate-current machine having only a single armature coil or winding in place of a considerable number of such coils or windings. Thus I am enabled to construct alternate-current machines for any speed and required rate of alternations in which there is but one simple annular armature-coil and one simple annular field-magnet coil, although I sometimes employ a compound field or fields of ordinary constructions. By these means alternate-current machines are greatly simplified in construction, while at the same time increased efficiency is obtained and the difficulties of insulating in such machines are much reduced.

In order that the nature of this invention, which consists in subjecting the single armature coil or winding to a succession of magnetic inductive impulses, either successively in the same direction or alternately in opposite directions, and in providing against prejudicial inductive reactions in the field, may be readily understood, reference is made to the accompanying drawings, in which—

Figures 1 and 2 are respectively an end elevation of the armature and a vertical section in the line of the shaft, illustrating diagrammatically one method of carrying my invention into practice. Figs. 3 and 4 are similar views to Figs. 2 and 1, respectively, illustrating diagrammatically another way of carrying out this invention. Fig. 4^a^ is an end elevation, and Fig. 4^b^ a side elevation, partly in longitudinal section, showing diagrammatically an arrangement similar to Figs. 3 and 4, but having a smaller number of parts. Figs. 5 and 6 illustrate a modified construction of electric generator according to this invention. Fig. 7 is a vertical section; Fig. 8, an elevation, and Fig. 9 a plan, of a portion of a further modified construction of electric generator. Figs. 10 and 11 are respectively an end elevation and a longitudinal section illustrating another construction.

Referring to Figs. 1 and 2, the armature-conductor is formed into a simple coil, ring, or annulus or hollow cylinder A, usually of large diameter and relatively of small radial depth or thickness, and is preferably supported with its axis in a horizontal plane. Masses I I, formed of laminated iron or iron wire, are placed around its periphery at intervals and with spaces between them. These masses, which are shown ⊔-shaped, are preferably laminated or subdivided, as shown. Alternately in angular position with regard to these outer iron portions I I other laminated iron masses K K are placed inside the coil A and close to its inner periphery. These iron masses K K are ⊔-shaped, the outer masses I I being placed so that their ends point toward the axis of the coil, while the inner ones K K have their ends pointing radially outward. It will thus be understood that the single coil or annulus A, which forms the armature-winding, is contained between two concentric circular rows of masses of iron I I and K K, the several portions of which alternate in angular position with one another in the order I K I K around the outside and inside of the armature-coil. The number of these inner and outer masses of iron is determined by the required rate of alternation and by the required rate of revolution of the moving part of the machine. Thus the number of alternations or complete periods per minute is equal to the number of revolutions per minute multiplied by half the number of such iron masses. The disposition of the armature-winding A practically does away with any necessity for working at a high-current density or for limiting the space occupied by insulating material. The conductors are, in fact, as easily and securely arranged as if they did not form part of a dynamo.

It will be observed that by the use of the masses K K (which I call "magnetic short-circuiting pieces") all or nearly all prejudicial inductive effects in the magnet are avoided, the flow of magnetic lines of force in the magnet being maintained practically constant. Thus the lines of force pass through the magnet and either through the pieces I I or K K, according to the position of the poles, or partly through one and partly through the other when the poles are passing from one to the other, the magnetic circuit never being interrupted.

The several pieces I I and K K should be so designed with regard to one another that whether the lines of force are passing through I I or through K K the resistance of the magnetic circuit should be sensibly constant. By this arrangement I avoid useless expenditure of energy, which would otherwise be manifested by the heating of the poles and core of the magnet and in other ways. This method of providing for the continuity of the magnetic circuit may be applied in other ways than those shown in the figures, which, however, sufficiently describe the principle.

The armature may be used with any suitable form of field magnet or magnets; but I prefer a simple form of field, as shown in Figs. 1 and 2, and consisting of an iron core C, mounted upon the shaft S, passing axially through the center of the armature-coil A, and having at either end a number of radial arms or projections *n n s s*, which come into close proximity to the ends or sides, or both, as in the arrangement shown of the iron masses I I and K K of the armature, the number of such projections *n n* or *s s* extending radially from each end of the field-core being equal in number to the masses of iron on the outside or on the inside of the armature-coil A. The field coil or winding F is within and concentric with the armature-coil A. This field-winding F may be wound on and rotate with the field-magnet C *n s* and shaft S, but is preferably held stationary on a frame provided for the support, also, of the armature-coil and its iron masses, as hereinafter described, and shown in dotted lines in Figs. 3 and 4. As the figures are diagrammatic this frame is not shown. Thus the only part of the machine rotated is the shaft S and the iron of the field-magnet, no collectors or rubbing contact of any kind being required.

In Figs. 3 and 4 the outer iron masses I I of the armature are ⊔-shaped, as before, inclosing the armature on three sides, the open ends of these ⊔ pieces I I facing the field-poles *n s*, there being other laminated pieces of iron K K extending across and between the field-poles *n s* alternately with the armature ⊔ pieces.

L L are side frames (shown in dotted lines) by which the iron masses I K and armature-coil A are carried, and in which the shaft S revolves. These frames are bolted together by bolts M, and carry a number of rods N, to each of which are attached the ends of a strap O, that partly encircles the field-winding F when this winding is to be held stationary. This arrangement, as shown in Figs. 4^a and 4^b, is very suitable for rapid rotations—as, for instance, when the motor is a steam turbine. The revolving magnet C *n s*, carried on the shaft S, consists of a cylinder of iron C, the end portions of which are partly cut away or grooved laterally, leaving the polar surfaces *n n s s*; or the cutting away or grooving may extend the whole length of the cylinder. The laminated ⊔-shaped iron portions I I K K are placed about the armature-coil A, the portions I I passing without the coil A, the portions K K being within the coil A. This arrangement allows of the magnet C *n s* being readily withdrawn or inserted without interfering with the armature-coil, field-coil, or iron masses I I K K. The number of polar surfaces *n s* and iron masses I K is determined by the required rate of rotation and rate of alternations.

The relative positions of the armature and field magnets may be varied in any suitable way. Thus Figs. 5 and 6 show an arrangement in which the field C, with its poles *n n s s* and field-winding F, instead of being within and concentric with the armature are outside of and concentric with the armature. In this arrangement Figs. 5 and 6 the armature masses I I K K and armature-coil A are supposed to be attached to and carried by the shaft S; but in this or any of the other arrangements either the armature or the field may be revolved.

Various other ways of arranging the parts will readily suggest themselves to those skilled in the art to which this invention relates. Thus the field and armature parts of the machine may be arranged to face each other in a horizontal direction, as hereinafter described with reference to Figs. 7, 8, and 9; or the field may be stationary as well as the armature, the rotating part comprising a number of laminated iron masses, which, by their movement, vary the magnetic induction exerted by the field on the armature. Figs. 7, 8, and 9 show one way in which this arrangement may be carried out. In these figures the supports for the laminated iron masses are not shown; but it is to be understood that these masses are supported in any suitable manner and driven by a shaft S. The field consists of a grooved casting C *n s*, containing the magnetism-winding F, and provided with projections *n n s s*, forming the poles of the magnet. The armature-winding A is surrounded at intervals on three of its sides by the laminated ⊔-shaped iron masses I I, the open ends of which project in the direction of the field-magnet. Between the armature and field is the rotating part of the machine, consisting of laminated iron masses K K K'

K', of which K K are of such a length as to extend from the poles n to the poles s of the field-magnet, while K' K', which are in pairs, are short radially, as shown, and are magnetically separated by a distance equal to the distance between the poles n s. The masses K K, preferably, do not extend from the field-poles n s to the armature iron masses I I, but are separated from the latter by a considerable distance, being, however, in close proximity to the poles n s. The masses K' K' are of such a size or width that they almost fill the spaces between I I and n s. This construction is clearly shown in Figs. 7, 8, and 9. The action of this arrangement is as follows: When the several pairs of pieces K' K' occupy the spaces between the poles n s and the iron masses I I of the armature, the magnetic lines are caused to traverse the pieces I I and thus inclose the coil A. When the masses K' K' are midway between the poles n n, the masses K K are in the position facing the said poles and the lines of force then pass direct through the said masses K K and not through the armature masses I I. Thus the armature masses I I are alternately magnetized and demagnetized, and alternate currents are thereby generated in the armature-coil A. By the presence of the masses K K in this form of machine, as well as in the forms illustrated by the preceding figures, the magnetic circuit is practically a continuous and uninterrupted one and the field of force is maintained constant with a minimum expenditure of energy and without any wasteful and injurious reactions and electric inductions in itself. These magnetic short-circuiting masses may be applied in other forms of machine for this purpose. The masses K K K' K' are mounted in any suitable manner upon a shaft S. These figures (7, 8, and 9) illustrate the arrangement of rotating laminated masses disposed in conjunction with a fixed single-coil armature and single-coil multipolar field. I may, however, apply the same form of armature with a form of field of alternating polarity, such as that shown in Figs. 10 and 11, and hereinafter described.

Although for simplicity and ease of construction I prefer to use a field-magnet of the forms or on the principle of those above described, I may employ other suitable forms, such as those which give alternate north and south poles in successive order at each end or side of the machine.

Figs. 10 and 11 illustrate a construction in which such a field is applied to an armature arranged as described with reference to Figs. 1 to 4. In this case the field-poles are alternately N and S, and the magnetic induction about the armature-coil A is reversed in direction instead of being only varied in intensity.

The field-magnets may be constructed in various ways. Thus, instead of the double star-wheel shown in Figs. 10 and 11, a number of magnet-bars may be arranged parallel with the shaft in a circle, as shown in dotted lines in Fig. 11, each bar or each alternate bar having a magnetizing winding and each provided with polar extensions occupying positions similar to the poles n n s s. (Shown in full lines in Figs. 10 and 11.) This arrangement may be modified in several ways without departing from the principle involved—as, for instance, by having the armature placed inside and rotating as in Figs. 5 and 6, the field being made to encircle it with the poles projecting radially inward; or the poles may be at the sides or ends of the armature, and either the magnet or the armature rotating. There are many ways other than those hereinbefore described and shown in the drawings annexed by which the principle of my improved armature may be applied.

The foregoing description is intended only to explain the principle of this invention and the manner of applying the same in the construction of electric generators.

The field may be excited from an external source, or it may be wholly or partly excited by a commuted current obtained from the armature.

What I claim is—

1. In a dynamo, an armature comprising a single coil or winding provided at opposite sides with a series of separate or independent iron masses, the masses at one side being arranged to act as magnetic inductors and placed alternately with those at the opposite side, which serve as magnetic short-circuiting masses.

2. In an alternate-current dynamo, an armature consisting of a single armature coil or winding, a number of iron masses separate from each other and arranged in alternating angular positions at opposite sides of the armature coil or winding, and a field-magnet the poles of which are moved relatively to said masses, the arrangement being such that said armature is subjected to a succession of magnetic inductive impulses, and the flow of magnetic lines of forces in the magnet are maintained practically constant, substantially as herein described.

3. In an alternate-current dynamo, an armature comprising a single coil or winding with iron masses at opposite sides thereof, those at one side being separate from and alternating in angular position with those at the opposite side, in combination with a field-magnet having polar extensions in proximity to the ends of said iron masses, for the purpose specified.

4. In an alternate-current dynamo, the combination of an armature comprising a single coil or winding, iron masses separate from each other and arranged alternately at opposite sides of said armature, and a field-magnet having polar extensions that are rotated relatively to said iron masses, the ends of said masses being arranged to be brought opposite said polar extensions in successive order and to maintain complete the magnetic circuit of

said field-magnet closed, substantially as herein described.

5. In an alternate-current dynamo, the combination of an armature consisting of a single coil or winding, and a field-magnet, the magnetic circuit of which is completed in consecutive order through iron masses that are separate from each other and are arranged in alternating angular positions at opposite sides of said armature.

6. In an alternate-current dynamo, an armature comprising a single coil or winding provided with a series of separate external iron masses, in combination with a field-magnet having a single exciting coil or winding, and polar extensions that are brought into proximity to the ends of said iron masses.

7. In an alternate-current dynamo, an armature comprising a single coil or winding provided at opposite sides with iron masses, the masses at one side being separate from and alternating in angular position with those at the opposite side, in combination with a field-magnet having a single exciting-coil, and polar extensions that are brought successively into proximity to the end of said masses, substantially as herein described.

8. In an alternate-current dynamo, an armature comprising a single coil or winding having a series of iron masses partly inclosing the same and a second series of iron masses arranged to act as short-circuiting bars separate from and alternating in angular position with those of the first series, in combination with a field-magnet having a single exciting coil or winding, and polar extensions that are moved relatively to said iron masses and the number of which of the same sign are equal to the masses in either series, substantially as herein described.

9. In an alternate-current dynamo, the combination of an armature comprising a single coil or winding provided at its inner and outer sides with iron masses, those upon the inner side being separate from and alternating in angular position with those at the outer side, and a field-magnet having a single exciting-coil and polar extensions that are brought into proximity with said iron masses in consecutive order, said armature and field-magnet coils being arranged concentrically, substantially as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM MORRIS MORDEY.

Witnesses:

F. J. BROUGHAM,

W. CROSS,

Both of 46 *Lincoln's Inn Fields, London.*