(No Model.)

2 Sheets—Sheet 1.

W. L. VOELKER.

DYNAMO ELECTRIC MACHINE OR MOTOR.

No. 335,325. Patented Feb. 2, 1886.

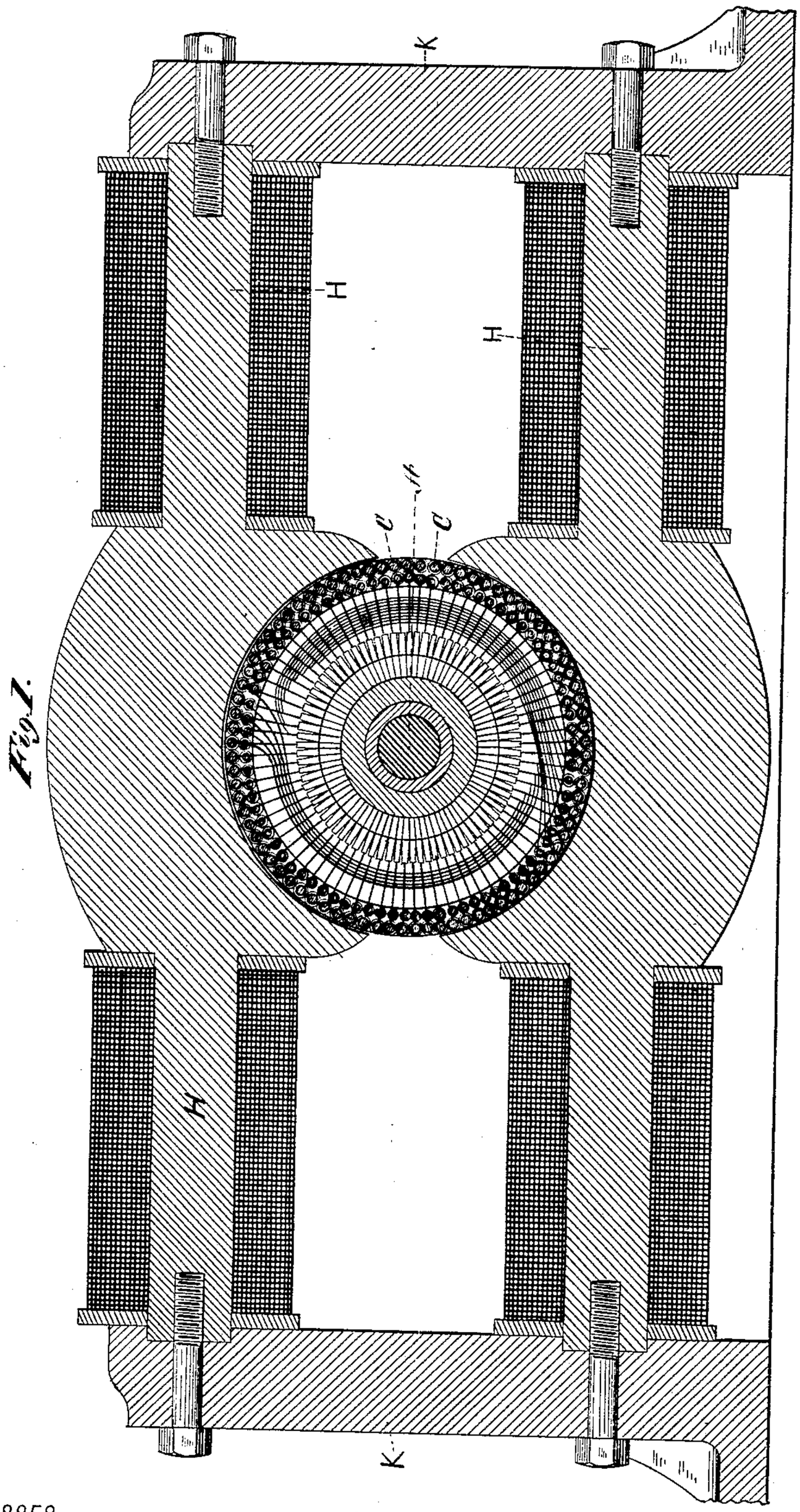

Fig. 1.

WITNESSES

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(No Model.)

2 Sheets—Sheet 2.

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DYNAMO ELECTRIC MACHINE OR MOTOR.

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Fig. 2.

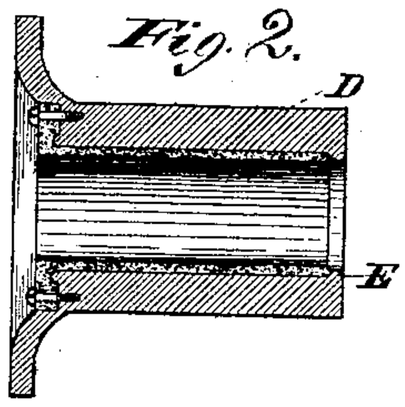


Fig. 3.

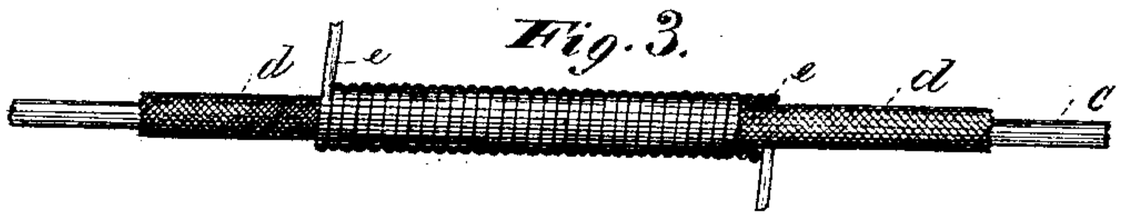


Fig. 4.

Fig. 5.

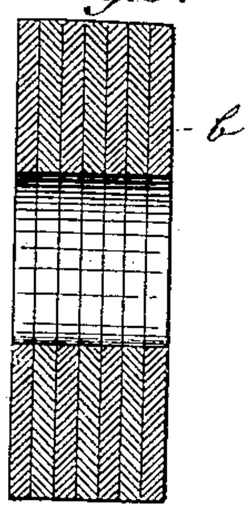


Fig. 6.

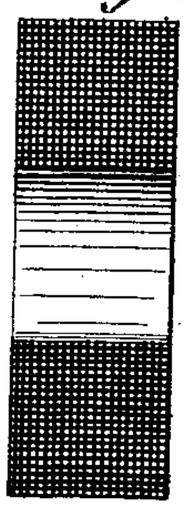
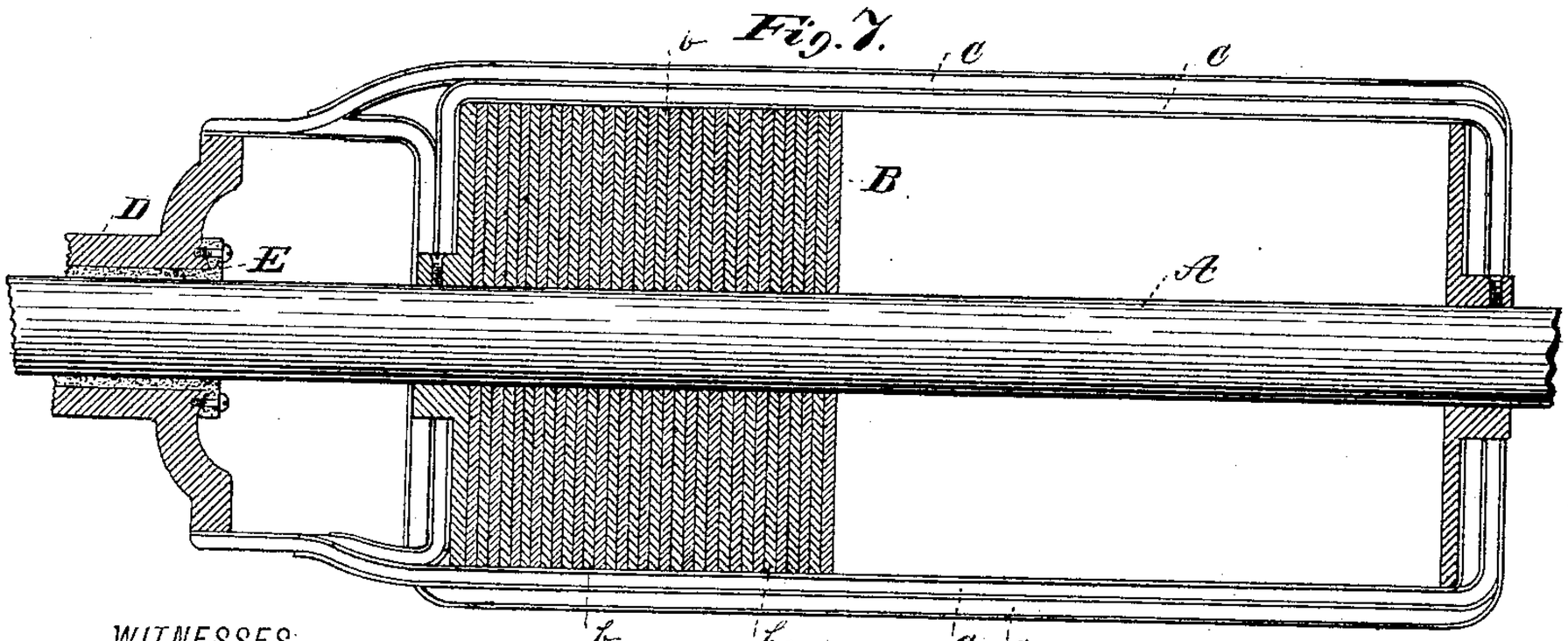


Fig. 7.



WITNESSES:
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Chas Downey

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By his Attorney
H. C. Townsend

UNITED STATES PATENT OFFICE.

WILLIAM LAWRENCE VOELKER, OF MORTON, PENNSYLVANIA, ASSIGNOR TO JOHN H. IRWIN, TRUSTEE, OF SAME PLACE.

DYNAMO-ELECTRIC MACHINE OR MOTOR.

SPECIFICATION forming part of Letters Patent No. 335,325, dated February 2, 1886.

Application filed June 15, 1885. Serial No. 168,692. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. VOELKER, a citizen of the United States, and a resident of Morton, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Dynamo-Electric Machines and Motors, of which the following is a specification.

The object of my invention is to improve the efficiency of dynamo-electric machines and motors, and has reference more especially to the construction of the body upon which the armature-coils are wound or carried.

It is a common practice to construct the armature-cores for cylindrical and annular armatures from a number of pieces of iron, the subdivision of the iron mass thus effected being conducive to rapid changes in the magnetic condition of the core and, to a certain extent, breaking up or preventing the circulation of the induced or Foucault currents, so as to lessen the heating of the armature. Ring-armatures, or those in which the coils are wound in and out around the magnetic annulus, have for this purpose been constructed of a number of iron wires covered with some insulating material, or from thin iron plates or annuli separated from one another by air-spaces or by paper or other insulating material. Cylinder-armatures have likewise been built up from thin plates or pieces of iron in the form of disks, or of other shapes, the individual parts making up the magnetic core or carrier being separated from one another by air-spaces, mica, paper, &c., and in many instances the natural or forced circulation of air around the parts have been resorted to for the purpose of keeping the armature cool. It has also been proposed to make up an armature of plates of iron separated from one another by plates of brass. In all such combinations the formation of the heating or Foucault currents is but partially prevented, while the results are generally secured at the expense of efficiency, owing to the comparatively large space occupied by the diamagnetic substance, whether it be air or a brass plate. This is especially true of an armature made up of a few iron plates alternating with plates of brass. In another construction of armature a number of plates of iron have been soldered together so as to form a solid mass. In this construction the plates are not separate, and the armature is not, in fact, mechanically subdivided into layers. The result is, as I have found by actual test, that the armature heats to a much greater extent under charges of magnetic condition than does the armature constructed, as hereinafter described, from a number of thin sheet-iron plates mechanically coated, as hereinafter set forth, and held together in any suitable way, but so that the various parts shall preserve their mechanical individuality and the armature shall be in fact a subdivided or laminated armature whose plates or individual portions are separated by the thin layers of air present when two separate plates are put into so-called "contact." Above all, such previous arrangements are realized only at the expense of the total mass of magnetic material, and as such structural arrangements rise in efficiency in retarding or dissipating the heat-currents, through the thoroughness of the subdivision, the distance by which the individual parts are separated, or other structural peculiarities that increase the amount of space occupied by non-magnetic material as compared with the amount of magnetic material, they are correspondingly deficient in amount of magnetic material and in their power of directing the magnetic lines of force upon the conductor of the armature.

I have discovered that by coating or plating the individual magnetic parts of a subdivided armature-core with a diamagnetic metal—such as zinc, tin, bismuth, or other metal diamagnetic in nature—the individual parts—such as thin soft-iron disks or plates—thus plated being assembled in contact to make up the armature-core body, the formation of the heat or eddy currents is almost entirely prevented. At the same time I am enabled to secure all the advantages due to a magnetic subdivision of the core, while, moreover, the magnetic efficiency of the core is almost at its maximum, owing to the small amount of diamagnetic material and the consequent large amount of magnetic material—such as iron.

As the preferable construction for an armature core or carrier made in accordance with my invenion, I make use of thin soft-iron disks, sheets, or annuli, electrically, chemically, or mechanically plated with any diamagnetic metal, the mass of the armature-core being made up of such sheets or plates individually of the proper form, and held together or in contact with one another upon the armature-shaft by suitable clamping devices, so as to form a cylindrical core or carrier of individual or separate plates magnetically continuous in the direction of the lines of force, but separated from one another in a direction transverse to those lines, and making, in fact, a series of separate plates whose plane surfaces lie in contact.

To make a cylinder armature, the plates or disks may be punched from thin sheet iron and placed upon the armature-shaft in contact with one another with their plane surfaces at right angles to the axis of rotation, such disks being held in position by being keyed to the shaft or otherwise secured, and kept from lateral displacement by collars at each end fastened to the shaft by set-screws. I also propose to similarly construct the cores for the field-magnets of the machine from thin sheet-iron plates plated with a diamagnetic metal and secured together in a suitable wrought or cast iron frame-work, as set out and claimed in another application filed by me as a division of the present application October 10, 1885, Serial No. 179,505.

A feature of improvement herein shown, but which is claimed in another application filed as a division of this case on the 10th day of October, 1885, consists in applying to that portion of the armature conductor or wire that passes through the magnetic field a sheath or covering of magnetic material—such as soft-iron.

The armature wire or conductor is preferably provided with the usual insulating sheath or cover, and the wrapping or sheath of iron is applied to the exterior of the latter. The wire or conductor thus sheathed is wound or applied directly to the armature core without further insulation. By this means the armature-carrier, with its conductors, form a nearly true armature for the field-magnets, thus producing an intensely saturated magnetic field for the electric conductor to pass through. The magnetic exposure of the conductor being thus largely increased, and the magnetic lines of force being brought to bear with greater directness upon said conductor, it is possible to develop powerful electric currents or mechanical energy with a greatly-reduced weight of copper wire, and an efficient machine may be produced having a very low internal resistance and small weight of armature.

The magnetic sheath may be applied to the armature-conductor in various ways. One of the ways is by wrapping the conductor with a spiral of thin iron wires or with a single iron wire; or it may be formed by covering the conductor with small thin iron washers or beads, or small iron rings placed thereon side by side; or it may be constructed of an iron spiral cut to the length of the armature-core and slipped upon the conductor as the latter is being wound on the core. The iron sheath might be applied in other ways, however.

In the forms above described it will be observed that the iron mass of the sheath is subdivided in planes substantially parallel or coincident with the magnetic lines of force. This feature, so far as my experience goes, I find to be of advantage. I do not, however, wish to be understood as limiting myself to this particular form of the sheath.

In the accompanying drawings I have illustrated my invention as applied to a machine wound after the Siemens fashion, and have also shown in conjunction with the machine an improved feature of construction in the commutator.

Figure 1 is a longitudinal section of the machine. Fig. 2 is a detail view of the commutator in section. Fig. 3 shows in detail the improved armature-conductor; Fig. 4, another form of the same. Fig. 5 is a cross-section through an armature-core of the ring form. Fig. 6 is a cross-section of another form of the same. Fig. 7 is a longitudinal section of the cylinder armature.

A indicates the armature-shaft, and B the armature-core, of cylinder form, made up of thin sheet-iron disks *b b*, plated with diamagnetic metal and secured upon the armature-shaft in the manner before described.

C indicates the copper conductor, applied in two layers to the armature-core and connected to the commutator D in any desired manner. The conductor is shown in detail in Fig. 3 with an insulating-sheath, *d*, of any desired kind, and the iron-wire sheath *e*, before described.

The commutator-plates are secured in place in any desired way upon a sleeve, E, of lava, such as is used in making lava tips for gas-burners. A sleeve of this material I find to be far superior to a rubber vulcanite or other material ordinarily employed, on account of its high insulating qualities and the impossibility of destroying or injuring the same by heat from sparking or flashing at the commutator. The field-of-force magnets H are made also from thin sheet-iron plated with diamagnetic metal, and held in position on the frame K in slots cut in the ends of the latter for the reception of the ends of the plates.

The slotted end pieces form the yokes of the magnets, and the lower part provides a means of bolting the whole structure to a foundation. The subdivision of the pole-pieces secured by thus making the core and pole pieces from thin plated iron sheets is also of advantage in reducing the tendency to development of currents therein, while at the same time, owing

to the small amount of diamagnetic material, the magnetic mass is large.

In Fig. 4 the armature-conductor is shown provided with a magnetic sheath formed of iron beads or rings.

In Fig. 5 an armature of the ring form is illustrated, made up from thin iron annuli, each plated with the diamagnetic metal.

In Fig. 6 a core is shown in which the magnetic subdivision is secured by making the core from iron wire, which wire is supposed, in this instance, to be plated with a diamagnetic metal.

What I claim as my invention is—

In a dynamo-electric machine or motor, a cylindrical armature made up, as set forth, from sheet-iron plates or disks having an electrical or mechanical plating of diamagnetic material, as described, and held or secured together upon their shaft by suitable clamping devices, the whole constituting an armature-body made up of separate or individual plates in contact with one another, so that the armature shall be mechanically subdivided or laminated in planes coinciding with the lines of magnetic force, and magnetically subdivided by films of diamagnetic metal, each united on one side with a disk or plate of iron, and having its other side constituting a plane surface resting in contact with a separate plane surface to make a plane of subdivision.

Signed at Morton, in the county of Delaware and State of Pennsylvania, this 12th day of June, A. D. 1885.

WILLIAM LAWRENCE VOELKER.

Witnesses:
J. E. P. RUTTER,
W. M. HENDERSON.