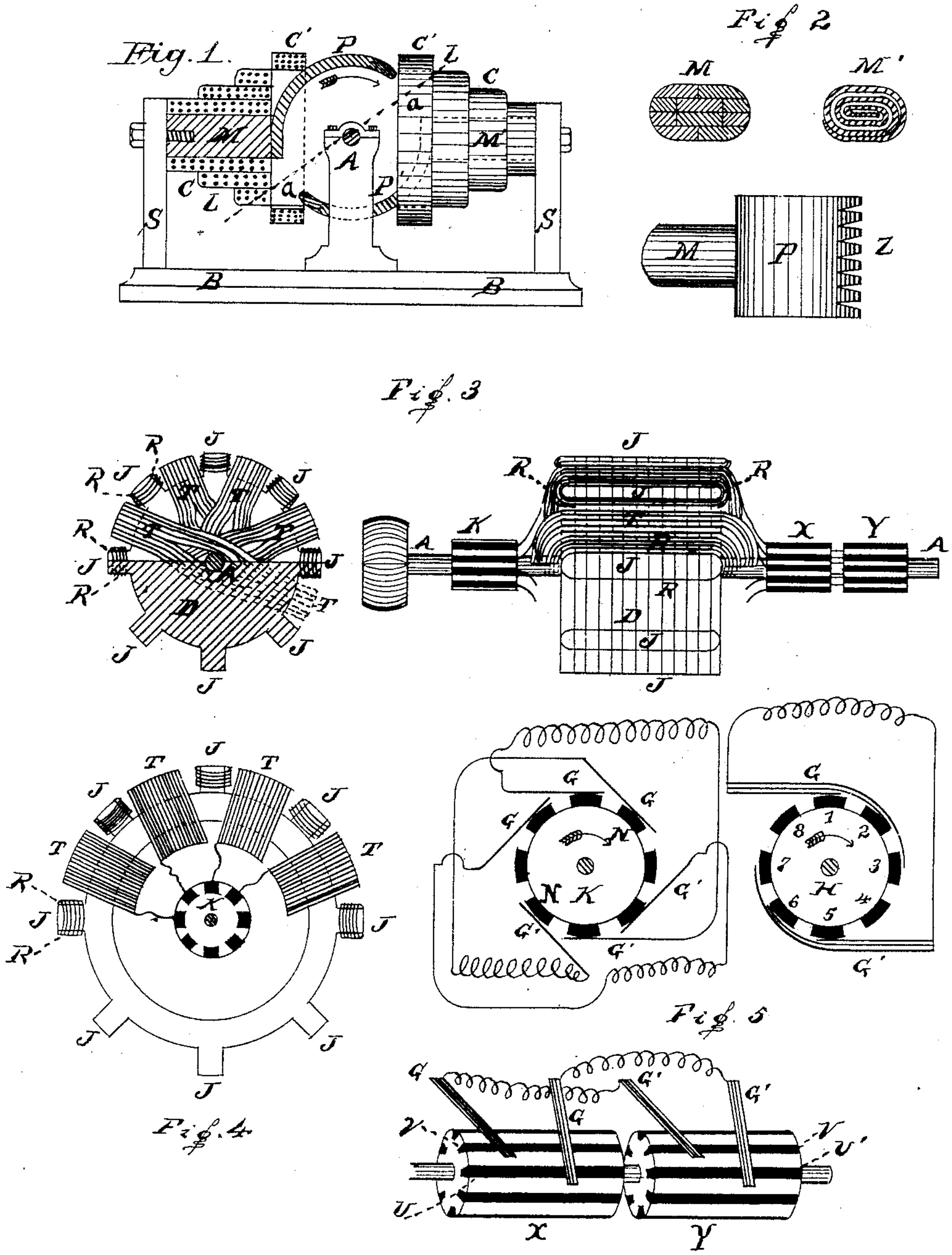
E. J. HOUSTON & E. THOMSON.
Dynamo-Electric Machines.

No. 219,157. Patented Sept. 2, 1879



Witnesses
W. Newton Meeks.
Edward W. Vogdes.

Inventors
Edwin J. Houston
Elihu Thomson

UNITED STATES PATENT OFFICE.

EDWIN J. HOUSTON AND ELIHU THOMSON, OF PHILADELPHIA, PA.

IMPROVEMENT IN DYNAMO-ELECTRIC MACHINES.

Specification forming part of Letters Patent No. **219,157**, dated September 2, 1879; application filed October 30, 1878.

To all whom it may concern:

Be it known that we, EDWIN J. HOUSTON and ELIHU THOMSON, both of the city and county of Philadelphia, Pennsylvania, have invented certain Improvements in the Construction and Operation of Dynamo-Electric Machines, whereby the capabilities of these machines are increased and the construction simplified, of which the following is a specification.

The arrangement of the field-magnets is shown in Figure 1. The base B of the instrument contains iron sufficient to provide thorough magnetic contact between the supports S S of the field-magnet cores M M′, which latter are arranged opposite each other in the same straight line, and of which there may be two or more.

The cores M M′ of the field-magnets are made of separate pieces of iron not in electric contact with each other. This is obtained by forming the cores of plates or rods filed into the desired form, as shown at M, Fig. 2; or they are made by rolling a sheet of iron into the desired form, as shown at M′, Fig. 2.

The magnet-cores M M′ have pole-extensions P P′, of such form as to inclose the armature, which revolves between them, gaps being provided at *a a* as near the cores M M′ of the field-magnets as practicable, subserving by their position a new purpose in preventing that weakening of the poles at those points which in many machines occurs when the armature is passing from one magnetic field to the other. The gaps *a a*, it will thus be seen, are made in a plane inclined in the direction of rotation of the armature, as shown by the dotted line L L. In machines heretofore invented the gaps are situated midway between the poles.

The coils C C of the field-magnets are wound conically, the wide portion being placed as near as possible to the revolving armature, thus serving, in addition to the ordinary purpose of magnetizing the field-magnets, the new purpose of directly influencing and strengthening the polarization of the armature-core itself. Furthermore, accessory coils C′ C′, wound in the same direction as C C, are provided, covering the gaps *a a* between the pole-pieces, and serving the new purpose of preventing the diffusion of the magnetic field and concentrating it upon the armature. The axis of the armature is suitably supported at A.

In Fig. 2 is shown another view of the pole-piece P, provided with serrations Z for the purpose of preventing the formation of induction-currents in the metal composing the pole-pieces on the revolution of the armature, and consequently preventing waste of power.

Fig. 3 shows the construction of the armature. Its core consists of one or more pieces of iron, D, of circular or polygonal shape, and provided with projections J J, extending radially outward from them. To avoid heating of the core many such pieces are placed side by side upon the same axis to make up the armature-core in the form of a deeply-fluted cylinder, D, Fig. 3.

Upon the projecting pieces J J J separate coils of insulated iron are wound longitudinally, as shown in Fig. 3 at R R, and their ends carried out to the commutator X Y, whose arrangement is to be hereinafter described.

The remaining spaces upon the armature—namely, the flutings—are filled to the form of a complete cylinder by winding coils completely over the ends of the cylinder, as shown in Fig. 3 at T T. These latter coils are separate and distinct, and the ends are carried out to the same commutator as the ends of the coils on the projections, or to a separate one when desired.

It is evident that either set of coils R R or T T may be dispensed with, and one only employed, since they constitute separate and distinct sources of electrical current.

When the set of coils T T, each separate and distinct, are alone used, the projections J J J of the armature-core may or may not be used.

When it is desired to increase the diameter of the cylindrical armature-core relatively to its length, the central portions may be removed, so as to provide an open space around the axis, as seen in Fig. 4. In this case the coils T T are not carried completely over the end of the cylinder, but are then wound upon the ring so provided in a manner differing from that in the well-known Gramme machine in the fact that they constitute separate and distinct coils, whose ends are each independently connected to a commutator of novel construction, to be hereinafter described.

The manner of operation is as follows: During the revolution of the armature in the magnetic field currents are developed according to the well-known electrical principles in the coils on the armature.

The coils R R on the projections J J J have currents developed in them while passing across the gaps *a a*, Fig. 1, while the coils T T, completely surrounding the armature-core, have their greatest current developed when passing opposite the pole-pieces P P′, no current being developed in them near the central point between the poles or at a point approximately near the center of the gaps *a a*. It will thus be seen that at any point of the revolution of the armature there will always be some portion of wire at that point developing current—a feature of construction not hitherto found in other forms of dynamo-electric machines.

The currents developed in the armature-coils are further re-enforced by their proximity to the coils C C, Fig. 1, of the field-magnets, and also on account of the influence of the accessory coils C′ C′, as hereinbefore described. These features of our invention practically constitute an application of the reaction principle to the armature-coils, and differ in this respect from any other machine hitherto invented.

The construction and operation of the commutators for our machine differ according as it is desired that the machine shall furnish direct currents or reversed currents.

Our commutators for the direct currents, when taken from the coils T T of the armature, Fig. 3, consist of a series of straight metal strips insulated from one another and placed parallel to one another in the form of a cylinder, K X Y, Fig. 3, around the axis A, supporting the armature. Fig. 5 shows this arrangement.

The coils T T, Fig. 3, being distinct from each other, their ends are connected as follows: The two ends, respectively, of any single coil are connected to opposite strips N N of the commutator, Fig. 5, and this is done consecutively, so that the order in which the strips follow one another corresponds with the order of arrangement of the coils upon the armature. The number of metal strips N N, Fig. 5, will be double the number of coils T T, Fig. 3, on the armature.

The commutators for conveying the currents from the coils R R, surrounding the projections J J J J, Fig. 3, may be exactly the same in construction and manner of connection as those of the coils T T, before described. We prefer, however, to connect the coils R R, Fig. 3, to two separate sets of strips composing two separate cylinders, X Y, Fig. 5, in the following manner: The two ends, respectively, of a single coil are connected to the strips U U′, Fig. 5, and those of the next adjacent coil to the next adjacent pair of strips V V′ in the same direction, and this is continued until all are connected, the number of strips U U′ and V V′, &c., being adjusted to the number of coils.

It will thus be seen that any single coil R has one of its extremities connected to the corresponding strip in the cylinder X, while its outer extremity is attached to the corresponding strip in the cylinder Y. Thus two separate series of strips attached to separate terminals of the coils compose the cylinders X and Y, respectively.

All the corresponding terminals of the whole series of coils R R are attached to strips in the cylinder X, while the remaining corresponding terminals are attached to strips in Y, each coil on the armature having, of course, two terminals, which are respectively of positive and negative polarity when developing currents. For example, all those terminals that become negative in passing any position of revolution of the armature may be attached to X, and those that become likewise positive to Y. This arrangement allows great simplicity of operation in carrying out the currents from the commutator.

Collecting-brushes are applied to the commutator-cylinders K X Y, Fig. 5, so as to close the circuits of the armature-coils through the external resistance desired—that is, collectors G G′ touch the cylinder K, Fig. 5, in such positions as may be required to carry out the currents developed in the coils. No collectors are applied in positions where no current is generated, thus differing in this respect from many other forms of machine hitherto known in which the current is led out at the neutral points.

A number of collectors, G G′, may be used in different angular positions with respect to one another, and employed either to furnish separate circuits or joined into a single circuit. In the latter case the collectors are preferably a single pair extending over and resting in contact with all those strips which are connected to coils generating currents in the same direction. This arrangement is shown at H, Fig. 5. The strips or terminals 1 2 3, being, for instance, positive, rest in contact with the collector G, while 5 6 7, being negative, are in contact with the collector G′. The strips 4 and 8 are supposed to be inactive.

When the commutator X Y, Fig. 5, is employed with the coils R R, Fig. 3, the manner of applying the collecting-brushes is essentially the same as before described in connection with the commutator K.

U U′ being united to form a circuit, and V V′ likewise, provided these are in positions where current is produced in the coils to which they are attached, the separate circuits thus produced may be united to form a single circuit, if desired.

Since the currents generated in the coils of the armature are successively in opposite directions, when a machine made in accordance with our invention is designed to furnish reversed currents no commutation is necessary, and the ends of the coils are each converted to a metal disk insulated from the axis and from the other disks. Upon the disks so provided collectors rest in such a way as to complete the circuit through each coil and through the external resistance through which the current is to be passed.

We claim—

1. In a dynamo-electric machine, the coils C C of the field magnets, wound conically, the wide portion being placed as near as possible to the revolving armature, and serving thereby, in addition to the ordinary purpose of magnetizing the field-magnets, that of directly influencing and strengthening the polarization of the armature.

2. In a dynamo-electric machine, the accessory coils C′ C′, arranged substantially in the manner and for the purpose specified.

3. In a dynamo-electric machine, pole-pieces P P′, of such a form as to leave gaps or open spaces *a a* opposite each other and as near as practicable to those parts of the cores of the field-magnets toward which the armature is moving, and for the purpose specified.

4. In a dynamo-electric machine, the combination of the coils C C, as described, with the accessory coils C′ C′, and with the pole-pieces P P′, arranged as set forth, for the purpose of intensifying the magnetic polarization of the revolving armature.

5. In a dynamo-electric machine, pole-pieces P P′, serrated as described, and for the purpose set forth.

6. In a dynamo-electric machine, an armature constructed of the core J J J J, wound with a double set of coils R R and T T, in the manner and for the purpose described.

EDWIN J. HOUSTON.
ELIHU THOMSON.

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