(No Model.) 3 Sheets—Sheet 1.

E. J. HARLING & E. HARTMANN.

DYNAMO ELECTRIC MACHINE.

No. 267,196. Patented Nov. 7, 1882.

Fig. 1.

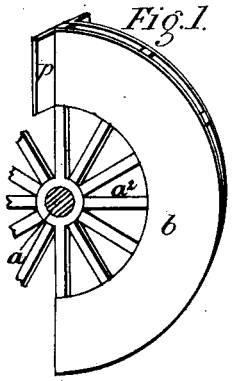


Fig. 2.

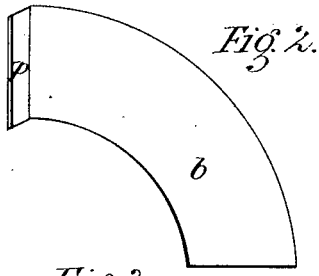


Fig. 3.

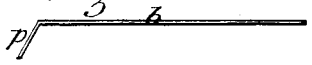


Fig. 4.

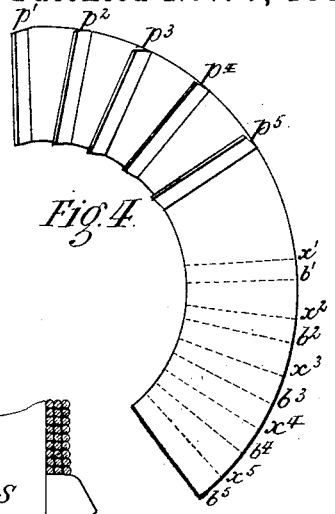


Fig. 5.

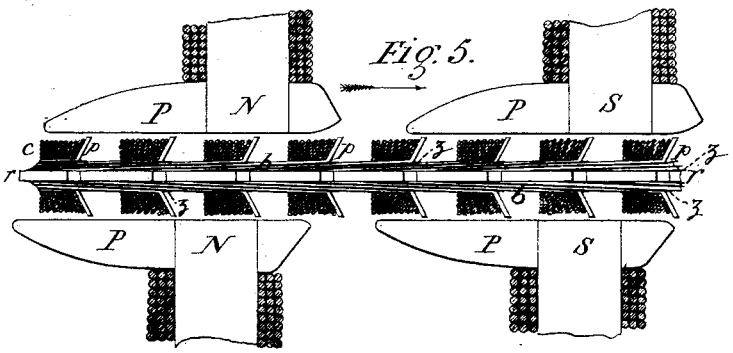
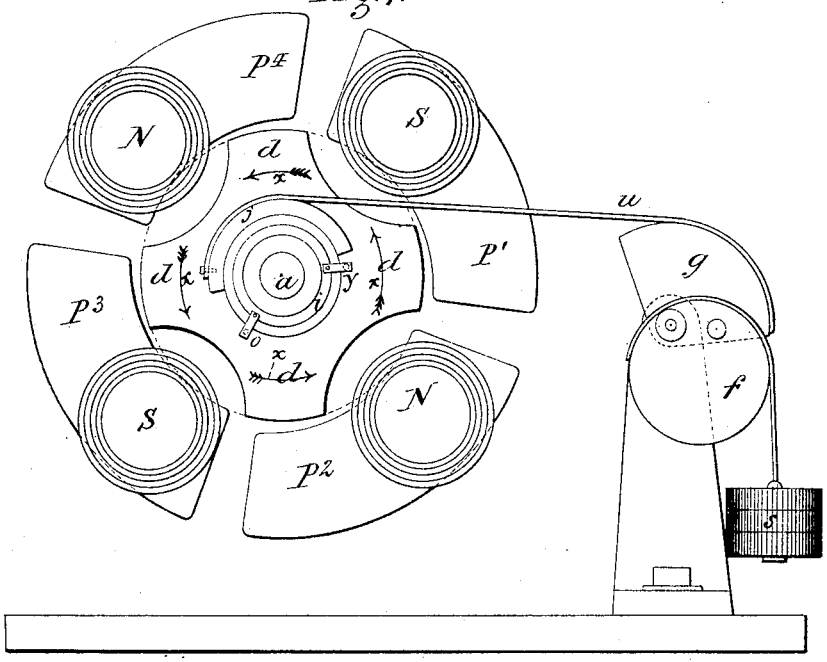


Fig. 7.



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By their Attorney,
James L. Norris.

(No Model.) 3 Sheets—Sheet 2.

E. J. HARLING & E. HARTMANN.

DYNAMO ELECTRIC MACHINE.

No. 267,196. Patented Nov. 7, 1882.

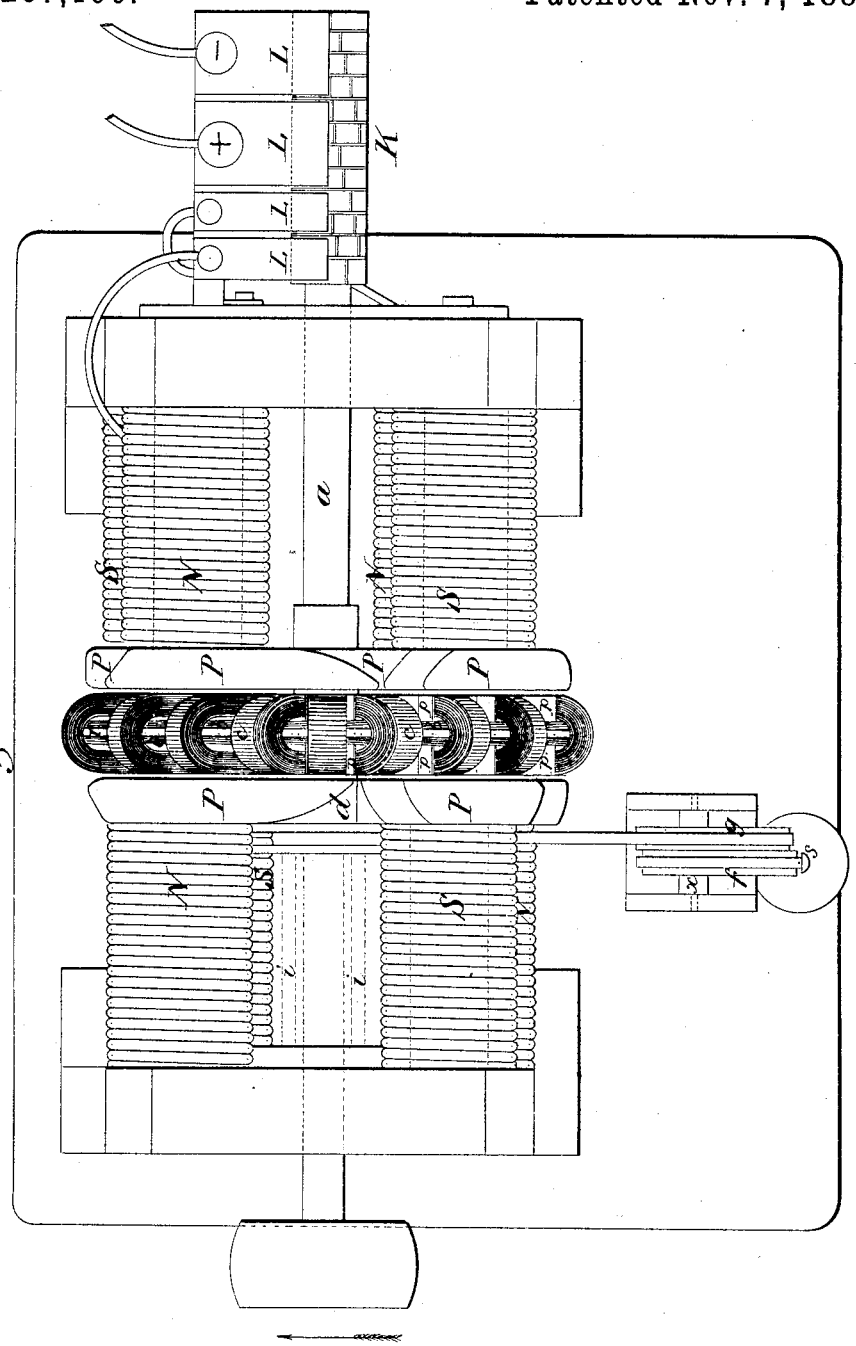

Fig. 6.

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(No Model.) 3 Sheets—Sheet 3.

E. J. HARLING & E. HARTMANN.

DYNAMO ELECTRIC MACHINE.

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Fig. 8.

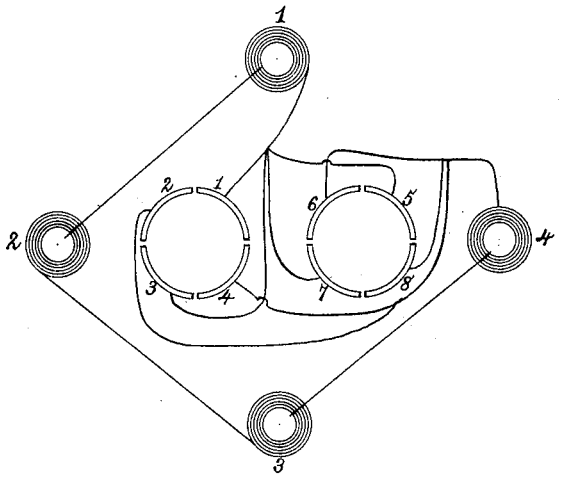
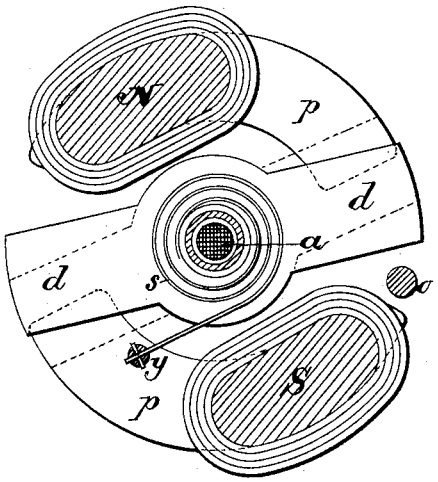


Fig. 9.



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UNITED STATES PATENT OFFICE.

ERNEST JOHN HARLING AND EMIL HARTMANN, OF LONDON, ENGLAND.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 267,196, dated November 7, 1882.

Application filed July 15, 1882. (No model.) Patented in England August 11, 1881, No. 3,472, and in France February 11, 1882, No. 147,324.

To all whom it may concern:

Be it known that we, ERNEST JOHN HARLING and EMIL HARTMANN, both of London, England, have jointly invented certain new and useful Improvements in the Construction of Dynamo-Electric Machines, (for which we have obtained a patent in Great Britain, No. 3,472, bearing date August 11, 1881, and in France, No. 147,324, February 11, 1882,) of which the following is a specification.

This invention relates, first, to improvements in the construction of dynamo-electric machines in which a rotating ring-armature is brought into close proximity with the field-magnets by means of combined projections and plates, the object of such improvements being to obtain a proper distribution of the magnetism induced, and to insure the magnetic polarization of the same in the proper manner throughout the armature; and, secondly, to improvements in the construction and arrangement of the field-magnets of the machine, whereby the magnetization and demagnetization of the parts of the armature are effected in a more effectual manner than is the case in similar machines as ordinarily constructed.

We will now describe the nature of the first part of our said invention, which consists in improvements in the construction of the armatures of dynamo-electric machines. The ring-armature is brought into close proximity with the field-magnets by means of projecting pieces, the latter being constructed and combined with the body of the armature in the following manner: The projecting parts have formed on them flat soft-iron plates, which plates are attached to the sides or to the peripheries, as the case may be, of a ring or a number of concentric or parallel soft-iron rings, a space being in some cases left between the end of each plate and the outer side of the next projection; but the plates may also be made to overlap each other, in which case it is preferable to make them sufficiently long to extend a quarter round the ring; but when there is only one pair of field-magnets the plates will be semicircular, and they will be decreased in length as the number of field-magnets is increased. In some cases we insulate each projection and that part of the plate which is near the same from the plate underneath, or the whole of the plate can be insulated from the plate underneath. We in most cases insulate with tissue-paper, and leave a small space at the end uninsulated. When entirely insulated the plates should be in connection with a central ring; but when they are not entirely insulated from each other the ring can be dispensed with. Each projection, with its plate, is made of wrought or soft cast iron. Over the said plates and round the ring or rings are wound the coils of copper wire, which may be wound and connected in the usual manner. One side of each coil is in close proximity with the projection of the plate on which it is wound; but a space is left between the other side of each coil and the next projection, such space serving to lessen the injurious effect of such projection on the coil, as the former would induce a current in the latter flowing in an opposite direction to the general or main current induced by the body or ring of the armature. The said spaces can, when desired, be filled in with an insulating and diamagnetic material. The said plates must be so arranged on the ring that the projecting pieces enter and leave the magnetic field before their respective coils and plates. The projecting pieces, when they are not formed thin, are split by a number of narrow grooves or recesses, this arrangement serving to check local currents generated in the metal constituting the projection. The same object can be attained by making the projections and plates in several parts, and arranging the latter on the ring or rings a little distance from each other.

The improvements in the construction and arrangement of the field-magnets constituting the second part of our said invention are as follows: The magnetic field is so arranged that the point of greatest magnetic intensity is not situated in the middle of the field, as is customary in ordinary machines, but is situated at or near one end of the same—that is to say, the end where the coils of the armature leave the field—so that when one of the above-mentioned projections and its generating-coil passes from one neutral point to the other it remains longer under the influence of the magnetic pole when approaching the same, but is withdrawn suddenly from its influence when leaving, whereby the electro-motive force is increased. These objects we effect by extending the poles

of the field-magnets on one side more than on the other, or on one side only, or, when pole-pieces attached to the field-magnet cores are used, by fixing the said pole-pieces to the cores in such a manner that the former will extend on one side more than on the other, or on one side only. The field-magnets, with their respective extensions or extending pole-pieces, are so arranged that the projections on the armature will first come under the influence of the free ends of the said extensions or pole-pieces and gradually approach the pole, and when the latter is reached they suddenly leave the magnetic field—that is to say, the projections, in the first instance, come opposite that part of the pole or of the extension of the pole where the magnetic influence is the least, and gradually approach the point where it is the greatest.

In order to prevent any variations of the motive power employed from affecting the action of the machine, we employ a regulator by preference constructed and arranged in the following manner: The said regulator is based upon the same principle as the hand-regulator of an ordinary magnetic machine—that is to say, when two poles of opposite polarity in the magnetic field are arranged to attract a bar of soft iron moving in close proximity with the faces or edges of the field-magnets, but never coming into actual contact therewith, the more the said regulator is attracted the more the face or edge of the same will cover the face or edge of the poles or pole-pieces of the field-magnets, whereby the effect of the said magnets upon the rotating armature and the generating-coils will be lessened. If the soft-iron regulator be sufficiently thick, the influence of the magnets on the rotating armature can be altogether destroyed when the said bar is caused to cover sufficient of the surface of the said poles. If there is only one pair of field-magnets, the said regulator consists of an iron bar, the center of which is pivoted between the poles of the field-magnets, and the two ends of the said bar come respectively opposite the extremities of the free ends of the pole-pieces. One end of the said bar is connected to an adjustable spring, or a spring is otherwise suitably arranged for counteracting any increased attraction on the bar, due to fluctuations in the strength of the current when the machine is running. In larger machines, although each pair of field-magnets can be provided with a separate regulator-bar, as above described, we in some cases, where there are two pairs of field-magnets, make the regulator-armature in the form of a cross, and when there are more than two pairs we in some cases make the regulator-armature in the shape of a star. In this case two neighboring rays of the star will form the connection between two poles, north and south. The said cross we arrange to move in close proximity with the inner periphery of the circle or similar figure formed by the poles or pole-pieces of the field-magnets. However, by a slight modification in form, the regulator armature or armatures can be arranged to move in close proximity with the outer periphery of the poles or pole-pieces of the field-magnets. In all cases the attraction of the field-magnets on the regulator-armature should be counteracted, to a certain extent, by means of an adjustable weight or spring connected to the latter, as will be well understood.

We will now proceed to refer to the accompanying drawings, from which the nature of our said invention will be more clearly understood.

The same letters of reference indicate like parts in all the figures.

Figure 1 is a perspective view, illustrating two of the armature-plates as attached to the opposite sides of spokes *a*, projecting from a boss on the armature-shaft, a central ring being omitted, and the plates being shown as semicircular segments, as at *b*, having the projections *p*.

Fig. 2 is a front view of a like plate, constructed to extend only a quarter round the said ring; and Fig. 3 is an edge view of the same.

Fig. 4 is a view of five plates lapped one over the other. These plates extend respectively from p' to b', p^2 to b^2, and so on, and the layers of non-conducting and diamagnetic material *z*, as shown in Fig. 5, (tissue-paper, for instance,) which separate the various plates, end at x' x^2, and so on. When a central separate metallic ring is omitted an air-space is left in the center between the said plates *b*, which form the body of the rotating armature, by attaching the rings formed by the said plates to a series of spokes or projecting pieces extending from a central boss attached to the shaft *a*. The said air-channel is shown in Fig. 1. By preference it is desirable to arrange the field-magnets on one side of the armature slightly in advance of those on the opposite side. This will produce a more continuous action in the coil *c*.

Fig. 5 is a horizontal section of a portion of the armature and two of the field-magnets, in which *r* designates a central soft-iron ring, to the opposite sides of which the plates are attached. *b* are the plates with the projections *p* and coils *c*, and N S, N S are the poles of the field-magnets.

Fig. 6 is a view of a machine with two pairs of field-magnets, constructed as hereinbefore described, and a regulator provided with a counteracting-weight, such regulator being more fully shown in Fig. 7. K is the commutator. L L L L are the brushes, which are by preference set in one straight line.

Fig. 7 is a side elevation of the magnets (two pairs at each side) and a cross-shaped regulator. N S, N S are the poles of the magnets, and P' P^2 P^3 P^4 the pole-pieces. *d* is the regulating-armature. It will be observed that any further attraction of *d* in the direction of the arrow will lessen the space between *d* and P, such attraction being counteracted by the weight *s*, which is suspended from the periph-

ery of the eccentric *f*. The latter is attached to the segment *g*, and both are pivoted at *x*. The more the weight is lifted by the increased attraction of P on *d* the greater will be the leverage by which the weight *s* acts on *x*. *a* is the shaft of the machine, which revolves within the stationary bush *i*, attached to the frame of the machine. The regulator *d* is so fitted on *i* as to revolve easily, and is connected, through the raised semicircular ridge *j* and the flexible connecting-strap *u*, (rope or chain,) with the segment *g*. *o* and *y* are two fixed abutments to limit the movements of *d*.

Fig. 8 is a diagram illustrating one method of connecting the coils and commutator. Four diametrically-opposite coils are by preference connected in the following manner: The first end of coil 1 to the first end of coil 2, the last end of the latter to the last end of coil 3, and the first end of coil 3 to the first end of coil 4. The last ends of coils 1 and 4 are connected to their respective segments of the commutator in such a manner that each end is in contact with four diametrically-opposite segments, which, however, do not form part of the same cylinder; but the two series of segments 1 2 3 4 and 5 6 7 8 are supposed to be side by side and concentric on the commutator. The segments numbered 1, 3, 5, and 7 of the commutator are all connected with coil 1, while the segments between the same are connected to coil 4. When the coil is under the influence of the beginning of the pole-pieces P its current is conducted through the field-magnet coils; but as soon, however, as it approaches the cores of the magnets N S and N S the current is sent through the working-circuit. The inner edges of the pole-pieces P do not form a circle. The dotted line shown in Fig. 7 indicates the circle struck from the center.

Fig. 9 shows a regulator as applied to a machine having a pair of magnets at each side, the action of such regulator being controlled by a spring. This figure shows the regulator, which consists of a bar, *d*, of soft iron, so arranged as to turn about its center and sliding over the pole-pieces P P′, not touching the same, but being in close proximity with them. When the machine starts and the field-magnets are excited the bar *d* is attracted toward the position shown in dotted lines, such attraction being counteracted by spiral spring *s*, the tension of which can be regulated by stud *y*. As the current tends to increase the bar is further attracted from its position, and consequently covers more of the surface of the pole or pole-pieces, thereby, as is well known, lessening the effect of the latter on the armature. Consequently the current and the field-magnets become too weak to retain the bar in its advanced position through the increased tension of the spring. The latter, therefore, will cause the bar to go back and free more or less of the surface of the pole-pieces, thereby increasing the inductive effect of the field-magnets on the armature. In this manner any fluctuation in the strength of the currents will be duly counteracted, as will be well understood. In some cases we substitute weights at one end of the bar for the said spring. *o* is a stop to prevent the bar moving in the wrong direction.

What we claim is—

1. An annular armature composed of the soft-iron plates *b*, having projections *p*, and arranged flatwise together with the said projections separated by spaces in which are wound coils arranged for connection with a commutator, substantially as described.

2. In a dynamo-electric machine, a field-magnet having its cores provided with transverse pole-pieces, which project to a greater extent on one side of the core than on the other, substantially as and for the purpose set forth.

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