(No Model.) 3 Sheets—Sheet 1.

E. J. HOUSTON.

DYNAMO ELECTRIC MACHINE.

No. 258,648. Patented May 30, 1882.

FIG. 1.

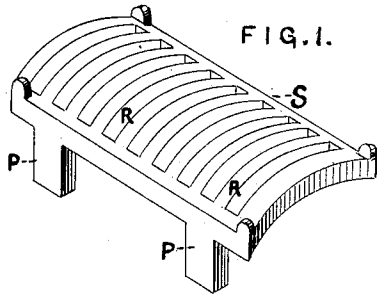


FIG. 2.

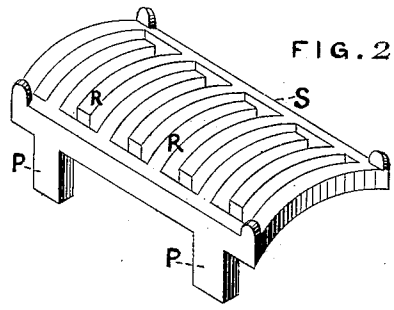


FIG. 3.

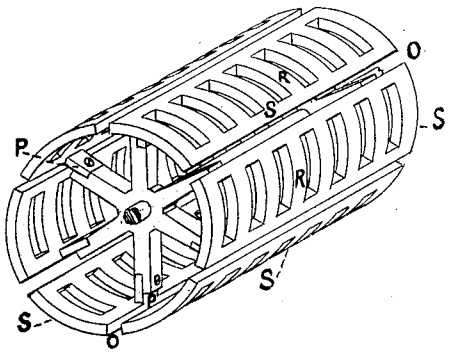


FIG. 4.

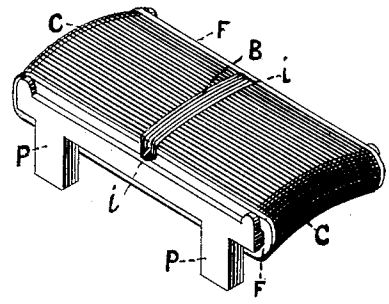


FIG. 5.

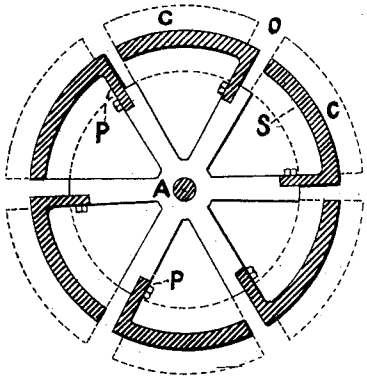


FIG. 6.

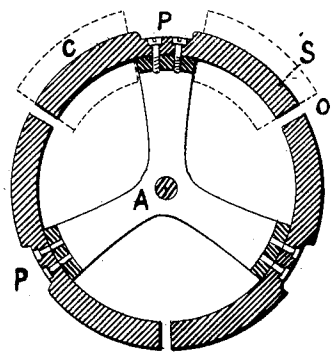


FIG. 7.

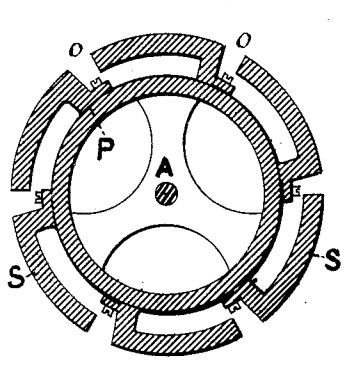
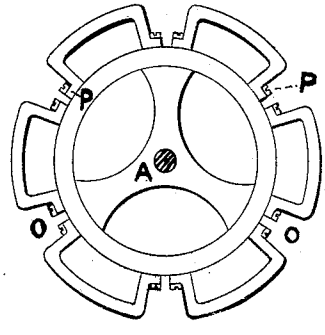


FIG. 8.



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(No Model.) 3 Sheets—Sheet 2.

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DYNAMO ELECTRIC MACHINE.

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FIG. 10.

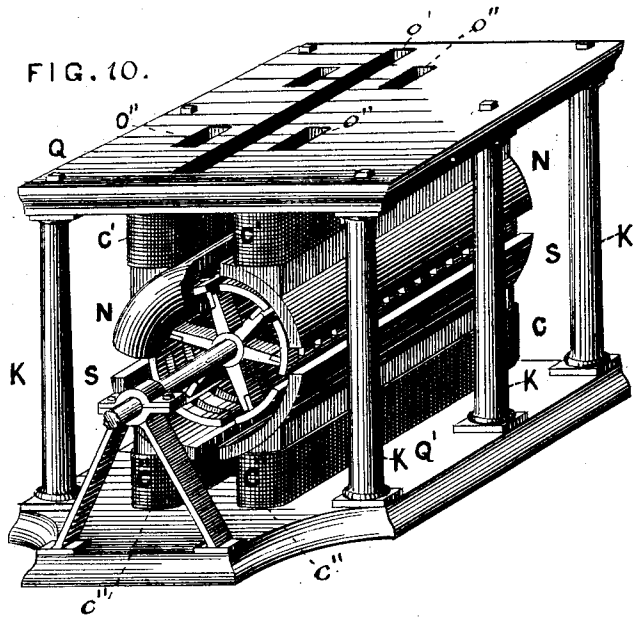


FIG. 15.

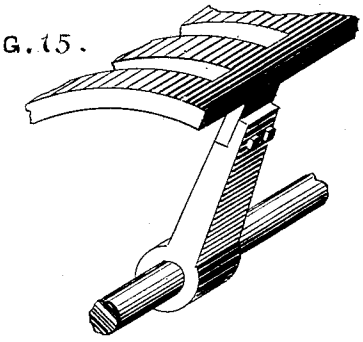


FIG. 16.

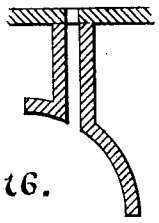
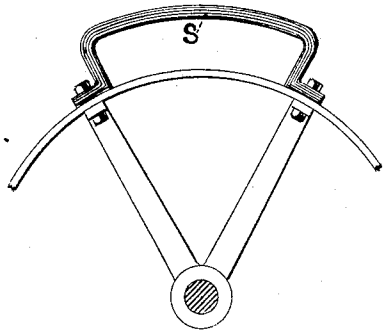


FIG. 9.



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DYNAMO ELECTRIC MACHINE.

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FIG. 14.

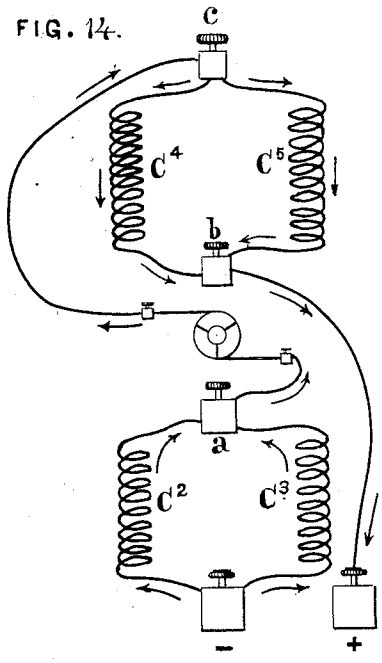


FIG. 13.

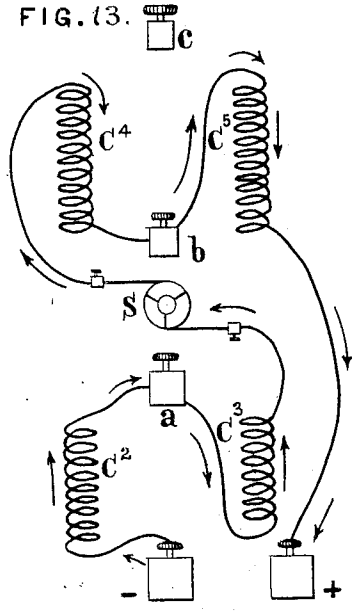


FIG. 11.

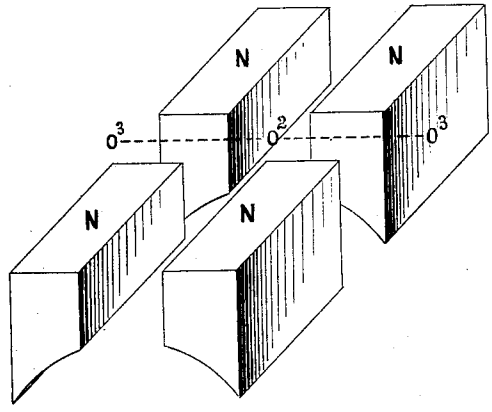
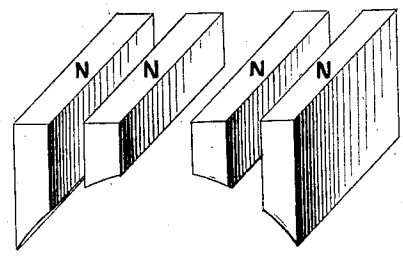


FIG. 12.



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DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 253,648, dated May 30, 1882.

Application filed October 21, 1881. (No model.)

To all whom it may concern:

Be it known that I, EDWIN J. HOUSTON, of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Dynamo-Electric Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings.

The object of my invention is to so construct a dynamo-electric machine as to obtain greater economy of power in driving, and also to permit any of the coils of the armature to be readily removed without disturbing the remaining coils.

A further object of my invention is to improve the ventilation of the machine and the construction of the frame to which the field-of-force magnets are secured.

In United States Letters Patent No. 223,658, dated January 20, 1880, an armature is described consisting of a series of longitudinal central ribs, of iron, parallel to the axis of rotation of the armature, provided with teeth extending circumferentially in both directions from said ribs, the spaces between the teeth being of such width as to permit the teeth of one section to nearly fill the spaces between the teeth of the next adjoining section, the whole being so arranged and shaped that when the sections are put together with the teeth of adjoining sections interlocking the whole shall form a hollow cylinder, whose surface is divided circumferentially by the teeth aforesaid.

In my present invention I construct the armature in sections that are entirely separate and distinct from one another, with free spaces between the adjoining sections, said spaces being in a direction parallel to the axis of rotation of the armature. I also divide the surface of the core by spaces extending circumferentially, in the manner to be hereinafter more fully described. By my construction I obtain the following advantages, viz: first, a more sudden and violent change in the magnetic polarization of the core during its revolution in the magnetic field, and a consequent increase in the electro-motive force of the current developed in the coils of insulated wire wound in the separate and separated divisions of the core; second, readier ingress and egress of currents of air, thereby securing a better ventilation of the armature-core; third, greater facility of construction, the sections of the armature being so arranged as to permit of their being wound in any ordinary lathe; fourth, facility of repair, the separate sections being so shaped and arranged in the completed machine as to permit them to be removed without in any way disturbing the core or the coils of adjoining sections.

In Figure 1 is shown one of the sections of my improved armature-core. It consists of a grating, S, of cast-iron or other suitable material, curved, as shown, so as to form, when placed in position with other similarly-shaped sections, a hollow cylinder, such as shown in Fig. 3. In the drawings I have shown the section as including an arc of nearly sixty degrees; but it is to be understood that I do not limit myself to a core constructed of six sections, since this principle of construction is applicable to armatures composed of any number of sections. Spaces extending circumferentially through the section are provided for the purpose of preventing the free circulation of induction-currents therein. To still further secure this result, I sometimes make the slots or spaces in the sections in the manner shown in Fig. 2. The sections as thus constructed are secured in any suitable manner to spider-arms, of brass or other non-magnetic material, in the manner shown in Figs. 3 and 15, by means of bolts passing through extensions P P, formed on one edge of the section. It is evident, however, that they could be secured to the spider-arms by bolts passing vertically downward from the upper surface of the section, near the edge thereof. The width of each section in the direction of the circumference of the armature is such as to allow an opening parallel to the axis of revolution between adjoining sections, as shown in Figs. 3, 5, 6, 7, 8, and 10, at *o o o*. Before the sections are placed in position they are separately wound with coils C C, of insulated wire, in a direction parallel to the axis of revolution, as shown in Fig. 4.

These coils are retained in place by flanges of vulcanized fiber or other suitable material, placed as shown. In order to prevent the coils from being displaced by centrifugal action, a band, B, (one or more,) is formed by wrapping wire around insulated pins *i i* on the outer surface of the section only, this being the only portion of the coil liable to displacement from this cause. The spider-arms can be placed either at the ends of the cylindrical core or at some distance inward from the ends, and, when desired, additional spider-arms may be placed between them. I prefer, however, to place them at some distance inward, as shown in Fig. 3, so as to allow of the employment of a more efficient form of pole-piece on the field-of-force magnet, to be hereinafter described. The armature thus constructed is readily and cheaply made, and is free from the annoyance often caused by the short-circuiting of the wires in armatures in which the wires cross at the ends of the cylinder. It also permits of the ready removal of a faulty section and the substitution of another without dismantling the machine.

Fig. 5 shows a vertical section through the completed armature, taken on the line of one of the spider-arms. The position occupied by the projection P, as regards the spider-arms, and the manner of attachment thereto, are here more fully shown. The openings *o o* between adjoining sections are also shown. I sometimes make two adjoining sections of the armature-core in one piece, somewhat after the manner of a single section of the armature shown in Patent No. 223,658, before referred to. The section as thus constructed is, however, made so short circumferentially as to still leave the transverse openings *o o* parallel to the axis between it and adjoining sections. I have shown in Fig. 6 another method of securing the sections to the radial spider-arms. In this case two sections are secured to the same arm by means of bolts or screws, as shown. When this form is used care must be taken to preserve the same direction of winding in all the sections.

Another method of holding the separate sections in place is shown in Fig. 7. In this case the separate sections are secured to a cylinder of brass or other suitable material, in the surface of which cylinder, if desired, openings may be formed in suitable position to allow the ready circulation of currents of air through the openings *o o* between adjoining sections. The sections may be made in the form of flat arches, as shown in Fig. 8, and secured at two points, as shown. In this case the separate sections may be formed of sheets, in the manner indicated in Fig. 9, separated from one another by air or other insulation, in a manner well known in the art, for the purpose of preventing the circulation of induction currents in the armature-core. With the latter object in view I sometimes construct the sections S of the core by wrapping wire on a suitably-shaped frame of wood or metal in a direction at right angles to that in which the insulated wire of the section is to be wound. The coils C C of insulated wire are wound in the manner already shown and described in connection with Fig. 4.

The completed armature-core constructed according to my invention will, as has been shown, be provided with openings *o o* parallel to the axis of rotation. To still further aid ventilation I sometimes construct the separate sections S of several shorter sections—two or more—shaped like those shown in Figs. 1 and 2, but shorter in the line of the axis of rotation. These sections would be such as would be obtained by cutting the section shown in Fig. 1 in the direction of its central rib, R.

When the armature-core is constructed in six sections, each wound as indicated in Fig. 4, and is connected to the spider-arms and mounted as partly shown in Fig. 3, it will contain six coils with twelve free ends. These ends may be connected up and carried to a commutator in any desired manner. The armature as thus constructed may be revolved in any suitable magnetic field and between the poles of field-of-force magnets of any desired construction. I prefer, however, to place it between the poles of field-of-force magnets constructed and arranged in a suitable manner to still further facilitate ventilation. The construction that I have devised for this purpose also possesses the function in a high degree of concentrating the magnetic field on the revolving armature. The construction is as follows: Iron plates Q and Q′, Fig. 10, are securely mounted upon and connected together by iron pillars K K K K, thus forming a hollow rectangular frame, partly open at the four vertical sides. Inside this frame suitably-shaped iron cores, with the pole-pieces N N S S, are securely bolted to the base and top plates, Q and Q′, respectively. The cores are wrapped with insulated wire in the ordinary manner. It will be seen from Fig. 10 that this particular construction leaves longitudinal spaces between the pole-pieces N N and S S and their coils C′ C′ and C″ C″, which are parallel to the spaces *o o* between the sections of the armature, thus insuring a thorough ventilation of the armature. I still further promote this end by cutting a slot, *o′*, in the top plate, Q, and sometimes also provide additional openings, *o″ o″ o″ o″*, which coincide with air-ducts extending axially through the cores of the magnets and their pole-pieces. This construction is also shown in Fig. 16, which is a vertical section through the core of a field-magnet and a portion of the upper plate on the line of one of the air-ducts.

The cross-section or mass of iron in the pillars K K must always be sufficient in mass or cross-section to give good magnetic connection between the bottom and top plates, Q Q and Q′ Q′. The field-magnets and frame, as thus constructed, besides insuring ventilation

of the armature and concentrating the magnetic field, are easily constructed, and can be readily and rapidly put together.

I sometimes still further divide the pole-pieces and their magnet-coils by providing a slot between them, as shown at O^3 O^3, Fig. 11, at right angles to the slot o^2. In such cases I may or may not employ the armature in which the sections S are formed of a number of shorter sections placed beside one another in a line parallel to the axis of rotation, or I may divide the magnetic field, in the manner shown in Fig. 12, by providing four or more separate cores and their corresponding coils, as shown. In all of these cases the coils c' c' and c'' c'' are wound and connected so that all the pole-pieces secured to the upper plate are of one polarity—as north; and all those fixed to the bottom plate are of the opposite polarity—as south. I prefer generally to carry the ends of the coils on the armature to a commutator of the construction described in Patent No. 223,658, already mentioned, in which case the mode of connection would be the same as therein described. When the separate sections are formed of several shorter sections placed beside one another on a line parallel to the axis, so as to form two or more parallel annular sets of coils, I may employ the current from one set, after passing it through a commutator, for the purpose of magnetizing the field-magnets, and the current from the remaining set or sets for work in a circuit outside the machine.

The armature-coils may be placed in the circuit of the field-magnet coils in any of the well-known ways. In order to facilitate the connection of the machine for currents varying in electro-motive force, I may prefer to connect so as to send the current through the machine as follows: from binding-post, Fig. 13, through the coil c^2; thence to an accessory binding-post, a, placed on the machine at any convenient point; thence through the coil c^3, as shown, all the coils in the figure being supposed to be wound in the same direction; thence through the armature S to the coil c^4; thence through c^5, and finally to the binding-post +, and so out of the machine. When this connection is employed in the field I connect the wires of the separate coils of the armature in series.

When it is desired to connect the machine for a lower resistance I couple the coils in multiple arc in a manner well known. In this case the connection may be as shown in Fig. 14. Here the current enters the machine at the binding-post — and branches through the coils c^2 and c^3, as shown; thence it passes to the binding-post a, and thence through the armature, the coils of which may or may not be connected in multiple arc. From the armature it passes to the binding-post c, and thence in two branches through the magnet-coils c^4 c^5, and finally reaches the binding-post +, from whence it passes out of the machine.

When the spider-arms are set in from the ends of the sections I can employ curved pole-pieces, extending over the ends and partly covering the inner surface of the separate sections of the revolving armature, in a manner well-known in the art. Such curved pole-extensions are partly shown in connection with Fig. 10.

What I claim as my invention is—

1. A cylindrical armature for a dynamo-electric machine, constructed in separate and distinct sections, as described, separated from one another by free air-spaces parallel to the axis of rotation of the armature.

2. A cylindrical armature for a dynamo-electric machine, constructed in separate and distinct sections, each of which is separated from adjoining sections by free-air spaces, and is provided with distinct and independent means for securing it in place, all constructed as set forth, whereby each section is magnetically independent of the others, and may be removed without disturbing the adjoining sections.

3. The combination, substantially as described, of a spider-frame of brass or other non-magnetic material, the curved armature-sections provided with the lugs P P, and screws or equivalent fastening means for each section, whereby the lugs P P and the connected section may be fastened to the spider-frame independently of the other sections.

4. In a dynamo-electric machine, a cylindrical armature-core constructed in sections, suitably mounted upon the shaft of the machine, said sections being separated from one another by free longitudinal slots extending in a direction parallel to the axis of rotation, for the purpose of ventilating the armature and insuring a more rapid change in the magnetic polarity thereof.

5. In a dynamo-electric machine, an armature-section consisting of a curved plate provided with slots extending in a direction parallel to the line of rotation and included within the edges of the plate, said plate being wound with coils of insulated wire parallel to the axis of rotation.

6. The combination, with a cylinder-armature constructed in independent sections separated from one another by air-spaces parallel to the axis of rotation, of compound field-magnets constructed, as described, so as to provide air-spaces between the cores and pole-pieces of the individual magnets, said spaces being parallel to those upon the armature, so as to aid in ventilation of the armature.

7. The combination, with the field-magnet plate provided with openings, as described, of hollow field-magnet cores bolted to said plates over the openings, substantially as and for the purpose described.

8. The combination, with the field-magnet plate, of two separate field-magnet cores bolted to the plate on opposite sides of a slot or perforation therein coinciding with the space between the two cores and their pole-pieces.

EDWIN J. HOUSTON.

Witnesses:
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FRANK H. MASSEY.