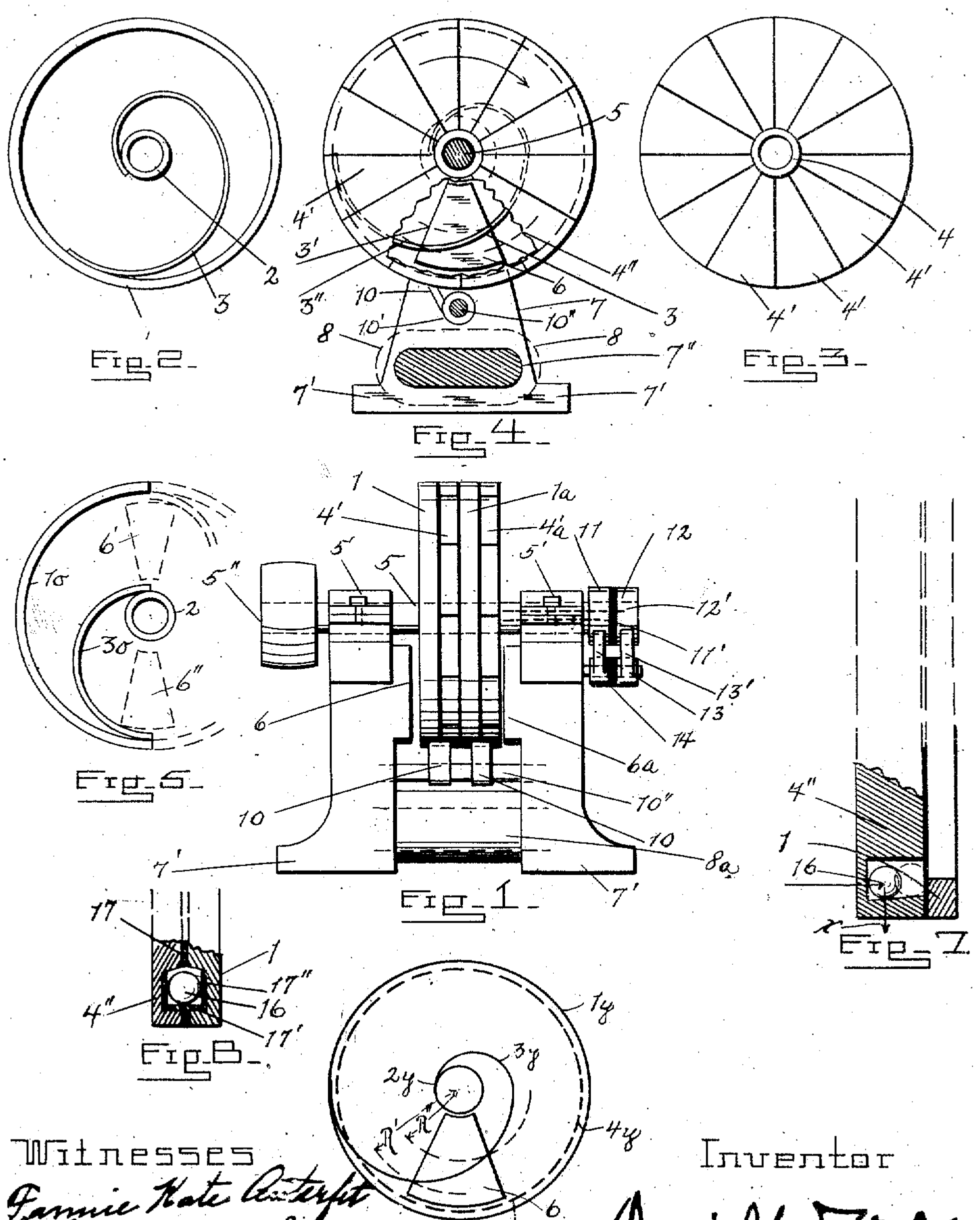
D. W. TROY.

DYNAMO ELECTRIC MACHINERY.

APPLICATION FILED NOV. 1, 1909.

979,603. Patented Dec. 27, 1910.



Witnesses

Fannie Kate Cuterfit

J. Palbert-Letcher

Inventor

Daniel W. Troy

UNITED STATES PATENT OFFICE.

DANIEL W. TROY, OF MONTGOMERY, ALABAMA.

DYNAMO-ELECTRIC MACHINERY

979,603. Specification of Letters Patent. Patented Dec. 27, 1910.

Application filed November 1, 1909. Serial No. 525,825.

To all whom it may concern:

Be it known that I, DANIEL W. TROY, a citizen of the United States of America, and a resident of the city and county of Montgomery, State of Alabama, have invented certain new and useful Improvements in Dynamo-Electric Machinery, of which the following is a specification, reference being had to the accompanying drawing, forming a part hereof.

This invention relates to apparatus for the production and utilization of direct currents. In a manner it is analogous to the acyclic machines in that current directions are never reversed and the relative movement of conductors and magnetic flux is unidirectional.

The object of the invention is to provide novel and efficient apparatus for the purposes mentioned, particularly for the production and utilization of currents at voltages heretofore difficult to employ in machines of the related class.

In the drawing Figure 1 shows a complete machine embodying the invention: Figs. 2 and 3 are parts of the armature; Fig. 4 is a partly broken and partly sectional view of the complete machine; Fig. 5 is a detail of a modification of the armature; Fig. 6 is a diagram illustrating the invention; Figs. 7 and 8 are detail sectional views showing modifications of the contact maintaining means.

From Fig. 4, which shows a partly sectional view of the field magnet showing one of the opposing pole faces 6 it will be seen that I employ a flux or field having a dimension in the direction of relative movement of armature conductors substantially less than the path of such movement. In Fig. 6 assume a magnetic flux directed upward from the pole face 6. Let 1^y be a peripheral conductor capable of rotation about its center and provided with a spiral member 3^y leading to an axial member 2^y. It is obvious that only so much of the radial projection of the spiral as lies between its intersections with the radial sides of the field is ever cutting the flux (see R' and R''. Fig. 6, R'—R'' being the length of the spiral which can cut the flux effectively at any instant, R' and R'', of course, being variables but varying together so that their difference is constant). Assuming the flux density uniform and of density B the E. M. F. produced by rotation of the spiral-spoked rim will be measured by the product of B into the rate of progression of the effective radial projection of the spiral. Assuming the flux to have a dimension in the direction of rotation of 30 degrees of arc and the spiral to have a dimension of 360 degrees, as shown, it is obvious that only 1/12 of the total radial length of the spiral can be cutting through the flux at any instant. The E. M. F. is therefore, 1/12 of what it would be for the same rate of rotation of a disk of like diameter to 1^y. 4^y is such a disk (indicated by a dotted circle). Assuming the disk axially connected to 2^y and otherwise insulated except by peripheral collecting means, rotation of disk and spiral will result in induction of an E. M. F. in each, that of the one being 1/12 that of the other and both acting radially in the same direction. If by any means the radial elements of the disk are successively connected to the peripheral member as they begin to traverse the flux there will be a current in the system (neglecting for the present eddy currents) which will follow the direction of the E. M. F. of the radial element and oppose that of the spiral, due, in this case, to an effective E. M. F. 11/12 that of the radial disk element. In Fig. 4 this will be readily understood. One of the pole pieces has been removed and on a shaft 5 is shown a disk element 4, subdivided as in Fig. 3, into a plurality of radial conductors, all connected axially and each having an angular width not greater (and preferably very much less) than that of the pole faces. Part of several of the radial members are broken away so as to show the spiral conductor 3, its radial effective length being for the figure, between the arcs 3' and 3''. Both the collar or axial member of the spiral conducting system (see 2, Fig. 2) and the like axial member 4 of the radially slotted disk are assumed to be insulated from the axis (although one may not necessarily be so) and connections made, as by conductors indicated at 12' and 11' (Fig. 1) to collecting rings 11 and 12. A brush or sliding contact 10—10 serves to maintain a connection between the peripheral portion 1 and one of the radial elements of the disk. As the disk and the peripheral member are of like diameter this function may be served by a single brush which maintains the contact at a point fixed with respect to the magnet. As constructed it will be seen that the armature corresponds to two acyclic armature systems (completely so except for the subdivision of the disk by radial slots) one of which cuts through the flux at a greater rate than the other and consequently generates higher E. M. F. although both rotate (or move relatively to the flux) at the same rate. Hence there is an effective E. M. F. which can drive a current in radially opposite directions through them.

In Figs 1 and 4, 7 is the field magnet, 6 and 6ª the opposite faces of the poles which determine the shape and dimensions of the flux-cross section. 5′, 5′ are journals for the shaft 5, here shown as supported by the magnet structure. 7′, 7′ are enlargements of the magnet structure to form a base. 7″ is a cross section of the magnet core, 8ª showing the wound core, (dotted area 8, 8, Fig. 4, showing its cross-section.) 5″ is a driving pulley. 13 and 13′ are collecting brushes insulated from each other as at 14.

In constructing a machine for actual use I employ a plurality of armature systems each of which is essentially the combination shown in Fig. 4, of the elements of Figs. 2 and 3—a subdivided disk and a spirally spoked wheel. Such an arrangement is shown in the armature of Fig. 1. 1 and 1ª are two peripheral conductors each corresponding to that of the system of Fig. 2. 4′ and 4′ª are radial disk elements like those of Fig. 3. Obviously as many such systems as desired may be assembled on one shaft. Since the direction of E. M. F. (effective) is different radially in spirals from that in disks it is only necessary to connect collar 4 of a disk to collar 2 of the adjacent spiral, and so on. In Fig. 1 a connection is made from collecting ring 11 to the collar of the radial elements of which 4′ª is one. They are successively maintained in connection with the adjacent peripheral element 1ª by the right hand brush 10. Assuming the inner or axial collar of the spiral connected to 1ª to be in contact with the collar of the disk elements of which 4′ is one, the brush 10 (to the left) completes the circuit from these elements to the peripheral element 1, whence the connection is by the last spiral to its axial collar and to collecting ring 12 by a conductor 12′, which with the conductor 11′, is shown in dotted lines. The circuit is therefore from 11 to 12 first radially outward, then radially inward by a spiral, then radially outward, then radially inward by a spiral, thence to collecting ring. Obviously only considerations of bulk limit the number of elements which may be thus assembled in series for the production of a total E. M. F. equal to the sum of all the effective E. M. F.'s of the several combinations of the elements of Figs. 2 and 3. A connecting brush, or its equivalent, is required for each combination, but only two collecting rings for any number. The material of the inductors is not an essential but where the distance between pole faces is substantial they may be made of iron or like permeable material to advantage.

Obviously, the arrangement which holds good for a complete-peripheral member and a spiral extended 360 degrees in the direction of movement between armature and magnet is equally applicable (if desired) to the case of a spiral of less length. In Fig. 5 a modification of this character is shown. 3⁰ is a spiral extended only 180 degrees, its peripheral member 1⁰ being but a half annulus. Such an arrangement may be employed where a magnet structure is provided with two polar gaps. See 6′ and 6″ Fig. 6. Two sets of peripheral contacts, however, will be required in this instance. The arrangement is self-evident and needs but mention.

I am by no means confined to the use of sliding contacts as the brushes 10, 10, to maintain the connection between the peripheral member belonging to the spiral conductor system and the radial conductors of the "disk" element, although it is necessary that the locus of this connection remain stationary with respect to the magnet. The machine is inoperative if fixed connections are made at the peripheral ends of the conductors and the locus of the connection must remain fixed with reference to the flux. To avoid the use of sliding contacts I provide means such as shown in typical forms in Figs. 7 and 8. In Fig. 7 I have shown a sectional view—the section being taken radially on a plane assumed to pass through the axis of the systems—which illustrates the general principle of both forms. 4″ is a section of the outer end of a radial disk element—as constructed here, preferably of non-magnetic material—1 is a section of the peripheral conductor—shown insulated from 4″. In a groove in the element 4″ are a plurality of members as 16, preferably iron or steel balls which may to advantage be coated with some metal such as brass or tin. The groove is so shaped that when the armature is in motion the resultant of the centrifugal force acts counter to the arrow *y*, *x* indicating the centrifugal thrust and the inclination of the outer wall of the groove causing the resultant to the left in the figure. The distance between the contact member 16 and the peripheral member 1, while large in the figure, is in practice made very small indeed, just enough to insure a good break of electrical continuity. When these contact balls, normally thrown out of contact with 1 but always in good contact with the radial members 4″, begin to enter the flux they are attracted by the closely approximated iron peripheral member—the attraction being a function of the flux density passing through both—and they roll over into contact, thus automatically maintaining a connection between the radial members and the peripheral conductor which exists nowhere else except at certain points fixed with respect to the flux. The arrangement of Fig. 8 is quite similar but is adapted for cases where the diameter of the ball-retaining groove is somewhat greater so that a pull is exerted on the balls toward the axis when they are passing beneath the polar gap (as if in the peripheries of the rotating parts of Fig. 1). Here the centrifugal force is allowed to act directly to maintain the condition of discontinuity of the parts. The balls, of which 16 is one, are normally insulated by fiber or the like, see sectional views at 17, 17′, 17″, so long as the centrifugal force is allowed to act, but under the influence of magnetic attraction they move radially inward and connect the elements 4″ and 1. In this case it is more or less immaterial of what metal the elements 4″ and 1 are composed. With the rotating system at rest (in either modification) some of the balls or movable contact makers are in operative position so that no complete opening of the circuit is experienced. These flux controlled contact closers are not essentials of this invention but merely valuable aids to its complete carrying into effect and they form the subject of a co-pending application Ser. No. 519,899, filed Sept. 27, 1909.

Having described my invention, what I claim is:—

1. In a dynamo-electric machine, a field magnet arranged to establish a field force, a pair of armature conductors movable together through said field by relative motion therewith of unidirectional character, one of said conductors more inclined than the other to the direction of relative movement and having a dimension in that direction greater than that of the field in such direction, and means for maintaining electrical connection between said conductors at points stationary with respect to said field.

2. In a dynamo-electric machine, a field magnet arranged to establish a field of force, a plurality of armature conductors all movable together through said field by relative motion therewith, one of said conductors more inclined than the others to the direction of relative movement and having a dimension in that direction greater than that of the field in such direction, and means for maintaining electrical conneection between said more inclined conductor and each of the others successively at points stationary with respect to said field.

3. In a dynamo-electric machine, a field magnet arranged to establish a field of force, an armature arranged to move through said field and having a plurality of conductors substantially normal to the direction of such movement and a return conductor substantially inclined to the direction of such movement, a peripheral conductor connected to said inclined conductor, and means for maintaining electrical connection between said peripheral conductors and each of said substantially normal conductors at points stationary with respect to said field.

4. In a dynamo-electric machine, a field magnet arranged to establish a field of force, an armature arranged to move through said field and having a plurality of conductors substantially normal to the direction of such movement and a return conductor substantially inclined to the direction of such movement, a second plurality of like substantially normal conductors and a second like substantially inclined conductor on said armature, said second substantially inclined conductor permanently connected electrically to said first substantially normal conductors, and means for maintaining electrical connection between said first substantially inclined conductor and each of said first substantially normal conductors and between said second substantially inclined conductor and each of said second substantially normal conductors at points stationary with respect to said flux.

Witness my hand this 25th day of October, 1909.

DANIEL W. TROY.

Witnesses:

Fannie Kate Centerfit,

J. Talbert Letcher.