

No. 767,787.

PATENTED AUG. 16, 1904.

E. R. WHITNEY.
COMMUTATING DYNAMO ELECTRIC MACHINE.

APPLICATION FILED DEC. 30, 1903.

NO MODEL.

Fig. 1.

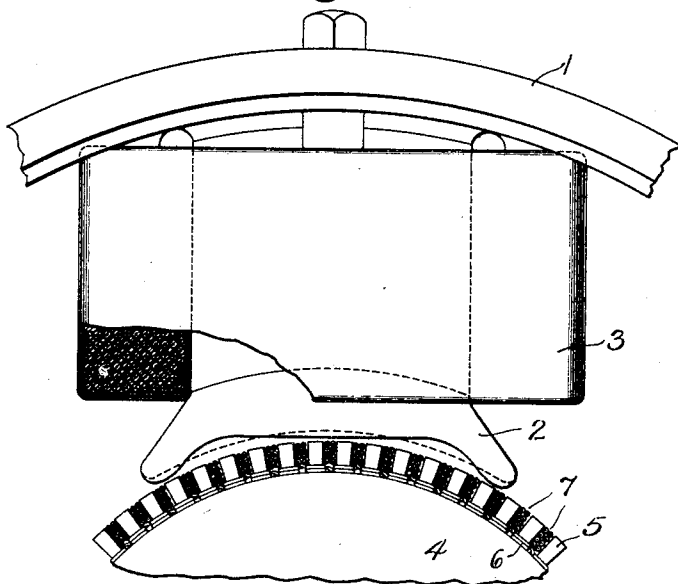


Fig. 2.

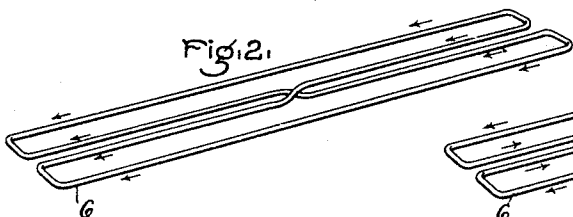


Fig. 3.

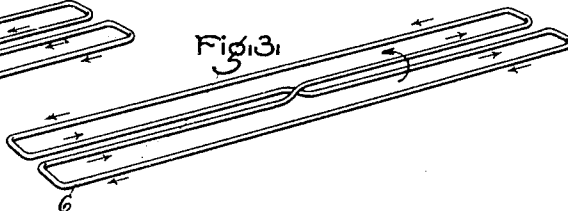


Fig. 4.

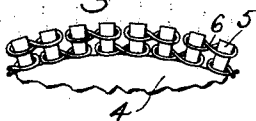
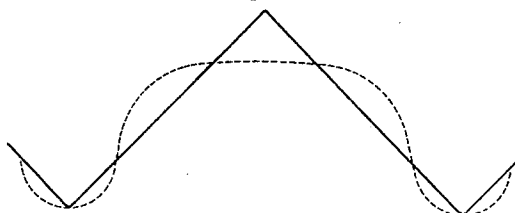


Fig. 5.



Fig. 6.



Witnesses:

George A. Thornton.

Allen Orford

Inventor,

Eddy R. Whitney,

By *Albert B. Davis*

Att'y

UNITED STATES PATENT OFFICE.

EDDY R. WHITNEY, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

COMMUTATING DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 767,787, dated August 16, 1904.

Application filed December 30, 1903. Serial No. 187,098. (No model.)

To all whom it may concern:

Be it known that I, EDDY R. WHITNEY, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Commutating Dynamo-Electric Machines, of which the following is a specification.

The object of my present invention is to improve the operation of commutating-machines by the provision of means for decreasing or minimizing the self-induction of armature-conductors during the periods in which the currents in them are being commutated. I accomplish this result by arranging a series of short-circuited windings upon the armature-core. Preferably each of these windings has some of its turns reversed with respect to others, so that when the winding passes under a field-pole the electromotive force generated by the working flux in one portion of the winding is substantially counterbalanced by the electromotive force generated in the other portion. The short-circuited windings are so arranged upon the core, however, that both portions assist in reducing the self-induction of the armature-conductors at the moment of commutation. In order to avoid an injurious current-flow in the short-circuited windings when they are under the pole-faces, I have found it desirable to so arrange the pole-faces that the curve of electromotive force induced in a conductor carried on the armature-core will have a substantially uniform slope.

The various features of novelty which characterize my invention are set forth with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawings, in which I have illustrated one embodiment of it.

Of the drawings, Figure 1 is an elevation, partly in section and partly diagrammatic, showing a portion of the field and armature of a dynamo-electric machine equipped with my invention. Figs. 2 and 3 are diagrammatic views illustrating the direction of the

electromotive force induced in different portions of the short-circuited windings at different periods in the revolution of the armature. Fig. 4 is a diagrammatic view illustrating one arrangement of the short-circuited conductors. Fig. 5 is a similar view indicating a different arrangement, and Fig. 6 is a diagram showing curves of the potential induced in armature-conductors with different-shaped pole-faces.

1 represents the field-ring of a dynamo-electric machine provided with internal pole-pieces 2, on which are mounted magnetizing-windings 3. The armature 4, coöperating with the pole-pieces 2, is formed with teeth 5, around and between which the armature-windings are placed. Short-circuited windings each comprising two turns, one of the turns of each winding being reversed with respect to the other, as is clearly shown in Figs. 2 to 4, inclusive, are placed on the armature with one turn around one tooth 5 and the other turn around an adjacent tooth 5. In the arrangement shown in Figs. 1 and 4 each armature-tooth is surrounded by one turn of each of two short-circuited windings 6, the other turn of one of the windings surrounding the tooth at the right of the first-mentioned tooth and the other turn of the second winding surrounding the tooth at the left of the first-mentioned tooth. In the construction shown in Fig. 5 but half as many short-circuited windings are employed, which are so arranged that each tooth is surrounded by but one turn of one short-circuited winding.

Preferably the short-circuited windings are placed at the inner ends of the teeth 5, as is clearly shown in Fig. 1, the space between the outer portions of the teeth 5 being filled by conductors 7, forming the main winding of the armature.

As the currents in successive armature-coils are commutated a magnetic flux is successively set up in armature-core teeth on each side of the coil being commutated, the magnetic circuit being completed across the top of the teeth through the air. The flux thus set up, as is well known, tends to cause sparking at successive commutator-bars. With the short-cir-

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shorted windings applied as I have described them the flux set up induces a current in the closed circuited windings which tends to destroy the flux which creates it, and thus minimizes the sparking effect. The large curved arrow in Fig. 3 shows the direction of the magnetic flux passing from one tooth to an adjacent tooth and the other arrows show the direction of the electromotive force induced thereby in the various portions of the short-circuited winding. It will be observed that the electromotive force induced in every portion of the short-circuited winding tends to produce a current flowing in one direction through the winding which is such as to destroy the flux creating it.

With the ordinary form of pole-face (indicated by the dotted line in Fig. 1) the curve of potential induced in an armature-conductor is that indicated by the dotted line in Fig. 6. In order to reduce to a minimum the flow of current in the short-circuited windings, the pole-face should be formed so that the curve of the potential induced in an armature-conductor shall have a substantially uniform slope, as indicated by the full-line curve in Fig. 6. This result may be obtained in various ways. I have found, for instance, that it may be obtained by shaping the pole-face substantially as indicated by the full line in Fig. 1. The change in pole-face indicated in Fig. 1 is exaggerated somewhat for the purpose of better illustrating the construction.

While I have described in detail one form of my invention as applied to toothed armatures, it will be easily understood by those skilled in the art that the invention is not limited to use in connection with a toothed armature-core nor to the particular form of my invention hereinbefore described and illustrated.

It is obvious that among other advantages resulting therefrom my invention gives a dynamo-electric machine which does not have to depend on the flux at the pole-tips for reversal and sparkless commutation. This is particularly advantageous with motors which reverse.

My invention also allows the use of a dynamo-electric machine of decreased size and weight for a given output.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a dynamo-electric machine, a toothed

armature, and a series of short-circuited windings, each consisting of two turns, one of said turns being reversed with respect to the other, placed with one of said turns surrounding one armature-tooth and the other turn surrounding an adjacent tooth.

2. In a dynamo-electric machine, an armature, and a series of short-circuited windings placed thereon, each of said windings having one portion reversed with respect to another portion.

3. In a dynamo-electric machine, an armature and a series of short-circuited windings placed thereon, each of said windings comprising a pair of turns, one of said turns being reversed with respect to the other so that the electromotive force generated in it by the working flux opposes the electromotive force set up in the other turns by said flux.

4. In a dynamo-electric machine, an armature and a series of short-circuited windings placed thereon, each of said windings comprising two turns one of which is reversed with respect to the other, and means for producing a working flux creating a potential in an armature-conductor the curve of which has a substantially uniform slope.

5. In a commutating dynamo-electric machine, an armature, a main winding placed thereon, and a series of permanently-short-circuited windings also placed thereon arranged to decrease the self-induction of the main armature-conductors at an instant at which the currents in them are commutated.

6. In a commutating dynamo-electric machine, an armature having a toothed core, a main winding placed thereon, and a series of short-circuited windings surrounding the core-teeth.

7. In a commutating dynamo-electric machine, an armature having a toothed core, a main winding placed thereon, and a series of permanently-short-circuited windings also placed thereon and arranged so that each of the core-teeth is surrounded by one of the short-circuited windings.

In witness whereof I have hereunto set my hand this 26th day of December, 1903.

EDDY R. WHITNEY.

Witnesses:

DUGALD MCK. MCKILLIP,
JOHN A. McMANUS.