

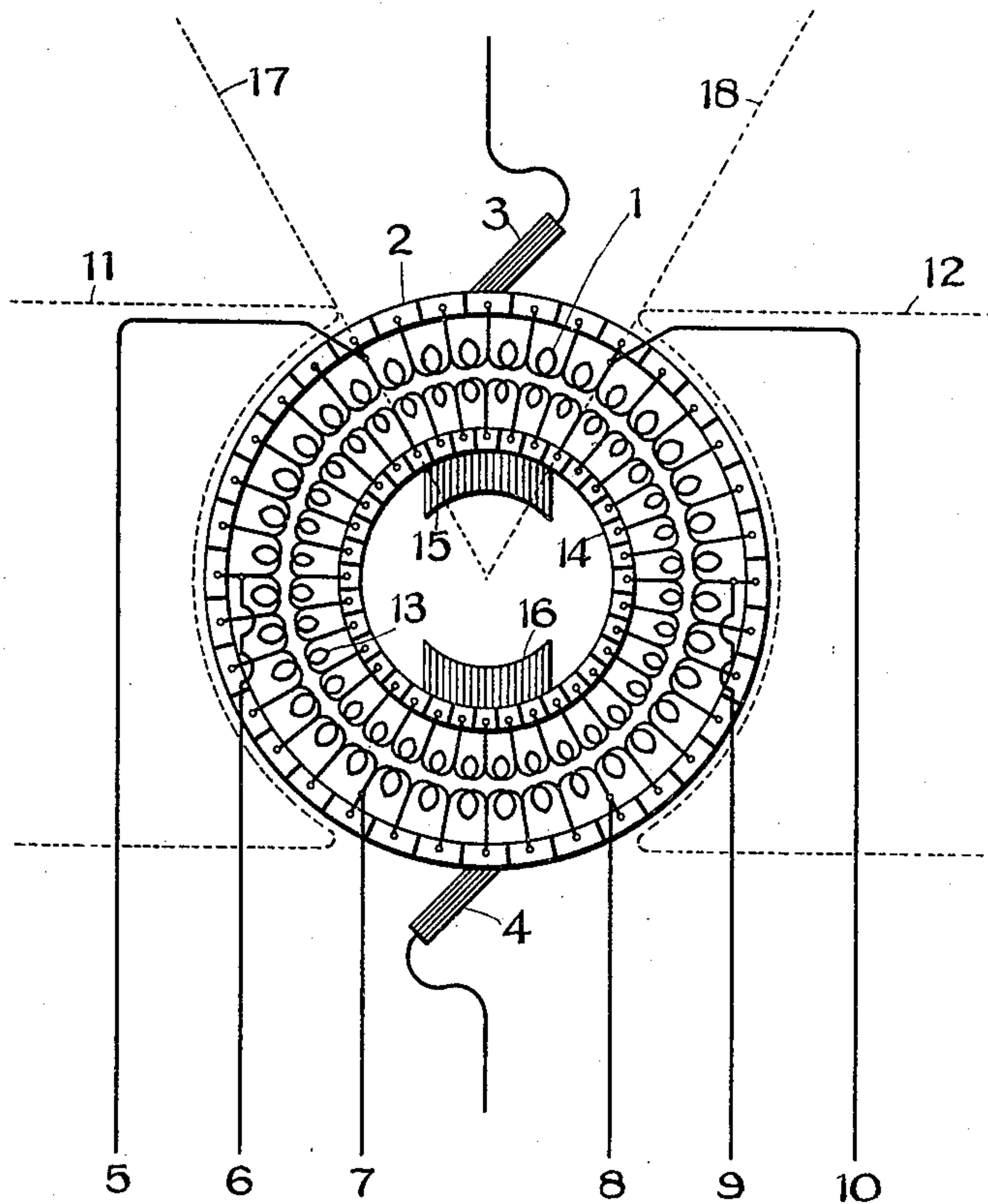
No. 678,904.

Patented July 23, 1901.

E. W. RICE, JR.
DYNAMO ELECTRIC MACHINE.

(Application filed Apr. 25, 1900.)

(No Model.)



Witnesses :

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UNITED STATES PATENT OFFICE.

EDWIN W. RICE, JR., OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE
GENERAL ELECTRIC COMPANY, OF NEW YORK.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 678,904, dated July 23, 1901.

Application filed April 25, 1900. Serial No. 14,267. (No model.)

To all whom it may concern:

Be it known that I, EDWIN W. RICE, Jr., a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machines, (Case No. 1,144,) of which the following is a specification.

My present invention relates to dynamo-electric machines, and more especially to that type provided with a commutator or commutators. It possesses many utilities, whether applied to alternating-current machines or to machines of the direct-current type.

Briefly characterized, my invention comprises means for reducing the apparent self-induction of armature-coils lying between pole-pieces, thereby greatly decreasing the sparking in commutating-machines, whether of the alternating-current or direct-current type, and decreasing or entirely preventing any tendency to hunt which may exist in alternating-current machines to which it may be applied.

The specific means which I prefer to employ for carrying out my invention in practice is the addition of a second winding superposed upon or intermeshed with the main armature-winding, this additional winding being provided with a separate commutator, to which it is connected in the ordinary manner. Short-circuiting brushes are placed upon this commutator at points corresponding to portions of the armature-winding lying between the poles. These short-circuiting brushes produce a short circuit in the additional or secondary winding, which is constantly progressing or shifting with respect to the conductors of the winding, but fixed with respect to the interpolar space. By reason of this arrangement the self-induction of coils in the main winding passing through the commutating region is so greatly reduced that practically no sparking occurs when the brushes coöperating therewith pass from one commutator-segment to the next. In synchronously operating alternating-current machines this same advantage is present if the machine be of a type provided with a commutator, while in all such machines, whether provided with a commutator or not, any tend-

ency to hunt which may exist is prevented. It has heretofore been common to utilize short circuits of various forms located upon the field-magnet structure to prevent hunting of the armature coöperating therewith. Such arrangements in many cases possess great utility, but are not so effective as that herein described, since by reason of the air-gap between the field and armature they are not in such close inductive relation to the armature-conductors.

A specific embodiment of my invention, together with advantages incident thereto, is set forth in the following description, which is to be taken in connection with the accompanying drawing.

The scope of my invention is not to be unnecessarily limited by reason of anything which I have said in describing the same, but is to be determined by reference to the claims appended thereto.

In the drawing I have shown my invention as applied to a rotary converter of the six-phase type now well-known in the art. The main armature-winding of the converter is indicated at 1 and may be of any ordinary type. A commutator 2 is connected to this winding in the usual manner, and upon this commutator bear brushes 3 4, connected with a direct-current-consumption circuit, (not shown,) but of any ordinary and well-known character. The alternating-current leads are indicated by the numerals 5 to 10, inclusive, and are tapped into the main armature-winding at points equally displaced from each other and connected to collector-rings in a manner well understood. For convenience the machine is shown as bipolar, the poles being indicated by dotted lines 11 12; but in practice it will be understood that such machines are usually constructed with a considerably larger number of poles.

So far the machine does not differ from those well known in practice. I, however, add to the ordinary machine an additional armature-winding, which for convenience I will designate as the "secondary winding." This winding is indicated at 13. It is either superposed upon the main winding 1 or intermeshed with it side by side, as may be found most convenient, and is provided with a commutator of

its own, (indicated at 14.) Short-circuiting brushes 15 16 bear on portions of this commutator, so as to short-circuit sections of the secondary winding lying in the region between the pole-tips. Thus, for example, the short-circuiting brush 15 short-circuits all of those commutator-segments connected to portions of the secondary winding lying within the angle represented by the dotted lines 17 18. The short-circuiting brush 16 acts in a like manner to short-circuit a portion of the secondary winding on the opposite side of the armature. These short-circuiting brushes are shown as distinct from each other and not connected together directly or through any intermediate circuit other than the armature-winding. The brushes may be conveniently formed of a number of individual brushes staggered upon the commutator or otherwise suitably arranged, and for the purpose of eradicating the last traces of sparking the outside brushes may be formed of carbon, the inner brushes being of copper or other metal of high conductivity in order to increase the conductivity of the short circuit.

Little remains to be said in explanation of the operation of my invention. As commutator-segments connected to the main armature-winding 1 pass under the brushes 3 4 the adjacent commutator-segments are short-circuited, thereby short-circuiting the armature-coils to which they are connected. Owing to the presence of the short circuit in the secondary winding 13 in close inductive relation to the coil in the main armature-winding undergoing commutation, the apparent self-induction of this latter coil is reduced nearly, if not quite, to zero, thereby causing current in this main armature-coil to fall almost instantly to zero. When, therefore, the commutator-segments mentioned pass out from under the cooperating commutator-brush, there will be no sparking due to opening the short circuit thus formed by the brush and scarcely any tendency to sparking due to the armature-current being set up in this coil in the opposite direction, since owing to its negligible apparent self-induction the current may rise instantly to its full value. The advantages flowing from the reduction in sparking thus occasioned are manifold and will be apparent to those skilled in the art. I may observe, however, that the application of my invention renders it possible to very greatly increase the capacity of commutating-machines, and this in spite of the space occupied by the additional secondary winding.

When the invention is used in connection with synchronously-operating alternating-current dynamo-electric machines, the local short circuit in the secondary winding acts to intercept that component of the armature

reaction which operates at right angles across the direction of the field. When the machine tends to hunt, this armature reaction varies periodically. This variation is, however, strongly and vigorously opposed by the short circuit formed in the secondary winding, which thereby vigorously opposes the tendency to hunt and so preserves a uniform speed of rotation.

When my invention is employed in connection with a rotary converter or similar machines, it operates, as will readily be seen, both to prevent hunting and to suppress sparking at the commutator.

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

1. The combination in a dynamo-electric machine, of two windings in fixed relation to each other, a commutator for each winding, and short-circuiting brushes for producing a local circuit in one of said windings.

2. The combination in a dynamo-electric machine, of two armature-windings, a commutator for one of said windings, and means for producing a progressive short circuit in the other winding so located as to improve the commutation of the first winding.

3. The combination in a dynamo-electric machine, of two armature-windings, and means for producing a progressive local circuit in one of said windings in inductive relation to coils undergoing commutation in the other winding.

4. The combination in a dynamo-electric machine, of a main winding, a commutator for said winding, a secondary winding in fixed relation to the main winding, and means for producing a progressive short circuit in the secondary winding.

5. The combination in a dynamo-electric machine, of a commutator, a main winding connected to the commutator, a secondary winding in fixed relation to the main winding and means for producing a progressive short circuit in said secondary winding in induction relation to coils of said main winding undergoing commutation.

6. In a dynamo-electric machine, the combination of pole-pieces, an armature provided with two windings, and a short circuit in one of said windings spanning approximately the angle between the pole-tips.

7. In a dynamo-electric machine, the combination of pole-pieces, an armature provided with two windings, and a progressive short circuit in one of said windings spanning approximately the angle between the pole-tips.

In witness whereof I have hereunto set my hand this 23d day of April, 1900.

EDWIN W. RICE, JR.

Witnesses:

BENJAMIN B. HULL,
ALEX. F. MACDONALD.