J. E. NOEGGERATH.

DYNAMO ELECTRIC MACHINE.

APPLICATION FILED JULY 23, 1908.

920,626.

Patented May 4, 1909.

Fig. 1.

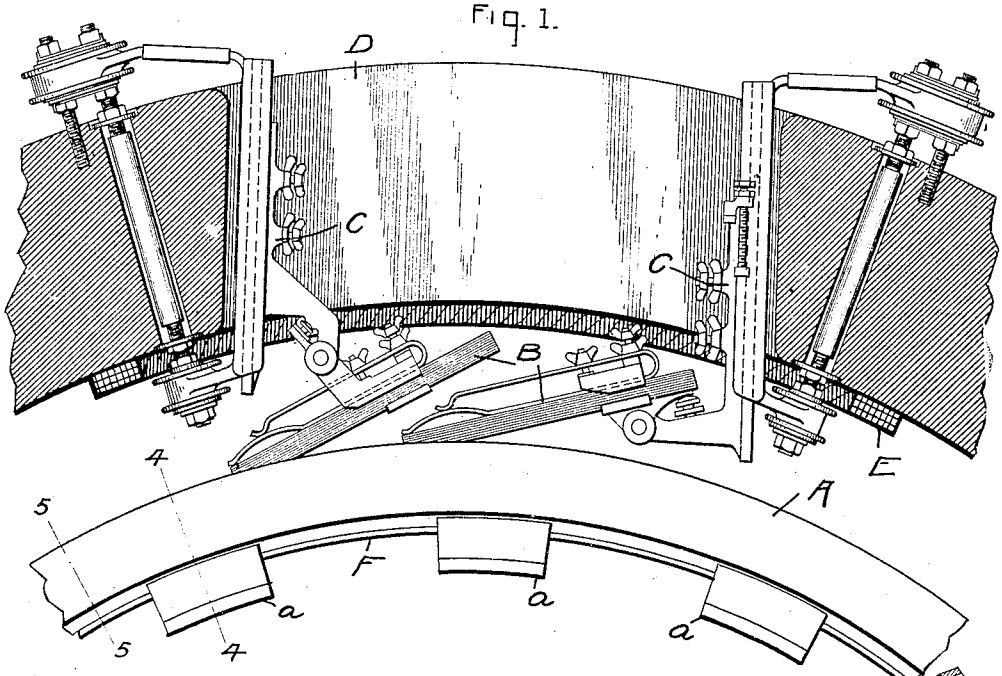


Fig. 2.

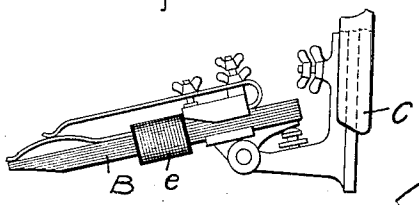


Fig. 3.

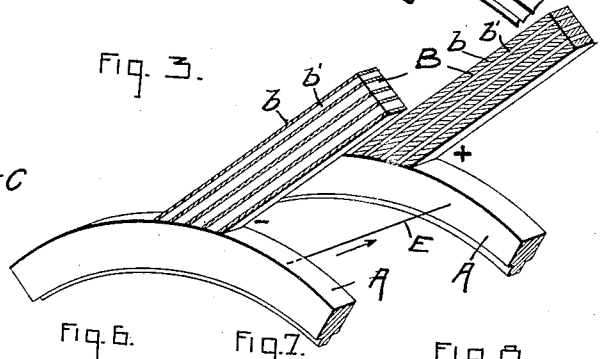


Fig. 4.

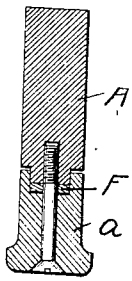


Fig. 5.

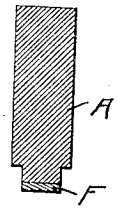


Fig. 6.

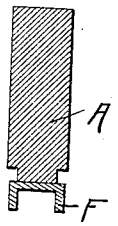


Fig. 7.

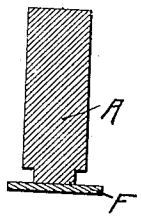
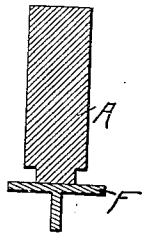


Fig. 8.



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UNITED STATES PATENT OFFICE.

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DYNAMO-ELECTRIC MACHINE.

No. 920,626. Specification of Letters Patent. Patented May 4, 1909.

Application filed July 23, 1908. Serial No. 444,881.

To all whom it may concern:

Be it known that I, JAKOB E. NOEGGERATH, 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, of which the following is a specification.

In order to obtain good efficiency from unipolar machines, they must be driven at high speeds. Furthermore, a comparatively large number of brushes must be employed to collect the current induced in the armature. If readily volatilized metal were used for collector-rings or brushes, the wear on this large number of brushes would be great. I, consequently, prefer, as disclosed in prior applications, to employ collector-rings of metal which does not readily volatilize, as, for instance, steel, with brushes composed partly of similar metal and partly of highly conducting metal such as copper. These brushes may be constructed of laminæ, partly of copper and partly of steel. The copper laminæ give the brushes high conductivity, while the steel laminæ reduce the wear on the brushes.

I have discovered that if the collector-rings are made of steel and the brushes are partly composed of steel laminæ, a very considerable stray flux passes through the collector-rings and brushes due to the comparatively low magnetic reluctance of this path. This flux shifts its position in the collector-rings, as the armature revolves and different parts of the ring are brought beneath the brush; and consequently eddy-currents are induced in the collector-rings, which result in heating losses materially affecting the efficiency of the machine.

One feature of my invention consists in providing means for preventing or reducing the stray flux, which produces these losses. I accomplish this by providing coils arranged to produce a magnetomotive force opposing a stray flux passing through collector-ring and brush. Each coil may surround the path of the stray flux through a number of brushes, or each coil may surround a single brush.

As a further means of reducing stray fluxes and resultant heating losses, I introduce non-magnetic material in the path of the flux passing through collector-ring and brush. To reduce the eddy current losses in the collector rings due to the reversal of current in them as they pass under the brushes, which losses would otherwise be appreciable because the rings are of magnetic material, I provide the rings with a strip of highly conducting material such as copper, which carries most of the current and is shaped so that the flux in the collector ring is made comparatively small.

A further feature of my invention consists in so distributing the volatile and non-volatile material in the brushes as to obtain a more even wear, than would be the case if all the brushes were similarly constructed. For a given brush construction, the amount of wear varies according to the polarity of the brush, the wear being greater where the current flows from brush to ring. The wear is thus greater at the negative brushes of a generator and at the positive brushes of a motor. I accordingly form those brushes, through which current flows to the collector-rings, with a greater proportion of steel and a smaller proportion of copper than the brushes at the other end of the machine.

My invention will best be understood by reference to the accompanying drawings, in which—

Figure 1 shows a portion of a unipolar machine having a coil for opposing a stray flux through the brushes; Fig. 2 shows a modified structure of the coil; Fig. 3 shows diagrammatically the differently constructed brushes at opposite ends of the machine; Figs. 4 and 5 are cross-sections of the collector-rings on the lines 4—4 and 5—5 of Fig. 1, respectively; and Figs. 6, 7 and 8 show modified constructions.

In the drawings, A represents a collector-ring, which is supported on the armature periphery (not shown) by studs *a a*.

B represents brushes bearing on the collector-ring. These brushes are carried by brush-holders C, which extend through apertures in the field magnet D, which apertures are provided to afford easy access to the brushes. It will be seen from Fig. 1 that if the collector-ring is of steel, the brushes B composed partly of steel laminæ, and the brush-holders C of magnetic material, that a path of comparatively low re-

luctance is afforded through collector-ring and brushes for a stray flux passing from the armature to the field magnet, and that this flux will shift in position with respect to the collector-ring as the collector-ring revolves. In order to reduce, or completely annul, this stray flux, a coil E is provided, which surrounds the aperture in the field magnet on its inner side, thus surrounding the paths of all stray fluxes passing through the brushes B at this aperture, so that if a current of proper direction and strength is sent through the coil E, the electromotive force produced will oppose the stray flux which would otherwise exist.

It is not necessary that the coils for opposing the stray flux should each surround a plurality of brushes; instead, coils *e* may be employed, as shown in Fig. 2, each surrounding a single brush. It has been said that the brushes are composed of copper and steel laminæ. I have also said that it is desirable to employ a greater proportion of steel in those brushes from which current flows to the collector-ring. Such an arrangement is indicated diagrammatically in Fig. 3, in which E represents an armature conductor connected at its opposite ends to collector-rings. The direction of current in the conductor is indicated by an arrow, and also by the plus and minus signs applied to the collector-rings. The copper laminæ are indicated by *b* and the steel laminæ by *b'*. It will be seen that the brush in engagement with the negative collector-ring is composed more largely of steel than the other brush. By this difference in their material, the wear on the two brushes is approximately equalized.

In addition to, or in place of, the coils for opposing a stray flux through the brushes, non-magnetic material may be introduced in the path of this stray flux. This may take the form of non-magnetic supporting studs *a*, for the collector-rings and copper strips F sheathing the inner periphery of the rings. These strips also reduce the losses due to eddy currents produced in the rings by reversal of current therein under the brushes, since the strips, being of high conductivity, carry most of the current and may be so shaped as to give a long path in air for any flux surrounding the strip, so that the amount of flux in the collector rings is made comparatively small. Suitable shapes for the strips are indicated in Figs. 6, 7 and 8. In Fig. 6 the width of the strip F is increased, and its edges bent down to form flanges extending away from the collector-ring so that the path in air of a flux surrounding the strip is comparatively long. In Fig. 7 the strip F is widened, but its edges are not bent down. In Fig. 8 the strip is widened and also has a depending central flange. Since these strips greatly reduce the flux in the collector-rings, they greatly reduce the eddy current losses due to current reversal in the rings.

I do not desire to limit myself to the particular construction and arrangement of parts here shown, but aim in the appended claims to cover all modifications which are within the scope of my invention.

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

1. In a dynamo-electric machine, collector-rings and brushes both having magnetic material in their composition, and coils arranged to produce a magnetomotive force opposing a stray flux passing through collector-rings and brushes.

2. In a dynamo-electric machine, collector-rings and brushes both having magnetic material in their composition, and coils surrounding the path of a stray flux passing through said brushes.

3. In a dynamo-electric machine, collector-rings of magnetic material, a magnetic field structure provided with apertures, brush-holders extending through said apertures, brushes having magnetic material in their composition carried by said brush-holders and engaging said collector-rings, and coils surrounding said apertures on the inner side of the field structure.

4. In a dynamo-electric machine, armature conductors connected at both ends to collector-rings, and brushes engaging said rings composed partly of hard and partly of soft metal, the brushes at one end of the conductors having a greater proportion of hard metal than the brushes at the other end.

5. In a dynamo-electric machine, armature conductors connected at both ends to collector-rings, and brushes engaging said rings composed of laminæ of hard and soft metals, the hard metal laminæ composing a greater part of the brushes at one end of the conductors than of the brushes at the other end.

6. In a dynamo-electric machine, collector-rings and brushes both having magnetic material in their composition, and members of non-magnetic material inserted in the path of a stray flux passing through rings and brushes.

7. In a dynamo-electric machine, collector-rings and brushes both having magnetic material in their composition, and highly conducting members of non-magnetic material inserted in the path of a stray flux passing through said rings.

8. In a dynamo-electric machine, collector-rings and brushes both having magnetic material in their composition, and a sheathing of highly conducting non-magnetic material on the inner side of said rings.

9. In a dynamo-electric machine, collec-

tor-rings having magnetic material in their composition, and strips of highly conducting non-magnetic material in contact with said rings.

10. In a dynamo-electric machine, collector-rings having magnetic material in their composition, and strips of highly conducting non-magnetic material in contact with said rings shaped to give a long path through air for a flux surrounding one of said strips.

In witness whereof, I have hereunto set my hand this 21st day of July, 1908.

JAKOB E. NOEGGERATH.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.