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W. V. SIEMENS & A. ROTTH.

DIRECT CURRENT DYNAMO ELECTRIC MACHINE.

(Application filed Jan. 6, 1900.)

(No Model.)

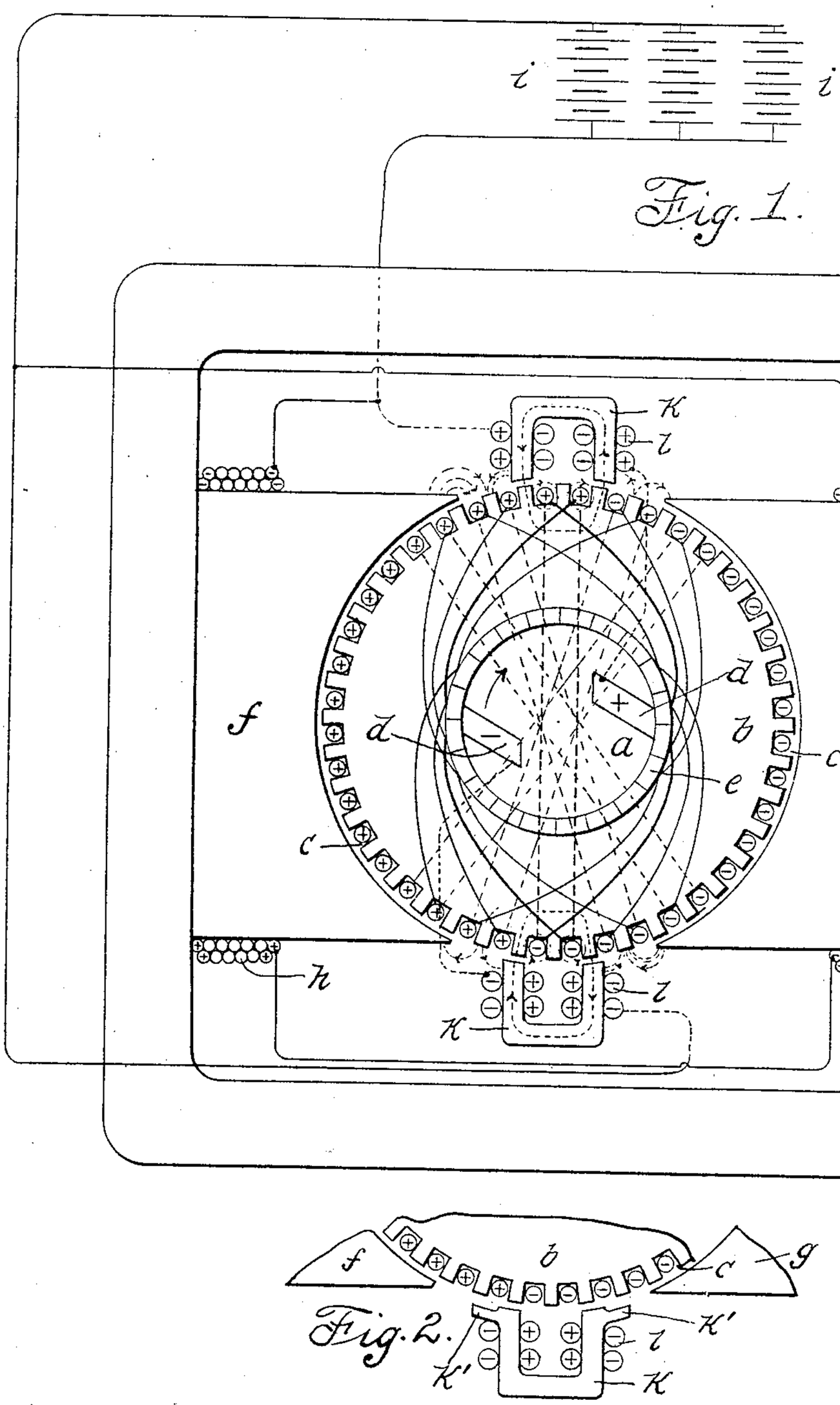

Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

WILHELM v. SIEMENS AND AUGUST ROTTH, OF BERLIN, GERMANY, ASSIGNORS TO THE SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA, OF CHICAGO, ILLINOIS.

DIRECT-CURRENT DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 665,586, dated January 8, 1901.

Application filed January 6, 1900. Serial No. 572. (No model.)

To all whom it may concern:

Be it known that we, WILHELM VON SIEMENS and AUGUST ROTTH, subjects of the Emperor of Germany, residing at Berlin, Germany, have invented a certain new and useful Improvement in Direct-Current Dynamo-Electric Machines, (Case No. 276,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to direct-current dynamo-electric machines, and has for one object the provision of improved means for subduing and preventing the sparking at the commutator-brushes occurring upon the reversal of current in the armature-coils in passing from a field of one polarity into a field of opposite polarity, or, in other words, when commutation of the current in the armature-coils is taking place.

Our invention has for its further object the provision of improved means for governing the direction of the lines of force emanating from the trailing pole-tips and directing them into the path of the armature-wire.

By means of our invention we are able to reduce the leakage coefficient.

In accordance with our invention we provide auxiliary means for deflecting the lines of force that would otherwise stray from the path of the armature-wire into the path of the armature. We preferably employ an auxiliary field-coil located near each trailing pole-tip, the field due to the auxiliary field-coils serving to react upon the lines of force emanating from the trailing pole-tips to deflect the same in the desired direction. These same auxiliary field-coils are also preferably employed for preventing sparking at the commutator.

By means of the auxiliary field-coils we are enabled to create fields which react upon the current in the armature-coil slightly prior to, during, and slightly subsequent to the commutation of current in the said armature-coil. To this end we construct the cores for these auxiliary field-windings in such manner that the magnetic effect due to these auxiliary windings will react upon the short-circuited windings of the armature during commutation. We thus are enabled to provide auxiliary field members which are capable of greatly decreasing the percentage of leakage lines of force and which at the same time are capable of preventing sparks when the current is being commutated, so that it is not necessary in order to effect sparkless commutation to rely solely upon the adjustment of the commutator-brushes with relation to the field-poles.

In practice, in connection with bipolar machines, for example, we prefer to employ two sets of auxiliary field-windings and prefer to provide in connection with each set a core, which auxiliary fields are each disposed between tips of opposite poles. In constant-potential work in order that the current flowing through the auxiliary field-windings may be proportionate to that flowing in the armature, which armature-current varies according to the load, we include the windings of the supplemental fields in series with the working conductors, the two sets of windings being preferably associated in parallel relation with each other. We are thus enabled to produce auxiliary fields which react upon the current that is about to be commutated proportionately to the load. We are also enabled thereby to create auxiliary fields which vary with the leakage lines of force, which latter change upon the change in load. While we preferably include the auxiliary field-windings in the main circuit, we do not wish to be limited to this arrangement, nor do we wish to be limited to the employment of the same current passing through the machine for the purpose of energizing the auxiliary field-windings, as any suitable source of current varying with the armature-current may be employed.

We will explain our invention more particularly by reference to the accompanying drawings, which illustrate one of many applications that may be made thereof.

In the drawings, Figure 1 is a diagrammatic view of a drum-armature shunt-wound direct-current generator, and Fig. 2 a de-

tailed view showing a modification of the auxiliary field-cores that may be employed.

Like letters refer to like parts in both views.

In Fig. 1 we have indicated in a well-known way the manner in which a drum-armature is wound; but for the sake of clearness we have not indicated all of the windings, a sufficient number being shown to indicate the nature of the armature-windings, and as the flow of the current through the windings of the armature and the function of the commutator for rectifying the current are well understood by those skilled in the art we do not deem a detailed description thereof to be essential. In the apparatus shown the drum-wound armature *a* has its coils wound about a mass of magnetic material *b*, provided with slots *c*, extending lengthwise of the armature, in which the armature-coils are disposed. The machine shown is of a bipolar two-path type, the current flowing from the armature to the commutator-brushes *d d* in two paths. The commutator-brushes rest upon the commutator *e* and in the position shown are capable of collecting the maximum amount of current generated. The field-poles *f g* are in this instance two in number, the field-winding *h* about the cores *f g* being in shunt of the working circuit, as shown. Current of constant potential is furnished to the translating devices *i i*, which are in parallel between the working conductors.

In practicing our invention we prefer to employ with the type of machine shown two cores *k k*, which are preferably in the form of horseshoes and extend longitudinally of and preferably have the same length as the armature. The core is of such construction that it is immediately adjacent to two short-circuited coils, so as to be in inductive relation thereto. In the type of machine shown the legs of the auxiliary field-cores are such a distance apart that two short-circuited coils are in inductive relation to the said cores. We preferably construct the auxiliary field-cores as shown in Fig. 2, where not only the short-circuited coils are reacted upon by the auxiliary fields, but the reaction between the auxiliary fields and the lines of force from the trailing pole-tips is increased. The action of the corrective auxiliary fields is heightened by employing auxiliary field-cores of the type shown, these cores being disposed upon diametrically opposite sides of the armature in the particular instance shown and each being located between tips of the opposite poles, as shown. The legs of the cores *k k* extend from the bases thereof toward the armature, each core being surrounded by a winding *l*, divided into two sections, each surrounding a leg of the core. We preferably include the auxiliary field-windings *l* in series with the working circuit, as shown, and arrange these windings preferably in parallel relation with each other. By including the auxiliary windings *l* in series with the working circuit we are enabled thereby to produce auxiliary fields which vary with the current output, so that the corrective current which produces the corrective fields for subduing or eliminating the sparking at the commutator and for guiding the flow of lines of force at the trailing pole-tips varies with the current generated in the machine. By this means the corrective current is automatically regulated in quantity.

While we prefer to employ the arrangement shown for supplying the auxiliary field-coils with current, it is obvious that other means may be used, and we do not therefore wish to be limited to a construction wherein the auxiliary field-windings are supplied with current directly from the dynamo with which they are associated.

In the positions of the parts illustrated each commutator-brush is shown in engagement with two commutator-segments. The direction of flow of the lines of force, due to the main field-windings *h h* and the auxiliary field-windings *l l*, is indicated by dotted lines and the arrows. The negative sign indicates the flow of current from the observer toward the illustration, while the positive sign indicates the flow of current in the opposite direction.

The machine shown being a two-path machine, the armature-coils are short-circuited, two neighboring coils at the same time, after having passed out of the influence of one main field-pole and before they have been brought into the influence of a main field-pole of opposite sign. Thus the auxiliary fields, due to the windings *l l*, react upon the coils when they are short-circuited and before the short-circuited coils are included in the main circuit and brought within the influence of the ensuing poles, it being assumed that the armature rotates in the direction indicated by the arrow. Thus current is set up in the short-circuited coils by the auxiliary fields before these coils are included in the main circuit, the current in the short-circuited coils, due to the auxiliary fields, flowing in the same direction as that set up in these coils, due to the ensuing main field-poles. Both coils *l l* in subduing the sparking at the brushes act together as a single field-winding.

It is obvious to those skilled in the art that commutation may be effected without short-circuiting the armature-coils, and we therefore do not wish to be limited to the employment of dynamos where the coils are short-circuited in effecting commutation.

Where it is desired, the ends of the legs of cores *k*, adjacent to the armature, may have lateral extensions *k' k'*, as shown in Fig. 2, extending toward the pole-tips, whereby more lines of force emanating from the pole-tips may be influenced by the auxiliary fields.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. In a dynamo-electric machine, the combination with a drum-armature having longitudinally-extending slots containing the armature-coils, of the commutator, a field member for the armature, and a core having an auxiliary field-winding adapted to decrease the effects of armature reaction, the said core having two legs separated from one another a distance equal to a multiple of the distance between the individual teeth of the armature, substantially as set forth.

2. In a dynamo-electric machine, the combination with the armature and commutator thereof, of a field member for the armature, and a core having a winding adapted to create a field to decrease the effects of armature reaction, the said core being provided with lateral projections extending toward the tips of the field member, substantially as described.

In witness whereof we hereunto subscribe our names this 8th day of December, A. D. 1899.

WILHELM v. SIEMENS.
AUGUST ROTTH.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.