(No Model.)

C. HERING.

DYNAMO ELECTRIC MACHINE.

No. 335,355. Patented Feb. 2, 1886.

Fig. 1

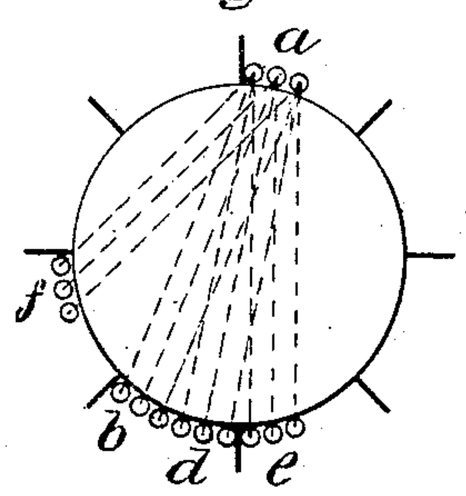


Fig. 2

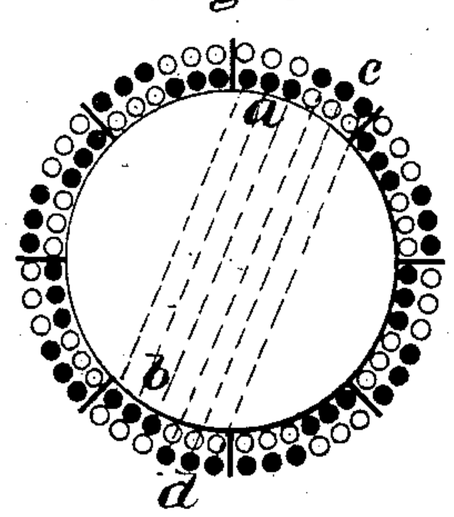


Fig. 3

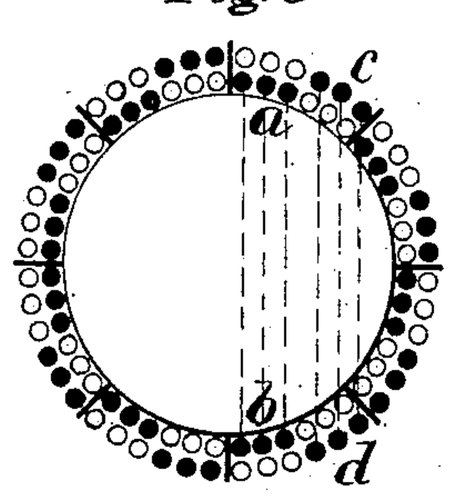


Fig. 4

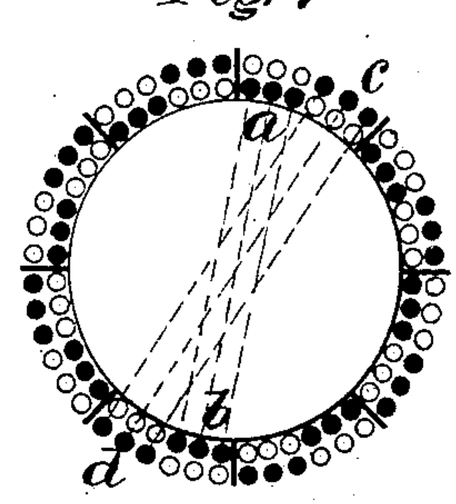
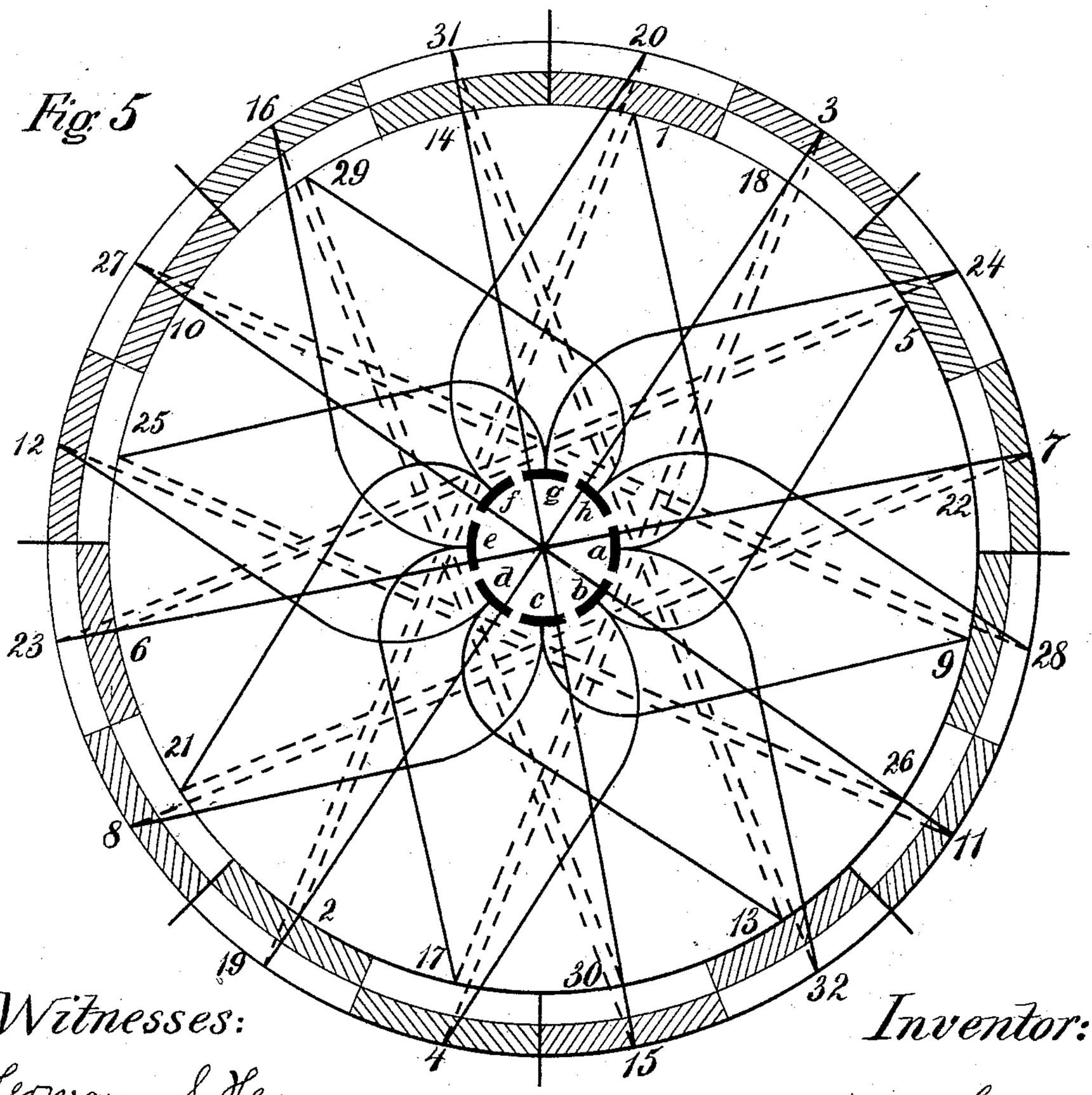


Fig. 5



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UNITED STATES PATENT OFFICE.

CARL HERING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO CHARLES H. BANES, OF SAME PLACE.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 335,355, dated February 2, 1886.

Application filed October 31, 1885. Serial No. 181,450. (No model.)

To all whom it may concern:

Be it known that I, CARL HERING, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a specification.

The objects of my invention are to insure greater efficiency in the operation of dynamo-electric machines, to simplify their construction, and to increase their durability by the introduction of means designed to avoid injurious sparking at the commutator, which is not only destructive of the high efficiency of the machine, but is also attended by a decreased durability. My improvements, to this end, refer to a new method of winding a cylindrical armature, whereby the wire is so disposed thereon as to cause the current generated in the coils that are short-circuited to flow in opposite directions instead of the same direction, so that the difference of the currents, instead of their sum, appears in the injurious spark at the commutator.

Figures 1, 2, 3, 4 represent in cross-section various methods for winding cylindrical armatures. Fig. 5 is a diagrammatic representation of one of the methods of winding an armature in accordance with the principles of my invention.

My invention relates to the method of winding the armature.

Various methods of winding cylindrical armatures are well known in the art. So far as I am aware, my method, which greatly simplifies the ease of construction and increases the efficiency of the armature, differs from them in the following respects: Each separate armature-coil is divided, as in some systems, into two parts; but the two portions, instead of being so wound on the armature as to cross each other, are in my system wound parallel to each other. To further elucidate this principle, reference is had to Figs. 1, 2, 3, 4, in which the two halves of the coils are shown as variously arranged on the armature.

In Fig. 4 is shown a method heretofore employed, in which the two halves *a b* and *c d* of the coil *a b c d* are wound so as to cross each other. In my invention, however, the two halves of the coils are disposed parallel to each other, as shown in Figs. 2 and 3, in which *a b* and *c d* represent, as before, the two halves of the single coil *a b c d*. It is evident, however, to one skilled in the art that besides the method I have shown in Figs. 2 and 3, there are other manners in which the wire may be disposed on the cylindrical armature so as to carry out the principles of this part of my invention—namely, so as to arrange the two halves of the armature-coil in planes parallel to each other. In Fig. 1, for example, three such methods are shown—namely, that in which the wire starting from *a* is carried around the armature in the direction indicated by the dotted lines from *a* to *b*, and is completed as in Fig. 2; or, starting from *a*, as before, the wire is carried around the armature in the direction indicated by the dotted lines from *a* to *e* in Fig. 1, and completed as in Fig. 3; or, starting from *a*, as before, the wire is carried around the armature in the direction indicated by the dotted lines from *a* to *f*. This is ultimately similar to Fig. 3.

It is evident that in an armature containing a greater number of coils there are still further applications which can be made of the aforementioned principles. If, however, the wire be carried around the armature in the direction as shown by the dotted lines from *a* to *d* in Fig. 1, it is evident that the other half of the coil must be so disposed on the armature as to cross the first at or near the axis of rotation, as heretofore shown in connection with Fig. 4.

The advantages which I claim of disposing the two halves of the coils on a cylindrical armature parallel to each other are as follows: First, the two halves do not cross each other, and so change the outline of the coil at the ends of the armature, thus avoiding unequal resistances by making the coils of more nearly the same length; second, it lessens the liability of short-circuiting of the coils at the points of crossing; third, it avoids injurious sparking at the commutator by disposing each half of the coil which is short-circuited entirely on one side of the neutral line, thereby causing the detrimental induced current to flow in opposite directions in the short-circuited coil, instead of, as in the old method, by bringing at least one of the halves of the short-cir-

cuited coils partly on one side of the neutral line and partly on the other side, thereby causing the currents to flow in the same direction around the coil, thus producing injurious sparking and consequent wear on the commutator.

It is well known to those skilled in the art that in cylinder-armatures of the Siemens type it is necessary to arrange two series of coils on the armature, which are of necessity connected in multiple arc, and therefore each supply half of the current. It will be observed on reference to Figs. 2, 3, 4, 5, that in my method of winding I do not dispose the coils of the last series directly over those of the first; but I divide each coil into two halves, and place each of the halves alternately on the inner and outer layers of wire on the armature, thus obtaining the advantages, well known in the art, of securing an equality of length in the different coils, also the same mean radius for each coil, and therefore the same mean linear velocity of the coil.

I do not claim as my invention the dividing of each armature-coil into two equal parts, since such a division has long been known in the art; nor do I claim the disposition of the two halves of each coil alternately on the inner and outer layers of wire on the armature; but what I do claim is such a method of winding as will secure each of the two halves so disposed in planes parallel to each other, and so avoid the injurious effects of crossing, as before pointed out.

In Fig. 5 a diagrammatic representation is shown of one of the methods of application of my invention wherein the method of winding an armature and the connection of the ends of the coil to the commutator-segments are represented. The eight commutator-segments are lettered, consecutively, from *a* to *h*. In this figure the windings are marked, consecutively, from 1 to 33. Starting from the segment *a* of the commutator, the coil runs from 1 2 3 4 to the next commutator-strip, *b*, showing that the two halves 1 2 and 3 4 of this coil are arranged in planes parallel with each other. So, in the same way, passing from the commutator-segment *b*, the windings take the direction 5 6 7 8, to the next commutator-strip, *c*, thus disposing the two halves of the coil 5 6 and 7 8 in planes parallel to each other. So, also, with 9 10 11 12 *d*, 13 14 15 16 *e*, 17 18 19 20 *f*, 21 22 23 24 *g*, 25 26 27 28 *h*, and, finally, 29 30 31 32, which is connected with the beginning, *a*, thus closing the endless circuit.

I claim as my invention—

1. In a dynamo-electric machine, a cylindrical armature, each of whose coils is divided into two equal parts and placed on the armature in planes parallel to each other alternately as the inner and outer layers of wire wound thereon, substantially as described and specified.

2. In a dynamo-electric machine in which each of the armature-coils is divided into two equal parts, placed alternately as the inner and outer layers of wire thereon, an armature in which a greater equality of the length of the wire in the separate coils thereof is obtained by winding the separate halves of the coils thereon in planes parallel to each other.

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Witnesses:
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