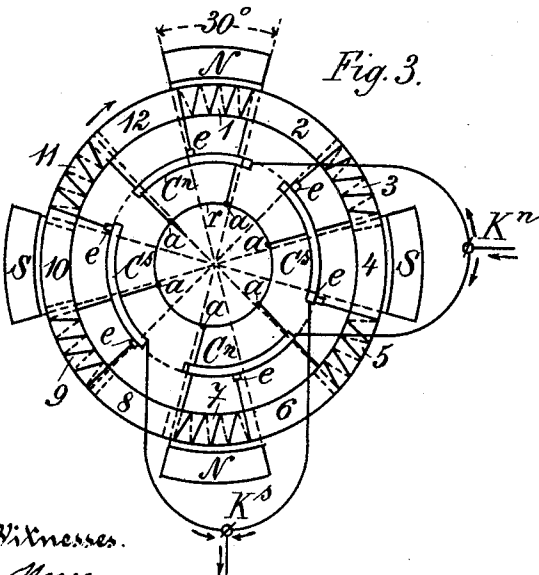
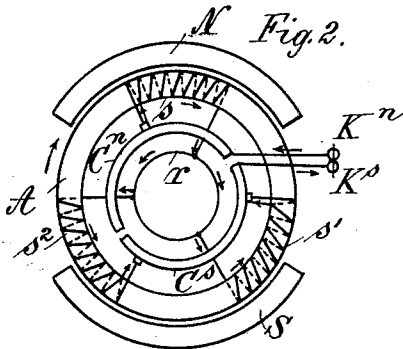
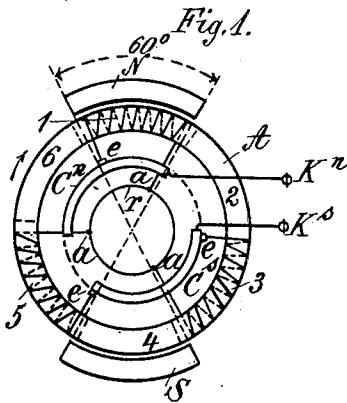


(No Model.)

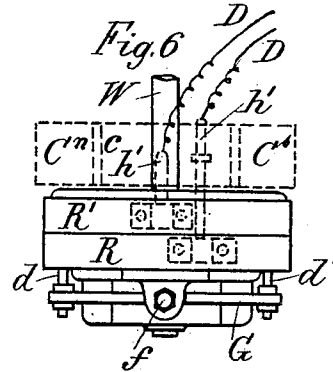
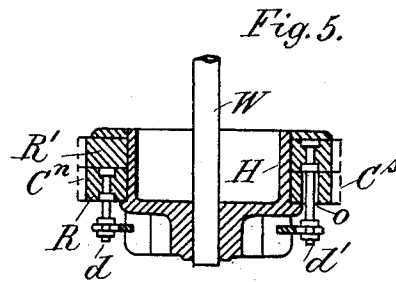
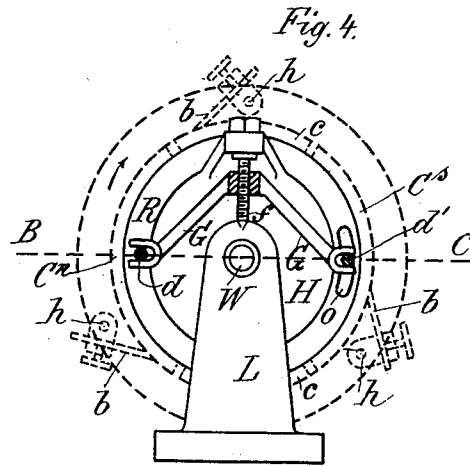
R. SCHORCH.
DYNAMO ELECTRIC MACHINE.

No. 560,328.

Patented May 19, 1896.



Witnesses.
Hessner
J. H. W. M. S.



Inventor:
Richard Schorch.
per Heinrich Lade
Attorney.

UNITED STATES PATENT OFFICE.

RICHARD SCHORCH, OF DARMSTADT, GERMANY.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 560,328, dated May 19, 1896.

Application filed December 14, 1893. Serial No. 493,645. (No model.) Patented in Switzerland July 27, 1892, No. 5,445.

To all whom it may concern:

Be it known that I, RICHARD SCHORCH, a subject of the Grand Duke of Hesse, Germany, and a resident of the city of Darmstadt, in the German Empire, have invented certain new and useful Improvements in a Dynamo-Electric Machine with Open-Coil-Armature Windings, (for which I have obtained a patent in the Republic of Switzerland, No. 5,445, dated July 27, 1892;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a dynamo-electric machine with open-coil armature—that is to say, with such a coiling of the armature that groups of bobbins are formed of the armature-bobbins by means of a conductor connecting their similar ends, their free ends being in connection with a current-delivery device. The machines of this kind hitherto known do not reach the perfection of the ordinary dynamo-machines with closed-coil armature in so far as regards, first, sparkless delivery of current; second, constant electromotive force during a revolution of the armature; third, highest useful effect by reason of the complete utilization of the magnetic field and of the wire wound upon the armature; fourth, general application of the system for the production of currents of any desired strength and variation. Therefore they are suitable only for the production of comparatively slight currents of constant strength.

The means by which, according to this invention, the above drawbacks are obviated consist, first, in a suitable arrangement and measure of the magnetic field; secondly, in a division and grouping suitable to the magnetic field of the armature-bobbins, and, thirdly, in a current-delivery device which effects the sparkless putting in and out of circuit of the armature-bobbins upon a variation in the strength of the current.

In the annexed drawings, Figure 1 shows the scheme of the new arrangement of the magnet-poles of the armature, &c., for a dynamo-machine with two magnet-poles, while Fig. 2 shows a wrong arrangement of this machine, so as to explain the faults of this arrangement. Fig. 3 shows the scheme of the

new arrangement for a machine with four poles by way of illustration of a multipolar machine. Figs. 4, 5, and 6 show the mechanism which serves to adjust the current-delivery device for sparkless operation by the changing of the current strength. Fig. 4 is a side elevation; Fig. 5, a horizontal section shown in line A B of Fig. 1, and Fig. 6 a top view.

The magnetic field consists of one pair or more of magnet-poles whose pole-surfaces are so long that the distance between two poles has double the length of pole-surface, the armature belonging to it divided into three times as many bobbin-spaces as there are magnet-poles. Of the coils of the bobbin spaces one or more quite similar bobbin groups are formed in the manner that the bobbins of every alternate bobbin-space are connected at one of their ends with a ring conductor, so that if a bobbin of such a group is covered entirely by a pole-surface the two following bobbins of the same group lie outside of the next pole-surface, one on each side of it. The delivery of the electric current is effected in the manner that during the rotation of the armature or of the magnet the free ends of the bobbin groups slide upon a commutator which has as many sliding ring-segments as there are magnet-poles, and it is fixed to the magnet in such a way that in the case of a stationary magnet it is stationary and in the case of a rotary magnet it rotates with the same. From the sliding ring-segments the electric current reaches to the external circuit. The length and position of the sliding ring-segments are to be so arranged as to put the armature-bobbins in and out of circuit without giving sparks. In regard to this I have found that in the same moment in which an armature-bobbin is to be put in or out of contact with a sliding ring-segment the induced electromotive force of the other bobbin which is in contact with the same sliding ring-segment must be in a certain proportion to the current strength of the external circuit. Therefore as soon as the strength of the current is varied either the length of the sliding ring-segments or the length of the sliding contacts at the bobbin ends must be varied. This variation must take place while the machine is in activity, but as by reason of the high speed of rotation

of dynamo-machines an adjustment at the rotating parts cannot well be effected. Therefore the length of the stationary sliding ring-segments is to be altered in case the armature rotates, and the length of the stationary sliding contacts at the bobbin ends is to be altered in case the magnet rotates. I effect this in the manner that I fix the equal parts of the longitudinally-divided sliding ring-segments or sliding contacts to two rings which are mounted upon the front standard of the dynamo-machine, so as to be capable of turning one toward another. The turning of these rings toward one another has the same effect as if the length of the sliding ring-segments or of the sliding contacts were altered.

In Fig. 1 the two magnet-poles N and S each cover an angle of sixty degrees. The armature A is equally divided into six bobbin-spaces 1 2 3 4 5 6, each of which, inclusive of the space left between the bobbins, similarly covers an angle of sixty degrees. Spaces 1 3 5 are wound with coils, which, by connecting the similar ends *a* to the ring conductor *r*, are united to form a bobbin group, the free ends *e* of which bobbins, upon the rotation of the armature, slide on the two fixed sliding ring-segments C^n C^s in communication with the outer electric circuit, each of which segments covers an angle of about one hundred and twenty degrees. Therefore each bobbin is in circuit during a turning angle of about one hundred and twenty degrees. In the position shown of the armature one of the bobbins of the group lies entirely within the surface of pole N, while the other two bobbins lie outside the surface of pole S. Therefore the former is in the position of maximum induction, while the other two are not being induced. K^n and K^s are the binding-screws for the outer circuit. Suppose the armature of Fig. 1 be turned more round to the right there will pass away from the pole-surface N just so many bobbin-windings as enter within the pole-surface S, or inversely, and therefore in all positions of the armature the number of windings inclosed by the poles is constant—that is to say, equal to the number of windings of a bobbin. Therefore the electromotive force is also constant, as is, further, the difference of the electric tension on the contact ring-segments C^n and C^s . Therefore the electromotive force or difference of potential at the terminals is constant. While two armature-bobbins are parallel connected upon a sliding ring-segment the electromotive force or difference of potential at the terminals increases a little by reason of the division of the current, but the difference is so small as to be barely observable in the external circuit. Now the bobbin-spaces of the even number 2 4 6 may be wound with bobbins which either are connected with an additional ring *r* at a group quite equal to that described above, whose free ends slide on the same sliding ring-segments as those of the first group, in which case the electromotive forces in both

the bobbin groups are equal one to another, and therefore the electromotive force in the armature is proportional to the number of windings which are induced by one magnet-pole, just as is the case with a dynamo-machine with closed-coil armature, or the bobbins of the bobbin-spaces 2 4 6 are to be jointed with the bobbins of the first group in such a manner that each of these bobbins is united with the bobbin of the preceding fourth bobbin-space, thus only forming one bobbin. For example, the bobbin of the space 4 is to be joined with the bobbin of the space 1. This is accomplished in the most simple manner by employing drum-winding instead of ring-winding—that is, by not winding the wires through the hollow armature, but over the same. In that way each bobbin has double the number of windings, which are induced in the same direction as obtained in the preceding case. Therefore the electromotive force of the armature is twice as great as in an armature with closed coiling. This is a suitable arrangement when it is desired to obtain high binding-tension or a low speed of the machine.

In Fig. 2 each magnet-pole covers more than one bobbin-space. Therefore the armature-bobbins $S S' S''$ are all induced, and owing to the great length of the sliding ring-segments C^n C^s a bobbin is in circuit during nearly half a revolution of the armature. Therefore, first, the electromotive force cannot be constant during a revolution of the armature, because the number of the induced wire-windings, being connected in circuit one behind another, is not constant; second, the electromotive force is smaller, because all induced wire-windings of the armature are connected in series, one behind another.

In Fig. 3 the armature is divided into twelve equal bobbin-spaces 1 2 3 4 5 6 7 8 9 10 11 12, and the bobbins of the spaces indicated by uneven numbers are, by the connection of their similar ends *a* with the ring conductor *r*, united into one bobbin group, their free ends *e* sliding on the four sliding ring-segments C^n C^n C^s C^s . The latter are in electrical communication with binding-screws K^n K^s , which are located in the external circuit. Each sliding ring-segment covers an angle of about sixty degrees. In the position shown of the armature two bobbins of the bobbin group lie entirely within the surface of poles N, while the other four bobbins lie outside the pole-surfaces S S'. The electromotive force of the two bobbins passing and induced by the two poles of like name are always equal, so that the current coming from K^n is equally distributed in the bobbins by pole N and both bobbin-currents reach to the ring *r* at equal electric tension. Thence they pass into the bobbins induced by the south pole, when again they both experience an equal increase in their electromotive force, so that the electric tensions in the ends *e*, sliding on the two contact ring-segments C^n C^s , are again

equal. The completion of the armature-winding in Fig. 3 may again be effected in the two different manners, as described in Fig. 1.

Figs. 4, 5, and 6 show the mechanism for
5 adjusting the current-delivery device for sparkless operation. L is the front standard of the dynamo-machine shaft W; H, a hollow cylinder cast in one piece with standard L, and having two rings R R', of wood or other
10 insulating material, mounted upon it so as to be capable of turning. *d* is a stud fixed in ring R on the left hand, and *d'* a similar stud fixed in ring R' on the right hand. The latter stud passes through a slot *o*, formed in the
15 front ring R. Both studs are engaged at their outer ends by a fork G, the upper part of which is in the form of a nut for a screw *f*, which is so carried in a lug on hollow cylinder H and in a recess in the standard L that upon
20 turning the same around to the right or left the fork G is worked up or down and the rings R R' are turned to a corresponding angle, the one to the left and the other to the right. The dotted part of Figs. 4 and 5 is adapted for the
25 bipolar machine, with rotary armature, shown in Fig. 1. In this case the contact ring-segments Cⁿ C^s are separated longitudinally in the middle and one-half applied to each of the rings R R'. In the uppermost position of the
30 fork G the halves come evenly together, and upon a downward movement of the fork they are displaced in contrary directions. The spaces between the contact ring-segments are filled in with insulating ring-pieces *c*. The
35 holders *h* for the current-receiving brushes *b* on the bobbin ends are attached to the armature A and carry brushes of the width of an undivided contact ring-segment. When, on the other hand, the magnet of the machine
40 rotates, the armature A is stationary, and the three brushes *b* are mounted upon both rings R R' instead of upon the armature, each brush being separated longitudinally in the middle and each half fixed upon one of two
45 holders *h'*, drawn in Fig. 6, and the ends of each are in connection through flexible wires D with an armature-bobbin. The contact-ring segments Cⁿ C^s and the filling-in pieces *c* between the same are fixed on a special ring
50 of wood or other insulating material, which is keyed on the machine-shaft W, and consequently rotates with the magnet. When fork G is in the highest position, the brush-holders *h'* lie side by side, so that the edges of two
55 brushes are in a straight line on the contact-ring segments or on the ring-pieces *c*, and as though there were only one brush in use of the width of a contact ring-segment. Upon fork G being worked downward the brush-
60 holders in pairs are separated or moved from one another, and of the brushes of a pair one is displaced on the commutator to the left and the other to the right.

With respect to the arrangement and adapt-
65 ability of the machine it is to be remarked: If in a machine with rotary magnet the current of the same direction should reach the

external circuit, the contact ring-segments instead of being in connection with the fixed
binding-screws Kⁿ K^s are to be placed in con- 70
nection with two contact-rings on the driving-shaft, insulated from each other, by which the current is carried outward. With stationary as well as with rotary magnet arrange- 75
ment the ends of the magnet-bobbins may be fixed straight to the sliding ring-segments. The rotary-magnet arrangement is specially adapted for use as a magnet-exciter for alternate-current or reverse-current machines with stationary armature. 80

The iron core of the armature may be of cylindrical disk or ring form and adapted for Gramme or Pacinotti winding.

What I claim as my invention, and desire to secure by Letters Patent, is— 85

1. In a dynamo-machine with open-coil-armature winding, the combination of a magnetic field, consisting of two magnet-poles or more each two adjacent ones of which are of opposite polarity and their pole-surfaces each 90
having such a length that the distance between two poles has double the length of a pole-surface, with an armature divided into thrice as many bobbin-spaces as the magnetic field has magnet-poles and of the windings 95
of these bobbin-spaces one or more bobbin groups being formed in the manner that the bobbins of each alternate bobbin-space are connected at one of their ends with a ring conductor so that, if a bobbin of such a group 100
is covered entirely by a pole-surface, the two following bobbins of the same group lie outside the next pole-surface one on each side of it.

2. In a dynamo-machine with open-coil-ar- 105
mature winding the combination of a magnetic field, consisting of two magnet-poles or more each two adjacent ones of which are of opposite polarity and their pole-surfaces each 110
having such a length that the distance between two poles has double the length of a pole-surface, with an armature divided into thrice as many bobbin-spaces as the magnetic field has magnet-poles and of the windings 115
of these bobbin-spaces one or more bobbin groups being formed in the manner that the bobbins of each alternate bobbin-space are connected at one of their ends with a ring conductor and with a mechanism for varying 120
the duration of the connection in circuit of the armature-bobbins upon variation of the strength of the current in the external circuit, consisting of two rings R, R' mounted on the front standard L of the machine so as to be capable of turning one toward another, 125
for the purpose described.

In testimony whereof I sign this specification in the presence of two subscribing witnesses.

RICHARD SCHORCH.

Witnesses:

JEAN PIETZ,

A. H. SCHAEFER.