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E. ARNOLD & J. L. LA COUR.

COMMUTATION OF CURRENTS IN ARMATURES OF DYNAMOS.

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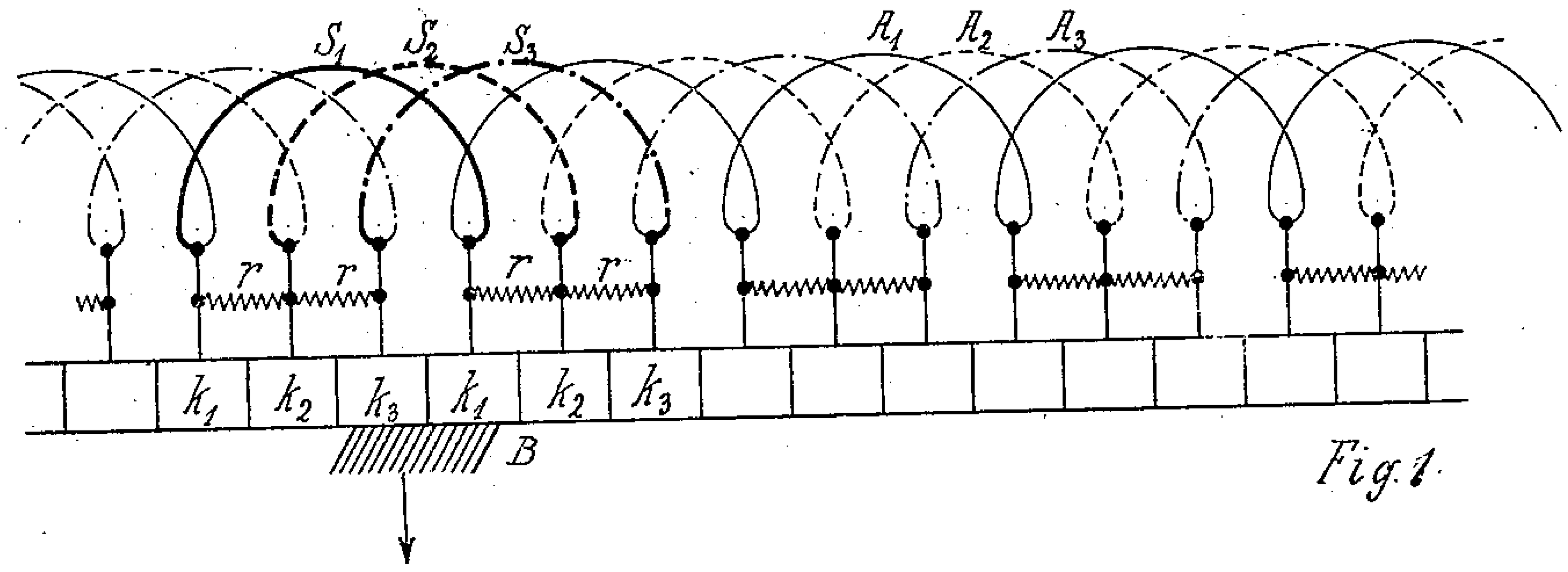

Fig. 1.

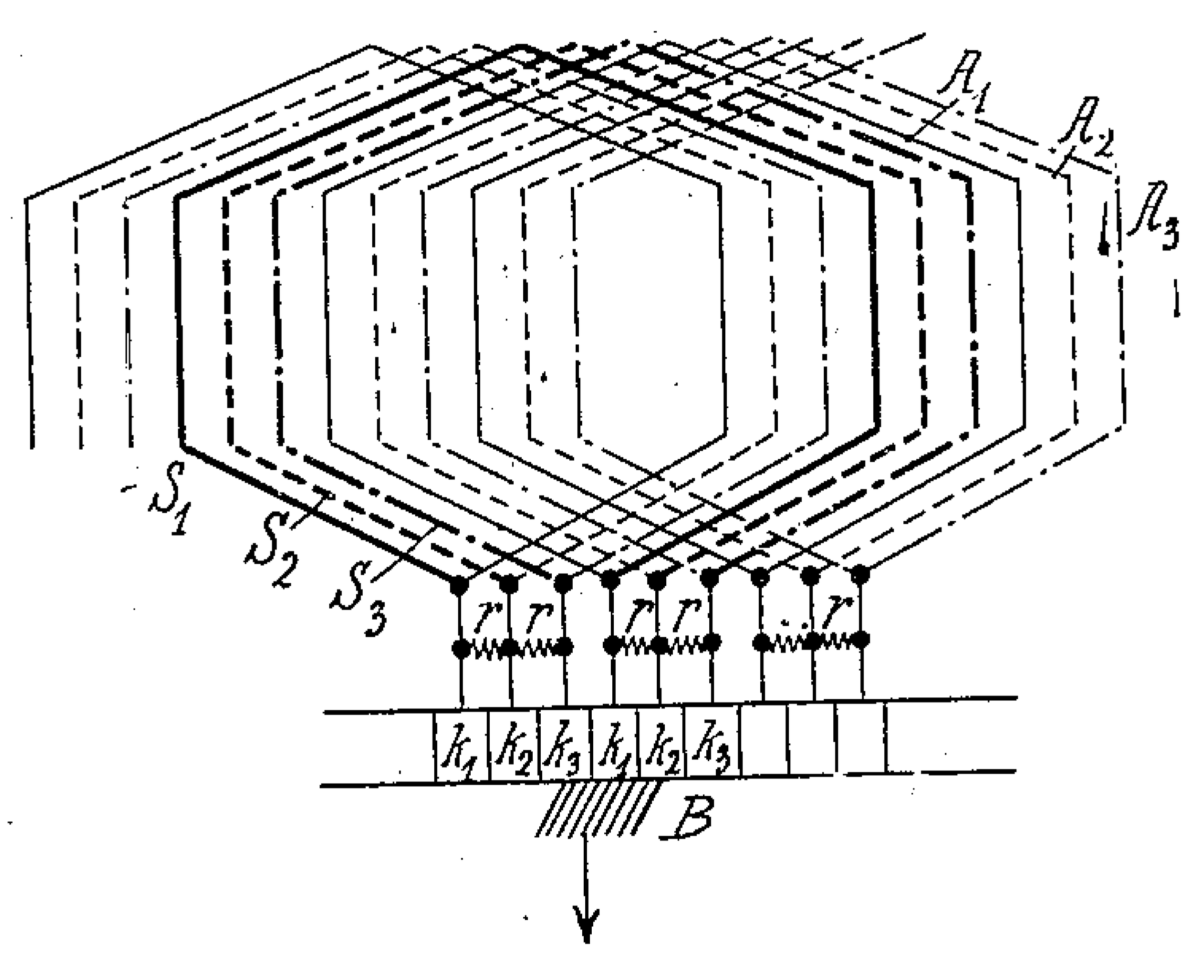

Fig. 2

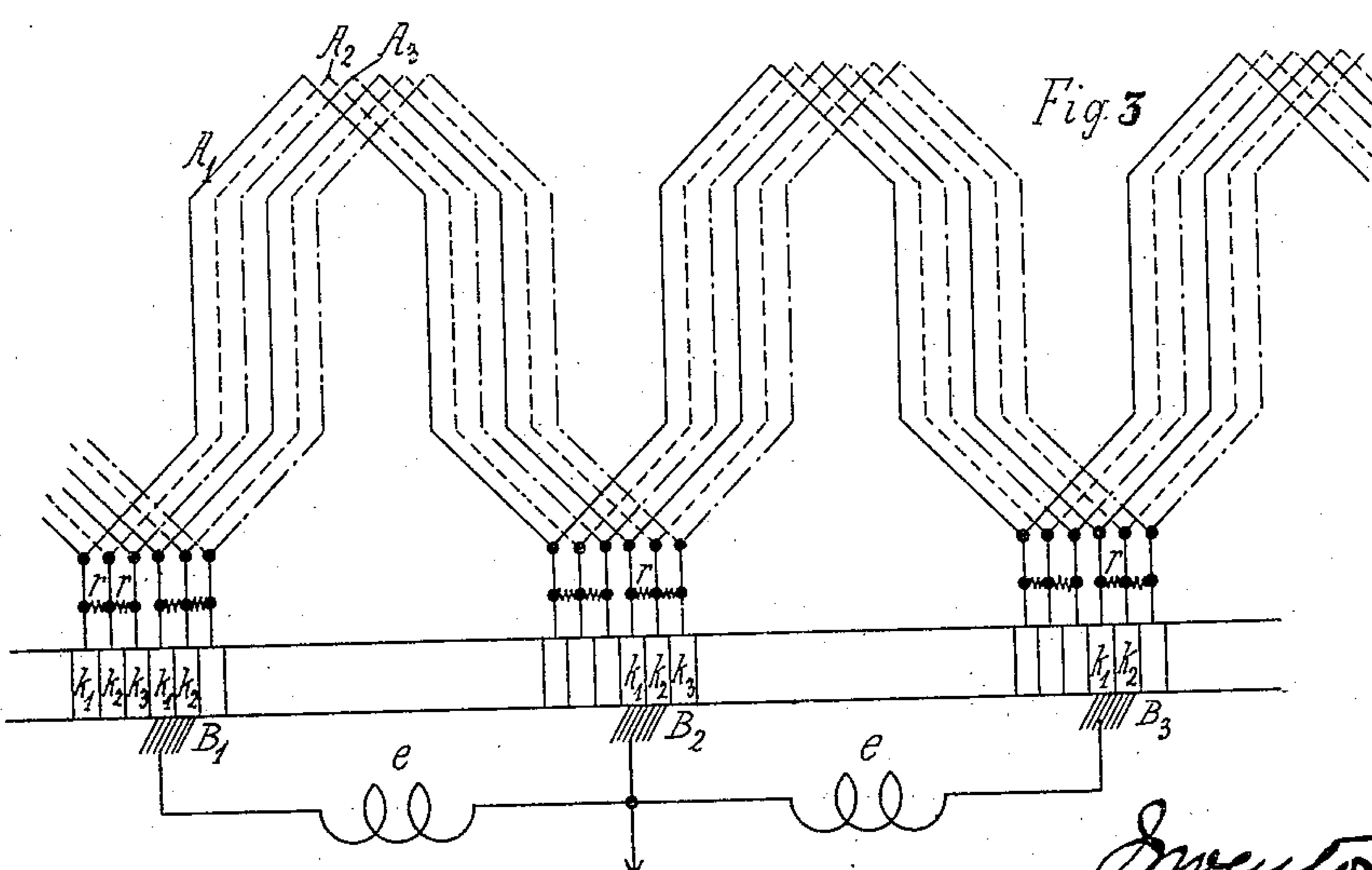

Fig. 3

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COMMUTATION OF CURRENTS IN ARMATURES OF DYNAMOS.

No. 842,163. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed December 16, 1904. Serial No. 237,157.

To all whom it may concern:

Be it known that we, ENGELBERT ARNOLD, of Karlsruhe, Germany, and JENS LASSEN LA COUR, of Edinburgh, Scotland, have invented certain new and useful Improvements in Commutation of Currents in Armatures of Dynamos, of which the following is a specification.

The better to procure the commutation of electric currents in dynamos it is frequently advantageous to connect by resistances the segments of the commutators or the segments of the auxiliary commutators. This is shown by the alternating-current commutators of A. Heyland, by the commutator of Seidener, and by the commutator described in the German Patent No. 156,959. The constructional arrangement of these resistances involves great difficulties.

The avoiding of such constructional difficulties is among the purposes of the present invention.

The resistances are inserted into insulating layers placed between the commutator-bars. Such resistances consist of thin metallic plates, metallic tissue, or metallic solutions which are painted in broad stripes upon the insulating material.

Figure 1 is a diagram showing the application of resistances to an armature-winding according to the present invention. Fig. 2 is a diagram similar to Fig. 1, but showing another brush position; and Fig. 3 is a diagram showing the application of the invention to a wave-winding.

The equipotential connections in continuous-current dynamos must have an electric resistance as low as possible and must serve to prevent sparking due to lack of symmetry in the winding or in the magnetic field; but the foregoing resistance connections must have so great an electric resistance that the additional currents due to the commutation of the armature-windings will remain below any admissible limit. On the other hand, the electric resistances above referred to must be so low that in the winding the commutator-bars whereof are not touched by the brushes current shall still be present.

Fig. 1 shows three closed armature-windings A', A^2, and A^3. Of these, A' is connected to the segments K', A^2 to the segments K^2, and A^3 to the segments K^3. The brush B is not allowed to touch more than three segments. Therefore its breadth is somewhat smaller than double the breadth of a segment. In the position shown in Fig. 1 coil S^2 of winding A^2 is in commutation. The commutating-current must flow through the two resistances r. Hence its intensity is limited by these resistances. While the coil S^2 has been particularly mentioned as being short-circuited, it will of course be understood that the coils S' and S^3 are short-circuited at the same time. In this position, however, A^2 is not switched off, as is done by the ordinary Weston windings, because current flows to the brush B from the winding A^2 through a great number of resistances r, which connect the three windings in multiple circuit. To avoid inward currents in the three coils S', S^2, and S^3, connected in multiple circuit by the resistances r, these coils must be located in the same slots as with the Heyland commutator.

Fig. 2 represents the diagram of a triply-closed loop-winding for a different position of the commutator relative to the brushes. Here the letters denote the same parts as in Fig. 1. The coils S are closed by the brush B and two resistances r. In this position the three windings A', A^2, and A^3 all get current from the brush B.

Fig. 3 represents the diagram of that part of a triply-closed wave-winding which lies under brushes having the same polarity. The letters signify the same as in the foregoing figures. Where a wave-winding is employed and brushes of the same polarity are placed at a distance from each other which will exactly equal a whole and even number of pole distances, which is the usual arrangement, some of the armature-coils will be closed by two brushes and the paralleling connection which joins them. This will result in destroying the effect of the resistances r. This will be seen upon an inspection of Fig. 3, which will reveal that the brushes B' B^2 B^3 of the same polarity touch the segments K' K^2, each pair of which is connected to the same windings. One or more armature-coils, therefore, are connected by the brushes. In these coils electromotive force is induced in continuous-current dynamos by the stray field of the slots and in alternating-current dynamos by the pulsations of the main field. To obviate the effect on the resistances as above outlined, devices for producing electromotive force counter to that generated in the closed coils are to be inserted in the connections between the brushes of like polarity, so that the resulting current will be zero.

In the manner described with multiple closed unsymmetric wave-windings as many brush-holder pins as desirable may be employed, so that we obtain a narrower commutator. With alternating-current commutator dynamos the electromotive force in the outer connections between the brushes of same polarity are most simply produced in the following way: In the said connections is inserted a number of stator-windings as great as that of rotor-windings which lie between the brushes. The before-mentioned stator-windings should lie in the same field as the rotor-windings. By these means the pulsations of the main field of the dynamos will induce equal electromotive force in the connections of the brushes as in the rotor-windings. An illustration of the said stator-windings inserted in the outer connections between the brushes of like polarity is seen in Fig. 3, where *e e* are two coils which lie on the stator in the same field as the short-circuited rotor-coils, and which are connected between the brushes B′ B² B³. The number of turns of each coil is equal to the number of turns of the rotor-coils.

The above-described appliance for the better commutation is as well adapted for ordinary continuous-current dynamos of high voltage and high number of revolutions as for single and multiphase commutator motors, generators, and converters. With continuous-current dynamos in the connections between the brushes accumulators of the desired voltage may be placed. This arrangement will, however, not be of great practical importance.

The present invention is thus an appliance for the commutation of current in dynamos, this appliance consisting of a combination of an n times-closed parallel winding with resistances which connect these n windings together. These resistances can be placed, as shown, between the segments of the commutator or be arranged in any manner already known exterior to the commutator. In the latter case they can be constructed of metallic wire.

What we claim as our invention, and desire to secure by Letters Patent of the United States, is—

1. The combination with an armature-winding, consisting of a plurality of parallel sections, of a commutator, the said sections being connected to adjacent segments of said commutator, resistances connecting the said sections, and brushes of a width not greater than the combined widths of a number of commutator-segments equal to one less than the number of armature-sections, bearing upon said commutator, substantially as described.

2. The combination with a wave-winding for an armature, said winding consisting of a plurality of parallel sections, of a commutator, the said sections being connected to adjacent segments of said commutator, resistances connecting the said sections, brushes of a width not greater than the combined widths of a number of commutator-segments equal to one less than the number of armature-sections, bearing upon said commutator, connections external to the armature between brushes of like polarity, and means for introducing electromotive force in said connections, substantially as described.

3. The combination with a wave-winding for an armature, said winding consisting of a plurality of parallel sections, of a commutator, the said sections being connected to adjacent segments of said commutator, resistances connecting the said sections, brushes of a width not greater than the combined widths of a number of commutator-segments equal to one less than the number of armature-sections, bearing upon said commutator, connections external to the armature between brushes of like polarity, and coils inserted in said connections, said coils being adapted to have generated in them electromotive forces of the same values as are generated in the corresponding coils of the armature between the brushes, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ENGELBERT ARNOLD.
JENS LASSEN LA COUR.

Witnesses for Engelbert Arnold:
WOLDEMAR HAUPT,
HENRY HASPER.

Witnesses for Jens Lassen la Cour:
JAMES PHILLIPS,
GEORGE BRAID.