No. 835,407. PATENTED NOV. 6, 1906.

M. DÉRI.

ALTERNATING CURRENT MACHINE.

APPLICATION FILED APR. 12, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

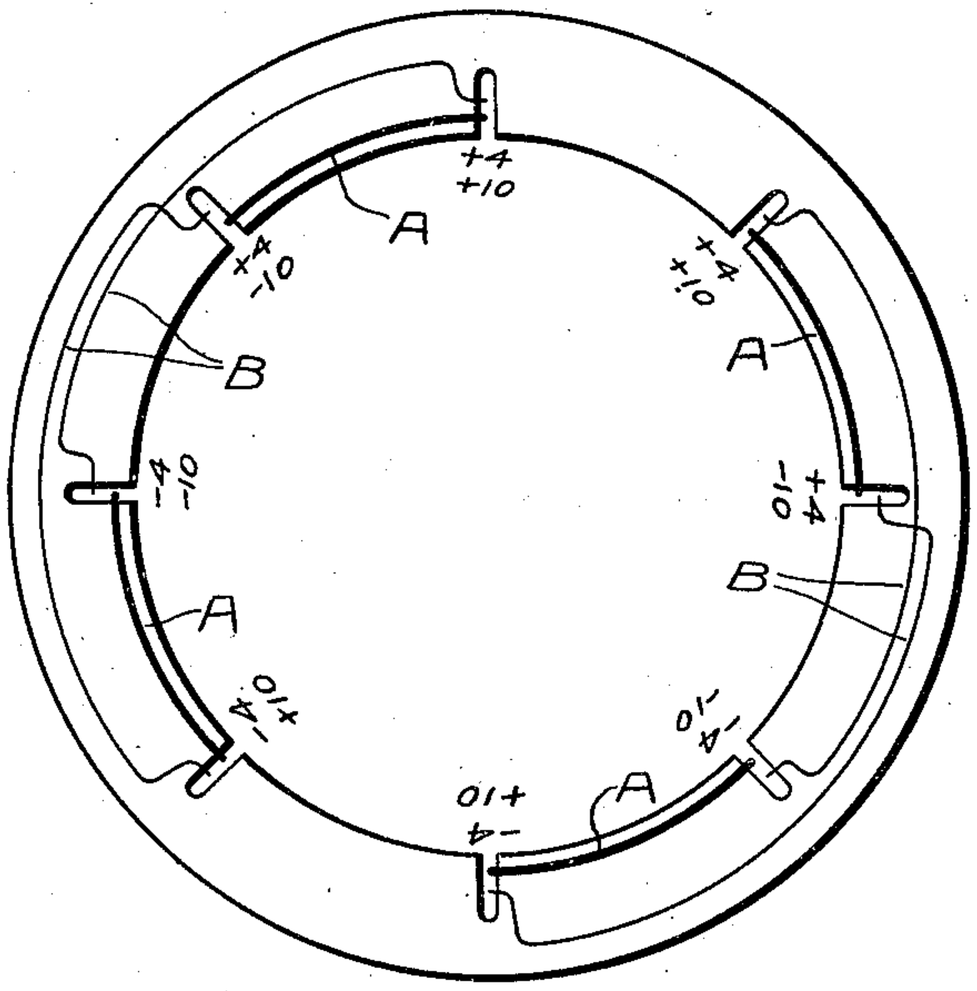
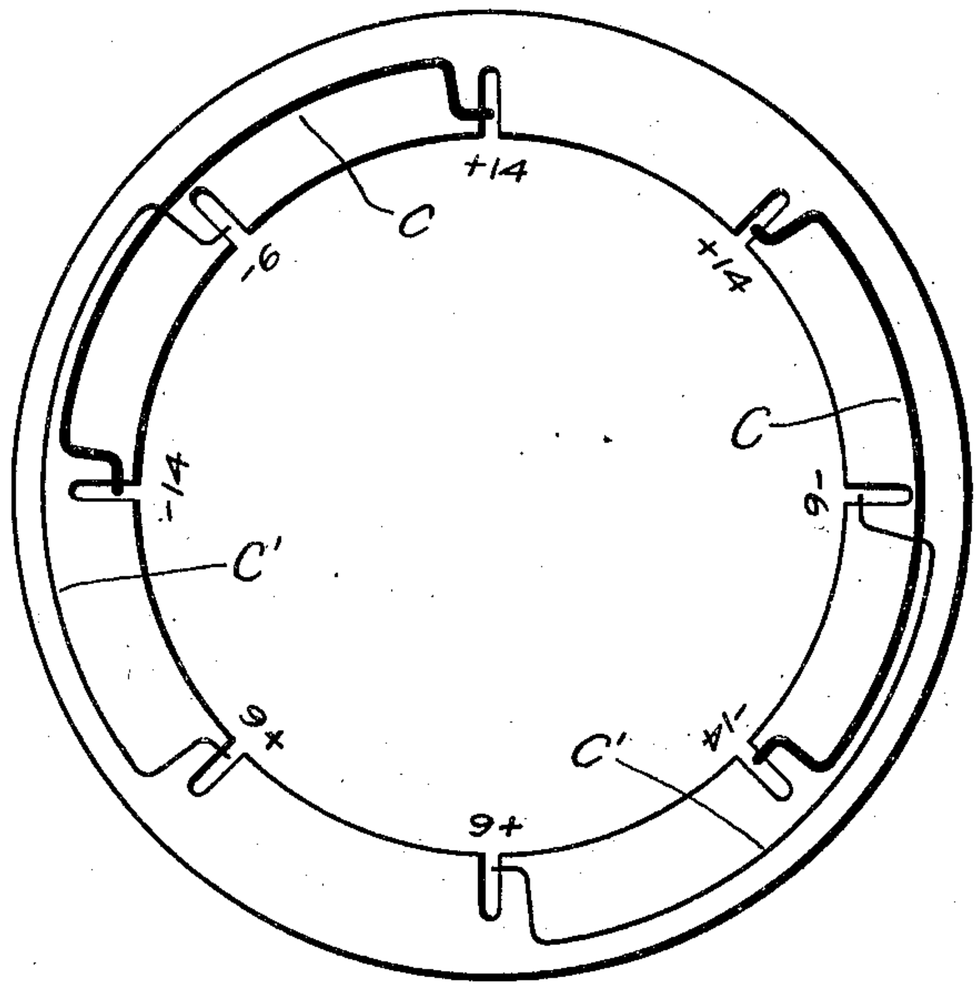


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

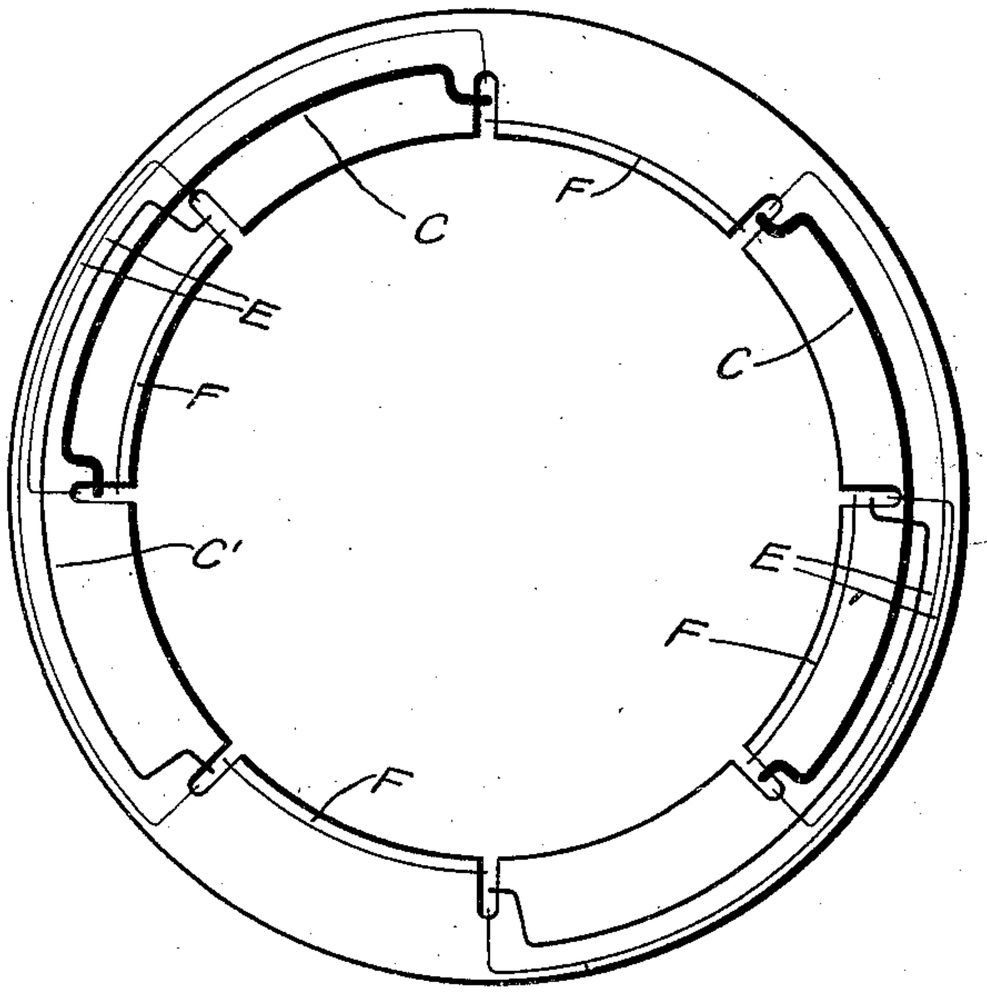
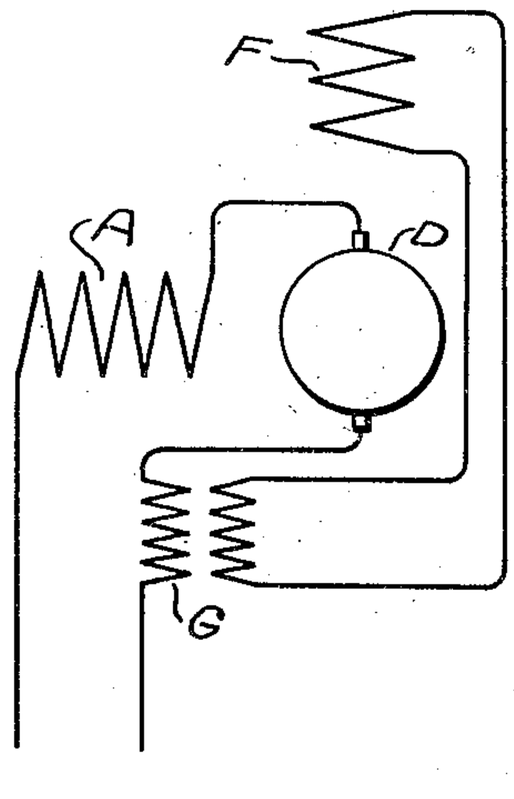


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

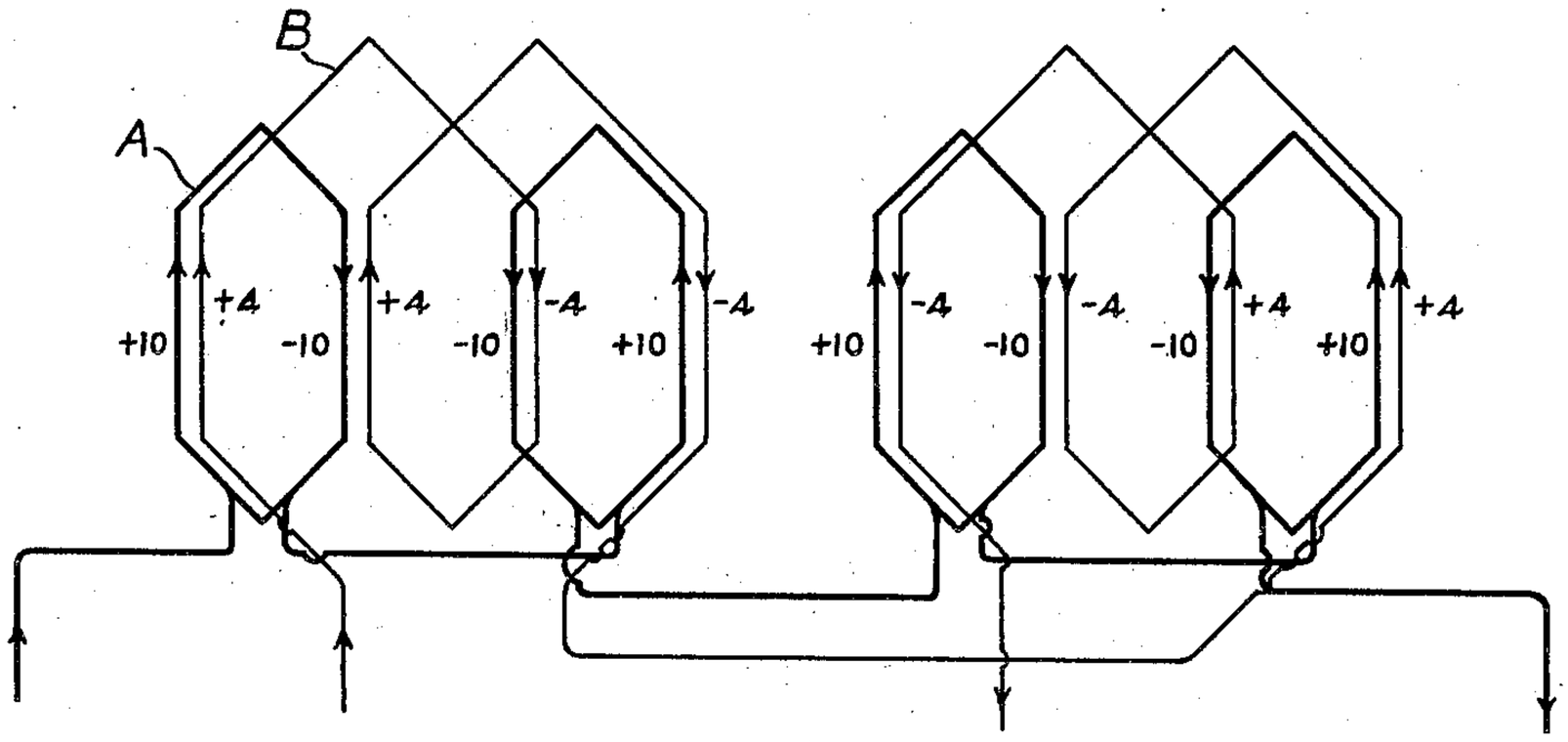
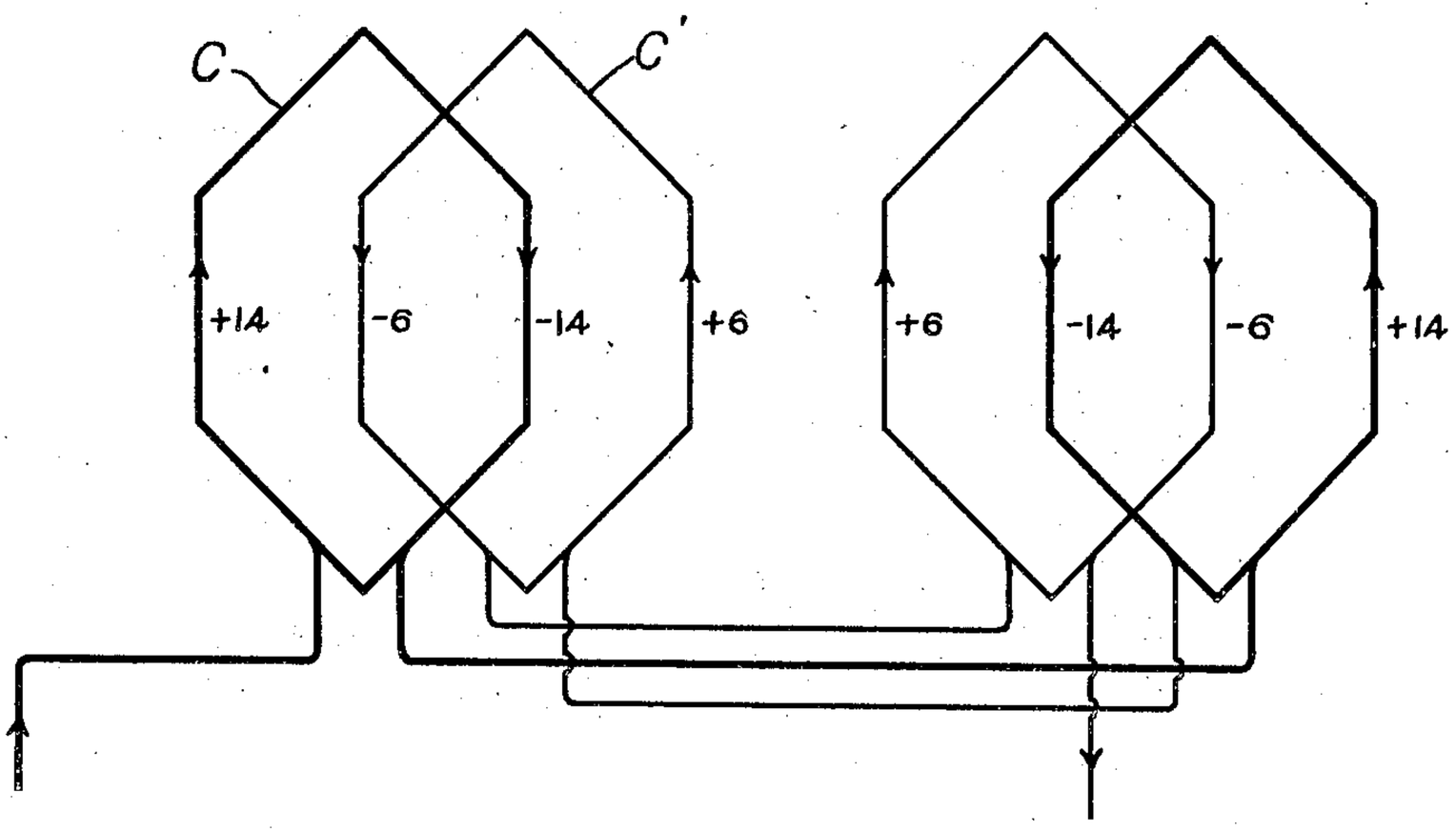


Fig. 6.



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UNITED STATES PATENT OFFICE.

MAX DÉRI, OF VIENNA, AUSTRIA-HUNGARY, ASSIGNOR TO STANLEY ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

ALTERNATING-CURRENT MACHINE.

No. 835,407. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed April 12, 1905. Serial No. 255,118.

To all whom it may concern:

Be it known that I, MAX DÉRI, a subject of the Emperor of Austria-Hungary, residing at Vienna, Empire of Austria-Hungary, have invented certain new and useful Improvements in Alternating-Current Machines, of which the following is a specification.

My invention relates to alternating-current dynamo-electric machines; and its object is to provide a novel arrangement of windings for such machines whereby the usual windings of the machine and transformer-windings may be combined conveniently and efficiently.

In certain types of alternating-current motors—as, for instance, the compensated series motor—it has been proposed heretofore to supply the compensating winding from the secondary of a transformer the primary of which is in series with the main field and armature windings of the motor.

By my invention I dispense with the use of an external transformer by placing the transformer-windings on the field structure of the motor in the same slots with the motor-windings and so arranging the motor-windings and transformer-windings relatively to each other that the operation of the motor is not affected by the presence of the transformer-windings, while the motor-current does not affect the transformer-windings. I secure this result by arranging the motor-windings and transformer-windings with different numbers of poles, so that the windings have no inductive effect upon each other.

My invention further consists in combining a motor-winding and a transformer-winding into a single set of coils common to both windings, so that a single set of coils performs the functions of both.

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

Figure 1 shows a motor provided with a motor-winding and a transformer-winding arranged non-inductively to each other in accordance with my invention. Fig. 2 shows the two windings combined into a single set of coils. Fig. 3 shows a complete set of motor and transformer windings for a compensated series motor, one of the motor-windings being combined with one transformer-winding as in Fig. 2. Fig. 4 shows diagrammatically a compensated series motor as ordinarily arranged and connected; and Figs. 5 and 6 show developments on a plane surface of the windings of Figs. 1 and 2, respectively.

In Fig. 1, A represents the field-winding of a four-pole motor carried in slots on the inner periphery of the field structure. For the sake of simplicity I have shown this winding as a concentrated winding. B represents a transformer-winding supported in the same slots, but arranged as a two-pole winding. With such an arrangement it is evident that the windings A and B are non-inductive with respect to each other, since the inductive effect upon winding B of a north pole produced by one coil A is neutralized by an opposite effect produced by a south pole, and similarly the effect produced by winding B upon each coil of the motor-winding is offset by an equal and opposite effect produced upon a second coil. This will be clearly seen by an inspection of Fig. 5, which shows the windings of Fig. 1 developed on a plane surface, from which it will be noted at once that the resultant inductive effect of each winding on the other is zero. Consequently the effects of the currents of the two windings are mutually undisturbed by the other, so that the same magnetic core may be employed both for the motor-flux and for the transformer-flux. Moreover, it is possible to combine the two windings into a single set of coils. For instance, if it is assumed that with the normal full-load current flowing through the winding A the ampere-turns are equal to 10, and if it is similarly assumed that with normal full-load current in the winding B the ampere-turns of each coil are equal to 4, the total ampere-conductors in each slot would be as indicated by the numerals placed opposite the several slots in Figs. 1 and 5—that is, if the direction of current in the conductors of the winding A, which lie in the topmost slot in Fig. 1 and in the right-hand slot in Fig. 5, be considered at any instant as positive and the direction of current in the conductors of winding B in the same slot be similarly considered as positive, the ampere-conductors in that slot would be equivalent to $4+10$ or $+14$. In the next slot to the left the sign of the current in the winding A would be reversed, while that in winding B would be positive, as in the first slot. The ampere-conductors in this slot would be $4-10$ or -6. By tracing the corresponding polarities of

the currents in the several slots the sum of the ampere-conductors for each slot will be found to be as indicated by the numerals in Figs. 2 and 6. It will be seen from these figures that some of the slots contain ampere-conductors equal to fourteen, while others of the slots contain ampere-conductors equal to six. By providing a set of coils of two different sizes C and C′ with the numbers of turns bearing a ratio of fourteen to six, placing these coils in the proper slots, as indicated by the numerals, and connecting them in series a single winding is formed which is precisely the same in its effect as the two windings A and B of Fig. 1—that is, the winding formed of the coils C and C′ will act both as a field-winding of the motor and also as a transformer-winding, and the two functions will be entirely separate from each other.

As illustrating one case to which my invention may be applied, reference may be had to Fig. 4. In this figure A represents the main field-winding of a series motor of the ordinary commutator type, the armature being indicated by D. F represents a compensating winding arranged to neutralize the armature reaction and supplied from the secondary of the series transformer G, the primary of which is in series with the armature, so that the current through the compensating winding is always proportional to the armature-current. These connections represent the arrangement that has been heretofore employed.

By my invention the windings of transformer G may be placed on the field-magnet of the motor without disturbing the action of windings A and F simply by making the transformer-windings of a different pole number from the windings A and F. Also these transformer-windings may be combined with the field-windings of the motor. For instance, if the primary winding of transformer G is arranged as indicated by the winding B in Fig. 1 it may be combined with field-winding A so as to form a single winding of two sets of coils C C′, as shown in Fig. 2.

Fig. 3 shows the field structure arranged with all these windings. The coils C C′ form a combined winding in the same manner as illustrated in Fig. 2. E represents the secondary transformer-winding, which is arranged in the same slots as the winding B in Fig. 1. F represents the compensating winding, which is a four-pole winding displaced ninety electrical degrees from the main field-winding A of Fig. 1. With this arrangement the motor operates in the same manner as though an external series transformer were employed, while the external transformer is entirely dispensed with. It is evident that the windings E and F may be combined, if desired, in precisely the same manner as the windings A and B of Fig. 1. The development of winding E would be the same as shown for winding B in Fig. 5, and the development of winding F would be the same as that shown for winding A in Fig. 5, except that it would be displaced ninety electrical degrees, or, in other words, one slot in Fig. 5, since in this figure are shown only two slots per pole. Obviously the combination of windings E and F could be effected in exactly the same manner as in the windings A and B, simply by noting the algebraic sum of the ampere-conductors due to these windings in each slot.

For the sake of simplicity I have shown my invention diagrammatically, with the motor-windings shown as concentrated windings. It will be understood that my invention is applicable to any well-known type of winding and to any alternating-current dynamo-electric machine in connection with which it is desired to employ a transformer. Furthermore, although I have illustrated my invention as applied to a motor, it is obvious that my invention is clearly applicable to any generator with which it may be desired to employ a series transformer—as, for instance, in the case of a self-compounding machine.

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 an alternating-current dynamo-electric machine, in combination with the stator and the usual winding carried in the stator-slots, a transformer-winding of a different number of poles carried in the same slots.

2. In an alternating-current dynamo-electric machine, in combination with the stator and the usual winding carried in the stator-slots, a transformer-winding of a different number of poles carried in the same slots and connected in series with the first-mentioned winding.

3. In an alternating-current dynamo-electric machine, in combination with the stator and the usual winding carried in the stator-slots, a transformer-winding of a different number of poles carried in the same slots, said windings being combined into a set of coils common to both windings.

4. In an alternating-current motor, a slotted field structure, and a motor-winding and a transformer-winding of different numbers of poles carried in the same slots.

5. In an alternating-current motor, a slotted field structure, and a motor-winding and a transformer-winding of different numbers of poles connected in series and carried in the same slots.

6. In an alternating-current motor, a slotted field structure and a motor-winding and a

transformer-winding of different numbers of poles carried by said structure, said windings being combined into a set of coils common to both windings.

7. In an alternating-current dynamo-electric machine, a slotted field structure, and two windings of different pole numbers, combined into a set of coils common to both windings, carried by said structure.

8. In an alternating-current dynamo-electric machine, a slotted field structure, and a set of coils carried in the slots proportioned and arranged to correspond in respect to ampere-conductors per slot to two windings of different numbers of poles.

9. In a compensated series motor, a slotted field structure, a main field-winding in the slots, a compensating winding in said slots, and primary and secondary transformer-windings of a different number of poles from the other windings also included in said slots, one of the transformer-windings being combined with one of the other windings in a set of coils common to both windings.

In witness whereof I have hereunto set my hand this 29th day of March, 1905.

MAX DÉRI.

Witnesses:
ALVESTO S. HOGUE,
AUGUST FUGGER.