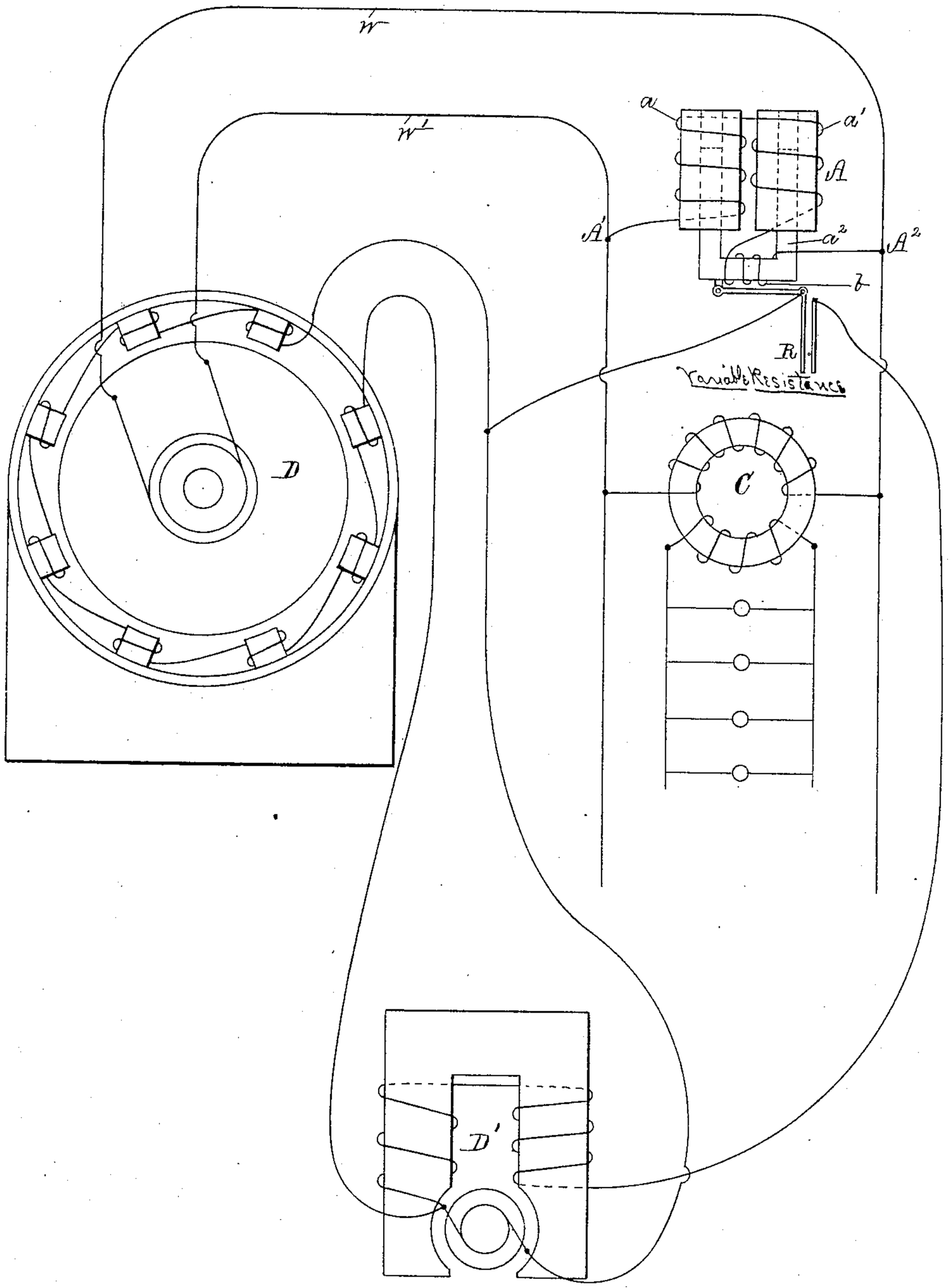
(No Model.)

E. & F. W. HEYMANN.

ALTERNATING CURRENT APPARATUS.

No. 427,571. Patented May 13, 1890.



Witnesses.

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UNITED STATES PATENT OFFICE.

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ALTERNATING-CURRENT APPARATUS.

SPECIFICATION forming part of Letters Patent No. 427,571, dated May 13, 1890.

Application filed June 10, 1889. Serial No. 313,784. (No model.)

To all whom it may concern:

Be it known that we, EDWARD HEYMANN and FRANK WILLIAM HEYMANN, both of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Alternating-Current Apparatus, of which the following is a specification, reference being had to the accompanying drawing, forming a part hereof, which is a diagram illustrating the principle of our invention and also one of its applications.

Solenoids and electro-magnets have long been known as "ammeters" or "current-indicators" of continuous or straight currents, and they have been generally used to modify resistances and for like purposes; but so far as we know no practical instrument capable of the general uses above indicated has ever been devised for use with alternating currents; and the main object of our invention is to furnish a practical apparatus which is operated by variations in current strength of a circuit in which the currents rapidly alternate.

One feature of our invention consists in the combination of a core with a main and an auxiliary coil, both coils forming a part of the alternating circuit; but the main coil is so wound as to magnetize the core in an opposite sense from its magnetization by the auxiliary coil—that is to say, the main coil is so wound on the core as to make one end of the core north and the other south at every current, say from left to right, and vice versa at every current from right to left—while the auxiliary coil is so wound that the currents which would be induced in it by alternations of the magnetism of the core are always in the same direction as the corresponding alternations in the main coil, as will be clear from considering the instrument A. (Shown in the diagram, in which the main coil is shown in two parts $a\ a'$ and the auxiliary coil is marked b.) Here when the current is from left to right—that is, from A′ to A²—if it traversed the main coil $a\ a'$, as it does the main coil of the converter C, it would make the core a^2 a magnet with its south pole on the left and its north pole on the right, and that would induce a current in the auxiliary coil b, whose course would be from left to right in the coil b as it is wound in the instrument A. The other alternation—that is, from right to left, instead of from left to right—will reverse the magnetism of core a^2, and will also reverse the direction of the induced current in the auxiliary coil b. Were the auxiliary coil b part of a separate and distinct circuit from the circuit of which the main coil $a\ a'$ forms a part, (and this is the common arrangement where main and auxiliary coils are used, as in the converter C,) the counter electro-motive force produced by the rapidly-alternating magnetism of the core a^2 would practically prevent the passage of any appreciable current through the main coil $a\ a'$, except when the auxiliary coil b is in closed circuit; and our theory of the matter is that a current is in truth induced in the auxiliary coil b by the rapid alternations of the magnetism of the core a^2 in our device A, almost precisely as a current is induced in the auxiliary coil of the converter C, and as is now well understood by all skilled in the art. It will, however, be clear that by our new arrangement of an auxiliary coil b with relation to the main coil $a\ a'$ the auxiliary coil is always part of a closed circuit whenever an alternating current exists in the main coil $a\ a'$, and consequently in our device the alternating current flows from A′ to A² and from A² to A′ with trifling resistance and as if the core a^2 were not present in the coils, while at the same time the core a^2 is attracted by the main coil $a\ a'$ in almost precisely the same manner as if the current were always in the same direction through the coil $a\ a'$ and the auxiliary coil b were absent.

One of the main advantages of this first feature of our invention is that we are enabled by its use to automatically regulate the electro-motive force of an alternating-current dynamo, as will be now explained.

In the drawing, D represents an alternating-current dynamo, and D′ its exciter, the straight current produced by the exciter D′ being carried through the coils of the field-magnet of the alternating dynamo D. When the dynamo D is used, as indicated in the diagram, to energize a number of converters in multiple, it is necessary that its electro-

motive force be kept practically constant, and to do this the current from the exciter D′ should be varied in strength, and this is commonly done by a variable resistance R; but heretofore it has been customary for an attendant to keep watch of a lamp and to vary the resistance R by hand whenever that lamp varied in glow. In our invention this regulation of the resistance R is accomplished automatically by our device A, as will be clear from the drawing without detailed description of the construction of the resistance R, which may be of any suitable type. It will be clear to all skilled in the art that any decrease in the load will tend to cause an increase in the difference of potential between the loads W W′ and any increase in the load a decrease in that difference of potential; but when the difference of potential tends to increase the current strength between the terminals A A² is also increased, and the resistance R thereby increased by the action of the core a^2 under the influence of the increased current through the coil $a\ a'$, and that increase of the resistance R which is in the field-circuit of the exciter D′ decreases the output of exciter D′, and thereby prevents increase of the difference of potential between the loads W W′. In like manner any increase in the load tends to decrease the difference of potential between the loads W W′, and thereby to decrease the current strength from A′ to A²; but this lessens the pull of the coil $a\ a'$ upon the core a^2 and diminishes the resistance of the rheostat R, and that increases the current strength in the field-circuit of exciter D′, and thereby prevents a fall in the difference of potential of dynamo D.

While we have shown both features of our invention as applied to preserving a constant difference of potential between the terminals of an alternating-current dynamo, it will be obvious to all skilled in the art that our invention can also be utilized to produce a constant current by varying the difference of potential between the terminals of an alternating-current dynamo, and it will also be clear that our combination of the core a^2 and the main coil $a\ a'$ and the auxiliary coil b is generally applicable to a large variety of uses with alternating currents.

We are aware that attempts have been made to automatically regulate the circuit of an exciter by variation in the current strength in the external circuit of an alternating-current dynamo whose field-coils were in the exciter-circuit, (see, for example, Patents No. 366,523 of 1887, and No. 392,370 of 1888,) and we do not claim, broadly, the regulation of an exciter-circuit by variation of the external circuit of an alternating-current dynamo.

What we claim as our invention is—

1. In combination, core a^2, main coil $a\ a'$, and auxiliary coil b, the coils being wound to make the direction of any alternating currents induced in coil b the same as the direction of the inducing alternating currents traversing coil $a\ a'$, and the main coil $a\ a'$ serving as a solenoid for the core a^2, all substantially as described.

2. In combination, alternating-current dynamo D, its exciter D′, core a^2, main coil $a\ a'$, auxiliary coil b, wound upon the middle part of core a^2 to make the direction of the currents induced in coil b the same as the direction of the inducing-currents in coil $a\ a'$, and variable resistance R, the position of the core a^2 with relation to coil $a\ a'$ regulating the resistance R, all substantially as described.

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Witnesses:
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