

No. 773,880.

PATENTED NOV. 1, 1904.

L. C. MARBURG.

SYNCHRONIZING DEVICE FOR DYNAMO ELECTRIC MACHINES.

APPLICATION FILED MAR. 7, 1904.

NO MODEL.

Fig. 1.

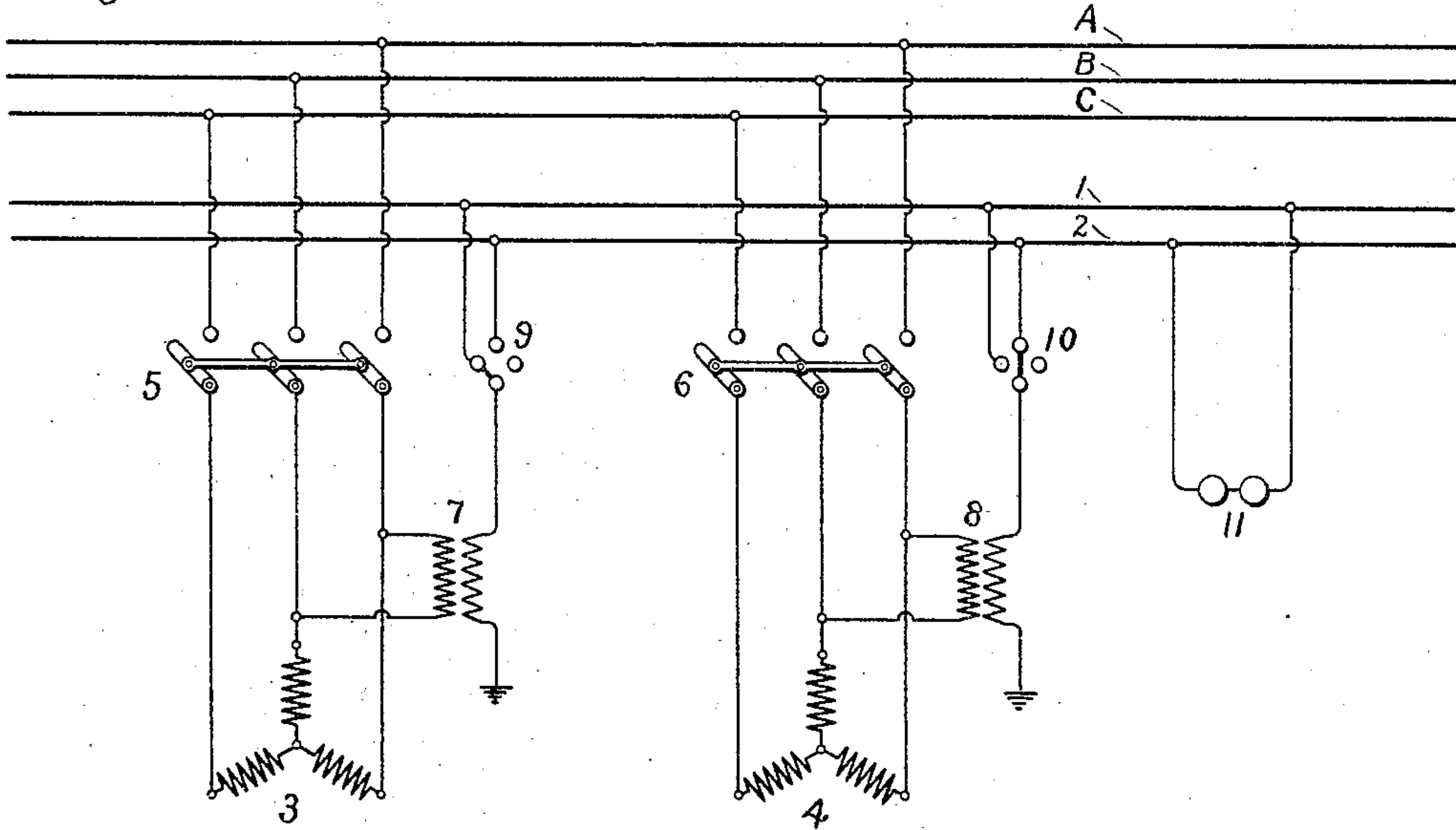
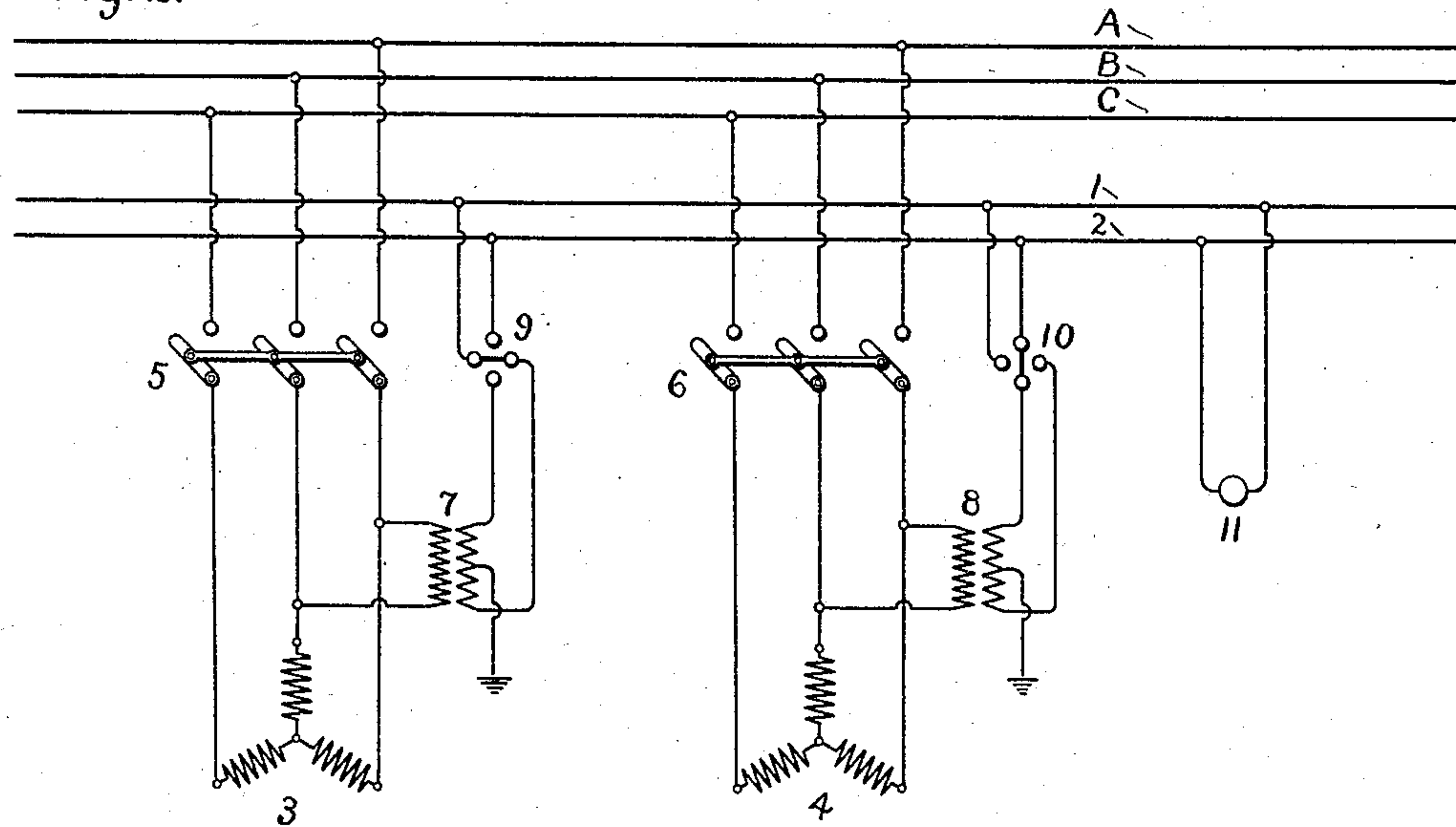


Fig. 2.



Witnesses

J. Ellis Glen.

Helen Orford

Inventor.

Louis C. Marburg

By *Arthur H. Davis*
Atty.

UNITED STATES PATENT OFFICE.

LOUIS C. MARBURG, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SYNCHRONIZING DEVICE FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 773,880, dated November 1, 1904.

Application filed March 7, 1904. Serial No. 196,896. (No model.)

To all whom it may concern:

Be it known that I, LOUIS C. MARBURG, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Synchronizing Devices for Dynamo-Electric Machines, of which the following is a specification.

This invention relates to synchronizing devices for dynamo-electric machines.

It is necessary in coupling machines in parallel to a set of distributing-bars that means be employed to bring a machine into a condition of phase identity with the phases already on the bus-bars before closing the switch. For the purpose of determining the exact instant when phase identity occurs various synchronizing means have been heretofore employed. The usual practice until very recently has been to connect potential-transformers derived from two machines or from the bus-bars and the machine being thrown in with a pair of incandescent lamps. By watching the lamps there is observed a period when the flashes intermit over a prolonged time interval, which is when the phases coincide and during which the change of phase relation in the impulses being delivered by the two machines is quite slow. This is the time when the switch must be thrown. In order to protect the operator against danger of shock in handling the synchronizing-plugs, it has been the common practice to ground the secondary of the potential-transformers. From this it results that the lamps must be synchronized dark instead of bright—that is to say, the interval when the lamp grows dark must be carefully watched, and when the dark interval is longest the switch must be thrown. In very modern stations a synchronizing-indicator is employed and synchronizing by means of lamps is rendered unnecessary; but there are still many installations where synchronizing is done by means of lamps for reasons of cheapness.

By means of my invention the synchronizing may be done with the lamps bright. I effect this result by grounding the middle portion of the transformer secondary, which per-

mits me to combine the electromotive forces supplied to the synchronizing-circuit as desired—that is to say, either in conjunctive or opposition relation—so that I can employ either the bright or dark test at pleasure.

My invention therefore consists in a synchronizing-circuit including a synchronizing switch or plug and a divided transformer secondary.

The features of novelty will be more particularly hereinafter described and will be definitely indicated in the claims.

In the accompanying drawings, Figure 1 is a diagram showing the system at present in common use for lamp-synchronizing, and Fig. 2 is a diagram showing my improvements.

A, B, and C represent three bus-bars of an alternating-current system of distribution. I have shown the invention in connection with a triphase system for purposes of convenience, though, of course, it is applicable to a system having any number of phases. 1 and 2 represent synchronizing-buses. This is for purposes of convenience. If desired, the synchronizing might be carried on in connection with the main bus-bars. 3 and 4 represent two generators connecting through suitable switches, as 5 and 6, with the main bus-bars. 7 and 8 represent potential-transformers derived from similar phases of the system, the secondaries of which have one terminal grounded and the other end connecting, through a synchronizing-receptacle 9 10, with the synchronizing-buses. In the synchronizing-buses are placed two incandescent lamps, as seen at 11, each of a voltage corresponding to the transformer secondary. With this system the plug of the synchronizing-receptacle connects the two transformer secondaries in opposition, so that current flows by way of the secondaries of transformer 7, synchronizing-receptacle 9, to bus 1, thence through the two lamps 11 and synchronizing-receptacle 10 to ground through the secondary of transformer 8 on the machine being thrown in. A series of flashes of the lamp then occurs, becoming more and more infrequent as synchronism is approached, until at length a stage is reached when the dark interval is of unusual length.

As to this the operator must judge the instant when the switch must be thrown, when the two machines are thrown into parallel on the distributing-buses A B C. With this system it is rather more difficult to estimate the exact instant when synchronism occurs, and there is, moreover, the possibility that a broken lamp or defective connection in the synchronizing-circuit is not so readily detected.

It is deemed more desirable to synchronize bright. This is easily accomplished by my arrangement, with which, moreover, but a single synchronizing-lamp is necessary. This arrangement is depicted in Fig. 2, where it will be seen that the secondaries of the transformers 7 and 8 are tapped at a middle point for the ground connection. In this case there is but half voltage furnished by each transformer, and only one lamp is therefore required. By tracing the circuit it will be seen that when the machines are running the synchronizing electromotive forces of the two transformers are both thrown upon the circuit, commencing at ground of transformer 7, passing through the lower section of the secondary to the synchronizing-receptacle, and thence through the synchronizing-bus 1 to the lamp 11, and by synchronizing-bus 2 and upper section of transformer secondary 8 to ground. Thus the two transformer-sections act in series relation, and when phase identity occurs the two electromotive forces are superposed, giving a voltage equal to one complete secondary wind-

ing, or enough to burn a single lamp at full incandescence. With this arrangement when the plugs are inserted the lamp gives intermittent flashes, the duration of the flashes gradually lengthening until synchronism occurs, when they are of unusual length. If the lamp is defective, it will be at once evident and the detection of phase identity is more easily made.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. Means for synchronizing alternating-current dynamo-electric machines, comprising two transformers corresponding to the devices being synchronized, a ground connection from a middle point of the transformer secondaries, and synchronizing-switches connecting one section of each transformer with the synchronizing-circuit.

2. Means for synchronizing alternating-current dynamo-electric machines, comprising a plurality of transformers having their middle points grounded, and synchronizing-sockets connecting said transformers with a synchronizing-circuit including an incandescent electric lamp.

In witness whereof I have hereunto set my hand this 4th day of March, 1904.

LOUIS C. MARBURG.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.