No. 701,886. Patented June 10, 1902.

# R. E. HUTHSTEINER.

## SYNCHRONIZING ALTERNATORS.

(Application filed Sept. 14, 1899.)

(No Model.)

Fig. 1.

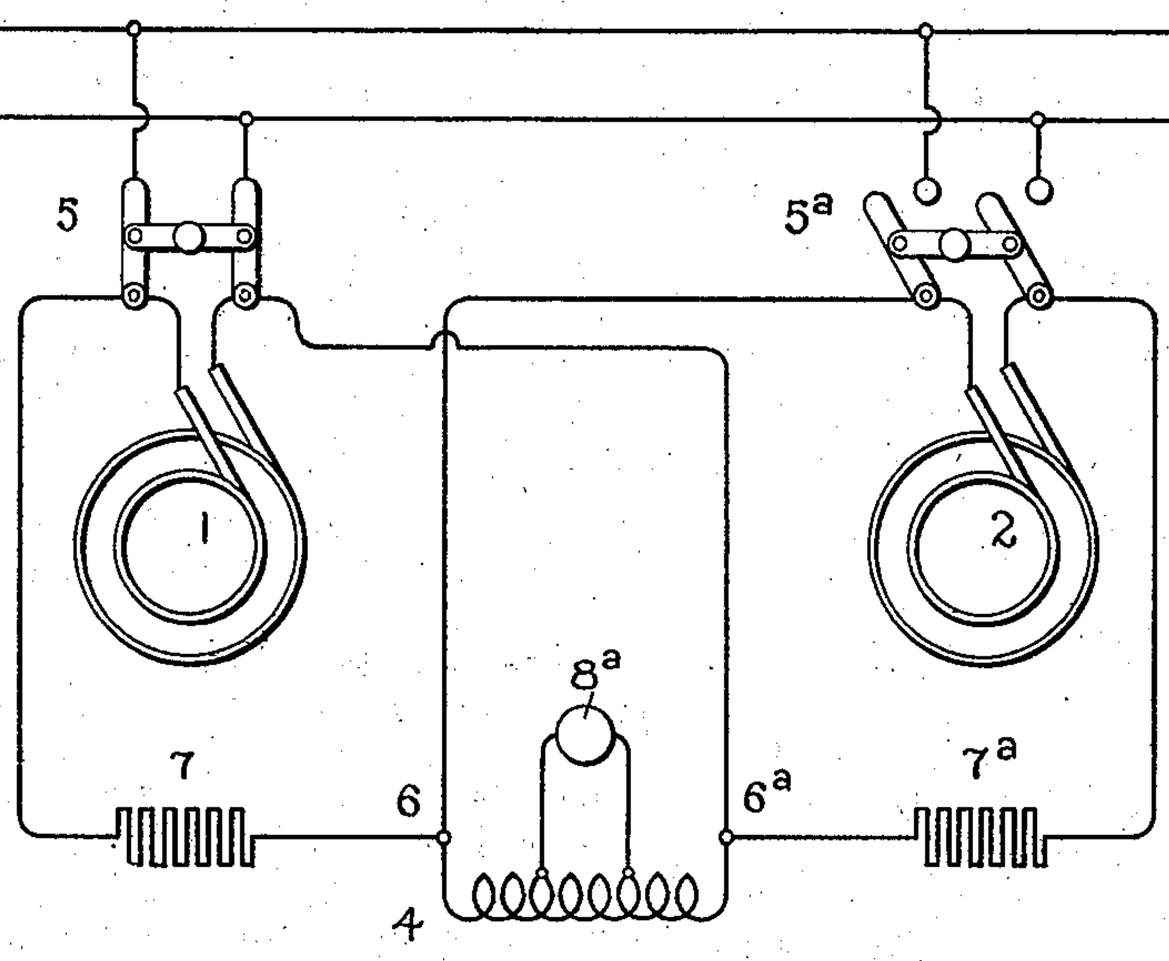
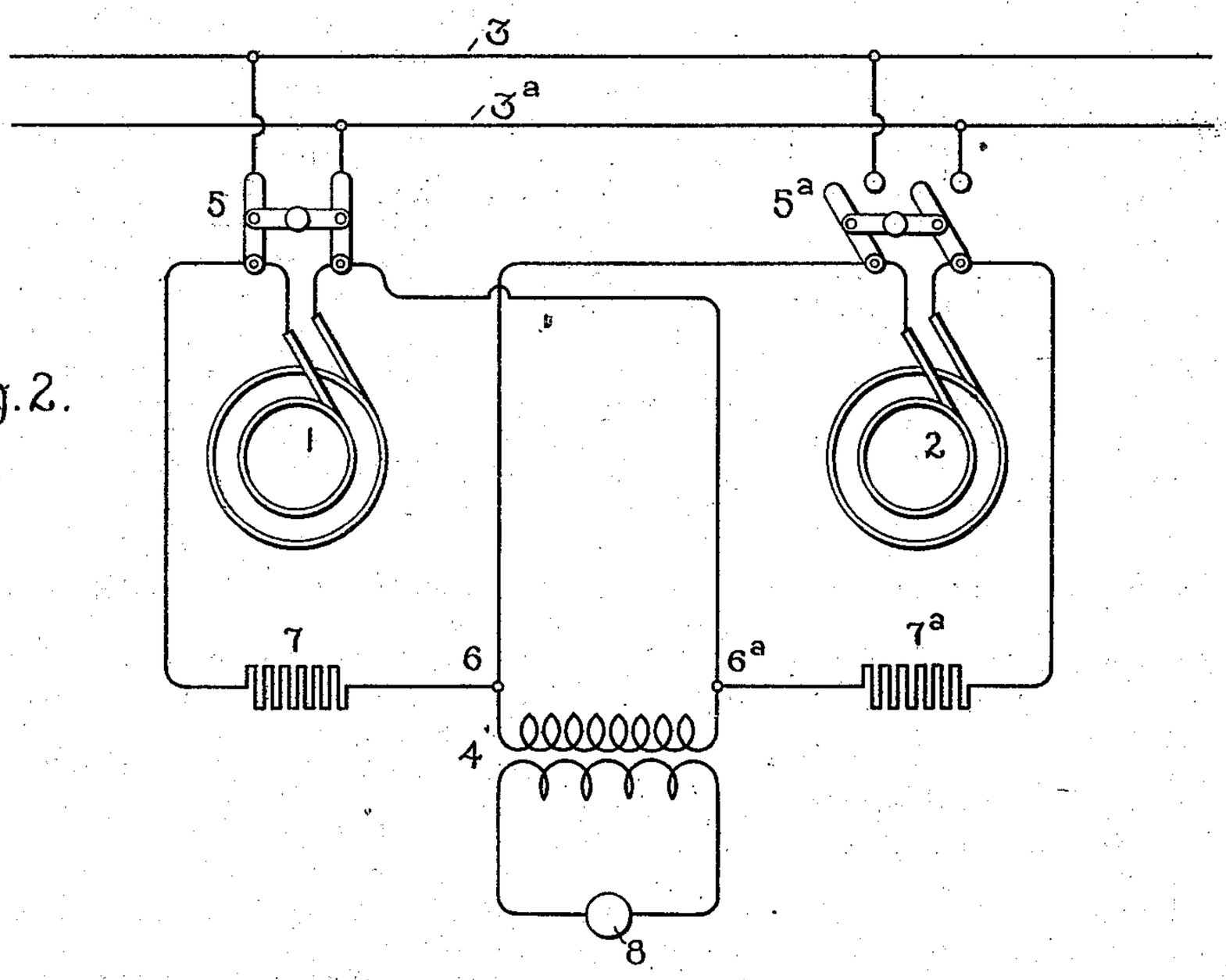



Fig. 2.




Witnesses.
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# UNITED STATES PATENT OFFICE.

ROBERT E. HUTHSTEINER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## SYNCHRONIZING ALTERNATORS.

SPECIFICATION forming part of Letters Patent No. 701,886, dated June 10, 1902.

Application filed September 14, 1899. Serial No. 730,416. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT E. HUTHSTEINER, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Synchronizing Alternators, (Case No. 1,113,) of which the following is a specification.

The object of the present invention is to provide a phase-indicator for synchronizing alternating-current generators, motors, &c., and for coupling them in parallel relation to a common circuit.

I carry out my invention by providing means for coupling the terminals of like instantaneous sign of the several machines with the terminals of a phase-indicator, interposing sufficient resistance or reactance in the circuit to reduce the current value therein when the machines are in phase opposition and are thrown into parallel relation to the supply-circuit.

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

In the accompanying drawings, which diagrammatically illustrate the invention, Figures 1 and 2 represent two different forms of synchronizing devices embodying my improvements.

1 2 represent a plurality of alternating-current generators, and 3 3ª two bus-bars connecting with a supply-circuit into which the alternators feed in parallel. The terminals of like instantaneous sign of the generators connect with the terminals of a phase-indicator 4, by which I mean any device which gives an intelligible indication, visual, oral, or otherwise, of approach or recession in identity of phase of the alternating currents. Controlling-switches for coupling the generators with the bus-bars 3 3ª are provided, as indicated at 5 5ª.

The phase-indicating device may be of any desired construction, that shown in Fig. 2 comprising an incandescent lamp in the secondary circuit of a transformer, the primary terminals of which, 6 6ª, connect, respectively, through non-inductive resistances 7 7ª with poles of like sign of the two generators. These resistances prevent a rush of current through the phase-indicator when the machine being synchronized is just being started up.

It is not essential to my invention that a phase-indicator operated by a current-reducing transformer be employed, as such a device may be operated directly by the resultant current of the two machines. Such an organization is indicated in Fig. 1, where an incandescent lamp 8ª is placed in shunt to a resistance which should be preferably non-inductive, or at least of low inductance. In coupling the machines in parallel one machine is connected to the bus-bars, as indicated at 5, and the other machine is started up. So long as the machines are out of phase the lamp produces a series of flashes while the machine is starting up and then glows with gradually-increasing luminosity, and when they get into exact step the lamp burns at full brilliancy. The switch 5ª is then thrown, coupling the two machines in parallel. Inasmuch as the circuit controlling the phase-indicating device is now connected across the two bus-bars said circuit will act as a short circuit and be wasteful of current. By employing a high non-inductive resistance 7 7ª the value of this waste may be reduced to a minimum and damage to the indicator avoided.

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

1. A phase-indicator for synchronizing alternating-current machines, comprising an indicating device responsive to alternating currents, circuit connections in parallel between said device and a plurality of machines, and current-reducing devices in said parallel connections.

2. A phase-indicator for synchronizing alternating-current machines, comprising an indicating device responsive to alternating currents, circuit connections in parallel between said device and a plurality of machines, current-reducing devices in said parallel connections, and switches for coupling the several machines in parallel relation to a distribution-circuit.

3. A phase-indicator for synchronizing alternating-current generators, comprising a transformer in the secondary circuit of which

is included an indicating device and having its primary terminals connected in parallel relation to the two generators to be synchronized, a resistance in series with the transformer and means for coupling said generators in parallel relation to the supply-circuit.

4. Means for coupling alternating-current machines in parallel relation to a common distribution-circuit, comprising controlling-switches for the several machines, a common phase-indicator for all the machines in parallel relation to their leads, and a current-reducing resistance in each parallel circuit, for the purpose described.

5. A synchronizing device for alternating-current dynamo-electric machines consisting of a transformer with means for connecting the machines to be synchronized in parallel relation to its primary, and an indicating device in the secondary.

6. A synchronizing device for alternating-current dynamo-electric machines consisting of a transformer with means for connecting both machines to be synchronized on its primary through a current-reducing device, and an indicating device in the secondary.

In witness whereof I have hereunto set my hand this 6th day of September, 1899.

ROBERT E. HUTHSTEINER.

Witnesses:

ALEX. F. MACDONALD,

EDWARD WILLIAMS, Jr.