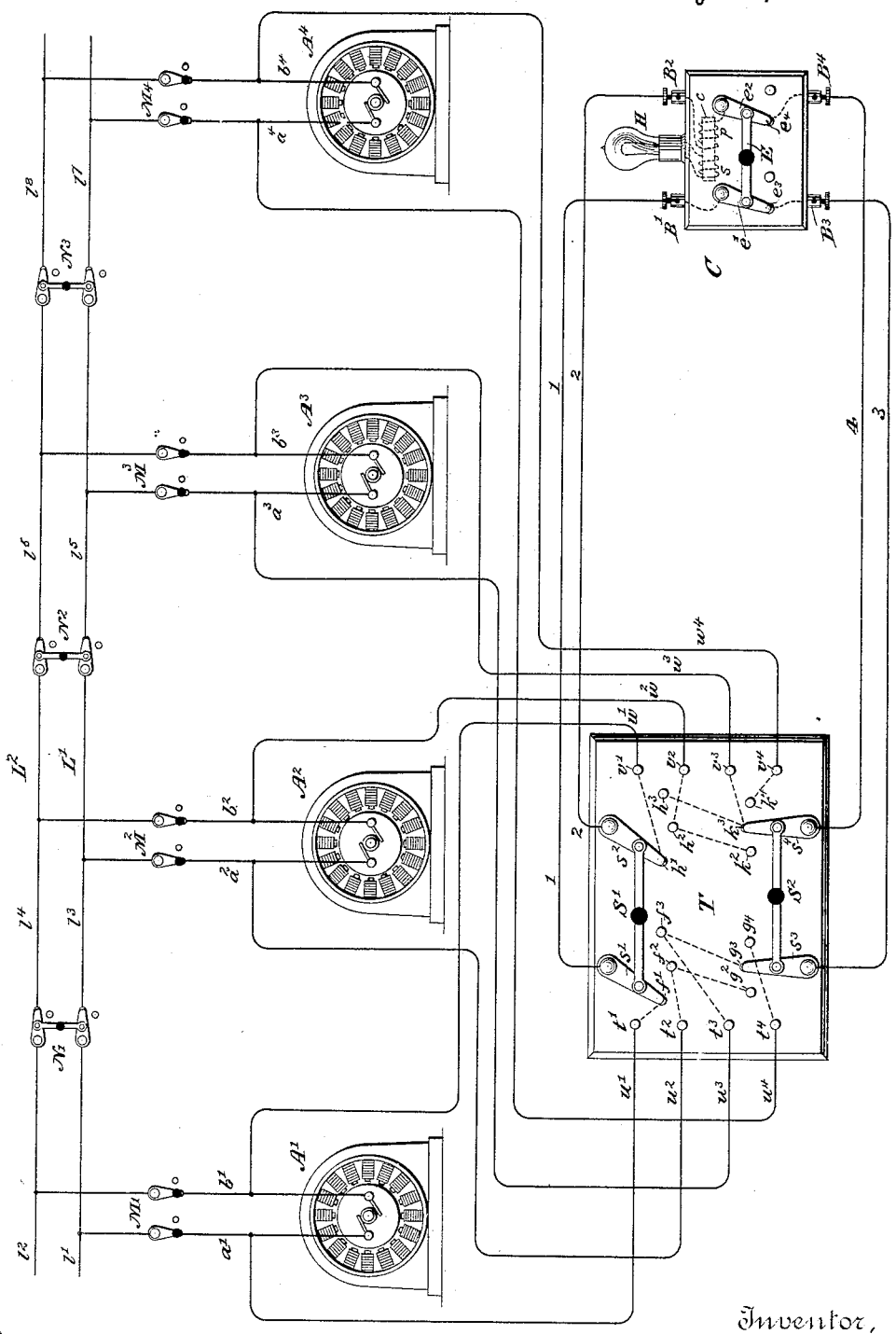
(No Model.)

P. LANGE.

APPARATUS FOR CONNECTING ALTERNATE CURRENT DYNAMOS.

No. 383,648. Patented May 29, 1888.



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UNITED STATES PATENT OFFICE.

PHILIP LANGE, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE ELECTRIC COMPANY, OF SAME PLACE.

APPARATUS FOR CONNECTING ALTERNATE-CURRENT DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 383,648, dated May 29, 1888.

Application filed October 1, 1887. Serial No. 251,189. (No model.)

To all whom it may concern:

Be it known that I, PHILIP LANGE, a citizen of the United States, residing in Pittsburg, in the county of Allegheny, in the State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Connecting Alternate-Current Electric Generators, of which the following is a specification.

The invention relates to an organization of apparatus and circuits for connecting alternate-current electric generators in multiple-arc circuit.

The object of the invention is to provide convenient means whereby the relative phases of the currents delivered by several different alternate-current generators may be readily determined, and devices whereby the machines may be connected together in multiple-arc or parallel circuit at the proper moments.

In certain applications for Letters Patent filed by Oliver B. Shallenberger, Serial Nos. 220,909 and 224,523, there are described a method and an apparatus for connecting alternate-current machines in the manner set forth.

The present invention involves certain improvements in the construction of the switch-board, so that more than two generators may be connected in multiple arc in a convenient manner by employing a single indicator.

In the accompanying drawing there is shown, partly in diagram, an organization of four electric generators delivering alternating currents and a single switch-board and indicating device for the same.

Referring to the figure, A′, A², A³, and A⁴ represent four alternate-current electric generators of convenient type, and L′ L² main-line conductors leading to any desired work-circuit. The generators are capable of being connected in multiple arc with the lines L′ and L² or with sections l', l^2, l^3, and l^4 at will by conductors a' b' a^2 b^2, &c., through switches M′, M², M³, and M⁴. The sections of the line L′ L² may be connected or disconnected by switches N′, N², and N³. Thus, when it is desired to feed separate circuits from the different generators, the switches may be opened. In order to insure that any given machine shall be connected with the lines at a moment when the current which it is delivering is such as would combine with the current being delivered to the lines by another generator and flow in the same direction upon the work-circuit, the indicating device C is employed. This device consists of a primary coil, p, and a secondary coil, s, wound upon a core, c. The terminals of the secondary coil are connected through the filament of an incandescent electric lamp, H. The respective terminals of the primary coil p are connected with a binding-post, B², and one arm, e^2, of a switch, E. The contact-point e^4 of this switch is connected with a binding-post, B⁴. The point e^3 of the arm e' is connected with a binding-post, B³. The binding-post B′ is connected with the arm e', and thus the posts B′ and B³ may be connected with each other through the switch-arm e'. The binding-posts B′ and B² are respectively connected by conductors 1 and 2 with the switch-arms s' and s^2 of a switch, S′, carried upon a switch-board, T. The binding-posts B³ and B⁴ are respectively connected with the switch-arms s^3 and s^4 of a switch, S², carried upon the switch-board T. Upon the switch-board T there are eight binding-posts, t' t^2 t^3 t^4 and v' v^2 v^3 v^4. The posts t' t^2 t^3 t^4 are respectively connected by conductors u', u^2, u^3, and u^4 with the conductors a' a^2 a^3 a^4, leading from one pole of each of the respective dynamos. The conductors v' v^2 v^3 v^4 are connected in like manner by conductors w' w^2 w^3 w^4 with the conductors b', b^2, b^3, and b^4, leading from the other poles of the respective dynamos. The points t', t^2, and t^3 are connected, respectively, also, with switch-points f' f^2 f^3, applied to the switch-arm s' of the switch S′, and the point t^4 is connected with a switch-point, g^4, applied to the switch-arm s^3 of the switch S². The points f^2 and f^3 are also connected with the switch-points g^2 and g^3, respectively applied to the switch-arm s^3. The points v', v^2, and v^3 are connected with the switch-points h' h^2 h^3, applied to the switch-arm s^2 of the switch S′, and the point v^4 is connected with a point, k^4, applied to the switch-arm s^4 of the switch S². The points h^2 and h^3 are respectively connected with the points k^2 and k^3 of the switch-arm s^4.

Supposing that the generators A′, A², and A⁴ are already connected with the lines L′ and L² in multiple arc, and it is desired to add the

generator A^3, the operation of the apparatus is as follows: If the switch S′ is in the position shown in the drawing, with its arms in contact with the points f' and h', respectively, then the respective poles of the generator A′ will be connected with the binding-posts B′ and B^2 of the synchronizing device C. From the post B^2 the connections may be traced to the arm e^2 through the primary coil p, thence through the point e^4 to the binding-post B^4, thence through the conductor 4 to the switch-arm s^4, and thence through the point k^3 and line w^3 to the conductor b^3, and thus with the pole of the generator A^3 corresponding to the pole of the generator A′, which is connected with the post B^2. The other pole of this generator A^3 is connected through conductors a^3 and w^3 to the point g^3, thence through the switch-arm s^3 to the binding-post B^3, thence through the arm e' to the binding-post B′ and through the conductor 1 to the switch arm s', thence through the point f' and conductor u' to the conductor a', leading from the corresponding pole of the generator A′. The circuit of the generator A^3 is thus completed through the primary coil of the converter in the indicating device C. If the current thus derived from the generator A^3 is such that its phases combine and flow in the same direction with those from the generator A′, then the lamp H will burn at its highest brilliancy. If, however, they oppose each other, it will burn at its lowest degree and yield little or no light. This will indicate the relative phases of the two generators and the proper moment at which the generator A^3 may be connected into circuit with the lines L′ and L^2 through its switch M^3, such moment being when the lamp H is at its minimum brilliancy.

For the purpose of connecting the individual generators into circuit, as required in any required combination, the switch-board T suffices, for by means of it any two of the series of generators may be connected through the indicating device. Thus in the position shown the generator A^3 will be synchronized with the generator A′, and vice versa. If the switch S′ be moved to the points f^2 and h^2, then the generators A^2 and A^3 may be synchronized. If the generators A′ and A^4 are to be synchronized, the switch S′ remains in the position shown and the switch S^2 is moved to the points g^4 and k^4; and likewise, by moving the switch S′ successively to the points f^2 and h^2 and f^3 and h^3, the generator A^4 may be synchronized with either the generator A^2 or A^3.

I claim as my invention—

1. The combination, with three or more alternate-current electric generators, of a switch-board for synchronizing the same, consisting of two double-point switches, contact-points for the respective arms of one switch connected with the respective poles of said generators, contact-points for the respective arms of the second switch connected with said poles, and an indicating device included in circuit between the respective switches.

2. The combination, with the alternate-current generators A′, A^2, and A^4, of the switches S′ and S^2, their contact-points $f'f^2h'h^2g^2g^4k^2k^4$, the indicating device C, connected between the switches, electrical connections from the respective poles of the generator A′ with the points f' h', respectively, connections from the respective poles of the generator A^4 with the points g^4 and k^4, respectively, and electrical connections from the respective poles of the generator A^2 with points f^2 g^2 and h^2 k^2.

3. A switch-board for connecting different alternate-current generators through an indicating device consisting of two switches, each having two contact-arms and each arm having contact-points, conductors leading from one pole of each generator except one to the respective contact-points of one arm of one switch, conductors leading from the other poles of the same generators to the respective contact-points of the other arm of the same switch, and similar electric connections from the respective poles of all the generators except one of the first-named with the contact-points of the respective arms of the remaining switch.

4. A switch-board for connecting different alternate-current generators through an indicating device consisting of two switches, each having two contact-arms and each arm having contact-points, conductors leading from one pole of each generator to the contact-points of one arm of each switch, conductors leading from the remaining poles to the contact-points of the remaining arms, and an indicating device included in circuit between said switches.

In testimony whereof I have hereunto subscribed my name this 5th day of September, A. D. 1887.

PHILIP LANGE.

Witnesses:
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