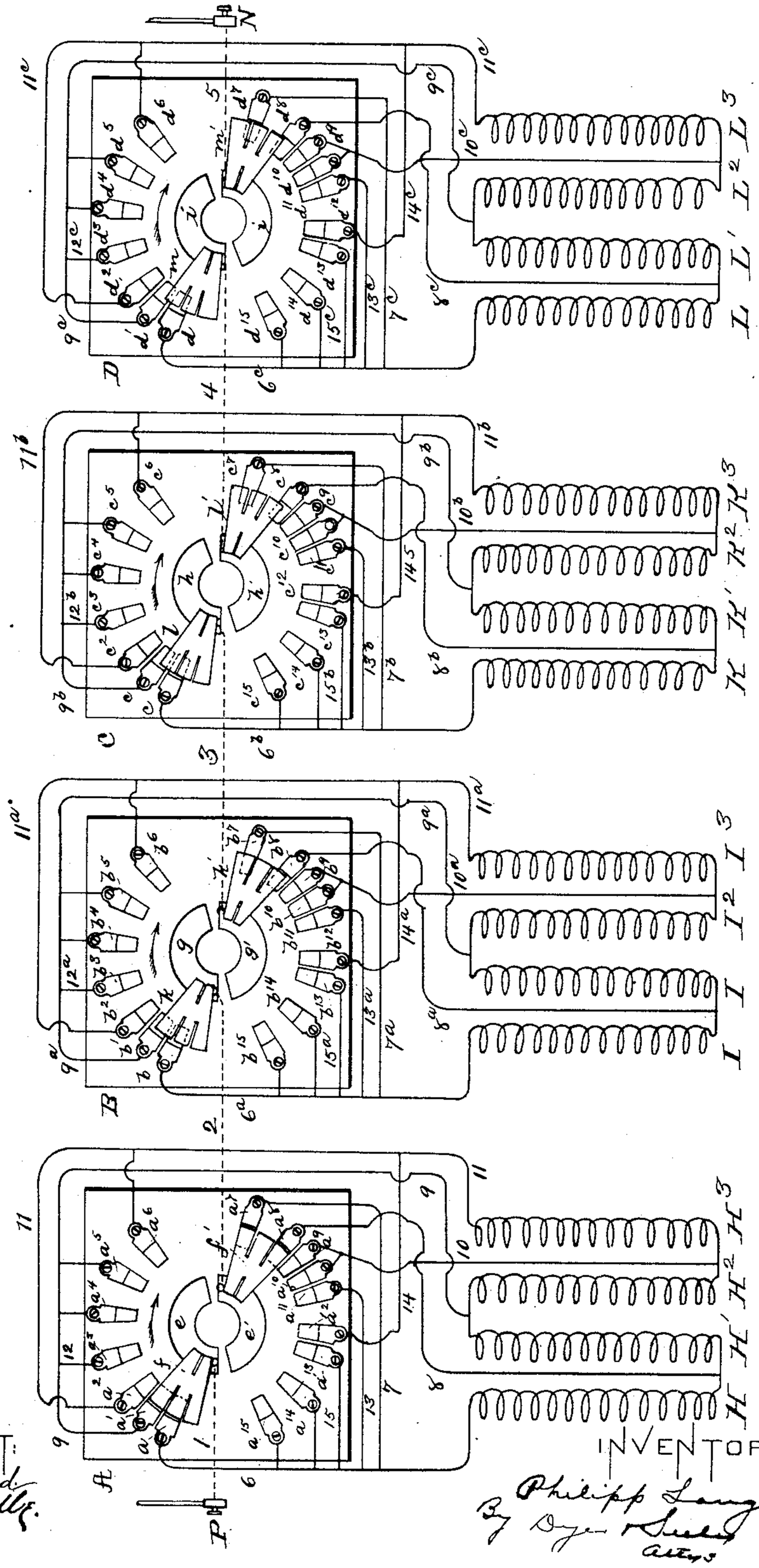
(No Model.) 3 Sheets—Sheet 1.

P. LANGE.

REGULATOR FOR ELECTRIC LIGHTS.

No. 330,244. Patented Nov. 10, 1885.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

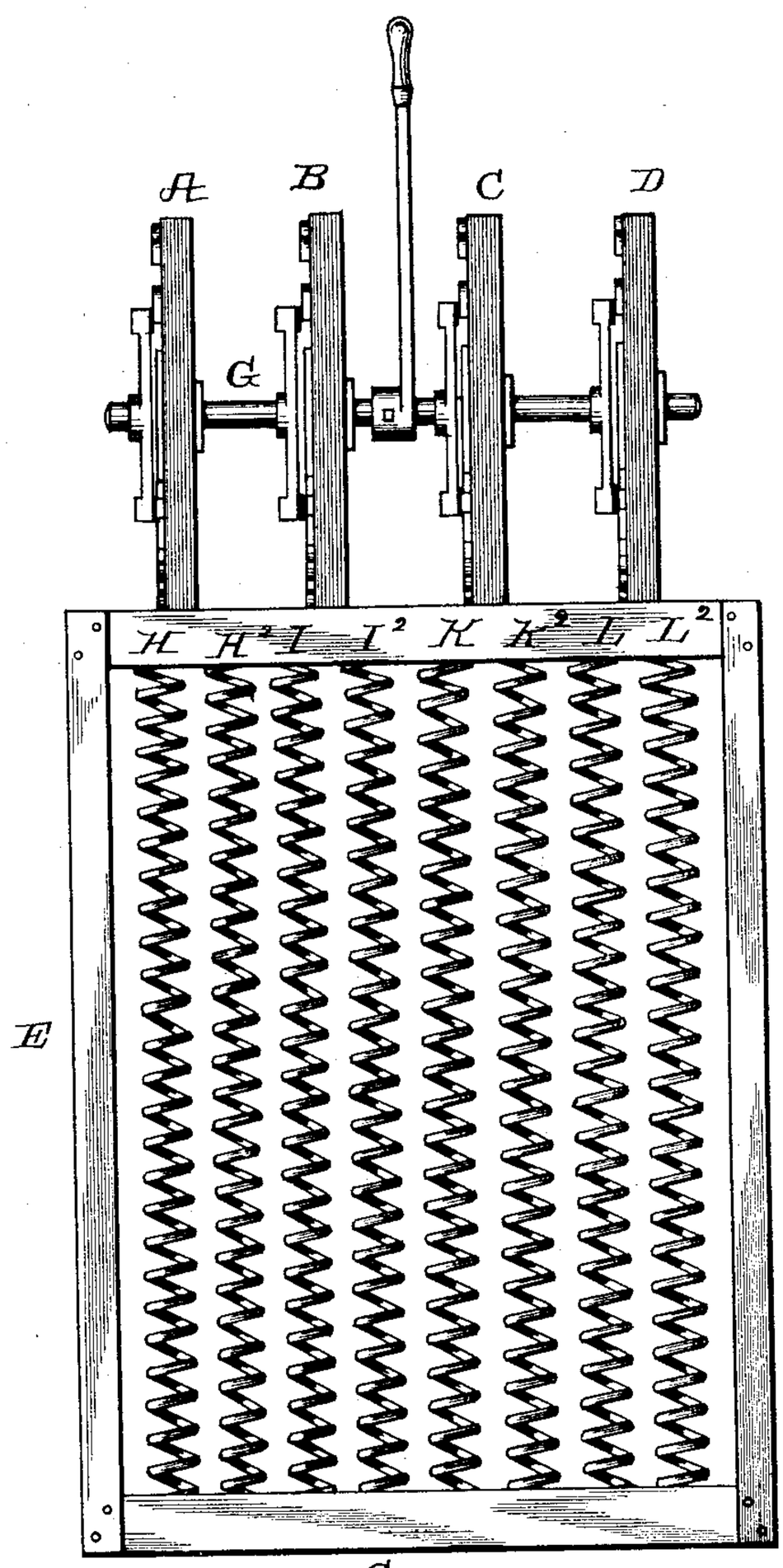
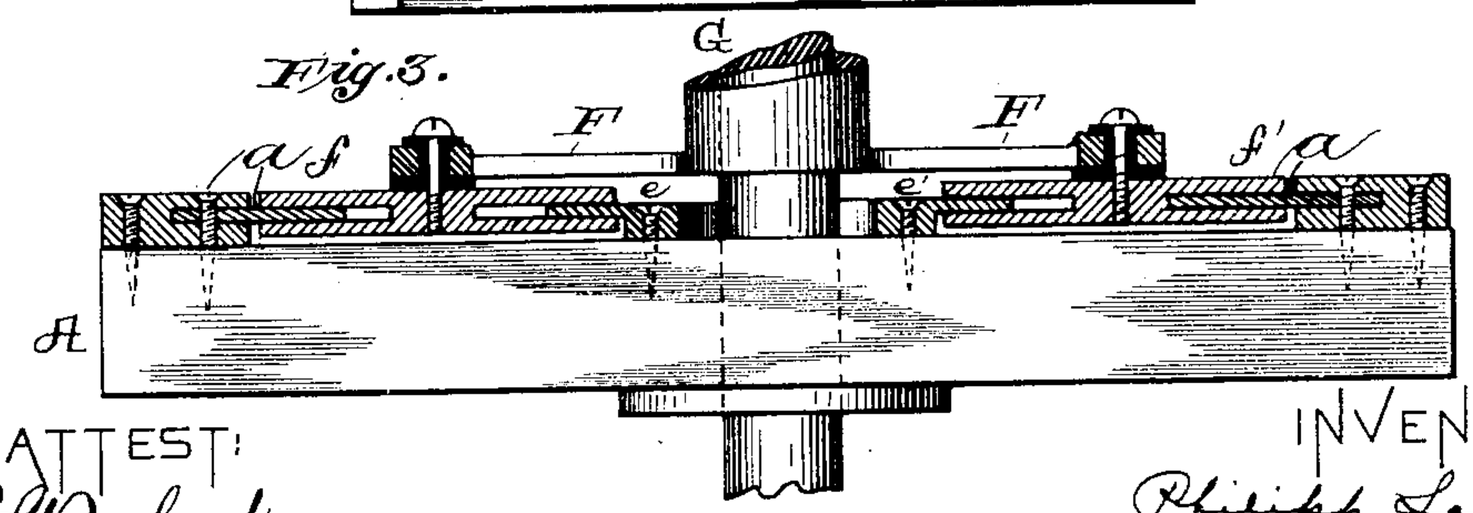


Fig. 3.



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3 Sheets—Sheet 3.

P. LANGE.

REGULATOR FOR ELECTRIC LIGHTS.

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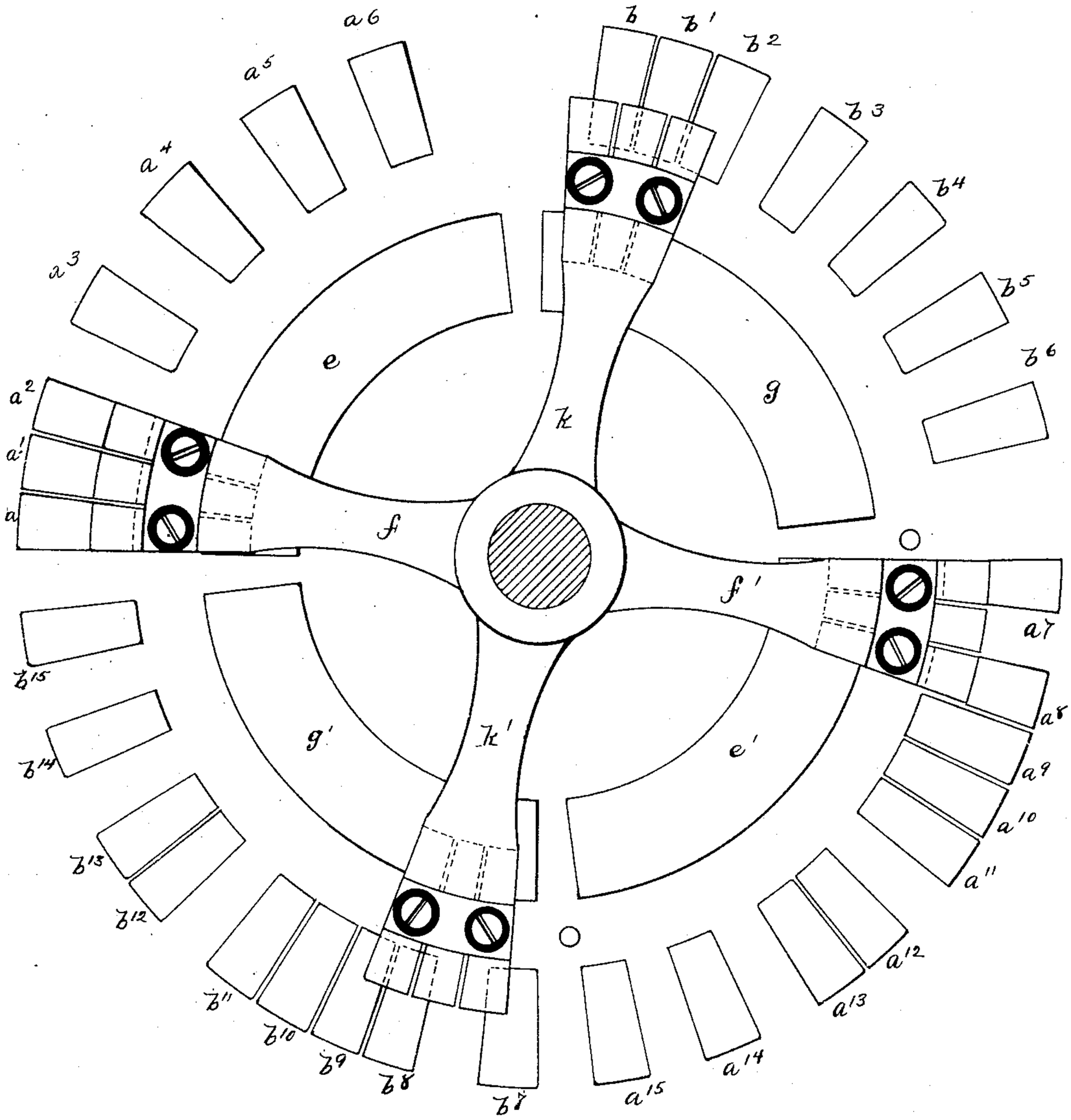
Fig. 4.



ATTEST:
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INVENTOR:
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UNITED STATES PATENT OFFICE.

PHILIPP LANGE, OF NEW YORK, N. Y., ASSIGNOR TO BERGMANN & CO., OF SAME PLACE.

REGULATOR FOR ELECTRIC LIGHTS.

SPECIFICATION forming part of Letters Patent No. 330,244, dated November 10, 1885.

Application filed July 9, 1885. Serial No. 171,920. (No model.)

To all whom it may concern:

Be it known that I, PHILIPP LANGE, of New York, in the county and State of New York, have invented a certain new and useful Improvement in Regulators for Electric Lights, of which the following is a specification.

This invention relates to an arrangement of adjustable resistances and commutators for adjusting the same in electric-light circuits for the purpose of raising and lowering the candle-power of the electric lamps, my object being to enable the changes in candle-power to be made very gradually and steadily, so that no sudden difference of illumination can occur.

The main feature of my invention is the use of two or more sets of resistance-coils, each having an independent commutator, both or all said commutators being worked by the same turning-lever or hand-wheel, whereby the different sets of resistance-coils are thrown into various arrangements of multiple-arc series and multiple series to vary the resistance of the circuit. I so arrange the commutator-arms that the movement of the common shaft causes those of the different sets to act successively, one after another, so that one set of resistances is partly changed, then the same change occurs on the next set, and so on.

The apparatus illustrated in the annexed drawings is one designed to produce twenty-eight changes from full candle-power to the lowest desired degree.

Figure 1 is a diagram of the resistance-coils and commutators in the preferred form; Fig. 2, a side view of the apparatus; Fig. 3 an enlarged cross-section of one of the commutators; and Fig. 4 illustrates a modified form of the invention.

Referring to Figs. 1, 2, and 3, A, B, C, and D are four wooden switch-boards supported upon a suitable frame or box, E, which incloses the resistance-coils. These are spiral coils of iron or other wire of such conductivity as may be desired for the particular situation in which the apparatus is to be used. Switch-board A has contact-blocks a a' a^2, &c. Switch-board B has contacts b b' b^2, &c. Switch-board C contacts c c', &c., and switch-board D contacts d d', &c.

Switch-board A has two central arc-shaped contacts, e and e', and two moving contact-plates, f and f', carried by but insulated from arms F F, which extend from the shaft G, common to all the switch-boards. All the switch-board contacts are supported off the surface of the switch-board, and moving plates f f' are forked, so as to inclose the other contacts and make effective sliding connections with them, as shown in Fig. 3. The moving contacts are always in connection with their respective contact-arcs e e'. The other switch-boards, B C D, have similar contact-arcs, g h i, and moving plates k l m, the last all carried by the shaft G.

The contacts of each succeeding switch-board are set a little behind those of the previous one—that is, so that, for instance, plate f reaches contact a^2 before k reaches b^2, and this before l reaches c^2, after which m reaches d^2.

Each commutator has connected with its contacts a set of resistance-coils. Commutator A has coils H, H', H², and H³; B has I, I', I², and I³; C has K K', &c., and D has L L', &c. Connections from the contact-blocks to these coils are made by wires, as indicated by the numbered full lines. P is one terminal of the apparatus and N the other. Here the ends of the conductor of the circuit whose resistance is to be varied are connected. From P wire 1 extends to e, from e' wire 2 goes to g, from g' wire 3 to h, from h' wire 4 to i, and from i' wire 5 to N. In this way the circuit is completed through the commutators.

In the position of the contact-plates shown in the diagram all the resistance-coils are short-circuited, the circuit being as follows: P 1 e f a, wires 6 7 a^7 f' 2 g k b 6^a 7^a b^7 k' g' 3 h l c 6^b 7^b c^7 l' 4 i m d 6^c 7^c d^7 m' i' 5 N. The lamps are thus at full candle-power. To gradually increase the resistance of the circuit, and thus reduce the brilliancy of the lamps, the contact-plates are all turned in the direction shown by the arrows. The first movement serves to bring f upon a^2 while still remaining on a and a', and to remove f' from a^7 and bring it upon a^9. Upon the other commutators there is no change in the contacts, the blocks being set behind one another, as explained. The circuit is now as follows: From a, a', and

a^2; from a by 6 to coils H and wire 8 to contact a^9, f', and wire 2; from a' by wire 9 to coils H′ and H² in multiple arc, and wires 8 and 10 to a^8 and a^9, respectively, f', and 2; from a^2 by wire 11 to coils H³, and wires 10 to a^9, f', and 2. The coils I K L are all short-circuited as before, the circuit to N being precisely as already described. Thus the small resistance of the four coils H, H′, H², and H³, in parallel circuit to one another, is placed in circuit. The next movement without in any way changing the contacts of commutator A produces the same change in commutator B that was before made in commutator A, bringing coils I I′, &c., into parallel circuit with each other, and in series with multiple-arc coils H H′, &c., thus making a still further small increase in resistance. The next movement changes neither A nor B, but makes the same change already described in C, and the next movement makes this change in D without affecting A, B, and C. At the end of these first four movements, therefore, the four sets are in series, and the four coils of each set in multiple arc with one another. I have stated that no change is made in A, B, and C until this first movement is completed in D. It will be noticed that f', k', and l' will be brought, respectively, upon a^{10}, b^{10}, and c^{10}; but these blocks have the same connections as a^9, b^9, and c^9 with wires 10, 10^a, and 10^b, and electrically the two form a single contact-block. The next change is in A, and consists in bringing f off of a and a' on a^3, and f' on a^{11}. Circuit is then from a^2, by wire 11, coils H³, wire 10, to a^9 or a^{10}, f', and 2; from a^3, by wires 12 and 9, to parallel coils H′ and H², and wires 8 and 10 to a^8 and a^9, f', and 2. Coils H are thus cut out of circuit, and the resistance is increased by the removal of this parallel branch from the circuit. Next, coils I are cut out, and then in succession coils K and L, as will be readily understood from the explanations previously given. Then there are four sets of three multiple-arc coils each. The next change is to remove f' from a^8, f still being on a^2 and a^3. Then the circuit is from a^2, by 11, to coils H³, and wire 10 to a^{10}; from a^3, by 9, to H² and H′, through H², by 10, to a^{10}, and through H′ and H in series, and 6 and 13 to a^{11}. This makes H and H′ in series parallel to H² and H³ in multiple arc to each other, which is a further increase in resistance. This change is then made in B, C, and D successively. Next in A f is removed from a^2, f' still being on a^{10}. Circuit is then by 9 to H² and H′, through H², by 10 to a^{10}, (H³ being thus cut out,) and through H′ H in series multiple arc to H², 6, and 13 to a^{11}. This makes one coil parallel with two coils in series. After the last-named change has been made in B, C, and D, f is moved to a^4 and a^5, and f' to a^{12} and a^{13}. Then the circuit is by 9 through H², H³ in series 11 and 14 to a^{12}, and through H′ and H in series 6 and 15 to a^{13}, two coils in series parallel to two others in series. The same change is repeated in B, C, and D. By next change in A f is brought to a^5 and f' to a^{14}. This makes the only circuit from a^4 and a^5 by 9 through H′ and H in series, and 6 to a^{14}. Same movement in B, C, D makes four, six, and eight coils in series successively. To make ten coils in series, f is moved to a^6 and f' to a^{15}. Then the circuit is 11, H³, H², H′, H, 6 to a^{15}. Twelve, fourteen, and sixteen coils are then successively thrown into series by commutators B, C, and D, and this completes the operation in that direction, all the moving plates being then at their final stops, and the lamps in circuit being now at the lowest desired candle-power. To bring the lamps up again, the plates are moved gradually back to their first position.

A lever, N, is shown for turning the shaft. A hand-wheel may be employed instead, if desired.

Instead of using four separate switch-boards, the contacts for the four commutators may all be placed upon one. This is illustrated in Fig. 4, which, however, shows an arrangement for only two commutators.

Blocks lettered a to a^{15} correspond with those of commutator A in the other figures. Those lettered b to b^{15} correspond with commutator B. Arms $f f'$ move on the former series of blocks and arms $k k'$ on the latter. The coils are connected in the same way as with the separate switch-boards, and arms $k k'$ are arranged to change their contacts after arms $f f'$ in the same manner. Fixed contacts $e e'$ and $g g'$ are arranged as before.

It is evident that any desired number of commutators on one or on several switch-boards may be employed. The arrangement in Figs. 1 and 2 is that which I have found most convenient in practice.

What I claim is—

1. The combination, with an electric circuit, of two or more sets of resistance-coils in series therein, a commutator for each set, and a common shaft for operating all the commutators, substantially as set forth.

2. The combination, with an electric circuit, of two or more sets of resistance-coils therefor and a commutator for each set, said commutators being operated successively by a common shaft, substantially as set forth.

3. The combination, with an electric circuit, of two or more sets of resistance-coils therefor and a commutator for each set consisting of fixed and moving contacts, the moving contacts of the commutators being arranged to make and break the successive fixed contacts one after another, as described, substantially as set forth.

4. The combination of two or more switch-boards, contacts on each switch-board connected with resistance-coils, and moving contacts for each switch-board, all carried by a common shaft, the moving contacts of the dif-

ferent switch-boards being set on the shaft behind one another, as described, substantially as set forth.

5. The combination, with the two or more commutators whose moving contacts reach corresponding fixed contacts successively, as described, of fixed contacts on each commutator, having the same electrical connections as preceding fixed contacts, whereby the electrical connections of one commutator are unchanged while changes are proceeding in the other commutators, substantially as set forth.

This specification signed and witnessed this 30th day of June, 1885.

PHILIPP LANGE.

Witnesses:
A. W. KIDDLE,
E. C. ROWLAND.

Correction in Letters Patent No. 330,244.

It is hereby certified that Letters Patent No. 330,244, granted November 10, 1885, upon the application of Philipp Lange, of New York, New York, for an improvement in "Regulators for Electric Lights," was erroneously issued to "Bergmann & Co., their heirs or assigns;" that said Letters Patent should have been issued to *Bergmann & Company, its successors or assigns;* and that the grant of said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 17th day of November, A. D. 1885.

[SEAL.]

H. L. MULDROW,
Acting Secretary of the Interior.

Countersigned:
M. V. MONTGOMERY,
Commissioner of Patents.