(No Model.)

# W. J. PAINE.

## METHOD OF REGULATING ELECTRIC LIGHTS.

No. 321,845. Patented July 7, 1885.

Fig. 1.

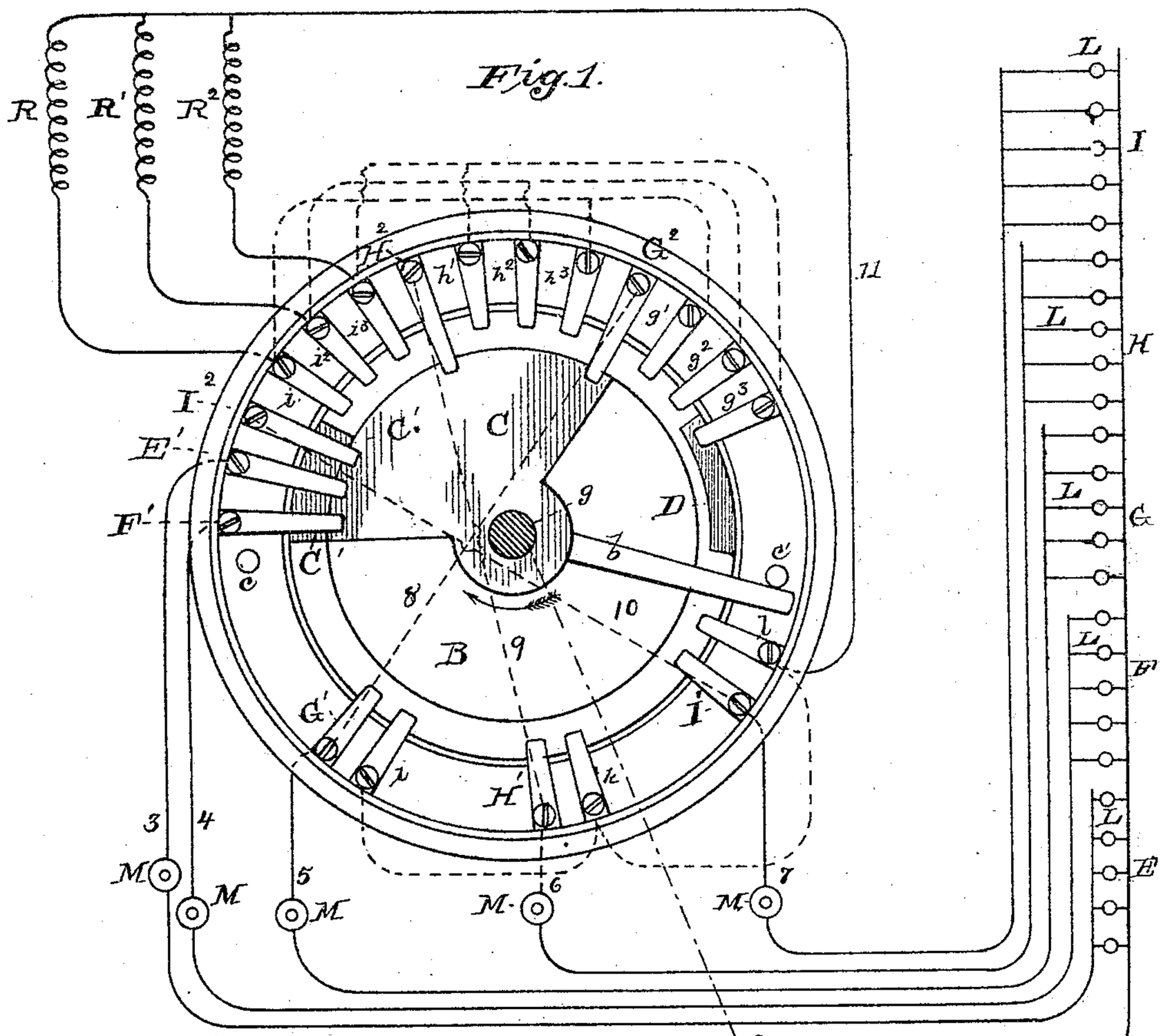
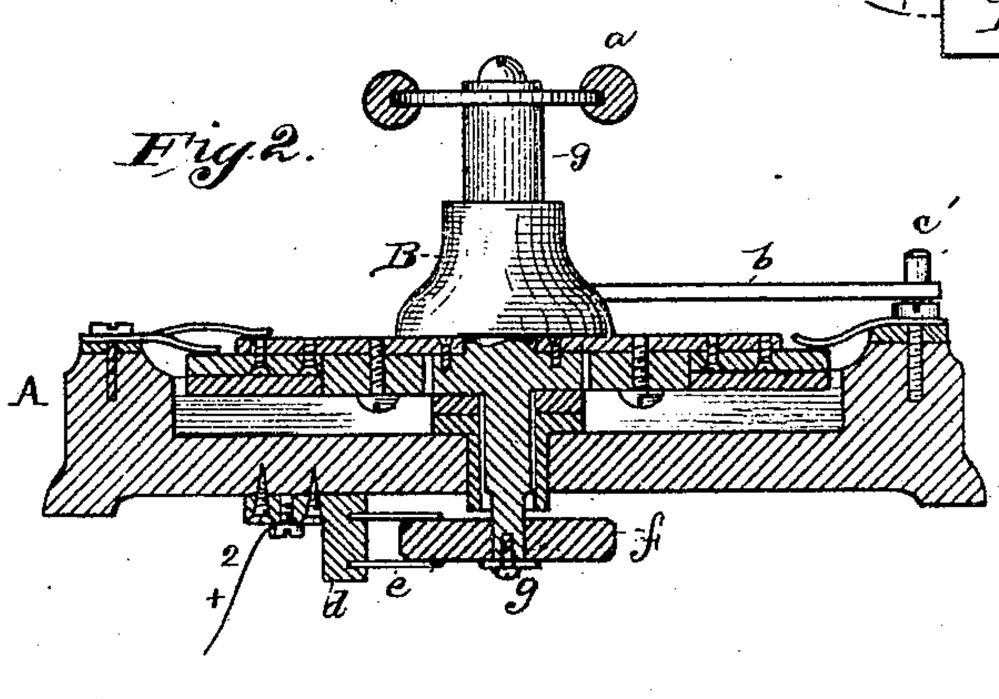



Fig. 2.

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## METHOD OF REGULATING ELECTRIC LIGHTS.

SPECIFICATION forming part of Letters Patent No. 321,845, dated July 7, 1885.

Application filed May 23, 1885. (No model.)

*To all whom it may concern:*

Be it known that I, WALTER J. PAINE, of Boston, in the county of Suffolk and State of Massachusetts, have invented a certain new and useful Improvement in Methods of Regulating Electric Lights, of which the following is a specification.

The object I have in view is to provide a method for raising and lowering the candle-power of incandescing electric lamps without the use of the bulky resistances heretofore employed, which were located in the circuit of all the lamps whose candle-power was to be varied, and hence had to carry the current for all the lamps.

I accomplish the object by arranging the lamps in groups, the lamps of each group being in the same circuit, and the lamps of the several groups being properly intermingled or located, and throwing these groups into and out of circuit successively, each group before being thrown out of circuit being reduced in candle-power by introducing resistance gradually into its circuit, and being thrown into circuit at low candle-power by the use of resistance which is gradually reduced to raise the group to full candle-power. A single switch performs this operation, and the same small resistance is used for all the groups. The switch is also arranged to throw other groups of lamps into and out of circuit at full candle-power. Additional separate switches are used—one for each group—for breaking the circuits of the groups, so that one or more of the groups can at any time be thrown out of circuit and kept out independent of the operation of the regulating-switch.

In the accompanying drawings, illustrating means for performing my method, Figure 1 is a top view of the switch with the handle omitted for clearness, the connection to lamps and resistance being shown in diagram; and Fig. 2, a vertical section of the switch.

The form of switch shown in drawings is composed of a stationary circular base of insulating material having a raised periphery forming a ring, A, carrying spring contact-fingers, which bear upon a revolving disk, B, located within ring A, and having contact-plates. The disk B is turned by handle *a*, and has a stop-arm, *b*, striking stops *c c* on the ring A, which stops limit the movement of the disk, it being turned in one direction to throw the groups of lamps from full candle-power successively into connection with the gradually-increased resistance and out of circuit, and in the other direction to produce the reverse effect.

The disk B has contacts upon two planes, the long fingers shown projecting over the lower plane to the higher plane, while the short fingers bear upon the lower plane which is around the periphery of the disk.

C is a segmental metal plate carried by the upper plane of disk B, and having an extension, C′, on the lower plane of the disk. The segmental plate C may be of any size less than one-half of the disk. It occupies in the switch shown about one-third of the upper surface of disk B on its higher plane, and is sufficiently large to connect together all the long fingers of the switch. The extension C′ on lower plane of disk B is large enough to bridge three of the short fingers. Upon the lower plane of disk B is another bridging-plate, D, which is somewhat longer than C′. This last plate bears the relation to the other plates shown in the drawings, and hereinafter set forth in connection with the description of the operation of the switch.

E F G H I are groups of incandescing electric lamps L, the lamps of each group being shown for clearness as located together. In practice, the lamps of the several groups will be intermingled or otherwise arranged to produce an equal distribution of the light as the groups are thrown into and out of circuit.

K is the dynamo-electric machine or other source of electric energy. One pole is connected by conductor 1 with one side of all the groups. From the opposite side of the groups separate conductors run to spring-fingers on the switch, as will be presently explained, while from the opposite pole of the dynamo a conductor, 2, runs to the center of the switch and to plates C C′.

Referring to Fig. 2, it will be seen that wire 2 runs to metal post *d* on the insulating-base

of switch. This post has springs *e*, making contact with disk *f* on central spindle, *g*. The spindle having plate C secured thereto, the result is a connection from dynamo to plates C C′.

The separate wires 3 4 from groups E F run directly to long spring-fingers E′ F′, arranged side by side, which fingers have no other connections. When these fingers are on plate C, the lamps of groups E F are at full candle-power, and these groups are thrown out of and into circuit at full candle-power by the movement of disk B.

The separate wires 5 6 7 of groups G H I run to short fingers G′ H′ I′, located at a considerable distance apart, greater than length of plate D, and these short fingers are connected with long fingers $G^2$ $H^2$ $I^2$ on the opposite side of A by wires 8 9 10. (Shown in dotted lines.) Located side by side with fingers G′ H′ I′ are other short fingers, *i k l*, which are connected together, as shown by dotted lines, and with a conductor, 11, extending to a three-part resistance, R R′ $R^2$. Following long finger $I^2$ are three short fingers, $i'$ $i^2$ $i^3$, which are connected with the other ends of the resistances R R′ $R^2$. Following long fingers $H^2$ and $G^2$ are other sets of short fingers, $h'$ $h^2$ $h^3$ and $g'$ $g^2$ $g^3$. The first and thirds sets of short fingers are connected together in direct order, $i'$ being connected with $g'$, $i^2$ with $g^2$, and $i^3$ with $g^3$. The connection with the intermediate set is reversed, $i'$ and $g'$ being connected with $h^3$, $i^2$ and $g^2$ with $h^2$, and $i^3$ and $g^3$ with $h'$. If more than three parts of resistance are used there will be more of these fingers, and if more than three sets of these fingers are employed (which would be necessary in a switch where the resistance is thrown into connection with more than three groups of lamps) the connection of alternate sets will be reversed. This arrangement is to prevent a change of conditions when plate C′ bridges the last finger of one set and the first of the next set.

Outside of the regulating-switch the separate group-wires have simple circuit making and breaking switches M, for breaking circuit of one or more groups independent of the regulating-switch. The resistances R R′ $R^2$ may be wire, lamp, or resistances of any character, as will be well understood.

The operation of the parts, assuming that all the circuits are closed at switches M, will be as follows: With the parts in the position shown in the drawings, the lamps of all the groups are in circuit and at full candle-power. The current passes from K, *via* 2, to C, and from thence through E′ F′ 3 4, groups E F and 1, back to K; also, from C through $G^2$ $H^2$ $I^2$ 8 9 10 G′ H′ I′ 5 6 7, groups G H I and 1, back to K. The disk B being turned in the direction of arrow in Fig. 1, plate C will pass from beneath fingers F′ E′, and groups F E will be thrown out of circuit in succession at full candle-power. When C passes from $I^2$, plate C′ will bridge $i'$ $i^2$ $i^3$, and D will bridge I′ and *l*, D reaching I′ before C leaves $I^2$. Now lamps of group I will be in circuit with the three resistances R R′ $R^2$, and will be reduced somewhat in candle-power. The current for group I will flow from K, *via* 2 C C′ $i'$ $i^2$ $i^3$ R R′ $R^2$ 11 *l* D I′ 7, lamps of I and 1, back to K. By a further movement the plate C will leave *i* and $i^2$ in succession, cutting out R and R′, with the effect of increasing the resistance and gradually lowering candle-power of I until C′ leaves $i^3$, when I will be thrown out of circuit. At this moment plate D leaves *l*. This operation is repeated for groups H and G, the arm *b* striking stop *c* when the last group G is thrown out of circuit. The lamps will then be all out of circuit. By the reverse movement group G will first be thrown into circuit at low candle-power in connection with the highest resistance, and the resistance will be gradually reduced by throwing in other resistance-circuits in multiple, and the lamps finally connected directly in circuit at full candle-power. This will be repeated for groups H and I in succession, and then E and F will be thrown in at full candle-power.

The throwing the lamps into and out of circuit in groups produces the effect of a gradual raising or lowering of the lights, the extent of subdivision determining the increase or reduction of light for each step.

The gradual reduction or increase of candle-power of each group of lamps through two or more intermediate stages before being thrown out of circuit and after being thrown into circuit is a point of importance. I consider the four changes effected by the switch shown as such a gradual increase or reduction of candle-power.

My switch is especially adapted for theater-lighting, where the production of proper scenic effects requires that the electric lamps should be capable of complete control in candle-power, the same as gas; but the switch may also be used for the lamps of a single room, or even for those of a single fixture. The number of groups controlled by the switch can be made as small or great as desired, (two or more,) or as the particular use may require, and each group may have as many or few lamps as desired, (two or more.) The fingers E′ F′ for throwing groups of lamps on and off at full candle-power may or may not be used.

The apparatus herein described is not claimed, it being the subject of an application for patent already filed, (Case B,) Serial No. 152,558.

What I claim is—

1. The method herein described of lowering and raising the candle-power of incandescing electric lamps, consisting in throwing groups of lamps into and out of circuit successively, raising gradually (through two or more intermediate stages between no light and full light) the candle-power of the lamps after throwing

them into circuit, and lowering gradually their candle-power before throwing them out of circuit.

2. The method herein described of lowering and raising the candle-power of incandescing electric lamps, consisting in throwing groups of lamps into and out of circuit successively, each group being thrown into circuit at low candle-power in connection with external resistance, which is gradually reduced until the lamps reach full candle-power, and before thrown out of circuit being reduced in candle-power by the introduction and gradual increase of external resistance.

3. The method herein described of lowering and raising the candle-power of incandescing electric lamps, consisting in throwing groups of lamps into and out of circuit successively, raising gradually the candle-power of the lamps after throwing them into circuit, and lowering gradually the candle-power before throwing them out of circuit, and throwing into and out of circuit other groups of lamps at full candle-power.

This specification signed and witnessed this 16th day of May, 1885.

WALTER J. PAINE.

Witnesses:

HENRY W. WILLIAMS,

A. W. KIDDLE.