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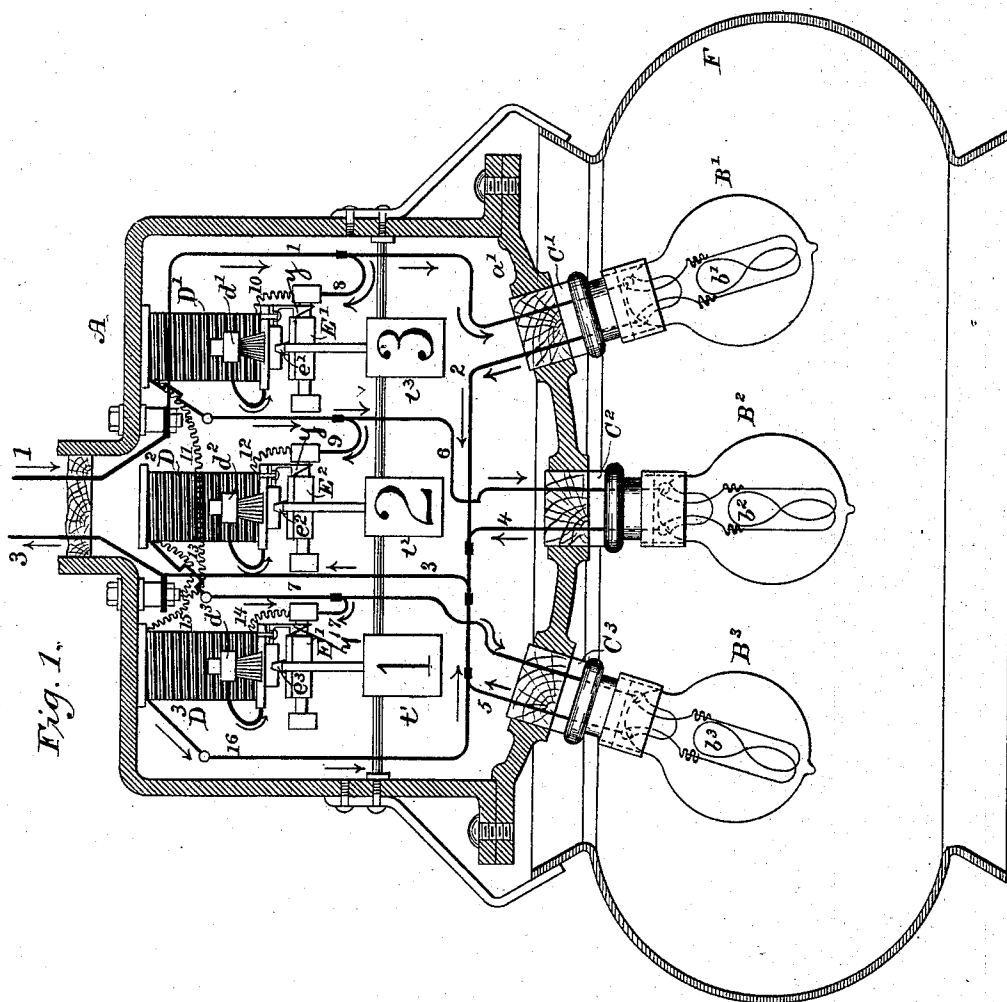
3 Sheets—Sheet 1.

W. STANLEY, Jr.

MULTIPLE INCANDESCENT ELECTRIC LAMP.

No. 322,496.

Patented July 21, 1885.



WITNESSES.
Chas. C. Elaggett.
John S. Orley

INVENTOR.
William Stanley, Jr.

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(No Model.)

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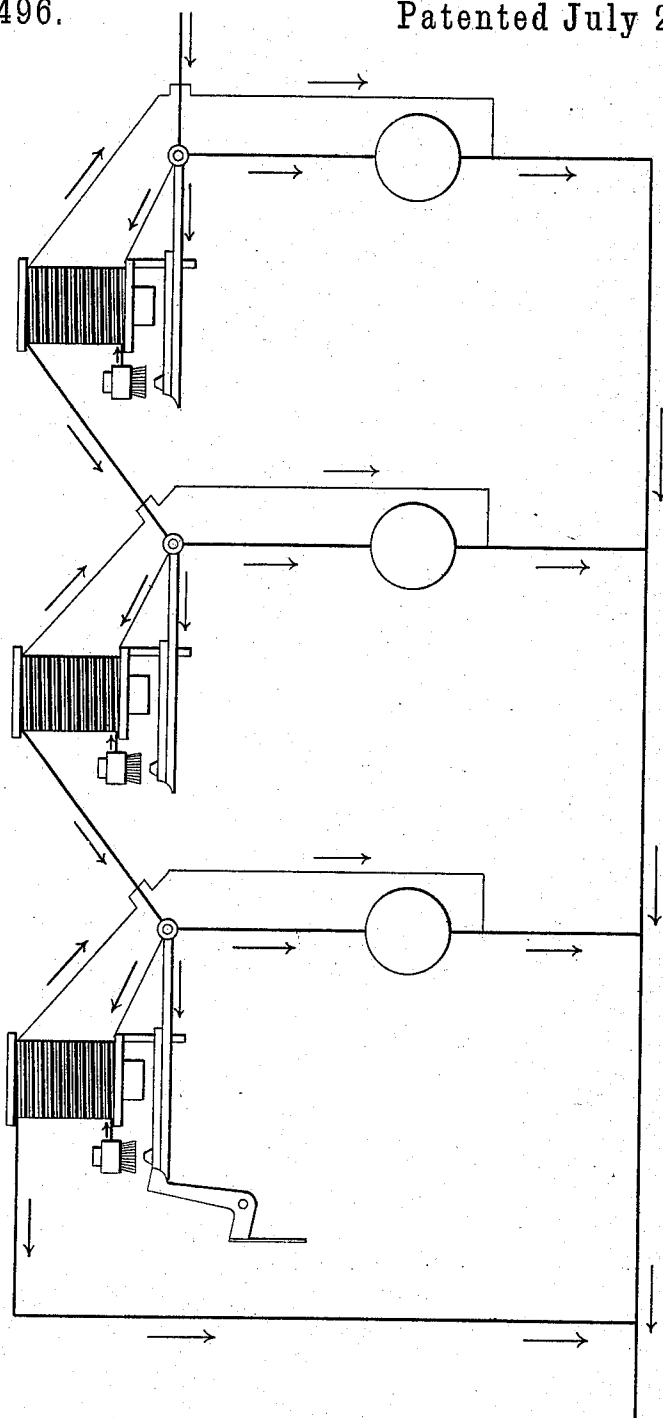
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Fig. 2.



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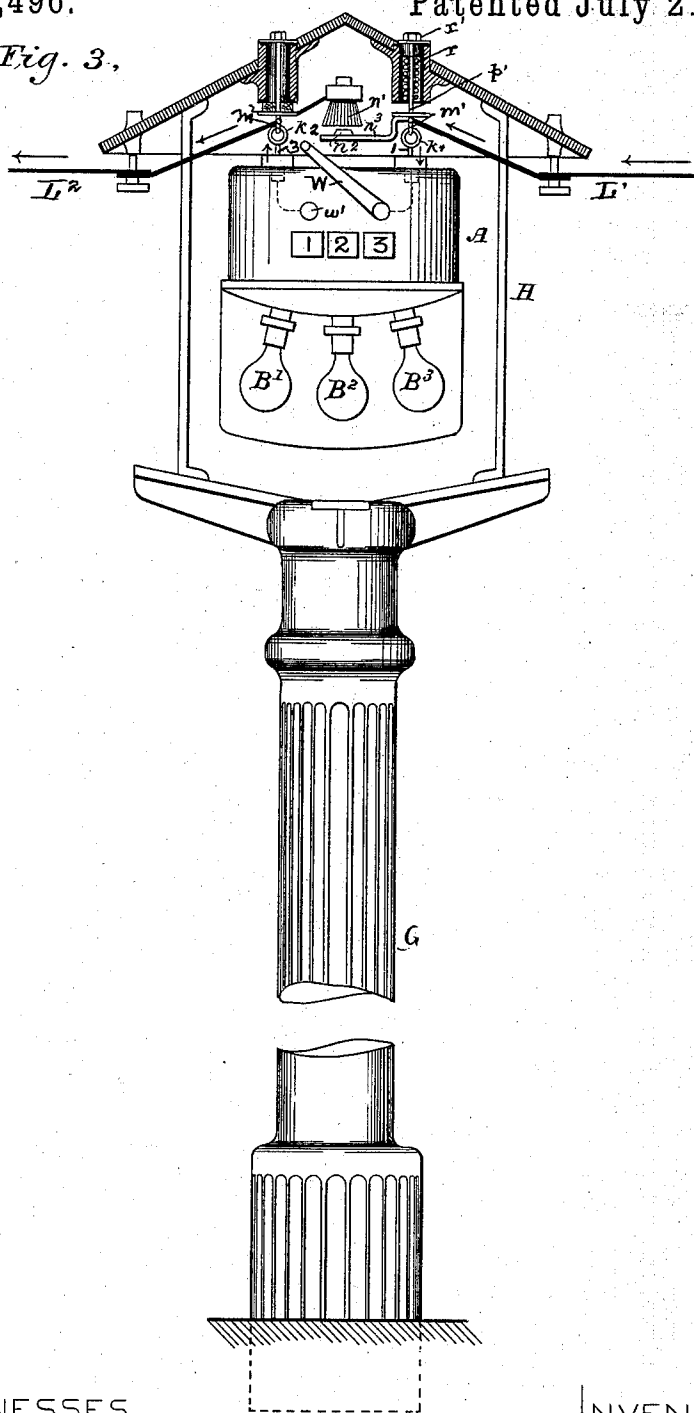
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Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF PITTSBURG, PENNSYLVANIA.

MULTIPLE INCANDESCENT ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 322,496, dated July 21, 1885.

Application filed July 11, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, Jr., a citizen of the United States, residing in the city of Pittsburg and State of Pennsylvania, have invented certain new and useful Improvements in Multiple Incandescent Electric Lamps, of which the following is a specification.

My invention relates especially to that class of electric lighting apparatus in which incandescing filaments are employed for producing the light.

The object of the invention is to provide means for introducing into circuit in succession individual members of groups of incandescent lights located in series in an electric circuit, the first member of each group being supplanted when it has become exhausted by the second, and the second in like manner by a third, and so on throughout the group, so that the number of lights in circuit is always the same. This system differs from others in that it is intended to run the lamps at a higher degree of incandescence than is ordinarily employed, so that the carbons are liable to be consumed in a limited time. The lamps are grouped in any convenient manner within a suitable inclosing or surrounding open globe. The electric current for supplying the same is normally led to the first lamp independently of the remaining lamps in the group, these being respectively included in normally-interrupted branch circuits. A shunt-conductor of high resistance connects the conductors leading to and from each of the incandescent lamps, and in each of these shunt-conductors there is included an electro-magnet. These electro-magnets are respectively designed to control the connections of the interrupted branch circuits in a manner which will hereinafter appear. So long as the first lamp in the series is in action the amount of current traversing the shunt-circuit, and thus the coils of the corresponding electro-magnet, is insufficient to actuate an armature which is applied thereto. When, however, the lamp becomes exhausted, the filament having become broken or so far consumed as to render its resistance abnormally great, there will be a rise of electro-motive force, and consequently a greater portion of the current will traverse

the shunt-circuit and the electro-magnet will become vitalized sufficiently to attract its armature. This movement of the armature completes the main-line connections from the conductor leading to the first lamp through the branch conductor, in which the second lamp is included. A shunt-circuit is thus established around the first or exhausted lamp, and the second lamp is caused to supplant the same. A second coil is applied to each electro-magnet, and this coil is included in the branch conductor leading to the succeeding lamp in the series. This second coil serves to fully vitalize the electro-magnet, and to both insure that the armature shall be drawn forward and be held in its position adjacent to the electro-magnet. In like manner the successive lamps in each group are brought in circuit and replaced as their filaments are successively consumed.

It will be understood that this invention is especially adapted to be employed in connection with electric lights which are run at such high temperature that they have but a short life, for by means of it as many lamps may be grouped together as are required for maintaining a constant light for any desired time. One advantage of considering the filament as combustible and running it so as to give a light of high candle-power is that after a carbon filament reaches a moderate degree of incandescence a given increase of light is obtained with less than a corresponding increase of current. The electro-motive force required is also correspondingly decreased on account of the decrease of resistance, and a consequent economy of working-force results; or, in other words, there exists an economy in the use of energy, so far as the current is concerned, when the lamps are run at a very high temperature, although the life of the lamp is necessarily shortened thereby. In practice, however, I find that to produce a given amount of light there is greater economy in running the lamps at such a high temperature as to consume them in a comparatively short time than to run them at a low temperature, and thereby increase the electro-motive force which is required to obtain a given amount of candle-power.

The invention also involves certain minor

features, which will be hereinafter fully described in connection with the drawings.

In the drawings, Figure 1 is an elevation, partly in section, of a group of lights and the circuit-controlling devices; and Fig. 2 is a diagram illustrating the organization of the circuits. Fig. 3 is a front elevation, partly in section, of a fixture for supporting the lamps.

Referring to the drawings, A represents a suitable inclosing and supporting case for the circuit-controlling mechanism, and the lamps themselves are represented at B', B², and B³. They are supported in any suitable manner upon suitable sockets, C', C², and C³, which extend from the lower portion, d', of the frame A. A main-line conductor, 1, leads to lamp B'. A conductor, 2, leads from this lamp to the outgoing conductor 3. With conductor 2 there are also connected conductors 4 and 5, which respectively lead from the lamps B² and B³. The conductors 6 and 7, leading to the lamps B² and B³, respectively, extend from two contact-points, d' and d'', which are respectively connected through the coils of two electro-magnets, D' and D². Normally the conductors 6 and 7 are not placed in circuit with the main line, for the reason that the contact-points e' and e'', which are respectively applied thereto, and which are carried upon the armature-levers E' and E² of the electro-magnets, are not in contact with the corresponding points, d' and d''. When, however, either of the electro-magnets becomes vitalized, the corresponding armature, E, is drawn forward, and the contact-point e' or e'' places the conductor 6 or 7 in circuit through the corresponding armature-lever. For this purpose the armature-lever E' is connected through a conductor, 8, with the conductor 1, leading to the lamp B', and the armature-lever E² is in like manner connected through a conductor, 9, with the conductor 6, leading to the lamp B². Normally, therefore, the current enters through the conductor 1, traversing the filament b' of lamp B', and passing then through the conductor 2 directly to the outgoing conductor 3. When, however, the filament b' has become so far consumed as to render the lamp useless, it is necessary that some means be provided for substituting the second lamp, B². To do this it is necessary only to vitalize the electro-magnet D'. For this purpose a shunt-conductor, 10, extends from the conductor 8 to one terminal of a second coil, which is applied to the electro-magnet D'. A conductor, 11, leads from the remaining terminal of this second coil to the outgoing conductor 3. When, therefore, the filament b', by reason of its consumption, offers an abnormally great resistance to the current, a sufficient portion of the current will be forced to traverse the conductors 10 and 11 to vitalize the electro-magnet D', and thus place the contact-point e' in connection with the point d'. The main-line connections will then be completed through the conductors 1 and 8, including the coils of the electro-

magnet D', to the conductor 6, and thus through the filament b² of the lamp B², thence through the conductor 4 to the outgoing conductor 3. The second lamp will thus be placed in circuit, and its connections will remain complete by reason of the current traversing the coils of the electro-magnet D'. The current which thus traverses the second coil of the electro-magnet by way of the points d and e serves to hold the armature securely in position, thus maintaining the contact secure.

For the purpose of insuring that the armatures E may not fall away from their electro-magnets by reason of any temporary interruption of the main-line connections, a hook or catch, y, is preferably applied to each in such manner that it will engage the corresponding armature-lever and hold it in its position adjacent to the magnet when it has been vitalized. When a burned lamp is replaced by a fresh one, it is necessary to withdraw the hook y from the corresponding armature-lever, and allow it to fall away from its magnet. In order to do this conveniently, a door or slide may be placed in the top or side of the case A.

For the purpose of placing a third lamp in series in the same manner when the second lamp B² has become exhausted, a conductor, 12, leads from the conductor 9 to the second coil, which is applied to the electro-magnet D², and a conductor, 13, leads from the remaining terminal of this coil to the conductor 3. The operation of cutting out the lamp B² and substituting the lamp B³ is precisely similar to that just described in connection with the lamp B'. When the lamp B² has become exhausted, a succeeding lamp, providing more than three lamps are contained in the group, is in like manner placed in circuit, or if the lamp B³ is the last in the group, then the connections of the main line are established independently of the lamps in the following manner:

A third electro-magnet, D³, which is similar in construction to the magnets D' and D², has one of its coils included in the conductor 16, leading from the contact-point d³ to the conductor 3. The contact-point e³ of this electro-magnet is connected, by means of a conductor, 17, with the conductor 7, leading to the lamp B³. A shunt conductor, 14, leads to the second coil of the electro-magnet D³, and the conductor 15 leads from the remaining terminal of this coil to the outgoing conductor 3. This conductor, like the corresponding conductors described with reference to the magnets D' and D², normally offers sufficient resistance to the current to prevent a sufficient amount of the current to magnetize the electro-magnet from traversing its coils. When, however, the filament b³ offers an abnormally great resistance to the current, the magnet B³ becomes vitalized by reason of the current caused to traverse the conductors 14 and 15. The connections of the shunt-circuit 17 and 16 are thus completed and the lamp B³ is cut out of

circuit. The main-line connections are thus complete directly from the conductor 2 through the electro-magnets to the conductor 3.

If it is so desired, an artificial resistance may be placed in the conductor 14, for the purpose of rendering the total resistance of the main line uniform, whether one of the lamps B is in operation or the entire number is cut out.

For the purpose of rendering the contacts established by the means of the levers E as perfect as possible, I prefer to construct the points *d* in the form of metallic brushes which project downward toward the corresponding points, *e*, and these last-named points are elongated so that when the armature lever is actuated they will be forced a considerable distance into the contact-brush, thus forming a reliable electrical connection.

The lamps B are, for convenience, inclosed within a suitable globe or shield, F, of transparent or semi-transparent material. The under surface of the plate *d'* of the frame A may, if desired, be coated with a reflecting material for the purpose of deriving from the lights as great an effect as possible.

In Fig. 3 I have illustrated mechanism whereby the lamps may be conveniently supported in a frame, H, upon a pillar, G, for the purpose of street illumination, for example.

When it is desired to remove the case A for the purpose of substituting new lamps for the lamps B, which have become exhausted, it is desirable that the connections of the main line should be maintained complete. For this purpose the case A is provided with supporting-rings *k'* and *k''*, to which the conductors 1 and 3 are respectively attached. Suitable hooks, *m'* and *m''*, are supported from the top of the frame H for the purpose of receiving the rings *k'* and *k''*. The hooks *m'* and *m''* are respectively connected with the incoming and outgoing portions of the main line *L'* and *L''*, respectively. A contact-brush, *n'*, which is similar to the contacts *d*, is also connected with the outgoing main line *L''*, and a point, *n''*, which is similar to the points *e*, is connected with the portion *L'* of the main line. The point *n''* is carried upon an arm, *n'''*, which is attached to the hook *m'*. This hook is carried upon a rod, *p'*, extending through a spiral spring, *r*, which is secured to a head, *r'*, placed above the spring. So long as no weight is applied to the hook the spring *r* holds the point *n''* in contact with the point *n'*, and the main-line connections are completed. When, however, the frame A is suspended upon the hooks, the point *n''* is drawn downward by reason of the resilience of the spring *r*, and the main-line connections are interrupted; but they are completed through the lamp by reason of the contact of the hooks *h* with the rings *k*.

For the purpose of conveniently shunting the current from the conductor 1 to the conductor 3 around the electro-magnet D, when it is so desired, a switch, W, is employed. The switch is electrically connected with the

conductor 1, while its contact-point *w'* is connected with the conductor 3.

For convenience in indicating which of the lamps have been burned, so that the inspector may know the condition of any of the groups, even while the current is not upon the line, I propose to employ an indicating device, such as illustrated in Figs. 1 and 3. This device consists merely of a series of drops, *t'*, *t''*, and *t'''*, which normally stand in front of corresponding apertures formed in the case A. When, however, any armature E is actuated, the corresponding drop is released and falls from before the aperture, thus hiding it from view. The drops will, therefore, remain in their concealed position until they are replaced by the inspector after having replaced the exhausted lamps by new ones. Any suitable form of catch may be employed for normally holding the drops *t* in place and for releasing them when the corresponding armature-lever is drawn toward its electro-magnet.

I do not confine myself to the use of one lamp in each group at the same time, as the lamps in each group may be easily arranged so as to be run in pairs or otherwise.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, substantially as hereinafore set forth, with a group of incandescent electric lamps, of an electric conductor normally connected through one of said lamps, normally-interrupted branch circuits in which the remaining lamps of said group are respectively included, a shunt-circuit around each of said lamps, and an electro-magnet included in each of said shunt-circuits, and a circuit-closing device, under the control of each of said electro-magnets, which serves to complete the connections of said main-line conductor through a succeeding lamp in said group when a preceding lamp becomes inoperative.

2. The combination, substantially as hereinafore set forth, with a group of incandescent electric lamps and a main-line conductor normally connected through the first lamp of said group, of normally-interrupted branch conductors, respectively including the remaining lamps in said group, a shunt-circuit around each of said lamps, an electro-magnet included in each of said shunt-circuits, each of which electro-magnets becomes vitalized when the lamp to which it is applied becomes inoperative, a circuit-controlling device controlled by each of said electro-magnets, which device serves to complete the main-line connections through the branch conductor, including the succeeding lamp of the group when said electro-magnet is vitalized, and a second magnetizing-coil applied to each of said electro-magnets and included in the corresponding branch conductor, whereby the vitalization of said electro-magnet is maintained when once established.

3. The combination, substantially as hereinafore set forth, with a group of incandes-

cent electric lamps and a main-line conductor for supplying electricity thereto, of normally-interrupted branch conductors in which said lamps are respectively included, a circuit-controlling device included in each of said branch conductors, a shunt-circuit around each of said lamps, and an electro-magnet included in each of said shunt-circuits, which electro-magnet serves, when vitalized, to complete the circuit-connections of the main line through a succeeding lamp in said group, substantially as described.

4. The combination, substantially as hereinbefore set forth, with a series of incandescent electric lamps, and a magnet and switch mechanism for substituting for each lamp as it becomes exhausted a succeeding lamp, of an automatically-operated indicating device, whereby the number of lamps which have become exhausted is indicated.

5. The combination, substantially as hereinbefore set forth, with a group of incandescent electric lamps, of an electric conductor normally connected through one of said lamps, normally-interrupted branch circuits in which the remaining lamps of said group are respectively included, a shunt-circuit around each of said lamps, and an electro-magnet included in each of said shunt-circuits, and a circuit-closing device, under the control of each of said electro-magnets, which serves to complete the connections of the said main-line conductor through a succeeding lamp in said group when the difference of potential at the terminals of the preceding lamp exceeds a predetermined amount.

WILLIAM STANLEY, JR.

Witnesses:

S. HOWARD SPRAGUE,
JNO. F. WILCOX.