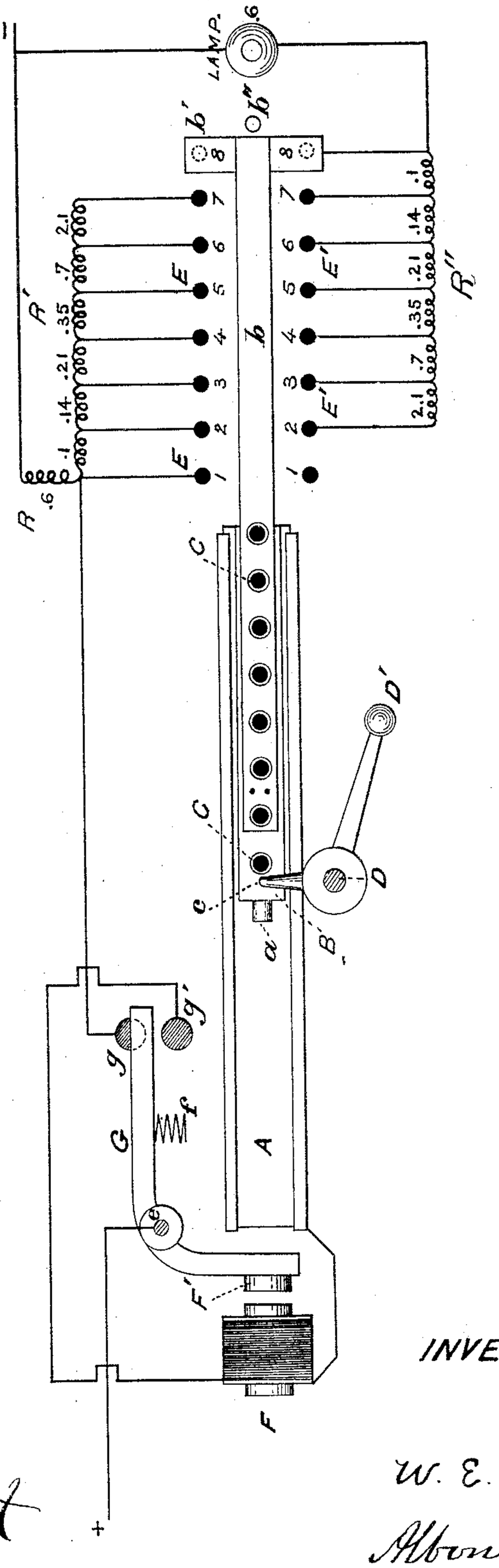
W. E. SAWYER & A. MAN.

Switch for Electric-Light.

No. 210,152. Patented Nov. 19, 1878.

FIG. 1.



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IMPROVEMENT IN SWITCHES FOR ELECTRIC LIGHTS.

Specification forming part of Letters Patent No. **210,152,** dated November 19, 1878; application filed October 15, 1878.

To all whom it may concern:

Be it known that we, WILLIAM EDWARD SAWYER, of the city, county, and State of New York, and ALBON MAN, of the city of Brooklyn, in the county of Kings and State aforesaid, have jointly invented certain new and useful Improvements in Electrical Lighting Apparatus and Circuits; and we do hereby declare the following to be a description of the same, and of the manner and process of making, constructing, and using them, in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, and use the same, reference being had to the accompanying drawings, making part of this specification, and to certain Letters Patent of the United States heretofore granted to us for certain inventions hereunto appertaining, and to which especial reference will hereinafter be made.

In Letters Patent of the United States No. 205,303 we have shown and described an electric-lamp-lighting switch, which not only turns the current on to and off from the lamp gradually, but admits of regulating the light proceeding from the lamp to any desired intensity; and in the same Letters Patent we have described a distributing system, by means of which the current from a single generator may be divided among any number of lamps.

Our present invention comprises a new lamp-lighting switch, which not only accomplishes the purpose of the switch above referred to, but is provided also with a safety device, the nature of which will be explained in detail hereinafter.

In the drawing accompanying and forming a part of this specification, Figure 1 illustrates our electric-lamp-lighting switch.

Reference being had to Fig. 1, it consists of a suitable metallic holder, A, grooved so as to keep a sliding piece, B, in place. To the sliding piece B is fixed a flat spring, *b*, carrying at one end a cross-piece, *b'*, which, as the slide is moved, makes contact with the sixteen pins, E E and E' E', arranged eight on each side of the spring.

The movement of the slide B backward and forward is accomplished by turning the crank D and D', which works upon the stud *d*. At each revolution of the crank the pin *c*, fixed in the hub of the crank, engages with a tooth, C, and moves the slide forward one tooth, until it has acted upon the last tooth, when farther movement is prevented by the contact of the cross-piece *b'* with the stop-pin *b''*. Turning the crank in the opposite direction in like manner moves the slide backward until its movement is arrested by the contact of the pin *a* with the armature-lever G.

In lighting a lamp such as that shown and described in Letters Patent No. 205,144, granted to us as aforesaid, we have found it important to turn on the current gradually, otherwise fractures of the carbon may ensue. It is possible that at times, when the current is fully turned on the lamp, there may occur an interruption in the supply; extinguishment of the light follows, and the carbon grows cool. Suppose, now, that the circuit of the lamp not having been destroyed, but being set for the full force of the current, the supply is suddenly renewed; instantly the carbon is heated from a low to an extremely high temperature, and its fracture may be expected. The electro-magnet F attached to the switch effectually guards against this danger. Unless the current is circulating in its coils the lamp cannot be lighted; and if there is an interruption in the supply the current cannot circulate in its coils, although the supply may be renewed, until the lamp shall first have been taken out of the circuit.

The armature F' is fixed to the bent lever G, pivoted at *e*, one extremity of which plays between the studs *g* and *g'*, according as the magnet is or is not actuated by the current. The spring *f* acts to force the armature away from the magnet, and establish a connection between the lever G and stud *g*.

The current from the + side of the generator enters the lever G, and, when the circuit is in its normal condition, passes by way of the stud *g'* through the coils of magnet F to the holder A; then, by way of slide B, spring *b*, cross-piece *b'*, and the eight pins E', to the lamp, and outward at the — point. A sudden interruption occurs. Instantly the armature is

forced away from the magnet by the spring *f*, and contact of the lever G with the stud *g* is established.

The lamp is now entirely out of the circuit, and the current flows solely from the lever through stud *g* and resistance R outward at the — point. It is in this position we have shown the switch; nor can the lamp ever be relighted unless the slide B be moved back until the cross-piece *b'* makes connection with 1' E, when the pin *a* strikes the lever G and forces the armature within the grasp of the magnet, at the same time establishing a connection between G and *g'*. Then, if there be a supply of current, the lamp may be lighted by moving the slide B forward; but if there be no supply, moving the slide forward will simply release the armature, and the lever G will again move to the stud *g*. By this device even carelessness is rendered harmless, and, inasmuch as seven turns of the crank are required to fully light the lamp, the current is not likely ever to be turned on very rapidly.

We have found that the internal resistance of a lamp such as that of Letters Patent No. 205,144 is not far from six-tenths of an ohm.

It is clearly important, to the end that other lamps in the circuit may not be affected, that the resistance of the circuit from the + to the — points shall be constant, whether the lamp be in or out of the circuit, or whether it be lighted feebly or at its full head. Therefore, when the lamp is out of the circuit—*i. e.*, the cross-piece *b'* resting upon the pins 1 1—the current flows by way of pin 1 E through the .6 ohm resistance R and outward at the — point. Thus when the lamp is entirely cut out the resistance of the circuit is precisely the same as when the lamp is fully lighted. The pins 1 E' and 8 E serve no useful purpose other than to keep the cross-piece *b'* in position.

Assuming, now, that it is desired to light the lamp, the current is let on by sevenths; but any other small fraction may be substituted. A single turn of the crank advances the cross-piece *b'* upon the two pins 2 2. The current divides, six-sevenths of it passing through resistance R^1, of .1 ohm, and resistance R, of .6 ohm, outward at the — point, the other seventh passing through the several resistance R^2, amounting altogether to 3.6 ohms, and through the lamp of .6 ohm outward at the — point. The resistance of the first circuit, which we will call the "shunt," is therefore .7 ohm, and that of the lamp is 4.2 ohms, making the resistance from the + point to the — points .6 ohm.

At the next turn of the crank the cross-piece *b'* bears upon pins 3 3, and the resistance is as follows: In the shunt-circuit .84 ohm, in the lamp-circuit 2.1=.6 ohm.

Upon pins 4 4 the resistance is in the shunt-circuit 1.05, in the lamp-circuit 1.4=.6 ohm. Upon pins 5 5 the resistance is in the shunt-circuit 1.4, in the lamp-circuit 1.05=.6 ohm. Upon pins 6 6 the resistance is in the shunt-circuit 2.1, in the lamp-circuit .84=.6 ohm. Upon pins 7 7 the resistance is in the shunt-circuit 4.2, in the lamp-circuit .7=.6 ohm. Upon pins 8 8 the current no longer flows through the shunt-circuit, but is solely through the lamp, the resistance of which is .6 ohm.

By what we have written it will be seen that we not only succeed in gradually lighting the lamp to any desired degree of intensity within the scope of the current of electricity, but maintain an absolutely constant resistance in the circuit, whereby other lamps in the circuit or in other circuits are absolutely unaffected.

In the Letters Patent granted to us hereinbefore referred to we have fully set forth and claimed these important features; but we consider the switch above described an improvement upon the methods set forth in said Letters Patent, though we do not intend to limit our patent of which this is the specification to any particular form of apparatus or special application of the invention, but intend to claim all forms and applications of the invention that fall within the substance of its scope.

For distributing the current from a single generator to two or more electric lamps, engines, or other apparatus, we have recourse to a commutator in connection with the generator, which, when these are two circuits from the generator, transmits the electric impulses alternately into each, and, when there are more than two circuits, transmits these impulses *seriatim* into the several circuits.

This commutator and system of distribution we intend to make the subject-matter of a separate patent.

Having thus fully described our invention, we claim and desire to secure by Letters Patent—

1. The combination, with an electric-lamp-lighting switch, of an apparatus which operates to prevent the completion of the lamp-circuit when there is no current to energize the lamp.

2. The combination, with an electric-lamp-lighting switch, of an apparatus energized by the current which actuates the lamp, and that operates when there is an interruption in the flow of the current to close the circuit of the lamp against a sudden recurrence of such flow.

3. The combination, with an electric lamp and a lamp-lighting switch, of two electrical circuits connected therewith, the switch operating to reduce the resistance of one circuit and increase the resistance of the other in such manner that at each reduction in the resistance of one circuit there will be an increase in the resistance of the other.

4. The combination of an electric lamp and a lamp-lighting switch of electrical circuits, so arranged that as the resistance in the circuit of the lamp is lessened, and consequently more current caused to flow through the lamp,

the resistance of an extraneous channel or channels is increased, each reduction in the resistance of the lamp-circuit being accompanied by such increase in the resistance of the extraneous channel or channels that the resistance of the main or branch circuit, which contains the circuit of the lamp and the extraneous channel or channels, is maintained constant, or nearly so.

5. An electric-lamp-lighting switch or apparatus which, after an interruption in the flow of current, operates to prevent the lighting of the lamp until it shall have first been brought into the position which it occupies when the lamp is not lighted.

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Witnesses:
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