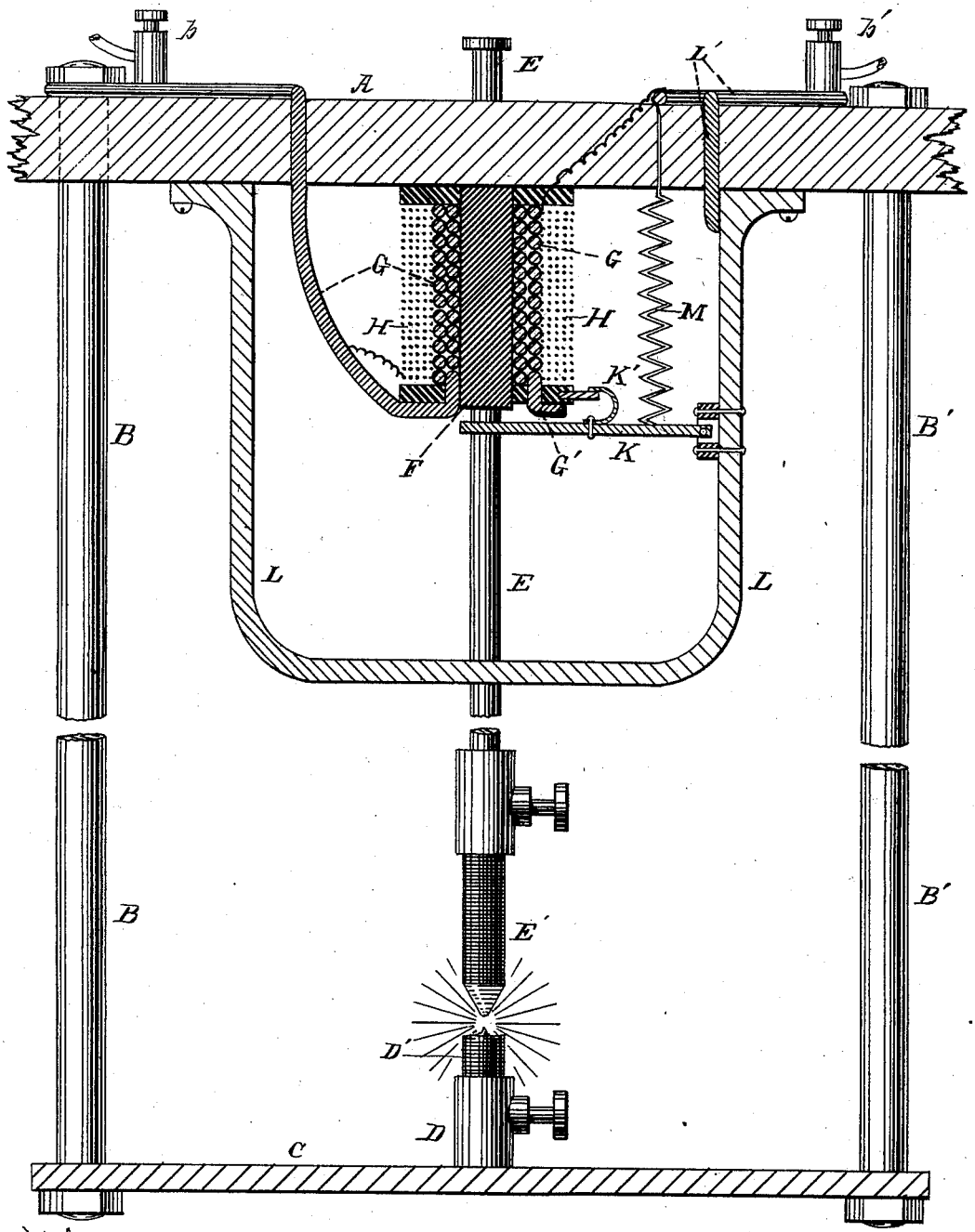
C. F. BRUSH.

Electric-Lighting Device.

No. 219,211. Patented Sept. 2, 1879.



Witnesses.

Frank M. Jabs.

W. E. Donnelly

Inventor.

Charles F. Brush.

By Leggett & Leggett.

Attorneys

UNITED STATES PATENT OFFICE.

CHARLES F. BRUSH, OF CLEVELAND, OHIO.

IMPROVEMENT IN ELECTRIC LIGHTING DEVICES.

Specification forming part of Letters Patent No. **219,211**, dated September 2, 1879; application filed July 3, 1879.

To all whom it may concern:

Be it known that I, CHARLES F. BRUSH, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electric Lighting Devices; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawing, which forms part of this specification.

My invention relates to electric lamps or light-regulators; and it consists in the combination, with the mechanism operating the carbons of the arc type of said lamps, of an automatic shunt or cut-off and a resistance, so constructed, combined, and electrically connected that if for any reason the said shunt or cut-off shall have operated to extinguish the lamp when it was in a normally operative condition the light shall be automatically re-established upon a reunion of the electrodes—as, for instance, if carbon a stick should break, and thus destroy the arc. In such a case, the resistance in the lamp being infinite, the cut-off would operate to shunt said lamp out of the circuit by establishing a path of low resistance for the current outside of the electrodes and the mechanism operating them. But whenever for any such accidental cause the cut-off mechanism is called into action it is not desirable that the lamp should be permanently extinguished, for the reason that the lamp proper is not at fault, and is still in a perfectly operative condition.

My design therefore is that upon a reunion of the electrodes the cut-off or shunting mechanism shall cease to operate, and that the current shall be properly re-established in the lamp and its light continued.

I will now describe a form of device by which the functions above alluded to may be automatically performed.

In the drawing is represented, in longitudinal vertical section, one form of device according to my invention.

A is a bar or slab, of wood or any suitable electro-non-conducting substance. B is an iron rod attached at its upper end to the slab A and at its lower end to an iron cross-piece, C.

B′ is another rod, of any material, mechanically connecting the parts A C. D is a holder for a carbon, D′. The parts B C D D′ are electrically connected with each other.

E is a vertically-sliding rod or tube of brass or other suitable electro-conducting material, ending below in a holder for retaining a carbon, E′.

The separation of the electrodes D′ E′ is accomplished by moving the rod E. Instead of here specifying how movement is imparted to this rod, I will refer to United States Letters Patent No. 203,411, granted to me May 7, 1878, and reissued May 20, 1879, No. 8,718. In these will be found fully described a very effective form of mechanism for the purpose of moving the rod E.

But I desire it to be distinctly understood that in my present invention I do not in any degree limit myself either to the carbon-separating mechanism shown in the patents above named or to any other definite means for separating the electrodes or governing them in their relations to each other.

My invention is equally applicable to all forms of arc-lamps—*i. e.*, lamps wherein light is obtained by the passage of the electric current through separated electrodes.

F is an electro-magnet core of soft iron. It is surrounded by two helices, G H, and is attached to the slab A. The helix G is of coarse wire and of correspondingly low resistance. The helix H is of fine wire, and it offers a high resistance to the current. This helix H is always in closed circuit with the current operating the lamp, so that said current divides itself between the helix H and the lamp's electrodes in proportion to the relative resistances offered in these two paths in manner and effect hereinafter more fully to appear.

The coarse-wire helix G connects with the pole *b* at one end, and, after describing a sufficient number of convolutions about the core F, terminates blindly, as shown at G′, thus forming no part of a closed circuit, while the armature K is separated from it, as shown in the drawing.

The armature K, while being insulated from the lamp-frame L, is pivotally attached thereto. Its drop and consequent distance in separation from the core F is determined by any suitable adjustable stop K′. As the armature K is held closer to or farther from the core F a

proportionately weaker or stronger current through the fine-wire helix H will be required to lift said armature into contact with the end G′ of the coarse-wire helix G.

M is a resistance electrically connecting the armature K and the pole *b′* of the lamp.

The lamp-casing L is electrically connected with the rod E, and also, through the wire L′, with the pole *b′*.

Having now specified one of a variety of means for carrying out my invention, I will describe the operation of the same.

While the lamp is in normal operation the various parts are in substantially the relation shown in the drawing, and the current is, say, from the pole *b′*, through the wire L′, frame L, and rod E, to the carbon E′; thence, through the carbon D′, its holder D, the cross-piece C, and rod B, to the opposite pole, *b*. Here is the path for the major portion of the current; but, as already said, there are two paths between which the current divides itself, according to their respective and relative resistances. One is that already traced out. The other is, say, from the pole *b′*, through the wire L′, fine-wire helix H, coarse wire G, to the opposite pole *b*. Now, when the resistance in the lamp proper is normal the armature K is in its open-circuit position—*i. e.*, dropped down and separated from the end G′ of the coarse-wire helix G; but if, for any reason, the resistance in the lamp (say, at the electric arc) is abnormally great, then the current will be greatly increased through the fine-wire helix H until the core becomes sufficiently magnetic to draw up its armature K into contact with the end G′ of the coarse-wire helix. As soon as this connection is made the electrodes are practically cut out of the circuit, for now the path of the current is from pole *b′*, through the wire L′, resistance M, armature K, and helix G, to the opposite pole *b*.

So long as the current takes this course the coarse-wire helix G forms a part of a closed circuit and strongly magnetizes the core F.

We now find the electrodes D′ E′ and the mechanism separating them released from the control of the operating current. Therefore the carbons, by force of gravity, will fall into contact into the position of closed circuit.

At this time, if the lamp is in a normally operative condition, it is desirable that the cut-off or shunting mechanism cease its operation, and that the current be again established through the electrodes, so as to produce the arc-light; and this will be accomplished, for, now, the carbons being united, they will offer a passage to the current having a resistance so much lower than offered by the resistance M that the current through the coarse-wire helix G will be so weakened that the core F will not be sufficiently magnetic to sustain its armature K, which will drop, and thus break the circuit at that point and re-establish the normal flow through the electrodes; but if the lamp is in such inoperative condition as to continue its abnormal resistance to the passage of the current, then the armature K will not be released, but will be maintained in its closed-circuit position, and the lamp will be permanently extinguished.

It will thus be seen that any accidental or immaterial cause, while it may call into action for a time the shunting mechanism, will not result in the continued extinguishment of the lamp.

The great utility of this automatic shunt will easily be recognized when it is employed with lamps several of which are burning in a single circuit, for in such a case the putting out of one lamp would extinguish all the rest, unless the current be provided a passage, as it were, around and outside of the faulty lamp.

I have found by repeated experiment and practical use in a system according to my invention, where a number of lights are burning in a single circuit, that the extinguishment and relighting of any lamp, as heretofore specified, is certainly effected, and without any interruption of the remaining lights on the circuit, the only influence being an augmentation of the arc proportionate to the small increase of current passing through said remaining lamps.

I do not limit myself to any definite number, arrangement, or construction of parts in any device for carrying out my invention. The form shown in the drawing is merely given to exhibit one embodiment of said invention and to assist in explaining the same.

Any form or construction of mechanism may be adopted which shall operate, first, to automatically shunt the current from a lamp when for any cause it shall offer an abnormally great resistance to the passage of the current; and, second, to continue to afford a free passage to the current independent of said lamp so long as said abnormal resistance in the lamp shall exist; and, third, to re-establish the normal operation of the extinguished lamp upon a reunion of its electrodes.

I do not here claim a device performing merely as pointed out in the first and second features just above specified, as such an invention is shown and broadly claimed by me in a prior application. It is the third function above-named that particularly constitutes the essence of my present invention.

What I claim is—

1. The resistance M, or its equivalent, in combination with any contrivance adapted to shunt the current from an electric lamp when for any reason said lamp shall offer an abnormally great resistance to the passage of the current operating it, substantially as and for the purpose shown.

2. The combination, with the electrodes D′ E′ of an electric lamp and the mechanism separating and governing said electrodes, of a suitable shunt or cut-off and a resistance, M, or its equivalent, said shunt or cut-off adapted automatically to afford a sufficiently free pas-

sage for the current independent of the lamp when from any cause said lamp shall offer an abnormally great resistance to the passage of said current, and said resistance adapted, on the union of said electrodes, to weaken or break the circuit through said shunt, and thus to re-establish the normal flow of current through the electrodes and reproduce the electric light, substantially as shown.

3. In combination with the carbons of an electric lamp and the mechanism operating them, an automatic shunt or cut-off device constructed to offer a resistance greater than the resistance offered by the said carbons when in contact, said shunt or cut-off constructed, first, to be called into operation to extinguish said lamp whenever from any cause it (the said lamp) shall offer an abnormally great resistance to the passage of the electric current, and, second, to be automatically relieved from said operation upon a reunion of the extinguished electrodes by reason of said electrodes offering a path to the current of a lower resistance than the resistance offered by said shunt or cut-off device, substantially as and for the purposes shown.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES F. BRUSH.

Witnesses:

LEVERETT L. LEGGETT,

JNO. CROWELL, Jr.