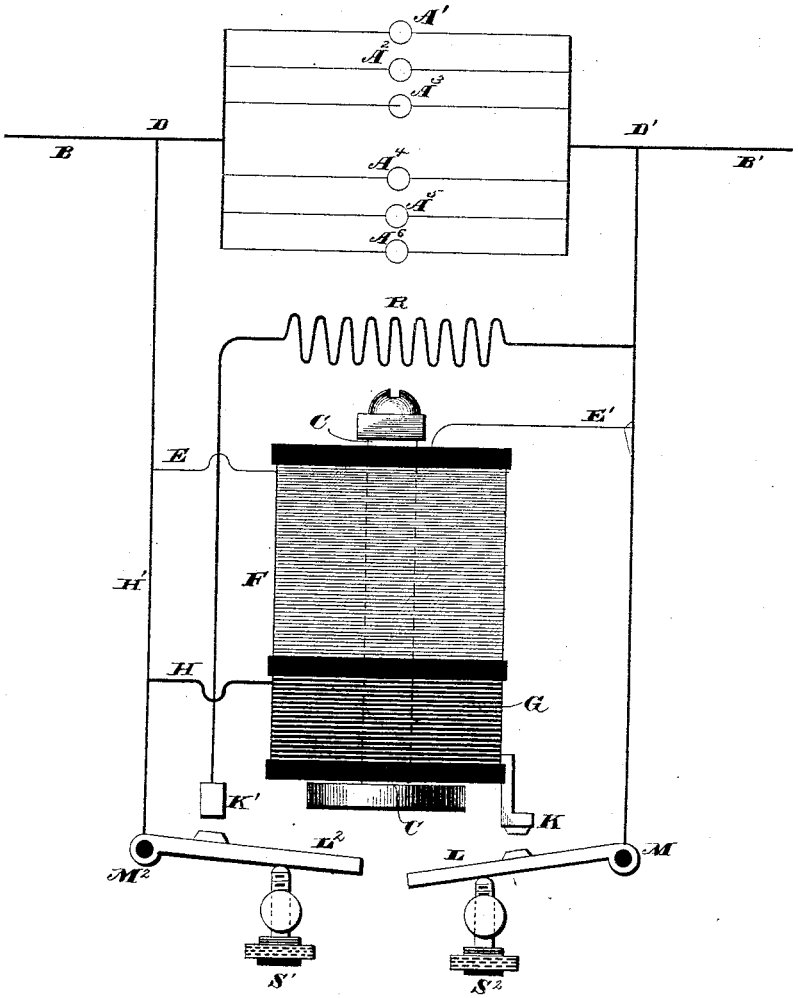
(No Model.)

C. F. BRUSH.

MULTIPLE SERIES CUT-OUT.

No. 347,025. Patented Aug. 10, 1886.



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MULTIPLE-SERIES CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 347,025, dated August 10, 1886.

Application filed December 19, 1885. Serial No. 186,187. (No model.)

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 Multiple-Series Cut-Outs; 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 appertains to make and use the same.

My invention relates to improvements in automatic cut-outs or shunting devices for multiple-series systems of electrical distribution, and more particularly to that one in which, in combination with each of the groups of electro-receptive devices arranged in multiple series is employed a shunting device for automatically reducing the normal flow of current through the remaining electro-receptive devices of a group upon the failure of one or more of them to operate. The objection to this system is, that it does not provide a complete and safe short circuit for the main current, should all the electro-receptive devices be inoperative, or such a number of them as would result in the destruction of the remaining ones or of the apparatus.

My invention overcomes this difficulty by means of mechanism similar to that shown in the accompanying drawing, which embodies one form of such mechanism and illustrates diagrammatically my invention as applied to one of a series of groups of electro-receptive devices.

In the drawing, A' A^2 A^3 A^4 A^5 A^6 represent the group of electro-receptive devices, which may be, and for the purpose of this illustration I will assume to be, incandescent lamps, each located in a branch circuit from the main conductor B B'.

C is an electro-magnet wound with two coils. One of these, F, is of high resistance and forms a constantly-closed shunt-circuit, D E E' D', around the group of lamps A' A^2, &c. The other coil, G, is of coarse wire, and has one of its terminals attached at H to a wire, H', leading to D on one side of the group of lamps, the other terminal forming the contact K. An armature-lever, L, is pivoted at M in electrical contact with the wire M D'. When the armature is sufficiently attracted by the magnet, it rises and strikes the contact K.

A second armature, L^2, also in the field of attraction of the magnet, is pivoted at M^2 in electrical contact with the wire M^2 H' D. When this armature is sufficiently attracted by the magnet, it rises and strikes the contact K', closing the shunt-circuit D H' M^2 L^2 K' R D' around the group of lamps. In this shunt-circuit is located the resistance R, which has a somewhat higher conductivity than the working conductivity of any one of the lamps. Set-screws S' S^2 serve to regulate the distance of the armatures from the magnet.

The armatures having been suitably adjusted, and so that L requires a greater attractive force to raise it than L^2, the operation of the device is as follows: With all the lamps A' A^2, &c., in operative condition, the normal current in the line B B' will divide itself between the lamps, except a small percentage which will pass around the group by the shunt-circuit, comprising the fine-wire coil F. This percentage of current magnetizes the core of the electro-magnet, but not sufficiently to raise the armature L^2, owing to the distance at which it is adjusted. Now, if one (or any predetermined number) of the lamps fail to operate, and if, as is presupposed, the current in the main circuit remains constant, the difference of potential at the terminals of the fine-wire coil will increase, magnetizing the core more strongly, and raising the armature L^2 until it strikes the contact K' and closes the shunt-circuit which includes the resistance-lamps, but not dimming them entirely. The effect of throwing in the resistance R parallel with the lamps and fine coil will be to reduce somewhat the difference of potential at the terminals of the fine coil, which would consequently reduce the strength of the magnet; but as the armature L^2 has advanced so much farther into the field of attraction it is still held up in contact with K'. Now, if the defective lamp or lamps be replaced and the shunt-circuit including the resistance R be opened by pulling down the armature L^2, the normal current will flow through the lamps and fine coil, as before; but if the defective lamp or lamps be not replaced, and if others of the group should by inadvertence or malice be allowed to become successively inoperative, it is evident that an increasing current will be forced through the fine coil F, the resistance

R, and such lamps as may remain operative, or if there be no lamps left in operation all the current will be forced through the fine-coil circuit and the resistance-circuit, in either case to the possible and probable injury of the apparatus. Similar difficulty will occur if when the main current is started there should be few or no lamps on any group. Now, the function of the second armature becomes apparent, for with the increased current flowing through the fine coil F, due to the causes I have just indicated, an increased strength of magnetism will result, raising the armature L, which will strike the contact K and close what is practically a short circuit around the group of lamps and around the resistance R and fine coil F, the course of the current in the short circuit being as follows: D H′ H, through the coarse coil G to terminal K, then through lever L and wire M D′.

The effect of making the coarse coil G a portion of the short circuit is to retain the armature L in contact with K, notwithstanding that the magnetizing effect of the fine coil F is practically destroyed by the great decrease in difference of potential at its terminals. This form of short-circuiting magnet has been previously patented to me, (Patent No. 234,456,) and such especial construction does not form part of my present invention; nor do I limit myself to the particular construction or arrangement of parts shown in the drawings, as various modifications will readily suggest themselves, and any form of automatic shunting device may be used.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a multiple-series system of electrical distribution, in combination with a group of electro-receptive devices and mechanism operated by the current for automatically reducing the normal flow of current through the remaining electro-receptive devices upon the failure of one or any predetermined number of them to operate, mechanism, also controlled by the current, to automatically short-circuit the current around said group upon the inoperation from any cause of more than said predetermined number of electro-receptive devices, substantially as set forth.

2. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of a normally-open shunt-circuit having a resistance less than any one or of any predetermined number of the electro-receptive devices of the group, and mechanism actuated by the current for automatically closing said shunt-circuit and diverting a sufficient amount of current through the same to reduce the normal flow of current through the remaining electro-receptive devices of the group upon the failure of any one or any predetermined number of them to operate, and a supplemental normally-open shunt-circuit of comparatively low resistance, and mechanism actuated by the current for automatically shunting the current around the group and high-resistance shunt whenever the latter is incapable of shunting a sufficient amount of current around the group to preserve intact the remaining operative electro-receptive devices included therein, substantially as set forth.

3. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of a constantly-closed shunt having an electro-magnet included therein and two normally-open shunt-circuits of different resistances, the circuit of lowest resistance being included in the helix of an electro-magnet, and devices actuated and controlled by the current for closing the circuit of high resistance and reducing the normal flow of current through the remaining electro-receptive devices of the group upon the failure of one or of any one predetermined number to operate, and for closing the circuit of low resistance and short-circuiting the group, substantially as set forth.

4. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of a constantly-closed shunt-circuit of high resistance included in the helix of an electro-magnet, and a normally-open shunt of comparatively low resistance included in the helix of an electro-magnet, and an armature for opening and closing said shunt-circuit, substantially as set forth.

5. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of a constantly-closed shunt of high resistance and two normally-open shunt-circuits—one of comparatively high and one of comparatively low resistance—and an electro-magnet included in the constantly-closed shunt and the normally-open shunt of comparatively low resistance, substantially as set forth.

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

CHARLES F. BRUSH.

Witnesses:

ALBERT E. LYNCH,

L. B. LE VAKE.