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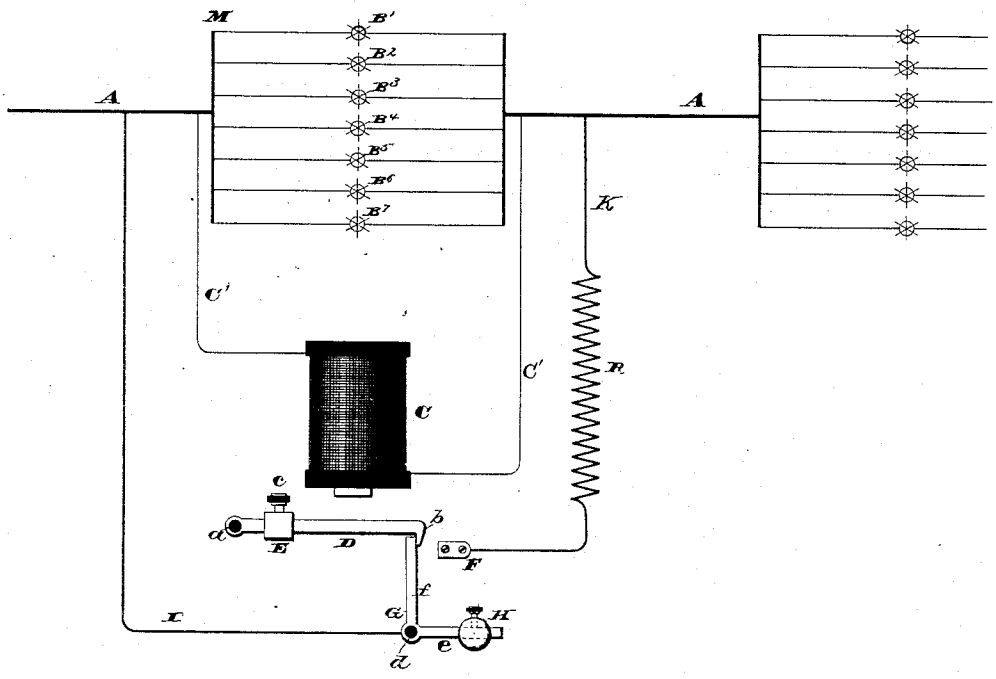
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MULTIPLE SERIES SYSTEM OF ELECTRICAL DISTRIBUTION.

No. 340,717. Patented Apr. 27, 1886.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

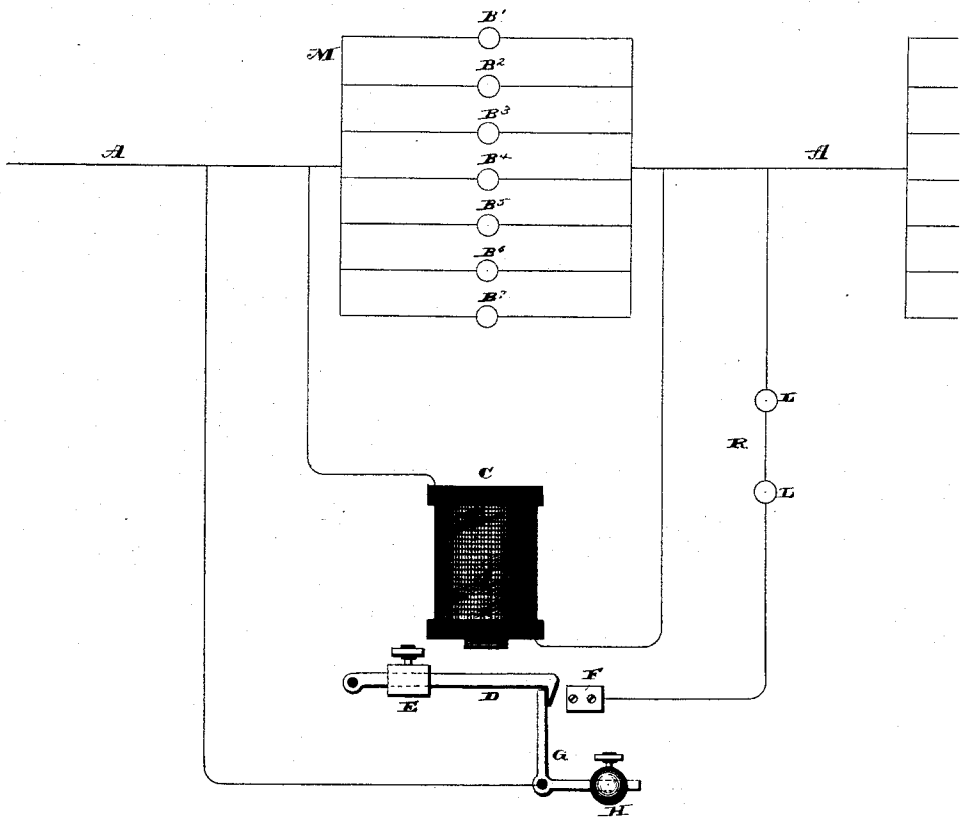
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Fig. 2.



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MULTIPLE-SERIES SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 340,717, dated April 27, 1886.

Application filed June 18, 1885. Serial No. 169,098. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR J. HOLT, of Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Multiple-Series Systems of Electrical Distribution; 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 an improvement in multiple-series systems of electrical distribution.

In a series of groups of electro-receptive devices the current (usually of a constant volume) in the main conductor will divide itself in definite proportions through each electro-receptive device of each group. With a constant volume of current in the main circuit of such a system, should any one or more of the electro-receptive devices of any particular group fail or become impaired from any cause, so that no current could flow through the branch or branches in which such device or devices are included, an abnormally large current will be forced through the remaining devices in such group, and if the electro-receptive devices consist of incandescent lamps this increase of current may, and often does, prove injurious and destructive of the remaining lamps of the group.

To prevent the destruction of the lamps of a group, it has been customary heretofore to provide each group of lamps or electro-receptive devices with an automatic cut-out or shunting mechanism which will operate, on the failure of any one or more of the lamps of the group, due to breakage of the lamps or burning out of the filaments therein, to short-circuit the entire group of lamps, and thereby cause the main current to pass through the short circuit and around the entire group until the defective lamps (one or more) have been replaced or removed. Such system has proved defective and objectionable, owing to the fact that one or more defective lamps in a group operates to short-circuit the entire group, and thus leave the consumer in darkness until the defective lamps have been renewed or replaced by new ones, unless light from some other source be furnished, and in that event it will often necessitate a careful examination of each lamp of the group in order to locate the defective one.

The object of my invention is to obviate the defects and objectionable features above noted, and to provide each group of lamps or electro-receptive devices in a multiple-series system with an automatic cut-out or shunting mechanism so constructed and arranged that upon the failure of any one or of any predetermined number of the lamps of a group a sufficient portion of the current will be diverted around the group to prevent the destruction of any of the lamps included therein, and yet cause such an amount of current to pass through the remaining lamps of the group as will preserve them in partial and visible operation, thus insuring a decreased supply of light to the consumer until the impaired or defective lamps have been renewed or replaced, and also enabling such defective lamp or lamps to be easily and readily detected.

With these ends in view my invention consists in the combination, with a group of electro-receptive devices in a multiple-series system, of an automatic cut-out or shunt mechanism so constructed and arranged that upon the failure of any one or any predetermined number of the electro-receptive devices of the group the cut-out or shunt will automatically throw in circuit, parallel with the remaining electro-receptive devices of the group, a shunt having a resistance less than the resistance of the electro-receptive devices (one or more) which have failed.

In the accompanying drawings, Figure 1 is a diagrammatic illustration of one embodiment of my invention, and Fig. 2 is a modification.

A is the main conductor, electrically connected with any suitable electric generator, and M is one of a series of groups of electro-receptive devices included in circuit therewith. The branches of the group M have included therein incandescent lamps or other electro-receptive devices $B' B^2 B^3$, &c.

C is an electro-magnet included in the constantly-closed shunt-circuit C', and whose coil forms a shunt of high resistance around group M. The armature D of the electro-magnet C

is pivoted at *a*, while its free end is constructed with a hook or catch, *b*. Upon the armature is placed a sliding weight, E, which may be adjusted toward or away from the free end of the armature, and secured at any point thereon by the set-screw *c*, and thus enable the armature to be adjusted so as to be operated by any predetermined strength of pull of the electro-magnet. A bell-crank lever, G, is pivoted at *d*, the horizontal arm *e* of which is provided with an adjustable weight, H, which tends to throw the vertical arm *f* in contact with the fixed stop or contact F. The end of the vertical arm *f* of the bell-crank is engaged by the hook or catch *b* on the armature and retained out of contact with the stop F. The bell-crank arm *f* is electrically connected with the conductor I, which is connected with the main conductor A at one side of the group M, while the fixed stop F is electrically connected with a conductor, K, the opposite end of which is connected with the main conductor on the other side of the group M. When the arm *f* of the bell-crank is in contact with the stop F, it completes a shunt-circuit, I K, around the group. In this shunt-circuit is included a resistance, R, which is of a less resistance than the working resistance of any one of the lamps in the group, but is of sufficiently high resistance to allow only a portion of the current to be diverted around the group through the shunt I K.

The operation is briefly as follows: As illustrated in the drawings, the arm *f* of the bell-crank lever is retained out of contact with the stop F by means of the engagement of the hook on the armature. In this adjustment of parts nearly all of the current will pass through the lamps $B' B^2 B^3$, &c., a very slight percentage thereof flowing through the high-resistance shunt including the electro-magnet C, but not an amount sufficient to cause the magnet to lift the armature D, the weight E being so adjusted as to prevent such action under the normal operation of the lamps in the group. Should one of the lamps break, the increased difference of potential (the current being presupposed constant) at the terminals of the group M will cause an increase of current to flow through circuit C′ and the coils of the magnet C, which will then, if the armature is properly adjusted, raise the armature and release the bell-crank lever, allowing the arm *f* to close the supplemental shunt-circuit I K, and thus cause a portion of the current from the main conductor to be diverted around the group M and through the shunt I K, and thereby relieve the remaining lamps of the group from any undue strain, and yet not dimming them entirely, but enough so that even if the attendant or consumer should fail to replace the defective lamp no harm would result, as the remaining lamps at the low temperature to which they would then be subjected by the current would not be injuriously affected. The remaining lamps will afford a certain amount of light, and the consumer or attendant is enabled to readily detect the defective lamp, as it will show no light at all. The defective lamp having been replaced by a good one, the bell-crank lever and armature are again set, as shown in the drawings, thereby opening the supplemental shunt-circuit, and diverting the current through all the lamps and restoring their brilliancy.

Resistance R in the supplemental shunt-circuit may be of any desired construction or character; but I prefer to use as such resistance one or more incandescent lamps, L, as illustrated in Fig. 2, and as the current flowing through such lamps will be always less than they are capable of withstanding they are practically indestructible.

While I have shown and described one form of automatic cut-out or shunting device, it is evident that many different forms and constructions of cut-out might be employed for effecting the desired result, and hence I would have it understood that I do not restrict myself to the particular construction and relative arrangement of parts shown and described; but.

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, the combination, with a group of electro-receptive devices and a shunt-circuit around said group, of another shunt-circuit having a resistance less than that of any one of the electro-receptive devices of the group and greater than the resistance of all of said electro-receptive devices, and an automatic cut-out or shunting device constructed and arranged so that upon the failure of any one or of any predetermined number of the electro-receptive devices of the group it will automatically throw in circuit, parallel with the remaining electro-receptive devices of the group, the shunt of the predetermined resistance, as specified, substantially as set forth.

2. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of a shunt of high resistance around the group having an electro-magnet included therein, and a supplemental shunt of less resistance than any one of the electro-receptive devices and of greater resistance than all of said electro-receptive devices, and containing a circuit-controlling device that is actuated by said electro-magnet, 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 of high resistance having an electro-magnet included therein, and a supplemental shunt around the group of electro-receptive devices, said shunt adapted to remain open in the normal operation of the electro-receptive devices of the group, and having a resistance less than the resistance of any one of the electro-receptive devices of the group and greater than all of said electro-receptive

devices, and devices, actuated and controlled by the magnet in the constantly-closed shunt-circuit, for automatically closing the supplemental shunt-circuit on the failure of one or more of the electro-receptive devices of 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 devices controlled by the current in a shunt-circuit around the group, and adapted to automatically reduce the flow of current through the remaining electro-receptive devices of the group on the failure of any one or more of them to operate, 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 including an electro-magnet, a normally-open shunt including a resistance less than the working resistance of any one of the electro-receptive devices, an armature adapted to be actuated by said electro-magnet, and a circuit-closer controlled by the armature and adapted to close the normally-open shunt, substantially as set forth.

6. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of an electro-magnet included in a constantly-closed shunt, a switch-lever included in a normally-open shunt, and an armature constructed to engage said switch-lever and retain it in its open position, and to be released by the attraction of the electro-magnet, substantially as set forth.

7. 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 around the group, and an electro-magnet included therein, a normally-open shunt around the electro-magnet, and devices, actuated and controlled by the electro-magnet, for automatically closing the shunt and diverting a portion of the current around the electro-magnet, substantially as set forth.

8. In a multiple-series system of electrical distribution, the combination, with a group of electro-receptive devices, of a shunt-circuit around said group, and mechanism, actuated and controlled by the current, for diverting a portion of the current through the shunt and a reduced portion through the remaining electro-receptive devices of the group on the failure of any one or more of them to operate, substantially as set forth.

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

ARTHUR J. HOLT.

Witnesses:
W. A. CARNEY,
L. B. LE VAKE.