(No Model.) 2 Sheets—Sheet 1.

J. P. TIRRELL.

APPARATUS FOR AUTOMATICALLY OPENING CLOSED CIRCUITS.

No. 304,376. Patented Sept. 2, 1884.

Fig. 1.

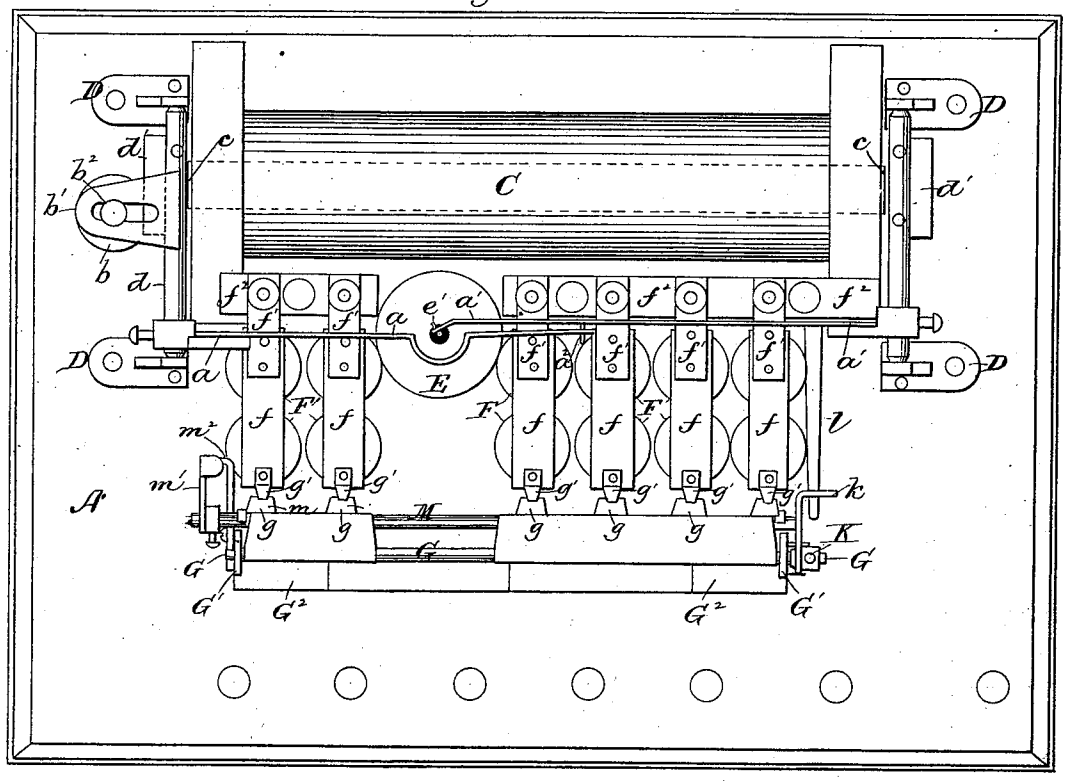
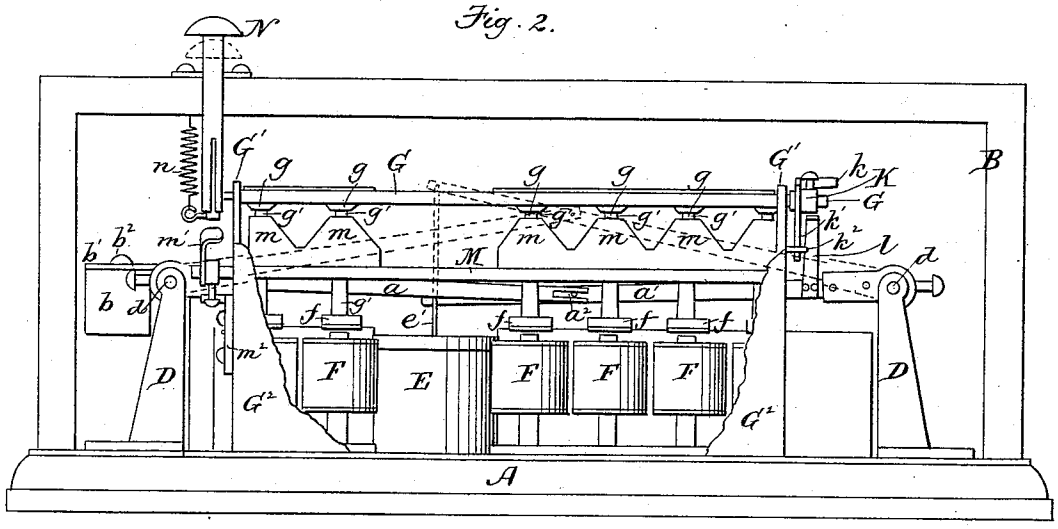


Fig. 2.



Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

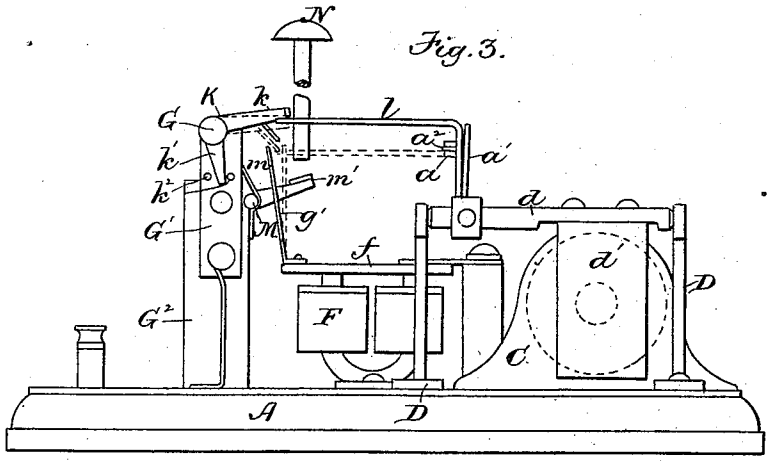


Fig. 4

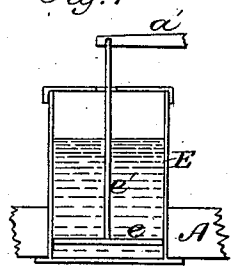


Fig. 5.

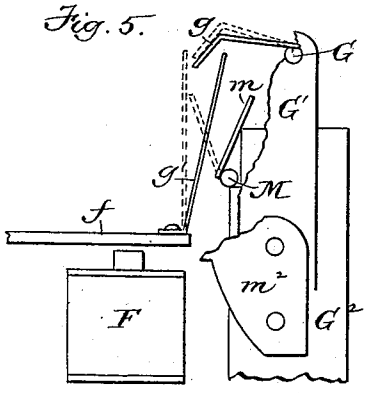
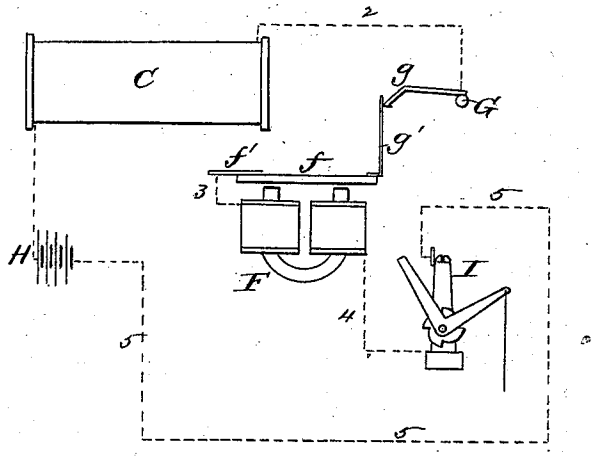


Fig. 6.



Witnesses.
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A. L. White

Inventor
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UNITED STATES PATENT OFFICE.

JACOB P. TIRRELL, OF BOSTON, ASSIGNOR TO GEORGE F. PINKHAM, OF QUINCY, MASSACHUSETTS.

APPARATUS FOR AUTOMATICALLY OPENING CLOSED CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 304,376, dated September 2, 1884.

Application filed December 1, 1883. (No model.)

To all whom it may concern:

Be it known that I, JACOB P. TIRRELL, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Apparatus for Automatically Opening Closed Circuits in Electric Gas-Lighting Systems, of which the following is a specification.

My invention relates to electric gas-lighting apparatus, and has for its object to provide improved automatic means whereby derangement of a circuit causing a ground-connection at a gas-burner is prevented from weakening the battery or injuriously affecting the other branch circuits in a system having a series of branch circuits, each including a gas-burner.

The invention consists, as a whole, in the combination of an electric circuit having one or more branch circuits, each provided with an electro-magnet and with suitable gas-lighting devices, a spark-coil or its equivalent in said circuit provided with one or more armatures, switching devices, substantially as described, adapted to cut out a branch circuit when said armatures are fully attracted, and a mechanical resistance or retarding device, whereby the armature or armatures of the spark-coil are prevented from being fully attracted by a momentary closure of the circuit.

In the accompanying drawings, Figure 1 is a top view of my improved apparatus. Fig. 2 is an elevation as viewed from the lower side of Fig. 1, and with parts broken away. Fig. 3 is an elevation from the right of Fig. 1. Figs. 4 and 5 are detached views of parts of the apparatus. Fig. 6 is a diagram of connections.

In these views, A is the wooden base, while B, Fig. 2, is a protecting-cover for the apparatus.

C is the usual spark-coil secured to base A, and provided with a core, *c*, of iron wires. (Indicated by dotted lines in Fig. 1.)

Uprights D, Figs. 1, 2, 3, secured to base A, support rock-shafts *d*, pivoted therein, and carrying armatures *d'*, which are arranged to be attracted by the core *c* of coil C. Levers *a a'*, secured to rock-shafts *d*, are connected at a^2 by a pin and slot, as shown, so as to move simultaneously. Lever *a'* has a piston-rod, *e'*, secured to its free end, and said rod is fixed to a piston, *e*, (see sectional view, Fig. 4,) which moves loosely in a vessel, E, filled with oil or similar fluid, the whole forming a "dash-pot" or mechanical resistance, and rendering the movement of levers *a a'* gradual. I do not limit myself, however, to this form of mechanical resistance, as any other suitable devices which will similarly retard the movement of the levers *a a'* may be used without departing from the spirit of my invention; nor do I limit myself to the provision of two armatures for the spark-coil, as a single armature may be employed, if preferred.

Secured to base A are a number of electro-magnets, F, one being placed in each of the circuits branching from the spark-coil, and arranged to operate armatures *f*, mounted on springs *f'*, which latter are secured to a common support, f^2, fastened to base A.

A rock-shaft, G, pivoted in bearings G', supported by a standard, G^2, carries a metallic strip formed into contact-arms *g*, which project obliquely downward toward armatures *f*. Vertical contact-springs *g'*, secured to the free ends of armatures *f*, are arranged to normally make yielding contact with contact-arms *g*, as shown by full lines in Figs. 1 and 2, and by dotted lines in Figs. 3 and 5, thereby completing the circuits which pass through said arms and springs. This arrangement of circuits is shown in Fig. 6, which shows a single circuit consisting of battery H, wire 1, spark-coil C, wire 2, shaft G, contact-arm *g*, spring *g'*, armature *f*, and spring *f'*, wire 3, magnet F, wire 4, gas-burner I, and wire 5, to battery. The springs *g'* and contact-arms *g* constitute switching devices, whereby the branch circuits are automatically opened after a prolonged closure, as hereinafter described. Of course, this circuit is normally broken at the gas-burner, and only closed by the contact of the electrodes at the burner during the operation of lighting.

It is obvious that one or any greater number of circuits may be run from the battery and spark-coil, each requiring an electro-magnet F and corresponding parts.

A two-armed lever, K, is secured to the end of the shaft G, and has its play limited by two pins, k^2, between which its lower arm, *k'*, vibrates, while its horizontal arm *k* has its free end bent at a right angle and arranged to be

engaged by an arm, *l*, secured to arm *a'*; consequently, whenever armatures *d'* are operated, as described, arm *l* rises, engages arm *k* of lever K, which is normally depressed by gravity, and raises the same as far as pins k^2 allow, as shown in full lines in Fig. 3.

The operation of the apparatus would be as follows: A closure of circuit in any one branch would first attract armature *f* in that branch, and thus draw contact-spring *g'* downward, but not far enough to release it from contact-arm *g*, as it would merely rub along it without breaking the connection, and, in fact, this would be liable to occur every time the circuit was closed for lighting purposes; but if the closure of circuit be permanent, owing to derangement, armature *f* in the affected circuit being drawn downward, armatures *d'* will slowly act to raise levers *a a'* and arm *l*, and at or near the end of the upward movement of said arm it will engage the arm *k* of the lever K, and thus simultaneously raise all of the contact-arms *g* on shaft G high enough to disengage the contact-spring *g'* on the armature *f*, which is depressed, as hereinbefore described, from the corresponding contact-arm, when resiliency of said contact-spring will cause it to spring inward toward shaft G, as shown in full lines in Fig. 5, out of contact with its contact-arm *g*. This will occur only in the case of the particular spring which we have considered, for all of the other armatures *f* not being depressed, the springs *g'* thereon will not be disengaged from their contact-arms *g*, as both the depression of said springs and the raising of said contact-arms is required for disengagement. The circuit being now broken in the deranged branch, and neither armatures *f* nor *d'* being then attracted, the levers *a a'* will fall by gravity and the apparatus resume its normal position, leaving the deranged circuit cut out, and with the contact-spring *g'* in that circuit out of contact with its corresponding contact-arm, *g*. To restore the springs *g'* to their normal position after a fault had been remedied, I provide a rock-shaft, M, provided with arms *m*, corresponding to those of shaft G, and with a lever, *m'*, so arranged that by gravity said arms *m* will normally rest, as shown in Fig. 5 in full lines; but the depression of the lever *m'* will cause said arms *m* to engage contact-springs *g'* and move them into the position shown in dotted lines in Fig. 5. The downward movement of lever *m'* is limited by a bracket, m^2, secured to support g^2, as shown. As a convenient means of operating said lever and rock-shaft, I provide a push-knob, N, Fig. 2, sliding through the cover B of the apparatus, and normally raised by a retractile spring, *n*, the depression of said button bringing its lower end against the extremity of lever *m'* and forcing it downward. To partially counterbalance the excess of weight of levers *a a'*, I provide a weight, *b*, Figs. 1 and 2, secured to an arm, *b'*, by a screw, b^2, passing through a slot in the same, so as to allow said weight being adjusted to regulate the time or rate of operation of the shaft *d*, to which said arm is attached. The employment of dash-pot or mechanical resistance E renders armatures *d'* practically inoperative under the ordinary lighting condition; but the attraction caused by the permanent closure of circuit, which is liable to be produced by derangement of the apparatus attached to the burner, will cause the affected circuit to be cut out after the lapse of half a minute, more or less.

It is evident that a separate electro-magnet may be used to operate levers *a a'*; but the spark-coil arranged as shown is more convenient and economical.

The described apparatus will usually be located in some convenient part of a building having an electric gas-lighting system and automatically cut out the branch circuit of any burner or burners in the system in case of an accidental ground-connection caused by the derangement of the terminal or contact points or otherwise. By thus cutting out any deranged branch circuit, waste of battery-power is prevented, and the operation of the circuits at the other burners is unimpaired. Failure of the lighting apparatus to operate at any burner gives notice that the circuit at that burner is disarranged, and has been cut out by the improved apparatus, so that an electrician may be summoned, who, after making the necessary repairs, will reset the apparatus by depressing the push-knob, as above described.

I claim—

1. The combination of an electric circuit having one or more branch circuits, each provided with an electro-magnet and with suitable gas-lighting devices, a spark-coil or its equivalent in said circuit, provided with one or more armatures, switching devices, substantially as described, adapted to cut out a branch circuit when said armatures are fully attracted, and a mechanical resistance or retarding device, whereby the armature or armatures of the spark-coil are prevented from being fully attracted by a momentary closure of the circuit, as set forth.

2. An electric circuit having a gas-lighting device, an electro-magnet provided with an armature, and a spark-coil or its specified equivalent, also having an armature combined with switching devices, substantially as described, which are caused to cut out the gas-lighting devices by the complete attraction of both of said armatures when a prolonged closure of the circuit occurs, and a mechanical resistance or retarding device, whereby a momentary or brief closure of the circuit caused by the ordinary contact of the electrodes of the gas-lighting device is prevented from completely attracting both armatures and operating the switching devices, as set forth.

3. The combination of an electric circuit having a series of branch circuits, each including gas-lighting devices, and an electro-mag-

net having an armature, a spark-coil or its equivalent in said circuit, also having an armature, a mechanical resistance, whereby the movement of said armatures is rendered gradual and insensitive to momentary closings of the circuit, and switching devices for the branch circuits, each operated by the simultaneous action of the electro-magnet or branch to which it belongs, and the retarded armature or armatures, whereby any branch is automatically cut out from the main circuit in case of derangement, as set forth.

4. The combination of an electric circuit having two or more branch circuits, each including gas-lighting devices, an electro-magnet and an armature therefor, a spark-coil or its equivalent located in said circuit, and having an armature, levers operated by said armatures, a mechanical resistance or dash-pot, whereby the rate of movement of said armatures when attracted by the spark-coil is limited, and switching devices for said branch circuit, composed of a series of contact-arms adapted to be operated simultaneously by said levers, and a corresponding series of contact-springs on the armatures of the magnets in the branch circuits, and operated independently thereby, said contact springs and arms being normally in yielding contact, and disconnected only by the movement of said levers caused by a prolonged closure of the circuit, as set forth.

5. In an electric gas-lighting apparatus, the combination, with the armatures of the switch-magnets, provided with the spring-arms g', of the rock-shaft having contact-arms g, and means, substantially as described, for restoring said arms to their normal position.

6. The combination of the spark-coil C, or its equivalent, the armatures d' d' thereof, the levers a a', secured to said armatures, and having a jointed connection to each other, the mechanical resistance or retarding device applied to said levers, the branch circuits, including the electro-magnets F, having armatures f, the switching devices composed of the springs g' on armatures f, and the contact-arms g, secured to a common rock-shaft, G, and means whereby said contact-arms are raised simultaneously by a complete attraction of the armatures d' d', as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 26th day of October, 1883.

JACOB P. TIRRELL.

Witnesses:
C. F. BROWN,
A. L. WHITE.