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R. J. PATTERSON.

AUTOMATIC CUT-OUT FOR ELECTRIC LIGHT CIRCUITS.

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NO MODEL.

Fig. 1.

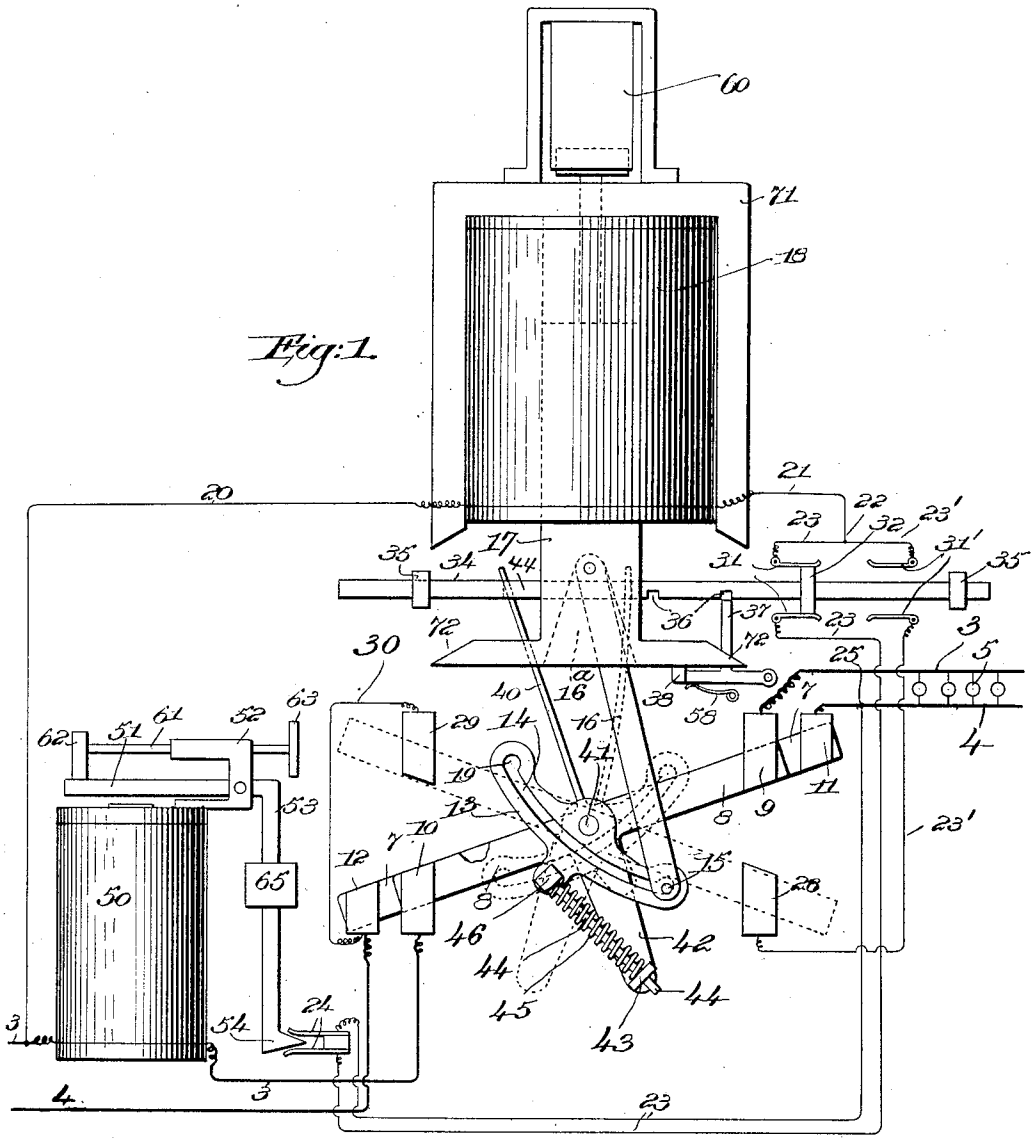


Fig. 2.

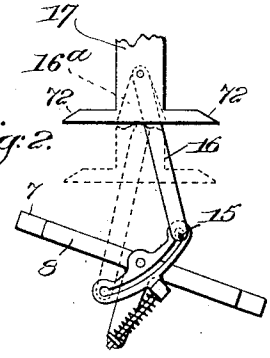


Fig. 3.



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No. 745,899. Patented December 1, 1903.

UNITED STATES PATENT OFFICE.

RALPH J. PATTERSON, OF WATERVILLE, MAINE, ASSIGNOR OF ONE-HALF TO L. R. WALLIS, OF WOBURN, MASSACHUSETTS.

AUTOMATIC CUT-OUT FOR ELECTRIC-LIGHT CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 745,899, dated December 1, 1903.

Application filed April 25, 1902. Serial No. 104,646. (No model.)

To all whom it may concern:

Be it known that I, RALPH J. PATTERSON, a citizen of the United States, and a resident of Waterville, county of Kennebec, State of Maine, have invented an Improvement in Automatic Cut-Outs for Electric-Light Circuits, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings representing like parts.

In my Patent No. 689,830, granted December 24, 1901, is described an indicator for electric circuits which is rendered operative when the current exceeds a certain predetermined amount and which when operative makes indication of the fact that an excessive current is being generated by causing the current to fluctuate rapidly. In said patent the fluctuation of the current is caused by intermittently introducing resistance into the circuit at short intervals of time, this being accomplished by providing a pair of arcing contacts which are caused to rapidly open and close during the existence of the condition which caused the excessive current. While a device of this character is effective where the current being used is comparatively small, I have discovered that where the maximum current desired is a comparatively heavy current the device is unsuited for universal use, because of the excessive heat which is generated during the formation of the arc between the arcing carbons. In my present invention I have overcome this difficulty by employing a snap-switch which is adapted to alternately open and close the main circuit during the time when the current is excessive, whereby the lights are automatically extinguished and relighted.

My invention comprises a main circuit including translating devices, a snap-switch adapted to alternately open and close the main circuit, and an operating-magnet which is rendered operative when the current exceeds a certain predetermined amount and which when operative alternately opens and closes the snap-switch. The connection between the operating-magnet and the switch is such that when the magnet is first energized its armature operates to open the snap-switch and when the magnet is next energized its armature operates to close the snap-switch. The coils of the operating-magnet are in a normally open shunt-circuit, and a starting-magnet which is preferably in series with the load is employed to close the shunt-circuit when the current becomes excessive, whereby the operating-magnet is energized and the snap-switch opened, thus opening the main circuit and shunt-circuit, whereby the operating-magnet is deënergized. As the armature of the operating-magnet resumes its initial position a spring-controlled auxiliary switch in the shunt-circuit is released by said armature and the auxiliary switch operated to again close the shunt-circuit, whereby the operating-magnet is again energized and the snap-switch closed, thus completing again the main circuit. If the excessive current is still being transmitted, the same operations are repeated.

The connection which I preferably employ between the armature of the operating-magnet and the snap-switch comprises a slotted rocker-arm or lever connected to the snap-switch and a link pivoted to the armature of the operating-magnet and having a pin playing in said slot.

By using a snap-switch for opening and closing the main circuit the device may be used in connection with circuits carrying a comparatively heavy current without any danger from arcs or sparks occasioned by the breaking or closing of the contacts of the switch, as would be the case where the switch-points are directly connected to the armature and open and close comparatively slowly.

In the drawings, Figure 1 is a diagrammatic view showing my improved apparatus. Figs. 2 and 3 are details to be hereinafter referred to.

3 and 4 designate the line-wires of the main circuit, which includes some suitable translating devices, such as lamps 5.

The switch I employ is some suitable form of what is ordinarily termed a "snap-switch"—that is, a switch in which the switch-blades are actuated by a spring which is put under tension by the switch-operating mechanism, whereby after the blades have been released the spring operates to throw them quickly

from one contact to the other—and in said switch 7 and 8 designate the two switch-blades, which are insulated from each other, and 9 and 10 the two contacts, which the switch-blade 8 engages when the switch is closed, and 11 and 12 the contacts which the switch-blade 7 engages, it being understood, of course, that the contacts 9 and 10 are connected to the line-wire 3 and the contacts 11 and 12 to the line-wire 4.

It is entirely within the scope of my invention to employ any familiar form of snap-switch, of which there are many types, and in the drawings I have shown one simple form which accomplishes the important result aimed at—to wit, the sudden and instant opening and closing of the switch-contacts.

The blades 7 and 8 are mounted on a pivot 41 and are connected together in some suitable way to move in unison.

13 is a rocker or switch-operating arm, which is preferably pivoted on the pivot 41. The construction of the switch is such that as the rocker-arm is turned about its pivot its initial movement serves to store up energy in a blade-actuator, which is released by the further movement of the rocker-arm and which when released serves to instantly throw the switch-blades. In this embodiment of my invention the blade-actuator is in the form of a spring 45, which surrounds a rod 44, pivoted at one end to the rocker-arm, as at 46, and having its other end passing loosely through an eye in the head of a pin 43, which is swiveled to an arm 42 rigid with the blades. The spring is confined between the pin 43 and the pivot 46 and tends normally to hold the blades and arm in the relative positions shown in full lines in Fig. 1. When, however, the rocker-arm is swung into the dotted-line position, the initial movement of said arm will compress the spring, and the spring will only tend to hold the blades more firmly in the position shown; but as soon as the arm has been turned so far as to bring the pivot 46 past the pin 43 the spring will then act against the said pin in an opposite direction and will instantly throw the switch-blades into open position. A reverse movement of the arm 13 will operate first to compress the spring 45 and then place the same in position to actuate the switch-blades to close the switch. The switch is actuated at the proper times to open or close the latter by a switch-operating magnet, and for this purpose the arm 13 is provided with the slot 14, which receives a pin or roll 15 on the end of a link 16, which is pivoted to the core or armature 17 of an operating-magnet 18. The slot is preferably slightly curved, and the ends thereof are provided with the recesses 19, with which the pin 15 engages when the latter is at either end of the slot.

Assuming that the snap-switch 6 is closed, as shown in Fig. 1, it will be seen that when the magnet 18 is energized and its armature or core is raised the rocker-arm 13 will be turned into the dotted-line position, Fig. 1, and the switch will be opened, thus breaking the main circuit. This breaking of the main circuit deënergizes the magnet 18, as will be presently described, thus permitting its armature to drop to the full-line position, Fig. 1, during which operation the pin 15 will slide down the slot to the dotted-line position, Fig. 2. As the armature reaches its initial position the magnet 18 is again energized, as will be presently described, and its armature raised; but as the pin 15 is at the opposite end of the slot the raising of the armature will operate to throw the snap-switch back to its original position, thus closing again the main circuit. My invention includes, therefore, a snap-switch and an operating-magnet therefor so connected to the switch that successive energizations of the magnet operate to alternately open and close the switch.

It will be noted that the link 16 is pivoted in a triangular-shaped recess 16ª in the magnet-core, the said recess being so shaped that when the core is in its lowered position the link will be in substantial contact with one of the inclined walls of the recess. This is quite an important construction, as the magnetic attraction between the link and the core when the magnet is energized is sufficient to hold the link in operative position, so as to insure the proper engagement of the pin in the recess 19 when its armature or core begins to move upward.

The coils of the magnet 18 are in a shunt-circuit which is in multiple arc with the load or translating devices. In the diagrammatic view in Fig. 1 the shunt-circuit includes the wire 20, which is connected to the line-wire 3, the coils of the magnet 18, the wire 21, which is branched at 22, one branch 23 having the normally open contacts 24 therein and being connected to the line-wire 4 at 25 on the same side of the main switch as the load or translating devices, and the other branch, 23′, being connected to a contact 28, with which the switch-blade 8 engages when the snap-switch is opened. A contact 29, which is connected to the line-wire 4 through the wire 30, is engaged by the other end of said blade 8 when the switch is opened. Each of the branches 23 23′ of the shunt-circuit have contacts therein with which an auxiliary switch coöperates, whereby the shunt-circuit is closed through either branch, according to the position of the auxiliary switch. The contacts in the branch 23 are designated by 31 and the contacts in the branch 23′ by 31′. The auxiliary switch comprises the contact 32, which is adapted to close the contacts 31 or 31′, according to the position of the said switch. The auxiliary switch may be of any suitable construction, and in the embodiment of my invention herein illustrated it is shown as comprising a sliding bar 34, on which the contact 32 is mounted, said bar being supported in any suitable bearings 35.

The auxiliary switch is a spring-actuated switch and is locked in either of its operative positions by means of a locking-pawl 37, which engages either one of the recesses 36 in the bar, said pawl having a tail 38, which is engaged by the armature or core 17 when the latter approaches its lowest position, as seen in Fig. 1, whereby the pawl is released. The spring for actuating the auxiliary switch is put under tension by the throwing of the snap-switch, so that after each operation of the snap-switch the auxiliary switch is in condition to be operated as soon as the pawl is released. Any convenient spring mechanism may be employed for thus operating the auxiliary switch, and I have herein illustrated as one simple means a spring 40, which is connected to the blades of the snap-switch and which plays in a slot in the bar 34. When the snap-switch is opened and the blades thrown into the dotted-line position, Fig. 1, the spring-arm 40 will travel in the slot 44 until it strikes the end of the same and will then be put under tension, as illustrated in dotted lines, Fig. 1. As soon now as the magnet 18 is deënergized and its armature by its downward movement unlocks the pawl 37 the tension of the spring 40 will throw the auxiliary switch into the dotted-line position to bridge the contacts 31′. When the switch is closed, the spring-arm 40 will be put under tension to throw the auxiliary switch in the opposite direction, as will be obvious. The normally open contacts 24 in the shunt-circuit are automatically closed whenever the current in the main circuit exceeds a certain volume, and for this purpose I have herein illustrated a starting-magnet 50, which is in series with the load, the armature 51 of said magnet being shown as pivoted to the stand 52 and having a weighted arm 53 provided with a contact 54, which is adapted to engage and bridge the contacts 24, thus closing the shunt-circuit.

The operation of the device is as follows, the parts being shown in Fig. 1 in the normal position, with the main circuit closed: The armature 51 of the starting-magnet is so adjusted that it will be attracted toward the magnet when the current in the main circuit exceeds a certain predetermined amount, and when this occurs the contact 54 will bridge the contacts 24, thus completing the shunt-circuit through the wire 20, coils of magnet 18, wire 21 23, contacts 24 to the line-wire 4. The operating-magnet 18 is thus energized and its core lifted, thus throwing the snap-switch into dotted-line position and breaking the main circuit. The upward movement of the armature will allow the locking-pawl 37, which is under the influence of a spring 58, to be thrown into locking position to hold the auxiliary switch in the position shown, and the throwing of the snap-switch will put the spring 40 under tension, as above described. Since the branch 23 of the shunt-circuit is connected to the line-wire 4 on the opposite side of the switch from the wire 20, the breaking of the main circuit also breaks the shunt-circuit, and the operating-magnet becomes deënergized. As the core of the operating-magnet reaches its lowest position it engages the locking-pawl 37 and releases the auxiliary switch, which is thrown into the dotted-line position, Fig. 1, under the influence of the spring 40. The shunt-circuit is now again closed, the said shunt-circuit comprising the wire 20, the coils of the magnet 18, the wire 21 and branch 23′, contact 28, switch-blade 8, contact 29, and wire 30. The operating-magnet is thus again energized and the snap-switch thrown to close the main circuit, such operation again putting the spring 40 under tension, and as soon as the snap-switch is thus thrown into full-line position, Fig. 1, the shunt-circuit is again broken between the contacts 28 and 29, whereby the operating-magnet is deënergized and its armature falls, the falling of the armature again releasing the locking-pawl 37 and allowing the auxiliary switch to be thrown into the full-line position, Fig. 1, ready for the next operation. If the excessive current is still being transmitted, these operations will be repeated, as will be obvious.

60 designates a dash-pot of any suitable or usual construction, which is connected to the core of the operating-magnet to retard its downward movement. This dash-pot may be constructed so that the movement of its piston may be more or less free, whereby the time elapsing between successive operations of the switch may be regulated.

In order to adjust the sensitiveness of the magnet 50, whereby it will be rendered operative by currents of any desired volume, I have provided means for varying the distance of the armature 51 from the said magnet. In this embodiment of my invention the stand 52 carries an adjusting-shaft 61, having a cam 62 at its end, which rests against the armature 51, said shaft being provided with a knurled head or wheel 63 for its operation. By turning the shaft the normal distance of the armature from its magnet may be varied, thereby bringing the armature more or less into the magnetic field, whereby the sensitiveness of the magnet may be regulated. This may also be more or less regulated by raising or lowering the weight 65 on the stem 53 of the armature.

In order to steady the action of the operating-magnet 18, I will preferably place around the same a U-shaped member of iron 71 and will provide the core with the arms 72, so shaped that when the core is raised the arms form, with the U-shaped member 71, a substantially continuous band of iron completely encircling the magnet. This increases the action of the core 17 when it is nearly in its elevated position, since the magnetic flux

when the core is raised will pass through the two arms 71 of the U-shaped member and the core 17.

It will be understood that the drawings illustrate my invention diagrammatically only and that therefore the specific details in the construction of the device may be varied widely without departing from the spirit of the invention.

While I have illustrated diagrammatically one form of snap-switch, it is entirely within my invention to employ any of the various well-known snap-switches. It will also be obvious that the specific connections may be varied and still come within my invention.

I believe that I am the first to provide an automatic cut-out in which a snap-switch having a spring or equivalent mechanism to throw the switch in both directions with a quick movement is used to open and close the main circuit, and an operating-magnet is so connected to the snap-switch that successive energizations of the magnet operate to alternately open and close the switch. I also believe that I am the first to employ an auxiliary switch for the shunt-circuit which includes the coils of the operating-magnet, which auxiliary switch is controlled as to its operation by the energizations of the operating-magnet.

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

1. A main circuit, a snap-switch therein adapted to open and close the circuit said snap-switch being constructed to open and to close with a quick movement, an operating-magnet controlled by variations in the strength of the current in the main circuit, and connections between said magnet and the switch whereby the successive impulses given by the magnet operate alternately to open and close the switch.

2. In a circuit-breaker, a snap-switch adapted to open and close the main circuit, said switch comprising an oscillatory switch-blade and means to give said blade a quick movement both in opening and closing the switch, means rendered operative by an excessive current to open said switch, and electrical means rendered operative when the main circuit is broken to close said switch.

3. In a circuit-breaker, a snap-switch adapted to open and close the main circuit, an operating-magnet for said switch, means rendered operative by an excessive current to energize said magnet whereby the switch is opened and the magnet deënergized, and means rendered operative by the breaking of the circuit to reënergize the magnet whereby the switch is closed.

4. In a circuit-breaker, a switch adapted to open and close the main circuit, an operating-magnet for said switch, means rendered operative by an excessive current to energize said magnet whereby the switch is opened and the magnet deënergized, and means rendered operative by the breaking of the circuit to reenergize the magnet whereby the switch is closed.

5. In a circuit-breaker, a snap-switch constructed to open and close the main circuit, an operating-magnet for said switch, said magnet being situated in a shunt across the main circuit, and means whereby successive energizations of the operating-magnet operate to open and close the switch alternately, said magnet receiving its first impulse when the current in the main circuit exceeds a certain amount, and its second impulse when the switch has been thrown to open the main circuit, whereby the switch is automatically opened and closed alternately so long as the excessive current continues.

6. In a circuit-breaker, a snap-switch constructed to open and close the main circuit, a normally open shunt-circuit including an operating-magnet for the switch, means rendered operative by an excessive current to close said shunt-circuit whereby the magnet is energized and the snap-switch opened, the opening of the main circuit breaking the shunt-circuit and deënergizing the magnet, and means operated by the deënergized magnet to again close said shunt-circuit whereby the magnet is again energized and the snap-switch closed.

7. In a circuit-breaker, a snap-switch constructed to open and close the main circuit, an operating-magnet connected to the switch, a normally open shunt-circuit including the coils of said magnet, a starting-magnet in series with the load, said starting-magnet when energized closing the shunt-circuit whereby the operating-magnet is energized and the snap-switch opened, and means operated by the armature of the operating-magnet when it returns to normal position to again close the shunt-circuit whereby the operating-magnet is again energized and the snap-switch closed.

8. In a circuit-breaker, a snap-switch adapted to open and close the main circuit, said switch comprising a switch-blade, and spring mechanism to throw the blade in both directions, an operating-magnet connected across the circuit in multiple arc with the load, and connections between said magnet and the spring, such that each energization of the magnet operates to store energy in the spring, whereby the switch is alternately opened and closed.

9. In a circuit-breaker, a snap-switch adapted to open and close the main circuit, an operating-magnet for said switch, a shunt-circuit including the coils of said magnet, means rendered operative by excessive current to close said shunt-circuit, whereby the operating-magnet is energized and the switch opened to break both main and shunt circuits, means operated by the armature of the magnet when it resumes its normal posi-

tion to again close the shunt-circuit whereby the switch is closed.

10. A main circuit including translating devices, a main switch to open and close said circuit, an operating-magnet for the switch, a shunt-circuit including the coils of the said magnet, an auxiliary switch in said shunt-circuit, means rendered operative by an excessive current to close the shunt-circuit whereby the operating-magnet is energized and the main switch opened to break the main circuit, and means rendered operative by the armature of the said magnet when it resumes its initial position to throw the auxiliary switch and close the shunt-circuit whereby the operating-magnet is again energized and the main circuit closed.

11. A main circuit including translating devices, a switch to open and close said circuit, an operating-magnet for said switch, successive energizations of said magnet operating to open and close the said switch alternately, a shunt-circuit including the coils of the operating-magnet, an auxiliary switch in said shunt-circuit, a starting-magnet in series with the translating devices, means operated by said starting-magnet to close the shunt-circuit, an auxiliary switch in the shunt-circuit, and means controlled by the movement of the operating-magnet to operate said auxiliary switch.

12. In an automatic cut-out, a snap-switch having a slotted rocker-arm, an operating-magnet having an armature and a link connecting said armature to the slotted rocker-arm, the construction being such that at successive actuations of the armature the link engages the rocker-arm at opposite ends of the slot whereby said arm is alternately operated in opposite directions.

13. In an automatic cut-out, a snap-switch having a rocker-arm provided with an inclined slot having a recess at each end, an operating-magnet, a link pivotally connected to the core of the magnet and having a pin or projection engaging said slot, the construction being such that each time the magnet is energized the pin by its engagement with the recessed portion of the slot operates the rocker-arm to throw the switch, and when the magnet is deënergized the pin slides down the inclined slot to the opposite end thereof whereby the successive energizations of the magnet operate to throw the switch in opposite directions.

14. In a circuit-breaker a snap-switch adapted to open and close the main circuit, said switch comprising a switch-blade and means to give said blade a quick movement in both opening and closing the switch, an operating-magnet, connections between the latter and the switch whereby the successive impulses given by the magnet operate alternately to open and close the switch, a starting-magnet to determine the times of operation of the operating-magnet, and means for adjusting the sensitiveness of said starting-magnet whereby the switch may be operated when the current reaches any predetermined strength.

15. In an automatic cut-out, a snap-switch adapted to open and close the main circuit, an operating-magnet for said switch, a shunt-circuit including the coils of said magnet, said circuit having two branches, an auxiliary switch adapted to close either of said branches, and mechanical means controlled by the operating-magnet for actuating said auxiliary switch, whereby the shunt-circuit is first closed through one branch and then through the other.

16. In an automatic cut-out, a switch to open and close the main circuit, an operating-magnet for the switch, said switch having a slotted rocker-arm, a link pivoted to the core of the magnet and having a pin playing in said slot, said pin during successive energizations of the magnet operating the rocker-arm from alternate ends of the slot, and means to hold the pin in operative position while the magnet is energized.

17. In an automatic cut-out, a switch to open and close the main circuit, an operating-magnet for said switch, said switch having a slotted rocker-arm, and a link pivoted in a recess in the core of the magnet and having a pin playing in the slot in the rocker-arm, the construction being such that when the magnet is energized the link is held in operative position by the magnetic influence of the core.

18. In a circuit-breaker, a snap-switch adapted to open and close the main circuit, an operating-magnet for said switch, a shunt-circuit including the coils of said magnet, an auxiliary switch in said shunt-circuit, means for operating the auxiliary switch by the movement of the snap-switch, and a lock for said auxiliary switch controlled by the armature of the operating-magnet.

19. In an automatic cut-out, a snap-switch adapted to open and close the main circuit, an operating-magnet for said switch, a shunt-circuit including the coils of said magnet, said circuit having two branches, one connecting across the main circuit on different sides of the snap-switch, and the other connecting across the main circuit on the same side of the snap-switch, an auxiliary switch adapted to close either of said branches, and means controlled by the operating-magnet for actuating said auxiliary switch, whereby the shunt-circuit is closed through the first branch when the main circuit is closed, and through the second branch when the main circuit is open.

20. In an automatic cut-out, a snap-switch adapted to open and close the main circuit, an operating-magnet for said switch, a shunt-circuit including the coils of said magnet, said shunt-circuit having two branches one of which connects across the main circuit on different sides of the snap-switch, and the other across the main circuit on the same side

of the snap-switch, means for operating the auxiliary switch from the snap-switch, and a lock for said auxiliary switch controlled by the operating-magnet, the construction being such that the circuit is closed through the first branch when the main switch is open, and through the second branch when the main switch is closed.

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

RALPH J. PATTERSON.

Witnesses:
EUGENE W. CRAWFORD,
W. P. KILCUP.