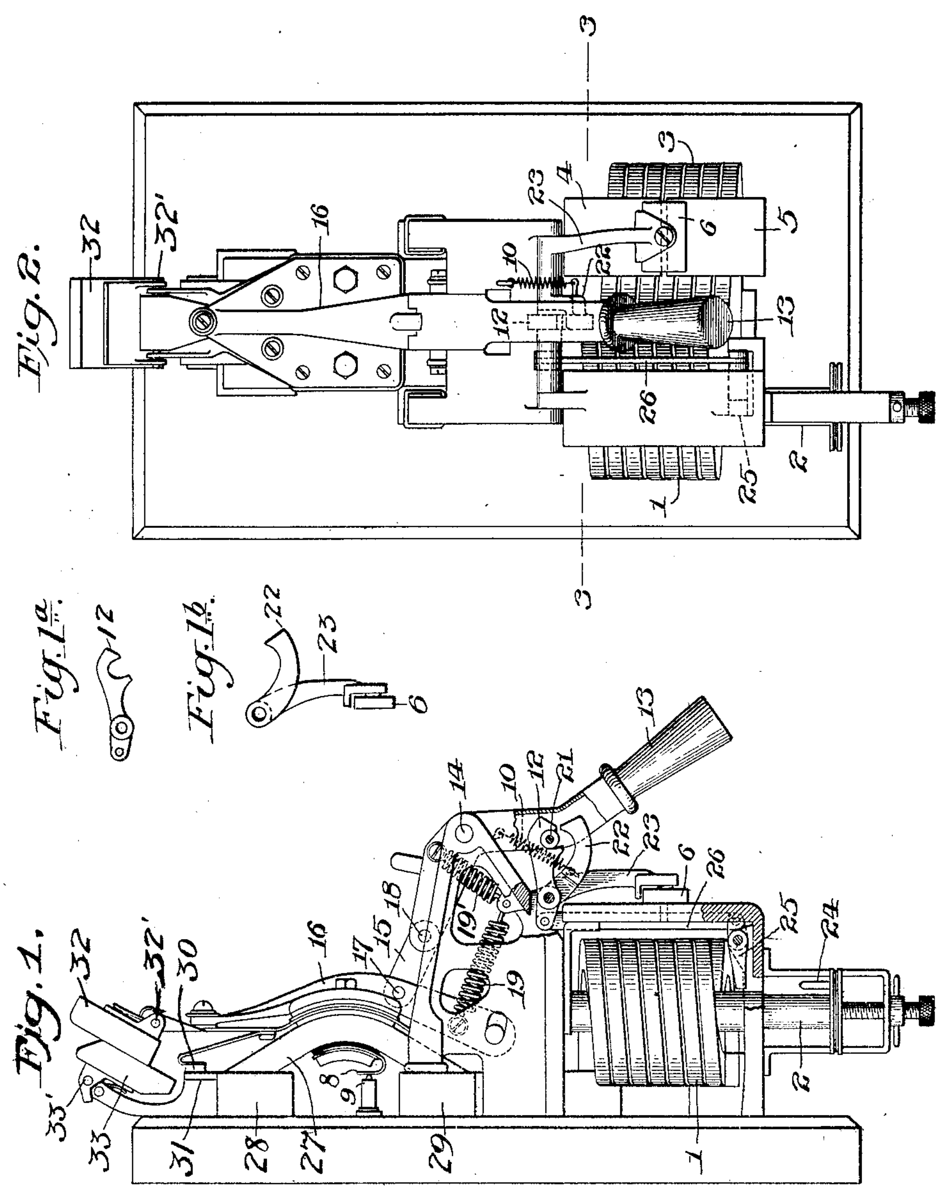
No. 779,003. PATENTED JAN. 3, 1905.

W. M. SCOTT.

AUTOMATIC MAGNETIC CIRCUIT BREAKER.

APPLICATION FILED JUNE 28, 1901.

2 SHEETS—SHEET 1.



WITNESSES:

Mae Hoffmann

Chas. L. White

INVENTOR

William Maxwell Scott

BY

M. C. Teasdale

ATTORNEY

No. 779,003. PATENTED JAN. 3, 1905.

W. M. SCOTT.

AUTOMATIC MAGNETIC CIRCUIT BREAKER.

APPLICATION FILED JUNE 28, 1901.

2 SHEETS—SHEET 2.

Fig. 5.

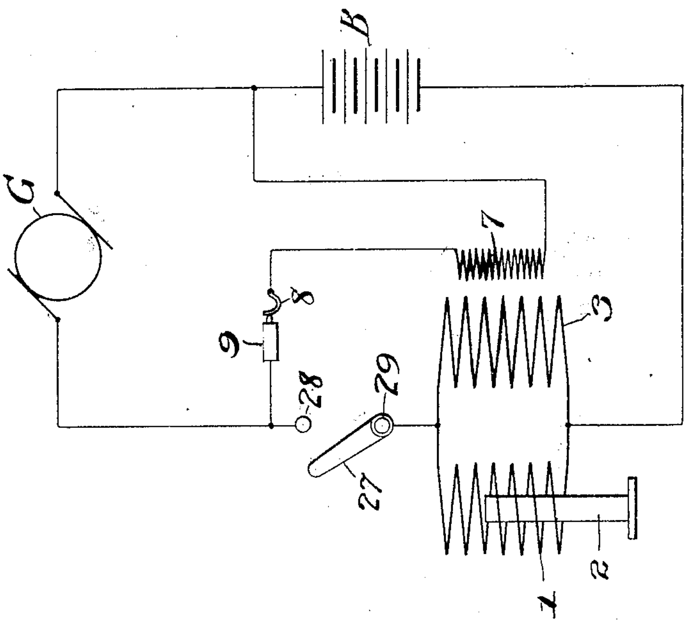


Fig. 3.

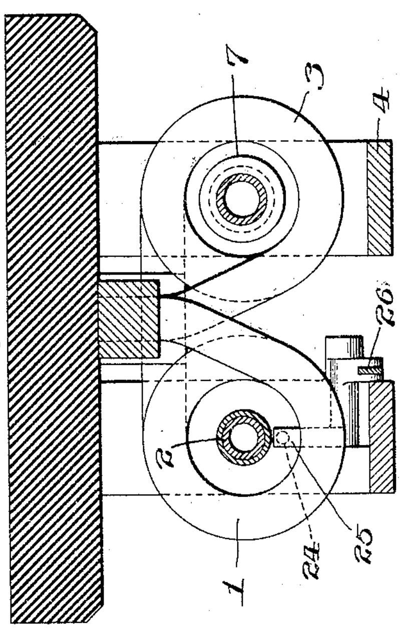
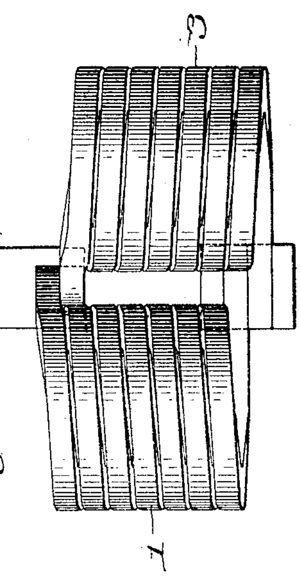


Fig. 4.



WITNESSES:

Mae Hoffmann

Chas. B. White

INVENTOR

William Maxwell Scott

BY H. W. Teasdale

ATTORNEY

UNITED STATES PATENT OFFICE.

WILLIAM M. SCOTT, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO CUTTER ELECTRICAL AND MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

AUTOMATIC MAGNETIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 779,003, dated January 3, 1905.

Application filed June 28, 1901. Serial No. 66,337.

To all whom it may concern:

Be it known that I, WILLIAM M. SCOTT, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Automatic Magnetic Circuit-Breaker, of which the following is a specification.

My invention relates to improvements in automatic circuit-breakers, the object being to provide means for interrupting an electric circuit upon the occurrence of several predetermined conditions.

It is the object of my invention to provide automatic protective means which shall operate to open an electric circuit upon the occurrence of an abnormal current-flow in either direction through the circuit, upon the potential of the circuit falling to a predetermined value or upon the reversal of the current in the circuit, and also upon the reversal of the current being attended by an abnormal current-flow.

My circuit-breaker is intended particularly for use in connection with circuits including devices capable of reversing the current in the circuit or causing a reversed-energy flow in the circuit. Such conditions are possible in circuits including storage batteries, boosters, motor-generator sets, and also in alternating circuits may include rotary transformers and kindred apparatus.

In the disclosure herein made my automatic circuit-breaker is shown in connection with the circuit including a storage battery to control the charge and discharge of said battery.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is a side elevation of my device with the circuit-breaker in the closed position. Fig. 1[a] is a detail of the latch 12. Fig. 1[b] is a detail of the armature-controlled latch-tripping mechanism. Fig. 2 is a front elevation of my device. Fig. 3 is a horizontal section on the line 3 3 of Fig. 2. Fig. 4 is an elevation of the coils with their jackets removed, and Fig. 5 is a diagrammatic view showing the arrangement of the coils of my circuit-breaker in the circuit to be protected.

Similar numerals refer to similar parts throughout the several views.

Coil 1 represents the usual overload tripping-coil of an automatic circuit-breaker and is provided with a plunger 2, carrying the pin 24. Upon the occurrence of abnormal current in whatever direction in the circuit to be protected the plunger 2 is drawn upwardly with a force depending upon the amount of current circulating through the coil 1. As the plunger 2 rises it becomes accelerated and possessed of considerable momentum. The pin 24 engages one end of the lever 25, tilting it upwardly and pulling downwardly upon the member 26, attached at its upper end to the short arm of the pivoted latch 12. This causes the latch 12 to be lifted from engagement with the roller 21, pivoted in the operating member supplied with the handle 13. As the outer end of latch 12 is rising, however, the left-hand lip of the latch as viewed in Fig. 1 forces itself against the roller 21, so that the operating-handle has delivered to it a blow the energy of which is derived from the moving plunger 2. The coil 3 is also a coarse-wire coil similar to coil 1 and is joined in parallel with said coil 1. Within the coil 3 is another coil, 7, of fine wire, which surrounds the same core that is embraced by coil 3. Both coils 3 and 7 have the same magnetic circuit, which consists of this internal core and the two pole-pieces 4 and 5 coming closely together and being separated by a small air-gap only at about the middle of the front of coil 3. Bridging this air-gap is an armature 6, supported by the member 23, pivoted concentrically with latch 12, said member being integral with the member 22, which is joined by the spiral spring 10 with the operating member 13 of the switch. So long as either coil 3 or coil 7 is furnishing sufficient magnetomotive force the armature 6 is held in the position shown in Fig. 1, which causes the spiral spring 10 to be under tension and the member 22 out of engagement with the latch 12, or so long as the combined effects of coils 3 and 7 results in a predetermined magnetomotive force the same conditions obtain as to the member 22 and the spring 10. Should spring 10, however, overcome the attractive force exerted on armature 6, or, in other words, should the attractive force exerted upon armature 6 diminish to a certain amount, the spring 10 will pull the member 22 upwardly and cause it to engage the latch 12, lifting it, and thereby releasing the operating member of the switch, causing the rupture of the circuit.

The operating member of the switch is pivoted at 14 in a bracket extending from the base of the instrument and has an extension pivoted at 18 to the link 15, which in turn is pivoted at 17, with a supporting-arm 16 pivoted at its lower end and having a motion of translation in a slot in the supporting-bracket. The member 16 carries the main movable laminated contact member of the switch and the supplemental metallic and carbon shunt-contacts. Insulated from the member 16 and all metallic parts carried thereby is the movable contact 8, which engages the fixed plunger-contact 9. These contacts 8 and 9 control the circuit of the coil 7, as shown in Fig. 5.

Upon the release of roller 21 from the latch 12 the toggle composed of the link 15 and the extension from the operating member collapses, and the member 16 rotates about its pivot to open a circuit by removing the movable contacts from engagement with their coöperating stationary contacts. The spring 19 and the spring 19′ under tension when the switch is closed assists in the opening movement.

27 represents the movable contact member, which bridges the main fixed terminals 28 and 29, having their engaging faces in the same vertical plane.

30 is the movable metallic shunt-contact, which engages with the stationary metallic shunt-plate 31, in electrical communication with the main terminal 28.

32 is the movable shunt-carbon, pivoted at 32′ in a rigid upwardly-extending portion of the member 16.

33 is the coöperating stationary carbon shunt-contact, pivoted at 33′ in an upwardly-extending bracket electrically and mechanically secured to the upper main terminal 28.

The carbons 32 and 33 are spring-pressed and are provided with pivots to permit them to adjust their contact-faces with respect to each other during the closing and opening movement of the switch.

As is well understood in the art of circuit-breakers, during the opening movement the bridge 27 first breaks circuit with the main terminals 28 and 29. Then the metallic shunt-contacts 30 and 31 separate, and lastly the carbons 32 and 33 separate, and it is at their surfaces that the arcing of the switch takes place, thereby preventing any pitting or blistering of the metallic contacts.

In Fig. 5 is shown a generator G, which is employed, for example, to charge a secondary battery B. In series with the generator and battery is joined my automatic circuit-breaker, as herein described, and is shown in this Fig. 5 in its elemental form. From this diagram it is clearly shown that the coils 1 and 3 are joined in parallel with each other and in series with the main circuit. The coil 7 is connected across the terminals of the generator G, thus being subjected to the potential difference maintained by said generator G.

Coils 1 and 3 being in parallel with each other, the current flowing through them divides and flows in each in amounts inversely proportional to the resistances of the coils or inversely as the impedances of these coils if employed upon alternating-current circuits. Thus by decreasing the resistance of the coil 1 the major portion of the current may be caused to pass through coil 1, and vice versa. Increasing the resistance of coil 1 or decreasing the resistance of coil 3 will cause a greater amount of current to flow through coil 3. Furthermore, by increasing or decreasing the number of turns in either coil 1 or coil 3 without changing its resistance will result in increased or decreased magnetizing effect, and by varying both the resistance and turns of either or both coils numerous proportions of magnetizing effects may be obtained. The coil 7 is connected directly across the circuit and is therefore subjected to the full-line pressure or voltage. Coils 7, whether the current be a continuous or an alternating one, is of constant polarity—that is, the direction at any instant of the magnetism generated by it is the same whether the current or energy flow in the main circuit be in one direction or another. Under these conditions the coil 7 furnishes sufficient magnetomotive force to hold the armature 6 attracted. If the voltage or pressure of the system decreases sufficiently, the magnetizing effect of the coil 7 diminishes to such an extent that even with some current flowing in the coil 3 the armature 6 is released and the circuit-breaker opened. Coil 7 is therefore the low-voltage coil. Coil 3 is a current-coil adapted to aid in controlling in event of reversed-current or reversed-energy flow—that is, should the current in the circuit or system be reversed in direction coil 3 would furnish ampere-turns in opposition to the ampere-turns of coil 7, and should the reverse current reach a sufficiently great value coil 7 would be entirely overcome, or so nearly overcome that armature 6 would be released and the circuit-breaker opened. By means of these coils 1, 3, and 7 the circuit is interrupted upon excessive current-flow in either direction through the circuit upon low-voltage condition or upon a reversal of current in the circuit and before the amount of such reversed current becomes excessive. As soon as the reverse current begins to flow coil 3 operates in opposition to the coil 7 and may be so proportioned with respect to the coil 7 or the spring 10 that a reverse current of a relatively small value will open the circuit-breaker. In case, however, the reverse current should become excessive, coil 1 will also operate to open the circuit-breaker. Such reverse-current flow would occur in the case where the storage battery B is discharging and operating the generator G as a motor.

By proportioning the magnetic effect of coil 7, of coil 3, and the strength of spring 10 the circuit-breaker may be caused to open at any desirable conditions of voltage, direct or reversed energy flow. By making the spring relatively weak and also the magnetizing effect of coil 7 relatively weak but a slight current in the reversed direction will cause the opening of the circuit-breaker. It is thus seen that the three coils of my circuit-breaker coöperate to control a circuit upon predetermined conditions of overload, low voltage, or reversed current.

Upon the opening of the circuit-breaker contacts 8 and 9 separate, thereby also opening the circuit of the coil 7, and when the circuit-breaker is closed the direction of the current through coil 7 is always the same whether the current through the generator and battery be in the one direction or the other.

What I claim is—

1. In a tripping mechanism, switch-restraining means, a plurality of coils connected in parallel with each other, one of said coils operating to control said restraining means, and a coil of constant polarity coöperating with another of said coils to control said restraining means.

2. In a tripping mechanism, switch-restraining means, a plurality of current-coils connected in parallel with each other, one of said coils operating to control said restraining means, and a coil of constant polarity coöperating with another of said current-coils to control said restraining means.

3. In a tripping mechanism, switch-restraining means, a plurality of coils connected in parallel with each other, one of said coils operating to control said restraining means, and a potential-coil coöperating with another of said coils to control said restraining means.

4. In a tripping mechanism, switch-restraining means, a plurality of coils connected in parallel with each other and in series in a circuit, one of said coils operating to control said restraining means, and a potential-coil connected in shunt with said circuit and coöperating with another of said coils to control said restraining means.

5. In an automatic electric switch, separable coöperative contacts, means for restraining said contacts in normal position, an overload-coil for controlling said restraining means, a coil in parallel with said overload-coil, a potential-coil, said coil and potential-coil coöperating to control said restraining means upon the occurrence of low voltage or a reversed-energy flow.

6. In an automatic electric switch, separable coöperative contacts, means for restraining said contacts in normal position, a plurality of current-coils in parallel with each other, one of said coils operating on overload to control said restraining means, a potential-coil, said potential-coil and another of said current-coils coöperating to control said restraining means upon reversed-energy flow or low voltage.

7. In an automatic electric switch, separable coöperative contacts, means for causing their separation, means for restraining the separating means, a current-coil for controlling said restraining means upon predetermined overload, and an electromagnet and an armature controlled thereby, said electromagnet comprising a series coil and a shunt-coil, said series and shunt coils coöperating to control said armature during energy-flow in normal direction and opposing each other upon reversed-energy flow and operating to release said armature to control said restraining means.

8. In an automatic switch, separable coöperative contacts, a controlling means comprising an overload-coil, and controlling means comprising coöperating current and potential-coils, said overload-coil and current-coil being connected in parallel.

9. In an automatic electric switch, separable coöperative contacts, a controlling means comprising an overload-coil, and further controlling means comprising a current-coil and a potential-coil, said overload-coil and said current-coil being connected in parallel with each other and in series in the main circuit, and said potential-coil being connected in a circuit in shunt to the main circuit.

10. In an automatic electric switch, separable coöperative contacts, a controlling means comprising an overload-coil, and further controlling means comprising a current-coil and a potential-coil, said overload-coil and said current-coil being connected in parallel, and a magnetic circuit common to said current and potential coils.

11. In an automatic electric switch, separable coöperative contacts, a controlling means comprising an overload-coil, further controlling means comprising a potential-coil and a current-coil, said overload-coil and said current-coil being connected in parallel, a magnetic circuit associated with said overload-coil, and an independent magnetic circuit common to said potential-coil and said current-coil.

WM. M. SCOTT.

Witnesses:

CHAS. D. WHITE,

MAE HOFFMANN.