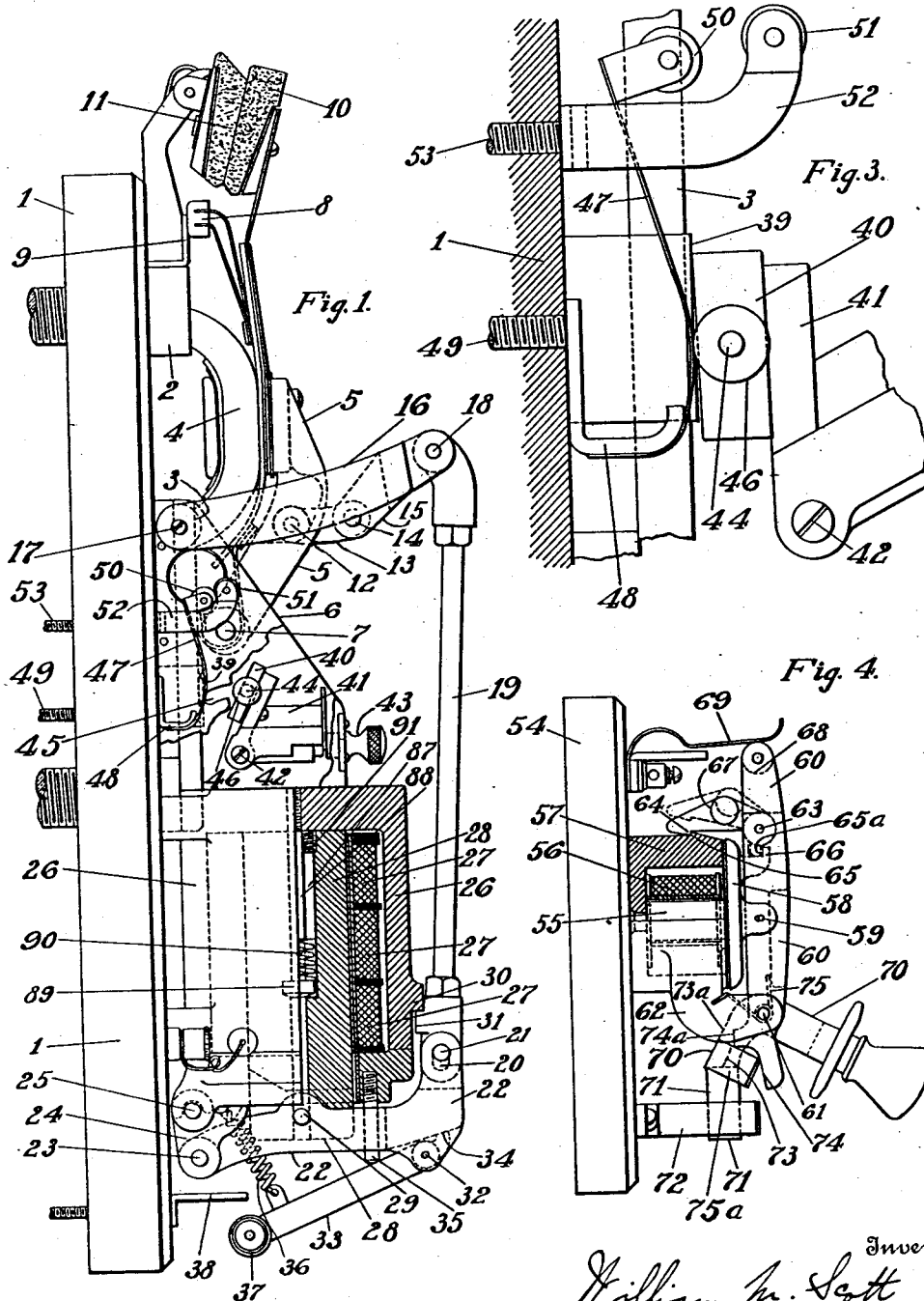


W. M. SCOTT.
ELECTRIC SWITCH CONTROL.
APPLICATION FILED MAR. 8, 1912.

Patented Apr. 8, 1913.

1,058,200.

3 SHEETS—SHEET 1.



Witnesses

Ethel L. Ferguson
Godfrey Shisler

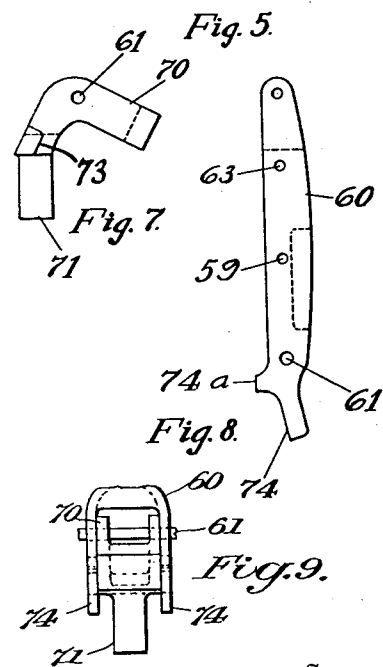
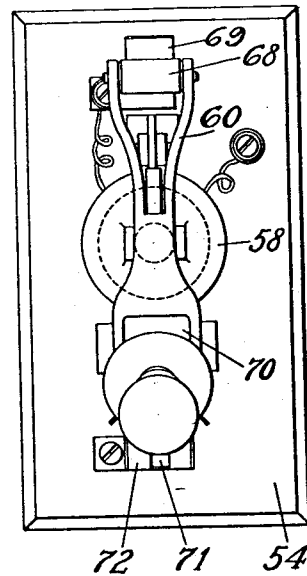
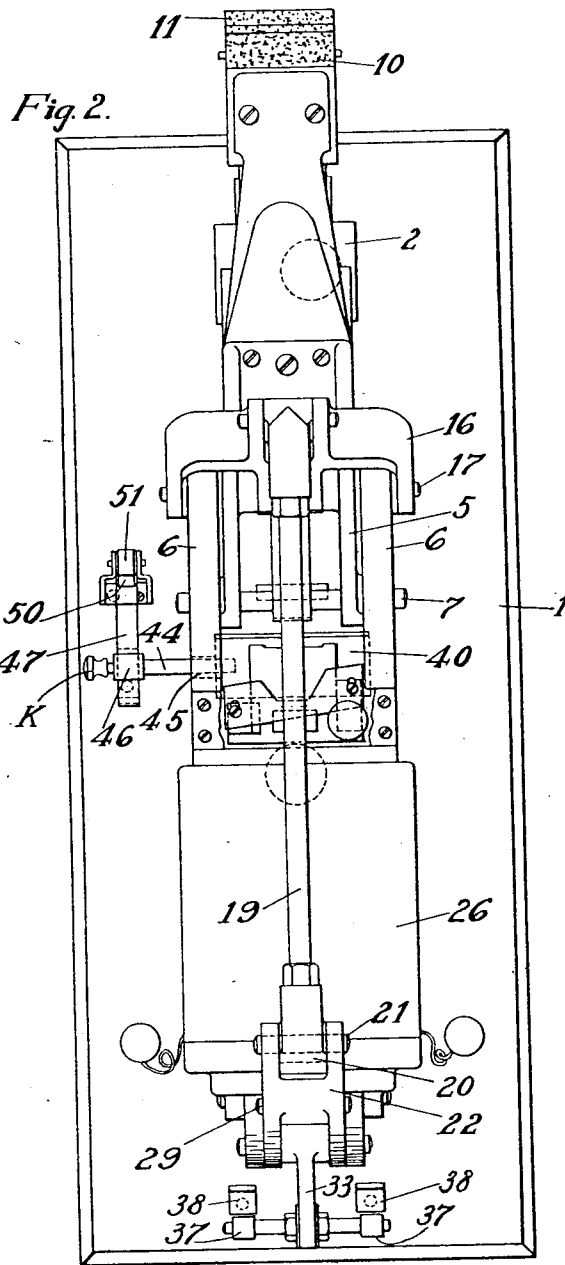
Inventor
William M. Scott

By Cornelius L. Chet
his Attorney

Patented Apr. 8, 1913.

3 SHEETS-SHEET 2.

1,058,200.



Witnesses

Ethel L. Ferguson.
Soddy Shisler.

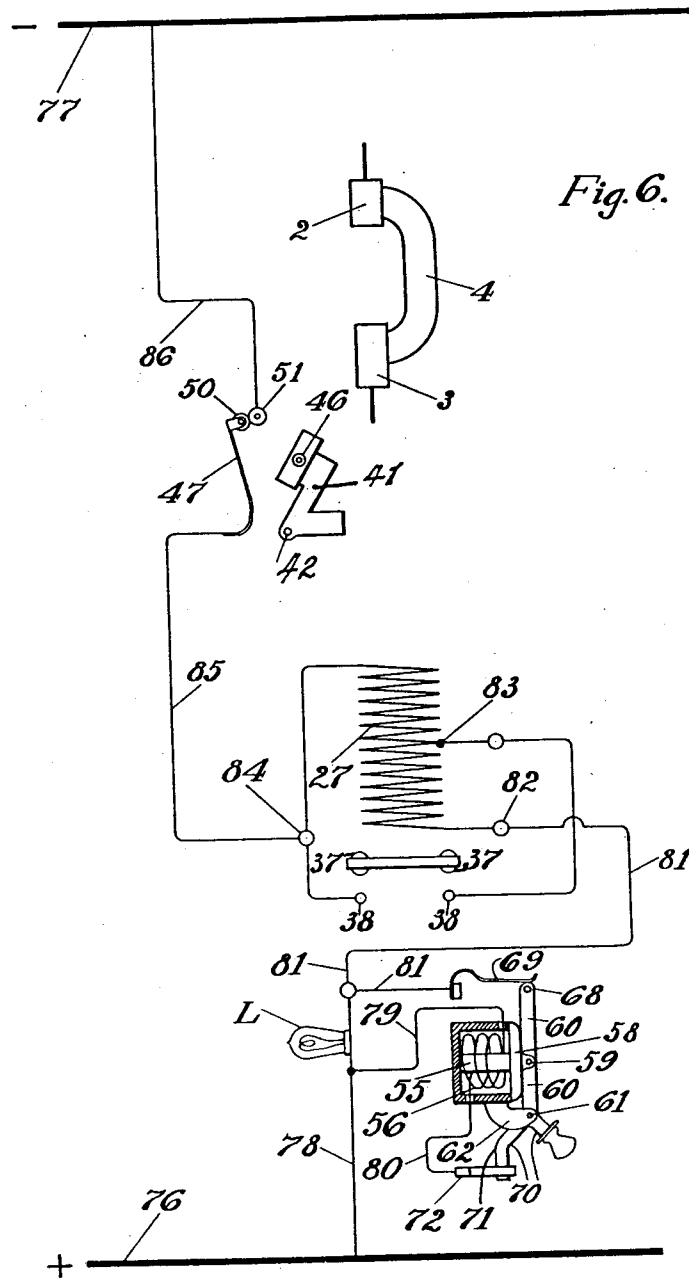
By *Cornelius D. Ely*
Attorney

Inventor
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Witnesses

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Godfrey L. his d. p.

Inventor
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his Attorney

UNITED STATES PATENT OFFICE.

WILLIAM M. SCOTT, OF BERWYN, PENNSYLVANIA.

ELECTRIC-SWITCH CONTROL.

1,058,200.

Specification of Letters Patent.

Patented Apr. 8, 1913.

Application filed March 8, 1912. Serial No. 682,506.

To all whom it may concern:

Be it known that I, WILLIAM M. SCOTT, a citizen of the United States, residing in Berwyn, in the county of Chester and State of Pennsylvania, have invented a new and useful Electric-Switch Control, of which the following is a specification.

My invention relates to electric switch or circuit breaker mechanism, and more particularly to a switch or circuit breaker mechanism in association with a system or apparatus whereby the switch or circuit breaker will not repeatedly alternately move toward closed and open positions during the continuance of the electrical condition in response to which it first opened or in virtue of which it should remain open if such condition continues.

My invention resides also in a switch or circuit breaker comprising electro-responsive means and means for mechanically holding the switch or circuit breaker in normal position, the electro-responsive means thereafter releasing the same from mechanical control and itself controlling a switch or circuit breaker.

My invention resides in the features hereinafter described and claimed.

For an illustration of one of the forms my invention may take, reference is to be had to the accompanying drawings in which:

Figure 1, is a side elevational view, partly in section, showing a circuit breaker and associated control parts. Fig. 2, is a front elevational view of the same. Fig. 3, is a side elevational view, on enlarged scale, of one of the control switches. Fig. 4, is a side elevational view, partly in section, of a control switch or circuit breaker. Fig. 5, is a front elevational view of the same. Fig. 6, is a diagram showing the electrical circuits and parts controlled thereby. Fig. 7, is a side view of a member of the control switch or breaker. Fig. 8, is a side view of a cooperating member of the control switch or breaker. Fig. 9 is a fragmentary front elevational view of the lower parts of the members shown in Figs. 7 and 8 in cooperating position.

Referring to the drawings, upon a base or switchboard 1 of insulating material, such as marble or the like, are mounted the main terminal blocks 2 and 3 of the main switch or circuit breaker. These terminals 2 and 3 are adapted to be bridged by the member 4 representing a laminated bridging member

which is secured to the arm 5 pivoted to the housing 6 and 7.

8 is a movable intermediate metallic shunt contact adapted to engage the intermediate stationary metallic shunt contact 9. The movable shunt carbon contact 10, carried by the arm 5 with the contact 8, engages the stationary shunt carbon 11. When the main switch or breaker opens, the bridging member 4 first separates from the main terminals 2 and 3, thereafter the intermediate metallic shunt contact 8 separates from stationary contact 9 and finally the carbon contact 10 separates from the carbon contact 11, the final arcing due to rupture of circuit occurring between the carbons 10 and 11.

Pivoted to the arm 5 at 12 is a link 13 pivoted at 14 to the extension 15 integral with the link 16 pivoted to the housing 6 at 17. The links 13 and 16 form a toggle which, in the circuit closing position shown in Fig. 1, is slightly overtraveled. To the link 16 there is pivoted at 18 the rod 19 having at its lower end the slot 20 in which is movable the pin 21 carried by the lever 22 pivoted at 23 to the link 24 which is pivoted at 25 upon a lug on the jacket or housing 26 of a solenoid whose winding is indicated in section at 27 and which has a vertically movable core 28 pivoted at 29 to the lever or arm 22. The housing or jacket 26 of the solenoid is secured upon the base 1.

Upon the front of the housing 26 is a projection 30 under the lower edge of which is adapted to engage the lug 31 on the rod 19, the lug 30 thus limiting the upward travel of the rod 19 which in consequence prevents the toggle 13, 16 overtraveling too far. Pivoted to the lever 22 at 32 is a lever 33 having a stop 34 limiting its counter-clockwise rotation on the pivot 32. A stop 35 secured to the housing 26 limits the clockwise rotation of lever 33 upon pivot 32. A spring 36 is attached at one end to the lever 33 and at its other end to the housing 26. At its end opposite pivot 32 the lever 33 carries two contact rollers 37, 37, in electrical communication with each other and adapted to engage the stationary contact springs 38, secured upon the base 1.

Associated with the lower main terminal 3 are magnet poles 39 adapted to be magnetized by the current passing through the terminal 3 to attract the armature 40 supported on member 41 pivoted to the housing 6 at 42. By means of the handle 43 the

armature 40 may be adjusted to different distances from the poles 39 so that the armature 40 will not be attracted except upon the current flowing through terminal 3 reaching predetermined values. The armature 40 carries pin 44 extending through slot 45 in the housing 6. At its outer end the pin 44 carries the roller 46 which, when the armature 40 has been attracted to the position shown in Fig. 3, engages the spring 47 and deflects it toward the base 1. The spring 47 is supported by and in electrical communication with the bracket 48 secured upon the base 1 by the bolt 49 which serves also as an electrical connection to the spring 47. At its upper end the spring 47 carries a roller 50 which, when the armature 40 is not attracted, engages the contact roller 51 supported by the conducting bracket 52 which is secured to the base 1 by bolt 53 which serves also as an electrical connection to the roller 51.

At any suitable distance from the switch or breaker shown in Figs. 1 and 2 is located a control switch or circuit breaker such as illustrated in Figs. 4 and 5. This switch or circuit breaker comprises a base 54 of insulating material upon which is secured an electro-magnet having the core 55, winding 56 and jacket 57. Disposed in front of the electro-magnet is the armature 58 having lost motion pivotal connection at 59 with the arm 60 pivoted at 61 to the bracket 62 upon the jacket or housing 57. At 63 the latch 64 is pivoted to the arm 60. On the jacket 57 is a formed notch 65 which is engaged by the hook latch 64 to hold the arm 60 in the position shown in Fig. 4 as hereafter described. The latch 64 has a lug 65^a adapted to be engaged by the lug 66 on the armature 58. There may be provided on the latch 64 a weight 67 causing the latch 64 to engage the notch 65 even in the case where the base 54 is horizontal. At its upper end the arm 60 carries a contact roller 68 adapted to engage with the contact spring 69 mounted upon the base 54.

Pivoted at 61 on the bracket 62, but independently of the arm 60, is the actuator or operating lever 70 carrying a movable contact 71, electrically connecting through lever or arm 60 with the roller 68. This movable contact 71 is adapted to engage with the stationary contact 72 secured upon the base 54. On the arm 70 is provided a surface 73 adapted to engage the lug 74 on the lower end of the arm 60 for limiting counter-clockwise rotation of arm 70, as viewed in Fig. 4. Wrapped around the pivot 61 is a spring 75 whose one end engages the arm 60 and whose other end engages the bracket 62, the tension of the spring being such that it tends to rotate the arm 60 in a clockwise direction on its pivot 61 as viewed in Fig. 4. Between the brackets 62 is a sur-

face 73^a provided for engaging projection 74^a on arm 60 thus limiting outward or clockwise movement of arm 60 which movement is retarded by the spring buffers 75^a.

In Fig. 6, 76 represents one conductor, for example the positive conductor, of a circuit for supplying the control current; and 77 represents the other conductor of that circuit. A conductor 78 connects conductor 76 through conductor 79 with one terminal of the winding 56 whose other terminal connects by conductor 80 with the stationary contact 72. Connection is made through contact 72 with movable contact 71. Thence through arms 70 and 60 to roller 68 and thence to contact 69 to conductor 81. Connected across the conductors 79 and 81 is the incandescent lamp L which is therefore a connection in parallel with the control switch or circuit breaker whose magnet winding is 56. The conductor 81 extends from the control switch or circuit breaker to the more or less distant circuit breaker, shown in Figs. 1 and 2, where conductor 81 connects to terminal 82 of the winding 27. One stationary contact 38 is connected to terminal 84 of the solenoid winding 27. The other stationary contact 38 connects to an intermediate terminal 83 of the winding 27 and the terminal 84 of the winding 27 connects by conductor 85 with roller contact 50 which is normally engaged with roller contact 51 which connects by conductor 86 to the other conductor 77 of the circuit supplying the control current.

The operation is as follows: The parts are shown in Figs. 1, 2, and 6 in the normal or circuit closing position of the main switch or breaker whose movable contact member is 4 and which switch or circuit breaker controls a circuit carrying lighting, power or any other current. If now it be desired to open the main switch or breaker by an attendant present at said switch or breaker, that attendant can do so by actuating the armature 40 as through a handle K on pin 44 to cause the roller 46 to engage spring 47 to deflect it toward the base 1 and thereby separate contact 50 from contact 51. As a result the circuit from conductor 76 to conductor 77 through the solenoid winding 27 is interrupted causing the deenergization of the solenoid whereupon its core 28 will be moved downwardly by gravity carrying with it the arm or lever 22 which then rotates about its pivots 23 and 25 in a clockwise direction until the pin 21 strikes the bottom of the slot 20 in the member 19 thereby delivering a blow to the rod 19 which transmits a pull downwardly upon the link 16 which causes the toggle 13, 16, to move from its slightly overtraveled position across the dead center position, whereupon it collapses and the arm 5 rotates in a clockwise direction about its pivot 7 as viewed in Fig. 130

1, separating the main bridge member 4 from terminals 2 and 3, and in succession the shunt contacts, thus rupturing the circuit. When the contacts 50 and 51 separate, not only is the winding 27 deenergized but the winding 56 at the more or less distant control switch or circuit breaker is interrupted and electro-magnet 56 is in consequence deenergized. While the winding 56 was energized it held its armature 58 attracted and in consequence the lug 66 engaging the lug 65^a held the latch 64 raised into the dotted line position in Fig. 4, so that the arm 60 was held in position only by the attraction upon armature 58. With the deenergization of the winding 56 the attraction upon the armature 58 ceases and the spring 75 rotates the arm 60 in a clockwise direction upon its pivot 61 separating roller 68 from spring 69 and lug 74^a comes into engagement with stop 73^a, the buffers 75^a retarding arm 60 in this movement. When the winding 27 has been deenergized and the lever 22 moves as above described it carries the arm 33 with it, and the spring in contracting moves the roller contacts 37 into engagement with stationary contacts 38. After the main switch or breaker has been tripped by the operator or attendant as above described, the release of the armature 40 which then takes the position indicated in Fig. 1 allows the reestablishment of contact between contacts 50 and 51. Furthermore, the circuit of the solenoid 27 has been opened at the distant switch or circuit breaker whose magnet winding is 56 which, as above described, responds to underload or no-voltage. It is thus seen that the main switch or breaker will always be tripped in response to either a reduction of current in the control circuit between conductor 76 and 77 or to a complete rupture of such circuit. Or the main switch or circuit breaker may be tripped automatically when the current through it reaches a predetermined value whereupon the armature 40 is attracted by the poles 39 causing a similar separation of contact 50 from contact 51 with the result in tripping above described.

It is to be understood that while the armature 40 is here shown as an armature of an overload tripping mechanism, that the contact 50 may be separated from contact 51 by any other electro-responsive means, as, for example, by means responsive to reversed current, reversed energy flow, underload, no-voltage, etc. Or the main switch or circuit breaker may be tripped at a distance by an operator rotating the handle or operating lever 70 in a counter-clockwise direction upon its pivot 61 to separate contact 71 from engagement with contact 72. The separation of contact 71 from contact 72 breaks the circuit of solenoid winding 27, which will cause the tripping of the main switch or

breaker and hence also the deenergization of the winding 56 which then causes the opening of circuit at 68, 69.

With the parts in the open circuit position, the main switch or circuit breaker may be closed by an operator at the distant control switch or circuit breaker. This is accomplished by the operator at the distant switch or circuit breaker raising the handle 70, rotating it in a counterclockwise direction about pivot 61, the surface 73 engaging the lug 74 and rotating the arm 60 with it in a counterclockwise direction about pivot 61, the contact 71 being separated from contact 72 before the latch 64 engages the notch 65. When the latch 64 engages the notch 65, the circuit of the coil 56 is open due to the separation between contacts 71 and 72, consequently the armature 58 has no control over the latch 64. The arm 60 is then held by the latch 64 as indicated in Fig. 4. The operator then returns the handle 70 to the position shown in Fig. 4 whereupon contact 71 again engages contact 72 and the circuit through the windings 56 and 27 is completed and those windings are energized. Due to the energizing of winding of 56 armature 58 is attracted as above described, and the latch 64 is disengaged from notch 65 so that the arm 60 is no longer mechanically held by the latch 64, but is magnetically held by the armature 58, the latch being then in the position shown by dotted lines in Fig. 4. But since the winding 27 has been energized, the core 28 is attracted upwardly. During the early part of the movement of the core 28 while contacts 37, 37 are in engagement with contacts 38, 38, that part of the winding 27 between the points 82 and 83 receives current and the part of the winding 27 between the points 83 and 84 is short circuited, the solenoid then producing the strongest magnetic effect and greatest force upon the core 28. As the core 28 moves upwardly as viewed in Fig. 1, it moves the lever 22 upwardly about its pivots 23 and 25, the pin 21 engaging in the top of the slot 20 and forcing the rod 19 upwardly with the resultant extension of toggle 13, 16 which rotates the arm 5 in a counter-clockwise direction about its pivot 7 carrying the movable contacts toward the stationary contacts in the main switch or circuit breaker. The carbons 10 and 11 first engage; then 8 and 9 engage, and finally the main movable contact 4 engages the stationary terminals 2 and 3. In this closing movement the toggle 13, 16 passes slightly over the dead center position to slightly overtraveled position and is arrested from further movement by the engagement of the lug 31 with the lug 30. The parts are now in circuit closing position as shown in Fig. 1. As the core 28 has moved upwardly in this closing movement, the lever 33 has engaged the stop 35 causing

the lever 33 to engage with its stop 34 against the lever 22 with an accompanying separation of contacts 37, 37 from 38, 38. The result is that the two parts of the winding 27 are now thrown into series with each other so that the resultant current flowing through the circuit between conductors 76 and 77 is reduced, with the consequent smaller heating effect upon the winding 27 which must remain in circuit. With this change in the path of the current with respect to the winding 27 the ampere turns are reduced, but since the reluctance of the magnetic circuit has been reduced by the advance of the core 28 the magnetic pull is nevertheless sufficient to complete the closing movement.

When the main switch or circuit breaker has been tripped, the control switch or circuit breaker breaks contact between 68 and 69 as previously described. The circuit through the winding 27 is not completely interrupted due to the presence of the lamp L which now burns brightly since the circuit is shunt to it, including the winding 56, has been broken. This indicates at the control switch or circuit breaker that the main switch or circuit has been tripped and the resistance of the lamp L is such that it prevents sufficient current flowing through winding 27 to energize it to the degree necessary for effecting the closing of the main switch or breaker.

If it should be attempted to reclose the main switch or breaker while the overload condition (or other electrical condition) still obtains, upon the first engagement of the contacts of the main switch or circuit breaker the armature 40 will be actuated to separate contact 50 from contact 51 thereby interrupting the circuit of the solenoid 27 with the resultant reopening of the main switch or circuit breaker notwithstanding the control switch or circuit breaker has been closed by the operator. And due to the fact that the contacts 71 and 72 cannot be brought into engagement with each other, to cause the closing movement of the main switch or circuit breaker, until the handle 70 is moved to such a position that the energization of magnet 56 will disengage the latch 64 from notch 65, it follows that attempted closure of the main switch or circuit breaker during the continuance of the condition in response to which it was tripped results in the full opening of the main switch or breaker and the opening of the control switch or breaker which prevents the reclosure of the control circuit except in response to actuation of the arm 70 first in a counter-clockwise and then in a clockwise direction about pivot 61. The result is that the main switch or circuit breaker can never "buzz", that is, it cannot rapidly alternately close and open.

In the core 28 is a counter-bore 87 into

which extends the rod 88 threaded into the jacket 26 and having the head 89 above which is disposed the buffer spring 90 which, when the core 28 drops is engaged by the ring 91 secured to the core 28 at the top of the counter-bore 87.

It is to be understood that my invention is not limited to the overtravel of the toggle or the use of other restraining means for holding the main switch or circuit breaker closed for it is within my invention to hold the main switch or circuit breaker closed by the solenoid 27 only, in which case the toggle will not be moved to overtraveled position, and the stops 30, 31 may be omitted. In other words my invention contemplates the holding of the main switch or circuit breaker, whether employing a toggle or other contact operating means, closed by the solenoid 27 in response to whose deenergization the circuit breaker will then open as the core 28 falls.

It is to be understood also that the lamp L may be omitted, and that the position of the main switch or circuit breaker is indicated by the position of the control switch or breaker of Fig. 4, since the latter reflects the positions of the main circuit breaker, since when the main circuit breaker is open the control circuit breaker of Fig. 4 is open, and the main breaker cannot be in closed position unless the control breaker is in closed position indicated in Fig. 4. The lamp however may be used under certain conditions as such a signal might be desired in addition to the indication afforded by the position of the control switch or breaker.

It is to be understood also that the solenoid 27 instead of being constituted of high and low resistance windings as described, may be made of a single winding with a resistance in series with it, this resistance to be short circuited when the core 28 is in its lowermost position, and this resistance may be external to the solenoid, or may be directly associated with it and wound non-inductively. Or the solenoid 27 may be made of high and low resistance windings but connected in parallel when the core 28 is in its lowermost position, and then the low resistance section may be open-circuited at the end of the solenoid closing movement, or a resistance may be thrown into series with such low resistance section.

What I claim is:

1. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, and a control switch in the circuit of said electro-magnetic means comprising a movable contact member and an electro-magnet, and means breaking the circuit of said electro-magnet when said movable contact member is moved to normal position.

2. The combination with a movable con-

tact member of a switch or circuit breaker, of means for moving said contact member to normal position and maintaining the same in normal position, an electro-motive device when energized actuating said means and when deenergized freeing said contact member from said means, and a control switch controlling said electro-motive device comprising a movable contact member and an electro-magnet restraining said contact member in normal position, and means breaking the circuit of said electro-magnet when said movable contact member of said control switch is moved to normal position.

3. The combination with a movable contact member of a switch or circuit breaker, of means for moving said contact member to normal position and maintaining the same in normal position, an electro-motive device when energized actuating said means and when deenergized freeing said movable contact member from said means, a control switch in the circuit of said electro-motive device comprising a movable contact member and an electro-magnet, means for restraining the movable contact member of said control switch in normal position, and means for transferring the restraint of said movable contact member of said control switch to said electro-magnet.

4. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, a control switch in the circuit of said electro-magnetic means, and means breaking said circuit when said control switch is moved to normal position.

5. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, a control switch in the circuit of said electro-magnetic means, an electro-magnet restraining said control switch in normal position, and means breaking the circuit of said electro-magnet when said control switch is moved to normal position.

6. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, a control switch in the circuit of said electro-magnetic means, a member for moving said switch to normal position, means restraining said switch in normal position when so actuated, an electro-magnet, said member breaking the circuit of said electro-magnet when moving said switch to normal position and restoring the circuit of said electro-magnet for transferring restraint of said switch to said electro-magnet.

7. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, a control switch in the circuit of said electro-magnetic means and comprising a movable contact member and an actuator therefor movable independently thereof for moving the same to normal po-

sition, and means for closing said circuit upon reversed movement of said actuator.

8. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, a control switch in the circuit of said electro-magnetic means and comprising a movable contact member and an actuator therefor for moving the same to normal position, means for closing said circuit upon reversed movement of said actuator, and an electro-magnet energized when said circuit is closed for restraining said movable contact member of said control switch.

9. The combination with a switch or circuit breaker, of electro-magnetic means controlling the same, and a control switch in the circuit of said electro-magnetic means comprising a movable contact member, a normally energized magnet restraining said contact member in normal position, an independently movable actuator for moving said movable contact member to normal position, and a switch opening the circuit of said electro-magnet controlled by said actuator when moving said movable contact member to normal position.

10. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, a control switch in the circuit of said electro-motive device, an electro-magnet restraining said switch in normal position, and means breaking the circuit of said electro-magnet when said control switch is moved to normal position.

11. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, a control switch in the circuit of said electro-motive device, an electro-magnet restraining said switch in normal position, means breaking the circuit of said electro-magnet when said control switch is moved to normal position, and means mechanically restraining said switch in normal position until said electro-magnet is energized.

12. The combination with a switch or circuit breaker, of normally energized electro-magnetic means controlling the same, a control switch in the circuit of said electro-magnetic means comprising a movable contact member and a normally energized electro-magnet restraining said movable contact member, an actuator for moving said movable contact member to normal position, and a switch interrupting said circuit controlled by said actuator when moving said movable contact member to normal position.

13. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, said electro-motive device included in a normally closed circuit, means responsive to deenergization of said electro-motive de-

vice for releasing said switch or breaker, a control switch having contacts included in said circuit, an electro-magnet in said circuit, said electro-magnet restraining said control switch in closed position when said circuit is closed, and means mechanically restraining said control switch in closed position until said electro-magnet is energized.

14. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position; said electro-motive device included in a normally closed circuit, means responsive to deenergization of said electro-motive device for releasing said switch or breaker, a control switch having contacts included in said circuit, an electro-magnet in said circuit, said electro-magnet restraining said control switch in closed position when said control switch is closed, and means mechanically restraining said control switch in closed position until said electro-magnet is energized, and means interrupting said circuit when said control switch is mechanically restrained and for closing said circuit to transfer the restraint of said control switch to said electro-magnet.

15. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, and an electro-magnetic switch controlling the circuit of said electro-magnetic means comprising two switches and a controlling electro-magnet, the opening of either switch breaking said circuit to deenergize said electro-magnetic means.

16. In combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, and an underload or low voltage circuit breaker controlling the circuit of said electro-magnetic means, said circuit breaker comprising two switches in series, and an operating member for opening one switch when it closes the other.

17. In combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, and an underload or low voltage circuit breaker controlling the circuit of said electro-magnetic means, said circuit breaker comprising two switches in series, and an operating member for opening one switch when it closes the other, means for mechanically restraining one of said switches, and the closure of the other of said switches transferring the restraint of said first switch from said mechanical means to an electro-magnet.

18. The combination with a switch or circuit breaker, of electro-magnetic means con-

trolling the same, a control switch in the circuit of said electro-magnetic means controlled by means responsive to current conditions in another circuit, and a second switch in the circuit of said electro-magnetic means restrained in circuit closing position by a normally energized electro-magnet in said circuit, and means for rupturing said circuit when moving said switch to normal position.

19. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, a control switch in the circuit of said electro-motive device, an electro-magnet restraining said switch in normal position, and means breaking the circuit of said electro-magnet when said control switch is moved to normal position, and a second control switch in the circuit of said electro-motive device controlled by electro-responsive means in another circuit.

20. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, a control switch in the circuit of said electro-motive device, an electro-magnet restraining said switch in normal position, means breaking the circuit of said electro-magnet when said control switch is moved to normal position, means mechanically restraining said switch in normal position until said electro-magnet is energized, and a second control switch in the circuit of said electro-motive device controlled by electro-responsive means in another circuit.

21. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, said electro-motive device included in a normally closed circuit, means responsive to deenergization of said electro-motive device for releasing said switch or breaker, a control switch having a plurality of independently movable contact members controlling said circuit, and an electro-magnet in said circuit, said electro-magnet restraining a movable contact member of said control switch in closed position when said circuit is closed, and a second control switch in the circuit of said electro-motive device controlled by electro-responsive means in another circuit.

22. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, said electro-motive device included in a normally closed circuit, means responsive to deenergization of said electro-motive device for releasing said switch or breaker, a control switch having contacts included in said circuit, an electro-magnet in said circuit, said electro-magnet restraining said control switch in closed position when said circuit is closed, and means mechanically

restraining said control switch in closed position until said electro-magnet is energized, and a second control switch in the circuit of said electro-motive device controlled by electro-responsive means in another circuit.

23. The combination with a switch or circuit breaker, of an electro-motive device for moving the same to normal position, said electro-motive device included in a normally closed circuit, means responsive to deenergization of said electro-motive device for releasing said switch or breaker, a control switch having contacts included in said circuit, an electro-magnet in said circuit, said electro-magnet restraining said control switch in closed position when said control switch is closed, and means mechanically restraining said control switch in closed position until said electro-magnet is energized, means interrupting said circuit when said control switch is mechanically restrained and for closing said circuit to transfer the restraint of said control switch to said electro-magnet, and a second control switch in the circuit of said electro-motive device controlled by electro-responsive means in another circuit.

24. In combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, an underload or low voltage circuit breaker controlling the circuit of said electro-magnetic means, a switch member breaking said circuit when restoring said underload or low voltage circuit breaker to normal position, and a control switch in the circuit of said electro-magnetic means controlled by electro-responsive means in another circuit.

25. In combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, an underload or low voltage circuit breaker controlling the circuit of said electro-magnetic means, said circuit breaker comprising two switches in series, and an operating member for opening one switch when it closes the other, and a control switch in the circuit of said electro-magnetic means controlled by electro-responsive means in another circuit.

26. In combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, and an underload or low voltage circuit breaker controlling the circuit of said electro-magnetic means, said circuit breaker comprising two switches in series, and an operating member for opening one switch when it closes the other, means for mechanically restraining one of said

switches, and the closure of the other of said switches transferring the restraint of said first switch from said mechanical means to an electro-magnet, and a control switch in the circuit of said electro-magnetic means controlled by electro-responsive means in another circuit.

27. The combination with a switch or circuit breaker, of normally energized electro-magnetic means adapted to release said switch or circuit breaker upon deenergization, a control switch for deenergizing said electro-magnetic means in response to electrical conditions in a circuit, a second control switch breaking the circuit of said electro-magnetic means in response to decreased current flow in the circuit of said electro-magnetic means, and a manually operable member for resetting said second control switch and simultaneously breaking the circuit of said electro-magnetic means.

28. The combination with a switch or circuit breaker, of normally energized electro-magnetic means adapted to release said switch or circuit breaker upon deenergization, a control switch for deenergizing said electro-magnetic means in response to electrical conditions in a circuit, and a second control switch breaking the circuit of said electro-magnetic means in response to decreased current flow in the circuit of said electro-magnetic means, said second control switch comprising a movable contact member and an independent actuator and an electro-magnet, said actuator transferring said movable contact member to the control of said electro-magnet when said actuator finally closes said second control switch.

29. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or circuit breaker released in response to deenergization of said electro-magnetic means, and independently movable contact members controlling the circuit of said electro-magnetic means, the actuation of one of said contact members breaking said circuit when moving another of said movable contact members to circuit closing position.

30. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, and an automatic electro-magnetic switch controlling the circuit of said electro-magnetic means, said automatic electro-magnetic switch comprising a plurality of independently movable switches and an associated electro-magnet, the opening of any of said switches adapted to break the circuit of said electro-magnetic means.

31. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker re-

leased in response to deenergization of said electro-magnetic means, and an automatic electro-magnetic switch controlling the circuit of said electro-magnetic means, said automatic electro-magnetic switch comprising a plurality of independently movable switches and an associated electro-magnet, one of said switches adapted to break the circuit of said electro-magnetic means while another is in circuit closing position.

32. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or circuit breaker released in response to deenergization of said electro-magnetic means, and an electro-magnetic switch controlling the circuit of said electro-magnetic means and comprising a plurality of switches and an electro-magnet, said switches adapted to alternately close the circuit of said electro-magnetic means.

33. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, and a control switch in the circuit of said electro-magnetic means and comprising a switch moved to circuit closing position by a member which simultaneously breaks the circuit of said electro-magnetic means.

34. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or circuit breaker released in response to deenergization of said electro-magnetic means, a control switch in the circuit of said electro-magnetic means comprising a switch moved to circuit closing position by a member

simultaneously breaking a circuit, and an electro-magnet for restraining said switch in circuit closing position energized in response to return movement of said member.

35. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or circuit breaker released in response to deenergization of said electro-magnetic means, a control switch in the circuit of said electro-magnetic means comprising a switch moved to circuit closing position by a member simultaneously breaking a circuit, an electro-magnet for restraining said switch in circuit closing position energized in response to return movement of said member, and means responsive to current conditions in another circuit for breaking the circuit of said electro-magnetic means.

36. The combination with a switch or circuit breaker, of normally energized electro-magnetic means, said switch or breaker released in response to deenergization of said electro-magnetic means, a control switch in the circuit of said electro-magnetic means and comprising a switch moved to circuit closing position by a member which simultaneously breaks the circuit of said electro-magnetic means, and means responsive to electrical conditions in another circuit for breaking the circuit of said electro-magnetic means.

In testimony whereof I have hereunto affixed my signature in the presence of the two subscribing witnesses.

WILLIAM M. SCOTT.

Witnesses:

ETHEL L. FERGUSON,
GERTRUDE MAHER.