W. M. SCOTT.

CIRCUIT CONTROLLING APPARATUS.

APPLICATION FILED NOV. 27, 1908.

998,925. Patented July 25, 1911.

3 SHEETS—SHEET 1.

FIG. 1.

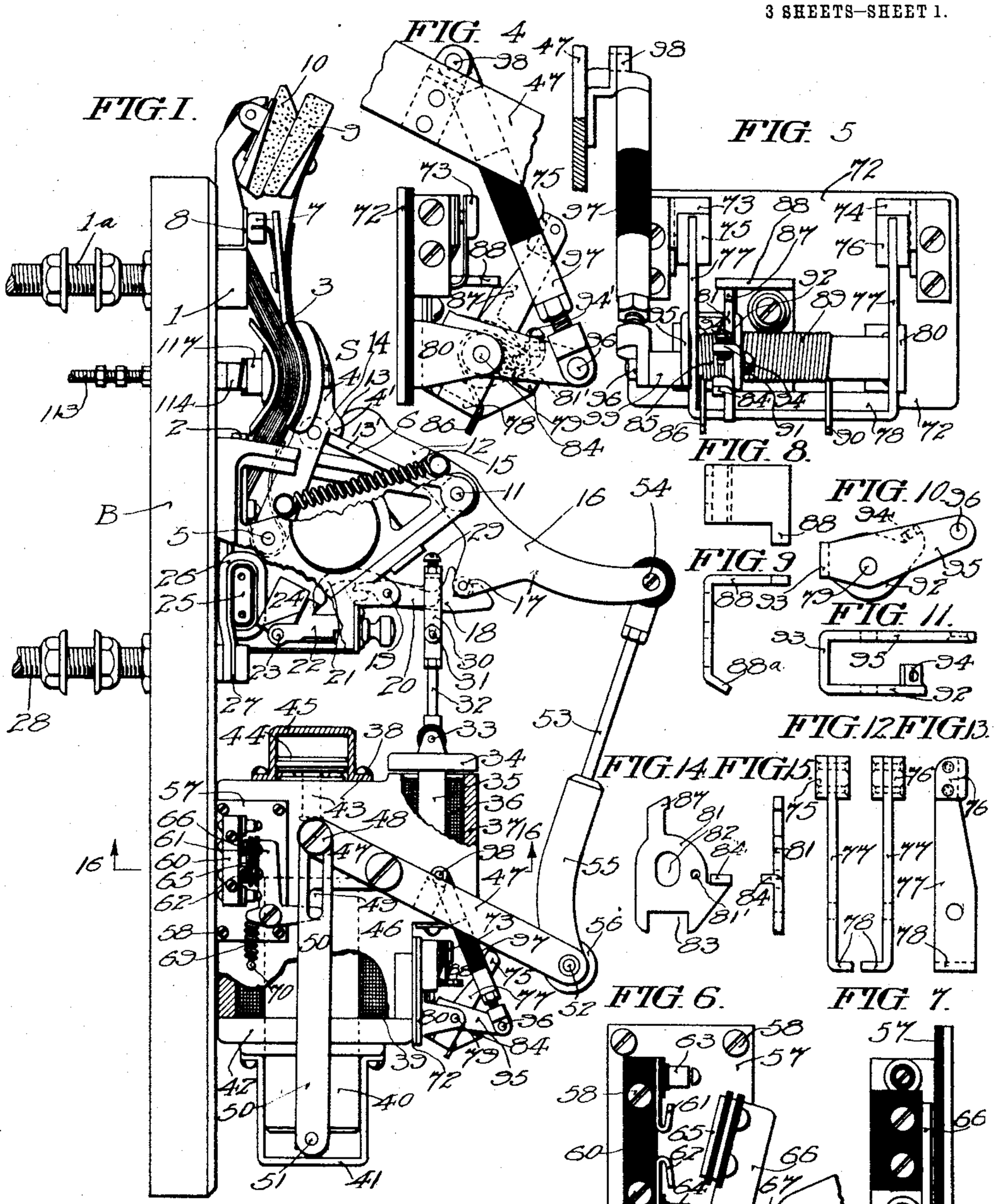


FIG. 4.

FIG. 5.

FIG. 8.

FIG. 10.

FIG. 9.

FIG. 11.

FIG. 12.

FIG. 13.

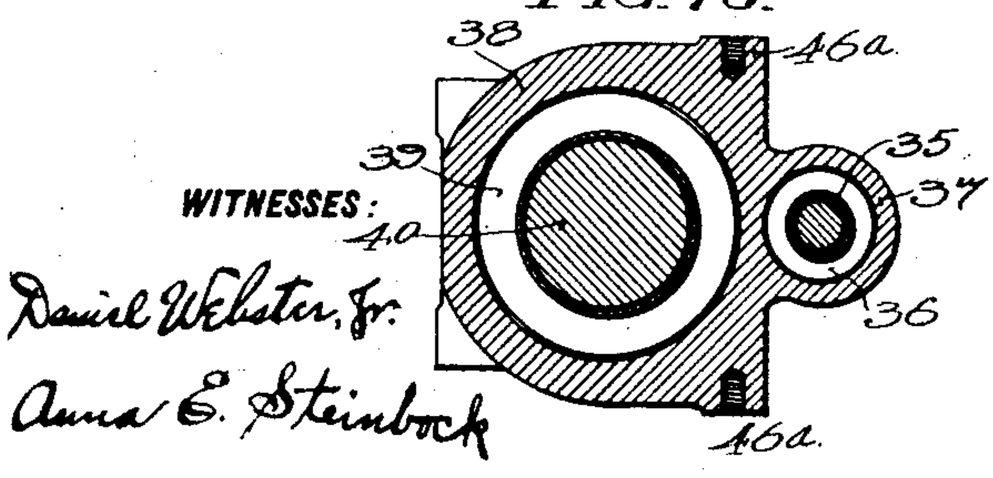
FIG. 14.

FIG. 15.

FIG. 6.

FIG. 7.

FIG. 16.



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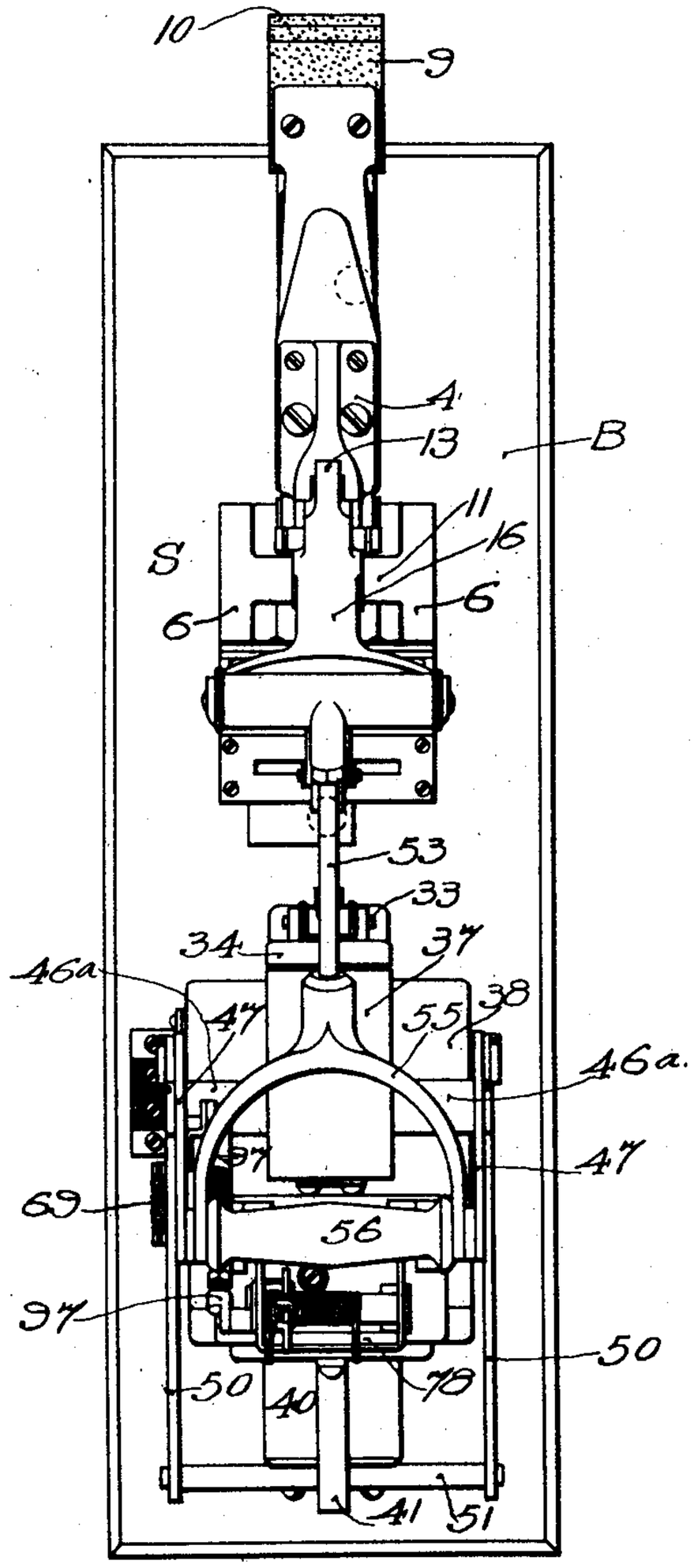
3 SHEETS—SHEET 2.

FIG. 2.



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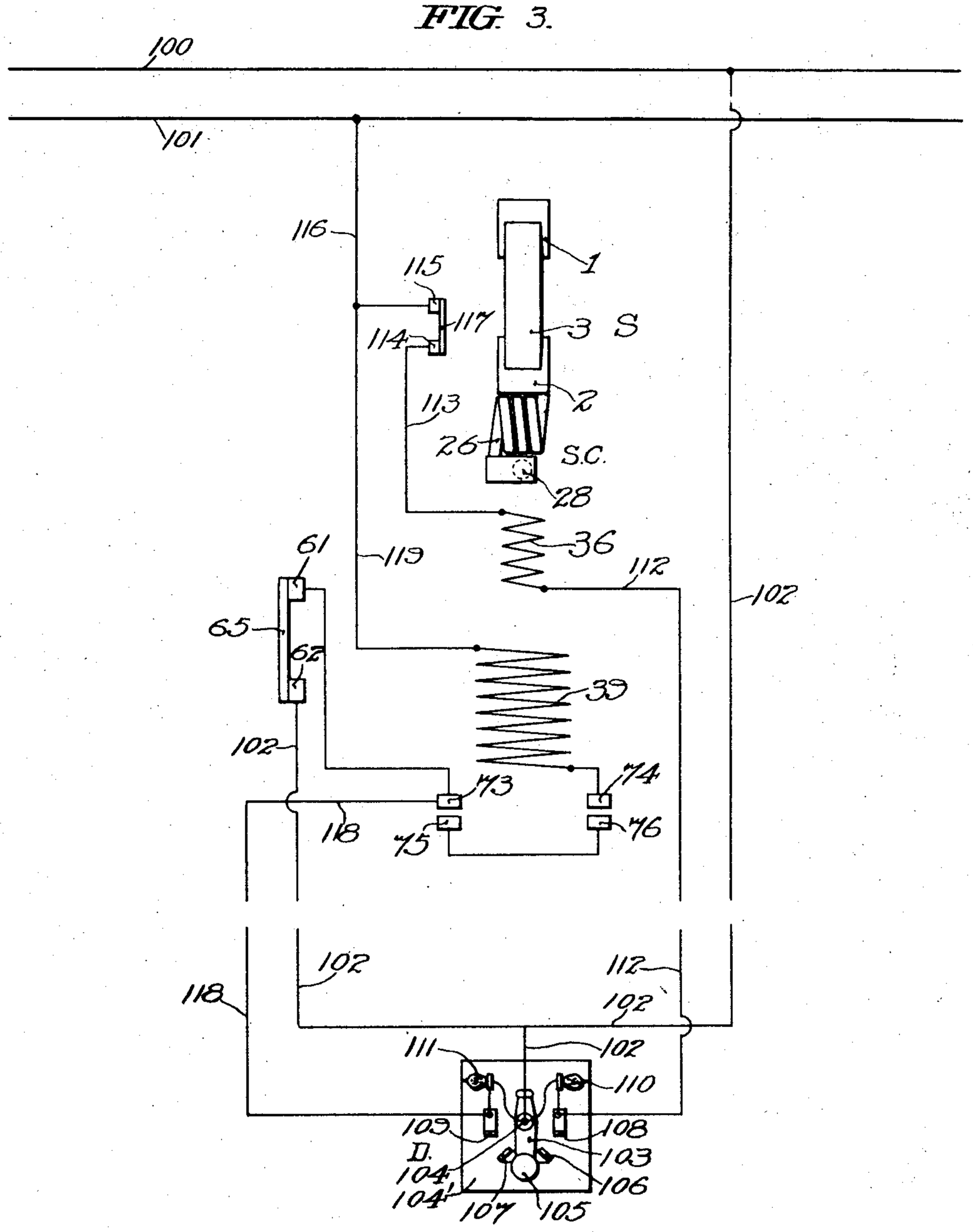
3 SHEETS—SHEET 3.

FIG. 3.



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CIRCUIT-CONTROLLING APPARATUS.

998,925. Specification of Letters Patent. Patented July 25, 1911.

Application filed November 27, 1908. Serial No. 464,732.

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 Circuit-Controlling Apparatus, of which the following is a specification.

My invention relates to means for controlling a circuit or circuits, and particularly to exercising such control from a distance.

More particularly my invention resides in circuit controlling apparatus comprising an electric switch, automatic or otherwise, which may be either tripped or caused to open from a distance and reset or closed from a distance.

My invention resides further in the features of construction hereinafter pointed out and claimed.

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

Figure 1 is a side elevational view, parts in section, illustrating an automatic electric switch or circuit breaker provided with electro-magnetic means for resetting or closing the same and for tripping or causing the same to open from a distance. Fig. 2 is a front elevation of the same. Fig. 3 is a diagrammatic view illustrating the control circuits and parts. Fig. 4 is a side elevational view, on enlarged scale, of a snap switch whose operating member is mechanically connected with the switch or circuit breaker operating member. Fig. 5 is a front elevational view of the same. Fig. 6 is a side elevational view, on enlarged scale, of what I term the "localizing" switch, which, after the beginning of the closing movement of the main switch or circuit breaker as controlled from a distance, robs a distant switch of control, and the switch or circuit breaker is moved to full circuit closing position independently of the distant switch. Fig. 7 is a side view of the localizing switch. Fig. 8 and Fig. 9 are plan and edge views respectively of a lug member of the snap switch shown in Figs. 4 and 5. Figs. 10 and 11 are side and plan views respectively of the spring winding member of the snap switch. Figs. 12 and 13 are edge and side views respectively of the contact and contact carrying member of the snap switch. Figs. 14 and 15 are side and edge views respectively of the latch or detent member of the snap switch. Fig. 16 is a horizontal sectional view through the closing and tripping solenoids.

In the drawings, B represents a suitable base, which may consist of a slab of marble, slate, or other suitable insulating material, upon which is mounted the main switch or circuit breaker S comprising the main contact blocks or terminals 1 and 2, secured upon the base B and adapted to be engaged and bridged by the laminated bridging contact member 3. The laminated contact 3 is supported by but insulated from the arm 4 pivoted at 5 to the bracket or housing 6 secured upon the base B. The supplemental metallic shunt contacts 7 and 8 are adapted to separate just after the bridge 3 separates from main contacts 1 and 2, and thereafter the carbon shunt contacts 9 and 10 separate, the final arc taking place at these carbons, as well understood in the art.

Pivoted at 11, in the housing 6, is a cam operating member 12 which has the cam surface 13 adapted to engage with the roller 14, pivoted in the arm 4, to force the laminated bridging member 3 against the main contacts 1 and 2 to close circuit. The lug 4′ on arm 4 engages the lateral extension 13′ on member 12 when the parts are in full circuit closing position, to prevent overtravel. The spring 15 is connected at one end to the cam member 12 and at its other end to the pivoted arm 4. The cam member 12 extends outwardly beyond the pivot 11 to form the lever 16 carrying the roller 17 with which is adapted to engage the latch 18 pivoted at 19 to the housing or bracket 6. This latch 18 holds the switch or circuit breaker S in circuit closing position. Also pivoted at 19 is the latch actuating member 20 having the tail 21 which extends into the path of upward travel of the member 22, pivoted at 23, and carrying the armature 24 of the over-load or other tripping magnet whose core is 25 surrounded by a winding 26 whose one terminal is at 27 in electrical communication with a stud 28 forming one terminal of the switch or circuit breaker. The other terminal of the winding or coil 26 is connected to the main switch contact 2, and the main contact 1 is connected with stud 1ª which forms the other terminal of the switch S. The latch actuating member 20 carries at its forward

end an adjustable screw 29 adapted to engage upon the top side of the latch 18 to actuate the same. To the latch actuating member 20 is secured a downwardly extending stirrup member 30 to which is pivoted at 31 the downwardly extending rod 32 pivoted at 33 to the head 34 on the core 35 of a tripping solenoid or magnet whose winding is 36 and which is provided with a jacket of magnetic material 37, this jacket being cast or made integral with the jacket 38 of the solenoid which closes the circuit breaker or switch S, the winding 39 of that solenoid surrounding the core 40 whose downward travel is limited by the stirrup 41 secured to the lower head 42 of the larger solenoid.

In its upward travel and during the latter part of its travel, the solenoid core 40 engages the pin or rod 43 which carries on its upper end the piston or plunger 44 of a dash pot whose casing or cylinder 45 is secured upon the top head of the larger solenoid.

Pivoted at 46 to lugs 46ª on the solenoid jackets are the levers or bars 47 which at their inner ends carry pins 48 engaging in the slots 49 in the vertically extending levers or bars 50 which are pivoted at their lower ends at 51 to the solenoid core 40. At its outer end each lever 47 is pivoted at 52 to the connecting rod 53 which, in turn, is pivoted at 54 to the arm 16 of the cam member 12 of the switch or circuit breaker S. Between the rod 53 and the levers 47 is the bifurcated member 55 carrying the operator's handle or grip 56 which extends between the two levers 47. By handle 56 the switch S may be manually closed.

The localizing switch, shown in Figs. 6 and 7, has the base 57 which is secured by screws 58 to the side of the solenoid jacket 38. To the plate 57 is secured by screws 59 a block of insulating material 60 upon which are secured the resilient switch contacts 61 and 62 having the binding posts 63 and 64 respectively. Adapted to engage and bridge the contacts 61 and 62 is the contact 65 carried by but insulated from the lever 66, pivoted at 67, and having an extension 68 to which one end of the tension spring 69 is secured, the other end being secured at 70 to the jacket 38. The lever 65 has also the tail or extension 71 which extends into the path of travel of the inner end of one of the pivoted bars or levers 47, so that when the breaker or switch S has opened and the lever 47 has rotated in a counted-clockwise direction about its pivot 46 it engages the top of the arm 71 to hold the localizing switch in open circuit position against the opposition of spring 69.

Immediately below the jacket 37 of the smaller tripping solenoid and secured to the jacket 38 of the larger operating solenoid, is the base plate 72 of the snap switch shown in Figs. 4 and 5. This switch has the two stationary yielding contacts 73 and 74 with which are adapted to engage respectively the movable contacts 75 and 76 carried on the arms 77 of the contact carrying member 78, shown further in Figs. 12 and 13. This contact carrying member 78 is pivoted upon the spindle or shaft 79 supported in the two standards 80. Also pivoted about the spindle 79, and adapted to reciprocate radially with respect thereto, is the latch or detent member 81 having the opening 82, see Figs. 14 and 15, for allowing such radial reciprocation. The detent member 81 has a notch 83 which straddles or embraces the contact carrying member 78, so that they move each with the other. It has also the wing or ear 84. To the member 81 is secured, at 81′, one end of the helically coiled spring 85, whose other end 86 engages the contact carrying member 78. This detent spring 85 being so coiled and under strain exerts a force in such direction or having a component in such direction as to tend to lift or elevate the member 81, so that its detent or extension 87 shall engage with the fixed projection or lug 88 secured to the base 72. The main actuating spring 89 has its one end 90 engaging on one side of the contact carrying member 78, while its other end is secured at 91 to the wing 92 of the spring winding member 93, shown in Figs. 10 and 11, which is also pivoted upon the shaft 79. The wing 92 carries a lug or projection 94 carrying the adjustable screw 94′ adapted to engage upon the top of the ear or wing 84 of the detent member 81. To the other wing 95 of the spring winding member 93 there is connected a pin 96, upon which is pivoted the adjustable connecting rod or lever 97 pivoted at 98 to the bar or lever 47. A bushing or separator 99 intervenes between the end of the connecting rod 97 and the wing 95 of the spring winding member.

Referring now to Fig. 3, 100 and 101 represent the two conductors of a circuit which may or may not be associated with the circuit including the main circuit breaker or switch contacts 1 and 2. The circuit breaker or switch S, with its operating and controlling mechanism, may be located at any suitable or desired place, while the distant control switch D may be at any other station or place. From the conductor 100 extends a conductor 102 which connects with the movable switch arm 103 pivoted at 104, to the base 104′, and having the operator's handle or grip 105. This lever 103 carries the two contacts 106 and 107 adapted to engage respectively with the stationary contacts 108 and 109, the contacts 106 and 107 being in communication with the conductor 102. Between the contact 108 and

the switch lever 103, or conductor 102, is connected an incandescent lamp 110. And, similarly, between the lever 103 and the contact 109 is connected the incandescent lamp 111. From the contact 108 extends a conductor 112 to one terminal of the solenoid winding 36, the other terminal of such winding being connected through conductor 113 to one terminal 114 of a switch located on the base B between the main contacts 1 and 2. The other contact 115 is connected by conductor 116 to the other circuit wire 101. The contacts 114 and 115 are bridged, when the circuit breaker or switch S is closed, by the contact 117 carried by but insulated from the laminated bridging contact 3.

From contact 109 extends a conductor 118 which extends to one contact 73 of the snap switch hereinbefore described. The switch contacts 75 and 76 are in electrical communication with each other and, accordingly, when the switch is closed, they bridge the contacts 73 and 74. One terminal of the winding 39 of the operating solenoid connects with the switch contact 74 while the other terminal of the winding 39 connects by conductor 119 with the circuit conductor 101. The conductor 102 connects also with the contact 62 of the localizing switch, whose contact 61 connects with the contact 73 of the snap switch.

The operation is as follows: Assuming the circuit breaker or switch S in circuit closing position as shown in Fig. 1, there is a circuit through the conductor 102, indicating incandescent lamp 110, conductor 112, solenoid winding 36, switch 117, to the other side of the circuit. Under these circumstances, the lamp 110 glows indicating at the distant switch D that the circuit breaker or switch S is closed. If the operator desires to trip the circuit breaker or switch S from the distant station, he moves the handle 105 to the right, as viewed in Fig. 3, so that contact 106 engages contact 108, whereupon lamp 110 is short circuited and a greater current will flow from conductor 100 through conductor 102, through contacts 106 and 108 and conductor 112 and the winding 36 of the tripping solenoid whereupon the solenoid core 35 will be attracted or pulled downwardly, against a spring, to transmit force through the connecting rod 32, stirrup 30 to the latch actuating member 20, which causes the screw 29 to impinge upon the upper side of the latch 18 to move it downwardly and thus release the cam member 12, whereupon, under the influences of gravity, the resiliency of the bridging member 3 and the tension of the spring 15, the laminated bridging member separates from its contacts 1 and 2, the final arc taking place at carbons 9 and 10, as hereinbefore described, and the cam member rotates in a counter-clockwise direction, as seen in Fig. 1, about its pivot 11 until the parts assume open circuit position. This same effect of opening the switch or circuit breaker S is, of course, obtainable by an overload or other condition in the circuit in which the switch or circuit breaker S is included. In such case, the armature 24 is attracted, due to the energization of the magnet winding 26, so as to cause the member 22 to strike against the under side of the tail 21 of the latch actuating member 20 which then strikes upon the top of the latch 18 to release the lever 16 of the cam member 12, as just described. As the bridging member 3 leaves its contacts 1 and 2, the switch contact 117 also separates from contacts 114 and 115, thus interrupting the circuit of the winding 36 of the tripping solenoid. In the opening movement of the circuit breaker, the lever or bar 47 rotates in the same direction as the lever 16, that is, in a counter-clockwise direction, about its pivot 46, thus pulling upwardly upon the connecting bar or rod 97 and causing the spring winding member 93, of the snap switch, to rotate in a counter-clockwise direction, as viewed in Figs. 1 and 4, causing the contact carrying member 78 to be carried around with it and to bring the contacts 75 and 76 into engagement with and to bridge the contacts 73 and 74. And, concurrently, the detent 87 on the detent member 81 rides under and past the stationary lug 88, whereupon the spring 85 lifts the detent member 81 so that the detent 87 engages behind the lug 88. With the snap switch thus closed, when the circuit breaker or switch S is in its open position, it will be seen, from Fig. 3, that there is a circuit through the lamp 111, the snap switch, and the winding 39 of the main operating solenoid causing the lamp 111 to glow and indicate that the circuit breaker or switch S is in open position and that the circuit of the solenoid 39 can be completed at the distant station D.

To close the circuit breaker or switch S, the operator moves the lever 103, which is either spring or gravity controlled, to always assume the central position shown in Fig. 3, to bring the contact 107 into engagement with contact 109, whereupon lamp 111 is short circuited and a greater current will flow from conductor 102 through conductor 118, through the snap switch, the winding 39 of the operating solenoid, through conductor 119 to the other side of the circuit. This energizes the operating solenoid so that its core 40 is drawn upwardly, the latter part of the movement being opposed by dash pot 44, 45, causing the bars 50 to engage, at the lower end of the slots 49, with the pins 48 on the levers 47, thus rotating levers 47 in a clockwise direction, as viewed in Fig. 1, and so pulling downwardly on the rod 53 and downwardly upon the outer end of the

lever 16, causing the cam member 12, of the switch or breaker S, to rotate in a clockwise direction about the pivot 11, whereupon the cam surface 13, engaging roller 14, forces the parts into circuit closing position as shown in Fig. 1, the latch 18 engaging roller 17 to lock the parts in such position. After this movement of bars or levers 47 has begun, the inner end of the one lever 47 moves out of engagement with the lever arm 71 of the localizing switch, allowing the spring 69 of that switch to bring the contact 65 into engagement with contacts 61 and 62. The result is, as seen from Fig. 3, that the operator at the switch D need not hold contacts 107 and 109 in engagement except momentarily, for after the localizing switch is closed, the circuit of the solenoid winding 39 remains closed independently of the distant switch. From this arrangement, it follows that once the closing movement has been started by the distant switch, the operator at the distant switch is powerless to prevent the completion of the closing movement or operation. And as the clockwise movement of the lever 47 begins, it thrusts downwardly upon the connecting rod or bar 97, thus moving the spring winding member 93 of the snap switch in a clockwise direction, as viewed in Figs. 1 and 4. This winds up the spring 89 and at the end of the switch or circuit breaker closing movement the adjustable screw 94′ carried by the lug 94 (the screw 94′ being adjustable for the purpose of nicely timing the instant of operation of the snap switch) engages upon the top of the ear or wing 84 of the detent member 81, causing it to move radially, in virtue of slot 82, and draw the detent 87, at the moment of locking switch S, from engagement with the stationary lug 88, whereupon the spring 89 snaps the contact carrying member 78 to open circuit position, thus separating the contacts 75 and 76 from contacts 73 and 74 respectively, and so breaking the circuit of the winding 39 of the operating solenoid, as will appear from Fig. 3, at the moment of locking switch S. The core 40 and attached bars 50 then drop to position of Fig. 1, the slots 49 permitting such movement. When the circuit breaker is opened, as hereinbefore described, the arm 47, in its counter-clockwise movement, as viewed in Fig. 1, finally engages with its inner end upon the top of the arm 71 of the localizing switch, opening that switch so as to throw the control of the solenoid winding 39 to the distant switch D.

From the foregoing description, it is apparent that I have provided means for controlling a switch or automatic circuit breaker from a more or less distant point, a solenoid operating only to close the switch or breaker, the switch or breaker closing movement being accompanied by the early closure of a localizing switch, and finally by the operation of a snap switch to break the circuit of the operating solenoid.

What I claim is:

1. The combination with a main switch, of a solenoid for moving said main switch to normal position, an operator's switch for controlling said solenoid, a local switch normally closed for controlling said solenoid independently of said operator's switch, said local switch being closed after the main switch movement to normal position is initiated, and a member associated with said main switch for opening said local switch when said main switch opens.

2. The combination with a main switch, of means for locking the same in normal position, an operating solenoid for moving said main switch to normal position, a solenoid for unlocking said switch, a distant switch for controlling said operating and tripping solenoids, a local switch controlling said operating solenoid, said local switch having a bias toward closed position, and mechanism of said main switch holding said local switch open until after the beginning of the closing movement of said main switch.

3. The combination with a main switch, of means for locking the same in normal position, an operating solenoid for moving said main switch to normal position, a tripping solenoid, a distant switch for controlling said operating and tripping solenoids, a normally closed local switch controlling the circuit of said operating solenoid, mechanism of said main switch holding said local switch open until after the beginning of the closing movement of said main switch, said local switch when closed rendering said operating solenoid indifferent to said distant switch, a second local switch controlling said operating solenoid, and a mechanical connection between said second local switch and said main switch for opening said second local switch when said main switch has attained normal position.

4. The combination with an electric switch, of means for restraining the same in normal position, a solenoid for operating said switch, a mechanical connection between the movable core or armature of said solenoid and said main switch, a local switch controlling said operating solenoid, said local switch being normally in position to allow energization of said operating solenoid, and means coöperating with said mechanical connection for holding said local switch in abnormal position until after the beginning of the closing movement of said main switch.

5. The combination with an electric switch, of a solenoid for moving said switch to normal position, a bar connected to the core of said solenoid, and a pivoted lever intervening between said bar and said switch,

said bar being slotted whereby after movement of said switch to normal position the core of said solenoid may return to its normal position.

6. The combination with a main switch, of an operating solenoid therefor, a distant switch in circuit with said solenoid, a local switch controlling said solenoid, and a switch in circuit with said solenoid operated with and by said main switch for deënergizing said solenoid when said main switch reaches normal position.

7. The combination with a main switch, of a solenoid for moving the same to normal position, a bar connected to the core of said solenoid, a pivoted lever coöperating with said bar, a connection from said lever to the movable member of said main switch, a switch and a local switch controlling the circuit of said solenoid, said switch and local switch being operated by said pivoted lever.

8. The combination with an electric switch, of a solenoid for operating the same, a jacket for said solenoid, a lever pivoted upon said jacket, a bar connected to the core of said solenoid and having a pin and slot connection with said lever, and a connection from said lever to the movable member of said switch.

9. The combination with a main switch, of an operating solenoid therefor, a jacket for said solenoid, a lever pivoted to said jacket, a connection from said lever to the movable member of said switch, and a bar connected with the core of said solenoid and having a lost motion connection with said lever.

10. The combination with a main switch, of a solenoid for operating the same, a covering therefor, a lever pivoted to said covering, a slotted connection between said lever and the core of said solenoid, local switches controlling said operating solenoid disposed upon said covering and both operated by said lever, one of said local switches being closed after the beginning of the closing movement of said lever, and another of said local switches operated to break the circuit of said solenoid when said main switch has reached normal position.

11. The combination with a main switch, of a solenoid for operating the same, a pivoted lever operated by the core of said solenoid in one direction only, a snap switch controlling the circuit of said solenoid, an operating connection between said lever and said snap switch, and means for accurately timing the actuation of said snap switch at the completion of the movement of said main switch to normal position.

12. The combination with a main switch, of a solenoid for operating the same, an operator's switch for controlling said solenoid, a local switch in parallel with said operator's switch and held closed after the beginning of the closing movement of said main switch, a second local switch controlling said solenoid, and mechanical means connected with said main switch for operating said local switches alternately.

13. The combination with a main switch, of a solenoid for operating the same, two local switches controlling said operating solenoid, mechanical means connected with said main switch for operating said local switches, and a distant switch controlling said operating solenoid, one of said local switches being controlled by the main switch after the closing movement of said main switch is initiated to maintain the energization of said solenoid independently of said distant switch and the second local switch actuated to deënergize said operating solenoid when said main switch has reached normal position.

14. The combination with a main switch, of a solenoid for operating the same, a mechanical connection between the movable core or armature of said solenoid and said main switch, two local switches controlling said solenoid, and both operated by the mechanical connection between said main switch and the movable core or armature of said solenoid, and a distant switch controlling said solenoid, one of said local switches closing a local circuit to maintain said solenoid energized after the initiation of the closing movement of said main switch, and the other local switch causing the deënergization of said solenoid when said main switch reaches normal position.

15. The combination with a main switch, of a solenoid for operating the same, an operator's switch controlling said solenoid, a local switch in parallel with said operator's switch, a second local switch controlling said solenoid, and mechanical means connected with said main switch for operating said local switches, said first local switch being opened when said main switch opens and closes after the beginning of the main switch closing movement, and said second local switch deënergizing said solenoid when said main switch reaches normal position and moved to a position to energize said solenoid when said main switch opens.

16. The combination with a main switch, of an operating solenoid therefor, a mechanical connection between the movable member of said solenoid and said main switch, a local switch controlling said solenoid and biased toward closed position, a second local switch controlling said solenoid, and means coöperating with said mechanical connection for opening said first local switch and closing said second local switch when said main switch opens.

17. The combination with a main switch, of a solenoid for moving the same to normal position, a lost motion connection between

the core of said solenoid and the movable member of said main switch, a lever comprised in said connection, a switch controlling said solenoid, and a connection from said lever to said controlling switch, whereby said controlling switch deënergizes said solenoid when said main switch has reached normal position.

18. The combination with a main switch, of a solenoid for moving the same to normal position, a lever connecting the core of said solenoid and the movable member of said main switch, said lever having lost motion with respect to said core, an operator's switch controlling said solenoid, a local switch controlling said solenoid, and a connection from said lever to said local switch, whereby said local switch deënergizes said solenoid when said main switch has reached normal position.

19. The combination with a main switch, of a solenoid for moving the same to normal position, a lever connecting the core of said solenoid and the movable member of said main switch, an operator's switch, two local switches controlling said solenoid, a connection from said lever to one of said local switches for deënergizing said solenoid when said main switch has reached normal position, and the second local switch actuated by said lever when said main switch opens to shift control of said solenoid to said operator's switch.

20. The combination with a main switch, of an operating solenoid therefor, a jacket for said solenoid, a lever pivoted to said jacket, a connection from said lever to the movable member of said switch, and a lost motion connection between said lever and the core of said solenoid, and controlling switches for said solenoid disposed upon said jacket and alternately operated by said lever.

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

WILLIAM M. SCOTT.

Witnesses:

A. E. STEINBOCK,

DANIEL WEBSTER, JR.