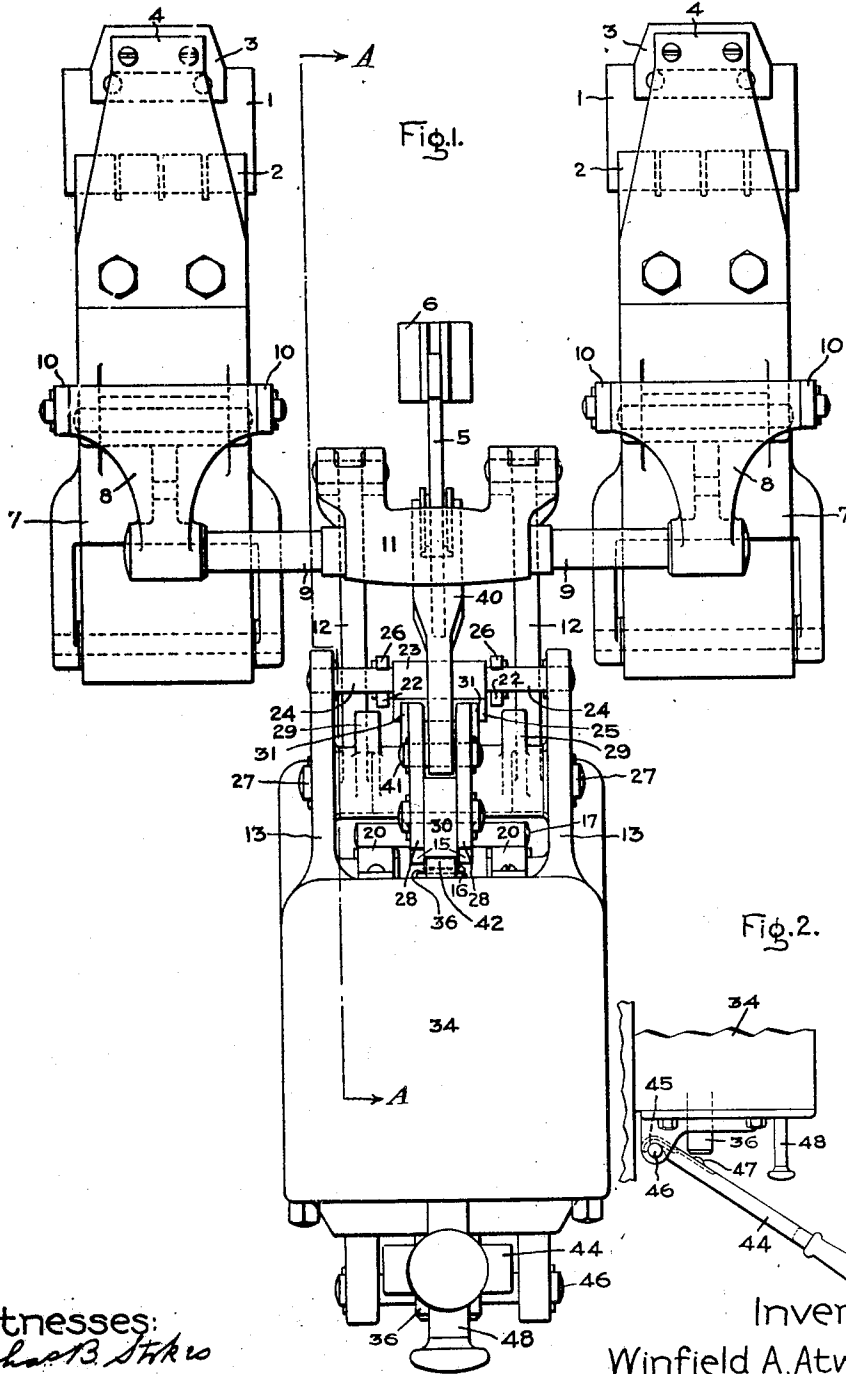


W. A. ATWOOD.
FIELD CONTROL SWITCH.
APPLICATION FILED JUNE 28, 1913.

1,229,014.

Patented June 5, 1917.
2 SHEETS—SHEET 1.



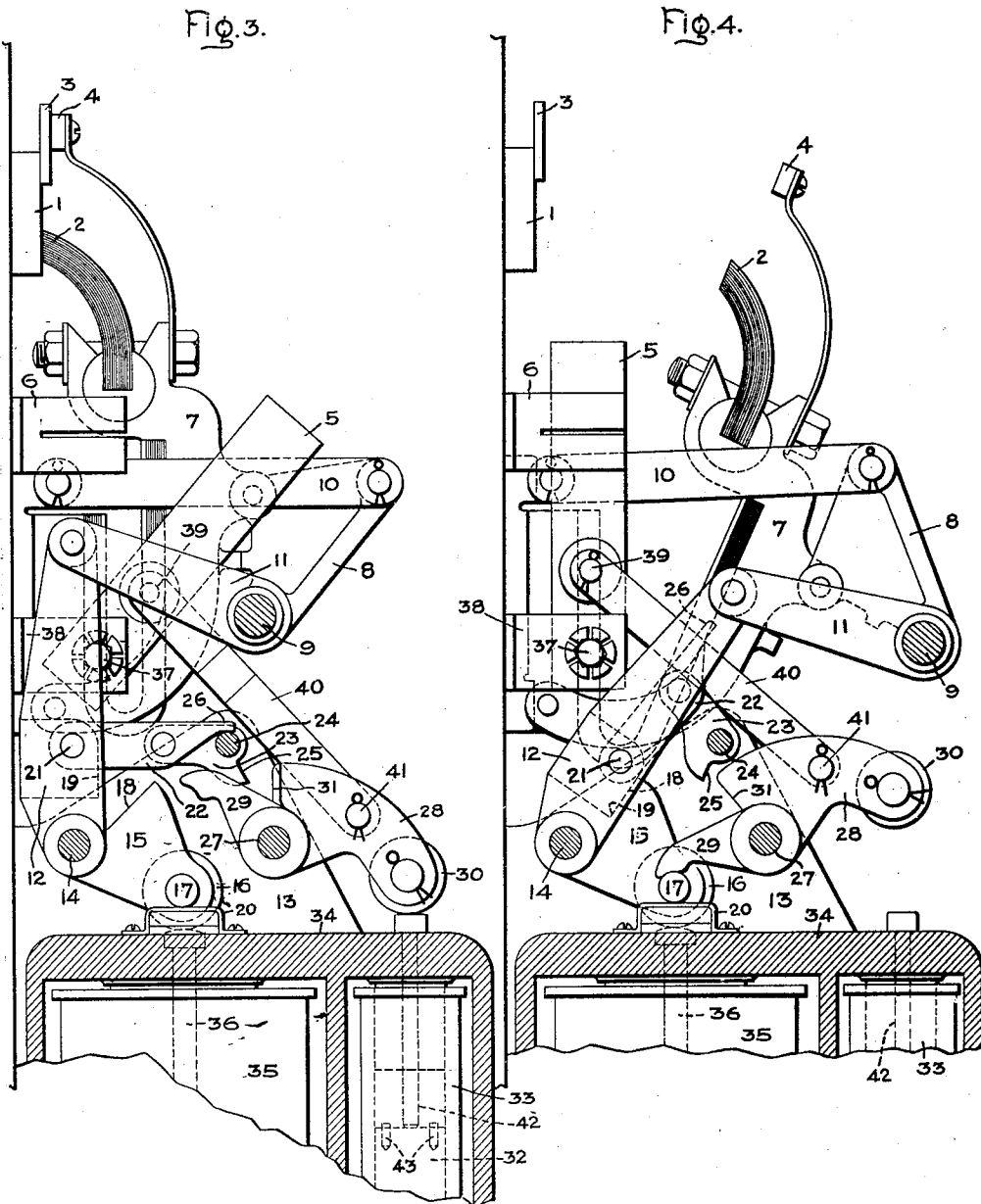
Witnesses:
Chas B. Stark
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Inventor
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His Attorney.

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UNITED STATES PATENT OFFICE.

WINFIELD A. ATWOOD, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

FIELD-CONTROL SWITCH.

1,229,014.

Specification of Letters Patent.

Patented June 5, 1917.

Application filed June 28, 1913. Serial No. 776,282.

To all whom it may concern:

Be it known that I, WINFIELD A. ATWOOD, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Field-Control Switches, of which the following is a specification.

My invention relates to electric switches, and more particularly to field switches for dynamo-electric machines.

More specifically my invention relates to solenoid-operated switches which automatically close the field circuit of a dynamo-electric machine through a resistance, just before the main circuit is broken, whereby the energy of the current resulting from the electromotive force produced by the sudden collapse of the field is dissipated and the well known attendant disturbances eliminated.

The object of my invention is to provide a switching mechanism which will operate to positively close the field switch with a proper time interval before the main circuit is opened and which will also positively open the field switch with a proper time interval before the main circuit closes. Another object of my invention is to provide switching mechanism for the main field circuit and for the resistance circuit which will coact automatically and in proper sequence. A further object of my invention is to provide a mechanism which will be positive in its action, occupying a minimum amount of space and which is in general an improvement upon previous switches of this character.

The novel features which I believe to be characteristic of my invention will be definitely indicated in the claims appended hereto; the features of construction and mode of operation will be best understood by reference to the following description taken in connection with the accompanying drawings in which Figure 1 is a front elevation of a switch embodying the novel features of my invention; Fig. 2 shows the application of the switch hand closing member; and Figs. 3 and 4 are end elevations partly in section

along the line A—A of Fig. 1 showing the main switch in open and closed positions and having one pole of this switch removed for the purpose of clearness.

Referring to the drawings, the switch construction shown comprises the cooperating main contacts 1 and 2, the movable main contacts 2 being of the usual laminated type and adapted to be put under a spring tension when the switch is closed. In connection with the main contacts are the auxiliary or shunt contacts 3 and 4 arranged to separate after the main contacts have broken engagement. The main contacts 1 and 2 and the corresponding auxiliary contacts 3 and 4 will hereafter be referred to as the main switch or the main field switch. Between the two poles of the main switch, as shown more clearly in Fig. 1, there is located an auxiliary or discharge switch for the dynamo electric machine comprising the movable contact member 5 and a cooperating fixed contact member 6. The movable contact member 5 is arranged to automatically close or open the field discharge resistance circuit in response to movement of the main switch contacts, by a novel coacting mechanism which will be hereinafter more fully described.

When the main switch is closed, the discharge or auxiliary switch is open, as shown in Fig. 3, so that no energy is consumed by the resistance which is thrown into the field circuit when the discharge switch is closed. During the operation of opening the main switch, however, and just before the main contacts separate, the discharge switch is automatically closed, thereby short circuiting the field winding through a resistance in order to efficiently dissipate the energy of the "inductive kick" so that the main switch opens with no disastrous effects. The "inductive kick" is understood as the energy of the current resulting from the electromotive force produced by the sudden change of intensity of the field magnetism. The discharge switch remains closed while the main switch is opened as shown in Fig. 4. Upon closing the main switch, and before the shunt contacts 3 and 4 come into engage-

ment, the discharge switch is automatically opened, to eliminate the resistance from the field circuit. Throwing a resistance into the field circuit to reduce the excessive arcing due to the "inductive kick" when the main switch opens, is well known in the art, but by my invention the aforementioned operations may be most efficiently and economically carried out, the sequence of operation of the switches being entirely automatic.

The type of switch construction shown in Fig. 1, as an embodiment of my invention, has two poles, each comprising the two movable main and auxiliary contacts 2 and 4 respectively, which are suitably mounted upon the frames 7 which are in turn connected by means of the rocker arms 8 to a common shaft 9. This shaft is actuated to move the main and auxiliary contacts of each pole into or out of circuit closing position. Links 10 are pivotally connected, at one end to the rocker arms 8 and at their other end to the switch support, to firmly support the switch frame and to facilitate the movement of the rocker arms 8. Rotatably mounted upon the shaft 9 is a U-shaped member 11 having bifurcated ends. Pivotally connecting each of the bifurcated ends, is another substantially U-shaped member 12 preferably integral, which is in turn mounted between the protective plates 13 upon the shaft 14. Mounted upon the same shaft 14, is an actuating lever member 15 which has at its other end preferably a roller bearing 16 mounted upon a shaft 17. The actuating lever 15 is arranged with a contact surface 18 which coacts with the contact surface 19 of the U-shaped member 12, to actuate the U-shaped members 11 and 12, the rocker arms 8, shaft 9, and the links 10, to close the main switch. Whether the main switch is open or closed, shaft 17 of the roller bearing 16 rests upon the bearing supports 20 which is the normal position of the actuating lever member 15. A rubber buffer shock absorber is held in position against roller 16 by supports 20. Upon opening the main switch, the contact surface 19 of the U-shaped member 12 comes into engagement with the contact surface 18 of the actuating member 15 and limits the opening movement of the switch. The engagement of the contact surfaces 18 and 19 to arrest the movement of the main switch in opening, is shown in Fig. 4. The mechanism so far described is that put into operation to close the main switch and may be called collectively the circuit closing mechanism of the main switch.

Pivotally mounted upon a shaft 21, which passes through the U-shaped member 12, are toggle links 22 and, pivotally connected with these toggle links, is a cooperating U-shaped toggle member 23 acting with the toggle links 22 to lock the main switch in its closed

position. The U-shaped toggle member 23 is mounted between the protective plates 13 upon a shaft 24 which is journaled in the protective plates. This U-shaped member has a lug 25 so positioned that an impact upon it will cause the toggle member 23 to move and, in its moving, to lift the toggle member 22. The latching toggle 22-23 then collapses permitting the U-shaped member 12 to move toward member 15 thus allowing the spring action of members 2 to open the main switch. The toggle links 22 each have at their ends a finger 26 which rests upon the shaft 24 when the toggle members are in their rigid or closed position and which prevents the toggle members from being moved beyond center.

Cooperating with the toggle member 23 is a tripping mechanism 28 secured to a shaft 27 which is in turn pivotally mounted between the protective casings 13. This tripping mechanism is comprised of the bifurcated arms 28 and the dogs 29 preferably integral. At one end, the bifurcated arms 28 are connected by a shaft upon which is mounted a roller bearing 30 and at the other end the arms terminate in shoulders 31 suitably positioned to make contact with the lug 25 when the tripping mechanism is actuated. The extent of travel of the tripping mechanism is limited in its tripping movement by the dogs 29, the ends of which terminate in a curved surface adapted to engage with the shaft 17 as shown in Fig. 4. This tripping mechanism coacts with the toggle members 22 and 23, and forms what may be called the circuit opening mechanism of the main switch.

The circuit closing and the circuit opening mechanisms for operating the main switch contacts have been described and I will now outline the methods by which these two mechanisms are actuated. Assume the contacts of the main switch are in closed position, as shown in Fig. 3. The switch is held closed by the rigid position of the toggle members 22 and 23 and cannot be opened until this toggle is collapsed. The toggle is collapsed by the impingement of the shoulders 31 of the tripping mechanism upon the lug 25, thus allowing the main switch to open. The tripping mechanism is actuated by the core 32 of the solenoid 33, and the plunger rod 42 transmits the movement of member 32 to the rocker arm 28. Inserted in the movable core 32 are the buffers 43 which make it impossible for the movable and the stationary parts of core 32 to be held together by residual magnetism. This solenoid 33 is also inclosed in the casing 34, only the upper sectional portion of which is shown in Figs. 3 and 4, and is energized through a circuit which is controlled at a distant point. When the remote

control tripping switch is closed, the solenoid 33 is energized and lifts its plunger or core 32, which in turn lifts plunger rod 42 which strikes the roller bearing 30 and rocks the tripping mechanism about its pivot 27. In the path of movement of the shoulders 31 is the lug 25 with which the shoulders come in contact to move the toggle member 23 about its pivotal point 24, and which actuates the cooperating toggle members 23 and 22, thus collapsing the toggle. Under the spring tension of the laminated contact members 2, the main switch opens and assumes the position shown in Fig. 4. After the tripping mechanism has opened the switch, it proceeds in its movement until arrested by the dogs 29 coming into contact with the shaft 17. The extent of opening of the switch is limited by the engagement of the contact surface 19 of the U-shaped member 12 with the contact surface 18 of the lever 15, as shown in Fig. 4.

In closing the main switch, it is only necessary to close the remote control closing-coil circuit which energizes the solenoid 35 and causes it to raise its plunger or core 36 and strike the roller bearing 16. The solenoid 35 is preferably inclosed in the casing 34 and is larger and more powerful than the solenoid 33. When the solenoid 35 is thus energized and its plunger rod 36 makes engagement with the roller bearing 16, the lever 15 is moved about its pivotal point 14 and in so moving rotates the U-shaped member 12 back toward the position it assumes when the main switch is closed. When this position is reached, the toggle members 22 and 23 reset, to lock the U-shaped member 12 in position. When the U-shaped member 12 is thus actuated, the cooperating U-shaped member 11 and rocker arm 8, coact to close the main switch. Simultaneous with the actuation of the lever 15, the dogs 29, which rest upon the shaft 17, are moved toward a vertical position and upon deenergization of the solenoid 35 the lever 15 drops back so that its shaft 17 again rests upon the supports 20 and the main switch assumes the closed position shown in Fig. 3. In the description of the drawings up to this point, I have described the operation of electrically closing and opening the main switch and the mechanism by which this operation is accomplished.

Between the poles of the main switch is a discharge switch comprising the fixed contact member 6 and the cooperating movable contact member 5 shown preferably as a knife blade switch. The contact blade member 5 is pivotally mounted at 37 between the bifurcated arms of the hinge clip 38 which is mounted upon the switch supporting base. Pivotaly connected to the contact blade member 5 at 39 is a link 40; the end

connected to the blade member 5 being bifurcated. The other end of the link 40 is movably mounted upon a pin 41 between the bifurcated arms 28 of the tripping mechanism. The mechanism thus described is the actuating mechanism for the discharge switch and coacts with the circuit closing and opening mechanism of the main switch in the following manner: Assume that the contacts of the main switch are closed, as shown in Fig. 3. The bifurcated arms 28 of the tripping means are in their nearest vertical position and in such position the connecting link 40 holds the contact blade member 5 of the discharge switch open. As long as the main switch is closed the discharge switch remains open. Upon energization of the solenoid 33 to open the main switch, the plunger or core 32 moves the plunger rod 42 which in turn moves the tripping mechanism so that the shoulders 31 come into engagement with the lug 25 to trip the toggles 22 and 23 and the tripping mechanism in so moving actuates also the link 40 which in turn moves the contact blade 5 toward its cooperating fixed contact 6. By this arrangement, when the tripping mechanism is actuated, the discharge switch is first closed, and then a short time interval afterward, the movement of the tripping mechanism has progressed far enough for the shoulders 31 to strike the lug 25 and allow the main switch to open, as shown in Fig. 4.

The discharge switch in closing, just before the main switch opens, throws a resistance in series with the field of the dynamoelectric machine so that when the circuit is finally broken through the main switch the energy of the "inductive kick" due to the change of intensity of the field magnetism is dissipated in the resistance, thereby greatly reducing the attendant disturbances when the auxiliary contacts 3 and 4 separate. The discharge switch remains closed until the solenoid 35 is energized to close the main switch. When the plunger rod 36 is actuated, it moves the lever 15 and likewise the shaft 17, which forces the dogs 29 and hence the tripping mechanism back to its vertical position. When the toggle members become reset to hold the main switch closed, the tripping mechanism has been moved through a sufficient distance to open the discharge switch as shown in Fig. 3, that is, just before the circuit through the main switch is closed the discharge switch is opened excluding the resistance from the field circuit.

It is sometimes necessary to operate this switch by hand. This is best performed by having a small removable lever. Fig. 2 shows this hand operating lever 44 in position to move the solenoid core 36 through

the same path that it is moved through by the electrical remote control apparatus. Integrally related with this lever 44 at one end is a hook 45, and at the other end a small handle is attached. A projection 47 also integral with the lever 44 is positioned so that it will form a contact surface between the lever 44 and the plunger 36. A small sub-frame carrying rod 46 is attached to the solenoid frame 34. To close the main switch by this method, hook 45 is caught on to rod 46 and the head of projection 47 moved into contact with plunger 36. The lever 44 is now pushed upward and will move plunger 36 upward against roller 16, and the main switch will be closed in the same manner as the foregoing description of the electrical closing operation sets forth.

The method of tripping the main switch by hand will best be understood in this case by reference to Figs. 1 and 2, where member 48 represents an extension of the core 32. This member 48 has an enlarged end for the hand contact, as is shown in Fig. 2. By giving member 48 an upward thrust, plunger rod 42 will force member 28 to break the holding toggle 22—23 thereby allowing the spring energy stored in member 2 to throw open the main switch. In the form of switch construction shown and described, the novel mechanism for operating the main and discharge switches is compact, which is an essential feature in switchboard construction, and is entirely automatic in operation, all the functions of the mechanism coacting in response to a remote control switch.

My invention may be embodied in many other forms than that shown and described and I therefore do not wish to be restricted to the specific arrangement and to the details of construction disclosed, but intend to cover by the appended claims all changes and modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is,—

1. In a control device, the combination with a main switch, actuating means for closing said switch, latching means for normally holding said switch closed, a pivotally mounted tripping member, and means for moving said tripping member about its pivot into a position to release said latching means and permit said switch to open, of an auxiliary switch, and a member pivotally connecting said tripping member and said auxiliary switch for always closing said auxiliary switch as said tripping member moves to tripping position prior to the release of said latching means and for opening said auxiliary switch prior to the closing of said main switch.

2. In a control device, the combination with a main switch, a pivotally mounted

actuating member for closing said switch, latching means for normally holding said switch closed, and a pivotally mounted tripping member, means for moving said member in one direction about its pivot to trip said latching means, said actuating member acting to move said member in the other direction to return said member to initial position, and a connection between said auxiliary switch and said tripping member for closing said auxiliary switch prior to the release of said main switch and for opening said auxiliary switch before the closing of said main switch.

3. The combination with a main switch, an independently movable actuating member for closing said switch, means for moving said actuating member to switch closed position, latching means for holding said switch in closed position, and an independently movable tripping member for releasing said latching means, of an auxiliary switch, and means mechanically connecting said tripping member and said auxiliary switch for always closing said auxiliary switch before said tripping member reaches into tripping position.

4. The combination of two switches, actuating means for closing one of said switches, latching means holding the switch closed, a tripping member pivotally movable to trip said latching means, and a link pivotally connected between said tripping member and the other of said switches for transmitting the thrust of said tripping member to said other switch and closing it before said tripping member trips said latching means.

5. The combination with a double pole switch, an actuating member movable to close said switch, a latching toggle for holding said switch closed, and a separately mounted tripping member movable into position to collapse said toggle and permit said switch to open, of an auxiliary switch mounted between the poles of said double pole switch, and a connection between said tripping member and said auxiliary switch for closing said auxiliary switch prior to the tripping of said double pole switch.

6. The combination with a main switch comprising a separately mounted actuating member movable to close said switch, an actuating toggle, latching means for locking said toggle in switch closed position, and an independently movable tripping member for tripping said latching means, of an auxiliary switch, and a member pivoted to said tripping member and to said auxiliary switch for always moving said auxiliary switch to closed position before said tripping member releases said latching means.

7. In a device of the character described, in combination with a main switch comprising actuating means for closing said switch, means for moving said means in switch closed

ing direction, latching means for holding said switch closed, a tripping member, means for moving said member into position to trip said latching means, and a member carried
 5 by said tripping member cooperating with said actuating means to return said tripping member to its initial position as said switch is closed, of an auxiliary switch, and a connection between said auxiliary switch and
 10 said tripping member for closing said auxiliary switch before said tripping member trips said latching means.

8. In a device of the character described, the combination with a main switch, an independently movable actuating member for closing said switch, an actuating toggle,
 15 latching means for holding said toggle in switch closed position, a pivotally mounted tripping member for collapsing said latching means and allowing said switch to open said
 20 actuating member acting to limit the movement of said switch in circuit opening position, of an auxiliary switch and a pivotal connection between said auxiliary switch and
 25 said tripping member for opening said auxiliary switch prior to the closing of said main switch.

9. The combination with a main switch, latching means for holding said switch
 30 closed, a pivotally mounted actuating member biased to initial position and movable about its pivot to close said switch, a pivotally mounted tripping member movable in one direction about its pivot into engage-
 35 ment with said actuating member releasing said latching means during said movement, an auxiliary switch, and a connection between said auxiliary switch and said tripping member for closing said auxiliary
 40 switch prior to the release of said latching means and for holding said tripping member in engagement with said actuating member, the closing movement of said actuating member acting to move said tripping member in
 45 the reverse direction, said connection thereby operating to open said auxiliary switch prior to the closing of said main switch.

10. The combination with a main switch, latching means for holding said switch
 50 closed, a tripping member, means for moving said tripping member into a position to release said latching means and further into a restrained position, an actuating member for closing said switch and operative to return
 55 said tripping member to initial position during its closing movement, an auxiliary switch, and a connection pivoted between said tripping member and said auxiliary switch operative in response to the move-
 60 ments of said tripping member to close said auxiliary switch prior to the release of said latching means and to open said auxiliary switch before said main switch closes.

11. The combination with a main switch,
 65 closing means for said switch including an

actuating member positioned to limit the opening movement of said switch and movable to close said switch, tripping means for said switch including a tripping member movable into tripping position and on further movement into engagement with said
 70 actuating member, an auxiliary switch, and means connecting said switch and said tripping member for closing said auxiliary switch prior to the opening of said main switch and for holding said tripping member in engagement with said actuating member, said actuating member operating to return said tripping member to initial position during its switch closing movement and cause the opening of said auxiliary switch before said main switch is closed.

12. The combination with two switches, a tripping member for tripping the first switch and moving farther to a limited position, a connection between said member
 85 and the second switch for closing said second switch in response to the movement of said tripping member prior to the tripping of the first switch and for holding said tripping member in its limited position, an actuating member for closing the first switch and limiting the movement of said tripping member in tripping direction, said tripping member being returned to initial position by
 95 the movement of said actuating member to close the first switch, said connection operating to open the second switch prior to the closing of the first switch.

13. The combination of two switches operative in a definite sequence, a pivotally mounted actuating member biased in one direction, means for moving said member in the opposite direction to open one switch and subsequently close the other switch, a
 105 pivotally mounted tripping member, and means for moving said tripping member in one direction to close the first switch and subsequently open said other switch, said tripping member being movable in the opposite direction in response to said actuating member.

14. The combination with main and auxiliary switches operative in a definite sequence, a tripping member for said main switch operatively connected to said auxiliary switch,
 115 means for moving said tripping member in one direction to first close said auxiliary switch then trip said main switch and finally assume a restrained position, an actuating member for closing said main switch and moving said tripping member in the opposite direction to open said auxiliary switch before the main switch is closed.

15. The combination with main and auxiliary switches operative in a definite sequence, closing means for said main switch including an actuating member movable into switch closed position and biased to initial position, tripping means for said main
 130

switch including a tripping member movable to tripping position and then into engagement with said actuating means, a pivotal connection between said tripping member
5 and said auxiliary switch operative to close said auxiliary switch before said tripping member reaches tripping position and to open said auxiliary switch in response to the

switch closing movement of said actuating member, before said main switch is closed. 10

In witness whereof, I have hereunto set my hand this 25th day of June, 1913.

WINFIELD A. ATWOOD.

Witnesses:

HELEN ORFORD,

MARGARET A. DELEHANTY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."