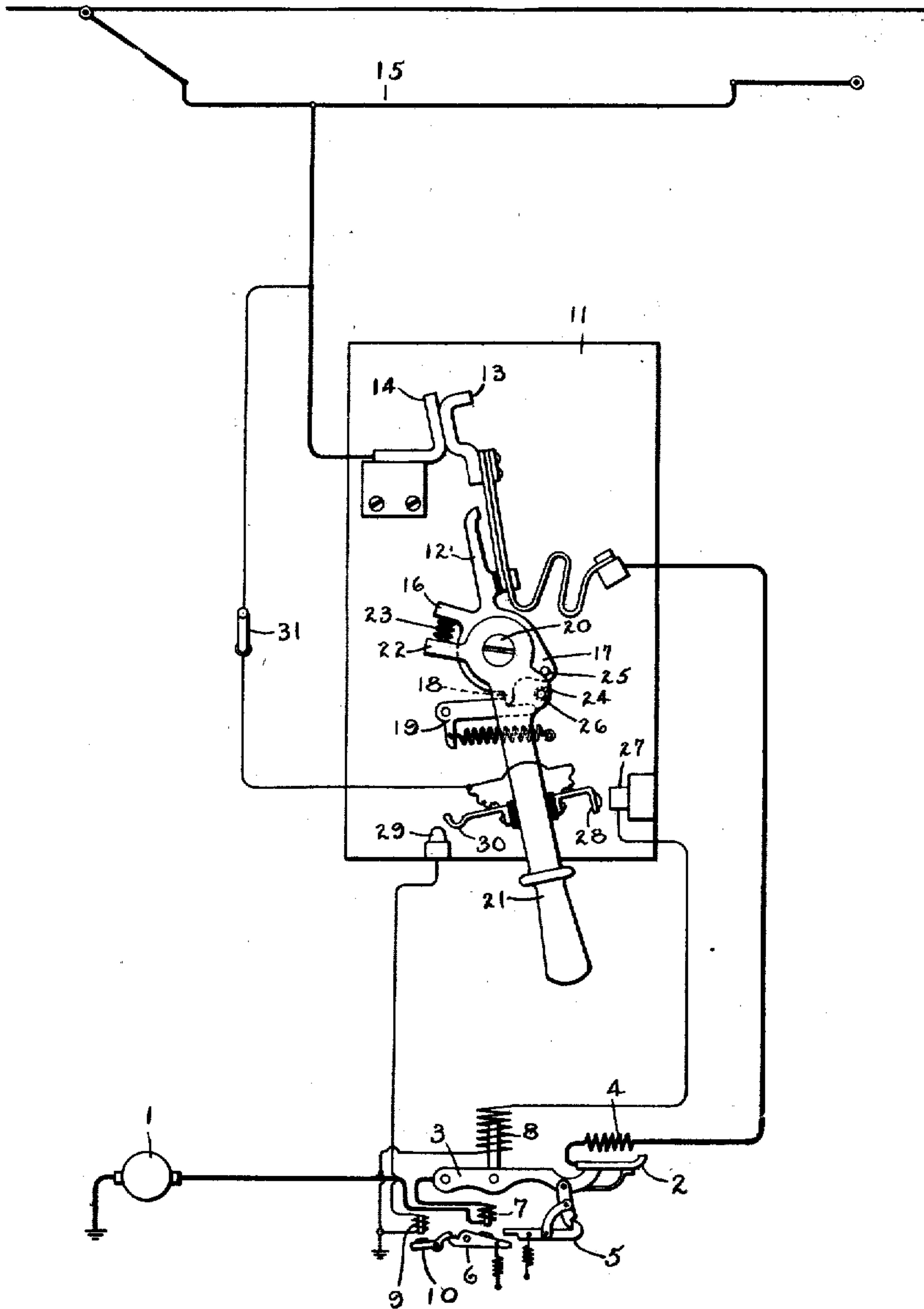


F. E. CASE.
ELECTRIC SWITCH.
APPLICATION FILED JAN. 11, 1908.

953,021.

Patented Mar. 29, 1910.



WITNESSES:
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UNITED STATES PATENT OFFICE.

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ELECTRIC SWITCH.

953,021.

Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed January 11, 1908. Serial No. 410,321.

To all whom it may concern:

Be it known that I, FRANK E. CASE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

My invention relates to electric switches and more particularly to switches used on electric cars and locomotives to open and close the main circuit through the motors and has for its object the simplification and improvement of the switches used for this purpose.

On electric cars and locomotives requiring heavy currents to operate them it is customary to control the current through the motors by means of power actuated switches or contactors mounted beneath the car and usually electrically actuated and operated from a master controller in the motorman's cab. An electrically-actuated circuit-breaker is connected in series with the motors to protect them against excessive current and is usually inclosed in an iron box or other suitable casing and mounted beneath the floor of the car. A circuit-breaker setting and tripping switch is mounted in some convenient place to control the circuits for actuating the circuit-breaker, and a main switch is connected in the main circuit between the circuit-breaker and the trolley or third-rail shoe to cut off the current through the circuit-breaker and motors so that the circuit-breaker and contactors may be inspected and repaired. Two switches are therefore required in the motorman's cab, and opening the main circuit to permit inspection of the devices beneath the floor of the car requires the operation of the control switch for opening the circuit-breaker and also the operation of the main switch for cutting off current from the circuit-breaker.

In carrying out my invention, the switching system is simplified by consolidating the main switch and the circuit-breaker setting and tripping switch in one structure so that the main switch and the circuit-breaker are connected in series and are both controlled by the operating handle of the main switch,

preferably in such a manner that the circuit-breaker opens or closes before the corresponding movement of the main switch. This result may be secured by any suitable connections between the main switch and the circuit-breaker, but preferably by making the operating handle of the main switch control the operation of the power actuated circuit breaker by acting as a control switch for the control circuits of the electrically-actuated circuit-breaker while if some other source of power is used to actuate the circuit breaker some suitable control device is connected to the operating handle. In the preferred construction, the cooperating control contacts for the circuit-breaker are mounted on each side of the operating handle of the main switch in such a manner that when the handle is moved in one direction to open the main switch the tripping coil of the circuit-breaker is energized to open the circuit-breaker before the main switch opens, so that the circuit-breaker takes the arcing as the circuit opens, while a movement of the operating handle in the other direction to close the main switch energizes the closing coil of the circuit-breaker and closes the circuit-breaker after the main switch is closed.

My invention will best be understood in connection with the accompanying drawing showing one of the many forms in which the invention may be embodied, and which is a diagrammatic representation of the motors of an electric car connected to a trolley through a standard electrically-actuated circuit-breaker and a main switch constructed according to my invention.

As shown in the drawing the motor 1 is connected in series with the fixed and movable contacts 2 and 3 of a standard circuit-breaker provided with a blow-out coil 4 mounted adjacent the contacts to disrupt the arc formed when the circuit is opened. The contacts are held in engagement by means of a latch 5 mounted in the path of the armature 6 of an overload coil 7 which is connected in series in the circuit and is calibrated to draw its armature into engagement with the latch and trip the circuit-breaker in case of excessive overload. The circuit-

breaker is closed by means of a closing solenoid 8 energized from a control circuit and having its core connected to the movable contact 3, and is tripped by hand by means of a tripping solenoid 9 having an armature 10 drawn into engagement with the armature 6 to trip the latch 5 when the tripping solenoid is energized from the control circuit.

The main circuit between the circuit-breaker and the trolley is opened and closed by means of a main switch comprising a base-plate 11 on which is mounted a movable arm 12 having a movable contact 13 cooperating with a fixed contact 14 mounted on the base 11 and connected to the trolley or third rail shoe 15. The movable arm 12 is provided with lugs 16 and 17 and with a catch 18 engaged by a spring-pressed latch 19 to hold the main switch closed. The movable arm 12 is pivotally mounted on a stud 20 on which is also mounted a rocking operating handle 21 having one lug 22 connected through a spring 23 to the lug 16 on the movable contact, and a second lug 24 for engaging a pin 25 mounted on the lug 17 of the movable contact. The operating handle 21 also carries a tripping pin 26, which engages the latch 19 and presses it down out of engagement with the catch on the movable arm 12 when the operating handle has been moved to compress the spring 23 and bring the lug 22 near the lug 16, whereupon the switch flies open. The operating handle has a limited movement independent of the arm 12, since the lugs on the handle and on the arm form a lost motion connection which permits the handle to move out of engagement with the lug 16 and into engagement with the pin 25 and vice versa without changing the position of the movable arm 12, unless it is free to move in response to the pressure of the spring 23. The parts are so proportioned that when the switch is closed the spring 23 holds the handle in the position shown, with both control circuits open and the handle free to move against the spring 23 far enough to close the circuit of the tripping coil without affecting the movable contact of the main switch.

The construction thus far described is substantially the same as in the standard equipment in which a main switch is connected in series with an electrically-actuated circuit-breaker. In accordance with my invention, the circuit-breaker setting and tripping switch is eliminated by constructing the main switch so that it not only controls the main circuit through the motors but also controls the circuits through the closing and tripping solenoids of the circuit-breaker. This result may be obtained in many different ways but the preferred

construction is that shown in the drawing in which a set of control contacts are mounted on each side of the operating handle 21 in such a position that the continued movement of the main switch handle, after closing the main switch, closes the circuit of the solenoid 8 and thereby closes the circuit-breaker, while the movement of the controlling handle in the other direction first compresses the spring 23 and closes the control circuit through the tripping solenoid 9 to trip the circuit-breaker open, and afterward trips the main switch open. The control contacts may be of any suitable construction but for purposes of illustration I have shown the circuit of the closing solenoid 8 controlled by the fixed contact 27 mounted on the base 11 and cooperating with a movable spring contact 28 mounted on the operating handle 21, while the tripping circuit is controlled by means of a fixed contact 29 and a cooperating spring contact 30 so arranged that the movement of the operating handle in a direction to open the main switch causes the yielding contact 30 to slide over the contact 29, thereby closing the tripping circuit long enough to trip the circuit breaker and again opening the tripping circuit before the pin 26 engages the latch 19 to trip the main switch. The yielding movable contacts 28 and 30 are connected through a cut-out switch 31 to the trolley and as long as the cut-out switch 31 is closed the control system for the circuit-breaker is operative regardless of the position of the main switch and the circuit-breaker.

The operation of the device is as follows: If the switch and the circuit-breaker are in the closed position, as shown in the drawing, and it is desired to cut off the current from all the devices beneath the car, the operating handle 21 is moved toward the fixed contact 29. During the first part of its movement the spring 23 is compressed, but no effect is produced on the movable arm 12, although the movable control contact 30 comes into engagement with the fixed contact 29, thereby closing the circuit of the tripping coil 9 and opening the circuit-breaker. As the operating handle continues its movement in the same direction the spring 23 is compressed still more, and the yielding contact 30 moves away from the fixed contact 29, thereby opening the tripping circuit. As the operating handle approaches the limit of its movement the tripping pin 26 engages and depresses the latch 19, thereby releasing the movable arm 12 and leaving it free to be moved by the spring 23, which expands and opens the main switch with a snap action. The movement of the operating handle has therefore

first opened the circuit-breaker and then opened the main switch, thereby cutting off the current from the circuit-breaker as well as all the other devices connected to the main circuit and rendering them safe to handle. When it is desired to close the main circuit, the operating handle is moved to the right, first bringing the lug 24 into engagement with the pin 25 to cause the movable arm 12 and the contact 13 to move with the operating handle, then bringing the contacts of the main switch into engagement, and finally closing the circuit breaker by bringing the control contacts 27 and 28 into engagement to close the circuit of the solenoid 8, this final movement being permitted by a spring blade on which the contact 13 is mounted. The handle 21 is then released and the main switch is held closed by the latch 19.

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 exact form shown 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. The combination with a power operated switch and a manually-operated switch connected in series, of controlling means for the operating means of the power operated switch actuated by said manually-operated switch during its opening and closing movement to open said power operated switch before said manually operated switch is opened and to close said power operated switch after said manually operated switch is closed.

2. The combination with a switch having main contacts and control contacts, of an electrically controlled power actuated switch connected in series with said main contacts, and control circuits for said latter switch connected to said control contacts to open and to close said power actuated switch in definite sequence to the opening and closing of said first switch.

3. In a switch, the combination with co-operating main contacts and a rocking operating handle for said contacts, of one set of control contacts closed after the main contacts engage by movement of the handle in one direction, and another set of control contacts closed before the main contacts separate by movement of the handle in the other direction.

4. The combination with two switches connected in series, of an operating handle having a lost motion connection with one switch, tripping means for opening the second switch, and means whereby said tripping

means is energized by movement of said handle to open said second switch prior to the opening of the first switch by said handle.

5. The combination with two switches in series, of an operating handle for the first switch, electrically actuated closing means and tripping means for the second switch, and contacts on said operating handle for closing the circuit of the closing means after the first switch closes and of the tripping means before the first switch opens.

6. In an electric switch, the combination with relatively movable coöperating contacts biased to separate, a latching device for holding said contacts in engagement, an operating handle connected through a lost motion connection to one of said contacts and having a movement independent thereof when said contacts are latched in engagement, connections whereby said independent movement of said operating handle actuates said latching device to release said contacts, and coöperating auxiliary contacts actuated by said handle during its independent movement.

7. In a switch, the combination with a fixed and a movable main contact, a rocking operating handle for said movable contact normally held out of operative position for opening the switch, and a latch for the movable contact released by movement of the handle to said operative position, of fixed and movable additional contacts closed and opened by said handle during its movement into operative position to open the switch.

8. In a switch, the combination with co-operating contacts and a rocking operating handle for said contacts, and yielding connections between said handle and one of said contacts to permit said handle to move independently thereof, of a fixed additional contact on each side of said handle, and yielding additional contacts mounted on said handle to coöperate with said fixed contacts.

9. In a switch, the combination with fixed and movable contacts, a latch for holding the contacts in engagement, and an operating handle for the movable contact yieldingly held between two operative positions when the switch is closed, of additional contacts actuated by movement of the handle toward either operating position.

10. In a switch, the combination with fixed and movable main contacts, and a latch for holding said contacts in engagement, of a rocking operating handle mounted to move independently of the movable contact for a short distance when the switch is closed, and control contacts actuated by said handle during said movement.

11. In a switch, the combination with a fixed contact, a movable member, a coöper-

ating movable contact yieldingly mounted
on said member, a latch for holding said
contacts in engagement, a rocking operating
handle movable between two lugs on the
5 movable member, and a spring between said
movable member and said handle normally
holding the handle in contact with one lug,
of cooperating additional contacts on each

side of said handle actuated by movement of
the handle in either direction.

In witness whereof, I have hereunto set
my hand this 9th day of January, 1908.

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FRANK E. CASE.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.