

J. EATON.
ELECTRIC SWITCH.
APPLICATION FILED AUG. 25, 1919.

1,413,397.

Patented Apr. 18, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

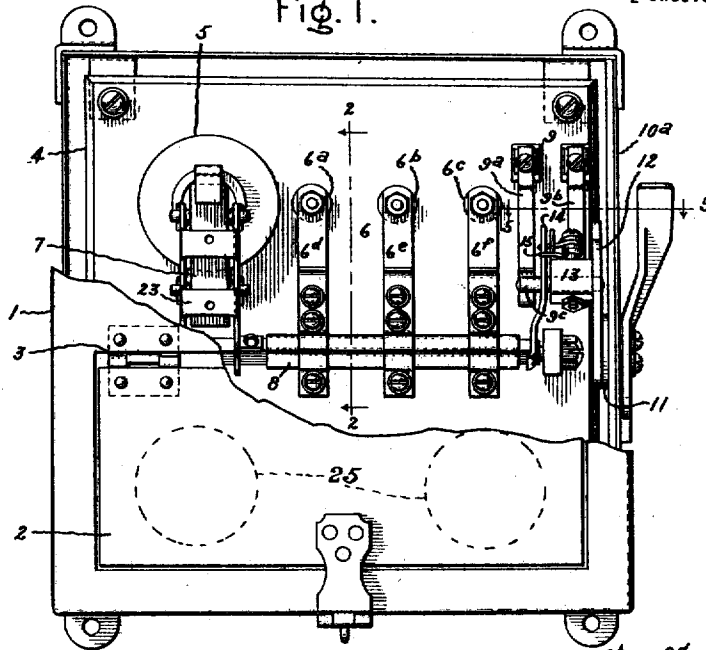


Fig. 2.

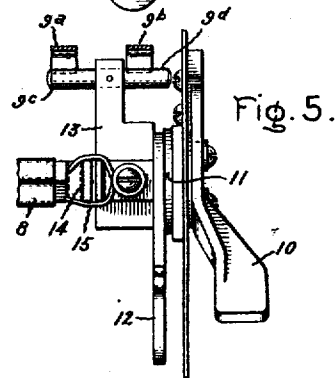
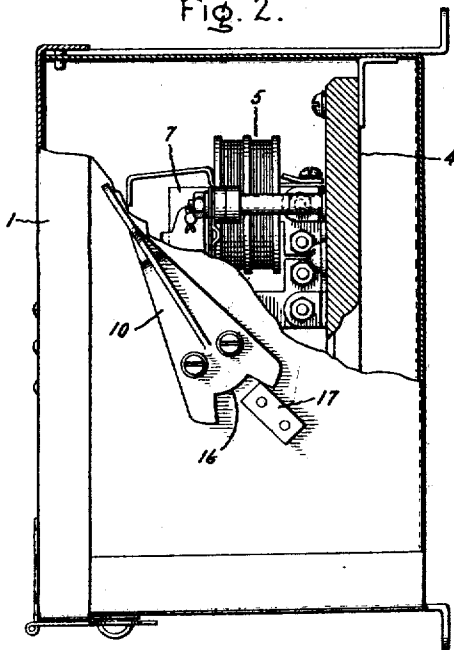
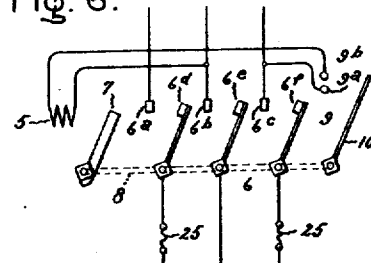


Fig. 6.



Inventor:
John Eaton,
by *Alfred G. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

JOHN EATON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC SWITCH.

1,413,397.

Specification of Letters Patent. Patented Apr. 18, 1922.

Application filed August 25, 1919. Serial No. 319,743.

To all whom it may concern:

Be it known that I, JOHN EATON, a subject of the King of Great Britain, residing at Schenectady, in the 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 has for its object the provision of improved means whereby the switch may be operated in a safe, reliable and efficient manner.

In one of its aspects my invention relates to improvements in the operating mechanism of electromagnetic switches whereby provision is made for quick opening and quick positive closing of the electromagnetic switch in response to movement of manually operated means. Although not necessarily limited to such use, my invention has a particular application as a safety first type of enclosed switch. A manually operated switch in the coil circuit of the electromagnet is provided, and when used as a safety first type of enclosed switch locking mechanism coacts with the electro-magnetic switch, the coil circuit switch and the door of a casing for the switches whereby the door may not be unlocked without opening the switches. My invention also embodies a no-voltage release feature, whereby upon the failure of voltage the switches being resiliently connected will open. The electromagnetic switch does not close automatically since the coil switch is open and will remain open until closed manually. By this arrangement when my invention is used as a safety first type of enclosed switch the switches may be inspected and fuses removed with safety since the switches are open when the door is open, and at the same time it provides a reliable no-voltage release. But at all times, it is necessary first to operate the locking mechanism, which opens said switches, before the door may be opened. While on a failure of voltage, both of the switches are opened, the door is not unlocked, which feature makes it doubly sure that the switches are open when the door is open.

Other objects and purposes of my invention will appear in the course of the follow-

ing specification, in which I have shown my invention embodied in concrete form for purposes of illustration.

In the accompanying drawing illustrating my invention, Fig. 1 is a top view of my switch with the enclosing casing partly broken away, Fig. 2 is a part vertical section of Fig. 1 taken on the line 2—2 looking in the direction of the arrow 2. Fig. 3 is a vertical section of Fig. 1 in which the door is shown in locked or closed position, Fig. 4 is a view similar to Fig. 3 with the door shown unlocked, Fig. 5 is a detail of Fig. 1 taken on line 5—5 looking in the direction of the arrow, and Fig. 6 is a diagram of the circuits.

Referring to the drawings, 1 is a casing provided with a door 2 hinged at 3. A base 4 is secured within the casing, on which is mounted an electromagnet 5 and stationary contacts 6^a, 6^b and 6^c of a switch 6. The armature 7 of said electromagnet is mounted on a rotatable shaft 8 which supports movable contact members 6^a, 6^b and 6^c of the switch 6. Thus far I have described the usual type of electromagnetic switch, comprising the electromagnet 5 and the switch 6, the operation of which is readily understood. Switch 6 should be mounted in an upright position to ensure proper operation of the same. On said base 4 are also mounted on flexible supports the stationary contacts 9^a and 9^b of a switch 9 in the circuit of the electromagnet 5. 25 are fuses of the usual type in the circuit.

An operating member or handle 10, outside of the casing 1, is rigidly secured to the shaft 11 which is rotatably mounted in the side 10^a of the casing, and projects into the casing as shown in Fig. 1. Secured to the end of the shaft 11 within the casing 1, is a member 12 which forms a part of the locking mechanism to be hereinafter described. Secured to the member 12 is a bar 13, made of insulating material, which supports the movable contacts 9^a and 9^b of the switch 9. A lever 14, rigidly secured to the shaft 8 is resiliently connected to the member 13 in any suitable manner, as by a spring 15. The relative position of shaft 8 with respect to bar 13 is such that switch 9 will be closed while the contacts of switch 6 are still some distance apart. Therefore the operation of

the handle 10 will open and close the switches 9 and 6. When the handle 10 is moved from closed toward open circuit position the spring 15 will be distorted by reason of the fact that shaft 8 is held with considerable force against rotation by coil 5. This will permit switch 9 to be opened thus opening the circuit to coil 5, spring 15 then forcing switch 6 to open with a quick action. In case switch 6 should stick, it will be mechanically opened upon further movement of the handle by the torque transmitted to shaft 8 by spring 15. Movement of the handle to closed circuit position will close switch 9 ahead of switch 6 thus energizing coil 5 so that switch 6 closes with quick action, the switches being held in closed position by coil 5. When the coil circuit is closed the speed of closing of switch 6 is taken out of the hands of the operator thereby making it practically impossible to prevent the switch from wiping home when it has once started to close. If the handle is held by the operator in a position to just close the coil circuit, switch 6 will move past the handle to closed position. Freezing or burning of the contacts due to light pressure is thereby prevented. As shown in Fig. 3 stationary contacts 9^a and 9^b will normally be depressed when switch 6 is closed, which will cause quick opening of switch 6 when the no-voltage release acts.

By thus operatively connecting the coil switch 9 and the electromagnetic switch 6, a special no-voltage release is acquired. On a failure of voltage, the electromagnet 5 will become deenergized, and the armature 7 will drop to open position in a well understood manner. In dropping to open position, the armature 7 rotates the shaft 8, thereby opening the switches 6 and 9. The switch 6 cannot be closed automatically since the coil switch 9 is open. Before the switch 6 may again be closed the switch 9 must be closed through the operation of the handle 10. Although the movement of the armature 7 has opened the switches 6 and 9, and to some extent moved the locking mechanism, it has not moved said mechanism sufficiently to unlock the door. For this reason also, the shaft 8 has been resiliently connected to the member 12, as described, to permit a slight further movement of the handle 10 to fully operate the locking mechanism, after the switches are open. The movement of the handle 10 is limited by means of a notch 16 on said handle and a stop 17 secured to the casing 1 projecting in the path of rotation of the handle within said notch, as shown in Fig. 2.

The locking mechanism herein consists of the member 12 and a member 18 which is secured to the door 2 of the casing. From Figs. 3 and 4 it will be observed that the member 12 is provided with a curved slot

or opening 19 and that the edge 20 thereof is curved in design. It will also be seen that the upper portion of the member 18 is bent over forming a projection 21 which rests upon the edge 20 of the member 12. Therefore, when the several parts are as shown in Fig. 3, in which the door 2 is closed, and the switches 9 and 6 are in closed position, the door is locked by reason of the projection 21 engaging the edge 20 of the member 12. The edge 20 of the member 12 is curved to correspond to the arc of a circle with shaft 8 as its center and a radius from said center to the projection 21, when the door is in closed position. Therefore, the handle 10 may be operated in a downward direction, until its movement is interrupted by the stop 17, at which point the member 12 is in the position shown in Fig. 4. Here it will be observed that the slot 19 corresponds to the arc described by the projection 21 in its path of rotation by the opening and closing of the door 2. The movement of the member 12 before reaching the position shown has opened the switches 9 and 6. These switches are in the same position they assume on a failure of voltage although the door is yet locked. Therefore, the resilient connection 15 has been provided also to permit the further movement of the member 12 to the position shown in Fig. 4. This makes it necessary always to operate the handle 10, which opens the switches before the door may be opened. In this position the door 2 may be opened, since the projection 21 is free to move in the slot 19. When the switches 9 and 6 are open and member 12 has been moved by handle 10 to the position shown in Fig. 4, the door 2 and members 18 and 21 may be moved to the open position shown in dotted lines in Fig. 4. In the last mentioned position it will be seen from the drawings that the member 12 is locked in the position shown, in which case the switches 9 and 6 are open, so long as the door 2 is open, and that the member 12 cannot be restored to the position shown in Fig. 3, in which case the switches 9 and 6 are closed, until the door 2 is closed and the parts assume the position shown in Fig. 4.

Fig. 6 is a diagram of the circuits in which the handle 10 is shown in the position it assumes when the door is unlocked. It will be observed that when the handle 10 is in this position, the coil switch 9 is open, which deenergizes the electromagnet 5, permitting the armature 7 to drop back and rotate the shaft 8, thus opening switch 6. The opening of the switch 6, however, is doubly assured by reason of the resilient connection between the handle 10 and shaft 8. By closing the switch 9, which also operates the locking mechanism to lock the door closed, the electromagnet 5 is energized and the switch 6 closed. The no-voltage feature in

this device and the locking mechanism, which is not shown in this diagram, have been fully described hereinbefore.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention the scope of which is set forth in the annexed claims.

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

1. The combination with an electromagnetic switch of a manually operated auxiliary switch in the coil circuit of the electromagnetic switch and a resilient connection between said switches whereby the auxiliary switch is independently manually operated to open the coil circuit whereupon the electromagnetic switch is opened with a quick action by said resilient connection.

2. The combination with an electromagnetic switch of a manually operated auxiliary switch in the coil circuit of the electromagnetic switch, and a resilient connection between the said switches whereby the switches are jointly manually operated until the auxiliary switch has closed the coil circuit of the electromagnetic switch, whereupon the electromagnetic switch is electromagnetically closed.

3. The combination with an electromagnetic switch of a manually operated auxiliary switch in the coil circuit of the electromagnetic switch, and a resilient connection between the said switches whereby the switches are jointly manually operated until the auxiliary switch has closed the coil circuit of the electromagnetic switch, whereupon the electromagnetic switch is electromagnetically closed, and the auxiliary switch is independently manually operated to open the coil circuit, whereupon the electromagnetic switch is opened with a quick action by said resilient connection.

4. The combination with a casing of a main switch in said casing, an electromagnet in said casing having an armature, a shaft carrying the movable contacts of said main switch attached to said armature, an auxiliary switch in the coil circuit of the electromagnet within said casing having an operating handle without the casing, and a resilient connection between the operating handle and said shaft whereby the movable contacts of the main switch and auxiliary switch are jointly operated by the operating handle until the auxiliary switch has closed the circuit of said electromagnet, whereupon the main switch is closed electromagnetically by movement of said armature, and the auxiliary switch is operated independently by

the operating handle to open the coil circuit, whereupon the main switch is opened with a quick action by said resilient connection.

5. The combination with a casing provided with a door, of a normally open electromagnetic switch within the casing, a switch in the coil circuit of the electromagnetic switch within the casing having an operating handle on the outside of the casing, and a locking mechanism operated responsively to the movements of said electromagnetic switch and the handle whereby the door cannot be opened unless the switches are opened.

6. The combination with a casing provided with a door of a normally open electromagnetic switch within the casing, a manually operated switch in the coil circuit of the electromagnetic switch having an operating handle on the outside of the casing, and a locking mechanism operated by said handle for locking the door in closed position when the coil switch is closed and permitting the unlocking of the door after the coil switch is opened.

7. The combination with a casing provided with a door of a normally open electromagnetic switch within the casing, a switch in the coil circuit of the electromagnetic switch, an operating handle outside of the casing, means connecting the two switches for operating said switches responsively to the movement of said handle and a locking mechanism operated by said handle for locking the door in closed position when said switches are closed and permitting the unlocking of the door after the said switches are opened.

8. The combination with a casing provided with a door, of a normally open electromagnetic switch within the casing, a switch in the coil circuit of the electromagnetic switch having an operating handle on the outside of the casing, means connecting the two switches whereby, upon the failure of voltage, said switches will be opened by the dropping of the armature of the magnet to open position and remain open until the coil circuit is closed by said operating handle, and a locking mechanism operated by said handle for locking the door in closed position when the switches are closed and permitting the unlocking of the door after the switches are opened.

9. The combination with a casing provided with a door having a projection, of a normally open electromagnetic switch, a switch in the coil circuit of the electromagnetic switch having an operating handle outside the casing, and a locking member operated responsively to the movements of said switches, disposed so as to arrest the movement of said projection so as to lock the door closed when the switches are closed, and provided with a slot in which said

projection may move to permit the opening of the door when the switches are opened.

10. The combination with a casing provided with a door, of a normally open electromagnetic switch within the casing, a switch in the coil circuit of the electromagnetic switch, an operating handle therefor on the outside of the casing, mechanism for locking the door responsively to the closing of the said switches by said operating handle, means connecting the two switches, the handle and the locking mechanism whereby, upon a failure of voltage, said switches will be opened and the handle moved by the dropping of the armature of the magnet to open position, and after the switches are thus opened a further movement of the handle unlocks the door.

11. The combination with a casing provided with a door, of a normally open switch within the casing, an operating handle therefor outside the casing, locking mechanism comprising a member provided with a slot, the said member and switch operated responsively to the movement of the handle, a projection on the door engaging the member to lock the door closed both when the switch is closed and when it is opened, and a resilient connection between the switch and the handle whereby a further movement of the handle in the opening

direction after the switch is in its normal open position permits the projection to move in the slots in said member so that the door may be opened.

12. The combination with a casing provided with a door, of a normally open electromagnetic switch, a normally open switch in the coil circuit of the electromagnetic switch, and operating handle for said switches outside the casing, locking mechanism comprising a member provided with a slot, said member and said switches operated responsively to the movement of the handle, and the armature of the electromagnet, a projection on the door engaging the member to lock the door closed both when the switches are closed and when they are in their normally open position, a resilient connection between the electromagnetic switch and the handle whereby a further movement of the handle in the opening direction after the electromagnetic switch is in its normal open position in response to either a failure of voltage or by the operation of said handle, the projection is permitted to move in the slot in said member so that the door may be opened.

In witness whereof, I have hereunto set my hand this 23rd day of August, 1919.

JOHN EATON.