

No. 766,391.

PATENTED AUG. 2, 1904.

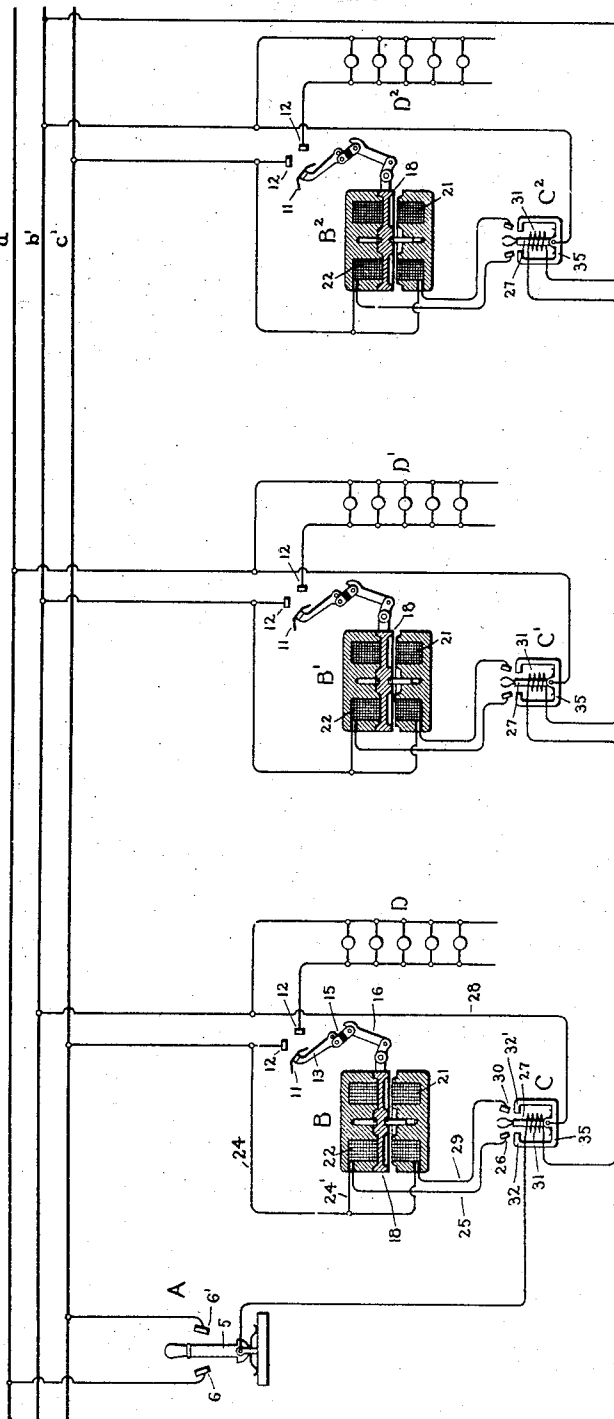
H. R. SARGENT & J. L. HALL.
REMOTE SWITCH CONTROL SYSTEM.

APPLICATION FILED NOV. 26, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

J. Ellis Glenn.
Helen Oxford

Inventors.

Howard R. Sargent,
John L. Hall.

by *Albert G. Lane*
Atty.

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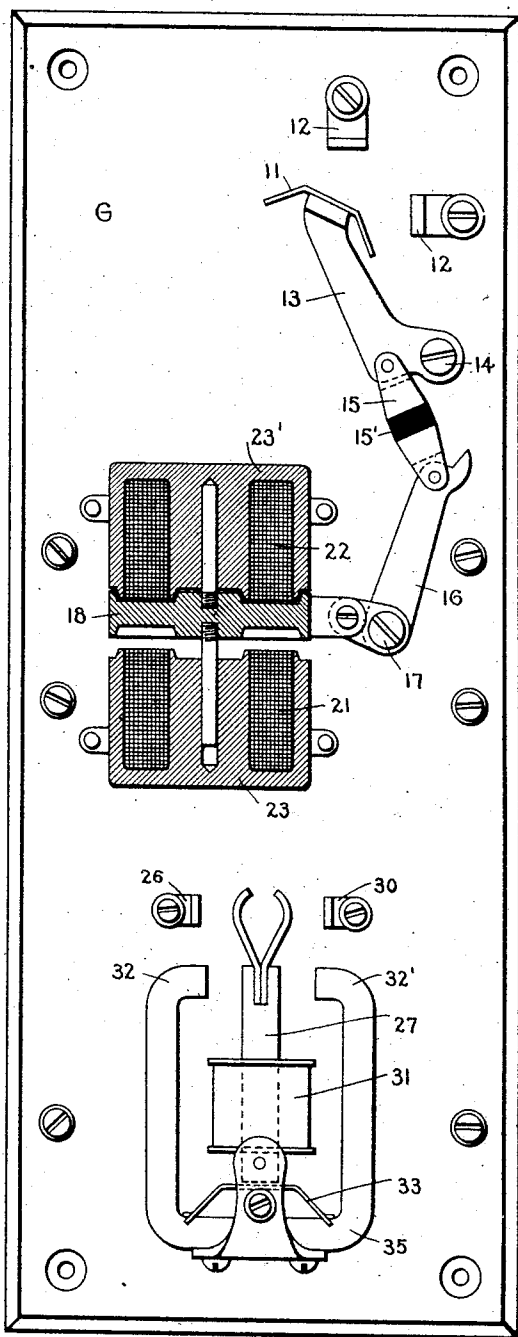
H. R. SARGENT & J. L. HALL.
REMOTE SWITCH CONTROL SYSTEM.

APPLICATION FILED NOV. 26, 1902.

NO MODEL.

2 SHEETS—SHEET 2.

Fig. 2.



Witnesses.

J. Ellis Glenn.
John Corford

Inventors.

Howard R. Sargent,
John L. Hall.

by

Albert H. Davis
Atty.

UNITED STATES PATENT OFFICE.

JOHN L. HALL AND HOWARD R. SARGENT, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

REMOTE-SWITCH-CONTROL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 766,391, dated August 2, 1904.

Application filed November 26, 1902. Serial No. 132,849. (No model.)

To all whom it may concern:

Be it known that we, JOHN L. HALL and HOWARD R. SARGENT, citizens of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Remote-Switch-Control Systems, of which the following is a specification.

Our invention relates to means for controlling the operation of electromagnetically-actuated switches which are employed for establishing or interrupting the circuit connections of a system of distribution or electrical apparatus located at a distance from the point of control, and is especially applicable to the so-called "three-wire" system of electrical distribution.

In the operation of an electromagnetically-actuated switch from a distant point it has been customary to use two controlling wires or conductors connected with the actuating-coils of said switch and running back to the point of control, so that said switch-coils may be energized to move the switch in either direction. In systems employing such electromagnetically-actuated switches it is necessary to use wires of sufficient size to carry the current required to operate the switches and also to employ a great number of wires, thus making these systems cumbersome and expensive to construct and maintain.

The object of our invention is to reduce the number of wires which are required to control a single switch or a number of switches from a distant point and at the same time to make the controlling-circuits independent of the circuits through the switch-actuating coils. To accomplish this result, we connect the actuating-coils of the electromagnetically-actuated switch to a source of current-supply and to the contact-terminals of a relay, preferably a polarized relay, and connect the actuating coil or coils of said relay to a source of current-supply in such a manner that by sending current through the said coil or coils in one direction the relay will be operated to complete the local circuit through one of said switch-actuating coils to close said switch

and by sending current through the said relay coil or coils in the opposite direction the circuit will be completed through the other switch-actuating coil to cause said switch to open.

In operating a plurality of switches we connect the actuating-coils of said relays to the source of current-supply in such a manner that but one wire is necessary for each relay or group of relays, a common return being used for all of the relays—that is to say, but one more wire than the number of switches or groups of switches is required for the independent control of any number of switches or groups of switches. In the application of our invention to the three-wire system of distribution the neutral wire of said system is used as the common return for the circuit containing the relay-actuating coils, thus dispensing with the additional wire and making it possible to employ but one extra wire for the control of each remote switch or group of switches.

In the accompanying drawings, which illustrate the preferred embodiment of our invention, Figure 1 represents diagrammatically a three-wire system of distribution equipped with electromagnetically-actuated switches controlled from a distant point, and Fig. 2 represents our preferred form of electromagnetically-actuated switch and the polarized relay which is used therewith.

Referring now to the drawings, A indicates the controlling-switch which may be located at the power-house, substation, or at any point from which it is desired to control a plurality of electromagnetically-actuated switches B, B', and B², &c. The electromagnetically-actuated switches B, B', and B² are adapted to complete or interrupt the branch circuits leading from the supply-mains *a*, *b*', and *c*' of a three-wire system of distribution to the translating devices D, D', and D², respectively. The switches B, B', and B² are identical in construction. Therefore but one of said switches will be described in detail and will be more clearly understood by reference to Fig. 2 of the drawings, in which the switch and relay

are shown as mounted on the panel G. The movable contact member 11 of the switch is adapted to bridge the fixed contacts 12 in the branch circuit leading to the translating devices, the said movable contact member being carried by the lever-arm 13, pivoted at 14. Also connected to the arm 13 is a connecting-link 15, which is pivotally attached to one arm of the bell-crank lever 16, pivoted at 17. The lever-arm 13 is insulated from the lever 16 by the insulating-strips 15', carried by the link 15. Attached to the other arm of said bell-crank lever 16 is an armature 18. The upward movement of the armature 18 operates the system of levers above described to open said switch, and a downward movement of said armature operates to close said switch. The levers 13 and 16, together with the connecting member 15, form a toggle-lever which operates to maintain the said switch in its closed position independent of the actuating-coil used for closing said switch. The movements of the armature 18 are controlled by the actuating-coils 21 and 22, respectively, said coils being inclosed within the magnetic casings 23 and 23', respectively, and operating when energized to attract the armature 18 and reciprocate the same.

The actuating-coil 22 of the electromagnetically-actuated switch B is connected to the supply-mains *b'* and *c'* in a local circuit comprising the conductors 24, 24', and 25, fixed contact 26 of the polarized relay C, pivoted armature 27 of said relay, and the conductor 28. The actuating-coil 21 is connected to the supply-mains *b'* and *c'* in an independent local circuit comprising the conductors 24 and 29, fixed contact 30 of the polarized relay C, pivoted armature 27 of said relay, and the conductor 28. The current for energizing the coils in these local circuits may be taken from a battery or other source of current-supply instead of from the supply-mains, as shown.

The polarized relay C is so constructed that when the actuating-coil 31 of said relay is not energized the pivoted armature 27 assumes a position midway between the poles 32 and 32' of the permanent magnet 35, being maintained in such position by means of the spring 33. When current is passed through the actuating-coil 31 in one direction, the pivoted armature 27, which carries said actuating-coil 31, is moved from its normal position midway between the poles 32 and 32' into contact with the fixed terminal contact 26, thus completing the local circuit through the actuating-coil 22 of the electromagnetically-actuated switch. When current is passed through the said actuating-coil 31 in the opposite direction, the movable member or armature 27 is attracted by the pole 32' and engages the fixed terminal or contact 30, thus completing the local circuit through the ac-

tuating-coil 21 of said electromagnetically-actuated switch.

The actuating-coils 31 of the polarized relays C, C', and C'' are connected to a source of current-supply, preferably located at the point of control. In the system shown in Fig. 1 the actuating-coils 31 are connected to the supply-mains *a'* and *c'* at the point of control by means of the double-throw switch A, the neutral main *b'* of the three-wire system of distribution being employed as the return-wire for the controlling-circuit. The switch A is connected in such a manner as to complete the circuit through the relay-actuating coils 31, so as to cause the current to flow in either direction through said coils. The controlling-switch A is preferably constructed so that it will assume normally an inoperative position, and thus maintain the controlling-circuit normally open.

In Fig. 2 we have also shown, on a larger scale, our preferred form of relay, in which the actuating-coil 31 is mounted on the pivoted armature 27 and the magnet 35 is made permanent. The spring 33 acts to maintain the pivoted armature 27 normally in a position midway between the poles 32 and 32' of the magnet 35. It will be clearly understood that the relative location of the actuating-coil and the permanent magnet may be changed readily without departing from the spirit of our invention. For instance, the armature 27 may be made a permanent magnet and the actuating coil or coils may be mounted on legs of the magnet 35.

The operation of the system shown in Fig. 1 will now be described. To close the electromagnetically-actuated switches, the movable member of the controlling-switch A is moved from its normal inoperative position into engagement with the contact 6, thereby connecting the actuating-coils 31 in series across the main *a'* and the neutral wire *b'*. The circuit through the actuating-coils 31 of the polarized relays C is thus completed in one direction, thereby causing the pivoted armature 27 of each of said relays to be attracted by the pole 32' of the magnet 35, bringing the same into engagement with the terminal 30, thus causing the local circuits through the actuating-coils 21 of the switches B, B', and B'' to be completed. When the said coil 21 of each switch is energized, the armature 18 is attracted and moves the movable member 11 into engagement with the fixed terminals 12 in the branch circuits.

The bell-crank levers 13 and 16 of the electromagnetically-actuated switch form a toggle-joint which when straightened out into the position it assumes when the switch is closed will maintain such position independent of the action of the magnet-coil 21 until a force such as the magnetic attraction of the coil 22 is applied to buckle said toggle. By so con-

structing said switch it is unnecessary to maintain the circuit closed through the actuating-coils 21 and 22. Therefore immediately after the said switch has been closed the movable member of the switch A may be released, and it will then automatically assume its normal position out of engagement with the fixed contacts 6 and 6'. The movable members or armatures 27 of the relays C, C', and C'' will then assume the position shown in the figures, being forced into said position by means of the springs 33.

When it is desired to open the electromagnetically-actuated switches, the movable member 5 of the switch A is thrown so as to engage the fixed contact-terminal 6'. This connects the actuating-coils 31 in series across the main *c'* and the neutral wire *b'*, thus causing a current-flow through the coils 31 of the polarized relays in a direction opposite to that obtained when the movable member 5 was in engagement with the contact 6. The said coils 31 are thus energized, so that the movable member 27 of each of said relays will be attracted by the pole 32 and will engage the fixed contact or terminal 26, thus completing the local circuit through the actuating-coil 22 of each of the electromagnetically-actuated switches. The completion of this local circuit energizes the said coil 22 and causes the armature 18 to be attracted, thus buckling the toggle above described and causing the movable member 11 of the said switch to assume the position shown in the figures. Releasing the movable member of the switch A deenergizes the coils 31 and allows the movable armature 27 of each relay to assume its normal position between the poles 32 and 32', thus opening the local circuit through the actuating-coil 21 and deenergizing said coil. The electromagnetically-actuated switches are maintained in their open position by gravity.

It will thus be seen that the control-circuits through the coils 31 of the relays C C' C'', &c., are independent of the local circuits through the actuating-coils of the switches B B' B'', &c., and that a very small amount of current is required to energize the coils 31 of said relays. The conductors in said control-circuit, therefore, may be made of fine wire, thus saving considerable expense in the installation of the system. Since the return-wires of all the relays or groups of relays are connected together in one common return, simplicity in connections and a great saving of wire are obtained, especially when the neutral wire of the three-wire system of distribution is used for the common return, as shown in the figures. It will be seen that for a certain number of switches to be operated from a distant point but one more wire or conductor than the number corresponding to the number of switches or groups of switches to be operated is required in the control-cir-

cuits, and when the three-wire system of distribution is employed but one wire is required for the control of each switch or group of switches.

Although but a single group of switches is shown in the system illustrated, it is clear that any number of switches or groups of switches may be installed, it being necessary to have an additional wire and controlling-switch for each additional electromagnetically-actuated switch or group of switches.

The specific electromagnetically-actuated switch herein shown and described forms no part of our present invention, but constitutes the subject-matter of a copending application of H. R. Sargent, Serial No. 27,797.

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

1. In a system of electrical distribution, the combination with supply-mains and branch mains, of an electromagnetically-actuated switch for opening and closing the circuit between the supply and branch mains, circuits in which the actuating-coils of said electromagnetic switch are located, and a relay adapted to complete said circuits whereby said switch is alternately opened and closed.

2. In a system of electrical distribution, the combination with supply-mains and branch mains, of an electromagnetically-actuated switch for opening and closing the circuit between the supply and branch mains, circuits in which the actuating-coils of said electromagnetic switch are located, a relay adapted to complete said circuits whereby said switch is alternately opened and closed, and means located at a distance for controlling the operation of said relay.

3. In a system of electrical distribution, the combination with supply-mains and branch mains, of an electromagnetically-actuated switch for opening and closing the circuit between the said supply and branch mains, circuits in which the actuating-coils of said electromagnetically-actuated switch are located, a polarized relay adapted to complete said circuits as desired, and means for maintaining said circuits normally open.

4. In a system of electrical distribution, the combination with supply-mains and branch mains, of an electromagnetically-actuated switch for opening and closing the circuit between said supply and branch mains, two circuits connected with said supply-mains in which the actuating-coil for opening said switch and the actuating-coil for closing said switch are respectively located, and a relay adapted to complete said circuits alternately to open and close said switch.

5. In a system of electrical distribution, the combination of supply-mains and branch mains, an electromagnetically-actuated switch for opening and closing the circuit between said supply and branch mains, two circuits in

which the actuating-coil for opening said switch and the actuating-coil for closing said switch are respectively located, a relay adapted to close said circuits one at a time, and means
5 located at a distance for completing the circuit through the actuating-coil of said relay to operate the same to cause the electromagnetically-actuated switch to open and close alternately.

10 6. In combination, a relay, two independent normally open circuits controlled by said relay, an electromagnetically-actuated switch the actuating-coil for opening said switch being located in one of the circuits and the coil
15 for closing said switch being located in the other of said circuits, and means for controlling the operation of said relay to complete said circuits and operate said switch as desired.

20 7. In combination, an electromagnetically-actuated switch, two independent normally open circuits in which the actuating-coil for closing said switch and the actuating-coil for opening said switch are respectively located,
25 a polarized relay for controlling said circuits, and a switch for completing the circuit through the actuating coil or coils of said relay in one direction to cause one of said circuits to be closed and for completing the circuit through
30 said relay-actuating coil or coils in the opposite direction to cause the other of said circuits to be closed.

8. In a system of electrical distribution, the combination of supply - mains and branch
35 mains, a plurality of electromagnetically-actuated switches for opening and closing the circuits between said supply and branch mains, circuits in which the actuating-coils of said switches are respectively located, a plurality
40 of polarized relays the armatures of which are adapted to make and break said circuits, and means for holding said armatures in such a position when the actuating-coils of said relays are deenergized that the said circuits are
45 maintained normally open.

9. In combination with the supply-mains of a three-wire system of electrical distribution, branch mains, an electromagnetically-actuated switch for opening and closing the circuit between the supply and branch mains, a relay
50 for controlling the actuating-coils of said switch, and a control-circuit for the actuating-coil of said relay which includes the neutral wire of said three-wire system.

55 10. In combination with the supply-mains of a three-wire system of electrical distribution, branch mains, an electromagnetically-actuated switch for opening and closing the circuit between the supply and branch mains, a relay
60 for controlling the actuating - coils of said switch, and means located at a distant point of control for connecting the actuating-coil of

said relay in circuit between the neutral wire and either outside wire of said system, as desired.

65 11. In combination with the supply-mains of a three-wire system of electrical distribution, branch mains, an electromagnetically-actuated switch for opening and closing the circuit between the supply and branch mains, circuits
70 in which the actuating-coils of said switch are located, a polarized relay for controlling said circuits, and a control-circuit for the actuating-coil of said relay which includes the neutral wire of said three-wire system.

75 12. In combination with the supply-mains of a three-wire system of electrical distribution, branch mains, an electromagnetically-actuated switch for opening and closing the circuit between the supply and branch mains, circuits
80 in which the actuating-coils of said switch are located, a polarized relay for controlling said circuits, and a switch located at a distant point of control for connecting the coil of said relay in circuit between the neutral wire and
85 either outside wire of said three-wire system whereby current may be sent in either direction through said relay-actuating coil to cause said electromagnetically-actuated switch to be opened and closed as desired.

90 13. In combination with the supply-mains of a three-wire system of electrical distribution, a plurality of branch mains, a plurality of electromagnetically-actuated switches for opening
95 and closing the circuits between said branch mains and said supply-mains, a plurality of relays for controlling the actuating-coils of said switches, and control-circuits for the actuating-coils of said relays or groups of relays which include the neutral wire of said
100 three-wire system.

14. In combination with the supply-mains of a three-wire system of electrical distribution, a plurality of branch mains, a plurality of electromagnetically-actuated switches for opening
105 and closing the circuits between the branch mains and said supply-mains, circuits in which the actuating-coils of said switches are located, a plurality of relays or groups of relays for controlling said circuits, and means
110 located at a distant point of control for connecting the actuating-coils of said relays or groups of relays in circuit between the neutral wire of said three-wire system and either outside wire as desired for the purpose of controlling the operation of said electromagnetically-actuated switches.

In witness whereof we have hereunto set our hands this 24th day of November, 1902.

JOHN L. HALL.

HOWARD R. SARGENT.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.