

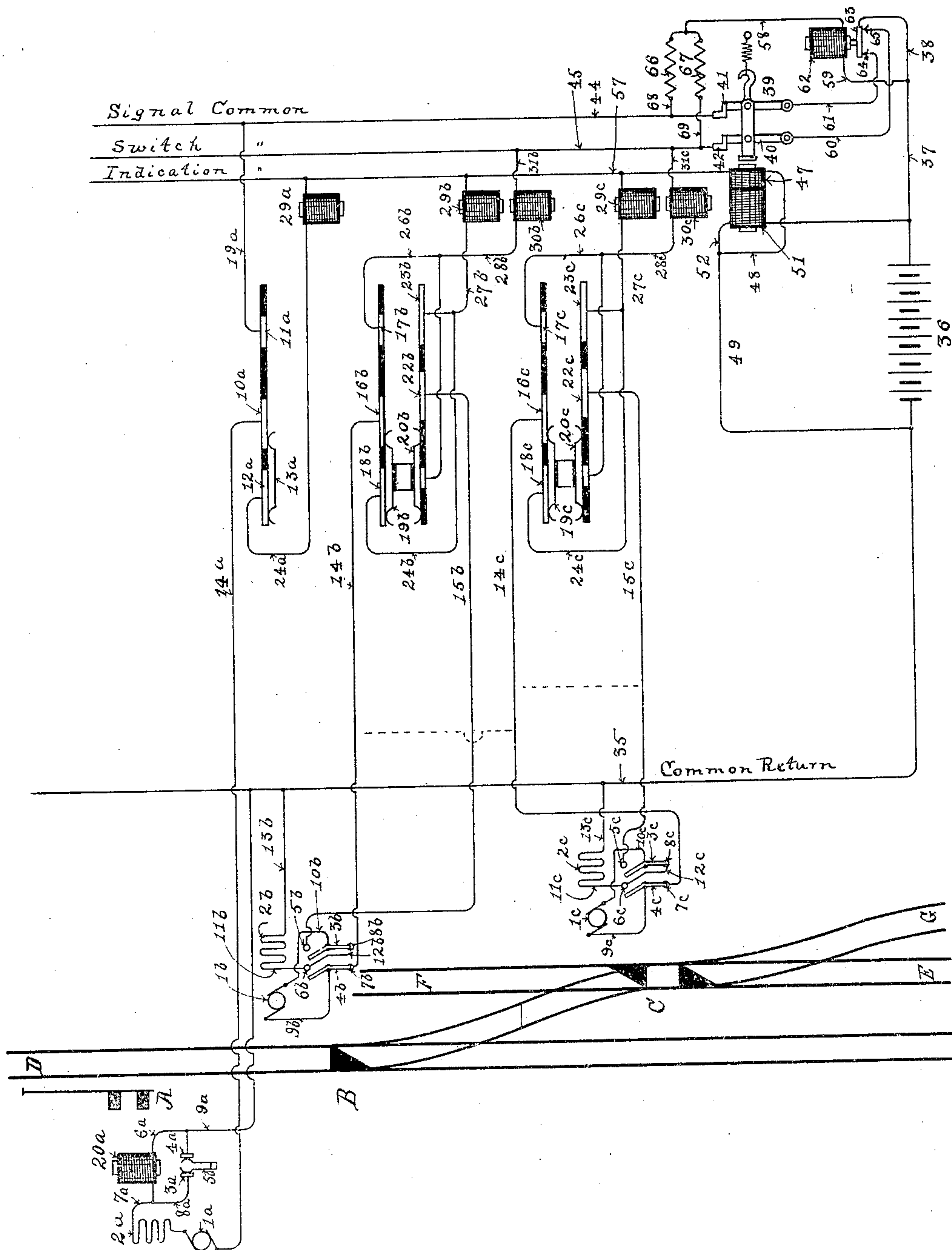
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PATENTED NOV. 7, 1905.

W. K. HOWE.

RAILWAY SWITCHING AND SIGNALING APPARATUS.

APPLICATION FILED MAR. 28, 1904.





# UNITED STATES PATENT OFFICE.

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## RAILWAY SWITCHING AND SIGNALING APPARATUS.

No. 804,126.

Specification of Letters Patent.

Patented Nov. 7, 1905.

Application filed March 28, 1904. Serial No. 200,347.

*To all whom it may concern:*

Be it known that I, WINTHROP K. HOWE, of Buffalo, New York, have invented certain new and useful Improvements in Railway Switching and Signaling Apparatus, of which the following is a description.

My invention relates to railway switching and signaling apparatus, and more particularly to that class of such apparatus in which the motive power is electricity.

It is, furthermore, an improvement upon and especially adapted to the system of electric railway switching and signaling disclosed in United States Letters Patent to John D. Taylor, No. 516,903, March 20, 1894; No. 554,097, February 4, 1896; No. 605,359, June 7, 1898, (reissued, No. 11,983;) No. 681,589, August 27, 1901; No. 707,181, August 19, 1902, and No. 707,182, August 19, 1902. By reference to the aforementioned patents it will be found that the system involves the effecting of a dynamic indication from the switch when the same is home and locked, which indication is produced by the continued rotation of the switch-motor armature, due to momentum, acting as a generator in a circuit including an indicating device and similar indication from the signal when the signal or signal-counterweight falls by the signal-motor acting as a generator in a circuit including an indicating device and actuated by the fall of the signal. By reference to said Patent No. 681,589 the apparatus for actuating the rail-switch, herein diagrammatically shown, will be fully understood. By reference to said Patent No. 707,181 the detailed construction of the interlocker, herein referred to as the "controller," will be fully understood, and by reference to Patent No. 707,182 the signal snap-switch, herein referred to and shown diagrammatically, will be fully understood.

In the operation of switch and signal mechanism of the character herein described it is essential that in the event of a cross of any wire leading from one pole of the battery with any wire leading to the opposite pole should eventuate in so cutting off the battery that pending such cross no signal or switch can be operated. It is also essential that the mechanism employed for so cutting off the battery should be protected against the possibility of

the operator or other person restoring the circuit pending such cross and move or partially move some switch or signal. While these features are essential, it is also essential in practice, where a number of switches and signals are employed taking power from a common battery, that in the event of such cross and such cutting off of the battery signals which have already been set after the proper movement of a switch or switches should not be reversed and set to "danger" in the face of approaching trains which have already secured the right of way and which, as a matter of fact, are entitled to the right of way notwithstanding the cross which may have occurred subsequent to the setting of such signal or signals. In other words, in the control of a large group of switches and signals operated from a common source of energy it is altogether undesirable that in the event of a cross the signals should all be set at "danger" by the cutting off of the battery wholly regardless of all existing conditions.

My present invention relates to means for meeting and overcoming the difficulty just explained in brief, and by reference to the diagram herewith I will the more fully disclose the conditions above referred to and my means for overcoming the same.

36 represents a source of electric energy.

1<sup>a</sup> represents the signal-motor operating the signal A.

1<sup>b</sup> and 1<sup>c</sup> represent the switch-motors operating the switches B and C.

The brush 13<sup>a</sup> and its contacts represent the signal-controller, and the brushes 19<sup>b</sup> 20<sup>b</sup> and 19<sup>c</sup> 20<sup>c</sup>, together with their contacts, represent the switch-controllers.

29<sup>a</sup>, 29<sup>b</sup>, and 29<sup>c</sup> represent the indication-magnets, and 30<sup>b</sup> and 30<sup>c</sup> represent the safety-magnets, fully disclosed and described in said Patent No. 707,181.

35 is the common return-wire carrying current back from all motors to battery.

44 is a wire common to all signal-circuits.

45 is a wire common to all switch-circuits, and 57 is a wire common to all indication-circuits.

I will first describe the operation of the signal A, it being understood that a number of similar signals may be employed in a group taking power from the same source of energy.



Assumed that it is desired to set the signal A to "safety" to give a train at D right of way, the brush 13<sup>a</sup> of the controller is moved so as to make electrical connection with the contacts 10<sup>a</sup> and 11<sup>a</sup>. This closes a circuit of the battery, so that current flows through wires 37 38, armature 63, wire 61, switch-arm 39, contact 41, wires 44 19<sup>a</sup>, contact 11<sup>a</sup>, brush 13<sup>a</sup>, contact 10<sup>a</sup>, wire 14<sup>a</sup>, armature 1<sup>a</sup>, field-coils 2<sup>a</sup>, wires 7<sup>a</sup> 8<sup>a</sup>, contact 3<sup>a</sup>, brush of snap-switch 5<sup>a</sup>, contact 4<sup>a</sup>, wire 9<sup>a</sup>, and common return back to battery. This causes the motor 1 to rotate by the mechanism described in said Letters Patent and moves the signal A to "safety." With the close of the movement of the signal-blade to "safety" the brushes 5<sup>a</sup> of the snap-switch are withdrawn from the contacts 3<sup>a</sup> and 4<sup>a</sup>, and the current is shunted through the magnet 20<sup>a</sup>, and signal is held at "safety," as clearly shown in said Patent No. 707,182. When it is desired to return the signal to "danger" and to secure indication that the signal has gone to the danger position, the brush 13<sup>a</sup> is moved to the position shown in the diagram, thus breaking the circuit between the contacts 10<sup>a</sup> and 11<sup>a</sup>. The fall of the signal, as described in said afore-mentioned patents, will rotate armature 1<sup>a</sup> in the reverse direction, and as the snap-switch 5<sup>b</sup> is replaced near the end of that movement a circuit will be closed, so that current from the armature of the motor 1<sup>a</sup> will flow through the field-coils 2<sup>a</sup>, wires 7<sup>a</sup> 8<sup>a</sup>, contact 3<sup>a</sup>, brush 5<sup>a</sup>, contact 4<sup>a</sup>, wire 9<sup>a</sup>, common return, wires 49 48, coils of magnet 47, indication common, indication-magnet 29<sup>a</sup>, wire 24<sup>a</sup>, contact 12<sup>a</sup>, brush 13<sup>a</sup>, contact 10<sup>a</sup>, wire 14<sup>a</sup> back to motor-armature. This energizes the magnet 29<sup>a</sup>, causing the proper indication that the signal A has returned to normal.

A normal movement of a switch—for example, the switch B—would be as follows: Suppose it is desired to move the switch B to give right of way to the siding. The controller carrying the brushes 19<sup>b</sup> 20<sup>b</sup> is moved so that the brush 19<sup>b</sup> bridges the contacts 16<sup>b</sup> and 17<sup>b</sup> and the brush 20<sup>b</sup> bridges the contacts 22<sup>b</sup> and 23<sup>b</sup>. This closes a circuit of the battery with the motor 1<sup>b</sup>, so that current flows from the battery through wires 37 38, armature 63, wire 60, switch-arm 40, contact 42, wires 45 31<sup>b</sup>, safety-magnet 30<sup>b</sup>, wires 28<sup>b</sup> 26<sup>b</sup>, contact 17<sup>b</sup>, brush 19<sup>b</sup>, contact 16<sup>b</sup>, wire 14<sup>b</sup>, contact 7<sup>b</sup>, switch-arm 4<sup>b</sup>, wire 9<sup>b</sup>, armature 1<sup>b</sup>, wire 10<sup>b</sup>, switch-arm 3<sup>b</sup>, contact 8<sup>b</sup>, wires 12<sup>b</sup> 11<sup>b</sup>, field-coils 2<sup>b</sup>, wire 13<sup>b</sup>, and common return back to battery. This energizes the motor and moves the switch, and, as described in the afore-mentioned patents, as the switch goes home and is locked the pole-changing switch 3<sup>b</sup> and 4<sup>b</sup> is reversed, so as to make electrical connections with the contacts 5<sup>b</sup> and 6<sup>b</sup> instead of the contacts 7<sup>b</sup> and 8<sup>b</sup>. This closes a circuit including the motor and the indication-magnet 29<sup>b</sup>, so that current flows

from the armature 1<sup>b</sup> through wire 9<sup>b</sup>, switch-arm 4<sup>b</sup>, contact 6<sup>b</sup>, wire 11<sup>b</sup>, field-coils 2<sup>b</sup>, wire 13<sup>b</sup>, common return, wires 49 48, coil of magnet 47, indication common, indication-magnet 29<sup>b</sup>, wire 27<sup>b</sup>, contact 23<sup>b</sup>, brush 20<sup>b</sup>, contact 22<sup>b</sup>, wire 15<sup>b</sup>, contact 5<sup>b</sup>, switch-arm 3<sup>b</sup>, wire 10<sup>b</sup> back to motor-armature 1<sup>b</sup>. This energizes the magnet 29<sup>b</sup> and produces the indication which can occur only when the rail-switch is home and locked and when the pole-changing switch is reversed, as described in said patent.

Having thus generally described the operation of an individual signal and an individual switch, I will next describe the method by which, in the event of a cross, current is cut off from the battery and any operation of any function, either switch or signal, rendered impossible while the cross exists.

39 is a switch in the signal common, and 40 is a switch in the switch common. These switches are held normally closed by means of the magnet 51, which is placed in a permanently-closed circuit of the battery 36. 47 is a secondary winding upon said magnet through which the currents due to indication pass, and passing normally are in such direction as to supplement the magnet 51 and passing abnormally neutralize the magnet 51. The operation of this device will be the better understood if we assume a cross to exist between the wires 14<sup>b</sup> and 14<sup>c</sup> and if we move the brushes 19<sup>b</sup> 20<sup>b</sup> for the purpose of causing a movement of the switch B, as just above described. Upon the movement of the said brushes current would flow from the battery 36 through wires 37 38, armature 63, contact 65, wire 60, switch-arm 40, contact 42, switch common 45, wire 31<sup>b</sup>, magnet 30<sup>b</sup>, wires 28<sup>b</sup> 26<sup>b</sup>, contact 17<sup>b</sup>, brush 19<sup>b</sup>, contact 16<sup>b</sup>, wire 14<sup>b</sup> to the cross with 14<sup>c</sup> and thence from the cross through 14<sup>c</sup> to contact 16<sup>c</sup>, brush 19<sup>c</sup>, contact 18<sup>c</sup>, wires 24<sup>c</sup> 27<sup>c</sup>, magnet 29<sup>c</sup>, indication common, magnet 47, wires 48 49 back to battery 36. It will be noted that the current thus flowing through the coil 47 is in the reverse direction from the indication-current described in connection with the signal and that described in connection with the switch, and therefore such current would cause the two coils 47 and 51 to neutralize each other and permit the switch-arms 39 and 40 to be turned away from the contacts 41 and 42 by their spring. This would break both the signal common and the switch common and prevent the possibility of movement of any switch or signal during the time such cross exists.

Suppose that upon the throwing out of the switch-arms 39 and 40, due to a cross, the operator or other person should manually restore said switch-arms 39 and 40 to their position of contact and then should hold the lever carrying the brushes 19<sup>b</sup> 20<sup>b</sup> at reverse position above described. In that event current would flow through the circuit above de-



scribed with reference to the switch-motor operating the switch B and would move the same to some extent, while a certain part of the current would be carried through the  
 5 cross from the wire 14<sup>b</sup> and the wire 14<sup>c</sup> and flowing through the wire 14<sup>c</sup>, contact 7<sup>c</sup>, switch-arm 4<sup>c</sup>, wire 9<sup>c</sup>, armature 1<sup>c</sup>, wire 10, switch-arm 3<sup>c</sup>, contact 8<sup>c</sup>, wires 12<sup>c</sup> 11<sup>c</sup>, field-coils 2<sup>c</sup>, wire 13<sup>c</sup>, and common return back  
 10 to battery would cause a partial movement of the switch C. It is to prevent the occurrence of such an event that the magnet 62 is employed, and I will now describe how said magnet 62 and how its attendant mechanism  
 15 will prevent the restoration of an operating-circuit by the manually closing of the switches 39 and 40 and render impossible a false movement of a switch, as above described, or a false movement of a signal, (for it will be ap-  
 20 parent that a similar cross existing between an active wire of either of the switches shown and the wire 14<sup>a</sup> of the signal might produce a similar result.)

Assuming the switches 39 and 40 to be  
 25 thrown out, due to a cross, as above described, current will then flow from the battery through wires 37 59, magnet 62, wire 58, (and directly from the wire 58 to both the signal common and the switch common, as  
 30 would be the case if my invention were not employed,) and thence through the circuit above described. This will energize the magnet 62 and cause it to raise its armature 63 and break the circuit of both the signal com-  
 35 mon and the switch common through withdrawal from the contacts 64 and 65. So long as the cross exists the two common wires will thus be opened at a point other than that by which they are opened at the switches 39 and  
 40 40, and it will be impossible for the operator to restore a circuit by the manual movement of the switches 39 and 40 while such cross exists.

To show now the part which my invention  
 45 plays, suppose the signal A to be set at "safety," giving a train at D right of way upon the main track. Suppose also it is desired to give a train at F the switch C to the siding G and suppose a cross to exist between the  
 50 wires 14<sup>c</sup> and 15<sup>c</sup>. Upon moving the controller carrying the brushes 19<sup>c</sup> and 20<sup>c</sup> current would flow from the battery through wires 37 38, armature 63, contact 65, wire 60, switch-arm 40, contact 42, switch com-  
 55 mon, wire 31<sup>c</sup>, magnet 30<sup>c</sup>, wire 28<sup>c</sup> 26<sup>c</sup>, contact 17<sup>c</sup>, brush 19<sup>c</sup>, contact 16<sup>c</sup>, wire 14<sup>c</sup>, thence through the cross to wire 15<sup>c</sup>, to contact 22<sup>c</sup>, brush 20<sup>c</sup>, contact 23<sup>c</sup>, wire 27<sup>c</sup>, magnet 29<sup>c</sup>, indication common, coil 47, wires 48  
 60 49 back to battery. This causes the magnet 47 to neutralize the magnet 51 and allows the switch-arms 39 and 40 to fly open, and thus break the circuit from the signal common through the magnet 20<sup>a</sup>, and allows the signal  
 65 A to go to "danger" by gravity in the face of

a train at D having right of way with the main track. I prevent this difficulty by the employment of the resistance-coils 66 and 67 and by having a separate common for sig-  
 nals and a separate common for switches in  
 70 the following manner: The resistance-coil 66, through the wire 68, connects the wire 58 with the signal common, and the resistance-coil 67 connects the wire 58, through the wire 69, with the switch common. If now the switches  
 75 39 and 40 are opened, due to a cross, as above described, current will flow from the battery 36 through wires 37 59, magnet 62, wire 58, and from thence will divide through the re-  
 80 sistance-coils 66 and 67, and a portion of the current will pass from the resistance-coil 66 through wire 68, signal common, wire 19<sup>a</sup>, con-  
 85 tact 11<sup>a</sup>, brush 13<sup>a</sup>, contact 10<sup>a</sup>, wire 14<sup>a</sup>, armature 1<sup>a</sup>, field-coils 2<sup>a</sup>, wire 7<sup>a</sup>, magnet 20<sup>a</sup>, wires 6<sup>a</sup> 9<sup>a</sup>, common return back to battery. This will permit of a sufficient flow of current to energize the magnet 20<sup>a</sup> sufficiently to hold the signal A, already set at "safety," in the  
 safety position. At the same time the resist-  
 90 ance-coil 67 will not permit the flow of a sufficient current through the switch common to cause the movement of any switch-motor.

It will be evident that when a signal-circuit is closed the resistance-coil 66 will permit of  
 sufficient flow of current to energize the mag-  
 95 net 62, and the resistance-coil 67 being of equal resistance will cause the same result with reference to a switch. Sufficient cur-  
 rent will always reach the brake-magnet to energize it, since said brake-magnet is of rela-  
 100 tively high resistance to the coil 66 and the magnet 62. The resistance-coil 66 prevents the flow of sufficient current to cause the movement of a signal-motor, and the resist-  
 105 ance-coil 67 prevents the flow of sufficient current not only to prevent a movement of a switch, but to prevent so large a drop in potential on a circuit of a signal set to "safety" (in the event of a metallic cross) as to permit  
 110 the brake-magnet to release the signal, and these conditions make evident the employment of a switch common and a signal common or a switch bus-bar and a signal bus-bar instead of an operating common or a common  
 115 bus-bar, as has been heretofore employed. It will thus be seen that whatever the relative condition of the switches or signals in a group or set operated from a common source of energy may be sufficient resistance is interposed  
 120 to prevent the movement of any function, and at the same time connections are such that any signal already set to the safety position will remain in that position regardless of the movement of a controller to operate another  
 125 switch.

I have shown my invention applied to a system employing the circuit-breaker relay above  
 described. It will be understood at once by  
 one skilled in the art that I may use my in-  
 130 vention with equal advantage where the elec-



tromagnetic cut-out is employed without the circuit-breaker relay, and I therefore claim such adaptation of the same. In such construction a shunt-circuit around the cut-out  
5 would connect the battery with the signal common, and in such shunt-circuit would be placed a resistance-coil which would prevent the operation of any switch-motor, but permitting the flow of sufficient current to maintain the energized state of any brake-magnet  
10 properly in operation before the cross takes place.

Having thus described my invention and its method of operation, what I claim is—

15 1. In combination with a source of electric energy, a plurality of railway switches and signals, motors and mechanisms for operating the same, operating-circuits, an electromagnetic cut-out for cutting off said battery in  
20 the event of a cross between any active wire and any wire leading to the opposite pole of the battery, a conductor common to all switch-motor circuits, a conductor common to all signal-motor circuits, a shunt-circuit around  
25 said cut-out, a conductor, and a resistance-coil connecting said shunt-circuit with said signal common, substantially as set forth, for the purpose of holding signals properly set prior to such cross from going to the danger

position in the event of a cross and the action 30 of said cut-out.

2. In combination with a source of electric energy, a plurality of railway switches and signals, motors and mechanisms for actuating the same, operating-circuits, an electromag- 35 netic cut-out for cutting off said battery in the event of a cross between any active wire and any wire leading to the opposite pole of the battery, an auxiliary circuit-breaker relay for cutting off said battery at a second 40 point, a conductor common to all switch-motor circuits, a conductor common to all signal-motor circuits, a conductor connecting the coil of said circuit-breaker relay with said switch common, a conductor connecting said 45 coil with said signal common, and a resistance-coil in each of said conductors leading from said coil to said common conductors, substantially as set forth, for the purpose of holding signals properly set prior to such 50 cross from going to the danger position in the event of a cross and the action of said cut-out.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WINTHROP K. HOWE.

Witnesses:

J. F. BRAAM,

A. J. BELFRY.