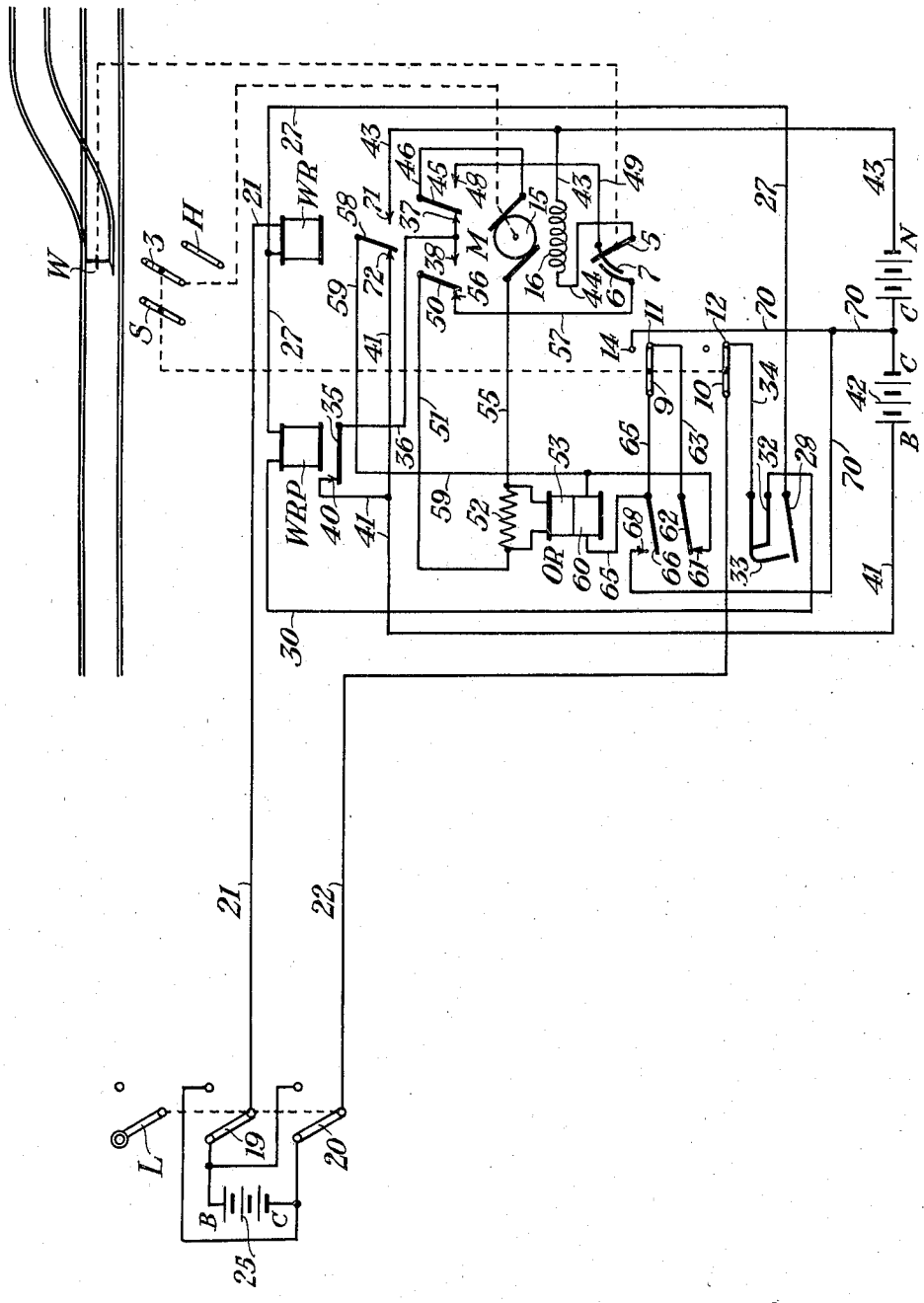
May 2, 1939. C. M. HINES 2,156,690

SWITCH CONTROL SYSTEM

Filed Sept. 27, 1938



INVENTOR
Claude M. Hines.
BY
HIS ATTORNEY

Patented May 2, 1939

2,156,690

UNITED STATES PATENT OFFICE

2,156,690

SWITCH CONTROL SYSTEM

Claude M. Hines, Pittsburgh, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Application September 27, 1938, Serial No. 231,885

8 Claims. (Cl. 246—219)

My invention relates to a control system for the motor for operating a railway track switch.

It has heretofore been proposed to provide a switch control system for the motor for operating a railway track switch, the control system including an overload relay having a pick-up winding which is connected in series with the switch motor so that the overload relay is operated on excessive flow of current in the circuit of the switch motor to interrupt the circuit for energizing the motor and thus prevent injury to the motor.

It has also been proposed to provide the overload relay with a holding winding which is energized when the contacts of the relay become picked up to thereby maintain the relay contacts picked up until the switch control lever is changed from one position to the other.

It has also been proposed to provide means for energizing the holding winding of the overload relay from a source in the vicinity of the switch, such as the battery or other source from which current is supplied to operate the switch motor, and to provide means controlled by the polarized switch control relay for controlling the polarity of the current supplied to the holding winding of the overload relay so as to maintain the polarity of this current in correspondence with the direction of energization of the pick-up winding of the relay.

Relatively heavy currents are required to operate the motors which actuate railway track switches and it is advantageous to provide means other than the contacts of the polarized switch control relay or of the overload relay to interrupt the circuit of the switch motor in the event of an overload.

It is an object of my invention to provide a switch control system of the type described and incorporating a relay separate from the polarized switch control relay and operative on picking up of the contacts of the overload relay to interrupt the circuit of the switch motor.

A further object of my invention is to provide an improved switch control system.

Other objects of my invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawing.

In the drawing the single figure is a diagram illustrating one embodiment of the improved switch control system provided by my invention.

Referring to the drawing, the reference character W designates a railway track switch which is operated by the well-known dual selector type of mechanism. In the form here shown diagrammatically the mechanism includes a dual selector lever S which operates the link 3. When the lever S is in its normal position as shown in the drawing, link 3 connects the switch W with the motor M, while when the lever S is in its reverse position, link 3 no longer connects the switch W with the switch motor M, but instead connects the switch with a hand-throw lever H.

The switch W operates a motor cut-out contact 5 in accordance with the position of the switch. The contact 5 is arranged so that it engages a stationary contact 6 in all positions of the switch W except the normal position thereof, while the contact 5 engages a stationary contact 7 in all positions of the switch except the reverse position thereof.

The selector lever S operates contacts 9 and 10 in accordance with the position occupied by the lever. When the lever S is in the normal position as shown in the drawing, contact 9 engages a contact 11, and contact 10 engages a contact 12, while when the lever S is in the hand-throw position, the contacts 9 and 10 do not engage the contacts 11 and 12 and the contact 9 engages a contact 14.

The motor M is provided with an armature 15 and a field winding 16, while a polarized relay WR and a neutral relay WRP are provided for controlling the circuits for energizing the motor M. In addition, an overload relay OR is provided and is responsive to the current taken by the motor M.

The polarized switch control relay WR is controlled by a switch control lever L which is located at a point, such as an interlocking tower, remote from the switch. The lever L has associated therewith contacts 19 and 20 to which are connected control wires 21 and 22. When the lever L is in the normal position as shown in the drawing, contact 19 connects control wire 21 to terminal B of a battery 25 and contact 20 connects control wire 22 to terminal C of the battery 25. When the lever L is in the reverse position, contact 19 connects control wire 21 to terminal C of battery 25, while contact 20 connects control wire 22 to terminal B of battery 25.

Control wire 21 is connected to one terminal of the winding of polarized switch control relay WR, the other terminal of which is connected by wire 27 to a movable contact 28 of overload relay OR. A brnach of wire 27 is connected to one terminal of the winding of relay WRP, the other terminal of which is connected by wire 30 to contact 32 of overload relay OR. The con-

tact 32 is engaged by a contact 33 when the contacts of relay OR are released, while the contact 33 is connected by wire 34 to contact 12 which is engaged by contact 10 when the selector lever S is in the normal position. The contact 10 has connected thereto the control wire 22. When contact 28 of relay OR is picked up, it first engages contact 33, thereby establishing connection from control wire 22 to wire 27. On further upward movement of the contact 28, it moves contact 33 out of engagement with contact 32, thereby interrupting connection from control wire 22 to wire 30 leading to a terminal of the winding of relay WRP.

The relay WRP is provided with a contact 35 which is connected by a wire 36 to normal and reverse polar contacts 37 and 38 of relay WR. The contact 35 when picked up engages a contact 40 which is connected by a wire 41 to terminal B of battery 42, while terminal N of this battery is connected by a wire 43 to one terminal of the motor field winding 16, the other terminal of which is connected by a wire 44 to switch operated contact 5.

The relay WR has a polar contact 45 which is connected by a wire 46 to a brush of the motor armature 15. The contact 45 when in its normal position, as shown in the drawing, engages the stationary contact 37, while when the contact 45 is in its reverse position, it engages a stationary contact 48 which is connected by a wire 49 to contact 7.

The relay WR has, in addition, a polar contact 50 which is connected by a wire 51 to one terminal of a resistor 52 and also to one terminal of the pick-up winding 53 of overload relay OR. The other terminals of the resistor 52 and of the relay winding 53 are connected by a wire 55 to a brush of the motor armature 15.

The resistor 52 has a positive thermal coefficient of resistance, that is, the resistance of the unit increases as the temperature increases. The various parts of the system are arranged and proportioned so that during normal operation of the motor M, most of the current taken by the motor flows through the resistor 52, and so little current flows through the overload relay pick-up winding 53 that the relay contacts remain released. However, if movement of the switch W is obstructed so that the motor M takes abnormal current for an unusual period of time, the resistor 52 becomes heated, thereby increasing its resistance and increasing the flow of current in the winding 53 to such a degree that the contacts of the relay become picked up.

The relay WR also has a polar contact 58 which is connected by a wire 59 to one terminal of the holding winding 60 of overload relay OR. The wire 59 is also connected to a contact 61, which, when the contacts of relay OR are released, is engaged by a contact 62 which is connected by a wire 63 to contact 11 associated with the selector lever contact 9.

The other terminal of the holding winding 60 of the overload relay OR is connected by a wire 65 to selector lever contact 9, while wire 65 is also connected to movable contact 66 of relay OR. Contact 66, when picked up, engages a stationary contact 68 to which is connected a branch of wire 70 leading from the center or common terminal C of the battery 42. Another branch of the wire 70 is connected to stationary contact 14, which in the handthrow position of the selector lever S is engaged by the contact 9.

The equipment is shown in the drawing in the position which it assumes when the switch W, the selector S and the control lever L are in their normal positions, and when the contacts of the overload relay OR are released.

As the control lever L is in the normal position, the contacts 19 and 20 establish circuits to supply current of one relative polarity, which may be considered normal polarity, to the control wires 21 and 22. As the contacts of overload relay OR are released, contact 33 engages contact 32, thereby establishing a circuit from control wire 22 to wire 30 leading to a terminal of the winding of the relay WRP. This circuit includes wire 22, selector lever contacts 10—12, wire 34, contacts 33—32 of overload relay OR, and wire 30.

When contact 28 of relay OR is released, it does not engage contact 33, and as a result the circuit from wire 22 to wire 27 leading to a terminal of winding of relay WR is interrupted.

As contacts 33—32 of relay OR establish a circuit from control wire 22 to wire 30, a circuit is established to energize the windings of the relays WRP and WR in series with current from the control wires 21 and 22. This circuit includes wire 22 and the previously traced circuit to wire 30, winding of relay WRP, wire 27, winding of relay WR and wire 21.

As the winding of relay WRP is energized, its contact 35 is picked up and engages contact 40 to thereby establish a circuit from wire 41 leading from terminal B of battery 42 to wire 36 leading to stationary contacts 37 and 38 of relay WR.

As the winding of relay WR is energized with current of normal relative polarity, the polar contacts of this relay are in their normal positions as shown, and the polar contact 45 engages contact 37, while the polar contact 50 engages contact 56.

As polar contact 45 engages contact 37, a circuit is established from wire 36, which is connected to terminal B of battery 42, to a brush of the motor armature 15, and as polar contact 50 engages contact 56 the other brush of the motor armature 15 is connected in series with the resistor 52 and the pick-up winding 53 of relay OR to contact 6. At this time, however, as the switch W is in its normal position, the switch operated contact 5 does not engage the stationary contact 6 and the energizing circuit of the switch motor M is interrupted.

In addition, as the contacts of overload relay OR are released and as the selector lever S is in its normal position, a shunt circuit is established which includes the holding winding 60 of the relay OR. This circuit includes winding 60, wire 65, selector lever contacts 9 and 11, wire 63, overload relay contacts 62—61 and wire 59 to the other terminal of the overload relay. This circuit shunting the holding winding of the overload relay serves to make the overload relay contacts slow in picking up on energization of the pick-up winding of the relay.

If at this time the operator wishes to effect movement of the switch W from the normal to the reverse position, he may do so by moving the switch control lever L from its normal to its reverse position.

On this movement of the lever L, the contacts 19 and 20 are operated to establish circuits to supply current of reverse polarity from the battery 25 to the control wires 21 and 22. On this change in the relative polarity of the current supplied to the control wires 21 and 22, the contact 35 of relay WRP becomes released and on subsequent energization of the relay winding

with current of the opposite polarity, contact 35 again becomes picked up. In addition, upon this change in the relative polarity of the current supplied to the control wires 21 and 22 the polar contacts of relay WR are shifted from their normal positions to their reverse positions.

As a result of this movement of the polar contacts 45 and 50 of relay WR, a circuit is established to energize the switch motor M and cause it to move the switch W from the normal to the reverse position, this circuit being traced from terminal B of battery 42 through wire 41, contacts 40—35 of relay WRP, wire 36, reverse polar contacts 38—50 of relay WR, wire 51, resistor 52 and pick-up winding 53 of relay OR in parallel, wire 55, motor armature 15, wire 46, reverse polar contacts 45—48 of relay WR, wire 49, contacts 7—5, wire 44, motor field winding 16, and wire 43 to terminal N of battery 42. The switch motor M being energized drives the switch W from the normal to the reverse position and when the switch W attains the reverse position, the contact 5 is moved out of engagement with contact 7, thereby interrupting the circuit for energizing motor M with the result that the motor ceases to operate.

In similar manner, if when the switch W is in the reverse position the operator wishes to effect movement of the switch to the normal position, he may do so by moving the switch control lever from its reverse to its normal position, thereby again effecting the supply of current of normal relative polarity from battery 25 to control wires 21 and 22, while the polar contacts of relay WR will be shifted from their reverse to their normal positions and will energize the switch motor M in a direction to cause the switch motor to move the switch from the reverse to the normal position. When the switch W attains its normal position, contact 5 is moved out of engagement with contact 6, thereby interrupting the energizing circuit for the switch motor and causing the motor to cease to drive the switch.

If, while the switch W is being moved from one of its positions to the other, further movement of the switch is prevented before the switch has completed its movement, the motor M will draw an excessively heavy current for an unusually long period of time. As a result of this heavy flow of current, the resistor 52 will become heated, thereby increasing its resistance and causing an increase in the flow of current in the pick-up winding of the overload relay OR sufficient to cause the contacts of the relay to become picked up. On picking up of the contacts of the relay OR, the circuit of the switch motor M will be interrupted in the manner hereinafter described in detail.

For purposes of illustration it will be assumed that the switch W is in the normal position, that it is desired to effect movement of the switch to the reverse position, and that movement of the switch is prevented before the switch has attained the reverse position.

In order to effect movement of the switch from the normal to the reverse position, the control lever L is moved from its normal to its reverse position, thereby effecting the supply of current of reverse relative polarity to the control wires 21 and 22, while the polar contacts of the relay WR are shifted from their normal to their reverse positions. On this movement of the polar contacts of the relay WR, a circuit is established to energize the switch motor M and cause it to drive the switch from the normal to the reverse position.

On obstruction of the switch, the motor M will draw an unusually heavy current and the pick-up winding 53 of overload relay OR will be energized sufficiently to cause the relay contacts to become picked up as previously explained. Picking up of the contact of relay OR will be delayed, however, because of the shunt circuit established for the holding winding 60 of the relay. This delayed operation of the contacts of relay OR is desirable as it prevents interruption of the switch motor circuit in response to a momentary overload.

On picking up of the contacts of the overload relay OR, contact 28 first engages contact 33 to thereby establish a circuit from control wire 22 to wire 27 leading to a terminal of the polarized switch control relay WR. On further upward movement of the contact 28, contact 33 is moved out of engagement with contact 32 to thereby interrupt the circuit from control wire 22 to wire 30 leading to a terminal of the relay WRP. As a result, the relay WRP is deenergized and its contact 35 becomes released, thereby interrupting the energizing circuit for the switch motor M. The motor M, therefore, will cease to move the switch W, while the motor will not be injured because of continued energization at a time when movement of the switch is obstructed.

It will be seen that on picking up of the contacts of the overload relay OR, the circuit for energizing the neutral relay WRP is interrupted, while a circuit is established to maintain the winding of relay WR energized from the control wires 21 and 22. As the winding of relay WRP is deenergized, the contact 35 becomes released and interrupts the circuit of the switch motor M, while the polar contacts of relay WR remain in the positions to which they have been operated. In addition, as the winding of relay WR is maintained connected to the control wire 22, the operator may reverse the direction of energization of the winding of the relay WR, and thereby effect movement of the switch W away from the obstruction.

In addition, upon picking up of the contacts of overload relay OR, the previously traced circuit shunting the holding winding 60 is interrupted by picking up of contact 62, while a circuit is established to energize the holding winding 60 with current supplied from battery 42, the direction of energization of the holding winding 60 corresponding to the direction of energization of the pick-up winding 53.

As previously stated, it is assumed that the obstruction to movement of the switch occurred at a time when the switch W was being moved to the reverse position. In order to effect movement of the switch to the reverse position, the relay WR is energized with current of reverse relative polarity and its contact 58 will be in engagement with reverse polar contact 71 to which is connected a branch of wire 43 leading from terminal N of battery 42.

As contact 58 engages contact 71, a circuit is established from wire 43, leading from terminal N of battery 42 to wire 59 leading to one terminal of pick-up winding 60, while on picking up of contact 66 of relay OR, wire 65 leading from the other terminal of the holding winding 60 is connected to wire 70 leading to the center or common terminal C of battery 42.

On picking up of the contacts of overload relay OR, therefore, a circuit is established to ener-

gize the holding winding 60 with current supplied from the battery 42, and this current is of a polarity corresponding to the polarity of the current supplied to the pick-up winding 53. As the holding winding 60 is energized, the contacts of overload relay OR will be maintained picked up following interruption of the switch motor circuit by contact 35 of relay WRP.

The contact 66 which completes the circuit to the holding winding 60 of relay OR, and the contacts 33—32 which control the circuit to the winding of relay WRP are arranged so that on picking up of these contacts, contact 66 will engage contact 68 and complete the circuit to the holding winding of relay OR, before contact 33 is moved out of engagement with contact 32 to interrupt the circuit to the winding of relay WRP and thus effect release of contact 35 and interruption of the switch motor circuit.

If following the occurrence of the obstruction to movement of the switch the operator wishes to return the switch W to the normal position, he may do so by returning the control lever L to the normal position. On this movement of the control lever L, the contacts 19 and 20 establish circuits to supply current of normal relative polarity from battery 25 to control wires 21 and 22 with the result that the direction of energization of the winding of the polarized switch control relay WR is reversed and the polar contacts of this relay are shifted from their reverse to their normal positions. On this movement of the contact 58, it is moved out of engagement with contact 71, thereby interrupting the previously traced circuit for energizing the holding winding 60 of overload relay OR. On movement of the contact 58 to its normal position, it engages a contact 72 to which is connected a branch of wire 41 leading from terminal B of battery 42, and a circuit is now established to energize the holding winding 60 of relay OR with current of the opposite relative polarity to that which was previously supplied to this winding. This circuit is traced from terminal B of battery 42 through wire 41, normal polar contacts 72—58 of relay WR, wire 59, winding 60 of relay OR, wire 65, contacts 66—68 of relay OR and wire 70 to terminal C of battery 42.

On this change in the polarity of the current supplied to the holding winding 60, the contacts of the relay become released and contact 66 interrupts the previously traced circuit for energizing the holding winding 60 with the result that the contacts do not become picked up again after they become released.

On the release of the contacts of the overload relay OR, contact 28 drops out of engagement with contact 33, thereby interrupting the circuit for establishing connection from control wire 22 to wire 27 leading to a terminal of the polarized relay WR. In addition, on release of the contacts of the overload relay OR, contact 33 moves into engagement with contact 32, thereby establishing the previously traced circuit for connecting control wire 22 to wire 30 leading to a terminal of the neutral relay WRP. Accordingly the windings of the relays WRP and WR are again connected in series and are energized from the control wires 21 and 22.

On energization of the winding of the neutral relay WRP, the contact 35 of this relay becomes picked up and engages contact 40 to again establish a circuit from wire 41 leading from terminal B of battery 42 to wire 36 leading to a polar contact of the relay WR.

At this time as the winding of the relay WR is energized with current of normal relative polarity, and the polar contacts of the relay are in their normal positions, as shown, on picking up of the contact 35 of the relay WRP, circuits are established to energize the switch motor M to cause it to move the switch W towards the normal position. When the switch W attains the normal position, contact 5 is moved out of engagement with contact 6 to thereby interrupt the energizing circuit for the switch motor.

In similar manner, if when the switch W is being moved from the reverse to the normal position movement of the switch is obstructed before the switch has attained the normal position, the overload relay OR will operate in the manner previously described to interrupt the circuit for energizing the winding of the neutral relay WRP from the control wires 21 and 22, while maintaining the circuit for energizing the relay WR from these wires.

In addition, on picking up of the contacts of the overload relay OR at such time, a circuit is established to energize the holding winding 60 of the relay OR with current of a polarity corresponding to that supplied to the pick-up winding 53 of the relay OR.

It will be seen that when the switch W is being moved from the reverse to the normal position, the polar contacts of the relay WR will be in their normal positions, as shown in the drawing, and the contact 58 will engage polar contact 72. Accordingly, on picking up of the contacts of the overload relay OR, a circuit is established to energize the holding winding 60 with current supplied from the battery 42, this circuit being traced from terminal B of battery 42 through wire 41, normal polar contacts 72—58 of relay WR, wire 59, winding 60, wire 65, contacts 66—68 of relay OR, and wire 70 to terminal C of battery 42. It will be seen that the current supplied to energize the holding winding 60 of relay OR is of a polarity opposite to that supplied at a time when the polar contacts of the relay WR are in their reverse positions. As the polarity of the current supplied to energize the holding winding is in agreement with that supplied to the pick-up winding 53, the contacts of the relay are held picked up as a result of energization of the holding winding 60.

If following obstruction of the switch during its movement to the normal position the operator wishes to return the switch to the reverse position, he may do so by returning the control lever L to the reverse position, thereby reversing the polarity of the current supplied to the control wires 21 and 22, and thus reversing the direction of energization of the winding of the polarized relay WR with the result that the polar contacts of this relay are shifted from their normal to their reverse positions. On this movement of the polar contacts of the relay WR, the previously traced circuit for energizing the holding winding 60 of the relay OR is interrupted, and a circuit is established to energize this winding with current of the opposite relative polarity, this circuit including wire 43 leading from terminal N of battery 42, reverse polar contacts 71—58 of relay WR, wire 59 and the other portions of the circuit previously traced in detail leading to terminal C of battery 42.

As a result of this reversal in the direction of energization of the holding winding 60 of relay OR, the contacts of this relay become released, and when contact 66 of the relay is released the energizing circuit for the holding winding is in-

terrupted with the result that the contacts of the relay do not thereafter become picked up again. On release of the contacts of the overload relay OR, contact 28 is disengaged from contact 33, thereby interrupting the circuit for establishing connection from control wire 22 to wire 27 leading to the terminal of the winding of the polarized relay WR, while contact 33 engages contact 32 to again establish the circuit for connecting wire 22 to wire 30 leading to a terminal of the winding of the neutral relay WRP. The winding of the relay WRP, therefore, will be energized and the contact 35 will be picked up to again establish the circuit for energizing the motor, while the polar contacts of the relay WR will establish circuits to energize the switch motor M in a direction to cause the motor to move the switch to the reverse position.

The control system provided by this invention is arranged so that when the selector lever S is in the hand-throw position, the circuits for energizing the windings of the relays WR and WRP are interrupted to thereby prevent operation of the motor as long as the selector lever S remains in the hand-throw position.

The system is also arranged so that on movement of the selector lever S to the hand-throw position, a circuit is established to energize the holding winding of the overload relay and so that when this winding is energized as a result of movement of the selector lever S to the hand-throw position, the winding will be maintained energized after return of the selector lever S to the normal position until the position of the control lever L is changed. This is advantageous as it operates, on movement of the dual selector lever to the hand-throw position and return to the normal position, to remove the switch from the control of the switch control lever until there is some manipulation of the switch control lever after the dual selector lever has been returned to the hand-throw position.

It will be seen that upon movement of the selector lever S to the hand-throw position, contact 10 is moved out of engagement with contact 12, thereby interrupting connection of control wire 22 with wire 34. Accordingly contact 33 is unable to establish a circuit from control wire 22 either to wire 27 leading to the winding of polarized relay WR, or to wire 30 leading to the windings of relays WRP and WR. The windings of relays WRP and WR, therefore, will be deenergized both while the contacts of relay OR are released and also when the contacts of this relay are picked up. As the contact 35 of relay WRP is released, the energizing circuit for the motor M is interrupted and the motor M cannot be operated.

In addition, upon movement of the selector lever S to the hand-throw position, contact 9 is moved out of engagement with contact 11, thereby interrupting the shunt circuit for the holding winding 60 of relay OR, while contact 9 is moved into engagement with contact 14, thereby establishing a circuit from wire 70, leading from terminal B of battery 42, to wire 65 leading to one terminal of the holding winding 60 of relay OR. The other terminal of the winding 60 is connected by wire 59 to polar contact 58 of relay WR. In one position of the polar contact 58 it engages contact 72 to which is connected wire 41 leading from terminal B of battery 42, while in the other position of polar contact 58 it engages contact 71 to which is connected wire 43 leading from terminal N of battery 42. It will be seen, therefore, that wire 59 leading from one terminal of the holding winding 60 of relay OR will be connected to terminal B or to terminal N of battery 42 depending upon the position occupied by polar contact 58 of relay WR at the time the selector lever S is moved to the hand-throw position.

On energization of the winding 60, the contacts of relay OR become picked up and contact 66 engages contact 68 to establish a stick circuit from wire 70 to wire 65 to maintain the holding winding 60 of relay OR energized after movement of selector lever contact 9 out of engagement with contact 14.

It will be seen that when the contacts of relay OR become picked up, contact 62 interrupts the shunt circuit for the winding 60 so that on return of the selector lever S to the normal position and movement of contact 9 into engagement with contact 11, the shunt circuit for winding 60 is not restored, but remains interrupted by contact 62.

As long as the selector lever S remains in the hand-throw position, the contact 10 interrupts the circuit from the control wire 22 to the windings of relays WR and WRP as previously explained, while contact 9 maintains the circuit for energizing the holding winding 60 of relay OR.

Accordingly, if while the selector lever S is in the hand-throw position the posiiton of the control lever L is changed, thereby reversing the polarity of the current supplied to the control wires 21 and 22, the position of polar contacts of relay WR will not be changed, while contact 35 of relay WRP will remain released, with the result that the motor M will not be affected by such change in the position of the control lever L.

On subsequent return of the selector lever S to the normal position, contact 9 no longer engages contact 14, but the winding 60 of relay OR is maintained energized by current supplied over the stick circuit established by contact 66 of relay OR. In addition, on return of the selector lever S to the normal position, contact 10 engages contact 12 and thereby connects wire 22 to wire 34. At this time, as the contacts of relay OR are picked up, contact 28 engages contact 33, while contact 33 is held out of engagement with contact 32. Accordingly a circuit is established from wire 34 to wire 27 so that when contact 10 is moved into engagement with contact 12 the winding of relay WR is connected to control wires 21 and 22, but the circuit to the winding of relay WRP remains interrupted with the result that contact 35 of relay WRP remains released.

If the operator in control of the switch control lever L now wishes to regain control of the switch W, he may be do by reversing the position of the switch control lever L. This reverses the polarity of the current supplied to the control wires 21 and 22, and as the winding of the relay WR is connected to the control wires at this time, as previously explained, the polar contacts of the relay WR will be changed from one position to the other with the result that polar contact 58 is moved out of engagement with one of the stationary contacts associated therewith, and into engagement with the other of the stationary contacts associated therewith. As a result of this movement of the polar contact 58, there is a reversal in the direction of energization of the holding winding 60 of relay OR with the result that the contacts of this relay become released, and contact 66 thereupon interrupts the stick circuit for the winding 60 so that after release of the relay contacts the relay winding is de-

energized and the contacts of the relay do not thereafter again become picked up.

On release of the contacts of relay OR, contact 26 moves out of engagement with contact 33, while contact 33 is moved into engagement with contact 32 to again connect the winding of relay WRP in series with the winding of relay WR, while contact 35 of relay WRP becomes picked up to again establish the circuit for the switch motor M. The switch motor M, therefore, will be energized in a direction determined by the position of the polar contacts 45 and 59 of relay WR.

From the foregoing, it will be seen that the improved switch control system provided by this invention incorporates a neutral relay in addition to the usual polarized switch control relay, and that the system is arranged so that the contacts of the polarized relay are not required to interrupt the energizing circuit for the switch motor.

During normal operation of the switch W, at the completion of the movement of the switch, the energizing circuit for the switch motor M is interrupted by the switch operated contact 5. In the event movement of the switch W is obstructed and the contacts of the overload relay OR become picked up, the winding of neutral relay WRP is deenergized with the result that its contact 35 is released and interrupts the energizing circuit for the switch motor.

In addition, on picking up of the contacts of the overload relay OR, the winding of relay WR remains connected to the control wires 21 and 22. Furthermore, at this time the degree of energization of this winding is increased because of the removal of the winding of the relay WRP from the circuit of the control wires 21 and 22. Accordingly at the time the contact 35 of relay WRP is released, the polar contacts of relay WR are held closed with more than usual force and no arcing occurs at the contacts of relay WR, while subsequent response of relay WR to a change in the polarity of the current supplied to the control wires 21 and 22 is made more certain.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, an overload relay controlled by the magnitude of the current in the motor supply circuit, a control circuit for energizing the windings of the neutral and polarized relays from said pair of conductors, and means controlled by the overload relay for interrupting said control circuit and for establishing a circuit for energizing only the winding of the polarized relay from said conductors.

2. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, an overload relay controlled by the magnitude of the current in the motor supply circuit, a control circuit for energizing the windings of the neutral and polarized relays in series from said pair of conductors, and means controlled by the overload relay for interrupting said control circuit and for establishing a circuit for energizing only the winding of the polarized relay from said conductors.

3. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, an overload relay controlled by the magnitude of the current in the motor supply circuit, the overload relay having contacts which when released establish a control circuit for energizing the windings of the neutral and polarized relays from the said pair of conductors, said contacts being operative on energization of the overload relay winding to first establish a circuit to energize only the winding of the polarized relay from said conductors and to thereafter interrupt the said control circuit.

4. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, an overload relay controlled by the magnitude of the current in the motor supply circuit, the overload relay having contacts which are normally released and which become picked up on a predetermined increase in the magnitude of the current flowing in the motor supply circuit, a circuit for energizing the winding of the neutral relay, said circuit being controlled by a contact of the overload relay and being interrupted on picking up of said overload relay contacts, and means for energizing the winding of the switch control relay from said conductors both when the overload relay contacts are picked up and when they are released.

5. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, an overload relay having a pick-up winding and a holding winding, means for energizing the relay pick-up winding in accordance with the magnitude of the current in the motor supply circuit, the

overload relay having contacts which become picked up on a predetermined increase in the magnitude of the current in the motor supply circuit, the overload relay contacts being operative when picked up to establish a circuit to supply current to the holding winding of such relay, means controlled by the polarized relay for controlling the polarity of the current supplied to the circuit of the holding winding, a circuit controlled by a contact of the overload relay for energizing the winding of the neutral relay, and means for energizing the winding of the polarized relay from said pair of conductors.

6. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, means for energizing the winding of the polarized relay from said pair of conductors, an overload relay having a pick-up winding and a holding winding, means for energizing the relay pick-up winding in accordance with the magnitude of the current in the motor supply circuit, the overload relay having contacts which become picked up on a predetermined increase in the magnitude of the current in the motor supply circuit or when the holding winding is energized, a circuit controlled by a contact of the overload relay for energizing the winding of the neutral relay, and a selector lever having a normal position in which it conditions the switch for operation by the motor and a hand-throw position in which it conditions the switch for manual operation, the selector lever being operative in the hand-throw position to establish a circuit to supply energy to the overload relay holding winding, the polarized relay controlling the polarity of the current supplied to the holding winding through such circuit.

7. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a neutral relay controlling a supply circuit for energizing the switch motor, a polarized relay controlling the direction of energization of the motor by current supplied by said supply circuit, means for energizing the winding of the polarized relay from said pair of conductors, an overload relay having a pick-up winding and a holding winding, means for energizing the relay pick-up winding in accordance with the magnitude of the current in the motor supply circuit, the overload relay having contacts which become picked up on a predetermined increase in the magnitude of the current in the motor supply circuit, a circuit controlled by a contact of the overload relay for energizing the winding of the neutral relay, and a selector lever having a normal position in which it conditions the switch for operation by the motor and a hand-throw position in which it conditions the switch for manual operation, the selector lever being operative when and only when in the hand-throw position to establish a circuit to supply energy to the overload relay holding winding, a contact of the overload relay being operative when picked up to also establish a circuit to supply energy to the overload relay holding winding, the polarized relay controlling the polarity of the current supplied to the holding winding by the circuits established by the selector lever and the overload relay contact.

8. In a switch control system, in combination, a railway track switch movable between a normal and a reverse position, a motor for operating said switch, a pair of conductors, means for supplying to said conductors current of one relative polarity or the other, a polarized relay having a winding energized from said pair of conductors, said relay controlling normal and reverse circuits for energizing said motor to cause it to operate in one direction or the other, an overload relay having a pick-up winding and a holding winding, means for energizing the relay pick-up winding in accordance with the magnitude of the current supplied to the switch motor through either said normal or reverse circuits, the overload relay having contacts which become picked up on a predetermined increase in the magnitude of the current in the pick-up winding, a contact of the overload relay controlling a holding circuit for supplying current to said holding winding, means controlled by the polarized relay for controlling the polarity of the current supplied to said holding circuit, and a neutral relay operative on picking up of the overload relay contacts to interrupt the normal and reverse circuits for energizing the switch motor.

CLAUDE M. HINES.