

May 17, 1938.

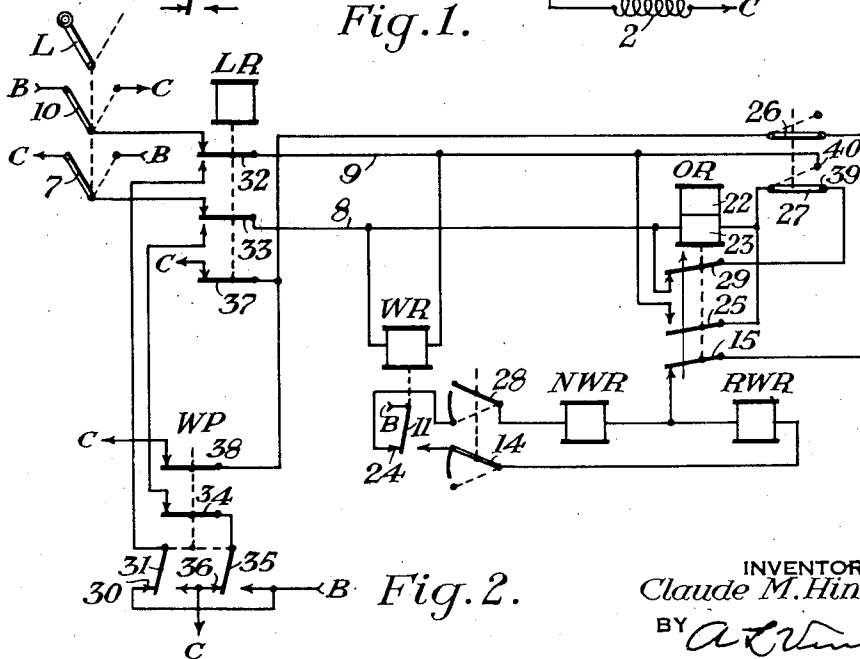
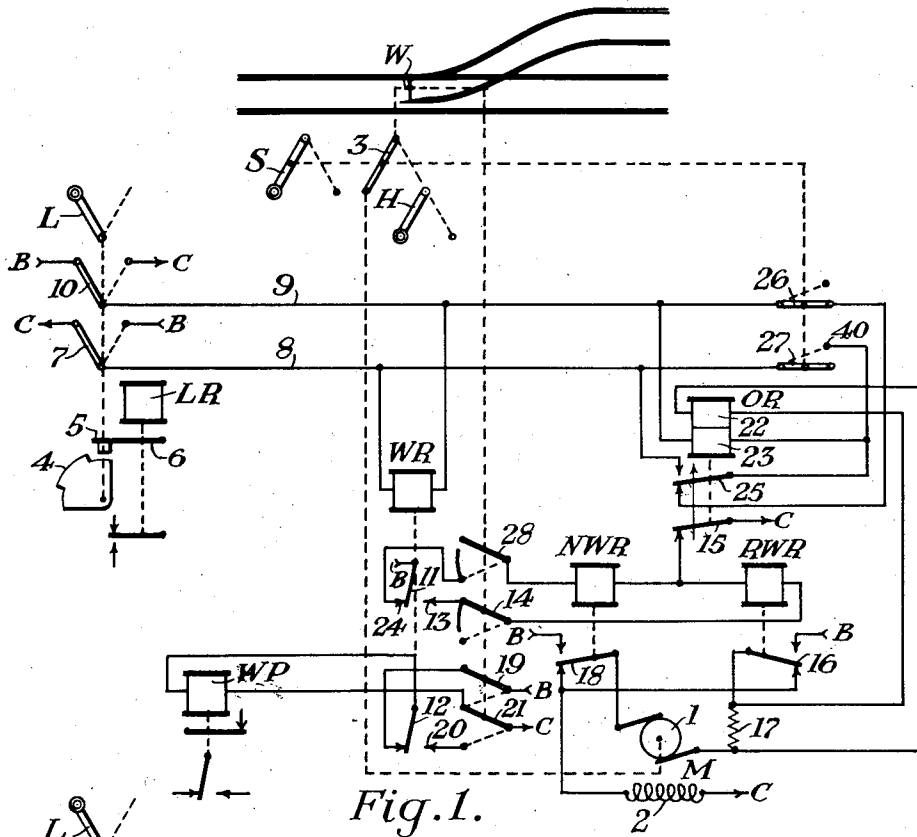
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2,117,323

RAILWAY SWITCH CONTROLLING APPARATUS

Filed Nov. 6, 1935

4 Sheets-Sheet 1



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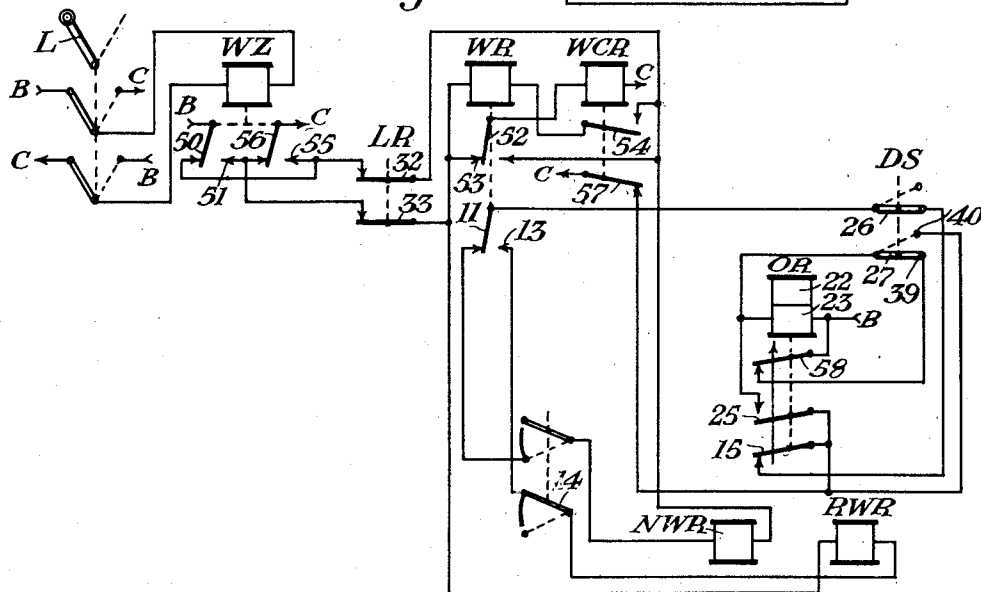
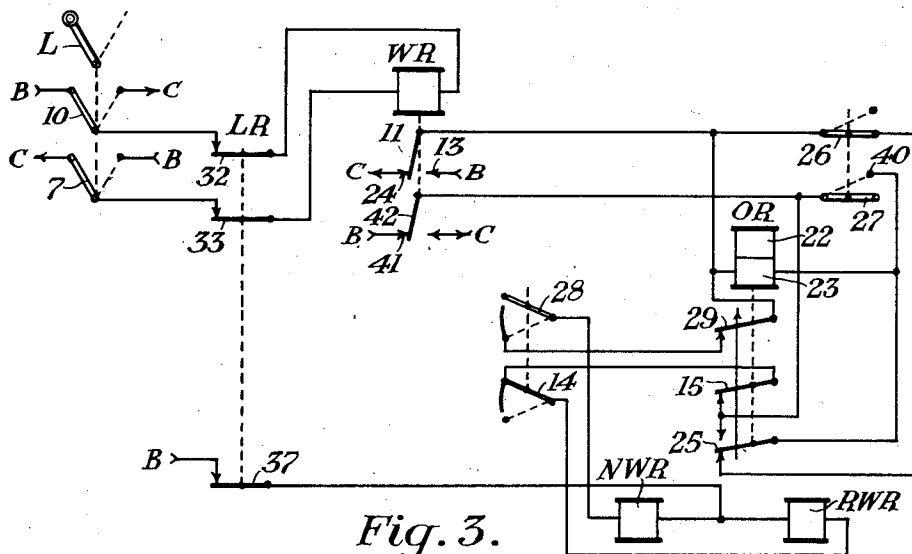
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RAILWAY SWITCH CONTROLLING APPARATUS

Filed Nov. 6, 1935

4 Sheets-Sheet 2



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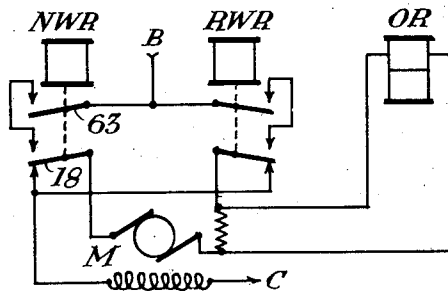
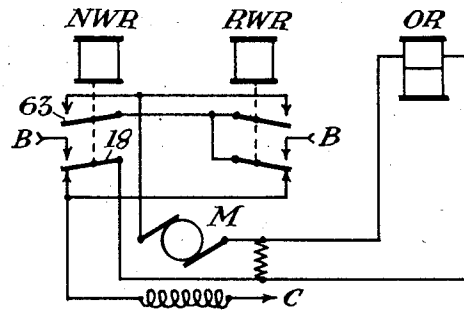
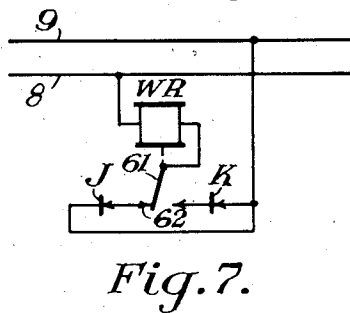
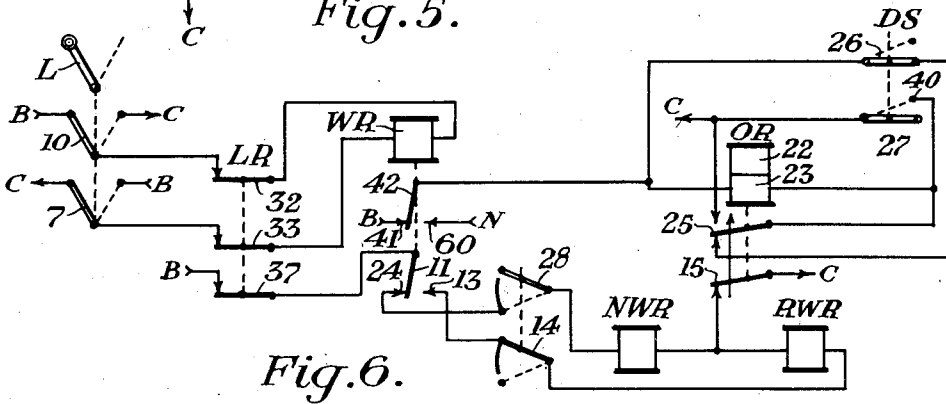
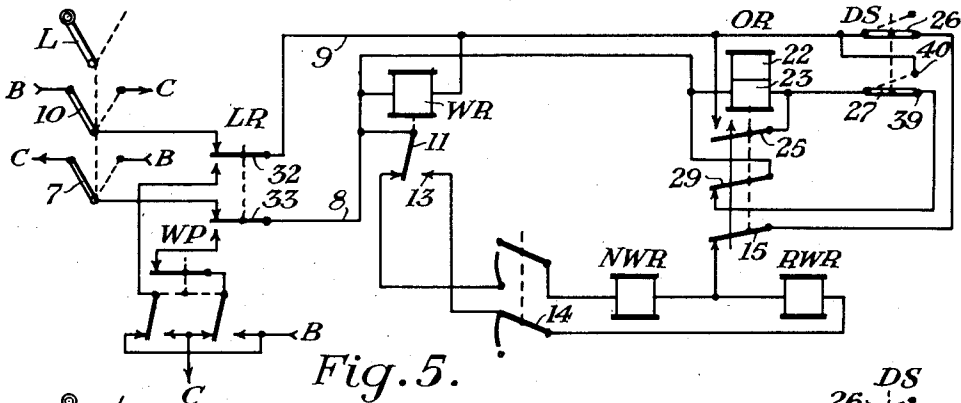
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2,117,323

RAILWAY SWITCH CONTROLLING APPARATUS

Filed Nov. 6, 1935

4 Sheets-Sheet 3



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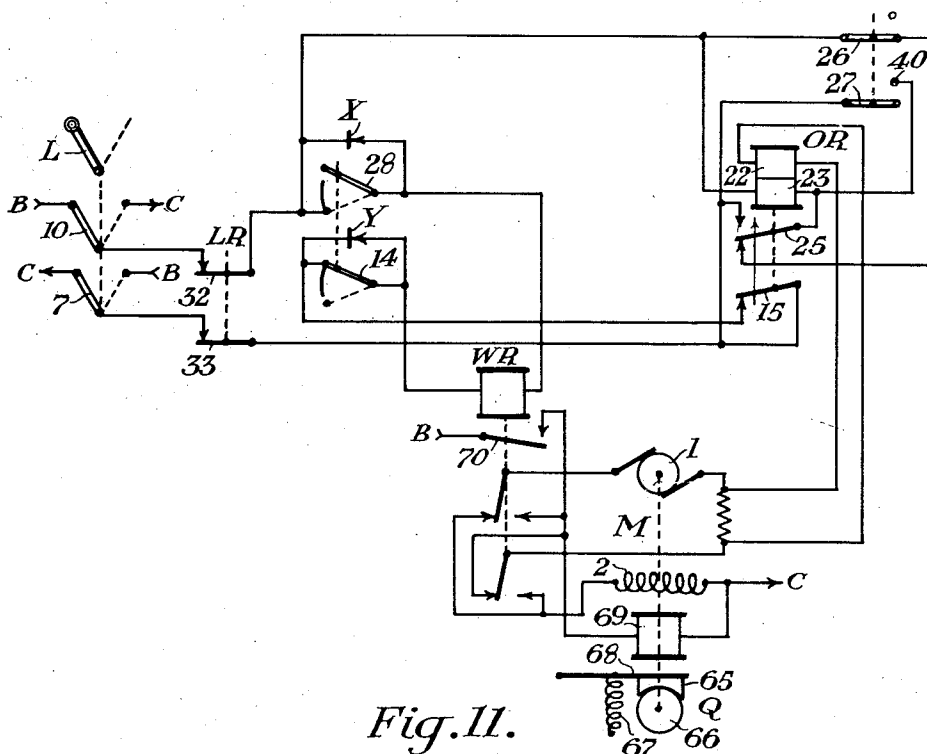
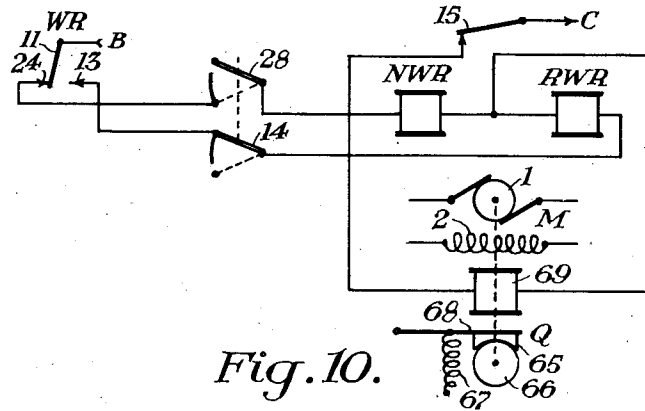
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RAILWAY SWITCH CONTROLLING APPARATUS

Filed Nov. 6, 1935

4 Sheets-Sheet 4



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2,117,323

RAILWAY SWITCH CONTROLLING APPARATUS

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

Application November 6, 1935, Serial No. 48,523

7 Claims. (Cl. 246—3)

My invention relates to railway switch controlling apparatus, and particularly to apparatus for the protection of a railway switch motor against overload.

5 I will describe several forms of apparatus embodying my invention, and will then point out the novel features thereof in claims.

The apparatus of this invention is an improvement over that disclosed in the copending application Serial No. 133,218 of Norman F. Agnew and myself, filed March 26, 1937, for Railway switch controlling apparatus.

10 In the accompanying drawings, Fig. 1 is a diagrammatic view illustrating one form of apparatus embodying my invention. Figs. 2 to 11, inclusive, are diagrammatic views illustrating modifications of portions of the apparatus shown in Fig. 1, and each also embodying my invention.

15 Similar reference characters refer to similar parts in each of the several views.

Referring first to Fig. 1, the reference character W designates a railway switch which is operated by the well-known dual selector type of mechanism. In the form here shown diagrammatically, this mechanism comprises a dual selector lever S which operates a link 3. When the lever S is in its normal position, as shown in the drawings, link 3 connects switch W with motor M, and when lever S is in its reverse position, link 3 disconnects the switch W from motor M and connects the switch with a hand throw lever H. The selector lever S also controls contacts 26 and 27 in accordance with the position of the lever. That is, contact 26 is closed only when the selector lever S occupies its normal position and contact 27 is closed only when the selector lever S occupies its reverse position.

20 The motor M is controlled by a normal switch control relay NWR and a reverse switch control relay RWR in such manner that motor M is caused to operate switch W to its normal position when relay NWR is energized and relay RWR is deenergized, and is caused to operate switch W to its reverse position when relay RWR is energized and relay NWR is deenergized.

25 The relays NWR and RWR are controlled by a polarized switch control relay designated by the reference character WR and by an overload device designated by the reference character OR. That is, when the overload device OR is in its initial deenergized condition, either the relay NWR or RWR may be energized depending upon the condition of the polarized switch control relay WR.

30 The polarized switch control relay WR is controlled by a lever designated by the reference character L which lever is usually located at some point remote from the switch.

35 Associated with the lever L is a locking device which comprises a segment 4 operatively con-

nected with lever L and cooperating with a dog 5 in such manner that the lever L cannot be moved from either extreme position unless the dog 5 is in its unlocking position as shown in the drawings. The dog 5 is controlled by an armature 6 of a locking relay designated by the reference character LR.

The locking relay LR is controlled in accordance with traffic conditions adjacent the switch, by any usual and well-known means not shown in the drawings, in such manner that the relay LR is energized only when the traffic conditions adjacent the switch are such as to permit safe operation of the switch W. The lever L, therefore, cannot be moved from either of its extreme positions, so as to cause operation of the switch W, if traffic conditions adjacent the switch are such as to cause the deenergization of the relay LR.

40 The overload device OR is here shown as a relay having two windings. As will be explained more in detail hereinafter, one winding 22, which I shall term an overload winding, is controlled by the current in the motor M, and the other winding 23, which I shall term the holding winding, is controlled by the switch lever L and by the dual selector lever S. Winding 22 is connected in parallel with thermal resistor 17 which under normal conditions carries the major portion of the motor current. When the switch is obstructed, motor M draws increased current which heats up resistor 17, thus increasing its resistance. This increased resistance causes a larger voltage drop across winding 22 thus causing sufficient current to flow in winding 22 to energize overload relay OR.

45 The reference character WP designates a polarized switch indication relay which is energized in the normal or reverse direction in accordance with the switch position provided the condition of the polarized switch control relay WR is in agreement with the condition of the switch. The switch indication relay WP may be utilized in the well-known manner, by means not shown in the drawings, for controlling signals which govern the movement of traffic over the switch W.

50 The operation of the apparatus shown in Fig. 1 will best be understood by explaining the operation and tracing the circuits simultaneously.

I shall first assume that with all apparatus in its normal condition, as shown in the drawings, the operator desires to cause switch W to move to its reverse position. He may do this by moving lever L to its reverse position. When lever L occupies its reverse position, relay WR will become energized in the reverse direction by virtue of a circuit which passes from a terminal B of a suitable source of energy through lever contact 7, wire 8, winding of relay WR, wire 9, and lever 60

contact 10 to terminal C of the same source of energy. When polarized switch control relay WR is energized in the reverse direction, its polar contacts 11 and 12 will move to the right so as to come into engagement with their right-hand contacts. When contact 11—13 of relay WR is closed, reverse switch control relay RWR will become energized by a circuit which passes from terminal B, through contact 11—13 of relay WR, reverse switch cut-out contact 14, winding of relay RWR, and back contact 15 of overload relay OR to terminal C. When reverse switch control relay RWR is energized, the motor M will be caused to operate in the reverse direction by a circuit which passes from terminal B through front point of contact 16 of relay RWR, resistor 17 and overload winding 22 of relay OR in multiple, armature 1, back point of contact 18 of relay NWR, and motor field 2 to terminal C. When motor M completes the movement of switch W to its reverse position, motor cut-out contact 14 will become opened so that relay RWR will become deenergized. When relay RWR is deenergized, current will be disconnected from the motor M so that the motor will cease operation. The switch indication relay WP at this time will be energized in the reverse direction by virtue of a circuit which passes from terminal B, through pole-changer contact 19, winding of relay WP, contact 12—20 of relay WR and pole-changer contact 21 to terminal C. The relay WP, therefore, may now be utilized in any well-known manner to indicate that the switch W occupies its reverse position.

I shall next assume that the switch W became obstructed and failed to reach its reverse position. In this event, the current drawn by the motor through resistor 17 will cause the voltage drop across overload winding 22 of relay OR to increase to such a value that overload relay OR will be operated from its initial deenergized condition to its operated or picked up condition as previously explained. It will be noted that the holding winding 23 of the relay OR is connected in a shunt path which includes normally closed selector lever contact 26 and back point of contact 25 of relay OR. Holding winding 23 is so connected in this shunt path that the flux induced in the holding winding 23 by the energization of the overload winding 22 will oppose the flux in the overload winding 22 so that the overload relay OR will have a slow acting characteristic. In other words, the shunting of the holding winding 23 causes relay OR to be slow in picking up so that momentary surges of current in the motor such, for example, as occur when the motor is starting will not cause the operation of the overload relay.

When the overload relay attains its operated or picked up condition, it will be retained in such condition by virtue of a stick circuit which passes from terminal B through contact 7 of lever L, wire 8, front point of contact 25 of relay OR, holding winding 23, wire 9, and contact 10 of lever L to terminal C. Holding winding 23 will be so connected that it will be energized in a direction to correspond to the energization of the overload winding. Therefore, when lever L is in such position as to operate the switch to its reverse position, the holding winding will also be energized in the reverse direction.

Contacts 15 and 25 of overload relay OR will be so adjusted that the front point of contact 25 will close before back point of contact 15 opens. The relay RWR, therefore, will not become deener-

gized so as to disconnect energy from overload winding 22 before holding winding 23 becomes energized.

When the operator desires to again assume control of the switch W, he may do this by manipulating lever L to its normal position which will momentarily energize holding winding 23 in the normal direction over the previously traced stick circuit so that the flux in winding 23 will be opposed and neutralized to cause relay OR to return to its initial deenergized condition.

When switch W is to be operated by hand throw lever H, it is desirable that the motor M should be removed from control by the switch lever L and that the motor M should not be restored to control of the switch lever L without some distinctive act by the operator, such, for example, as manipulating the lever L, even though the switch W should again be coupled to the motor M.

Assuming that the switch W is again occupying its normal position, the movement of dual selector lever S will disconnect the switch W from the motor M, will connect the switch to hand throw lever H and will open contact 26 and close contact 27—40. The opening of contact 26 will open the shunt path around holding winding 23 and the closing of contact 27—40 will energize holding winding 23 by virtue of a circuit which passes from terminal B, through contact 10 of switch lever L, wire 9, winding 23, selector lever contact 27—40, wire 8, and contact 7 of lever L to terminal C. When the overload relay is energized, its back contact 15 will be opened so that neither normal switch control relay NWR nor reverse switch control relay RWR can be energized. Relay OR will be retained in its picked up condition until switch lever L is moved to its opposite position by virtue of a stick circuit which passes from terminal B through contact 10 of lever L, wire 9, winding 23, front point of contact 25 of relay OR, wire 8, and contact 7 of lever L to terminal C.

From the foregoing, it will be apparent that I have provided a simple and reliable means of controlling an overload relay for disconnecting a railway switch motor upon excessive current flow therein which device has a slow acting characteristic so as to be substantially immune to momentary surges of current in the motor. Furthermore, the overload relay may also be operated by the manipulation of a dual selector lever so that remote control of the motor is prevented when the switch is being operated locally by hand. In addition, I also provide means for retaining the overload relay in its operated condition wherein the motor is rendered inoperative until such time as the operator at the remote control point manipulates the switch lever so as to initiate a new movement of the switch.

Referring next to Fig. 2, the lever L is herein shown as the type which is not provided with mechanical locking and which is free to move at all times. Movement of the switch under dangerous traffic conditions, however, is prevented by controlling the polarized switch control relay WR over front contacts of the locking relay LR. Furthermore, it will be noted that when the locking relay LR is deenergized due, for example, to the presence of a train in the switch W, the polarized switch control relay will be energized and maintained in one condition or another by circuits controlled by contacts of the switch indication relay WP. For example, with the switch control relay WR and the switch indication relay both

in their normal condition, the switch control relay WR will be energized in the normal direction when the locking relay LR is released by virtue of a circuit which passes from terminal B through polar contact 30—31 of relay WP, back point of contact 32 of relay LR, wire 9, relay WR, wire 8, back point of contact 33 of relay LR, neutral front contact 34 of relay WP and polar contact 35—36 of relay WP to terminal C. The relay WR, therefore, is prevented from moving from its initial condition while the locking relay LR is released.

The polarized switch control relay WR is otherwise controlled in the usual manner by the switch lever L and the relay WR controls the normal and reverse switch control relays NWR and RWR in the usual manner.

It will be noted that the normal and reverse switch control relays NWR and RWR are each provided with a control circuit which includes back contact 15 of overload relay OR, selector lever contact 26, and then two branch paths, one of which includes front contact 37 of locking relay LR, and the other of which includes front neutral contact 38 of indication relay WP. The back contact 15 of the overload relay OR and the selector lever contact 26 are provided for disconnecting energy from the switch control relays NWR or RWR when the switch W is obstructed and when the switch is to be operated by lever H, respectively. The front contact 37 of relay LR in multiple with front contact 38 of relay WP provides a means for energizing the relay NWR or RWR for normal operation of the switch and a means for energizing one or the other of the switch control relays NWR and RWR in the event the switch should creep or otherwise be moved when the locking relay LR is released. For example, if the switch W should begin to move from its normal position when the relay LR is released, energy would be supplied to normal switch control relay NWR as soon as normal motor cut-out contact 28 becomes closed by virtue of a circuit which passes from terminal B through polar contact 11—24 of relay WR, normal motor cut-out contact 28, relay NWR, back contact 15 of overload relay OR, selector lever contact 26, and front neutral contact 38 of relay WP to terminal C. When normal switch control relay NWR is energized, the motor M will be energized in the normal direction to drive switch W back to its normal position.

The holding winding 23 of the overload relay OR is provided with the usual shunt path which includes back contact 29 of relay OR and selector lever contact 27—39. When the overload relay is operated by excessive current in the motor M or by manipulation of the selector lever S so as to energize the holding winding 23 through a pick-up circuit which passes from terminal B through contact 10 of lever L, front point of contact 32 of relay LR, wire 9, selector lever contact 40—27, winding 23, wire 8, front point of contact 33 of relay LR and contact 7 of lever L to terminal C, the shunt path through the winding 23 will be opened by the opening of back contact 29 of the relay OR and a stick circuit for maintaining relay OR picked up will be established by the closing of front contact 25 of relay OR. It will be noted that this stick circuit, with the lever L in the normal position, passes from terminal B through contact 10 of lever L, front point of contact 32 of relay LR, wire 9, front contact 25 of relay OR, holding winding 23 of relay OR, wire

8, front point of contact 33 of relay LR and contact 7 of lever L to terminal C.

When the overload relay OR is in its operated condition, the relays NWR and RWR are both retained in their deenergized condition so that the motor M cannot be operated.

When the operator desires to again assume control of the relays NWR and RWR, he may do so by reversing switch lever L so that the holding winding 23 will become energized in the opposite direction. When the winding 23 is energized in the opposite direction, the relay OR will become released so that the stick circuit will be broken by the opening of front contact 25 of relay OR.

Referring next to Fig. 3, it will be noted that the polarized switch control relay WR is controlled by easily traced circuits which are in turn controlled by the locking relay LR and by the switch lever L. The normal and reverse switch control relays NWR and RWR are controlled by the polarized switch control relay WR and the locking relay LR. For example, the normal switch control relay NWR is controlled by a circuit which passes from terminal B through front point 37 of locking relay LR, relay NWR, normal cut-out contact 28, back contact 29 of relay OR, and polar contact 11—24 of relay WR to terminal C. Therefore, relays WR, NWR, and RWR may be energized only if the locking relay LR is energized.

The holding winding of the overload relay OR is provided with the usual shunt connection which includes back contact 25 of relay OR and dual selector contact 26. The holding winding is also provided with two pick-up circuits and two stick circuits. When the polarized switch control relay WR is in its normal condition, for example, a pick-up circuit for relay OR passes over a path from terminal B through normal polar contact 41—42 of relay WR, dual selector contact 27—49, holding winding 23 and polar contact 11—24 of relay WR to terminal C. After relay OR attains its operated condition, one or the other of the stick circuits is established. For example, with relay WR in its normal condition, a stick circuit is established over a path which passes from terminal B through normal polar contact 41—42 of relay WR, front point of contact 25 of relay OR, winding 23 and polar contact 11—24 of relay WR to terminal C. The other pick-up and stick circuits for winding 23 may be readily traced over similar paths except including the reverse polar contacts instead of the normal polar contacts of relay WR.

Both back contacts 15 and 29 will be so adjusted as to remain closed until front point of contact 25 closes so that the energy may not be disconnected from the overload winding 22 until the stick circuit is established.

It will be noted that the holding winding 23 is energized in either the normal or the reverse direction according as the relay WR is in its normal or reverse condition. The overload relay, therefore, may be caused to return to its initial deenergized condition by reversing the energization of the relay WR.

Referring now to Fig. 4, the reference character WZ designates a polar relay which is controlled by the lever L. The relay WZ in turn controls the polarized switch control relay WR. The relay WZ, therefore, simply serves as a repeating relay for the lever L and is generally utilized in the manner shown where the distance from the location of the lever L to the location of the relay WR is such as to make the use of a repeating relay either necessary or desirable.

The polarized switch control relay WR is normally deenergized and can be energized only if the relay WCR is energized. The relay WCR can be energized only if the condition of relay WZ disagrees with the condition of relay WR. For example, relay WCR will become energized if relay WZ is energized in the reverse direction when the relay WR is energized in the normal direction and the relay WCR will become deenergized when relay WR becomes energized in the reverse direction in response to the energization of relay WZ. In other words, relay WCR becomes momentarily energized upon each reversal of energization of relay WZ so that relay WR will become energized. When relay WR responds to such energization, the relay WCR becomes deenergized to cause relay WR to become deenergized and so to remain until a new operation of relay WR is desired. For example, the reversal of the energization of relay WZ will energize relay WCR by virtue of a circuit which passes from terminal B through polar contact 50—51 of relay WZ, front contact 33 of relay LR, polar contact 52—53 of relay WR and relay WCR to terminal C. When relay WCR is energized, relay WR will be energized in the reverse direction by virtue of a circuit which passes from terminal B through polar contact 50—51 of relay WZ, front contact 33 of relay LR, relay WR, front contact 54 of relay WCR, front contact 32 of relay LR and polar contact 55—56 of relay WZ to terminal C. When relay WR is energized in the reverse direction, the opening of contact 52—53 will deenergize relay WCR so that relay WR will become deenergized.

The normal and reverse switch control relays NWR and RWR are controlled by both the relay WZ and the relay WR. That is, both these latter relays must be in a corresponding condition in order to energize either one of the former relays. For example, with all apparatus in the normal condition, reverse switch control relay RWR may be energized when both relays WZ and WR are energized in the reverse direction by virtue of a circuit which passes from terminal B through polar contact 50—51 of relay WZ, front contact 33 of relay LR, relay RWR, reverse switch cut-out contact 14, polar contact 13—11 of relay WR, dual selector contact 26, back contact 15 of relay OR, and back contact 57 of relay WCR to terminal C.

When relay RWR is energized, the motor M will drive switch W to its reverse position.

The holding winding 23 of the overload relay OR is shunted by the usual shunt path which includes back contact 58 of relay OR and dual selector contact 27—39.

The holding winding 23 is also provided with a pick-up circuit which passes from terminal B through winding 23, dual selector contact 27—40, and back contact 57 of relay WCR to terminal C.

When relay OR is picked up either by excessive current in the motor M or by manipulation of the dual selector lever S, the shunt path across the winding 23 will be opened and the relay OR will be maintained in such condition by virtue of a stick circuit which passes from terminal B through winding 23, front contact 25 of relay OR, and back contact 57 of relay C. The operator may release relay OR by the manipulation of lever L which will energize relay WCR momentarily so as to open the stick circuit for relay OR.

Referring now to Fig. 5, the polarized switch control relay WR is controlled in a manner similar to that described for the apparatus shown in

Fig. 2. That is, relay WR is controlled by lever L when locking relay LR is energized and is controlled by the polarized switch indication relay WP when the relay LR is released.

The normal and reverse switch control relays NWR and RWR are controlled by the lever L and the polarized switch control relay WR. For example, with all apparatus in the normal condition, relay RWR may be energized when lever L is moved to its reverse position so that relay WR is energized in the reverse direction, by virtue of a circuit which passes from terminal B through contact 7 of lever L, front point of contact 33 of relay LR, wire 8, polar contact 11—13 of relay WR, reverse switch cut-out contact 14, relay RWR, back contact 15 of relay OR, dual selector contact 26, wire 9, front point of contact 32 of relay LR, and contact 10 of lever L to terminal C.

The overload relay is provided with the usual shunt path which includes back contact 29 of relay OR and dual selector contact 27—39.

The relay OR is also provided with the usual pick-up circuits. For example, with all apparatus in the normal condition, winding 23 may be energized when the dual selector lever S is moved to its reverse position by virtue of a circuit which passes from terminal B through contact 10 of lever L, front point of contact 32 of relay LR, wire 9, dual selector contact 40—27, winding 23 of relay OR, wire 8, front point of contact 33 of relay LR and contact 7 of lever L to terminal C.

When relay OR is operated either by the motor current or by the selector lever, it will be maintained in its operated condition by virtue of a stick circuit which passes over the same path as just described for the pick-up circuit up to and including wire 9 and thence through front contact 25 of relay OR, winding 23, wire 8, and the same path as the pick-up circuit to terminal C. The relay OR may be returned to its initial deenergized condition upon the manipulation of lever L so that winding 23 is momentarily energized in the reverse direction.

Referring next to Fig. 6, the polarized switch control relay WR and the normal and reverse switch control relays NWR and RWR are controlled by the lever L and the locking relay LR in a manner similar to that described for the apparatus shown in Fig. 3. That is, when the locking relay LR is energized, the relay WR is controlled by the lever L and the relays NWR and RWR are controlled by the relay WR.

The holding winding 23 of the overload relay OR is provided with the usual shunt path which includes the back point of contact 25 of relay OR and dual selector contact 26.

The winding 23 of the overload relay OR is provided with the usual pick-up circuits controlled by the dual selector lever S. For example, when relay WR is in its normal condition, winding 23 may be energized by current in one direction over a circuit which passes from terminal B through polar contact 41—42 of relay WR, winding 23, and dual selector contact 40—27 to terminal C. When relay WR is energized in the reverse direction, winding 23 may be energized by current in the opposite direction over a circuit which passes from terminal C through selector lever contact 27—40, winding 23 and polar contact 42—60 of relay WR to terminal N which terminal is of negative polarity with respect to terminal C. Winding 23 of relay OR, therefore, may be energized in the normal or reverse direction according to the condition of polarized switch control relay. Windings 22 and 23 will

be so arranged that the direction of current flow is the same in each winding.

When relay OR is operated, the shunt path will become opened and the holding winding will be energized by one or the other of its stick circuits depending upon the condition of relay WR. For example, when relay WR is in its normal condition as shown in the drawings, a stick circuit will be established which passes from terminal B through contact 41—42 of relay WR, winding 23 and front point of contact 25 of relay OR to terminal C. When the operator desires to again assume control of the switch, he may do so by reversing the direction of energization of relay WR which relay will in turn momentarily reverse the energization of winding 23.

Referring next to Fig. 7, the reference characters J and K designate two asymmetric units so poled that the polarized switch control relay WR is normally deenergized. For example, when the relay WR is energized in the reverse direction, current will flow over a path which passes from wire 8 through relay WR, polar contact 61—62 of relay WR and asymmetric unit J back to wire 9. When polar contact 61 moves to its reverse position, current cannot flow through the relay WR because asymmetric unit K is so poled as to permit the passage of current in the normal direction only. The apparatus shown in Fig. 7, therefore, provides a simple and reliable means for normally maintaining the polarized switch control relay WR in a deenergized condition. The method illustrated in Fig. 7 may be utilized for the control of the relay WR shown in any of the preceding figures except Fig. 4 wherein a relay WCR is provided for this purpose.

Referring now to Figs. 8 and 9, the relays NWR and RWR are shown in each figure with additional front contacts for the control of the motor M. The purpose of the extra front contact of each relay in the motor operating circuit is to open the motor circuit at two points instead of one point so that the arc usually accompanying the breaking of a circuit may be more readily extinguished. For example, when relay NWR of Fig. 8 becomes deenergized at the completion of the movement of the switch, the motor operating circuit will be broken at the front point of contact 18 and also at front contact 63 so that the arc at each contact will be substantially less than if only one contact is used to break the motor operating circuit.

It will be readily apparent that the apparatus shown in Fig. 9 operates in a similar manner and differs from the apparatus shown in Fig. 8 only in the manner which the contacts of the relays NWR and RWR are connected in the motor circuit.

The double break motor operating circuits illustrated in Figs. 8 and 9 are particularly applicable for controlling the motor M when the motor is of the high voltage type. It is obvious, however, that the motor M shown in Figs. 1, 2, 3, 4, 5, and 6 may be controlled in this manner to minimize the effects of arcing regardless of the operating voltage of the motor.

Referring next to Fig. 10, the reference character Q designates a brake for preventing unnecessary operation of the motor M after the current is disconnected from the motor. In the form here shown, the reference character 65 designates a brake shoe which cooperates with a drum 66 operatively connected to the armature I of the motor M. The shoe 65 is normally biased to a braking position by a spring 67 cooperating

with a pivotally mounted armature 68 to which the shoe is fastened. The armature 68 is controlled by a magnet 69 in such manner that when the magnet 69 is energized, the shoe 65 is raised free of the drum 66.

The magnet 69 is controlled in series with either the relay NWR or the relay RWR by the polarized switch control relay WR. That is, when either relay NWR or RWR is energized, the magnet 69 is also energized so that the brake is ineffective. It will be also noted that when overload relay OR is in its energized condition, energy will be disconnected from magnet 69 so that the brake Q will become effective to prevent further rotation of the armature I.

It will be readily apparent how the brake Q can be applied to the apparatus shown in Figs. 2, 3, 4, 5, and 6, although for purposes of this invention, I have shown the brake applied to a portion of the apparatus shown in Fig. 1.

Referring now to Fig. 11, the reference characters X and Y designate two asymmetric units connected in multiple with switch cut-out contacts 28 and 14, respectively, and so poled as to prevent the energization of polarized switch control relay WR when the lever L and the switch W occupy corresponding positions. For example, if lever L is moved to its reverse position, relay WR will become energized in the reverse direction by virtue of a circuit which passes from terminal B through contact 1 of lever L, front contact 33 of locking relay LR, back contact 15 of overload relay OR, reverse cut-out contact 14, relay WR, asymmetric unit X, front contact 32 of relay LR, and contact 10 of lever L to terminal C. When the switch completes its movement to the reverse position in response to the reverse energization of relay WR, reverse cut-out contact 14 will become opened so that current will be disconnected from relay WR since asymmetric unit Y will prevent the flow of current in the reverse direction to relay WR. The asymmetric units X and Y, therefore, function in cooperation with cut-out contacts 14 and 28 to provide for energization of the relay WR only when the switch W is to be moved.

The relay WR controls the switch motor M direct without the use of the normal and reverse switch control relays NWR and RWR. That is, the operating circuits for the motor M are controlled by neutral and polar contacts of the relay WR in such manner that when the relay WR is energized, the motor M will operate in the normal or reverse direction according as the relay WR is energized in the normal or reverse direction and when the relay WR is deenergized, the motor will be disconnected from its source of energy.

The brake Q operates to prevent excessive movement of the motor M in a manner similar to that described for the apparatus shown in Fig. 10. That is, when relay WR is energized, the magnet 69 is energized over a front contact 70 of the relay WR so that the brake is ineffective and when relay WR is deenergized, the magnet 69 is also deenergized so that the brake is effective for preventing unnecessary rotation of the armature I.

The overload relay OR controls the relay WR by means of back contact 15 and the overload winding 22 of relay OR is controlled in the usual manner by the current flowing in motor M. The holding winding of relay OR is provided with the usual shunt path including back point of

contact 25 of relay OR and dual selector contact 26.

The winding 23 of relay OR is provided with the usual pick-up circuit which may be energized in the normal or reverse direction depending on the position occupied by lever L when selector lever S is moved to its reverse position. For example, if lever L occupies its normal position, winding 23 may be energized when selector lever S is reversed by virtue of a circuit which passes from terminal B through contact 10 of lever L, front contact 32 of relay LR, winding 23, dual selector contact 40—27, front contact 33 of relay LR, and contact 7 of lever L to terminal C.

When overload relay OR is operated either by excessive current in the motor M or by manipulation of the selector lever S, winding 23 will be energized by a stick circuit, when lever L occupies its normal position, which circuit passes from terminal B through contact 10 of lever L, front contact 32 of relay LR, winding 23, front point of contact 25 of relay OR, front contact 33 of relay LR, and contact 7 of lever L to terminal C. Relay OR, therefore, will be maintained in its operated condition until such time as the stick circuit is broken. This may be accomplished in the usual manner, that is, by reversing the direction of energization of the winding 23 so that relay OR is forced to return to its normal de-energized condition.

Although I have herein shown and described only several forms 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 combination, an overload relay having a pick-up winding and a holding winding, a motor rendered inoperative when said overload relay is picked up, means for connecting said pick-up winding to said motor whereby said overload relay is picked up when the current in said motor exceeds a predetermined amount, means including a back contact of said overload relay for closing a shunt path around said holding winding whereby said relay is made slow to pick up, means operative when said relay is picked up for energizing said holding winding, and other means for removing said shunt path and for then energizing said holding winding whereby said overload relay is caused to pick up independently of the current in said motor.

2. In combination, a polarized relay, means for reversibly governing said polarized relay, a motor including operating circuits, means including contacts of said polarized relay for reversibly supplying energy to said operating circuits, a normally released overload relay effective when picked up to prevent the supply of energy to said operating circuits, a first winding of said overload relay included in said operating circuits to pick up the overload relay if the current in the operating circuits exceeds a predetermined value, a second winding of said overload relay, means for shunting said second winding when said relay is released to cause said overload relay to be slow in picking up, and means governed by said polarized relay for reversibly energizing said second winding when said overload relay is picked up.

3. In combination, a relay, a circuit, means

governed by said relay for supplying energy to said circuit, an overload winding of said relay included in said circuit to operate the relay if the current in the circuit exceeds a predetermined value, an auxiliary winding of said relay, means for energizing said auxiliary winding to operate said relay independently of the current in said circuit, and means effective when said relay is operated to energize said auxiliary winding to maintain said relay in its operated condition.

4. In combination, a relay, a circuit, means governed by a back contact of said relay for supplying energy to said circuit, an overload winding of said relay included in said circuit to pick up the relay if the current in the circuit exceeds a predetermined value, an auxiliary winding of said relay, means for energizing said auxiliary winding to operate the relay independently of the current in said circuit, and means including a front contact of said relay for energizing said auxiliary winding to maintain the relay in its picked up condition.

5. In combination, a railway track switch, a motor for operating said switch, circuits for said motor, means for supplying energy to said circuits, a relay effective when operated to prevent the supply of energy to said circuits, an overload winding of said relay included in said circuits to operate the relay if the current in said circuits exceeds a predetermined value, means for conditioning said switch for manual operation, an auxiliary winding of said relay, means effective when said switch is conditioned for manual operation to energize said auxiliary winding to operate said relay independently of the current in said circuits, and means effective when said relay is operated to energize said auxiliary winding to maintain said relay in its operated condition.

6. In combination, a railway track switch, a motor for operating said switch, circuits for said motor, manually controlled means for reversibly governing the supply of energy to said circuits to control said motor, a relay effective when operated to prevent the supply of energy to said circuits, an overload winding of said relay included in said circuits to operate the relay if the current in the circuits exceeds a predetermined value, an auxiliary winding of said relay, means for energizing said auxiliary winding to operate said relay independently of the current in said circuits, and means effective when said relay is operated by either winding to energize said auxiliary winding until a new operation of said manually controlled means is initiated.

7. In combination, a railway track switch, a motor, a manual lever, a selector lever having a normal position in which said switch is connected to said motor and a reverse position in which said switch is connected with said manual lever, circuits for supplying energy to said motor, a normally released relay effective when picked up to prevent the supply of energy to said motor, an overload winding of said relay included in said circuits to pick up the relay upon excessive current flow in the circuits, an auxiliary winding of said relay, means including a contact which is closed only when said selector lever occupies its normal position for shunting said auxiliary winding to provide said relay with a slow pick-up characteristic, and means including a contact which is closed only when said selector lever occupies its reverse position for energizing said auxiliary winding to pick up said relay independently of the current in said circuits.

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