

Nov. 10, 1936.

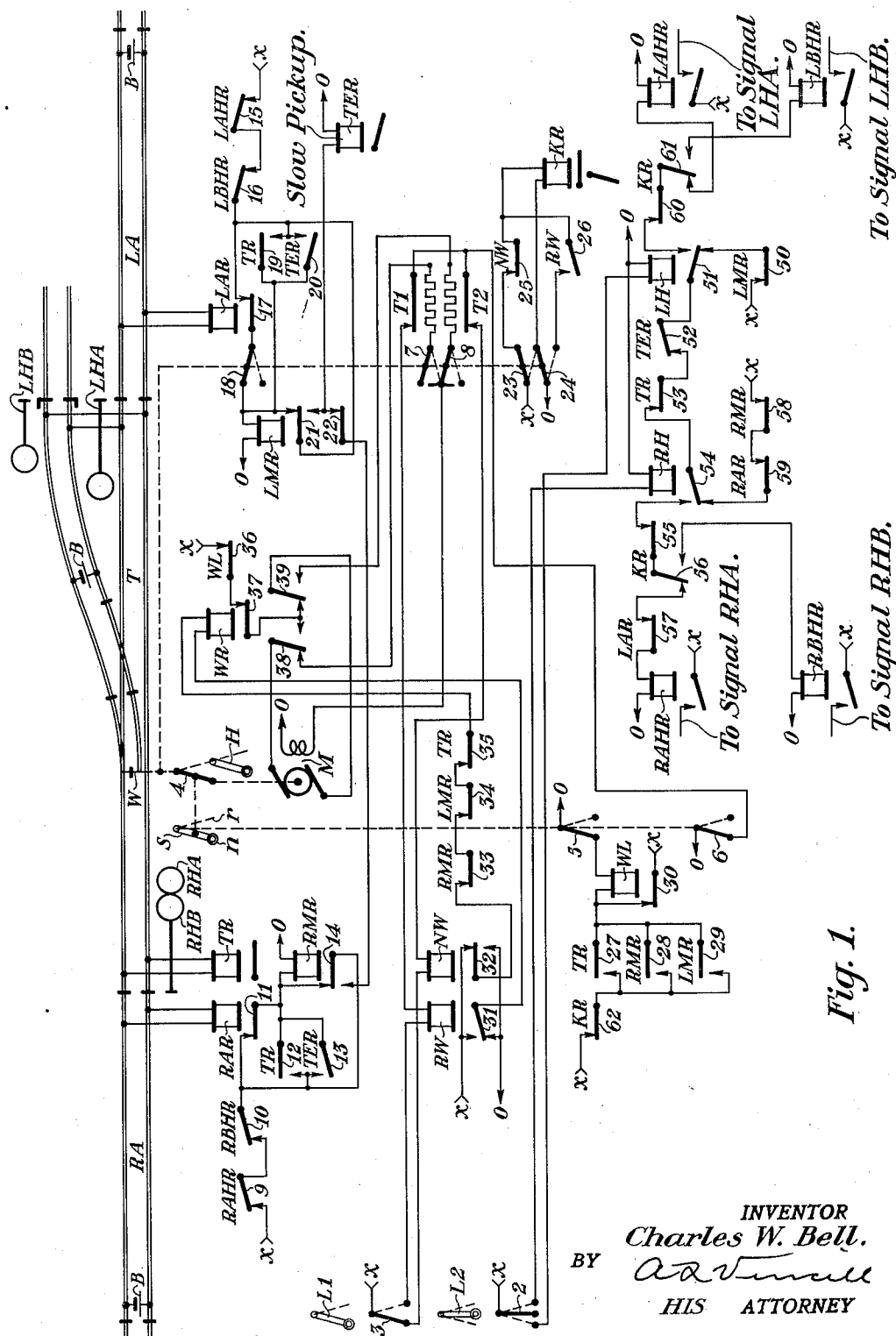
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2,060,485

RAILWAY TRACK SWITCH CONTROLLING APPARATUS

Filed Feb. 19, 1935

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

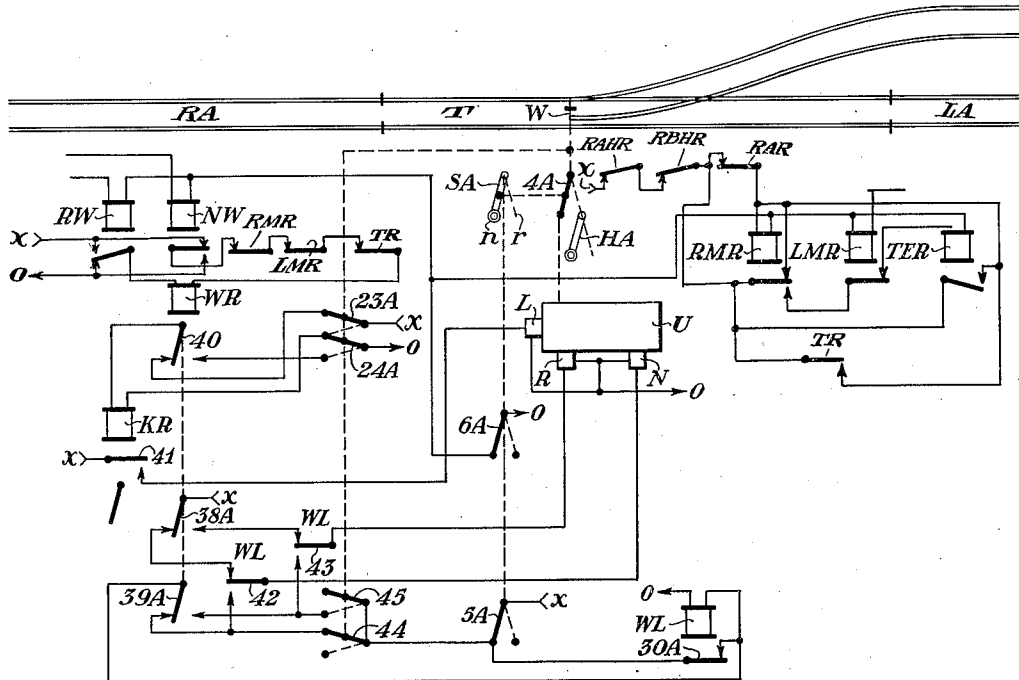


Fig. 2.

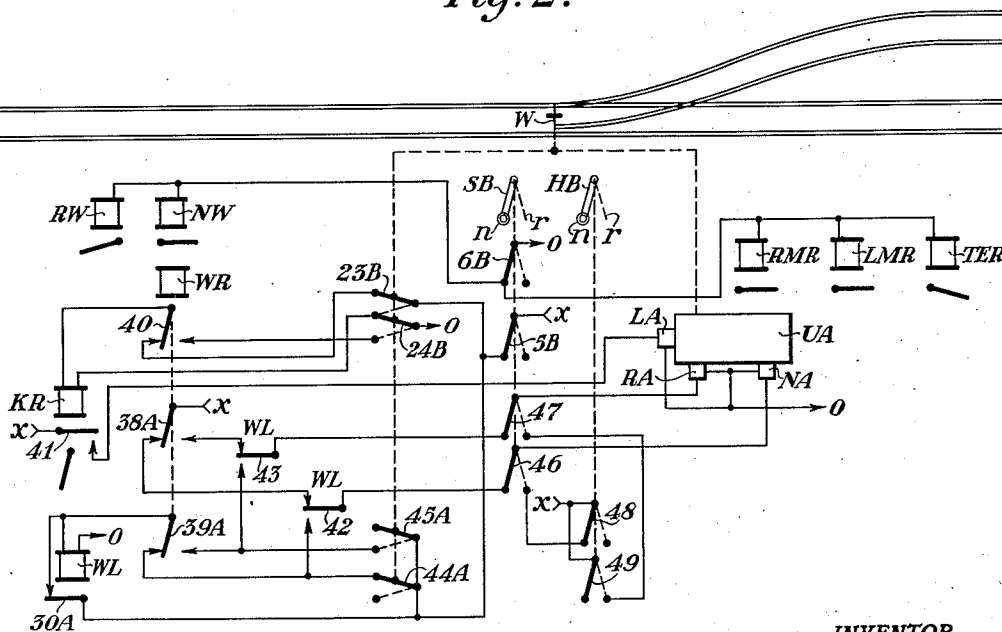


Fig. 3.

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RAILWAY TRACK SWITCH CONTROLLING
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12 Claims. (Cl. 246—3)

My invention relates to railway track switch controlling apparatus, and more particularly to a means for safe-guarding the operation of a remotely controlled power operated switch under conditions where local operation of the switch is required. My invention is, in part, an improvement upon that disclosed and claimed in an application for United States Letters Patent Serial No. 7,233, filed February 19, 1935, by Earl M. Allen, for Railway track switch controlling apparatus. I will describe several forms of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a diagrammatic view illustrating one form of apparatus embodying my invention. Figs. 2 and 3 are diagrammatic views illustrating modifications of a portion of the apparatus shown in Fig. 1, and also embodying my invention.

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

Referring first to Fig. 1, the reference character T designates a stretch of single railway track including a track circuit having a track relay designated by the reference character TR. The section T contains a track switch designated by the reference character W. The switch W, as here shown, connects to one end of a passing siding. To the left of and adjacent section T is a section of single track designated by the reference character RA. The section RA is provided with a track circuit having a track relay designated by the reference character RAR. To the right of and adjacent section T is a section of single track designated by the reference character LA. The section LA is provided with a track circuit having a track relay designated by the reference character LAR. Each of the track circuits in sections RA, T and LA is provided with a track battery designated by the reference character B.

The switch W may be operated by any suitable remote controlled means, such, for example, as a motor M. The motor M is controlled by a polarized switch control relay designated by the reference character WR. The relay WR is controlled by relays designated by the reference characters NW and RW which, as here shown, are controlled from a remote point by a contact 3 actuated by a manually operable lever L1. The relays NW and RW may also be operated by any other suitable means, such, for example, as shown in the application of Lloyd V. Lewis, Serial No. 373,675, filed June 25, 1929.

When the relay NW is energized and the relay

RW is deenergized, relay WR is energized by current of one polarity to operate switch W to its normal position; and when relay NW is deenergized and relay RW is energized, relay WR is energized by current of opposite polarity to operate switch W to its reverse position.

The operating mechanism for the switch includes the usual switch machine comprising motor M and a set of switch circuit controller contacts operated in the usual manner. The contacts 7 and 8 are so controlled that contact 7 is open only when the switch is normal, and 8 is open only when the switch is reversed. The apparatus includes a pair of thermal relays T1 and T2 for protecting the motor against overload in the event the switch becomes stalled.

Signals LHA, LHB, RHA and RHB, for governing traffic passing over the switch W, are controlled by signal control relays LAHR, LBHR, RAHR and RBHR, respectively, which in turn are controlled by directional signal relays designated by the reference characters RH and LH. The relays RH and LH are, as here shown, controlled from a remote point by a contact 2 actuated by a manually operable lever L2, but may also be controlled by any other suitable means, such, for example, as disclosed in the previously mentioned application of Lloyd V. Lewis, Serial No. 373,675, filed June 25, 1929. When any of the signal control relays, such as LAHR, is deenergized, the corresponding signal displays a stop indication, and when such relay is energized, the corresponding signal is caused to display a proceed indication, the circuits for the control of the signal lamps or mechanisms by the signal control relays being omitted for simplicity.

The reference characters RMR and LMR designate approach locking relays for eastbound and westbound traffic respectively, which, as will be explained more in detail hereinafter, prevent operation of the switch and signals under certain dangerous traffic conditions.

Associated with the pair of approach locking relays is a time element relay having a slow pick-up characteristic and designated by the reference character TER. The relay TER has a back contact 52 which is closed only when the relay is in its initial condition and front contacts 13 and 20 which are closed only when the relay attains its operated condition at the expiration of a time interval after the relay becomes energized.

The reference character KR designates a switch indicating relay having a neutral armature which is energized only if the position of the switch

is in agreement with the control relay NW or RW, and a polar armature which assumes a normal or reverse position corresponding to the position of the switch.

- 5 The reference character WL designates a lock relay which is employed, when the switch is being locally operated, as will hereinafter be explained, for opening the operating circuits for motor M controlled by the contacts of the switch control relay WR.

10 The switch W is also provided with local control means here illustrated as two mechanical levers, H and S, which, when operated in sequence, permit the switch to be operated by hand. As will be pointed out in detail hereinafter, lever S controls apparatus which at times prevents control of the switch by its remote controlled means and at the same time inserts a mechanical medium between the switch and lever H whereby lever H will operate the switch. In the form here shown diagrammatically, this mechanical medium is a link 4 operated by the manually operable lever S. When lever S occupies its normal or left-hand position the link 4 couples the switch W with the motor M. When lever S is moved to its right-hand or reverse position, the switch W is disconnected from the motor M and is connected with the lever H which may then be manipulated to operate the switch.

30 The switch governs three contacts 18, 23 and 24 in accordance with the switch position, by any usual and well-known means, in addition to governing motor cut-out contacts 7 and 8, previously mentioned.

35 In order to simplify the drawings, the relay contacts have not in all instances been placed directly under the relay actuating such contacts. Each such contact has, however, been provided with a reference character having a suitable distinguishing prefix corresponding to the reference character of the actuating relay.

40 The approach locking relay RMR is provided with a pick-up circuit which passes from terminal X of a suitable source of current through back contact 9 of relay RAHR, back contact 10 of relay RBHR, front contact 11 of track relay RAR, and relay RMR to terminal O of the same source of current. The pick-up circuit also includes back contact 12 of relay TR and front contact 13 of relay TER each of which bridges contact 11 of relay RAR. The relay RMR is also provided with a stick circuit which includes contacts 9 and 10 of relays RAHR and RBHR, as well as front point of contact 14 of the relay RMR.

55 The approach locking relay LMR is provided with a similar pick-up circuit which includes back contact 15 of relay LAHR, back contact 16 of relay LBHR, front contact 17 of relay LAR and switch indicating contact 18, as well as back contact 19 of relay TR and front contact 20 of relay TER in multiple and bridging contact 17 of relay LAR and switch indicating contact 18. The stick circuit for relay LMR includes contacts 15 and 16 of the relays LAHR and LBHR as well as front point of contact 21 of relay LMR.

60 The time element relay TER is provided with two operating circuits. One circuit includes contacts 9 and 10 of the relays RAHR and RBHR and back point of contact 14 of the relay RMR, as well as front contact 22 of the relay LMR. The other operating circuit includes contacts 15 and 16 of the relays LAHR and LBHR, and back point of contact 21 of the relay LMR.

75 The switch indicating relay KR is provided with

a circuit which includes switch indicating contacts 23 and 24, and front contact 25 of relay NW and front contact 26 of relay RW.

The relay WL is provided with a pick-up circuit which includes contact 5 actuated by lever S, front contact 62 of relay KR, and, in multiple, back contact 27 of relay TR, back contact 28 of relay RMR and back contact 29 of relay LMR. A stick circuit is also provided which includes front contact 30 of relay WL.

10 The relays NW and RW, in addition to being controlled by contact 3 actuated by lever L1, are also controlled by contact 6 actuated by lever S and contacts of the thermal relays T1 and T2.

15 The switch operating relay WR is provided with a control circuit which includes front and back points of contact 31 of the relay RW, front and back points of contact 32 of the relay NW, front contact 33 of the relay RMR, front contact 34 of the relay LMR, and front contact 35 of relay TR.

20 The motor M is provided with a circuit which includes front contact 36 of relay WL, front neutral contact 37 of relay WR, as well as polar contacts 38 and 39 of relay WR. It is obvious from the drawings, without further explanation, as to the manner in which switch W, under normal conditions, is caused to move between its normal and reverse positions in response to the manipulation of the lever L1 to a corresponding position.

30 The relay RAHR is provided with a circuit which passes from terminal X through front contact 50 of relay LMR, back point of contact 51 of relay LH, back contact 52 of relay TER, front contact 53 of relay TR, front point of contact 54 of relay RH, front neutral contact 55 of relay KR, normal point of polar contact 56 of relay KR, front contact 57 of relay LAR, and relay RAHR to terminal O. The relay RBHR is provided with a circuit which passes over the path just recited for relay RAHR up to and including front neutral contact 55 of relay KR, and thence through reverse point of polar contact 56 of relay KR to relay RBHR.

45 The relay LAHR is provided with a circuit which includes front contact 58 of relay RMR, front contact 59 of relay RAR, back point of contact 54 of relay RH, front contact 53 of relay TR, back contact 52 of relay TER, front point of contact 51 of relay LH, front neutral contact 60 of relay KR, and normal point of polar contact 61 of relay KR. The relay LBHR is provided with a circuit which passes over the same path as recited for relay LAHR up to and including front neutral contact 60 of relay KR, and thence through reverse point of polar contact 61 of relay KR to relay LBHR.

55 Having thus described in general the arrangement of the various parts of Fig. 1, I will now explain its operation.

60 With all of the apparatus in its normal condition as shown in Fig. 1, I shall assume that a train, desiring to make switching movements over the switch W, enters section RA. The entrance of the train into section RA releases approach track relay RAR thereby opening front contact 11 of relay RAR in the pick-up circuit for relay RMR, which relay does not release, however, since the stick circuit for relay RMR is closed through back contacts 9 and 10 of relays RAHR and RBHR, and front point of contact 14 on relay RMR. I shall also assume that the train is brought to a stop at signal RHA; and since local operation of the switch has been

found to be more convenient than remote operation for switching movements, a trainman proceeds to the switch and reverses selector lever S to condition the switch for local operation. The manipulation of lever S to its reverse position, as previously described, moves link 4 to disconnect the switch from motor M and to couple the switch with hand throw lever H; and also opens contacts 5 and 6.

10 The opening of contact 5 deenergizes relay WL, and the opening of contact 6 deenergizes relay NW. The releasing of relay WL opens its own front contact 36, thereby disconnecting the current from the switch mechanism M and operation of the mechanism is prevented. Since both relays NW and RW are now deenergized, the relay WR is also deenergized, so that even if current were available, the motor M could not be operated.

20 When the relay NW became released, the control circuit for the relay KR became opened at front contact 25 of relay NW; therefore, no signal can be caused to indicate proceed.

Since no current can be supplied to motor M and no signal can be cleared, the switch W is now in a safe condition for local operation.

I shall now assume that the switching movements have been completed, that the switch W has been manually placed in its normal position, that the selector lever S has been returned to its normal position and that the train has entered section LA. The restoration of lever S to its normal position again couples link 4 with motor M and closes contacts 5 and 6. The closing of contact 6 energizes relay NW and restores control of relays NW and RW to lever L1. The energization of relay NW closes its front contact 25 to reestablish the control circuit for relay KR. The energization of relay KR closes its own front contact 62 to establish the pick-up circuit for relay WL through contact 5 and back contact 27 of relay TR which became closed when the train entered section LA. The energization of relay WL will close its front contact 36 to restore energy to the switch mechanism M, as soon as front contact 35 of relay TR becomes closed upon the clearing of section T by the train. It will now be assumed that the train has cleared section LA and that all apparatus has been restored to its initial condition.

If it is desired to display a proceed indication at signal RHA to govern the train movement after local operation of the switch, this may be done after the selector lever has been returned to its normal position and contact 6 has been reclosed to energize relay NW, provided the train has not already entered section T. The energization of relay NW, as previously explained, will close its front contact 25 to establish the control circuit for the relay KR. The energization of relay KR will close its front neutral contacts 55 and 60 and the signal control circuits will again be established. If the lever L2 is now manipulated so as to energize relay RH, the relay RAHR will be energized and signal RHA will indicate proceed by means of circuits not shown in the drawings. The energization of relay RAHR will open its back contact 9 thereby releasing relay RMR. When the relay RMR is released the closing of its back contact 28 will establish the pick-up circuit for relay WL, thereby closing front contact 36 of relay WL and restoring the control of motor M to relay WR. When the train enters section T, the closing of back contact 12 of relay TR will complete the pick-up circuit for relay

RMR through back contact 9 of relay RAHR since the control circuit for relay RAHR became opened by the opening of front contact 53 of relay TR when the train entered section T. When the train clears section T, relay RMR will remain energized through front point of its own contact 14, the control circuit for relay WR will again be established by the closing of front contact 35 of relay TR, the signal control relay circuits will again be established by the closing of front contact 53 of relay TR, and relay WL will remain energized through its own front contact 30.

In the event that, after local operation of the switch and the restoration of the selector lever to its normal position, the train does not enter section T but, instead, proceeds in the opposite direction, the energization of relay WL with the consequent restoration of control of the mechanism M to the relay WR may be effected by manipulation of lever L2 to clear any of the signal control relays RAHR, RBHR, LAHR or LBHR, provided relay KR is energized, since the energization of any of these relays will deenergize either relay RMR or LMR to close either back contact 28 or back contact 29 in the pick-up circuit for relay WL.

It is apparent that relay KR may be energized only if the relays NW and RW and the position of switch indicating contacts 23 and 24 are in agreement. In the event the switch was left by the trainman in the reverse position, with the relay NW energized as shown, the relay KR would remain deenergized and front contact 62 would remain open so that relay WL could not be energized by the closing of back contact 27 of relay TR when section T became occupied. Under these circumstances, the relays NW and RW would have to be brought into agreement with the position of the switch by manipulation of lever L1 in order to establish a circuit for the energization of relay KR so that relay WL might be energized by the releasing of either one of the relays RMR or LMR, which has previously been explained.

The approach locking relays RMR and LMR become deenergized upon the energization of any one of the associated signal control relays. The deenergization of either relay RMR or relay LMR prevents the operation of the switch by the remote control means and also prevents the clearing of the opposing signals. Assuming that signal RHA has been cleared to govern a train occupying section RA, it will be seen that relay RMR will be deenergized and may be again energized, provided signal RHA is caused to indicate stop, by any one of three methods. First, by the clearing of section RA, secondly by the occupancy of the detector section T, and lastly, by the completed operation of the time element relay TER. In the event that the train neither clears section RA nor occupies section T, and it is desired to release the locking of the switch, this may be done by placing signal RHA in the stop condition which will initiate the operation of relay TER. Upon the expiration of a given time interval, which is provided to prevent the possibility of changing the route immediately in the face of an approaching train, the relay TER will have completed its operation to close contact 13 to establish a pick-up circuit for relay RMR, thereby releasing the locking of the switch, and also reestablishing the control circuits for the opposing signals provided traffic conditions are safe for permitting the display of a proceed indication. As will be explained hereinafter, the apparatus shown in Figs. 2 and

3 provides a means for deenergizing each approach locking relay without initiating the operation of the time element relay when the selecting apparatus is operated to permit local operation of the switch, and further provides for the normal operation of the time element relay TER and the restoration of the usual control circuits for the approach locking relays RMR and LMR when the selecting apparatus is restored to its initial condition. In other words, the apparatus shown in Fig. 1 provides for the operation of the approach locking relays in their usual manner, while the apparatus shown in Figs. 2 and 3 provides for making the approach locking effective when the switch is conditioned for local operation and for retaining the approach locking in its effective condition after the switch has been conditioned for remote operation until such time as the approach locking is released in the usual manner.

The apparatus, including relay LMR, would operate for a train approaching switch W from the section LA or from the siding, in the same manner as that just described for a train approaching from the opposite direction with the exception that, with the switch W reversed, the pick-up circuit for the relay LMR would be opened by switch indicating contact 13 instead of by front contact 17 of relay LAR.

While I have shown the approach locking relays RMR and LMR to be controlled over one track circuit in approach to the switch, and to be released by the occupancy of the detector section, it is understood that such control for these relays need not necessarily be limited to one track circuit each.

From the foregoing explanation of the apparatus shown in Fig. 1, it will be seen that I have provided a simple, reliable and economical means for safeguarding the local control of a power operated railway track switch. When the switch is conditioned for local operation by the reversal of the lever S, operation of the switch by the remote controlled means is prevented and the signal circuits are interrupted to hold the signals in the stop condition. The apparatus shown in Fig. 1 further provides for the restoration of the control of the switch to the remote controlled apparatus, after being locally operated, if the selector lever is returned to its normal position and if the condition of the remote control apparatus is in agreement with the position of the switch, and then only if the detector section is occupied and subsequently cleared, or if any of the signal control relays are energized and subsequently deenergized.

In Figs. 2 and 3, signals RHA, RHB, LHA and LHB, relays RH, LH, RAR, TR, LAR, RAHR, RBHR, LAHR and LBHR with their control circuits, and portions of the control circuits for relays RW, NW, RMR, LMR, and TER have, for simplicity, been omitted. It is understood, however, that while such signals, relays and circuits are not shown, they are employed in Figs. 2 and 3 in the same manner as shown in Fig. 1 except where modifications are shown.

Referring now to Fig. 2, the reference character U designates the well-known electro-pneumatic mechanism suitable for the operation of the switch W.

The operating mechanism U for the switch W may be caused to move the switch between its normal and reverse positions upon the energization of a normal magnet N or a reverse magnet R provided a lock magnet L is energized. The

normal and reverse magnets N and R are controlled by the switch control relay WR and the lock magnet is controlled by the relay KR.

The switch W is also provided with a local control means here shown as a lever HA, and with suitable selecting means for coupling the switch with the mechanism U or with the lever HA. The selecting means is here shown as a link 4A operated by a manually operable selector lever SA which operates in a manner similar to that described for lever S shown in Fig. 1. Lever SA is provided with contacts 5A and 6A which are closed only if lever S is in its normal position.

The relays NW, RW, LMR, RMR and TER are controlled in the same manner as shown in Fig. 1 except that the contact 6A is introduced between the operating winding of these relays and the terminal O so that when lever SA is reversed these relays may not be energized.

The switch indicating relay KR is provided with a circuit which includes switch indicating contacts 23A and 24A, as well as polar contact 40 of the relay WR.

The lock magnet L is controlled by lock contact 41 of the relay KR. The normal magnet N is provided with a circuit which includes the normal point of polar contact 38A of relay WR, and the front point of contact 42 of relay WL, and the reverse magnet R is provided with a circuit which includes the reverse point of polar contact 38A of relay WR and the front point of contact 43 of relay WL. The normal and reverse magnets N and R are, when the WL relay is deenergized, also controlled at times by switch indicating contacts 44 and 45.

The WL relay is provided with a pick-up circuit and a stick circuit each of which includes contact 5A. When the switch is normal, the pick-up circuit includes switch indicating contact 44 and normal point of polar contact 39A of relay WR, and when the switch is reversed, includes switch indicating contact 45 and reverse point of polar contact 39A of relay WR. The stick circuit includes front contact 30A of relay WL.

The switch governs, in addition to contact 18 not shown in Fig. 2, four contacts 23A, 24A, 44 and 45 in accordance with the switch position, by any usual and well-known means.

The signals RHA, RHB, LHA and LHB and relays RH, LH, RAR, TR, LAR, RAHR, RBHR, LAHR and LBHR, although not shown in Fig. 2, are controlled in the same manner as previously described for the apparatus shown in Fig. 1.

Having thus described in general the arrangement of the various parts of Fig. 2, I will now explain its operation.

With all of the apparatus in its normal condition, as shown in Fig. 2, I shall assume that switch W is to be locally operated for a train which is assumed to occupy section RA. A trainman reverses selector lever SA to condition the switch for local operation. The reversal of lever SA opens contacts 5A and 6A. The opening of contact 6A deenergizes relays NW, RMR, LMR, and in addition, prevents the energization of relays RW and TER. The opening of contact 5A deenergizes relay WL. The releasing of relay WL removes the control of the normal and reverse magnets N and R from the relay WR. The releasing of relays RMR and LMR will open the signal control relay circuits at front contact 58 of relay RMR and front contact 50 of relay LMR, so that no signals can be caused to indicate proceed over the switch. The switch W is now in

a safe condition for local operation by lever HA.

I shall now assume, with the train again in section RA, that the switching movements have been completed, that the switch W has been manually placed in its normal position, and that the selector lever SA has been restored to its normal position. The restoration of lever SA to its normal position again couples link 4A with mechanism U and recloses contacts 5A and 6A. The closing of contact 5A establishes the pick-up circuit for relay WL through normal switch indicating contact 44 and normal point of polar contact 39A on relay WR. The energization of relay WL establishes its own stick circuit and restores to relay WR, by the closing of front points of contacts 42 and 43 on relay WL, the control of normal and reverse magnets N and R. The closing of contact 6A restores the control of relays NW and RW to the lever LI, causes the time element relay TER to initiate its operation, energizes relay LMR, and completes a circuit for energizing relay RMR as soon as front contact 13 of relay TER becomes closed. When relay TER completes its operation and relay RMR becomes energized, the closing of front contact 33 of relay RMR will again establish the control circuit for the switch control relay WR. The energization of relay LMR will close its front contact 50 in the control circuit for relay RAHR so that signal RHA may be caused to indicate proceed for governing the movement of the train over the switch W, as soon as relay TER returns to its initial condition and contact 52 recloses.

In the event the switch, after switching movements have been completed, is left by the trainman in a position which does not agree with the position of the polar armature of relay WR, such, for example, as if the relay WR were in its normal position, as shown in the drawings, and the switch W were in its reverse position, the relay WL cannot be energized and the control of the switch cannot be restored to the relay WR until such a time as the relay WR is brought, by manipulation of lever LI, into agreement with the position of the switch. Furthermore, when the relay WL is prevented from picking up due to a disagreement between the position of the switch and the position of the polar armature of relay WR, energy is applied, by means of either switch indicating contact 44 or switch indicating contact 45, directly to either the normal magnet N or the reverse magnet R depending upon the position of the switch, so that the switch will be maintained by power in the position left after local operation. The lock magnet L is energized by back contact 41 of relay KR due to the de-energization of relay KR by the disagreement between the position of the polar contact 40 of relay WR and switch indicating contacts 23A and 24A. The switch W is, therefore, in a safe condition for traffic, when the lever SA is in its initial position, regardless of the position of the polar armature of relay WR with respect to the position of the switch W.

From the foregoing explanation of the apparatus shown in Fig. 2, it is apparent that I have provided another simple, reliable and economical means for safeguarding the local control of a remote controlled switch. When the switch is conditioned for local operation the switch is removed from control by the remote apparatus and the signal control relay circuits are interrupted to hold the signals in the stop condition. The apparatus shown in Fig. 2 also provides for the restoration of the control of the switch to the

remote controlled apparatus, if either section RA or LA is occupied by a train upon and only upon the expiration of a measured time interval after the selector lever is returned to its normal position, and then only if the position of the switch and the position of the polar armature of the switch control relay are in agreement. Furthermore, after the restoration of the selector lever to its normal position, a proceed signal may be displayed for governing traffic passing over the switch, provided the control of the switch has been restored to the switch control relay. An additional safeguard is also provided in that, in the event of a disagreement between the position of the switch and the position of the polar armature of the switch control relay, the switch will be maintained by power in the position to which last operated by the local lever until such time as the control of the switch is again assumed by the switch control relay.

Referring now to Fig. 3, the reference character UA designates still another electro-pneumatic mechanism suitable for the operation of the switch W.

The operating mechanism UA may be caused to move the switch W between its normal and reverse position in response to the energization of a normal magnet NA or a reverse magnet RA provided a lock magnet LA is energized. The normal magnet NA and the reverse magnet RA are controlled by the switch control relay WR and the lock magnet LA is controlled by the relay KR.

Associated with and adjacent mechanism UA is a local switch operating means which, as here shown, is a lever designated by the reference character HB. Also associated with and adjacent mechanism UA is a selector lever designated by the reference character SB. When lever SB occupies its normal position mechanism UA is under the control of relay WR, provided relay WL is energized, and when lever SB occupies its reverse position, mechanism UA is under the control of local switch control lever HB.

The relays WR, NW, RW, LMR, RMR and TER are controlled in the same manner as described for the apparatus shown in Fig. 2.

The relay WL is provided with a circuit which is identical in all respects to the circuit shown for this relay in Fig. 2.

The selector lever SB is provided with a contact 5B and a contact 6B each of which is closed only when the lever SB is in its normal position, and is also provided with contacts 46 and 47, which are employed for, at times, transferring the control of the switch mechanism UA to the lever HB. The lever HB is provided with contacts 48 and 49 which are employed for energizing the normal and reverse magnets NA and RA to cause the switch to move between its normal and reverse position after the control of mechanism UA has been transferred to lever HB.

The switch indicating relay KR is provided with a circuit which includes switch indicating contacts 23B and 24B, and polar contact 40 of relay WR, as well as contact 5B of lever SB, so that relay KR will be deenergized and remain deenergized as long as lever SB is in its reverse position.

The lock magnet LA is controlled by back contact 41 of relay KR. When the lever SB is in its normal condition and the relay WL is energized, the normal and reverse magnets NA and RA are controlled by polar contact 38A on the relay WR and when the relay WL is deenergized

the magnets NA and RA are controlled by switch indicating contacts 44A and 45A. When the selector lever SB is in its reverse position the normal magnet NA is controlled by contact 48 actuated by lever HB, and the reverse magnet RA is controlled by contact 49 also actuated by lever HB. Since, as previously described, the KR relay is deenergized when the lever SB is in its reverse position so that the lock magnet LA is energized by the closing of back contact 41 of relay KR, the switch may be caused to follow the manipulation of lever HB between its normal and reverse positions when the selector lever SB is reversed.

The switch governs, in addition to contact 18 not shown in Fig. 3, four contacts, 23B, 24B, 44A and 45A in accordance with the switch position by any usual and well known means.

Having thus described in general the arrangement of the various parts of Fig. 3, I will now explain its operation.

The signals RHA, RHB, LHA and LHB and relays RH, LH, RAR, TR, LAR, RAHR, RBHR, LAHR and LBHR, while not shown in Fig. 3, are controlled in the same manner as shown in Fig. 1.

With all of the apparatus in its normal condition, as shown in Fig. 3, I shall assume that switch W is to be locally operated for a train which is assumed to occupy section RA. A trainman reverses selector lever SB to condition the switch for local operation. The reversal of lever SB opens contacts 5B and 6B and also actuates contacts 46 and 47. The opening of contact 6B deenergizes relays NW, RMR and LMR, and, in addition, prevents the energization of relays RW and TER. The opening of contact 5B deenergizes relay WL and relay KR. The actuation of contacts 46 and 47 places the control of the normal and reverse magnets NA and RA under the control of contacts 48 and 49 actuated by the lever HB. The releasing of relay WL removes the control of the normal and reverse magnets NA and RA from the relay WR. The releasing of relays RMR and LMR opens the signal relay control circuits. The releasing of the relay KR energizes the lock magnet LA. The switch W may now be caused to move under its own power between the normal and reverse position in response to the manipulation of lever HB.

I shall now assume, with the train again in section RA, that the switching movements have been completed, that the switch W has been placed by lever HB in its normal position, and that the selector lever SB has been restored to its normal position. The restoration of lever SB to its normal position recloses contacts 5B and 6B. The closing of contact 5B establishes the pick-up circuit for relay WL through normal switch indicating contact 44A and the normal point of polar contact 39A of relay WR. The closing of contact 5B also establishes the control circuit for the relay KR. The energization of relay WL establishes its own stick circuit and restores to relay WR, by the closing of front points of contacts 42 and 43 on relay WL, the control of normal and reverse magnets NA and RA. The closing of contacts 6B restores the control of relays NW and RW to the lever LI, causes the time element relay TER to initiate its operation, energizes relay LMR, and establishes a circuit for the energization of relay RMR as soon as front contact 13 of relay TER becomes closed. When relay TER completes its operation and relay RMR becomes energized, the closing

of front contact 33 of relay RMR will again establish the control circuit for the switch control relay WR. The energization of relay LMR will close its front contact 50 to again establish the control circuit for relay RAHR so that signal RHA may be caused to indicate proceed for governing the movement of the train over the switch W as soon as relay TER returns to its initial condition and contact 52 recloses.

In the manner as previously described for the apparatus shown in Fig. 2, the control of the switch mechanism UA cannot be restored to the relay WR unless the position of the switch and the position of the polar armature of the relay WR are in corresponding positions. Also, in the event of disagreement between the position of the switch and the position of the polar armature of the relay WR, energy is applied directly to the normal magnet NA or the reverse magnet RA depending upon the position of the switch, so that the switch will be maintained by power in its initial condition. The switch W is, therefore, in a safe condition for traffic, when lever SB is restored to its initial position, regardless of the position of the polar armature of relay WR with respect to the position of the switch.

From the foregoing explanation of the apparatus shown in Fig. 3, it is apparent that I have provided a simple, reliable and economical means for safeguarding the local operation, under power, of a remotely controlled power operated railway track switch. When the switch is conditioned for local operation, the switch is transferred from control by the remotely controlled apparatus to control by a lever adjacent the switch, and the signal control relay circuits are interrupted to hold the signals in the stop condition. The apparatus shown in Fig. 3 further provides for the restoration of the control of the switch to the remotely controlled apparatus if either section RA or LA is occupied by a train, upon and only upon the expiration of a given time interval after the selector lever is returned to its normal position, and then only if the position of the switch and the position of the polar armature of the switch control relay are in agreement. Also, after the return of the selector lever to its normal position, a proceed signal may be displayed for governing traffic passing over the switch, provided the control of the switch has been restored to the switch control relay. An additional safeguard is further provided, in that in the event of a disagreement between the position of the switch and the position of the polar armature of the switch control relay, the switch will be maintained by power in the position to which last operated by the local switch control lever until such time as the control of the switch is again assumed by the switch control relay.

Although, as previously pointed out, I have, for simplicity, omitted in Figs. 2 and 3 certain apparatus and circuits which are illustrated in Fig. 1, it is understood that the omitted apparatus and circuits operate in conjunction with the apparatus shown in Figs. 2 and 3 in the same manner as described for the apparatus in Fig. 1, except as otherwise shown and described.

In each of the modifications of my invention as illustrated in Figs. 1, 2 and 3, it will be seen that I have provided a reliable means for the local control of a remote controlled power operated railway track switch, in which, if the selector lever and the local switch operating lever are both in either the full normal or full reverse position, the switch is in a safe condition

for traffic regardless of whether the switch is under the control of the remote controlled apparatus or under the control of the local switch operating lever. Furthermore, each of the modifications of my invention provides for the restoration of the switch to the remotely controlled apparatus, if and only if traffic conditions adjacent the switch are such as to permit this being safely done, and also provides, when the selecting device is in its initial condition, for the display of signal indications to govern traffic movements passing over the switch.

Although I have herein shown and described only a few 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 with a railway track switch, remote controlled means for governing said switch; power operated apparatus for controlling said switch including a pair of switch control relays having circuits selectively controlled by said remote controlled means, a polar relay energized in one direction or the other according as one or the other of said switch control relays is energized, and a mechanism selectively responsive to the direction of energization of said polar relay; a selector lever normally occupying one position but manually operable to a different position to disable said power operated apparatus, and a contact operably governed by said lever and closed only when the lever occupies such one position and included in the circuit for each of said switch control relays.

2. In combination, a railway track switch, remote controlled means including a normal switch control relay and a reverse switch control relay for at times operating said switch, means local to said switch for at other times operating said switch, a selector lever having a normal position in which said switch is conditioned for operation by said remote controlled means and a reverse position in which said switch is conditioned for operation by said local means, a contact mechanically connected to the selector lever and closed only when said selector lever is in its normal position, and circuits including said contact for each of said normal and said reverse switch control relays.

3. In combination with a railway track switch, a first device controlled by means remote from the switch, a second device controlled by means local to the switch, a selector lever movable to one position to place the switch under the control of said first device or to another position to place the switch under the control of the second device, a lock relay normally occupying one position, means causing said lock relay to move to a different position when the selector lever occupies said other position, means requiring correspondence between the switch and said first device to restore said lock relay to said one position, and means effective when said lock relay occupies said different position to prevent control of the switch by said first device.

4. In combination, a railway track switch, mechanism for operating said switch, a remotely controlled polar relay for at times governing said mechanism, locally controlled means for at other times governing said mechanism, apparatus for selecting between said polar relay and said locally

controlled means, a lock relay having a normal position, means for changing the position of said lock relay to remove said mechanism from control by said remotely controlled polar relay when said selecting apparatus is operated to permit local operation of the mechanism, and means including said polar relay to restore said lock relay to its normal position for placing said mechanism under the control of said polar relay if said selecting apparatus is returned to its initial condition.

5. In combination, a railway track switch, a normal and a reverse magnet for controlling movements of said switch to normal and reverse positions respectively, remote controlled means for at times controlling said normal and reverse magnets, a lock relay having a normal condition, a normal switch indicating contact, a reverse switch indicating contact, means for causing said lock relay to assume a different condition to remove said normal and reverse magnets from control by said remote controlled means and to place said normal and reverse magnets under control by said normal and reverse switch indicating contacts respectively.

6. In combination, a railway traffic governing device having two positions, remote controlled apparatus capable of assuming different conditions, means for operating said device to one position or the other in accordance with the condition of said remote controlled apparatus, manually operable means for conditioning said device for local operation, a lock relay having a normal position, means for causing said lock relay to assume a different position upon the manipulation of said manually operable means to condition said device for local operation, means for removing said device from control by said remote controlled apparatus when said lock relay assumes such different position, and means for causing said lock relay to assume its normal position to restore said device to control by said remote controlled apparatus effective if the condition of said remote controlled apparatus corresponds to the position of said device.

7. In combination, a railway traffic governing device having two positions, remote controlled apparatus capable of assuming different conditions, means for operating said device to one position or the other in accordance with the condition of said remote controlled apparatus, manually operable means for conditioning said device for local operation, a normally energized lock relay, means for deenergizing said lock relay upon the operation of said manually operable means to condition said device for local operation, means for removing said device from the control of said remote controlled apparatus when said lock relay is deenergized, means for energizing said lock relay to restore said device to control by said remote controlled apparatus effective only if the condition of said remote controlled apparatus corresponds to the position of said device, and means for maintaining said device in the position to which last operated until said device is restored to control by said remote controlled apparatus.

8. In combination, a railway traffic governing device having two positions, remote controlled apparatus capable of assuming different conditions, means for operating said device to one position or the other in accordance with the condition of said remote controlled apparatus, a manually operable means for conditioning said

device for local operation, a lock relay having a normal position, means for causing said lock relay to assume a different position upon the operation of said manually operable means to condition said device for local operation, means for removing said device from the control by said remote controlled apparatus when said lock relay assumes such different position, means for causing said lock relay to assume its normal position to restore said device to control by said remote controlled apparatus, and means for maintaining said device in the position to which last operated until said device is restored to control by said remote controlled apparatus.

9. In combination, a first section of railway track, a second section of railway track including a railway track switch, means controlled from a point remote from said switch for operating the switch, apparatus for conditioning said switch for local operation, a normally energized approach locking relay controlled by traffic conditions in both said sections, and means independent of traffic conditions in said two sections for deenergizing said approach locking relay when said apparatus is actuated to condition said switch for local operation.

10. In combination, a railway track switch, means controlled from a point remote from said switch for operating the switch, a normally energized approach locking relay effective when deenergized for locking said switch, a time element relay, means for at times initiating the operation of said time-element relay when said approach locking relay is deenergized, means for energizing said approach locking relay to release the locking of said switch when said time element relay completes its operation, apparatus for conditioning said switch for local operation, and means responsive only to the operation of said apparatus to condition said switch for local operation and effective to deenergize said approach

locking relay but not to initiate the operation of said time element relay.

11. In combination with a railway track switch, remote controlled means including a polar relay for at times operating said switch, means local to said switch for at other times operating said switch, a selector lever having a normal position in which said switch is conditioned for operation by said remote controlled means and a reverse position in which said switch is conditioned for operation by said local means, a contact closed only when said selector lever is in its normal position, a switch indicating contact, a stick relay effective when deenergized to remove said switch from control by said polar relay, a pick-up circuit for said stick relay including a contact of said polar relay and said selector lever contact as well as said switch indicating contact, and a stick circuit for said stick relay including said selector lever contact.

12. In combination, a railway track switch in a section of railway track having a track circuit including a track relay, remote controlled means for at times operating said switch, means local to said switch for at other times operating said switch, a selector lever having a normal position in which said switch is conditioned for operation by said remote controlled means and a reverse position in which said switch is conditioned for operation by said local means, a contact closed only when said selector lever is in its normal position, a switch indicating relay, an approach locking relay, a stick relay effective when deenergized to remove said switch from control by said remote controlled means, and a pick-up circuit and a stick circuit for said stick relay each including said selector lever contact, said pick-up circuit also including a contact of said switch indicating relay and a back contact of said track relay in multiple with a back contact of said approach locking relay.

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