July 15, 1941. J. J. VANHORN 2,249,097

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 29, 1939 2 Sheets-Sheet 1

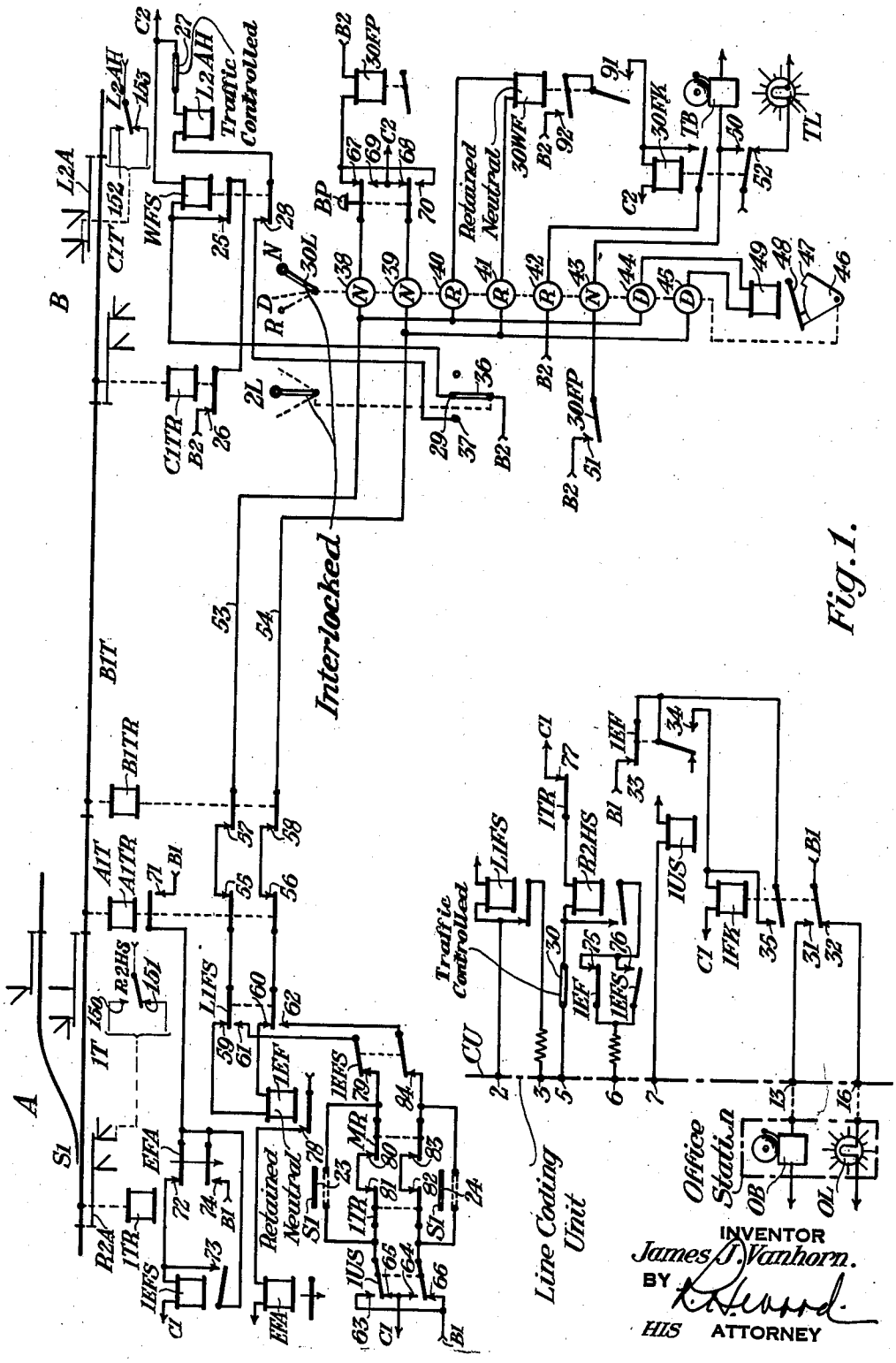


Fig. 1.

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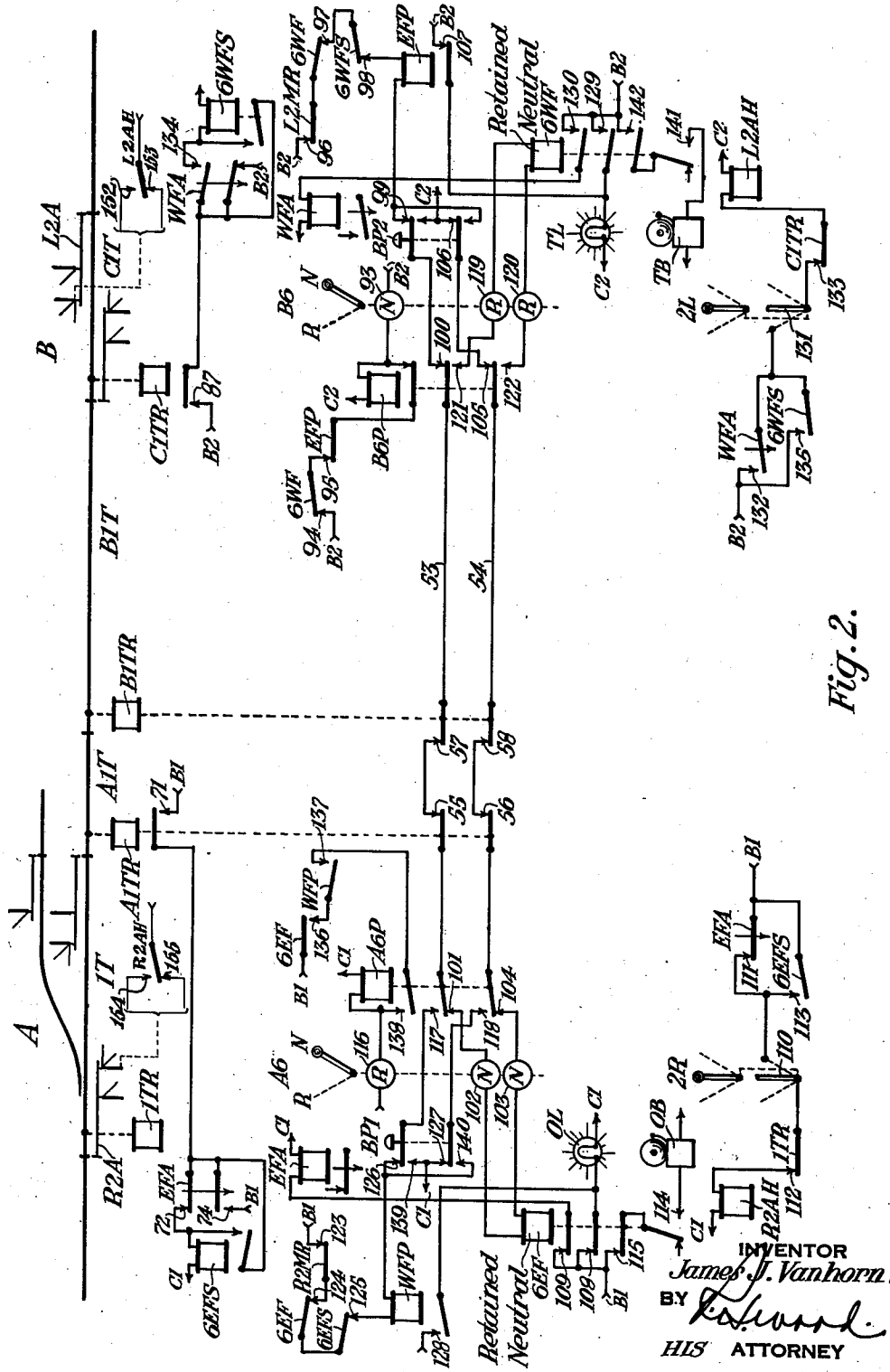


Fig. 2.

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2,249,097

RAILWAY TRAFFIC CONTROLLING APPARATUS

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Application July 29, 1939, Serial No. 287,285

7 Claims. (Cl. 246—25)

My invention relates to railway traffic controlling apparatus, and particularly to traffic locking apparatus for railways.

When traffic is to be operated in either direction over a railway track extending between two spaced locations traffic locking apparatus is provided which commonly includes a traffic locking circuit controlled jointly by two operators one at each end of the stretch of railway. Such traffic locking circuit is adapted to prevent the manipulation of traffic governing signal levers or units for changing the direction of traffic on the stretch of track between such two spaced locations while the stretch is occupied or while a traffic governing signal is displayed for a train to proceed into such stretch. When a traffic locking circuit extends between two attended interlocking stations or towers and is controlled by traffic levers included in respective interlocking machines, the traffic locking circuit is commonly arranged to permit signaling between the two opertors as an aid in the joint control of traffic between the two interlockings. In cases where one or both of the interlockings are of the all-relay type or are remotely controlled such as, for example, by means of a centralized traffic control system and the different traffic governing signals are governed by non-interlocked levers or other units which have no mechanical locks applied thereto signaling between the operators over the traffic locking circuit cannot be accomplished satisfactorily because the traffic locking circuit must be continuously energized. Any interruption of this circuit for the purpose of signaling between the operators when a wayside signal controlled by such circuit is set to display its proceed indication might result in the placing of the signal at stop and consequently interrupts a train movement.

Accordingly, a feature of my invention is the provision of novel and improved means for traffic locking between two spaced locations, and specifically between two interlockings, at least one of which is of the all-relay, automatic or remotely controlled type. Another feature of my invention is the provision of novel and improved means for traffic locking of the type here involved for which only two line wires are required for the traffic locking circuit, and this circuit may be used for signaling between the operators as well as for controlling the wayside traffic governing signals. A further feature of my invention is the provision of apparatus for traffic locking of the type here contemplated wherewith interruption of the traffic locking circuit by an unauthorized movement of a traffic lever by the operator at the leaving end of the circuit is avoided. Other features and advantages of my invention will appear as the specification progresses.

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

In the accompanying drawings, Fig. 1 is a diagrammatic view of one form of apparatus embodying my invention when used for traffic locking between an unattended interlocking location of a centralized traffic control system and an attended interlocking of the mechanical interlocked lever type. Fig. 2 is a diagrammatic view of another form of apparatus embodying my invention when used for traffic locking between two all-relay interlockings.

In each of the two views like reference characters refer to similar parts.

Referring to Fig. 1, the lineargraph at the top of the drawings illustrates a stretch of railway track extending between two spaced locations A and B at each of which an interlocking is located, and over which stretch of track traffic moves in either direction. In the following description locations A and B are at times referred to as interlockings A and B, respectively. At location A the track is formed with a detector track section 1T having a track switch S1 leading to a siding track located therein and which switch has the usual wayside signals associated therewith at will be readily understood by an inspection of Fig. 1. At location B the track is formed with a detector track section CIT which has the usual wayside signals associated therewith for governing traffic therethrough. These wayside signals at locations A and B may be of any one of the standard types and the control thereof is shown only insofar as is required for an understanding of my invention. It is sufficient to point out that the wayside signal R2A at location A governs traffic moving eastbound from location A to location B, and the wayside signal L2A at location B governs traffic moving westbound from location B to location A. At location A an unattended interlocking is located and hence the wayside or traffic governing signal R2A is controlled by a relay or control unit which in turn is governed by an operator at a remote office station as will be described hereinafter. At location B is located an attended interlocking having mechanically interlocked levers, such as, for example, an electromechanical interlocking machine. Hence wayside signal L2A is controlled in

part by a manually operable signal lever of the interlocking machine as will appear hereinafter.

The track between the locations A and B is preferably formed into insulated track sections and as shown in Fig. 1 it is formed with two such sections AIT and BIT. Each track section of the stretch is provided with any desired form of track circuit which circuit includes a track relay connected with the rails at one end of the section and which relay is here identified by the reference character R plus a prefix corresponding to the associated track section. The relationship of each track relay with its respective track section is indicated conventionally by a dash line. It will be understood that automatic wayside signals may be provided between the locations A and B and controlled in accordance with well-known practice.

Before proceeding further with the description, it should be pointed out that contact fingers of the track relays and other relays to be referred to later in the specification, are in many instances shown remote from the windings of the relays. In each such case, the contact finger is identified by the reference character corresponding to that of the relay by which it is operated plus a distinguishing numeral, and the contact finger is shown in the position corresponding to the normal position of the relay. Furthermore, it will be understood that each location A and B is provided with a suitable source of current such as a battery not shown. These two sources of current one at location A and the other at location B are preferably of the same voltage and in Fig. 1 the terminals of the battery at location A are identified by the reference characters BI and CI, and the terminals of the battery at location B are identified by the reference characters B2 and C2.

Looking at the interlocking at location A, there is provided a remotely controlled relay for each of the wayside signals, the control relay R2HS for governing wayside signal R2A only being shown for the sake of simplicity since signal R2A is the only wayside signal at interlocking A which is involved in governing traffic moving eastbound to location B and the description of the control of the other wayside signals is not required for a full understanding of my invention.

The relay R2HS controls the operating circuit for wayside signal R2A in the usual and well-known manner and it is sufficient to point out that when relay R2HS is energized and picked up closing front contact 150, the signal R2A is operated to a proceed position and when relay R2HS is deenergized and released closing back contact 151, the signal R2A is operated to the stop position. The system for controlling signal control relay R2HS and the other signal control relays not shown at interlocking A from a remote office station may be a direct wire system using a line wire for each relay, or it may be a code system using a single two-wire line circuit for selectively controlling all the relays. I shall assume that the remote control of the interlocking at location A is effected by a centralized traffic control system of the time code type covered in the United States application for Letters Patent Serial No. 600,786, filed March 23, 1932, by L. V. Lewis, for Remote control systems, and to which application reference is made for a full understanding of such systems. It is sufficient for the present application to point out that a line coding unit CU shown conventionally is located at interlocking A and is selectively operated in response to code signals sent from a central office station not shown. When the coding unit CU is operated, positive energy is made to appear at the terminals 2, 3, 5, 6 and 7 of the unit according to the code signal operating the unit. Positive energy is applied to the terminal 5 only during the reception of the code signal corresponding to signal control relay R2HS and that relay is picked up over a pick-up circuit easily traced and which circuit includes the usual traffic control indicated by contact 30. Positive energy remains on terminal 6 subsequent to the reception of such code signal to retain relay R2HS picked up over a stick circuit including terminal 6, either front contact 75 of a relay IEF or front contact 76 of a relay IEFS, both of which relays will be later referred to, winding of relay R2HS, front contact 77 of track relay ITR and terminal CI. Hence, once a code signal is received by coding unit CU for operating relay R2HS that relay is picked up and retained picked up for operating signal R2A until such time as a code signal is received from the office station for removing positive energy from terminal 6 or traffic causes contact 75, 76 or 77 to be opened in a manner to later appear. In a similar manner, a traffic control relay LIFS is energized and picked up in response to a code signal that causes positive energy to appear at terminal 2 of unit CU, and relay LIFS is retained picked up subsequent to such code signal by means of a stick circuit connected with terminal 3 of unit CU to which terminal positive energy is applied subsequent to the code signal that picked up relay LIFS until such time as a code signal is received by unit CU for deenergizing the relay LIFS. Also, a relay IUS is energized and picked up in response to a code signal that operates unit CU to cause positive energy to appear at terminal 7 of unit CU, relay IUS being picked up only during the reception of the respective code signal since positive energy is made to appear at terminal 7 only during the reception of the code signal. The function of relays LIFS and IUS will appear when the operation of the apparatus is described.

An indication relay IFK is associated with coding unit CU for applying at times positive energy to terminals 13 or 16. As described in the aforementioned Lewis application Serial No. 600,786, positive energy when applied to certain terminals of the coding unit causes the coding unit to transmit an indication code signal to the central office station for governing indication or signaling devices. As illustrated conventionally by dash lines, a signaling unit or indication bell OB at the office station is sounded in response to the code signal transmitted when positive energy is applied to terminal 13, and another signal unit or indication lamp OL is illuminated in response to the code signal transmitted when positive energy is applied to terminal 16. Positive energy is applied to terminal 13 and 16 over simple circuits respectively including front contact 31 and back contact 32 of indication relay IFK. Indication relay IFK in turn is controlled over a pick-up circuit and a stick circuit. The pick-up circuit extends from terminal BI of the current source over front contact 33 and reverse polar contact 34 of relay IEF, winding of relay IFK and to terminal CI. The stick circuit involves terminal BI, front neutral contact 33 of relay IEF, front contact 35 and winding of relay IFK and terminal CI.

The apparatus at interlocking A also includes a slow release repeater relay EFA which is con-

trolled over a simple circuit including front contact 73 of relay 1EF. A traffic following relay 1EFS is also provided for the apparatus at interlocking A and this relay is controlled over a pick-up circuit which extends from terminal B1 over back contact 71 of track relay A1TR, front contact 72 of relay EFA, winding of relay 1EFS and to terminal C1. A stick circuit is provided for relay 1EFS which includes two paths one path of which is completed over back contact 71 of track relay A1TR and its own front contact 73, and the other path of which is completed over back contact 74 of relay EFA and front contact 73. The function of relay EFA and of the traffic following relay 1EFS will appear hereinafter.

Looking at the interlocking at location B, the interlocking machine includes a traffic lever 30L and a wayside signal lever 2L which levers are mechanically interlocked in the well-known manner but which is not shown. The signal lever 2L is normally positioned in a center position and is operable to a left-hand position where a contact member 36 engages a stationary contact 37, contact member 36 being also adaptable of engaging a stationary contact 29 at the normal position of the lever. A signal control relay L2AH is governed by the signal lever 2L. The manner whereby relay L2AH is governed by lever 2L may be any one of the standard arrangements in present day use and as here shown the circuit for relay L2AH includes terminal B2, contact 36—37 of lever 2L, front contact 28 of a stick relay WFS, winding of relay L2AH, a traffic controlled contact 27 and terminal C2. Relay WFS in turn is shown controlled over a pick-up circuit and a stick circuit, the pick-up circuit extending from terminal B2 over lever contact 36—29, winding of relay WFS and to terminal C2; and the stick circuit extending from terminal B2 over front contact 26 of track relay C1TR, front contact 25 and winding of relay WFS and to terminal C2. It follows that when signal lever 2L is released by the mechanical interlocking and is moved to its left-hand position, the signal control relay L2AH is energized and picked up closing front contact 152 for operating the signal L2A to a proceed position. When a train advances past signal L2A and enters section C1T to shunt track relay C1TR, the stick relay WFS is deenergized causing relay L2AH to be deenergized and released closing back contact 153 to operate signal L2A to a stop position. To reenergize signal control relay L2AH for operating signal L2A for a following train, the signal lever 2L must first be replaced at its normal position to pick up relay WFS and then operated again to its left-hand position.

The traffic lever 30L is operable to a normal position N, a reverse position R and to an indication position D. The lever 30L is provided with a series of contacts 38 to 45, inclusive, for selectively closing circuits at different positions of the lever. These contacts operated by lever 30L are shown conventionally in the well-known manner and each contact is provided with a reference character N, R or D to indicate the position of the lever 30L at which the contact is closed. The traffic lever 30L has connected therewith a segment 46 provided with a notch 47 adaptable of engaging a locking dog 48 of a lock magnet 49, the arrangement being such that lever 30L is arrested in its movement from normal position N to reverse position R at indication position D until such time as magnet 49 is energized to lift locking dog 48 out of engagement with notch 47.

An indication relay 30FK is associated with lever 30L for controlling a signaling unit or indication bell TB and a second signaling unit or indication lamp TL. The bell TB is governed over either of two circuits, a first one of which includes front contact 50 of relay 30FK, and a second one of which includes front contact 51 of a relay 30FP to be referred to later and contact 43 closed at the normal position N of lever 30L. The lamp TL is illuminated over back contact 52 of indication relay 30FK.

In order to permit traffic to move in either direction between locations A and B, the two interlockings are associated by a traffic locking circuit and which circuit includes a directional relay at each location, eastbound directional relay 1EF being located at location A and westbound directional relay 30WF being located at location B. This traffic locking circuit is completed between the two locations over two line wires 53 and 54 in which there are preferably interposed front contacts of the track relays of the intervening track sections, front contacts 55 and 56 of track relay A1TR and front contacts 57 and 58 of track relay B1TR being interposed in the wires 53 and 54 as will be readily understood by an inspection of Fig. 1. That is to say, the traffic locking circuit is held open as long as the stretch of track between locations A and B is occupied.

The directional relays 1EF and 30WF are preferably of the retained neutral polarized type, that is, the neutral front contacts are retained closed during a reversal of the energizing current, such relays being well-known to the art.

A directional repeater relay 30FP is provided at location B and its winding is interposed in the traffic locking circuit as will shortly appear.

The traffic locking circuit is also governed by manually controlled devices one at each interlocking. To be explicit, at interlocking A the relay L1FS which is controlled by the operator at the central office station through the centralized traffic control system serves as a manually controlled device for controlling the traffic locking circuit, the front contacts 59 and 60 of relay L1FS or the back contacts 61 and 62 of that relay being interposed in the circuit in a manner to be described hereinafter. At interlocking B the traffic lever 30L serves as a manually controlled device for governing the traffic locking circuit, the contacts 38 and 39 being interposed in the circuit when the lever is set at its normal position and the contacts 40 and 41 being interposed in the circuit when the lever is set at its reverse position.

In order that signaling may be effected between the operator attending the interlocking B and the operator at the central office station who controls the interlocking at location A, the traffic locking circuit is also governed by two pole changers one located at each interlocking. At interlocking A the front contacts 63 and 64 and the back contacts 65 and 66 of relay 1US serve to pole change the traffic locking circuit. At interlocking B a push button BP is provided, the traffic locking circuit being completed over the contacts 67 and 68 when the push button is released and being completed over contacts 69 and 70 when the push button is depressed.

In describing the operation of the apparatus of Fig. 1, I shall assume the apparatus first occupies its normal position, that is, the position shown in Fig. 1, so that the eastbound direction for traffic is established. That is to say, the op-

erator of the centralized traffic control system is normally given control of traffic over the territory between interlockings A and B. Under this normal condition of the apparatus the traffic control relay LIFS at interlocking A is energized and the traffic lever 30L at interlocking B is set at its normal position N. The traffic locking circuit is supplied with current from battery at interlocking B and the circuit can be traced from terminal B2 over winding of repeater relay 30FP, normally closed contact 67 of push button BP, contact 38 of traffic lever 30L, line wire 53, front contacts 57 and 55 of track relays BITR and AITR, respectively, front contact 59 of traffic control relay LIFS, winding of directional relay IEF, front contacts 60, 56 and 58 of relays LIFS, AITR and BITR, respectively, line wire 54, contact 39 of lever 30L, normally closed contact 68 of push button BP and to terminal C2 of the battery at interlocking B. The directional relay IEF at interlocking A is energized to close its neutral front contacts and to close its normal polar contacts since the polarity of the current normally flowing in the traffic locking circuit is such that the directional relay IEF is energized at normal polarity. The repeater relay 30FP at location B is proportioned so that the voltage impressed across its winding by the one battery B2—C2 is not sufficient to energize the relay at its pick-up value and the relay is normally released closing its back contacts. This normal condition of the traffic locking circuit is indicated at the central office station by the illumination of lamp OL because positive energy has been applied to terminal 16 of the coding unit over back contact 32 of indication relay IFK. At interlocking B, lamp TL is illuminated over back contact 52 of indication relay 30FK to indicate the normal condition of the traffic locking circuit to the operator at interlocking B.

If the operator at the central office station desires to operate signal R2A for directing an eastbound train from location A to location B, he transmits a code signal for operating the coding unit CU to pick up the signal control relay R2HS, relay R2HS being first picked up over its pick-up circuit when positive energy is made to appear at terminal 5 in response to the code signal and is then retained energized over its stick circuit by the positive energy applied to terminal 6 since the directional relay IEF is now picked up closing front contact 75. When the train advances past signal R2A and enters section IT and shunts track relay ITR opening front contact 77, the relay R2HS is released and causes signal R2A to assume its stop position. With the train advancing into section AIT to shunt track relay AITR opening front contacts 55 and 56, the traffic locking circuit is opened and directional relay IEF is deenergized and released. The repeater relay EFA is now deenergized and releases at the end of its slow release period. During the slow release period of relay EFA, current is supplied to the traffic following relay IEFS over its pick-up circuit since track relay AITR is now deenergized closing back contact 71. The traffic following relay IEFS is then retained picked up over its stick circuit until such time as the eastbound train arrives at location B and vacates section BIT so that the traffic locking circuit is reclosed and the directional relay IEF is reenergized and picked up causing the repeater relay EFA to be again picked up. In the event the operator at the central office station desires to dispatch a second or following eastbound train from location A before the first train has arrived at location B, he sends a code signal to operate unit CU for again energizing the signal control relay R2HS, relay R2HS being retained energized over its stick circuit including front contact 76 of traffic following relay IEFS. It follows that under the normal condition of this apparatus the operator of the centralized traffic control system can dispatch eastbound trains from location A.

With the apparatus at its normal condition and assuming the operator at interlocking B desires to send a westbound train to location A, he signals to the operator at the central office station by depressing the push button BP for a brief interval causing the current supplied to the traffic locking circuit to be pole changed so that directional relay IEF at location A is reversed closing its reverse polar contact 34 during the interval push button BP is depressed, the neutral contact of relay IEF remaining closed, however, due to relay IEF being of the retained neutral type. With reverse polar contact 34 of relay IEF closed the indication relay IFK is picked up and is then held energized over its stick circuit after the push button BP is released and the traffic locking circuit reenergized at normal polarity. With relay IFK picked up closing front contact 31, positive energy is applied to terminal 13 of coding unit CU and an indication code signal is transmitted to the central office which causes bell OB to sound informing the operator at the central office station that the operator at location B desires a reversal in the direction of traffic. The lamp OL at the central office station is, of course, extinguished when relay IFK is picked up.

If the operator at the central office station consents to a reversal in the direction of traffic, he signals this fact to the operator at location B by transmitting a code signal which operates unit CU to deenergize traffic control relay LIFS. With relay LIFS released opening front contacts 59 and 60, and closing back contacts 61 and 62, the traffic locking circuit is transferred from directional relay IEF to the source of current at location A. The traffic locking circuit can now be traced from terminal B2 at location B over winding on relay 30FP, the elements 67, 38, 53, 57, 55, 61, back contact 79 of relay IEFS, front contact 80 of an approach locking relay MR not shown but which is associated with signal R2A in the usual manner front contact 81 of track relay ITR, back contact 65 of relay IUS, terminal C1 to terminal B1 of the battery at location A, back contact 66 of relay IUS, front contact 82 of relay ITR, front contact 83 of relay MR, back contact 84 of relay IEFS, the following elements 62, 56, 58, 54, 39, 68 and terminal C2. Since the two batteries at the two interlocking locations are interposed in the traffic locking circuits in series the increased voltage impressed on the repeater relay 30FP is sufficient to cause that relay to be picked up closing front contact 51 so that the bell TB is sounded to signal to the operator at location B that the operator of interlocking A consents to a reversal in the direction of traffic. The operator at location B next moves the traffic lever 30L to its indication position where contacts 44 and 45 are closed, so that the lock magnet 49 is connected across the traffic locking circuit for energization thereof by the battery at location A, the contacts 38 and 39 of lever 30L being now opened so that the repeater relay 30FP and the battery at location A are disconnected from the

traffic locking circuit. The magnet 49 is energized to lift locking dog 48 with the result that the lever 30L is released and can be moved to its full reverse position R where contacts 40 and 41 are closed to connect the directional relay 30WF with the traffic locking circuit for energization of that relay by the battery at location A, the connection being such that relay 30WF is energized at normal polarity. With traffic lever 30L moved to its reverse position, the mechanical interlocking releases signal lever 2L and the operator at interlocking B can cause signal L2A to be operated to a proceed position by moving lever 2L to its left-hand position causing relay L2AH to be energized and picked up in the manner previously explained. With the direction of traffic established for westbound trains by the traffic locking circuit, the operator at location B can dispatch trains westbound to location A by operating signal lever 2L in the manner explained hereinbefore. It is to be observed that when the traffic locking circuit is set for westbound traffic the switch S1 can be used for trains moving to the siding track without affecting the traffic locking circuit because with switch S1 reversed contacts S1—24 and S1—23 of the usual switch circuit controller are moved to the positions shown by dotted lines in Fig. 1 to complete the traffic locking circuit.

With westbound direction established and assuming the operator of interlocking A desires a reversal in the direction of traffic, he signals to the operator at location B by sending a code signal which operates unit CU to pick up relay 1US for a brief interval. With relay 1US picked up closing front contacts 63 and 64 the traffic locking circuit is pole changed and directional relay 30WF is energized at reverse polarity closing reverse polar contact 91 interposed in the pick-up circuit of indication relay 30FK. With indication relay 30FK picked up to close front contact 50 and open back contact 52, the bell TB is sounded and the lamp TL is extinguished to inform the operator at location B of the desire on the part of the operator of the interlocking at location A for a reversal in the direction of traffic. If the operator at location B consents to the reversal in the direction of traffic he places the traffic lever 30L back to its normal position. The operator of interlocking A after having transmitted a code signal for operating relay 1US next sends the code signal effective to reenergize relay L1FS and that relay is picked up to transfer the traffic locking circuit back to the eastbound directional relay 1EF and the eastbound direction of traffic is reestablished.

It is to be noted that signaling is effected between the operator of interlocking B and the operator of interlocking A over the two-wire line circuit by using polarized relays of the retained neutral type which permit this signaling between the operators without affecting the control of the wayside signals. For example, in the case the relay R2HS is energized and signal R2A operated to a proceed position for an eastbound train and the operator at interlocking B depresses the push button BP for signaling a desire for a reversal in the direction of traffic, the front neutral contact 75 of directional relay 1EF remains closed during the reversal in the energization of relay 1EF and the position of signal R2A is not affected. Furthermore, the use of a repeater relay 30FP which requires double line voltage to pick up that relay prevents possible false picking up of relay 30FP due to a cross on the line circuit which might result in false signaling to the operator at interlocking B of a desire for a reversal in the direction of traffic.

Referring to Fig. 2, the track layout is the same as in Fig. 1. The interlockings A and B of Fig. 2 are both of the all-relay type, that is, the signal functions are controlled by levers having no mechanical interlocking. The interlocking A includes a traffic lever A6 and the interlocking B includes a traffic lever B6. Each lever A6 and B6 is operable to a normal position N and to a reverse position R and each is, of course, non-interlocked with the other levers of the associated machine and has no lever lock magnet.

A traffic locking circuit including two line wires 53 and 54 extending between interlockings A and B the same as in Fig. 1 is associated with levers A6 and B6 for governing relays at each of the two locations for the control of traffic between the two interlockings and which relays are similar to the relays of Fig. 1 except as will be noted hereinafter. In other words, the levers A6 and B6 form two manually controlled devices for governing the traffic locking circuit. Two manually operable push buttons BP1 and BP2 are provided at locations A and B, respectively, for at times pole changing the traffic locking circuit.

It is believed that the apparatus of Fig. 2 can best be understood by a description of its operation. Under normal conditions, both levers A6 and B6 are set at their normal positions for conditioning the traffic locking circuit as required to establish eastbound direction of traffic. With lever B6 set at its normal position, closing normal contact 93, a repeater relay B6P is energized over a simple pick-up circuit easily traced, relay B6P being also provided with a stick circuit which includes back contact 94 of a directional relay 6WF and front contact 95 of a directional repeater relay EFP. The traffic locking circuit under this normal condition can be traced from terminal B2 at interlcoking B over front contact 96 of an approach locking relay L2MR associated with signal L2A in the usual manner but not shown since it forms no part of my invention, back contacts 97 and 98 of directional relay 6WF and traffic following relay 6WFS, respectively, winding of directional repeater relay EFP, normally closed contact 99 of push button BP2, front contact 100 of relay B6P, line wire 53, front contacts 57 and 55 of track relays B1TR and A1TR, respectively, back contact 101 of a repeater relay A6P at location A, normally closed contact 102 of lever A6, winding of directional relay 6EF, a second normally closed contact 103 of lever A6, back contact 104 of relay A6P, front contacts 56 and 58 of relays A1TR and B1TR, respectively, line wire 54, front contact 105 of relay B6P, normally closed contact 106 of push button BP2 and terminal C2. Directional relay 6EF at location A and directional repeater relay EFP at location B are now energized and picked up, the polarity of the current being such that the directional relay 6EF, which is of the retained neutral polarized type, is energized at normal polarity. With relay EFP picked up closing front contact 107, the lamp TL at location B is illuminated to inform the operator of the closed condition of the traffic locking circuit. Also, lamp OL at location A is illuminated over front contact 108 of directional relay 6EF to indicate the closed condition of the traffic locking circuit to the operator at location A. With directional relay 6EF picked up closing front contact 109, slow

release repeater relay EFA is energized and picked up. If the operator at location A now desires to send a train eastbound to location B, he moves a signal lever 2R to the right-hand position closing lever contact 110 so that signal control relay R2AH is energized and picked up closing front contact 154 to operate signal R2A to a proceed position. The circuit for relay R2AH includes terminal B1, front contact 111 of repeater relay EFA, lever contact 110, front contact 112 of track relay 1TR, winding of relay R2AH and terminal C1.

As the eastbound train advances past signal R2A and enters track section 1T to shunt track relay 1TR opening front contact 112, the signal control relay R2AH is released closing back contact 155 to set signal R2A at stop. As the train advances into section A1T and shunts track relay A1TR, the traffic locking circuit is opened at front contacts 55 and 56 of relay A1TR and the directional relay 6EF at location A and the directional repeater relay EFP at location B are deenergized and released. The slow release repeater relay EFA is now without current due to the opening of front contact 109 of relay 6EF and relay EFA is released at the end of its slow release period. During the slow release period of relay EFA and because back contact 71 of track relay A1TR is now closed, current is supplied to the traffic following relay 6EFS and that relay is picked up and then held energized over its stick circuit subsequent to the release of the repeater relay EFA until such time as the eastbound train arrives at location B to vacate track section B1T and restore the traffic locking circuit so that the directional relay 6EF is reenergized causing relay EFA to be also reenergized. With the traffic following relay 6EFS picked up closing front contact 113, the signal control relay R2AH can be reenergized to permit following moves from location A while the first train is between locations A and B.

It is to be noted that with signal R2A operated for an eastbound movement and an unauthorized movement of traffic lever B6 at location B takes place, such movement does not cause signal R2A to be set at stop because repeater relay B6P is retained energized over its stick circuit when lever contact 93 of lever B6 is open and hence such unauthorized movement of lever B6 does not affect the traffic locking circuit. Again, it should be noted that should the operator at location B depress push button BP2 in an attempt to signal to the operator at location A while the wayside signal R2A is set at a proceed position for an eastbound movement, the wayside signal R2A is not set at stop because the directional relay 6EF is of the retained neutral type and a reversal in its energizing current due to the operation of the pole changing push button BP2 at location B does not affect the position of front contact 109 of relay 6EF. It should also be noted that as long as the train occupies the stretch and the traffic locking circuit is open so that directional relay 6EF and repeater relay EFP are released, both lamps OL and TL are dark to indicate this condition of the traffic locking circuit to the two operators.

Assuming that the apparatus of Fig. 2 is normal and the operator at location B desires to have the direction of traffic reversed so that he can send a westbound train from location B, the operator at location B signals to the operator at location A by depressing the push button BP2 to pole change the traffic locking circuit so that the directional polarized relay 6EF is energized at reverse polarity closing its reverse polar contact 114. A circuit including front contact 115 and reverse polar contact 114 of relay 6EF is closed to operate the bell OB to inform the operator at location A that a reversal in the direction of traffic is desired. If the operator at location A agrees to a change in the direction of traffic, he moves his lever A6 to its reverse position where contact 116 is closed causing repeater relay A6P to be picked up opening back contacts 101 and 104 and closing front contacts 117 and 118 to transfer the traffic locking circuit from the directional relay 6EF to the current source at location A. The connection of battery at the location A is such as to oppose the battery at location B with the result that the repeater relay EFP at location B is deenergized and released to open front contact 107 interposed in the circuit for lamp TL so that lamp TL becomes dark to inform the operator at location B that the operator at location A agrees to a reversal in the direction of traffic. The lamp OL at location A is also dark since the directional relay 6EF is now released to open front contact 108.

The operator at location B now moves his traffic lever B6 to its reverse position opening contact 93 and closing contacts 119 and 120 so that when repeater relay B6P is released to close back contacts 121 and 122 the traffic locking circuit is connected with the directional relay 6WF and that relay is picked up by the current supplied from the battery of location A. The traffic locking circuit is now established from terminal B1 over front contact 123 of an approach locking relay R2MR not shown but associated with signal R2A in the usual manner and the following elements 124, 125, winding of directional repeater relay WFP, 126, 117, 55, 57, 53, 121, 119, winding of directional relay 6WF, 120, 122, 54, 58, 56, 118, 127 and terminal C1. Directional relay 6WF is now picked up and its normal polar contacts are closed since the direction of current is such as to energize relay 6WF at normal polarity. Also, the directional repeater relay WPF at location A is picked up. The closing of front contact 128 of relay WFP illuminates lamp OL to inform the operator at location A that the traffic locking circuit is again closed. Also, the closing of front contact 129 of directional relay 6WF at location B completes a circuit for illuminating lamp TL to inform the operator at location B that the traffic locking circuit is again closed. With directional relay 6WF picked up closing front contact 130, a slow release repeater relay WFA is energized and picked up. The operator at location B next moves his signal control lever 2L to its left-hand position to complete a circuit for signal control relay L2AH, the circuit extending from terminal B2 over front contact 132 of repeater relay WFA, lever contact 131, front contact 133 of track relay C1TR, winding of relay L2AH and terminal C2. With relay L2AH picked up closing front contact 152 the signal L2A is operated to a proceed position to permit a westbound movement.

As the train advances west past signal L2A and enters track section C1T to shunt track relay C1TR opening front contact 133, the signal control relay L2AH is deenergized closing back contact 153 with the result that the signal L2A is set at stop. The traffic following relay 6WFS is next picked up by current supplied over back contact 87 of track relay C1TR and front contact 134 of repeater relay WFA, and relay 6WFS is then re-

tained energized over its stick circuit so that the signal control relay L2AH can be reenergized and signal L2A operated for a following westbound train because the circuit for relay L2AH is now completed at front contact 135 of the traffic following relay 6WFS.

As long as the westbound train occupies the stretch between locations A and B, the traffic locking circuit is held open the same as described hereinbefore but as soon as the westbound train reaches location A, the circuit is completed to reenergize the directional relay 6WF and the directional repeater relay WFP.

Again it should be observed that an unauthorized movement of lever A6 on the part of the operator at location A after the wayside signal L2A has been operated for a westbound train, does not cause signal L2A to be set at stop because repeater relay A6P at location A is retained energized over its stick circuit which includes back contact 136 of relay 6EF, front contact 137 of relay WFP and its own front contact 138, and relay A6P on being retained energized holds the traffic locking circuit completed at its front contacts 117 and 118.

Assuming the traffic locking circuit of Fig. 2 is conditioned for westbound traffic in the manner explained above, the stretch of track is unoccupied and the operator at location A desires to send a train eastbound from location A, the operator at location A signals to the operator at location B by depressing his push button BP1 to pole change the traffic locking circuit by closing contacts 139 and 140 of push button BP1 with the result that the directional relay 6WF is reversed closing its reverse polar contact 141. Since front contact 142 of relay 6WF is already closed the closing of reverse polar contact 141 of relay 6WF completes the circuit for the signal bell TB and signals the operator at location A that the operator at location B desires a change in the direction of traffic. The operator at location B then moves his traffic lever B6 to its normal position to close contact 93 to energize the repeater relay B6P. The movement of lever B6 to its normal position opens contacts 119 and 120 to remove the directional relay 6WF from connection with the traffic locking circuit. With repeater relay B6P picked up closing front contacts 100 and 105 the battery at location B is connected with the traffic locking circuit and opposes the battery at location A with the result that the repeater relay WFP is deenergized to open front contact 128 which in turn causes the lamp OL at location A to be extinguished signaling the operator at location A that the operator at location B agrees to a change in the direction of traffic.

The operator at location A next moves his traffic lever A6 to its normal position closing normal contacts 102 and 103 to connect the directional relay 6EF with the traffic locking circuit, and to open contact 116 which causes the repeater relay A6P to be deenergized and released to transfer the traffic locking circuit from the battery at location A to direction relay 6EF. The apparatus is now restored to its normal condition and the operator at location A can dispatch eastbound trains by operation of his signal lever 2R in the manner explained hereinbefore.

Although I have herein shown and described only two 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. Railway traffic controlling apparatus in combination with a stretch of track extending between two spaced locations, a traffic governing signal at each end of the stretch for governing traffic through the stretch and a traffic locking circuit extending between said locations responsive to traffic occupying said stretch; two polarized directional relays one at each of said locations, said relays each characterized by retaining its front neutral contacts closed when the energizing current is reversed, a signal control relay at each location controlled by a front neutral contact of the directional relay to the same location and effective when picked up to cause the traffic governing signal of that location to be operated to a proceed position, manually controlled means partly at each location to connect either the directional relay at one location and the current source at the other location or vice versa with said traffic locking circuit to energize one or the other of said directional relays at normal polarity to control the respective signal control relay and cause operation of the corresponding traffic governing signal and establish the direction of traffic through said stretch, a signaling unit for each location, said signaling units each controlled over a reverse polar contact of the directional relay at the same location, and manually operable pole changing means at each location interposed in said traffic locking circuit to reverse the polarity of the current supplied by the source of the same location to said traffic locking circuit to cause at times a reversal of the directional relay at the opposite location to operate the associated signaling unit and at the same time retain the signal control relay energized.

2. Railway traffic controlling apparatus in combination with a stretch of track extending between two interlockings each of which includes a wayside signal governing traffic through the stretch, a signal control lever, a traffic lever and a source of direct current; a traffic locking circuit including two line wires extending between said interlockings, two retained neutral polarized relays one at each interlocking, circuit means partly at each interlocking including contacts of said traffic levers to connect the polarized relay at one interlocking and the current source at the other interlocking or vice versa with said line wires to energize a selected one of said polarized relays at normal polarity to establish the direction of traffic between said interlockings, a signal control relay at each interlocking effective when energized to cause the wayside signal at the same interlocking to be operated to a proceed position, means at each interlocking including a front neutral contact of the polarized relay and a contact of the signal control lever of the same interlocking to control the associated signal control relay and cause operation of the corresponding wayside signal to its proceed position, a signaling unit at each interlocking located remote from the wayside signal at the same interlocking and controlled over a reverse polar contact of the polarized relay at the same interlocking, and a pole changing push button at each interlocking interposed in said circuit means and each operating when depressed to reverse the connections of the current source of the same interlocking with said line wires to cause a reversal of the polarized relay at the other interlocking to operate the associated signaling unit when the wayside signal at

such other interlocking has been operated to its proceed position.

3. Railway traffic controlling apparatus in combination with a stretch of track extending between two interlockings each of which includes a wayside signal governing traffic through the stretch, a signal control lever, a traffic lever and a source of direct current; a traffic locking circuit including two line wires extending between said interlockings, two retained neutral polarized relays one at each interlocking, circuit means partly at each interlocking including contacts of said traffic levers to connect the polarized relay at one interlocking and the current source at the other interlocking or vice versa with said line wires to energize a selected one of said polarized relays at normal polarity to establish the direction of traffic between said interlockings, a signal control relay at each interlocking effective when energized to cause the wayside signal at the same interlocking to be operated to a proceed position, means at each interlocking including a front neutral contact of the polarized relay and a contact of the signal control lever of the same interlocking to control the associated signal control relay and cause operation of the corresponding wayside signal to its proceed position, a signal bell and a signal lamp at each interlocking, a pole changing push button at each interlocking interposed in said circuit means and each operative when depressed to reverse the connections of the current source of the same interlocking with said line wires to cause a reversal of the polarized relay at the other interlocking, circuit means at each interlocking including a front neutral contact of the associated polarized relay to operate the associated lamp to indicate the condition of the traffic locking circuit, and other circuit means including a reverse polar contact of the associated polarized relay to operate the associated bell.

4. Railway traffic controlling apparatus in combination with a stretch of track extending between a first and a second interlocking each of which includes a wayside signal governing traffic through the stretch and a source of direct current, said first interlocking having a wayside signal control relay and a traffic control relay, said second interlocking having a wayside signal control lever interlocked with a traffic control lever provided with a lever lock and operable to a normal and a reverse and an indication position, a retained neutral polarized relay at each interlocking, a pair of line wires extending between said interlockings, a first circuit means including a front contact of said traffic control relay and a normal contact of said traffic control lever to connect the current source at said second interlocking and the polarized relay at said first interlocking with said line wires to energize that polarized relay at normal polarity, a second circuit means including a back contact of said traffic control relay and a reverse contact of said traffic control lever to connect the current source at said first interlocking and the polarized relay at said second interlocking with said line wires to energize that polarized relay at normal polarity, means including an indication position contact of said traffic lever to connect its lever lock with said line wires, a signal bell at each interlocking each of which is controlled over a reverse polar contact of the associated polarized relay, a pole changing relay at said first interlocking having contacts interposed in said second circuit means for at times causing a reversal of the polarized relay at said second interlocking for operating the associated signal bell, a pole changing push button at said second interlocking interposed in said first circuit means for at times causing a reversal of the polarized relay at said first interlocking for operating the associated signal bell, means including a front neutral contact of the polarized relay and a front contact of the wayside signal control relay of the first interlocking for controllng the associated wayside signal, and means including a contact of said signal control lever for controlling the wayside signal at said second interlocking.

5. Railway traffic controlling apparatus in combination with a stretch of track extending between a first and a second interlocking each of which includes a wayside signal governing traffic through the stretch and a source of direct current, a traffic control device at each interlocking operable to a first and a second position, a pair of line wires extending between said interlockings, a directional relay at each interlocking, a directional repeater relay at said second interlocking, said repeater relay having a pick-up voltage substantially equal to the combined voltages of said two sources of current, a first circuit means including a first position contact of each of said traffic devices to connect said repeater relay and the current source of said second interlocking and the directional relay of said first interlocking with said line wires to effectively energize that directional relay to establish traffic from the first to the second interlocking, a second circuit means including a second position contact of each of said traffic devices to connect the current source of said first interlocking and the directional relay of said second interlocking with said line wires to effectively energize that directional relay to establish traffic from the second to the first interlocking, and a signal bell at said second interlocking controlled over a front contact of said repeater relay to sound the bell when the traffic device of the first interlocking is operated to its second position and the traffic device of the second interlocking is operated to its first position so that both sources and said repeater relay are connected in series over said line wires.

6. Railway traffic controlling apparatus comprising in combination with a stretch of railway track having a wayside signal at each of two spaced locations for governing traffic in opposite directions through the stretch and a two-wire traffic locking circuit extending between such locations for controlling the wayside signals in accordance with the positions of two manually controlled devices one at each location, a signal control relay at each location effective when energized to cause operation of the wayside signal at the same location to a proceed position, an electromagnet at each location effective when energized to permit energization of the associated signal control relay, said electromagnet at a selected one of said locations characterized as a retained neutral polarized relay having a front neutral contact which permits the energization of the associated signal control relay, a current source at each location, a first circuit means including a contact of each of said devices closed at a first position thereof to connect the current source at said selected one location and the electromagnet at said other location to said traffic locking circuit to energize that electromagnet for permitting energization of the respective signal control relay and operation of the respective wayside signal to its proceed position, a second circuit means including a contact of each of said devices closed at a second position thereof to con-

nect the current source at said other location and said polarized relay at said one location to said traffic locking circuit to energize that relay for permitting the energization of the respective signal control relay and operation of the respective wayside signal to its proceed position, a signaling unit at said one location controlled over a polar contact of said polarized relay, and a manually operable pole changer at said other location interposed in said second circuit means to reverse at times the connection of the associated current source to the traffic locking circuit to reverse the energization of said polarized relay and cause operation of said signaling unit while the wayside signal at said one location is retained at its proceed position.

7. Railway traffic controlling apparatus comprising in combination with a stretch of railway track having a wayside signal at each of two spaced locations for governing traffic in opposite directions through the stretch and a two-wire traffic locking circuit extending between such locations for controlling the wayside signals in accordance with which one of two directional relays one at each location is energized, a current source at each location, a traffic lever at each location operable to a normal or a reverse position, a repeater relay for each of said traffic levers, said repeater relay at one location controlled over a pick-up circuit including a reverse position contact of its traffic lever and over a stick circuit including a back contact of the directional relay at said one location, said repeater relay at the other location controlled over a pick-up circuit including a normal position contact of its traffic lever and over a stick circuit including a back contact of the directional relay at said other location, a first circuit means including a front contact of the repeater relay at said one location and a reverse position contact of the traffic lever at said other location to connect the current source at said one location and the directional relay at said other location to said traffic locking circuit to energize that directional relay to control the associated wayside signal whereby a subsequent unauthorized movement of the traffic lever at said one location is ineffective to disturb the control of the wayside signal, and a second circuit means including a front contact of the repeater relay at said other location and a normal position contact of the traffic lever at said one location to connect the current source at said other location and the directional relay at said one location to said traffic locking circuit to energize that directional relay to control the associated wayside signal whereby a subsequent unauthorized movement of the traffic lever at said other location is ineffective to disturb the control of the associated wayside signal.

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