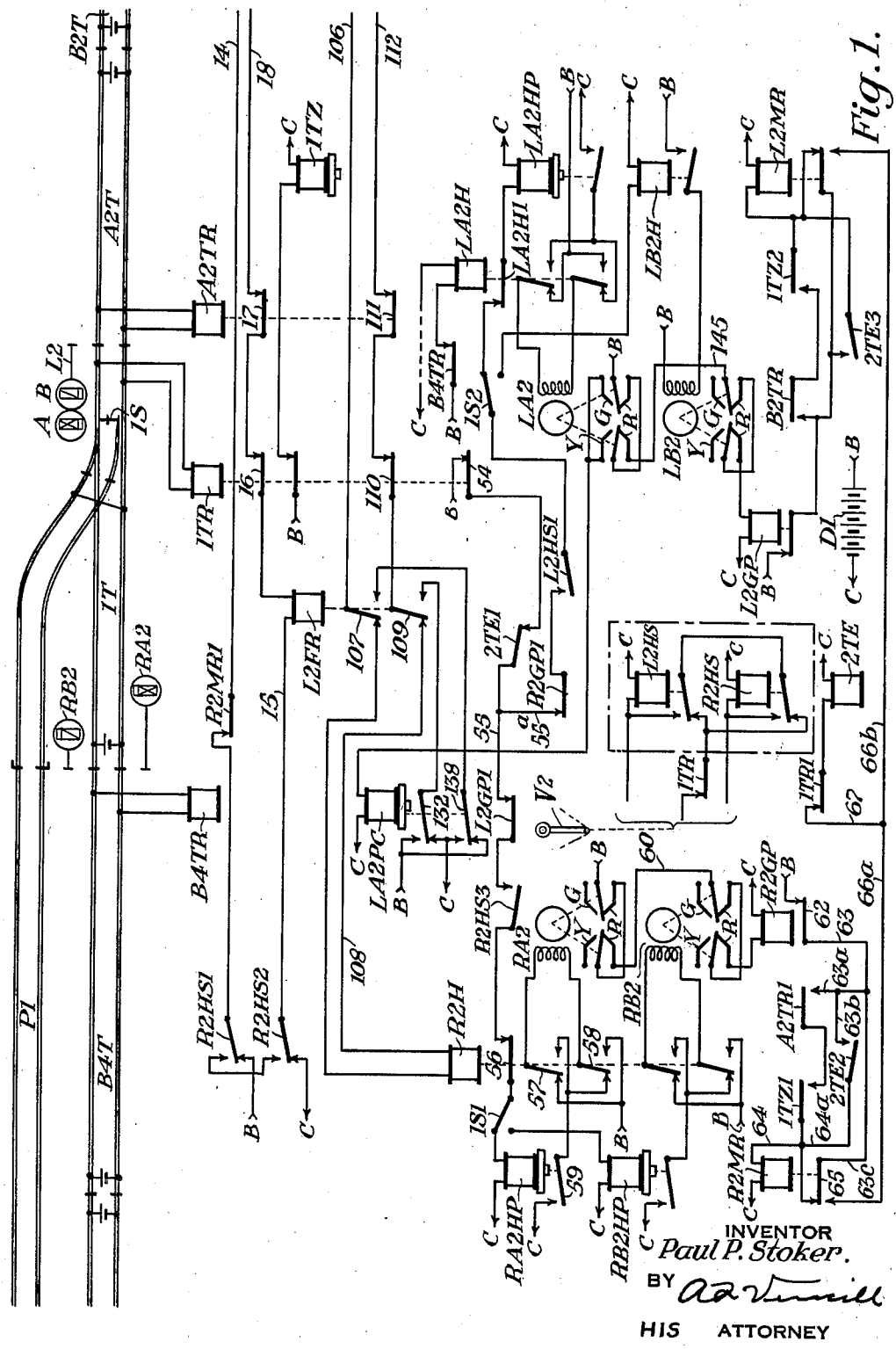
April 18, 1939. P. P. STOKER 2,154,539

TRAFFIC CONTROLLING APPARATUS

Filed May 2, 1935 4 Sheets-Sheet 1



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April 18, 1939. P. P. STOKER 2,154,539

TRAFFIC CONTROLLING APPARATUS

Filed May 2, 1935 4 Sheets-Sheet 2

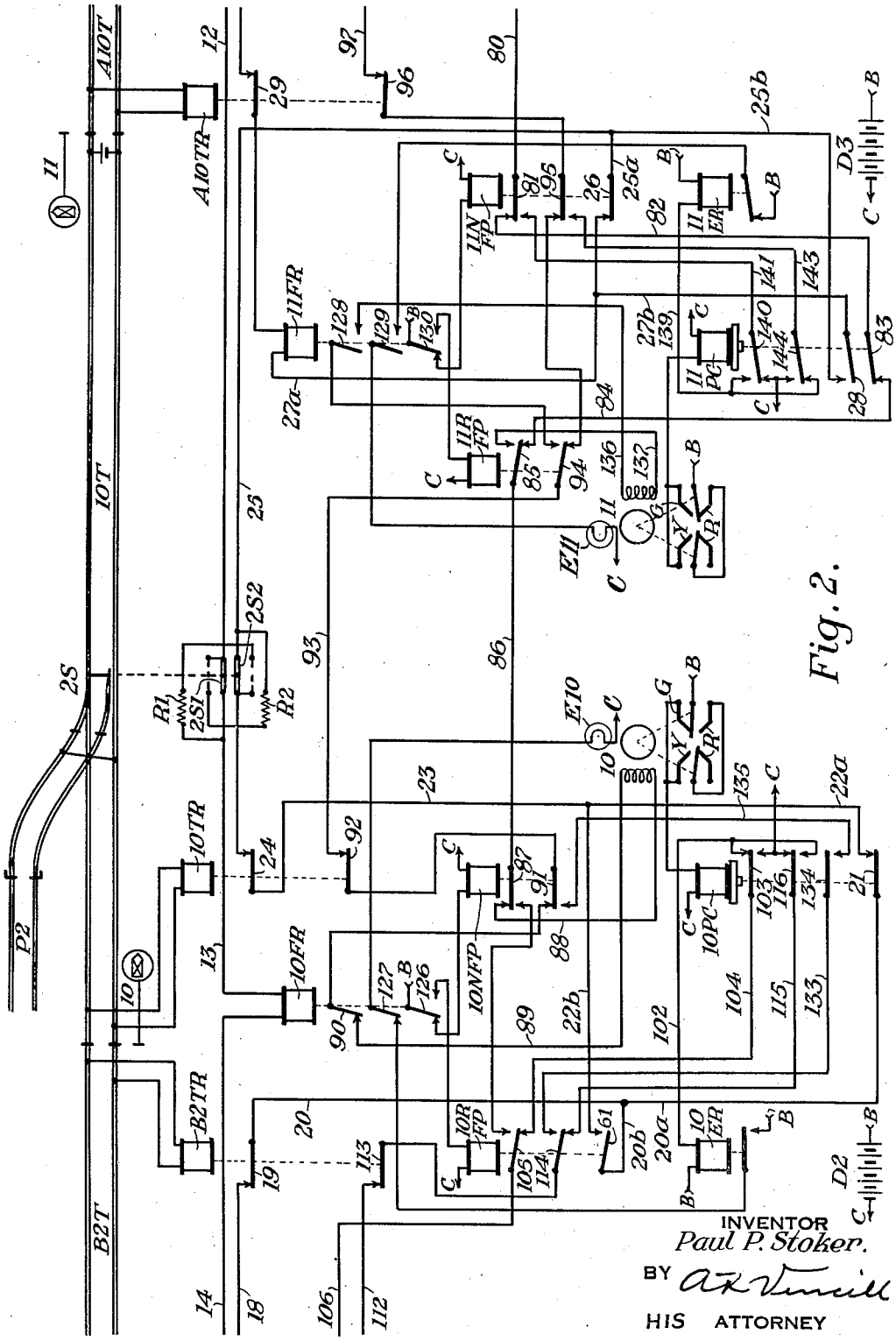


Fig. 2.

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TRAFFIC CONTROLLING APPARATUS

Filed May 2, 1935 4 Sheets-Sheet 3

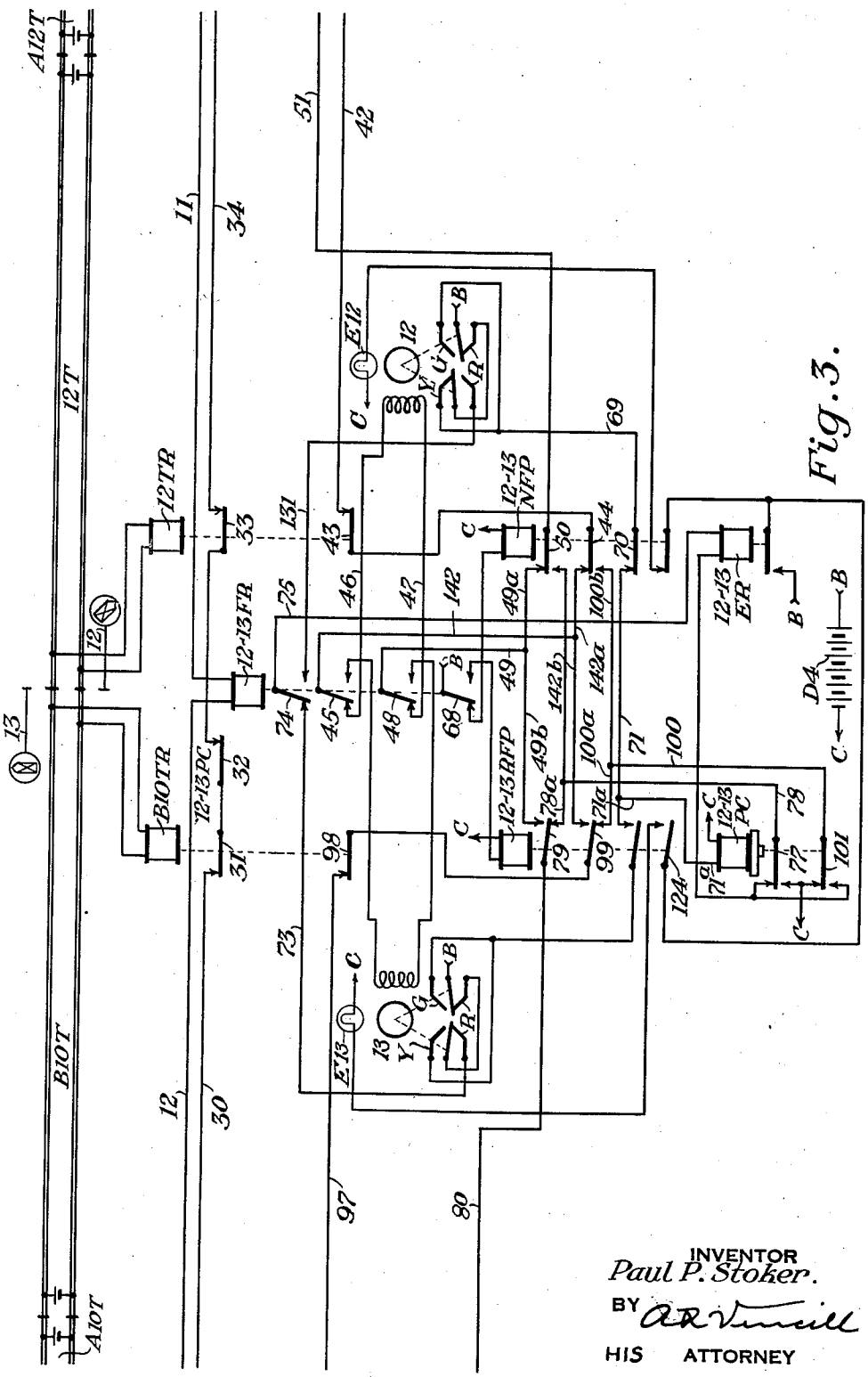


Fig. 3.

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TRAFFIC CONTROLLING APPARATUS

Filed May 2, 1935 4 Sheets-Sheet 4

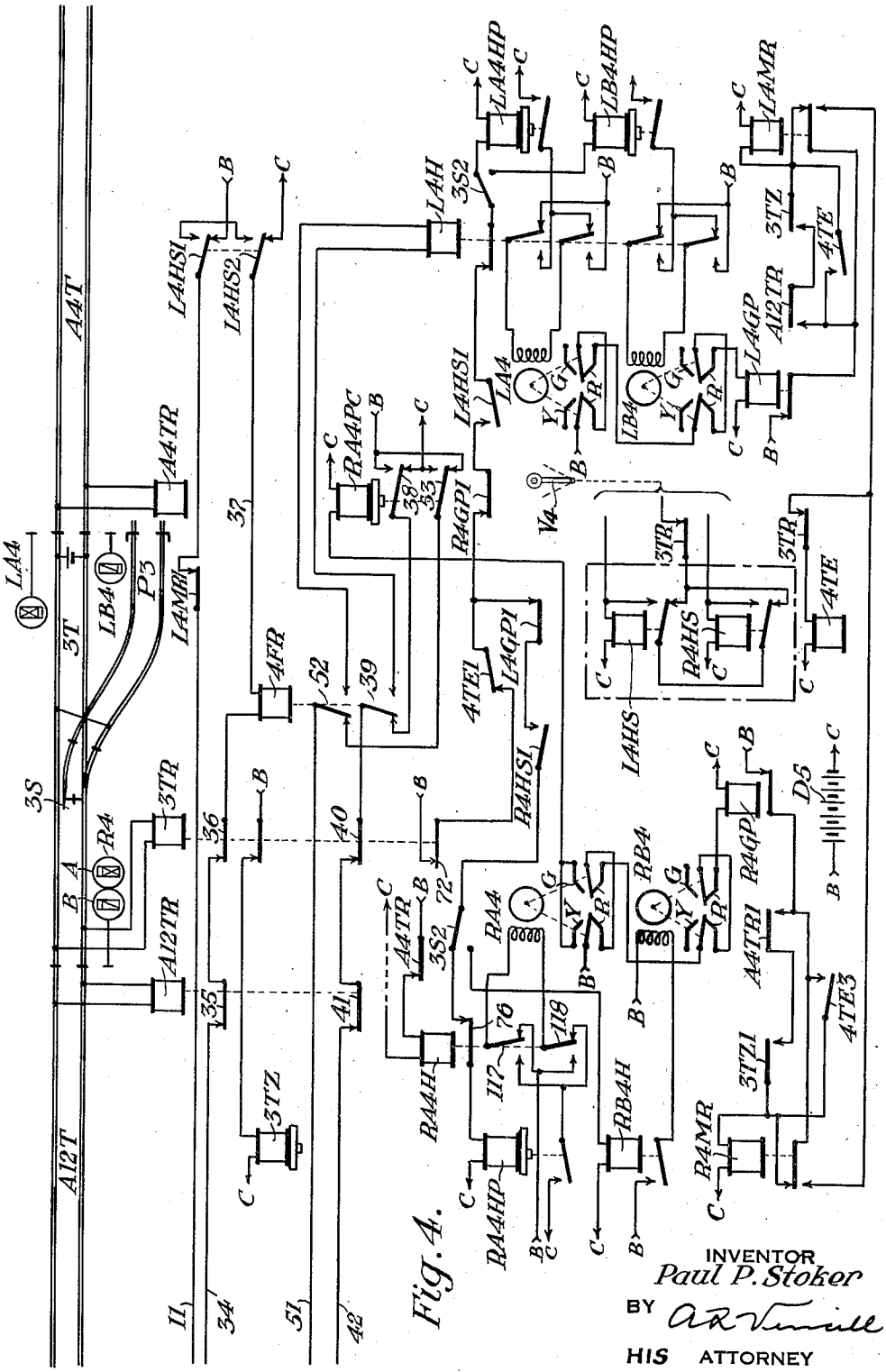


Fig. 4.

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Patented Apr. 18, 1939

2,154,539

UNITED STATES PATENT OFFICE

2,154,539

TRAFFIC CONTROLLING APPARATUS

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Application May 2, 1935, Serial No. 19,462

16 Claims. (Cl. 246—3)

My invention relates to railway traffic controlling apparatus, and more especially to that class of apparatus wherein an operator located at a central dispatching office, or operators located at the respective ends of a controlled stretch of track, direct traffic through the stretch.

An object of the invention is to provide a traffic locking circuit that controls the intermediate signals of the stretch and consists of but two conductors extending between the ends of the stretch and two additional conductors extending between adjacent signal locations of the stretch. Another object is to so arrange the circuits and apparatus that traffic may be set up in either or both directions from an intermediate point in the stretch.

I will describe one form of apparatus embodying my invention and will then point out the novel features thereof in claims.

The accompanying drawings, Figs. 1 to 4, inclusive, when placed end-to-end from left to right in the order named, show a diagrammatic view of one form of the apparatus embodying my invention as applied to a stretch of single track from a passing siding P1 shown at the left-hand end of the stretch, to a passing siding P3 shown at the right-hand end of the stretch. By means of the customary insulated rail joints the traffic rails of the stretch are divided up into track sections B4T, 1T, A2T, B2T, 10T, A10T, B10T, 12T, A12T, 3T, and A4T with only the left-hand end of the section A4T shown. The sections 1T and 3T include switches 1S and 3S, respectively, of the associated sidings P1 and P3, while one of the intermediate sections 10T includes a switch 2S for the associated siding P2. It is to be understood, however, that the invention is not confined to this particular arrangement of track sections and this arrangement is only one of many convenient ways of dividing a stretch of single track.

Wayside signals are shown located at intervals along the way to govern the traffic. These signals may be of the well-known semaphore type or of any of the well-known light signal types, but for the purpose of this disclosure search light type signals have been employed.

The signals R2, 10, 12 and R4 govern traffic moving from left to right, and signals L4, 13, 11 and L2 govern traffic moving from right to left.

The lamp circuits of the semi-automatic signals located at the respective ends of the stretch are not shown, as the lamps of these signals are assumed to be constantly lighted from a suitable current source. The lamps E10, E11, E12, and E13 of the automatic signals 10 to 13, respectively, located at intermediate points of the stretch are approach lighted under control of approach lighting relays 10ER, 11ER and 12—13ER.

Relays B4TR, 1TR, A2TR, B2TR, 10TR, A10TR, B10TR, 12TR, A12TR, 3TR, and A4TR are track relays controlled by their respective track circuits in the usual manner.

Relays L2FR, 10FR, 11FR, 12—13FR and 4FR are polarized traffic relays that govern the direction of traffic by their respective signals. Relays 10NFP, 10RFP, 11NFP, 11RFP, 12—13NFP and 12—13RFP are neutral repeater relays of the above-identified polarized traffic relays and are merely employed to obtain the required number of contacts without the necessity of overloading the polarized relays.

Relays R2H, LA2H, RA4H and L4H are polarized home control relays used to control their respective signals. The relays RA2HP, RB2HP, LA2HP, RA4HP, LA4HP and LB4HP are slow-releasing repeating relays of the above polarized home control relays and are used to bridge the pole-changing period of such relays. The pole-changing relays LA2PC, 10PC, 11PC, 12—13PC and RA4PC are slow-acting repeaters of their respective signals. Relays LB2H and RB4H are neutral home control relays of their respective signals. The relays R2GP, L2GP, R4GP and L4GP are repeaters of their respective signals in the stop position.

The relays L2MR, R2MR, L4MR and R4MR are locking relays with automatic track circuit release and are also released, in emergency, by the associated time element relays 2TE and 4TE.

The relays L2HS and R2HS are operator controlled relays governing traffic over switch 1S and the adjacent territory, while relays L4HS and R4HS are operator controlled relays governing traffic over switch 3S and the adjacent territory. The operator may, for example, control these relays by means of levers V2 and V3.

In the accompanying drawings the contacts of each relay, whenever possible, are shown directly under that relay, but in each instance where this is impractical, the contact is labeled with its relay designation and with a numerical suffix. Separate sources of current are employed at the respective signal locations and for convenience these have been diagrammatically illustrated as comprising batteries D1 and D5

having their positive terminal identified by the letter B and their negative terminal identified by the letter C.

It is believed the invention can best be described by explaining the operations which are performed when the signals are to be cleared for a traffic movement. To clear the signals for a movement from left to right, the operator controlled relay L4HS must be in its released position, all intervening track sections unoccupied with their respective track relays picked up, and the operator controlled relay R2HS energized. A circuit is then completed from a B terminal of the battery D5 through back contact L4HS1; through the front contact L4MR1 of locking relay L4MR, to check that the L4 signal has not been cleared and then returned to stop without giving an approaching train sufficient time to stop before entering the control stretch; the conductor 11, the winding of traffic relay 12—13FR, conductor 12, through contacts bridged by arm 2S1 of the circuit controller of switch 2S, conductor 13, the winding of traffic relay 10FR, conductor 14, the locking relay front contact R2MR1, through the front contacts R2HS1 and R2HS2 in series, conductor 15, the winding of traffic relay L2FR, front contacts 16 and 17 of track relays 1TR and A2TR, conductor 18, front contact 19 of track relay B2TR, conductors 20 and 20*a*, front contact 21 of relay 10PC and conductor 22*a* to conductor 23, or, if traffic has been set up for the opposite direction, from conductors 20 and 20*b*, front contact 61 of relay 10RFP and conductor 22*b* to conductor 23, front contact 24 of track relay 10TR, contacts bridged by the switch circuit controller arm 2S2, conductor 25, conductor 25*a*, front contact 26 of relay 11NFP to conductor 27*a*, or, if traffic has been set up for the opposite direction, over conductors 25 and 25*b*, front contact 28 of relay 11PC, conductors 27*b* and 27*a*, through the winding of traffic relay 11FR, front contact 29 of track relay A10TR, conductor 30, front contact 31 of track relay B10TR, front contact 32 of relay 12—13PC, front contact 33 of relay 12TR, conductor 34, front contacts 35 and 36 of track relays A12TR and 3TR, respectively, the winding of traffic relay 4FR, conductor 37, and through the back contact L4HS2 to a C terminal of the battery D5.

With current flow through all of the traffic controlling relays in the direction traced, they are energized in the normal direction to the left, as illustrated in the accompanying drawings. With the traffic relays in this position, and the operator controlled relay R2HS energized, a circuit will be completed for clearing one of the R2 signals, as will subsequently be described.

Since the signal RA4 at the right end of the stretch is at stop, its distant signal 12 is held in its caution position. The circuit over which the signal 12 is held extends from a B terminal of battery D5 through back contract 53 of relay RA4PC, normal polar contact 52 of relay 4FR, conductor 51, front contact 50 of relay 12—13NFP, conductors 49*a* and 49, through the normal polar contact 48 of relay 12—13FR, conductor 47, the winding of the signal 12, conductor 46, normal polar contact 45 of relay 12—13FR, conductors 142 and 142*a*, front contact 44 of relay 12—13NFP, front contact 43 of track relay 12TR, conductor 42, front contacts 41 and 40 of track relays A12TR and 3TR, respectively, the normal polar contact 39 of relay 4FR and through the back contact 38 of relay RA4PC to a C terminal of the battery D5.

On the other hand, if signal RA4 is in the clear or caution position, relay RA4PC is energized over a circuit extending from a B terminal of the battery D5 through R and G, or Y, contacts of the signal RA4 and through the winding of relay RA4PC to a C terminal of the battery D5. With the relay RA4PC energized, it will be apparent that the circuit traced through the winding of signal 12 will be in the reverse direction and such signal will accordingly operate to its clear position. With the circuits as illustrated it will be apparent that the relay 12—13NFP is energized over a circuit including the normal polar contact 68 of traffic relay 12—13FR.

With signal 12 in either its clear or caution position, relay 12—13PC is energized over a circuit extending from a B terminal of battery D4 through G, or R and Y, contacts of signal 12, conductor 69, front contact 70 of relay 12—13NFP, conductor 71, conductor 71*a*, and through the winding of relay 12—13PC to a C terminal of the battery D4.

With traffic set up as described above, signal 10 is held in its clear position over a circuit extending from a B terminal of the battery D4 through the R contacts of signal 13 closed in the stop position, and therefore checking that the signal 13 is at stop, conductor 73, the normal polar contact 74 of relay 12—13FR, conductor 75, the winding of approach lighting relay 12—13ER, front contact 77 of relay 12—13PC, conductors 78 and 78*a*, back contact 79 of relay 12—13RFP, conductor 80, front contact 81 of relay 11NFP, conductor 82, back contact 83 of relay 11PC, conductor 84, back contact 85 of relay 11RFP, conductor 86, front contact 87 of relay 10NFP, conductor 88, the winding of signal 10, conductor 89, normal polar contact 90 of relay 10FR, front contact 91 of relay 10NFP, front contact 92 of track relay 10TR, conductor 93, back contact 94 of relay 11RFP, front contact 95 of relay 11NFP, front contact 96 of track relay A10TR, conductor 97, front contact 98 of track relay B10TR, back contact 99 of relay 12—13RFP, conductors 100*a*, 100, and through the front contact 101 of relay 12—13PC to a C terminal of the battery D4.

If signal 12 is at stop due to a train being in section 12T or A12T and with traffic set up as outlined above, the circuit traced through relay 12—13PC will be interrupted at both the G and Y contacts of signal 12 and relay 12—13PC will accordingly assume its released position. With relay 12—13PC in the released position, current flow through the circuit traced to signal 10 will be in the reverse direction to that traced and signal 10 will accordingly move from its clear to its caution position.

With signal 10 in either the clear or caution position, the associated relay 10PC is held energized and completes a circuit for operating the home signal control relay R2H to its normal position. This circuit extends from a B terminal of battery D2 through the winding of approach lighting relay 10ER, conductor 102, through front contact 103 of relay 10PC, conductor 104, back contact 105 of relay 10RFP, conductor 106, normal polar contact 107 of relay L2FR, through the winding of relay R2H, conductor 108, normal polar contact 109 of relay L2FR, front contacts 110 and 111 of track relays 1TR and A2TR, conductor 112, front contact 113 of track relay B2TR, back contact 114 of relay 10RFP, conductor 115, and through the front contact 116 of relay 10PC to a C terminal of the battery D2. If signal 10 is in the stop position, the circuit of relay 10PC will

be interrupted at the Y and G contacts of signal 10 and the relay 10PC will accordingly be in the release position and accordingly the current flow over the circuit traced to the relay R2H is in the direction for energizing it to its reverse position, opposite to the position in which it is shown.

With relays R2H and R2HS energized, and with switch 1S in its normal position, an energizing circuit is completed for the repeating relay RA2HP. This circuit extends from a B terminal of the battery D1 through front contact 54 of track relay 1TR, the back contact 2TE1 of the time element relay 2TE; front contact L2GP1, checking that the opposing signals are at stop; front contact R2HS3 of the energized operator controlled relay R2HS, front neutral contact 56 of relay R2H, circuit controller 1S1 in its normal position, and through the winding of relay RA2HP to a C terminal of the battery D1. If the switch 1S is in the reverse position, its circuit controller arm 1S1 will be in its reverse position and accordingly relay RB2HP will be energized in lieu of RA2HP.

With relays R2H and RA2HP energized, a circuit is closed for energizing signal RA2 effective to move it to a proceed position. This circuit extends from a B terminal of battery D1 through the normal polar contact 57 of relay R2H, the winding of signal RA2, the normal polar contact 58 of relay R2H and through the front contact 59 of RA2HP to a C terminal of the battery D1. If relay R2H is energized in the normal direction as illustrated, the current supply to the winding of the signal RA2 is in such direction that it will operate the signal to its clear position; but if relay R2H is in its reverse position, the current flow through signal RA2 will be in the opposite direction and the signal will be operated to its caution position. If relays R2H and RB2HP are energized, the signal RB2, instead of signal RA2, will be the one which is operated to a proceed position. Since the signal RB2 is controlled by relays R2H and RB2HP in the same manner as signal RA2 by the relay R2H and the relay RA2HP, the manner of operating RB2 to its clear or caution position will be apparent.

The energizing circuit of stop position signal repeating relay R2GP extends from a B terminal of the battery D1 through the R contacts of signal RA2 in series, conductor 60, through the R contacts of signal RB2 in series, and through the winding of relay R2GP to a C terminal of the battery D1. It will be apparent, therefore, that when either signal RA2 or RB2 is removed to a proceed position, the circuit of relay R2GP will be interrupted. When the relay R2GP releases, its front contact 62 opens the stick circuit of locking relay R2MR which, in turn, releases, and at its contact R2MR1 opens the traffic locking circuit, thereby preventing the position of the traffic relays being changed when signal RA2 or RB2 is in a proceed position. The pick-up circuit for relay R2MR, if the signal is operated to its stop position by a train entering the section over which it governs, extends from a B terminal of the battery D1, through front contact 62 of relay R2GP, conductors 63 and 63*a*, back contact A2TR1 of track relay A2TR, through back contact 2TZ1 of the track repeating relay 1TZ, conductor 64, and through the winding of relay R2MR to a C terminal of the battery D1. If the signal is returned to stop by the operator, the pick-up circuit extends over conductors 63 and 63*b* through the front contact 2TE2 of the time element relay, conductors 64*a* and 64. The time element relay 2TE operates only when the signal has been returned to stop by the operator. The circuit of the relay 2TE extends from a B terminal of the battery D1, through front contact 62, conductors 63 and 63*c*, back contact 65 of relay R2MR, conductors 66*a* and 67, front contact 1TR1 and through the winding of relay 2TE to a C terminal of the battery D1. The stick circuit for relay R2MR comprises the first portion of the operating circuit of relay 2TE, but includes the front contact 65 of relay R2MR instead of the back contact.

Referring to Fig. 4, the leaving end of the stretch, the operator clears signal R4 by picking up operator controlled relay R4HS. The polarized home control relay RA4H is energized through circuits controlled by sections extending to the right of the stretch. These circuits have no bearing on the invention and therefore have not been shown. Relay RA4HP, controlled in part by contact 76 of relay RA4H, checks the track circuit through the section 3T at contact 72 of track relay 3TR, and checks the normal position of switch 3S through the circuit controller contact 3S2 of the switch 3S, and, through being controlled by relay RA4H, checks the track circuit of section A4T and others so as to prevent opposing moves. Relay RA4HP is a slow releasing repeater of relay RA4H, while the relay RB4H is the home control relay for signal RB4. The controlling circuits for these relays extend from a B terminal of the battery D5, through contact 72 of track relay 3TR, back contact 4TE1 of time element relay 4TE, through the front contacts L4GP1 and R4HS1; through the circuit controller arm 3S2 in its upper position, when the switch 3S is in its normal position; the front neutral contact 76 of relay RA4H, and through the winding of relay RA4HP to a C terminal of the battery D5. If the switch 3S is in its reverse position, a circuit will be completed through relay RB4H in lieu of relay RA4HP.

With relays RA4H and RA4HP energized, a circuit is completed for moving the signal RA4 to a proceed position. For example, if the polar home control relay RA4H is energized in the normal direction, its polar contacts will be in the position shown and the circuit completed through the winding of signal RA4 will be in such direction that it will be operated to its clear position. If the relay RA4H at the time has its polar contacts in their reverse positions, the current flow through the winding of the signal will be in the reverse direction and it will accordingly move to its caution position. With the relay RB4H energized, the signal RB4 is operated to its caution position over the obvious circuit completed through the front contact of relay RB4H.

With signal RA4 in either the clear or caution position, the relay RA4PC is energized. The circuit for this relay extends from a B terminal of the battery D5 through the R and G or Y contacts of signal RA4 and through the winding of relay RA4PC, to a C terminal of the battery D5. The relay R4GP is normally energized over a circuit extending from a B terminal of the battery D5 through the R or stop position contacts of signals RA4 and RB4 in series. Therefore, if either signal RA4 or RB4 is moved to a proceed position, the relay R4GP becomes deenergized. The control and operation of locking relay R4MR by relay R4GP and by the operator is similar to that described for locking relay R2MR

and a description of these operations is therefore believed to be unnecessary.

The operations required to set up traffic from right to left over the stretch by clearing signals L4 and L2 and the control of these signals is similar to that described for signals R2 and R4. The circuits and apparatus at the respective ends of the stretch and comprising Fig. 1 and Fig. 4, respectively, are identical, and therefore in describing the establishment of traffic from right to left, circuit changes occurring at these locations in the stretch will be readily understood. In order to establish traffic from right to left, the opposite direction to that described, the operator controlled relay R2HS must be deenergized, all intervening track sections clear, and the operator controlled relay L4HS energized. A circuit will then be completed over the traffic circuit from the current source D1 through the back contacts R2HS1 and R2HS2 instead of from source D5 through back contacts L4HS1 and L4HS2; and since the battery D1 is connected to the traffic circuit in opposed relation to the connection of battery D5, the current flow through the traffic circuit will be in the reverse direction to that formerly traced. The traffic relays when energized will accordingly move their polar contacts to the reverse position, opposite to that shown. Since, as previously stated, the equipment of Fig. 1 and Fig. 4 is alike, the changes occurring at these locations as a result of the operation of traffic relays L2FR and 4FR to their reverse positions will be readily understood.

At the location of signal 10, the traffic relay 10FR, at its polar contact 90, opens a point in the circuit formerly traced through the winding of signal 10, which accordingly moves to its stop position, and at its polar contact 127 opens a point in the circuit to the lamp E10 of this signal. The relay 10FR also, at its polar contacts 126, opens the circuit of relay 10NFP and closes the circuit of relay 10RFP.

At the location of signal 11, traffic relay 11FR, at its polar contact 128, closes a point in the energizing circuit of signal 11 and at contact 129 closes a point in the circuit of the lamp E11 of this signal. The relay 11FR also, at its contacts 130, opens the circuit of relay 11NFP and completes a circuit through the relay 11RFP.

At the location of signals 12 and 13, the traffic relay 12—13FR, at its polar contacts 45 and 48, opens points in the circuit formerly traced through the winding of signal 12, which then moves to its stop position, and then closes points in the circuit including the winding of signal 13. The relay 12—13FR also, at polar contact 74, transfers the connection of the winding of approach lighting relay 12—13ER from conductor 73, heretofore connected to a B terminal of the battery D4 through R contacts of signal 13 to conductor 131, now connected to a B terminal of battery D4, via the R contacts of signal 12, now in its stop position.

With the relays 10RFP, 11RFP and 12—13RFP energized, and relays 10NFP, 11NFP and 12—13NFP deenergized, and the signal LA2 in its stop position, circuits are completed for moving signals 11 and 13 to caution and proceed positions, respectively. The circuit for signal 11 extends from a B terminal of battery D1 through back contact 138 of relay LA2PC, reverse polar contact 107 of relay L2FR, conductor 106, front contact 105 of relay 10RFP, back contact 87 of relay 10RFP, back contact 87 of relay 10NFP, conductor 86, front contact 85 of relay 11RFP, conductor 137, through the winding of signal 11, conductor 136, reverse polar contact 128 of relay 11FR, front contact 94 of relay 11RFP, conductor 93, front contact 92 of track relay 10TR, back contact 91 of relay 10NFP, conductor 135, back contact 134 of relay 10PC, conductor 133, front contact 114 of relay 10RFP, front contact 113 of track relay B2TR, conductor 112, front contact 111 of track relay A2TR, and 110 of track relay 1TR, reverse polar contact 109 of relay L2FR, and through the back contact 132 of relay LA2PC to a C terminal of the battery D1. With current flow through the winding of signal 11 in the direction traced, the signal 11 is moved to its caution position. With the signal 11 in its caution position, an operating circuit is completed for the pole-changing relay 11PC. This circuit extends from a B terminal of the battery D3, through R and Y contacts of the signal 11 and through the winding of relay 11PC to a C terminal of the battery D3.

With relay 11PC picked up, the circuit completed through the winding of the signal 13 extends from a B terminal of battery D3, through the winding of approach lighting relay 11ER, conductor 139, front contact 140 of relay 11PC, conductor 141, through the back contact 81 of relay 11NFP, conductor 80, front contact 79 of relay 12—13RFP, conductors 49b and 49, reverse polar contact 48, through the winding of signal 13, the reverse polar contact 45, conductors 142 and 142b, through front contact 99 of relay 12—13RFP, front contact 98 of track relay B10TR, conductor 97, front contact 96 of track relay A10TR, back contact 95 of relay 11NFP, conductor 143, and through the front contact 144 of relay 11PC to a C terminal of the battery D3. It will be readily understood that to clear signal L2 the operator must pick up operator controlled relay L2HS and that the operations which follow will correspond to those which followed the picking up of relay R4HS to clear signal R4.

It will be observed that the controlling circuit of signals RA2 and RB2 includes front contact L2GP1 of the stop position repeating relay L2GP, thereby checking that the LA2 and LB2 signals are both at stop when one of the R2 signals is being cleared. In a similar manner, the contacts R2GP1 of relay R2GP check that signals RA2 and RB2 are in their stop position when one of the L2 signals is cleared. It will be apparent that the same protection is provided for opposing signals located at the opposite end of the stretch.

It will also be observed that at the double intermediate signal location, before signal 12 or 13 can be moved to a proceed indicating position, traffic relay 12—13FR will interrupt the operating circuit of the opposing signal at such location; also at the one single intermediate signal location the traffic relay 11FR must be in its normal position and have opened the circuit to the winding and lamp of signal 11 and, in addition, traffic relay 10FR must be in its normal position before a circuit can be completed for moving signal 10 to a proceed position. Similarly, both traffic relays 10FR and 11FR must be in their reverse position before a circuit can be completed through the winding of signal 11.

In the preceding description the operations required to clear the signals for movement of traffic through the stretch in either direction were described without regard to any influence the circuit controllers of switch 2S at an intermediate point in the stretch might have. The circuit controller of switch 2S is employed to control the traffic

circuit in such manner that when the switch 2S is moved to the reverse position, traffic will automatically be set up in opposite directions from this switch location.

If, for example, traffic has been set up for a train movement into the stretch from the right end thereof, and the train entering the stretch is to pick up or leave cars on the siding P2, the operator will release the operator controlled relay L4HS after the train has entered the stretch. This does not alter the traffic set up because the polar relays in the traffic circuit retain their armatures in their last operated position and the dropping of relay L4HS is merely effective to reconnect battery D5 in bridge of the right-hand end of the traffic circuit in opposition to that already connected to the left-hand end of the circuit. Since no current flows over the circuit under this condition, the polar armatures of the traffic relays remain in their last operated position.

When the train arrives at switch 2S and this switch is moved to its reverse position, the circuit controller arms 2S1 and 2S2 first separate the left and right-hand portions of the traffic circuit from each other and then bridge the respective halves of the circuit with resistors R1 and R2, so that the left-half of the traffic circuit is now included in a circuit now open at contacts 24 of track relay 10TR, including battery D1, while the right half is included in a closed circuit including the battery D5. It will be observed that if the train enters the siding P2 and clear of track section 10T, the circuit through the left-hand end of the traffic circuit will also be completed, and that in such case the direction of current flow will be the same as when relay L4HS is picked up to set up traffic from right to left through the stretch. Therefore, the polar contacts of traffic relays L2FR and 10FR will remain in their original position as required for traffic movements from right to left. In the case of the right-hand portion of the traffic circuit, however, the current flow will be in the opposite direction to that originally set up, and accordingly the traffic relays 11FR, 12—13FR and 4FR will move their polar armatures to the opposite position and will accordingly prepare their associated signal circuits for traffic movements from left to right. After the necessary switching operations have been performed and the train recedes from the switch back onto the main line, the switch 2S is restored to its normal position and its circuit controller arms 2S1 and 2S2 reconnect the two halves of the circuit together. Since the batteries at opposite ends of the traffic circuit are in opposing relation, there will be no resultant current flow over the circuit and, therefore, the polarized traffic relays will not change the position of their polar contacts at this time. The operator may now clear signal L2 to direct the train movement on through the stretch or, if he desires, be may clear signal R4 to enable the train to recede out of the stretch under full signal protection.

In a similar manner, if the signals are cleared for movement of a train into the stretch from the left end, the switch 2S may be reversed after the train has passed it, and if the operator has previously released relay R2HS, current will flow through the right-hand section of the traffic circuit as soon as the switch 2S has been reversed in the same direction as when signal R2 is cleared, and accordingly the signals remain set for the direction of traffic from left to right from the switch location. When the train clears section 10T, either by entering the siding or by moving on into section A10T, the track relay 10TR will complete the circuit through the left-hand portion of the traffic circuit; and since current supplied to it is from battery D1 instead of D5, the direction of current flow is reverse to that originally set up. The traffic relays L2FR and 10FR accordingly move their polar armatures to the opposite position, as required in the preparation for traffic movements from right to left. The operator may therefore now direct the movement of the train out of the stretch in either direction.

Under either of the foregoing examples, it will be readily apparent that when the train leaves the stretch the polarized relays included in the left portion of the traffic circuit will have their armatures in the opposite position to the armatures of the traffic relays included in the right-hand portion of the traffic circuit. As soon, however, as the operator picks up relay R2HS or L4HS to establish traffic in a given direction, all of the polarized relays in the traffic circuit will be energized by current flow in the same direction to again establish traffic through the stretch in the direction depending on which of the operator controlled relays has been picked up.

It will be appreciated from the foregoing that the apparatus and circuits herein employed are so arranged that the unoccupied condition of all sections of the stretch and the stop position of all opposing signals are checked before traffic can be set up through the stretch; also, that once the direction of traffic has been established, since polarized relays which retain their armatures in their last operated position are employed, is free from the danger of a loss of traffic direction. Furthermore, that a novel arrangement has been provided enabling the train to reverse its direction of travel at an intermediate point in the stretch and that full signal protection is provided for such movement.

Although I have herein shown and described only one form of apparatus embodying my invention, it is to be 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, a stretch of railway track over which traffic normally moves in either direction, a normally deenergized directional circuit for the stretch including a directional relay at each end of the stretch and the outgoing and return conductors of which are normally disconnected from each other, a source of current at each end of the stretch normally connected to said circuit, a home signal control relay at each end of the stretch, operator controlled means to selectively disconnect one or the other of said sources of current from said circuit and for connecting the conductors of said circuit together to render the other source at the opposite end active to energize said circuit, and contacts on the directional relay at the end of the circuit from which the source of current has been disconnected to prepare an operating circuit for said home signal relay at its end.

2. A railway signal system for a stretch of railway, a first set of signals located at intervals to govern traffic in one direction through the stretch, a second set of signals located at inter-

vals to govern traffic in the opposite direction through the stretch, a track circuit for each signal responsive to traffic conditions in advance of the signal, manually controlled means to establish the direction of traffic to cooperate with the track circuits to selectively clear one or the other of said sets of signals; a railway track switch associated with the stretch of railway located at an intermediate point in the stretch having a normal position for directing traffic movements along said stretch and having a reverse position for directing traffic movements to or from said stretch; and means controlled by said track switch in its reverse position for clearing signals of one of said sets for governing traffic movements in the corresponding direction away from said switch while signals of the other set are clear for governing traffic movements in the opposite direction away from said switch.

3. A railway signal system for a stretch of railway, a first set of signals located at intervals to govern traffic in one direction through the stretch, a second set of signals located at intervals to govern traffic in the opposite direction through the stretch, a control circuit for each signal responsive to traffic conditions in advance of the signal, a manually controlled directional means cooperative with the control circuits to selectively clear one or the other of said sets of signals, and means at an intermediate point in the stretch operable to cooperate with said manually controlled directional means for clearing signals of one of said sets to the rear of a train occupying such intermediate point to enable such train to recede out of the stretch under full signal protection.

4. A railway signal system for a stretch of railway, a first set of signals located at intervals to govern traffic in one direction through the stretch, a second set of signals located at intervals to govern traffic in the opposite direction through the stretch, a control circuit for each signal responsive to traffic conditions in advance of the signal, manually controlled directional means adapted to cooperate with the control circuits to selectively clear one or the other of said sets of signals, and means at an intermediate point in the stretch operable to cooperate with said manually controlled directional means while there is a train occupying said stretch at such point to clear signals in the rear of the train for directing traffic movement in the direction opposite that under which the train entered the stretch.

5. A railway signal system for a stretch of railway, a first set of signals located at intervals to govern traffic in one direction through the stretch, a second set of signals located at intervals to govern traffic in the opposite direction through the stretch, a control circuit for each signal responsive to traffiic conditions in advance of the signal, manually controlled directional means adapted to cooperate with the control circuits to selectively clear one or the other set of signals; and a device cooperating with said manually controlled directional means for clearing signals of one set in the rear of a train at an intermediate point in said stretch while said manually controlled directional means is in condition for clearing signals of the other set in advance of the train.

6. In combination, a stretch of railway over which traffic normally moves in either direction, a directional circuit for the stretch extending between the ends thereof and including a source of current at each end of the stretch normally connected in said circuit in opposed relation to the corresponding current source at the opposite end, a bridge at each end of the stretch, operator controlled means to selectively disconnect one or the other of said current sources from said circuit and for temporarily substituting the associated bridge therefor to render the source of current located at the end opposite that of the selected bridge active to energize said circuit, polarized relays included in said circuit and operated to set up traffic through said stretch in a direction depending on the source of current from which said relays have been energized, and means for separating the circuit at an intermediate point in the stretch and for then bridging the separated portions at such point to prepare the respective portions for energization from the connected current sources to operate the polarized relays in the respective portions of the original circuit to set up traffic in opposite directions from such intermediate point.

7. In combination with a stretch of railway, a normally closed directional traffic circuit extending between the ends of the stretch and including in series polarized signal control relays at respective signal locations along the stretch, a source of current at one end of the stretch included in said circuit, a second source of current at the other end of the stretch also included in said circuit but connected in opposing relation to said first current source so that no current normally flows through said circuit, means for removing one or the other of said current sources from said circuit and for directly connecting the conductors together at such point to enable the circuit and the relays therein to be energized by current flow in a direction depending on the source of current remaining connected in said circuit to enable said relays to selectively determine the direction in which traffic is to be set up through the stretch, and means for enabling different portions of said circuit to be energized from the connected current sources so that the relays of one portion will become energized by current flow in the opposite direction to that last flowing through such relays to enable the establishment of traffic in the portion of the stretch served by such portion of the traffic circuit in the opposite direction to that last established through the entire stretch.

8. In combination, a stretch of railway over which traffic normally moves in either direction, a directional circuit for the stretch, a source of current at each end of the stretch normally connected to said directional circuit in opposing relation to each other so that normally there is no current flow over the circuit, a directional relay at each end of the stretch, an operator controlled means at each end of the stretch each adapted when energized to disconnect the source of current at its end of the stretch from the directional circuit and to substitute therefor a direct current bridge to enable the energization of the associated and distant relay in one direction by current supplied at the opposite end of the stretch in the direction required to enable the establishment of traffic in a given direction through the stretch depending on the current source employed in the energization of said relays, and means for separating the respective ends of the circuit and for closing together such separated ends to effect energization of each directional relay from the associated current source to operate them in opposite directions to estab-

lish opposite directions of traffic through the stretch from the point of separation of the circuit.

9. In combination, a stretch of railway over which traffic normally moves in both directions, a first set of signals located at intervals to govern the passage of trains through the stretch in one direction, a second set of signals located at intervals to govern the passage of trains through the stretch in the opposite direction; operator controlled means, including a series of polarized directional relays selectively energized in one direction or the other for selectively clearing either the first or the second set of signals to direct the movement of a train through the stretch, means controlled by a train as it passes signals of the set cleared to cause their return to stop, and means at an intermediate point in the stretch which can be operated to enable a selected portion of said relays to be energized in the proper direction to enable an operator to clear opposing signals passed by a train entering the stretch to direct the movement of a train receding out of the stretch.

10. In combination, a stretch of railway over which traffic normally moves in both directions, a first set of signals located at intervals to govern the passage of trains through the stretch in one direction, a second set of signals located at intervals to govern the passage of trains through the stretch in the opposite direction; operator controlled means, including a series of polarized directional relays selectively energized in one direction or the other for selectively clearing either the first or the second set of signals to direct the movement of a train through the stretch, means controlled by a train as it passes signals of the set cleared to cause their return to stop, and means at an intermediate point in the stretch which can be operated to enable a selected portion of said relays to be energized in the proper direction to enable an operator to clear opposing signals passed by a train entering the stretch to direct the movement of a train receding out of the stretch irrespective of the end of the stretch via which it entered.

11. In a signaling system wherein a group of polarized relays of the type which retain their polar contacts in their last operated position are energized by current passed through all of them in one direction or the other to set up traffic in one direction or the other, the provision of means enabling a circuit to be completed through a portion of such relays with the current flow in the reverse direction to that last passing through all of the relays to reverse the position of their contacts with respect to the position of the contacts of the polarized relays not included in such portion and accordingly the direction of traffic only over that portion of the stretch over which they exercise control.

12. In combination, a circuit including two polarized traffic governing relays respectively associated with the opposite ends of a stretch of railway track over which traffic is to move in either direction, a current source at each end of the circuit normally connected thereto for supplying current to said circuit, a remotely controlled relay associated with each end of the circuit, means governed by each relay when energized to exclude the associated current source from said circuit to enable the traffic governing relays therein to be energized from the source at the opposite end of the circuit, signals governed by the traffic governing relays to permit traffic to move through the stretch in a direction determined by the end at which said circuit is supplied with current, and means at an intermediate point of the stretch operable to enable the reconnection of the disconnected source to the circuit to be effective to energize the traffic relay at its end to permit traffic to move from such intermediate point out of the stretch in either direction.

13. In combination, a stretch of railway track, a plurality of signals spaced along said stretch for governing traffic movements in a given direction over said stretch, other signals spaced along said stretch for governing traffic movements in the opposite direction over said stretch, a traffic direction circuit, a contact at each signal location included in said traffic direction circuit and controlled by a signal at the same signal location and arranged to be closed only when that signal is directing a train to proceed, means for energizing said traffic direction circuit by current of either polarity, means controlled by said traffic direction circuit when energized by current of a given polarity for clearing said plurality of signals, and means controlled by said traffic direction circuit when energized by current of the opposite polarity for clearing said other signals.

14. In combination, a stretch of railway track, a signal located at a given point for governing traffic movements in a given direction on said stretch, a second signal located at a second point for governing traffic movements in the opposite direction on said stretch, a traffic direction circuit, means for energizing said traffic direction circuit by current of either polarity, means controlled by said traffic direction circuit when energized by current of a given polarity for clearing said first signal, means controlled by said traffic direction circuit when energized by current of the opposite polarity for clearing said second signal, a contact in said traffic direction circuit closed by said traffic direction circuit upon becoming energized by current of said given polarity, a second contact in said traffic direction circuit closed by said traffic direction circuit upon becoming energized by current of said opposite polarity, a third contact in multiple with said second contact closed by said first signal while directing a train to proceed, and a fourth contact in multiple with said first contact closed by said second signal while directing a train to proceed.

15. In combination, a stretch of railway track, a signal located at a given point for governing traffic movements in a given direction on said stretch, a second signal located at a second point for governing traffic movements in the opposite direction on said stretch, a traffic direction circuit including a first and a second polarized control relay for said first and second signals respectively, means for energizing said traffic direction circuit by current of either polarity, a neutral relay energized by a circuit including a normal contact closed by said first polarized relay when energized by current of a given polarity, a second neutral relay energized by a circuit including a reverse contact closed by said second polarized relay when energized by current of the opposite polarity, means controlled by a normal contact of said first polarized relay and by a front contact of said first neutral relay and also by a back contact of said second neutral relay for clearing said first signal, and means controlled by a reverse contact of said second polarized relay and by a front contact of said second neutral relay and also by a back contact of said first neutral relay for clearing said second signal.

16. In combination, a stretch of railway track, a signal located at a given point having a lamp cooperating with a mechanism operable to a stop position and also to a second position for directing traffic movements in a given direction on said stretch, a second signal located at a second point having a lamp cooperating with a mechanism operable to a stop position and also to a second position for directing traffic movements in the opposite direction on said stretch, a traffic direction circuit, means for energizing said traffic direction circuit by current of either polarity, means controlled by said traffic direction circuit when energized by current of a given polarity for operating the mechanism of said first signal to its second position and also for lighting the lamp of said first signal when a train approaches said signal, and means controlled by said traffic direction circuit when energized by current of the opposite polarity for operating the mechanism of said second signal to its second position and also for lighting the lamp of said second signal when a train approaches said second signal.

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