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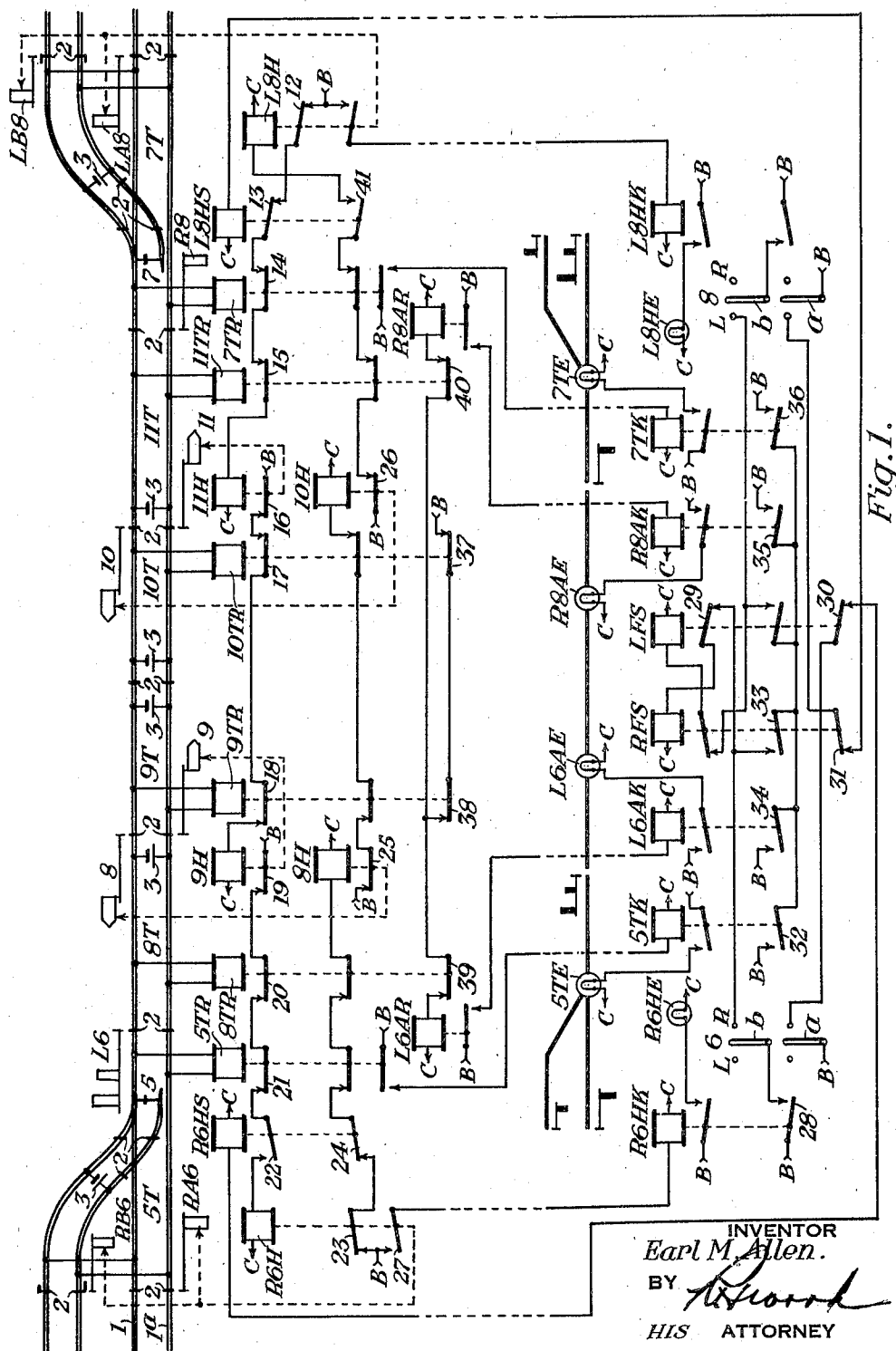
E. M. ALLEN

2,102,988

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Aug. 15, 1936

2 Sheets-Sheet 1



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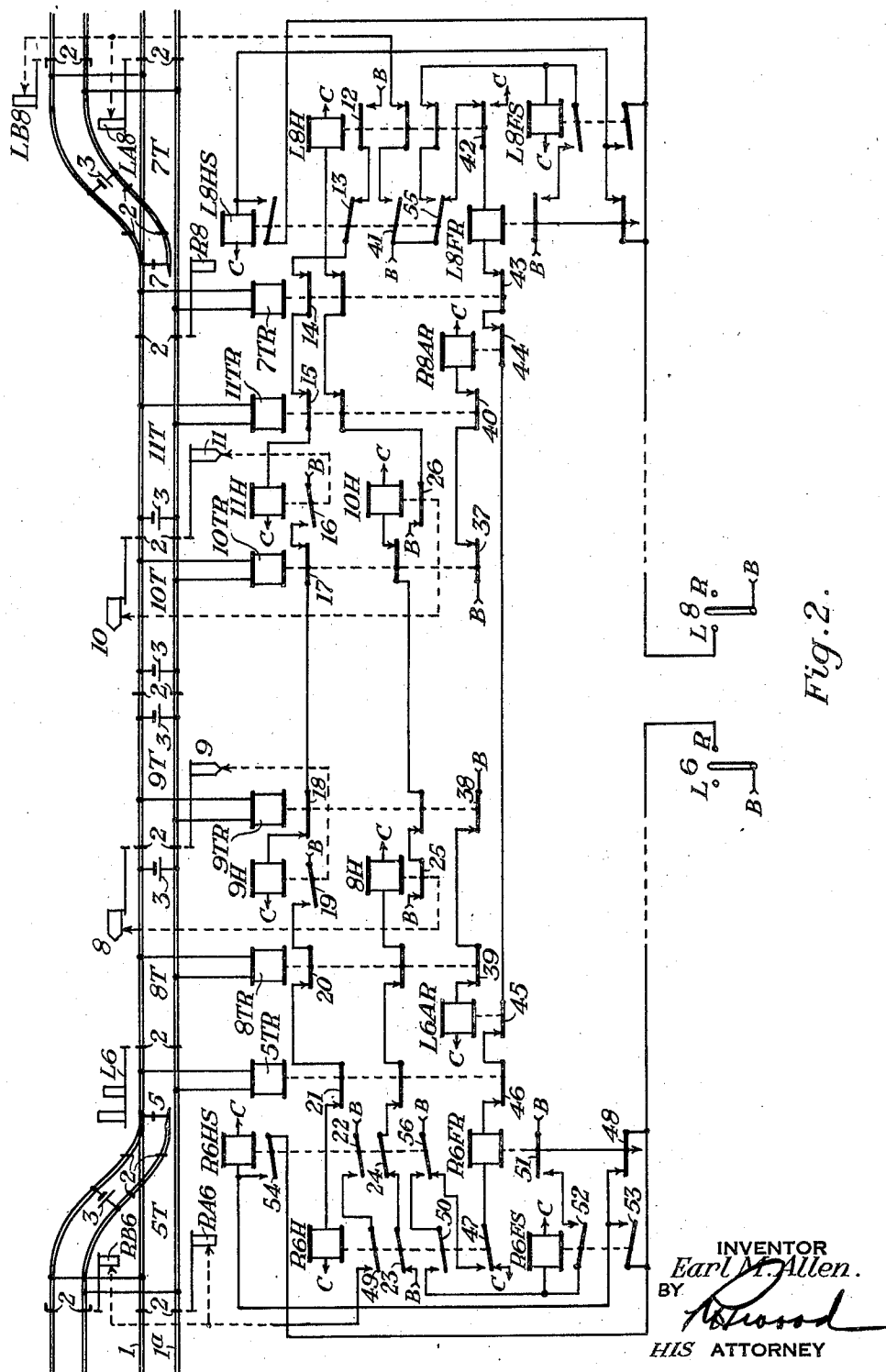
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UNITED STATES PATENT OFFICE

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RAILWAY TRAFFIC CONTROLLING
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Application August 15, 1936, Serial No. 96,227

15 Claims. (Cl. 246—3)

My invention relates to railway traffic controlling apparatus, and more particularly, to apparatus for use in connection with centralized traffic controlling systems for railroads. In systems of this character, it is customary to govern the railway signals and switches at widely spaced points by means of relays which are controlled from a centrally located control point, usually the dispatcher's office, and to transmit to the point of control indications of the conditions of occupancy of the various sections of track in order to inform the control operator of the movement of trains to enable his control of the switches and signals to be more readily effected.

One object of my invention resides in the provision of direction selecting means for interlocking the control relays for the signals in certain cases so as to prevent interference with train movements in the event of improper manipulation of the signal control levers of the centralized traffic control system which control these relays.

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

Referring to the accompanying drawings, Fig. 1 illustrates one form of apparatus embodying my invention and comprises, in the upper portion, a track diagram of a stretch of single track railroad together with a portion of a block signalling system for governing traffic movements over the stretch, while the lower portion includes the control office apparatus comprising a track model or miniature representation of the stretch of track together with the control levers and interlocking apparatus at the office for controlling certain of the signals. Fig. 2 comprises a track diagram and a portion of a signal system similar to that of Fig. 1 in which certain of the signals are controlled by the signal levers shown in the lower portion but which differs from Fig. 1 in that the interlocking of the signals is effected by means of a traffic wire extending the length of the stretch.

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

Referring to Fig. 1 of the drawings, the references 1 and 1^a designate the track rails of a stretch of railway track over which traffic moves in both directions between the passing tracks shown at the ends of the stretch. The track rails 1 and 1^a are divided by insulated joints 2 to form track sections each of which is identified by the reference character T with a distinguishing prefix, and each track section is provided with the usual track circuit comprising a track battery 3 and a track relay TR. Sections 5T and 7T each include a track switch identified by the references 5 and 7, respectively, and traffic movements through the switch sections 5T and 7T are governed by the signals bearing the

general references 6 and 8, respectively, with identifying prefixes, while traffic moving through the single track stretch is governed by the intermediate signals bearing the designations 8, 9, 10, and 11. Each signal is controlled by a signal relay identified on the drawings by the reference H with a prefix corresponding to the signal it controls. In accordance with the usual practice, the head block signals RA6 and RB6 are controlled by the signal relay R6H in accordance with the position of the track switch 5. For simplicity, this control is indicated by a dotted line connection from the contacts of relay R6H to signals RA6 and RB6 on the drawings, and it is to be understood that the energization of relay R6H is effective to clear signal RA6 for a train movement from left to right on the main line when switch 5 is normal, and to clear signal RB6 for a train movement from left to right out of the siding when switch 5 is reversed. The relays H are controlled in tandem in the usual manner, the control limits for relay R6H extending to the opposing head block signal LA8 or LB8. The latter signals are similarly controlled by the signal relay L8H and similarly govern train movements from right to left into the single track stretch.

It is to be understood that in practice usually the polarity of the line circuits is controlled to provide three position control of the signals, and that directional stick relays may be associated with the intermediate signals to provide for permissive following movements in accordance with the well known principles of absolute permissive block signalling, but these features have not been shown as they are not required to illustrate the present invention. Furthermore, it is to be understood that the usual approach locking is provided to prevent operation of switch 5 or 7 if a signal governing traffic movements over the switch is put to stop when a train is approaching. The relays L6AR and R8AR shown in Fig. 1 are each controlled by the track relays of a portion of the single track stretch, and it is to be understood that these relays are approach relays which are provided primarily to control the switch locking when a train is approaching signal L6 or R8.

Located at the dispatcher's office at other points of control, a track model TM as illustrated in Fig. 1 is provided which is a miniature representation of the stretch of track comprising the controlled territory and includes an indication lamp TE for each switch section and a lamp AE for each adjacent approach section. The lamps TE and AE are controlled respectively by indication relays TK and AK, these indication lamps and relays being identified by numerical prefixes corresponding to the reference for the track or approach sections which control them. A control panel containing various levers and indication

lamps is also provided, but to illustrate the present invention, only the levers 6 and 8 for controlling the correspondingly numbered signals are shown together with indication lamps HE and indication relays HK for the opposing head block signals R6 and L8.

Each signal control lever controls a pair of control relays HS for governing the line circuits for the opposing signals, of which only the relays R6HS and L8HS for governing train movements in opposite directions into the single track stretch are shown.

The communication system connecting the control office with the various signal locations in the field may be of any suitable type, but preferably is of the selective or code type, in which communication is established intermittently between the control office and various field stations over a single pair of line wires. Direct wire control may also be used, and, as illustrative of either form, dotted line connections are shown from the signal lever contacts to the HS relays and from the track and approach relays in the field to the corresponding indication relays in the office, as will be apparent from the drawings.

The interlocking features of my invention, as herein illustrated, are applied to the opposing head block signals bearing the general references R6 and L8, which govern train movements in opposite directions into the single track stretch. These signals are interlocked in Fig. 1 by means of a pair of interlocked relays RFS and LFS located at the control office and controlled by the signal levers and indication relays K in a manner hereinafter to be explained.

It is believed that the apparatus of my invention may be most readily understood from a description of its operation under various conditions, and, therefore, starting with the apparatus in the condition shown in the drawings, it will be assumed that signal RA6 is to be cleared for a train movement from left to right through the single track stretch. Assuming this stretch to be unoccupied and the head block signals at stop, the track relays TR and also the approach relays AR will be energized, the various indication relays K will be released and all of the indication lamps E will be dark. If the operator at the control office moves signal lever 6 from its normal position, as shown, to position R, a circuit will be completed from one terminal B of a suitable source of energy, right hand contact a of lever 6, back contact 30 of relay LFS, through relay R6HS to terminal C. This circuit, as already explained, is merely illustrative of the control, but whatever the communication system may be, it is to be understood that a movement of lever 6 to position R will cause relay R6HS to become energized, but only if relay LFS is released.

Normally, a line circuit is closed, as shown, from one terminal B, of a suitable source of current adjacent signals L8 over back contacts 12 and 13 of relays L8H and L8HS, front contacts 14 and 15 of the track relays 7TR and 11TR, signal relay 11H to terminal C of the same source. Relay 11H is, therefore, energized and completes a circuit from terminal B of a source adjacent signal 11 over front contacts 16, 17, and 18 of relays 11H, 10TR and 9TR, through signal relay 9H to terminal C of the same source. Relay 9H is, therefore, also energized and completes a circuit from terminal B of a source adjacent signal 9, over contacts 19, 20, 21, and 22 of relays 9H, 8TR, 5TR, and R6HS through relay R6H to

terminal C of the same source, thereby energizing relay R6H to clear signal RA6 or RB6, depending upon the position of switch 5.

It is to be understood that in addition to the line wires shown in the drawings, that a common return wire to which the various terminals C are connected, is provided extending from one end of the stretch to the other.

The circuits for both directions being similar, it will be evident from the drawings without tracing the circuits in detail that when relay R6HS is picked up, its back contact 24, which corresponds to back contact 13 of relay L8HS in the circuit for the opposite direction, will open to deenergize relay 8H, causing signal 8 to indicate stop and contact 25 to open, thereby releasing relay 10H to cause signal 10 to indicate stop and opening contact 26 in the circuit for relay L8H. It follows that when relay R6HS is energized, the signals governing the movement of traffic from left to right will clear subject to traffic conditions while the opposing signals will be held at stop.

When relay R6H becomes energized to clear signal RA6 or RB6, its front contact 27 becomes closed to energize relay R6HK to thereby light the "signal clear" indication lamp R6HE and to complete a circuit from terminal B, contact 28 of relay R6HK, right-hand contact b of lever 6, back contact 29 of relay LFS, relay RFS to terminal C. Relay L8HS is controlled by lever 8 over a circuit which is similar to that for relay R6HS, as is apparent from the drawings, and it will be evident, therefore, that the clearing of a signal for a traffic movement from left to right causes relay RFS to become energized to open its back contact 31 to prevent the response of relay L8HS to a movement of lever 8 to the left. It follows that when relay RFS is energized the operator is prevented from opening back contact 13 of relay L8HS and is thus prevented from interfering with the intermediate signals 11 and 9 at clear and is also prevented from interfering with signal RA6 or RB6 at clear, except in a proper manner, namely, by restoring lever 6 to normal.

Since the circuits for the two directions are similar, it follows that relay LFS becomes energized when signal LA8 or LB8 is cleared and its back contact 30 prevents interference with these signals or with the intermediate signals 8 and 10 by inadvertent manipulation of lever 6, and the signals for the two directions are thus fully interlocked by means of the two directional relays RFS and LFS.

Returning now to the condition first described, and assuming that a train accepts signal RA6 or RB6 and enters section 5T, relay 5TR releases and causes relay 5TK to become energized, lighting lamp 5TE in the track model TM and completing a stick circuit for relay RFS which may be traced from terminal B over front contacts 32 and 33 of relays 5TK and RFS, back contact 29 of relay LFS, through relay RFS to terminal C, so that relay RFS is held energized to maintain the established direction of traffic after the train enters the single track stretch and the head block signal at the entering end is restored to stop. Relays L6AK, R8AK and 7TK control the corresponding indication lamps of the track model to indicate the movement of the train through the stretch as is obvious from the drawings and these relays control contacts 34, 35 and 36, respectively, which maintain the stick circuit

for relay RFS in the same manner as contact 32 of relay 5TK. Relay L6AR has an energizing circuit which may be traced from terminal B, front contacts 37, 38, and 39 of track relays 10TR, 9TR, and 8TR through relay L6AR to terminal C, while the circuit for relay R8AR is similar but includes front contacts 37, 38, and 40 of track relays 10TR, 9TR, and 11TR. It will be apparent that one or more of the approach or track indication relays will be energized to maintain the stick circuit for relay RFS energized as long as the train occupies any portion of the single track stretch, and that if the opposite direction has been set up, these relays serve to maintain relay LFS energized under corresponding conditions.

The control limits for the approach relays AR overlap in Fig. 1, and in this respect the circuits are a departure from the usual practice as illustrated for example by the circuits for these relays shown in Fig. 2. This is because the apparatus of Fig. 1 is arranged for use with a communication system in which the indications are transmitted by code over an intermittently available line circuit. Usually, the indications governing the relays L6AK and R8AK will be transmitted by different coding units, and the overlap in the control circuits insures that when a train is moving from one approach section to the other, the code announcing that it has vacated one approach section will not be transmitted in advance of the code announcing the occupancy of the other approach section, in case it happens that the line circuit is temporarily not available for the transmission of the last mentioned code.

It will be apparent from the foregoing description that the apparatus of Fig. 1 is so arranged that the operator at the control office may set up one direction of traffic or the other for movements through the single track stretch, but only when the stretch is unoccupied. The established direction of traffic is then registered by an operation of the directional relays and these relays become locked when a train moving in the established direction enters the stretch so as to prevent interference with the signals which govern that train by inadvertent manipulation of the lever controlling the signals for the opposite direction. In the apparatus of Fig. 2, the interlocking of the opposing signals at the two ends of the stretch is also accomplished by interlocked directional relays controlled through the medium of the communication system by which the signals are controlled, but the arrangement is somewhat different in that in this form of the invention one directional relay is located at each end of the stretch and the two directional relays are interlocked by means of a traffic wire extending from one end of the stretch to the other.

In Fig. 2, those portions of the signaling system which are shown to illustrate the invention are similar to the corresponding portions of Fig. 1 as hereinbefore described, with the exception that front contacts 22 and 41 of the signal control relays are included in local circuits for the signals in Fig. 2, whereas in Fig. 1, these contacts are in the line circuits for the signal relays. Therefore, in Fig. 2 one or the other of the head block signal relays R6H or L8H is normally energized, depending upon the traffic direction last established, but both these relays cannot be energized at the same time. Also in Fig. 2, contact 37 is not included in the circuit for relay L6AR

and contact 38 is not included for relay R8AR, these circuits being arranged in the conventional manner in Fig. 2.

The interlocking directional control apparatus in Fig. 2 comprises a slow release traffic relay FR and a directional stick relay FS at each end of the stretch. The traffic relays FR are connected in series in a circuit which may be traced from terminal B of the source adjacent signals L8, through back contact 55 of relay L8HS, front contact 42 of relay L8H, relay L8FR, contacts 43, 44, 45, and 46 of relays 7TR, R8AR, L6AR and 5TR, relay R6FR, and back contact 47 of relay R6H to terminal C of the same source. The relays FR may also be energized when relay R6H is energized and relay L8H is released, and the circuit in this case may be traced from terminal B of the source adjacent signals R6, through back contact 56 of relay R6HS, front contact 47 of relay R6H, relay R6FR, contacts 46, 45, 44, 43, relay L8FR, and back contact 42 of relay L8H to terminal C of the same source. It follows, therefore, that relays FR are energized when the stretch is unoccupied and one or the other of the signal relays R6H or L8H is energized and the corresponding control relay HS is deenergized.

Assuming that the apparatus of Fig. 2 is in the condition shown in the drawings, and that the operator desires to effect a train movement from left to right, the closing of contact R of signal lever 6 at the office will effect, through the medium of the communication system, the closing of a pickup circuit for relay R6HS which includes front contact 48 of relay R6FR, and relay R6HS when energized will complete a stick circuit including its own front contact 54 and will open its back contact 24 to effect the successive release of relays 8H, 10H and L8H. Relay L8H upon releasing will deenergize relays L8FR and R6FR, and by closing its back contact 12 will complete a circuit to successively energize relays 11H, 9H, and R6H. Relay R6H upon becoming energized will complete a circuit over front contacts 22 and 49 of relays R6HS and R6H to clear signal RA6 or RB6, depending upon the position of switch 5, and will also complete a circuit from terminal B, over front contacts 56 and 50 of relays R6HS and R6H through relay R6FS to terminal C. The energization of the directional relay R6FS thus depends upon the same conditions as are required for the energization of relay RFS in Fig. 1, namely, the entire stretch must be unoccupied and the head block signal must be cleared. Relay R6FS when energized closes its stick circuit, which may be traced from terminal B, through back contact 51 of relay R6FR, front contact 52 and winding of relay R6FS to terminal C. Relay R6FS is consequently held energized as long as relay R6FR is released. Since relay R6H becomes energized when the stretch is vacated, (or before, if the usual absolute permissive control is provided) relay R6FS will remain energized not only as long as the stretch is occupied but after it is vacated provided the control relay R6HS is energized, as will be apparent from the drawings. If relay R6HS is released by restoring lever 6 to normal while relay R6FS is energized, and lever 6 is again moved to position R, relay R6HS will be picked up over the circuit including front contact 53 even though contact 48 is open. It is apparent, therefore, that the control circuits for relay R6HS are such that the head block signal RA6 or RB6 may be cleared under any condition that per-

mits the line relay R6H to become energized. Furthermore, since the conditions governing relay L3FR are the same as those governing relay R6FR, it will be apparent that when relay R6HS is energized or the stretch is occupied, the opposing control relay L3HS is rendered non-responsive to the operation of signal lever 8 because the front contacts of both relays L3FR and L3FS are open.

It will be readily apparent, therefore, that in the form of the apparatus illustrated in Fig. 2, as well as that illustrated in Fig. 1, the operator may set up one direction or the other but only when the stretch is unoccupied; that the established direction is registered as a result of clearing a signal, and that when a train enters the stretch the signals which govern it cannot be interfered with by an inadvertent operation of the signal lever controlling the signals for the opposite direction.

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. In a centralized traffic control system for railroads, a stretch of railway track, a signal at each end of the stretch for governing the movement of traffic into the stretch, a manually controllable signal control relay for each signal, direction selecting means for governing said signal control relays, means responsive to the operation of either signal control relay when the stretch is unoccupied for actuating said direction selecting means, means rendered effective when said direction selecting means is actuated by the signal control relay at one end of the stretch to prevent the operation of the signal control relay at the other end of the stretch, and means preventing a change in the operated condition of said direction selecting means when any portion of the stretch is occupied.

2. In a centralized traffic control system for railroads, a stretch of railway track, a signal at each end of the stretch for governing the movement of traffic into the stretch, a manually controllable signal control relay for each signal, direction selecting means for governing said signal control relays, means responsive to the operation of either signal control relay for clearing the corresponding signal provided the stretch is unoccupied and the opposing signal is at stop, means for so actuating said direction selecting means when either signal is cleared as to prevent the operation of the signal control relay at the other end of the stretch, and means preventing a change in the operated condition of said direction selecting means when any portion of the stretch is occupied.

3. In a centralized traffic control system for railroads, a stretch of railway track, a signal at each end of the stretch for governing the movement of traffic into the stretch, a manually controllable signal control relay for each signal, means for clearing each signal when the associated signal control relay is energized provided the stretch is unoccupied and the signal control relay for the other signal is deenergized, direction selecting means rendered effective when either signal is cleared to prevent the operation of the signal control relay for the other signal, and means locking said direction selecting means

against operation when the stretch is occupied.

4. In a centralized traffic control system for railroads, a stretch of railway track, a signal at each end of the stretch for governing the movement of traffic into the stretch, a signal control relay for each signal remotely controlled from a control office, means for clearing each signal when the associated signal control relay is energized provided the stretch is unoccupied and the signal control relay for the other signal is deenergized, direction selecting means rendered effective when either signal control relay is energized to prevent the energization of the other signal control relay, and means for preventing the operation of said direction selecting means when the stretch is occupied.

5. In a centralized traffic control system for railroads, a stretch of railway track, two opposing signals including one at each end of the stretch for governing the movement of traffic into the stretch, signal control means for each signal manually controllable from a remote office for clearing one signal or the other in accordance with traffic conditions in said stretch, indication means controlled by traffic conditions in said stretch for indicating at said office the condition of said stretch, direction selecting means manually controllable only when the stretch is unoccupied to register the traffic direction established when a signal is cleared, means controlled by said indication means effective to prevent a change in the condition of said direction selecting means when the stretch is occupied, and means controlled in accordance with the condition of said direction selecting means for preventing the operation of the control means for the signal opposing the one which is cleared.

6. In a centralized traffic control system for railroads, a stretch of railway track including a plurality of track sections, a signal at each end of the stretch for governing the movement of traffic into the stretch, a signal control relay for each signal, indication means for indicating the condition of each of said track sections, manually controllable direction selecting means, a signal lever for each signal, a circuit for each signal control relay including a contact controlled by the corresponding signal lever and a contact controlled by said direction selecting means, means for selectively operating said direction selecting means, and means for retaining said direction selecting means in its operated condition controlled by said indication means.

7. In combination with a stretch of railway track, a signal at each end of the stretch for governing the movement of traffic into the stretch, a signal control relay for each signal, manually controllable means for selecting the direction of traffic to be established in said stretch, a signal lever for each signal, a circuit for controlling each signal control relay including a contact controlled by the corresponding signal lever and a contact selectively controlled in accordance with the direction established by said means, and means operable only when the stretch is unoccupied for operating said direction selecting means to set up one direction of traffic or the other.

8. In combination with a stretch of railway track divided into track sections, a track relay for each section, a signal at each end of the stretch for governing the movement of traffic into the stretch, a manually governed signal control relay for each signal, a control circuit for each signal controlled by a front contact of one and

a back contact of the other signal control relay and by each track relay for the stretch, means for selecting the direction of traffic to be established in said stretch, a circuit for each signal control relay including in series a manually controlled contact and a contact controlled in accordance with the direction established by said means, manually controllable means for governing said direction selecting means to set up one direction of traffic or the other, and means preventing the operation of said direction selecting means except when all of said track relays are energized.

9. In a centralized traffic control system for railroads, a stretch of railway track divided into track sections each provided with a track relay, a signal at each end of the stretch for governing the movement of traffic into the stretch, a control circuit for each signal controlled by front contacts of each track relay, direction selecting means, manually controllable means for selectively actuating said direction selecting means operable only if the stretch is unoccupied, and manually controllable means for selectively energizing the control circuit for one signal or the other in accordance with the condition of said direction selecting means.

10. In combination, a stretch of railway track, two opposing signals including one at each end of the stretch for governing the movement of traffic into the stretch, a signal control relay for each signal, a control circuit for each signal controlled in accordance with traffic conditions in said stretch and including contacts closed only when the associated signal control relay is energized and the control relay for the opposing signal is deenergized, manually operable means for controlling said signals including a signal lever for controlling each signal control relay and direction selecting means for electrically interlocking said control relays, means locking said direction selecting means against operation when a train accepts a clear signal and occupies the stretch, and means controlled by said direction selecting means when locked in response to the clearing of either signal to prevent the energization of the signal control relay for the opposing signal in response to an operation of its lever.

11. In combination with a stretch of railway track, a head block signal for each direction including one at each end of the stretch for governing the movement of traffic into the stretch, an intermediate signal for each direction each located at an intermediate point in said stretch, a signal control relay for each head block signal, manually controllable direction selecting means, a signal lever for each head block signal, a control circuit for each intermediate signal controlled by a back contact of the signal control relay for the opposite direction, a control circuit for each head block signal controlled by the signal control relay and intermediate signal for the same direction, a circuit for controlling each signal control relay including a contact controlled by the corresponding signal lever and a contact selectively controlled by said direction selecting means, means requiring the stretch to be unoccupied to render said direction selecting means operable to set up one direction of traffic or the other, and means preventing a change in the condition of said direction selecting means when any portion of the stretch is occupied.

12. In combination with a stretch of railway track, a head block signal for each direction including one at each end of the stretch for gov-

erning the movement of traffic into the stretch, an intermediate signal for each direction each located at an intermediate point in the stretch, a signal control relay for each direction, a control circuit for each intermediate signal controlled in accordance with traffic conditions in the portion of said stretch in advance of said signal, each said circuit being controlled also by a back contact of the signal control relay for the opposite direction, a control circuit for each head block signal controlled in accordance with traffic conditions in said stretch and including a front contact of the signal control relay for the same direction, manually operable direction selecting means for establishing one direction of traffic or the other in said stretch, and a circuit for each signal control relay including a manually controllable contact and a contact selectively closed in accordance with the traffic direction set up by said direction selecting means, and means preventing the operation of said direction selecting means except when said stretch is unoccupied.

13. In combination with a stretch of railway track, a signal for each direction including one at each end of the stretch for governing the movement of traffic into the stretch, a manually controllable signal control relay for each signal, a directional stick relay for each direction, a circuit for each signal control relay including a manually operable contact and a contact controlled by the directional stick relay for one direction, a pickup circuit for each directional stick relay including a contact closed when the signal for the corresponding direction is cleared, and a stick circuit for each directional stick relay including contacts closed when any portion of the stretch is occupied.

14. In combination with a stretch of railway track, a signal for each direction including one at each end of the stretch for governing the movement of traffic into the stretch, a manually controllable signal control relay for each signal, a directional stick relay for each direction, a circuit for each signal control relay including a manually operable contact and a contact controlled by the directional stick relay for one direction, a pickup circuit for each directional stick relay including a contact closed when the signal for the corresponding direction is cleared, a stick circuit for each stick relay, and means comprising a line circuit extending from one end of the stretch to the other and closed only when the entire stretch is unoccupied for controlling said stick circuits.

15. In combination with a stretch of railway track, a signal at each end of the stretch for governing the movement of traffic into the stretch, a control office, a code controlled relay for each signal, a signal lever for each signal and direction selecting means at said office, code controlled indication means at said office for governing said direction selecting means, means for controlling each said code controlled relay in accordance with the condition of said direction selecting means and of the corresponding signal lever, means for clearing each signal in accordance with traffic conditions in said stretch when the corresponding code controlled relay is energized and the code controlled relay for the opposing signal is deenergized, and means for controlling said indication means in accordance with traffic conditions in said stretch.