Feb. 28, 1939. A. LANGDON 2,149,222

CENTRALIZED TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

Filed Aug. 15, 1934 5 Sheets-Sheet 1

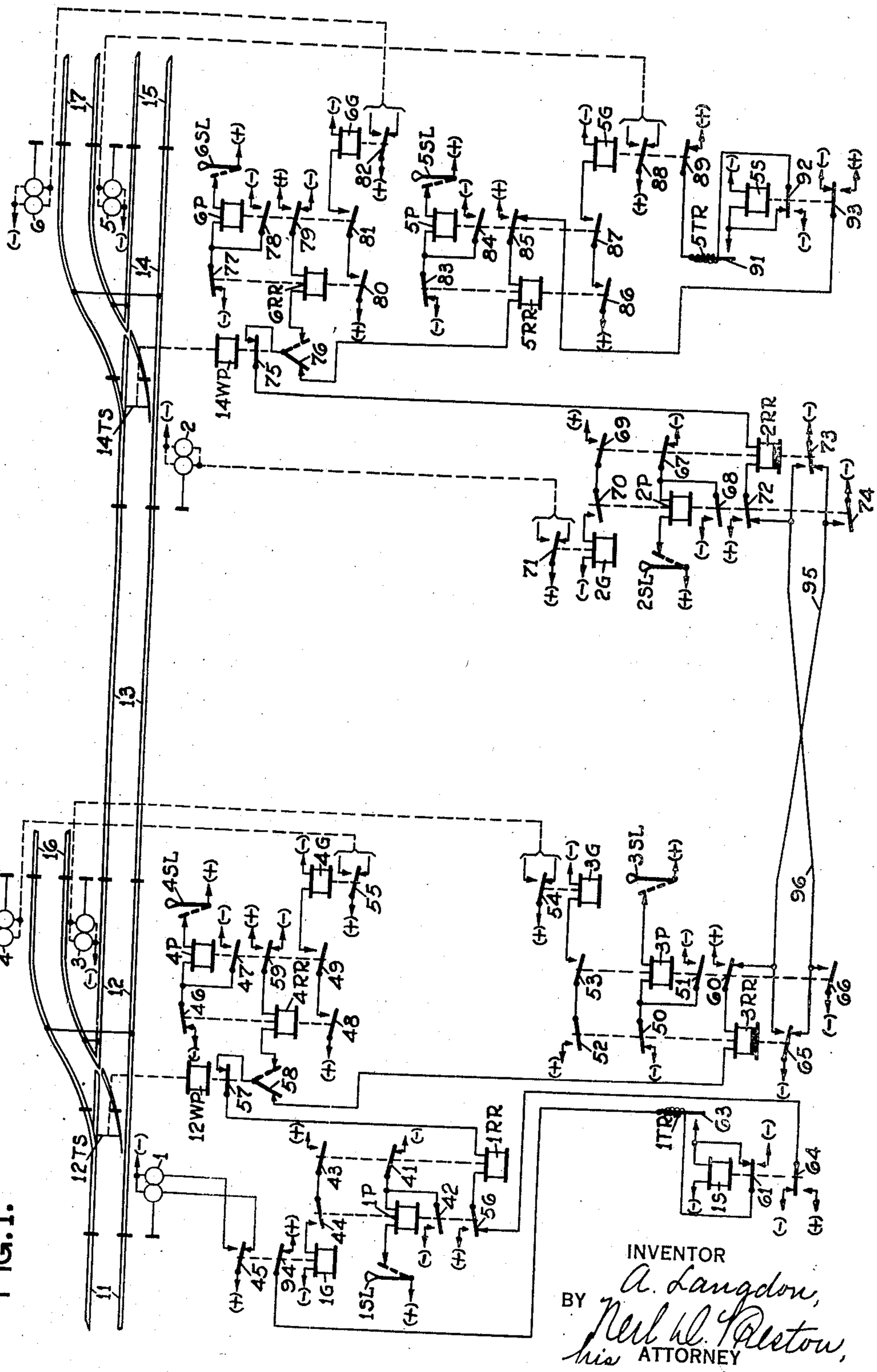

FIG. 1.

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CENTRALIZED TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

Filed Aug. 15, 1934 5 Sheets-Sheet 2

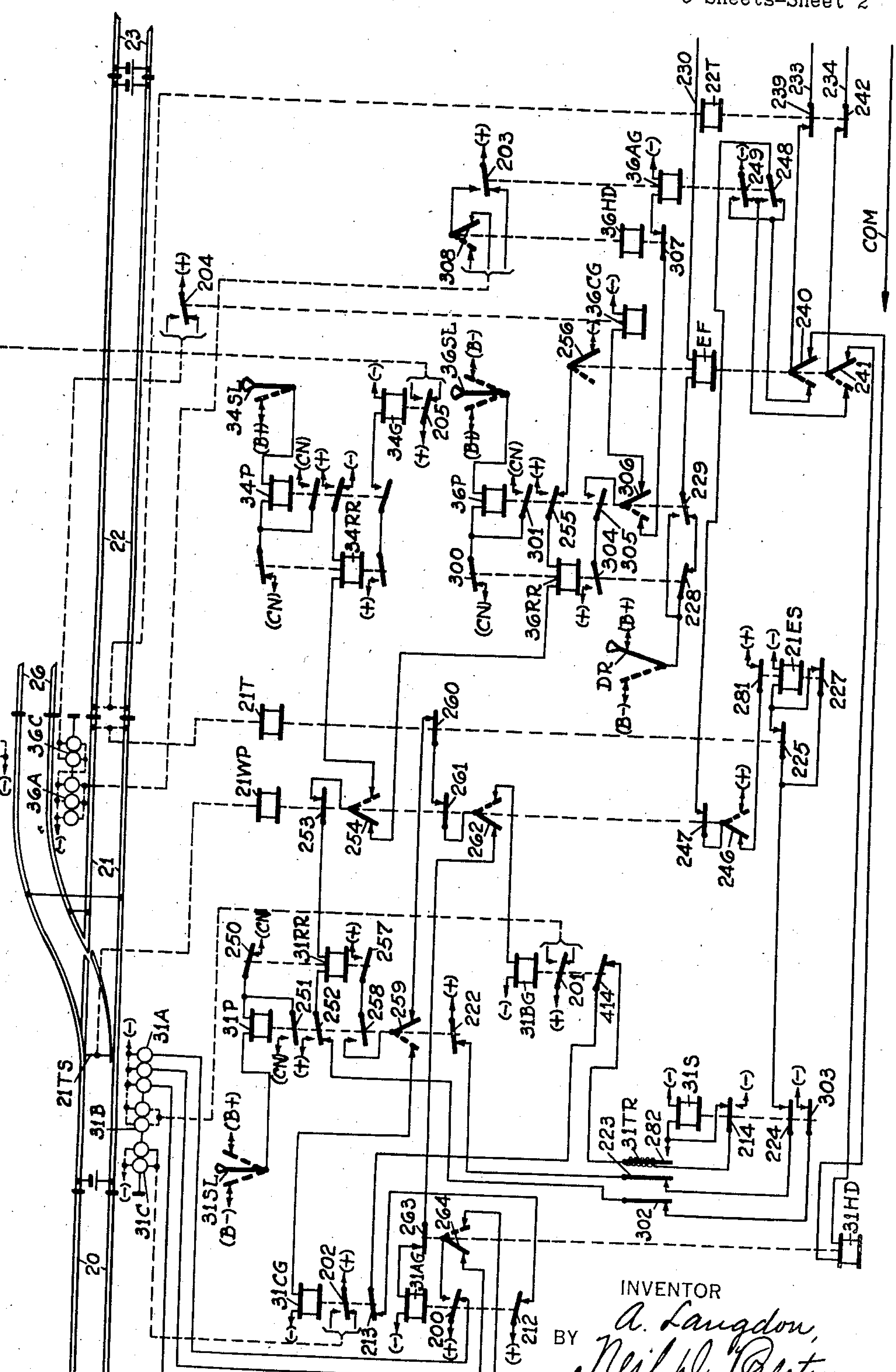

FIG. 2.A.

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CENTRALIZED TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

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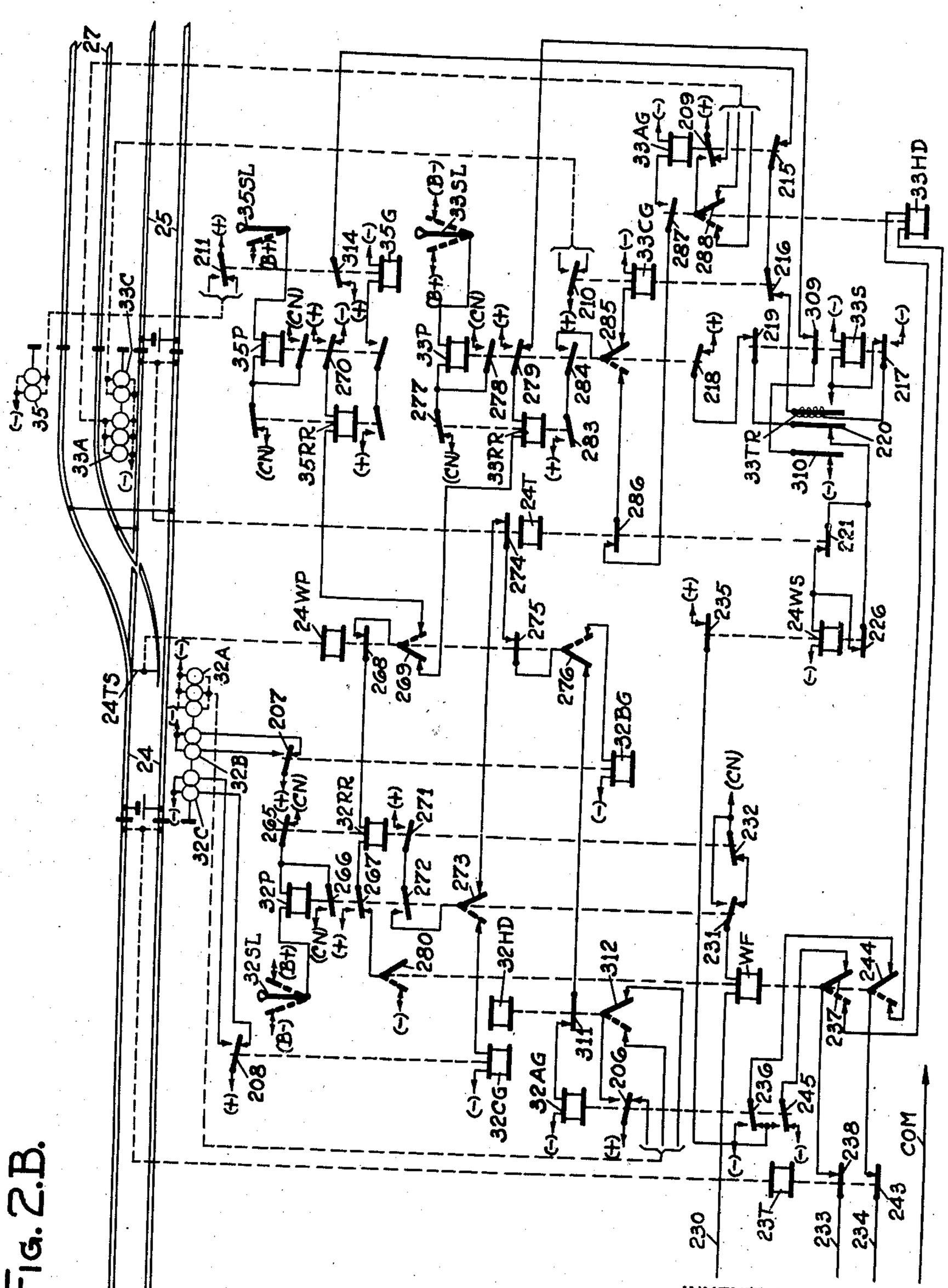

FIG. 2.B.

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CENTRALIZED TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

Filed Aug. 15, 1934 5 Sheets-Sheet 4

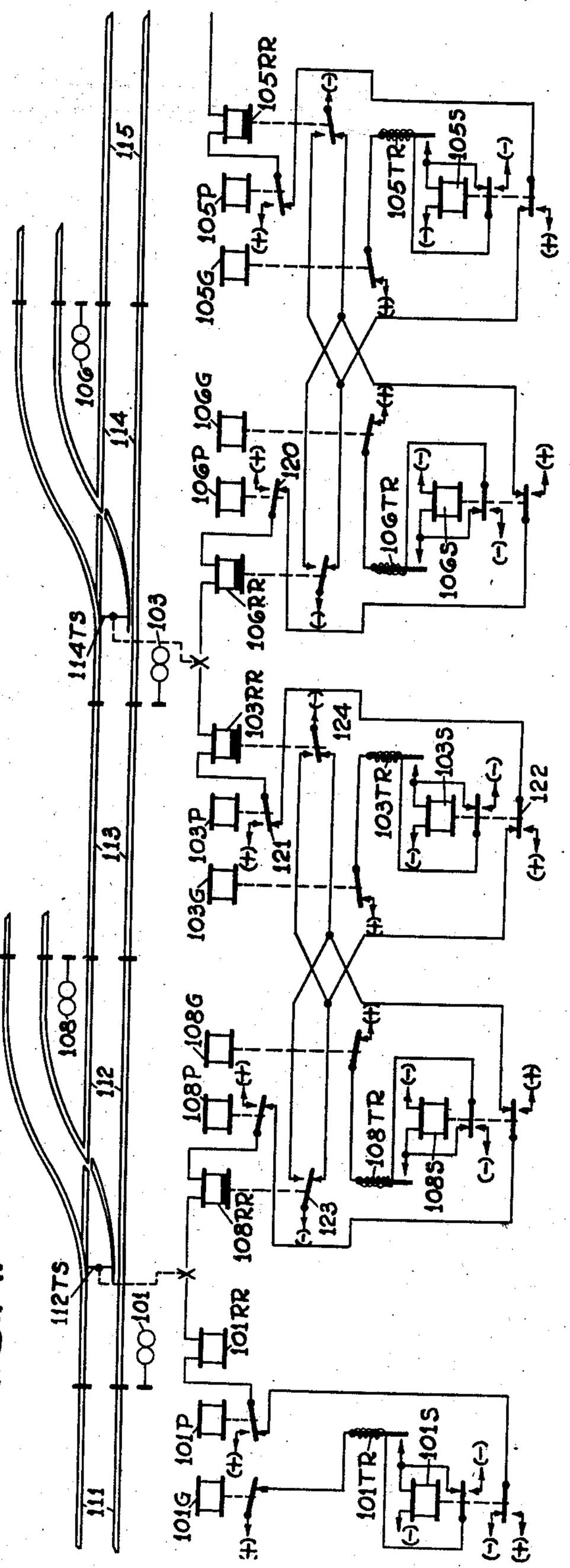

FIG. 3.A.

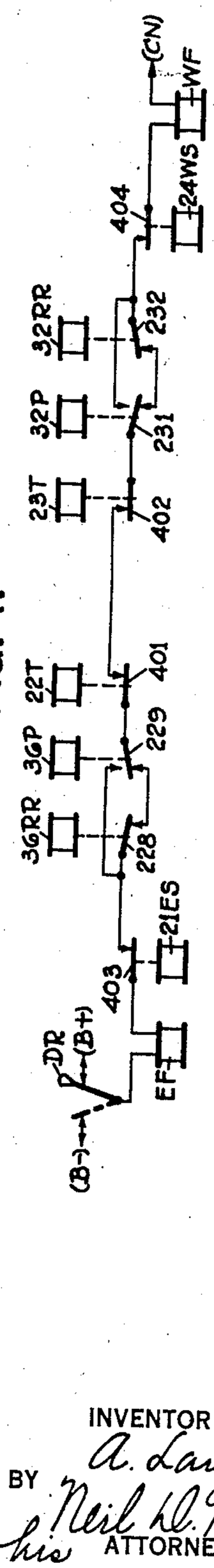

FIG. 4.

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CENTRALIZED TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

Filed Aug. 15, 1934 5 Sheets-Sheet 5

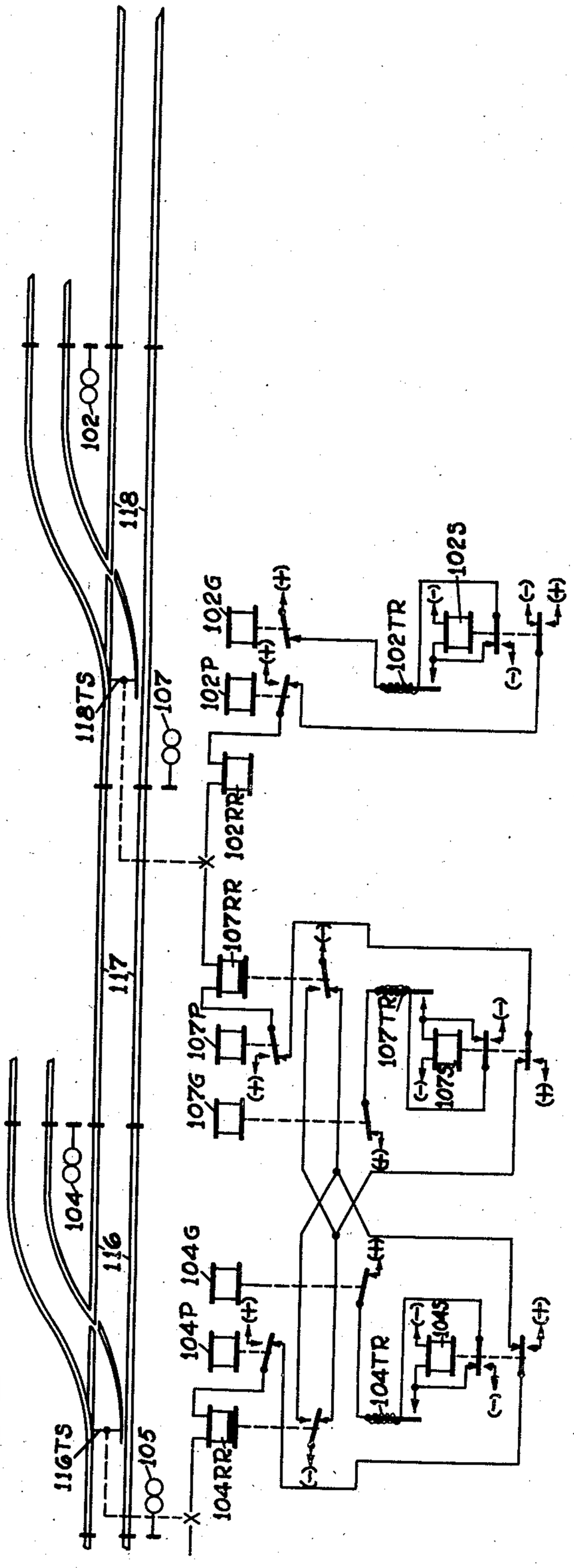

FIG. 3.B.

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Patented Feb. 28, 1939 2,149,222

UNITED STATES PATENT OFFICE

2,149,222

CENTRALIZED TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

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Application August 15, 1934, Serial No. 739,977

20 Claims. (Cl. 246—3)

This invention relates to centralized traffic controlling systems for railroads, and more particularly pertains to a system for the interrelation of signals and switches in interlocking plants.

It often happens in interlocking plants that a group of switches and signals are spaced a distance from another group of switches and signals with intervening or interconnecting track sections. The switches and signals in any one group may be interlocked and interrelated in accordance with any one of several types of interlocking. However, to provide for the passage of traffic from one interlocked group to the other, it becomes necessary to provide an interrelationship between the two interlocked groups of switches and signals.

The present invention proposes to provide means for the interrelation of two or more interlocked groups both where such groups are adjacent each other and where such groups are separated by an appreciable distance. For those groups separated by an appreciable distance, the present invention provides a traffic lever or button for each such traffic section, which traffic lever must be operated to a position corresponding to the direction of traffic set up for that traffic section. Such a traffic lever is constructed to remain in its last operated position so as to advise the operator of the potential direction of traffic for each such traffic section.

In other words, a system is contemplated wherein the operator can supervise the positioning of railroad track switches and the clearing of signals to govern traffic over various routes through an interlocking plant together with means associated with each traffic section of track connecting the route determining points, which means must be operated in order to establish movement of traffic into such a section, and which means also reflects the previous direction of travel in such section.

Such directional traffic governing levers are provided in such a manner that the accidental reversal of a lever of this character does not effect a route already established and having its governing signal cleared, that is, once a signal is cleared for a particular route, the only way that route can be changed is by the return to stop of the lever governing such signal for that route.

Another characteristic feature of the present invention resides in the arrangement of the traffic direction control for each section in such a manner that the clearing of a signal for the entrance of a train into such section prevents the reversal of traffic direction in that section, but the clearing of a signal for the leaving of a train from such traffic section does not prevent the reversal of traffic direction in the section providing the previously mentioned entering signal has been put to stop.

Further objects of the invention are to accomplish the above and other purposes in a safe and reliable manner to meet the requirements of railway signalling practice.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawings and in part pointed out as the description of the invention progresses.

In describing the invention in detail, reference will be made to the accompanying drawings, in which like reference characters designate corresponding parts throughout the several views, and in which:

Fig. 1 illustrates in a conventional manner an interlocking system arranged in accordance with the present invention for such situations as require no traffic direction lever for facility in operation because of the short section between two interlocked groups.

Figs. 2A and 2B, when placed end to end, constitute an interlocking system arranged in accordance with the present invention, as applied to two interlocked groups where there is an appreciable intervening section and where a directional control lever for such intervening section is highly desirable, as hereinafter more specifically pointed out;

Figs. 3A and 3B illustrate a modified form of Fig. 1 to illustrate the manner in which the two interlocked groups illustrated are arranged when they are associated with one or more other interlocked groups; and

Fig. 4 illustrates in a conventional manner a modified form of Figs. 2A and 2B in which the reversal of traffic in an intervening section between two interlocked groups is positively prevented so long as that section is occupied by a train.

For the purpose of simplifying the illustration and facilitating in the explanation thereof, the various parts and circuits constituting the embodiment of the invention have been shown diagammatically and certain conventional illustrations have been employed, the drawings having been made more with the purpose of making it easy to understand the principles and mode of operation, than with the idea of illustrating the specific construction and arrangement of parts that would be employed in practice.

The various relays and their contacts are illustrated in a conventional manner, and symbols are employed to indicate terminals of batteries or other suitable source of electric current instead of showing all of the wiring connections to these terminals.

The symbols (+) and (—) are used to indicate the positive and negative terminals respectively of suitable batteries or other sources of electrical energy; and those circuits with which these symbols are used are presumed to have current flowing from the positive terminal designated by (+) to the negative designated by (—). The symbols (B+) and (B—) indicate connections to the opopposite terminals of a suitable battery or other direct current source which has a central or intermediate tap designated (CN); and the circuits with which these symbols are used, may have current flowing in one direction or the other depending upon the particular terminal used in combination with the intermediate tap (CN). The symbol (CN) may at times be employed to replace the illustration of a common wire. If alternating current is employed to replace the direct current sources illustrated by these symbols, then these symbols may be used to indicate or represent the instantaneous relative polarities of the alternating current sources thus employed.

In the accompanying drawings, the invention has been shown applied to simple track layouts including a stretch of track having track switches connecting diverging routes thereto; but it should be understood that the invention is not limited, as thus shown, to the control of switches and signals of such a simple layout, but may be extended for any desired number of switches and signals and may be readily applied to all types of track layouts commonly found in interlocking plants.

Apparatus

The track layout of Fig. 1 includes a stretch of track, which for convenience in describing the present invention, is divided into five track sections, namely, track sections **11**, **12**, **13**, **14** and **15**. The track section **12** is shown as including a suitable railroad track switch **12**TS which serves to connect a turnout track section **16** to the main track; and similarly, the track section **14** includes a suitable railroad track switch **14**TS which serves to connect another turnout track section **17** to the main track.

The track switches **12**TS and **14**TS are preferably operated by suitable switch machines (not shown) to normal and reverse positions, which switch machines may be of any suitable type, such for example as disclosed in the patent to W. K. Howe Pat. No. 1,466,903 dated September 4, 1923, and which switch machines are remotely controlled by the operator located in a central tower through suitable control circuits such as shown for example in the application of S. N. Wight Ser. No. 689,109, filed Sept. 12, 1933, corresponding to British Patent No. 440,048, dated December 12, 1935. The control circuits for these track switches have not been illustrated in the drawings, because it is believed that the present invention may be best understood by a description of a simple disclosure which does not include the details of the switch control.

Although various signal arrangements might be provided for the track layout chosen for the embodiment shown in Fig. 1, the signal **1** is illustrated as governing east bound traffic over the main track up to the signal **2**, which signal **2** governs east bound traffic over the main track up to the next succeeding east bound signal (not shown). Signals **1** and **2** also govern traffic over the diverging routes formed by the track switches **12**TS and **14**TS respectively. Signal **5** is provided for governing west bound traffic over the main track to the signal **3**, which in turn governs west bound traffic up to the next succeeding west bound signal (not shown). For the purpose of governing traffic from the diverging track section **16** onto the main track, the signal **4** is associated with the track switch **12**TS; while the signal **6** is associated with the track switch **14**TS for the purpose of governing traffic onto the main track from the track section **17**. These signals are illustrated as being of the color light signal type, but may be of any other type, or any other suitable signalling means, governed in accordance with the present invention by signal levers located in the central office or tower.

In actual practice, some of the signalling relays, devices and the like, may be located in suitable sub-towers along the track way, while certain other devices including the control levers may be located in the operator's central office or tower; but for convenience in describing the present invention, it is assumed that the control levers for the signals and their various associated circuits and relays are located in the central tower, and that suitable control circuits are provided for remotely connecting the central tower with the traffic controlling devices in the field. It is of course to be understood that any suitable disposition of the apparatus may be made without affecting the system of the present invention in its operation and usefulness.

In the central office, a suitable control machine is provided upon which the switch and signal control levers together with the traffic control levers are mounted in convenient positions adjacent or upon a miniature track diagram corresponding in every respect to the actual track layout in the field. Also, suitable indications would be employed in practice to indicate to the operator the position of the switches, the condition of the signals, and the occupied or unoccupied condition of the track sections, but for convenience in describing the present invention neither the relative position of the control levers nor the indications of the traffic controlling devices are illustrated.

The signal control levers **1**SL, **4**SL, **3**SL, **2**SL, **5**SL and **6**SL are employed for governing the signals **1**, **4**, **3**, **2**, **5** and **6** respectively (see Fig. 1).

As above mentioned, the condition of occupancy of the various track sections is preferably repeated in the tower by track relays or track repeating relays, but for convenience in describing the invention applied to the track layout of Fig. 1, such means has been omitted from the drawings. Such track sections into which the track is divided by suitable insulated joints are assumed to have track circuits of the usual closed circuit type.

The position of the track switches is indicated in the tower by suitable switch repeating relays indicated by the letter reference characters WP and associated with the particular track switch as indicated by the preceding numerals. Each of these switch repeating relays WP is of the polar neutral type, and is energized with current of a particular polarity depending upon the particular position of its corresponding track switch and its locked condition, and whenever a switch is unlocked, the corresponding repeating relay WP is deenergized.

In applying the present invention to a system employing switch control with approach and detector locking, it may be desirable to provide repeating relays associated with the relays WP, which indicate the correspondence of the switch control means with the track switch, and the contacts of which may be substituted in the circuits of the present disclosure in place of the contacts of the relays WP, all of which has been more specically disclosed in the pending application of S. N. Wight Ser. No. 689,109 filed September 12, 1933, corresponding to British Patent No. 440,048, dated December 12, 1935, and in the U. S. Patent to S. N. Wight, Patent No. 2,027,569 dated January 14, 1936.

Levers repeating relays P are associated with their respective signal control levers SL, as indicated by their preceding numerals. Likewise, route relays RR are associated with their respective signal levers SL, as indicated by their preceding numerals. These route relays RR indicate whether a particular route is established over the actual track layout by reason of their energization over a route circuit corresponding to the track layout.

Relays G are associated with their respective signals, as designated by the numerals preceding their letter reference characters. Each of these relays, when deenergized, causes its associated signal to indicate stop; but, when energized, causes its associated signal to indicate proceed subject to traffic conditions in accordance with the usual practice.

A time element thermal relay 1TR is illustrated as associated with the signal 1; and similarly, a time element thermal relay 5TR is illustrated as associated with the signal 5. Each of these thermal relays has associated therewith a stick relay S, as designated by their preceding numerals, which stick relays are controlled by their respective thermal relays TR and signal relays G in a joint manner explained hereinafter. It is noted in this connection, that in practice where there is a large layout and other sections associated with the switches such as sections 11 and 15 (only partially shown), a thermal relay TR and stick relay S would be associated with each of the signals (see Figs. 3A and 3B later considered). These thermal time element relays TR are associated with their respective signals in a manner for delaying the operation of their respective track switches a predetermined time after the putting to stop of such signals governing traffic over the track switches. Also, such delay period may be made effective only when a train is approaching the signal, although this is not shown in the drawings. These thermal relays are also used in accordance with the present invention, as illustrated in the present disclosure, for controlling the reversal of traffic direction.

The control of the track switches by the stick relays S is sometimes accomplished through the medium of directional stick tumble down relays to provide for the rear releasing of the track switches in a route, all of which may be employed without departing from the present invention.

(Figs. 2A and 2B.) The structure and arrangement disclosed in Figs. 2A and 2B is very similar to that provided in Fig. 1, but has been arranged to be more particularly adaptable for interrelating two interlocked groups where there is an appreciable distance between such groups, and where it is desirable to provide a directional control lever to govern traffic in such intervening section.

The track layout includes sections 20, 21, 22, 23, 24 and 25 for the main track. The track switch 21TS connects a diverging track section 26 to the main track; and similarly, a track switch 24TS connects a diverging track section 27 to the main track.

Signal 31A provides for the control of east bound traffic over the main track up to the signal 32A; while the signal 31B controls the traffic for the diverging route onto section 26. Likewise, signal 32A governs traffic over the main track; while the signal 32B controls east bound traffic onto the diverging track section 27. The signals 36A and 33A control west bound traffic on the main track; while the signals 34 and 35 control traffic off the respective diverging tracks. The main track signals have been provided with call-on signals 31C, 36C, 32C and 33C respectively. The call-on signals, as for example 31C, control traffic over either the main track or the diverging route, and have the significance, when cleared, that a train may proceed prepared to stop on sight of an obstruction. It is to be understood that the main signals, as for example 31A and 31B, indicate that the section in advance is not occupied and that it is safe for traffic to proceed in the usual manner. The call-on type of signal is a necessary adjunct of an interlocking system of the type contemplated in accordance with the present invention in order to provide for certain necessary switching operations.

It is assumed that the track switches 21TS and 24TS are operated by suitable power switch machines and controlled in a similar manner as mentioned in connection with the track switches of Fig. 1.

Each track switch has associated therewith a suitable switch repeating relay illustrated as relays 21WP and 24WP, which relays may have substituted therefor in the circuits of the disclosure suitable correspondence relays as mentioned in connection with Fig. 1, but for an understanding of the present invention it is unnecessary to consider such features of the contemplated system.

The track section 21 is illustrated as having a track circuit with the usual track battery and track relay 21T, and similarly the track sections 22, 23 and 24 are indicated as having track relays 22T, 23T and 24T respectively. The remaining sections are preferably provided with track relays also, which relays have not been considered as necessary to the present disclosure.

Each signal is provided with a signal control lever SL, a signal control lever repeating relay P, a signal relay G, and a route relay RR, each of which letter reference characters is provided with a suitable preceding numeral to indicate with which signal it is associated. The signal control relays G are subject to the control of the relays P and RR for determining when a route has been established, and may also be controlled in accordance with traffic conditions, although only certain of these relays have been illustrated as thus controlled. Thermal relays TR and stick relays S are associated with certain signals for reasons similar to those pointed out in connection with Fig. 1.

Directional stick relays 21ES and 21WS have been illustrated as associated with the track switches 21TS and 24TS respectively for reasons more readily apparent hereafter. However, it

is to be understood in this connection that suitable relays 21WS and 24ES would also be associated with the respective track switches in actual practice. These directional stick tumble down relays WS and ES control the lock relays for the respective track switches and provide for the rear releasing of the switches in a route as a train passes through.

Relays HD are controlled in accordance with traffic conditions in advance of the signals with which they are associated and provide for the automatic control of such signals in the usual manner.

For the purpose of providing directional control over the track sections 22 and 23, a directional control lever DR, which in practice is associated on the miniature track diagram with the corresponding miniature track sections 22 and 23, is provided to control directional relays EF and WF. These directional relays EF and WF are of the polarized type having polar armatures which are actuated to opposite positions upon the application of opposite polarities, which armatures remain in their last actuated positions irrespective of subsequent deenergization. Such retaining means may be of the magnetic stick type or of the mechanical stick type, the particular means employed to accomplish the stick feature being immaterial.

The directional relays EF and WF provide for the control of the HD relays for opposing signals 31 and 33 over only two line wires. Such control of the HD relays also provides for checking whether these two separated directional relays are in corresponding polar positions, all of which will be pointed out more specifically hereinafter.

It is believed that the characteristic features and purposes of the present invention will be best understood by giving the remaining description from the standpoint of typical operations.

Operation (Fig. 1)

Normal conditions

Although track switches are usually left in their last operated positions, the track switches 12TS and 14TS have been shown as being in their normal positions and are presumed to be in correspondence with the respective switch machine control levers (not shown. The signal control levers, however, are usually returned to normal "at stop" positions, as shown, so that the respective signals are displaying stop indications.

More specifically, the red lamp of signal 1 is energized through back contact 45 of relay 1G; the red lamp of signal 3 is energized through back contact 54 of relay 3G; the red lamp of signal 4 is energized through back contact 55 of relay 4G; the red lamp of signal 2 is energized through back contact 71 of relay 2G; the red lamp of signal 5 is energized through back contact 88 of relay 5G; and the red lamp of signal 6 is energized through back contact 82 of relay 6G.

With the track sections unoccupied, the track relays are normally energized, but as automatic track circuit control is not provided in connection with the directional features characteristic of the present invention in Fig. 1, such relays have not been illustrated.

The switch repeating relays WP are energized in accordance with the normal positions of their track switches, as above mentioned, thus causing the circuits with which they are associated to be selected in accordance with the normal positions of the track switches.

With the signal control levers in their "at stop" positions, the time element stick relays S are energized through their respective stick circuits, as presently to be set forth. The pick-up of these relays S is accomplished either by the elapse of a time measured by their respective thermal relays TR, as described later, or by other types of releasing means (not shown) commonly used in approach and detector locking when the time period measured by the thermal relays is not required.

The relay 1S is maintained picked up by a stick circuit closed from (+), through a circuit including back contact 94 of relay 1G, heating element of relay 1TR, front contact 61 of relay 1S, windings of relay 1S, to (—). The current, which flows in this circuit to maintain the relay 1S energized, is insufficient to actuate the thermal element of the relay 1TR.

Signal control

Consideration will now be given to the individual control of the signals by their respective levers subject to route control, directional locking and time releasing of such locking, which features will be described hereinafter.

For example, assuming the system to be in normal conditions, as illustrated, the actuation of the signal lever 1SL to its dotted line position causes the relay 1P to be energized by a circuit closed from (+), through a circuit including the lever 1SL in its dotted line position, windings of relay 1P, back contact 41 of relay 1RR, to (—). A response of the relay 1P to such energization completes its stick circuit including front contact 42, thereby rendering the relay 1P wholly dependent upon the lever 1SL, if the route relay 1RR is picked up in response to the energization of relay 1P provided the route is established and proper to be cleared, as will be subsequently described.

The relay 1G is then energized with 1RR picked up by reason of a circuit closed from (+), through a circuit including front contact 43 of relay 1RR, front contact 44 of relay 1P, windings of relay 1G, to (—). Such energization of the relay 1G opens the stick circuit for the relay 1S at back contact 94, and moves contact 45 from a back point to a front point thereby causing signal 1 to give a proceed indication.

The control of the relay 1G may also be made subject to traffic conditions to provide for semi-automatic control in the usual manner, all of which has been omitted for simplicity of the features of the present invention.

From the above, it is apparent that the operation of a signal lever conditions the route circuits, which if proper allow the clearing of the signal associated with that lever. This conditioning of the route circuit also prevents opposing signal levers from being effective, as the picking up of the route relay RR at the opposite end of the route prevents the pick-up of the lever repeating relay at that end of the route.

This part of the description is intended to point out that each signal lever can condition a route circuit, and that the response of such route circuit governs the resulting response of the associated signal. Thus, the pick-up and stick circuits for each relay P and the energizing circuit for each relay G will now be pointed out.

The pick-up circuit for the relay 4P may be closed from (+), through a circuit including the lever 4SL in a dotted line position, windings of relay 4P, back contact 46 of relay 4RR, to (—).

The stick circuit for the relay 4P is closed after its response from (+), through a circuit including the lever 4SL in its dotted line position, windings of relay 4P, front contact 47 of relay 4P, to (—). The energizing circuit for the relay 4G is closed with relays 4P and 4RR picked up from (+), through a circuit including front contact 48 of relay 4RR, front contact 49 of relay 4P, windings of relay 4G, to (—). When the relay 4G is picked up the stop indication of the signal 4 is removed and a proceed indication is established.

The pick-up circuit for the relay 3P may be closed from (+), through a circuit including lever 3SL in its dotted line position, windings of relay 3P, back contact 50 of relay 3RR, to (—). The stick circuit for the relay 3P is closed after its response from (+), through a circuit including lever 3SL in its dotted line position, windings of relay 3P, front contact 51 of relay 3P, to (—). The pick-up circuit for the relay 3G is closed with relays 3P and 3RR picked up from (+), through a circuit including front contact 52 of relay 3RR, front contact 53 of relay 3P, windings of relay 3G, to (—). When the relay 3G is energized, the red indicator of the signal 3 is de-energized and the green or proceed indicator of the signal 3 is energized.

The pick-up circuit for the relay 2P may be closed from (+), through a circuit including lever 2SL in its dotted line position, windings of relay 2P, back contact 67 of relay 2RR, to (—). The stick circuit for the relay 2P is closed after its response from (+), through a circuit including lever 2SL in its dotted line position, windings of relay 2P, front contact 68 of relay 2P, to (—). The pick-up circuit for the relay 2G is closed with the relays 2P and 2RR picked up from (+), through a circuit including front contact 69 of relay 2RR, front contact 70 of relay 2P, windings of relay 2G, to (—). When the relay 2G is energized, open back contact 71 de-energizes the red indicator of the signal 2, and the closed front contact 71 energizes the green indicator of signal 2.

The pick-up circuit for the relay 6P may be closed from (+), through a circuit including lever 6SL in a dotted line position, windings of relay 6P, back contact 77 of relay 6RR, to (—). The stick circuit for the relay 6P is closed after its response from (+), through a circuit including lever 6SL in its dotted line position, windings of relay 6P, front contact 78 of relay 6P, to (—). The energizing circuit for the relay 6G is closed with the relays 6P and 6RR picked up from (+), through a circuit including front contact 80 of relay 6RR, front contact 81 of relay 6P, windings of relay 6G, to (—).

The pick-up circuit of the relay 5P may be closed from (+), through a circuit including lever 5SL in its dotted position, windings of relay 5P, back contact 83 of relay 5RR, to (—). The stick circuit for the relay 5P is closed after its response from (+), through a circuit including lever 5SL in its dotted line position, windings of relay 5P, front contact 84 of relay 5P, to (—). The energizing circuit for the relay 5G is closed with the relays 5P and 5RR picked up from (+), through a circuit including front contact 86 of relay 5RR, front contact 87 of relay 5P, windings of relay 5G, to (—). When the relay 5G is picked up, it opens back contact 88 to de-energize the red indicator of the signal 5, and then closes front contact 88 to energize the green indicator of signal 5.

Route circuits

Following the picking up of a lever repeating relay P, the route circuit for the route governed by the associated signal is energized provided such route is actually set up over the trackway and provided the opposing signal has not been conditioned to be cleared. Also, in accordance with the present invention, certain of the route circuits are dependent upon traffic direction checks and releases. The contacts and controls of these checks and releases will be included in the route circuits as pointed out in this section, although a detailed explanation of their operation will be considered separately.

Assuming that the track switch 12TS is in its normal locked position (as illustrated), and that the operator desires to clear the signal 1, he moves the signal lever 1SL to its dotted line position in which it energizes the relay 1P through its pick-up circuit. After the response of the relay 1P, its stick circuit is closed.

The picking up of the relay 1P closes its front contact 56, which completes a circuit for the route relays 1RR and 3RR closed from (+), through a circuit including front contact 56 of relay 1P, winding of relay 1RR, front contact 57 of relay 12WP, polar contact 58 of relay 12WP in its left hand normal position, windings of relay 3RR, back contact 60 of relay 3P, back contact 73 of relay 2RR, to (—). The energization of relay 1RR opens the pick-up circuit of the relay 1P, but as its stick circuit is closed through its front contact 42, the relay 1P is wholly dependent upon the lever 1SL.

The energization of the relay 3RR opens the energizing circuit of relay 3P at the back contact 50 of relay 3RR, so that any subsequent actuation of the lever 3SL to its dotted line position does not energize the relay 3P nor interrupt in any way the route circuit already established. It is also apparent that if the levers 1SL and 3SL were operated simultaneously that (+) would be applied to both ends of the circuit including relays 1RR and 3RR so that they would remain deenergized.

Should the operator desire to establish the opposite direction of traffic over the track switch 12TS, then the lever 3SL should be actuated to its dotted line position and the lever 1SL left in its normal position. This picks up the relay 3P which in turn closes the route circuit including the relays 1RR and 3RR from (+), through a circuit including front contact 60 of relay 3P, windings of relay 3RR, polar contact 58 of relay 12WP in a left hand normal position, front contact 57 of relay 12WP, winding of relay 1RR, back contact 56 of relay 1P, front contact 64 of relay 1S, to (—). This energization of the route circuit causes the relay 3P to be wholly dependent upon the lever 3SL, and also prevents the control of the relay 1P by the lever 1SL by reason of open back contact 41.

When the track switch 12TS is in a reverse position, then the operation of the lever 1SL establishes a route circuit for relays 1RR and 4RR in series from (+), through a circuit including front contact 56 of relay 1P, windings of relay 1RR, front contact 57 of relay 12WP, polar contact 58 of relay 12WP in a right hand position, winding of relay 4RR, back contact 59 of relay 4P, to (—). It is apparent that the energization of this route circuit causes the relay 1P to be wholly dependent upon the lever 1SL, while the control of relay 4P by its lever 4SL is prevented by reason of open back contact 46 of relay 4RR.

If the opposite direction of traffic is desired over the reverse route including the track switch 12TS in its reverse position, then the lever 4SL is actuated which picks up the relay 4P. This closes the route circuit including the relays 1RR and 4RR from (+), through a circuit including front contact 59 of relay 4P, windings of relay 4RR, polar contact 58 of relay 12WP in a right hand reverse position, front contact 57 of relay 12WP, windings of relay 1RR, back contact 56 of 1P, front contact 64 of relay 1S, to (—). It is apparent that the energization of this route circuit causes the relay 4P to be wholly dependent upon its lever 4SL through its stick circuit including front contact 47, and prevents the relay 1P from control by reason of open back contact 41 of relay 1RR.

Attention is now directed to the interlocked group on the right hand portion of Fig. 1. Let us assume that traffic is to be established over the track switch 14TS in a normal position in an east bound direction. The operator moves the lever 2SL to its dotted line position in which the relay 2P is picked up which closes the route circuit including the relays 2RR and 5RR from (+), through a circuit including front contact 72 of relay 2P, windings of relay 2RR, front contact 75 of relay 14WP, polar contact 76 of relay 14WP in a left hand position, windings of relay 5RR, back contact 85 of relay 5P, front contact 93 of relay 5S, to (—). The energization of this route circuit causes the relay 2P to be wholly dependent upon its lever 2SL, and prevents the relay 5P from being energized by its lever 5SL by reason of the opening of back contact 83 of relay 5RR.

If the opposite direction of traffic over this route is desired, then 5SL is operated to its dotted line position and relay 2SL is left in its normal position. This causes the picking up of the relay 5P which in turn closes a circuit for the relays 2RR and 5RR from (+), through a circuit including front contact 85 of relay 5P, windings of relay 5RR, polar contact 76 of relay 14WP in a left hand normal position, front contact 75 of relay WP, windings of relay 2RR, back contact 72 of relay 2P, back contact 65 of relay 3RR, to (—). The energization of this route circuit causes the relay 5P to be wholly dependent upon its lever 5SL, and prevents the control of relay 2P by its lever 2SL.

With the track switch 14TS in its reverse position, then either of two opposite directions of traffic may be established over the track switch in such reverse position depending upon whether the lever 2SL is operated to its dotted line position or whether relay 6SL is operated to its dotted line position.

When the lever 2SL is operated to its dotted line position, then the relay 2P is picked up which closes the route circuit including relays 2RR and 6RR from (+), through a circuit including front contact 72 of relay 2P, windings of relay 2RR, front contact 75 of relay 14WP, polar contact 76 of relay 14WP in its right hand reverse position, windings of relay 6RR, back contact 79 of relay 6P, to (—).

The energization of this route circuit causes the relay 2P, to be wholly dependent upon its lever 2SL by reason of the opening of its pick-up circuit at contact 67, and the relay 6P is prevented from response to the lever 6SL by reason of its open contact 77.

If the lever 6SL is operated to its dotted line position and the lever 2SL is left in its normal position, then the relay 6P is picked up closing the route circuit including the relay 2RR and 6RR from (+), through a circuit including front contact 79 of relay 6P, windings of relay 6RR, polar contact 76 of relay 14WP in a right hand normal position, front contact 75 of relay 14WP, windings of relay 2RR, back contact 72 of relay 2P, back contact 65 of relay 3RR, to (—). The energization of this route circuit causes the relay 6P to be wholly dependent upon its lever 6SL by reason of the open back contact 77, and prevents the control of the relay 2P by the lever 2SL by reason of the open back contact 67.

From the above specific descriptions of the route circuits, it is apparent that each route circuit corresponds to the actual track layout in each interlocked group, is energized at that end from which traffic is to proceed, and, when thus energized, prevents the energization of such route circuit from the opposite end.

Traffic direction control between groups.—We may now consider how the opposing signals such as signals 1 and 5 in the two separate interlocked groups are prevented from being cleared at the same time. Let us assume that the lever 1SL is operated to its dotted line position with the track switch 12TS in its normal position. This causes the energization of the relay 1P which in turn energizes the relays 1RR and 3RR which prevents the energization of the relay 3P by the lever 3SL within the same group.

It is noted that the energizing circuit for these relays 1RR and 3RR includes a back contact 73 of the relay 2RR of the other group. Thus, if the route circuit for either the signal 5 or the signal 6 is energized, then the energization of the route relays 1RR and 3RR by the lever 1SL is prevented, and the signal 1 cannot be cleared. In other words, the signal 1 cannot be cleared when either the signal 5 or signal 6 is cleared. Of course the opposite is true also, that is, the signals 5 and 6 are prevented from being cleared when signal 1 is cleared for reasons understood by analogy.

However, if the signal 2 is cleared by reason of the actuation of the lever 2SL to its dotted line position, then the energization of the relay 2RR does not prevent signal 1 from being cleared, because the relay 2P is picked up which closes front contact 74 applying negative potential to the wire 95 so that the relays 1RR and 3RR can be energized upon the actuation of the lever 1SL. In other words, corresponding directions of traffic may be established in the two adjacent interlocked groups, but opposing directions of traffic are positively prevented.

It is to be noted, that, if the route circuit including the relays 1RR and 3RR is energized resulting in the clearing of signal 1, such clearing of the signal 1 can not be interrupted by the putting to stop of the signal 2, if it had been cleared, because of the closed front contact 65 of the relay 3RR which applies (—) to the back contact 60 of the relay 3P. In other words, assuming the signal 2 to be at stop and the signal 1 to be cleared, the actuation of the lever 2SL to its dotted line position and the successive response of the relays 2P and 2RR cause (—) to be applied to wire 95 by front contact 74 before back contact 73 opens; but, when the signal 2 is cleared and the lever 2SL is returned to stop while the signal which is still clear, the relays 2P and 2RR drop away in succession so that front contact 74 is open before back contact 73 is closed. This would cause the momentary deenergization of the circuit for relays 1RR and 3RR

if it were not for the application of (—) by front contact 65 of relay 3RR. Similar provisions are also made for the opposite direction.

The above description points out the manner in which opposing signals within the same interlocked group and between two adjacent interlocked groups are positively prevented from being cleared at the same time in accordance with the present invention. In the provision of this directional control, it is also necessary that the direction of traffic cannot be changed immediately upon the operation of the signal levers but shall be delayed for a sufficient time to allow for the safe passage of traffic in a manner now to be considered.

Irrespective of whether the track section 13 intervenes between the signals 3 and 2 or whether the signals 2 and 3 are opposite each other, provision must be made that the signal 1 can not be cleared immediately after the signal 3 is put to stop in the face of an approaching train, as this condition might allow two trains to move in opposite directions towards each other without any intermediate signals to prevent a head-on collision. This also applies to the movement of traffic in the opposite direction.

Let us assume that a train is approaching the signal 1 which has been cleared by reason of the operation of the lever 1SL to its dotted line position. The energization of the relay 1G to clear the signal 1 through front contact 45, also de-energizes the stick relay 1S at back contact 94. As pointed out above, under such a condition the signal 3 cannot be cleared because of the open contact 50 included in the circuit for the relay 3P. Also, should the operator return the signal lever 1SL to its normal position deenergizing the relay 1P and the relay 1G to put the signal 1 at stop, the signal 3 cannot be cleared in response to the operation of the lever 3SL until after a predetermined time measured by the thermal relay 1TR.

More specifically, the deenergization of the relay 1P and closure of its back contact 56 upon the restoration of the lever 1SL, closes a circuit from (+), through a circuit including back contact 64 of relay 1S, back contact 56 of relay 1P, windings of relay 1RR, front contact 57 of relay 12WP, polar contact 58 of relay 12WP in a left hand normal position, windings of relay 3RR, back contact 60 of relay 3P, front contact 65 of relay 3RR, to (—). The relay 3RR is made slightly slow acting so that its contact 65 remains closed, while the contact 56 of the relay 1P moves from a front point to a back point position. Thus, the relays 1RR and 3RR are maintained energized upon the dropping of the relay 1P, so that the relay 3P is prevented from responding to the lever 3SL at open back contact 50.

Upon the closure of back contact 94 of relay 1G following the dropping away of the relay 1P, energy is applied to the thermal relay 1TR by a circuit closed from (+), through a circuit including back contact 94 of relay 1G, winding of thermal relay 1TR, back contact 61 of relay 1S, to (—). The current flowing in this circuit causes the thermal relay after a time to close front contact 63 to pick up the relay 1S which then closes its stick circuit through front contact 61 as heretofore pointed out. The opening of back contact 61 and the inclusion of the winding of relay 1S in the circuit of the thermal relay winding increases the resistance of the circuit to such a value that the current, although sufficient to hold the relay 1S energized, is insufficient to maintain the thermal relay actuated so that after a time the thermal relay restores to normal.

As soon as the back contact 64 of the relay 1S is open, the relays 1RR and 3RR are deenergized so that the relay 3P can respond to its lever by reason of the closure of back contact 50. The relays 3RR and 1RR can then respond immediately as soon as relay 3P picks up.

From this it is seen that the response of the relays 3P and 3RR to the actuation of lever 3SL to energize the relay 3G and clear the signal 3 is delayed, following the restoration of the signal lever 1SL to its normal position, a predetermined time measured by the thermal relay 1TR. This allows sufficient time for the train approaching the signal 1 to stop in approach to such signal.

Under the circumstances just described, the delay period measured upon the restoration of the lever 1SL is not only imposed upon the signal 3, but is also imposed upon the control of the signals 5 and 6 in the next adjacent interlocked group. This is accomplished by reason of the fact that relay 3RR is not de-energized until the relay 1S is picked up, and, as back contact 65 of relay 3RR is included in the route circuits for the signals 5 and 6, the relay 2RR and either relay 5RR or relay 6RR cannot be energized until after the delay period measured by the thermal relay 1TR.

It will be apparent from the consideration of the circuits of Fig. 1 that as soon as the relay 3RR is de-energized, the wire 96 then receives energy from (—) continuously. More specifically, the relay 3P closes front contact 66 before the relay 3RR can again pick up, so that the clearing of either the signal 5 or 6 may be accomplished in the regular manner.

Although only the signals 1 and 5 have been shown and described as having time release relays TR and stick relays S, each of the remaining signals of Fig. 1 are preferably provided with similar apparatus.

Such an arrangement as provided in Fig. 1 in accordance with the present invention, serves to prevent the quick reversal of traffic direction by quick manipulation of the signal levers thereby giving adequate protection to the movement of trains within and between two adjacent interlocked groups both where the track section 13 is present between the signals 2 and 3 and where the signals 2 and 3 are substantially opposite each other.

Modification (see Figs. 3A and 3B).—The principles of the present invention, as disclosed in Fig. 1 of the accompanying drawings, have been also illustrated in Figs. 3A and 3B which, when placed end to end, illustrate a more extended track layout. The simplified layout of Fig. 1 was chosen in order to simplify the detailed discussion of the operation, but the more extended track layout of Figs. 3A and 3B has been chosen to indicate conventionally how the invention may be applied to more complicated track layouts.

The track layout of Figs. 3A and 3B includes a stretch of track which is divided into sections 111, 112, 113, 114, 115, 116, 117 and 118. The track sections 112, 114, 116 and 118 include railway track switches 112TS, 114TS, 116TS and 118TS respectively. These track switches serve to connect turnout track sections to the main track the usual way. The track sections 113, 115 and 117 are illustrated as traffic sections connecting the successive interlocked groups and correspond to the section 13 of Fig. 1. These sections may be omitted in practice where the

interlocked groups are close together the same as mentioned in connection with section 13 of Fig. 1.

Each of the track sections including a track switch have been shown as having signals governing the entrance of traffic into such sections in both directions. These signals 101, 103, 105, 107, 102, 104, 106 and 108 may be readily identified with the respective sections from the drawings, and are controlled by their respective G relays identified by reason of the distinctive numerals preceding the letter reference character G.

Certain of the relays have been shown in block without control circuits, while certain other relays have their control merely indicated, all of which is for the purpose of simplicity in the illustration of the extension of the invention.

For example, the relays WP for the respective track switches have been omitted, but certain of their contacts merely indicated by an "*x*" in the respective route circuits which have been shown.

The signal levers, the control circuits for the signals, and various other features shown in Fig. 1 have been omitted from Figs. 3A and 3B, but they should be considered as employed in connection therewith.

Lever repeating relays P are associated with their respective signals, as indicated by their preceding numerals. Likewise, route relays RR are associated with their respective signals, as indicated by their preceding numerals.

Signal relays G are associated with their respective signals, as designated by the numerals preceding their letter reference characters; and each of these relays, when deenergized, causes its associated signal to indicate stop or clear depending upon whether it is deenergized or energized respectively, as has been illustrated in Fig. 1.

A time element relay TR and a stick relay S is shown as associated with each of the signals of the track layout, as designated by the numerals preceding their letter reference characters.

As each of the signals is provided with its own time release thermal relay TR and stick relay S, the interconnection between the interlocked groups are connected to the relays RR and S instead of through the relays RR and P as indicated in Fig. 1, where only the signals 1 and 5 have time releases and stick relays.

For example, the route circuit for the relays 103RR and 106RR may be closed, when the relay 106P is picked up, from (+), through a circuit including front contact 120 of relay 106P, windings of relay 106RR, contacts of relay 114WP (not shown), windings of relay 103RR, back contact 121 of relay 103P, front contact 122 of relay 103S, back contact 123 of relay 108RR, to (—). The picking up of contact 124 of relay 103RR applies potential from (—) to front contact 122 in place of back contact 123. This function of front contact 124 corresponds to the function of front contact 73 of relay 2RR of Fig. 1, for example.

Each of the route circuits includes contact corresponding to contact 122 of relay 103S for the purpose of delaying the reversal of traffic direction similarly, as described for the contact 64 and 93 of Fig. 1. It is desired to point out, that the time control of the relay 101S is effective to prevent the clearing of the signal 106 for a predetermined time after the putting to stop of the signal 101; but such control does not extend to the signal 104. In other words, the time release for each signal governs the reversal of traffic direction in the section which it immediately governs, the traffic section connecting two interlocked groups (if provided), and the section in the next interlocked group up to the opposing signal. This is true for each of the different combinations of sections, as will be readily understood.

It is believed that further specific description of Figs. 3A and 3B is unnecessary, as the circuits will be readily understood by analogy to Fig. 1.

Operation (Figs. 2A and 2B)

Normal conditions.—The track switches 21TS 24TS have been shown in their normal conditions with their respective switch machine control levers (not shown) in correspondence therewith. Similarly, the signal control levers are shown in their "at stop" positions so that their respective signals are displaying stop indications.

More specifically, the red lamp of signal 31A is energized through back contact 200 of relay 31AG; the red lamp of signal 31B is energized through back contact 201 of relay 31BG; the red lamp of signal 31C is energized through back contact 202 of relay 31CG; the red lamp of signal 36A is energized through back contact 203 of relay 36AG; the red lamp of signal 36C is energized through back contact 204 of relay 36CG; the red lamp of signal 34 is energized through back contact 205 of relay 34G; the red lamp of signal 32A is energized through back contact 206 of relay 32AG; the red lamp of signal 32B is energized through back contact 207 of relay 32BG; the red lamp of signal 32G is energized through back contact 208 of relay 32CG; the red lamp of signal 33A is energized through back contact 209 of relay 33AG; the signal 33C is energized through back contact 210 of relay 33CG; and, the red lamp of signal 35 is energized through back contact 211 of relay 35G.

The various track sections are preferably provided with track circuits of the usual type of which sections 21, 22, 23 and 24 are illustrated as provided with the usual track batteries and track relays T with suitable preceding numerals to designate the sections with which they are employed. With these closed circuit type of track circuits, the track relays are normally energized.

The switch repeating relays WP are energized in accordance with the normal positions of their respective track switches, as above mentioned, thus causing the circuits with which they are associated to be selected in accordance with the normal positions of the track switches.

With the signal control levers SL in their "at stop" positions, the stick relays S are energized through their respective stick circuits, which will be presently set forth. The pick up of these relays S is accomplished either by the elapse of a time measured by their respective thermal relays TR, as described later, or by other types of releasing means not shown but commonly used in approach and detector locking when the time period measured by the thermal relays is not required.

The stick relay 31S is maintained picked up by a stick circuit closed from (+), through a circuit including back contact 212 of relay 31AG, back contact 213 of relay 31CG, back contact 414 of relay 31BG, heating winding of the thermal relay 31 TR, front contact 214 of relay 31S, windings of relay 31S, to (—). The current, which flows in this circuit to maintain the relay 31S energized, is insufficient to actuate the thermal element of the relay 31TR.

The stick relay 33S is maintained picked up by a stick circuit closed from (+), through a circuit including back contact 314 of relay 35G, back contact 215 of relay 33AG, back contact 216 of

relay 33CG, winding of thermal relay 33TR, front contact 217 of relay 33S, windings of relay 33S, to (—). The current, which flows in this circuit to maintain the relay 33S energized, is insufficient to actuate the thermal element of the relay 33TR.

The track sections 21 and 24 including the track switches 21TS and 24TS preferably have associated therewith suitable directional stick relays for each direction of which only the relays 21ES and 24WS have been shown. The relay 21ES is normally energized by a circuit closed from (+), through a circuit including back contact 222 of relay 31P, back contact 223 of relay 31TR, front contact 224 of relay 31S, front contact 225 of relay 21T, windings of relay 21ES, to (—). The relay 21ES is provided with front contact 227 which shunts the track relay contact 225, thereby making this relay 21ES a stick relay with respect to the track relay 21T.

The relay 24WS is energized by a circuit from (+), through a circuit including back contact 218 of relay 33P, front contact 219 of relay 33S, back contact 220 of thermal relay 33TR, front contact 221 of relay 24T, windings of relay 24WS, to (—). The relay 24WS includes a front contact 226 which shunts track contact 221, thereby making the relay 24WS a stick relay with respect to the track relay 24T.

The lock relays (not shown) for the track switches are selected through contacts of the associated relays G, ES and WS. In other words, whenever a signal is cleared the switch is locked against operation, and the directional stick relays ES and WS for each switch maintain such locking when the train accepts the route and until after it passes beyond the associated detector track section.

With the conditions illustrated, the traffic direction circuit for relays EF and WF is closed from (B+), through a circuit including directional lever DR in a right hand position, back contact 228 of relay 36RR, back contact 229 of relay 36P, windings of relay EF, line wire 230, windings of relay WF, back contact 231 of relay 32P, back contact 232 of relay 32RR, to (CN). The current which flows in this circuit causes the polar contacts of the relays EF and WF to be actuated to their right hand positions. It will be apparent, that, if the lever DR were operated to the opposite or left hand position, potential would be applied to this circuit from (B—), which would cause current to flow in the circuit in the opposite direction resulting in the actuation of the polar contacts of these relays to left hand positions.

With the directional relays EF and WF having their polar contacts in right hand positions, the relay 31HD is conditioned in accordance with traffic in advance of the signal 31; but if the contacts of the relays EF and WF were in their opposite positions, the relay 33HD would be conditioned in accordance with traffic in advance of signal 33 over the same two pair of line wires, namely, line wires 233 and 234.

For example, the circuit for the relay 31HD is closed from (+), through a circuit including front contact 235 of relay 24WS, back contact 236 of relay 32AG, polar contact 244 of relay WF in a right hand position, front contact 243 of relay 23T, line wire 234, front contact 242 of relay 22T, polar contact 241 of relay EF in a right hand position, windings of relay 31HD, polar contact 240 of relay EF in a right hand position, front contact 239 of relay 22T, line wire 233, front contact 238 of relay 23T, polar contact 237 of relay WF, back contact 245 of relay 33AG, to (—).

On the other hand, if the relays EF and WF have their contacts actuated to the opposite or left hand positions, a circuit is closed for the relay 33HD from (+), through a circuit including front contact 281 of relay 21ES, polar contact 246 of relay 21WP in a left hand position, front contact 247 of relay 21WP, back contact 248 of relay 36AG, polar contact 240 of relay EF in a left hand position, front contact 239 of relay 22T, line wire 233, front contact 238 of relay 23T, polar contact 237 of relay WF in a left hand position, windings of relay 33HD, polar contact 244 of relay WF in a left hand position, front contact 243 of relay 23T, line wire 234, front contact 242 of relay 22T, polar contact 241 of relay EF in a left hand position, back contact 249 of relay 36AG, to (—).

Establishing a route.—Let us assume that a train is approaching the signal 31 upon the track section 20 and that the operator desires to send this train over the main track to the signal 32 and from thence over the track switch 24TS in a reverse position on to the turn-out track section 27.

To do this, the operator first positions the switch control levers (not shown) for the track switches 21TS and 24TS so that these track switches assume normal and reverse positions respectively. The operator then actuates the direction lever DR to a right hand position (as now shown) which causes the polar contacts of the relays EF and WF to assume right hand positions. Following such actuation of the directional control lever, the operator may then position the signal levers 31SL and 32SL to their right hand positions. Although the above sequence of direction and signal lever operation is preferable, the order may be changed and still obtain the same results.

With the lever 31SL in a right hand position, a circuit is closed for the relay 31P from (B+), through a circuit including lever 31SL in a right hand dotted line position, windings of relay 31P, back contact 250 of relay 31RR, to (CN). As soon as relay 31P picks up, a stick circuit is closed from (B+), through a circuit including lever 31SL in a right hand position, windings of relay 31P, front contact 251 of relay 31P, to (CN).

With the track switch 21TS in its normal position, the response of the relay 31P can immediately close the route circuit for relays 31RR and 36RR in series. This route circuit is closed from (+), through a circuit including front contact 252 of relay 31P, windings of relay 31RR, front contact 253 of relay 21WP, polar contact 254 of relay 21WP in a left hand position, windings of relay 36RR, back contact 255 of relay 36P, polar contact 256 of relay EF in a right hand position, to (—).

The energization of the relay 31P from (B+), causes its polar contacts to be operated to right hand positions. Thus, the response of the relay 31RR causes the relay 31AG to be energized by a circuit closed from (+), through a circuit including front contact 257 of relay 31RR, front contact 258 of relay 31P, polar contact 259 of relay 31P in a right hand position, front contact 260 of relay 21T, front contact 261 of relay 21WP, polar contact 262 of relay 21WP in a left hand position, front contact 263 of relay 31HD, windings of relay 31AG, to (—). The picking up of the contacts of the relay 31AG opens the energizing circuit of the red lamp of the signal 31A at back contact 200 and closes the circuit

for either the green lamp or the caution lamp of signal 31A through front contact 200 depending upon the position of the polar contact 264 of relay 31HD. If the signal 32A is still at top, then the relay 31HD will be energized, as above pointed out, with its polar contact 264 in a left hand position, thereby energizing the caution indicator of the signal 31A by a circuit obvious from the drawings. On the other hand, if the signal 32A is cleared the polarity applied to the relay 31HD is reversed by contacts 236 and 245 of relay 32AG, so that the polar contact 264 of relay 31HD assumes a right hand position to energize the green indicator of the signal 31A.

In the particular situation under consideration, the signal 32B is to be cleared to allow the train to pass on to the turn-out track section 27. Thus, the signal 32A will remain at stop and the relay 31HD remains energized as shown, so that only the caution indicator of the signal 31A may be cleared at this time.

The clearing of the signal 31A by the energization of the relay 31AG opens the stick circuit of the relay 31S at back contact 212 of relay 31AG. Also, the response of the relay 31P to its pick up circuit opens the energizing circuit for the relay 21ES at back contact 222. The purpose of these controls will be pointed out hereinafter.

The actuation of the signal lever 32SL to a right hand position closes a circuit for the relay 32P from (B+), through a circuit including lever 32SL in a right hand position, windings of relay 32P, back contact 265 of relay 32RR, to (CN). The response of the relay 32P closes a stick circuit for the relay 32P from (B+), through a circuit including lever 32SL in a right hand position, windings of relay 32P, front contact 266 of relay 32P, to (CN).

The response of the relay 32P closes the route circuit for the relays 32RR and 35RR in series from (+), through a circuit including front contact 267 of relay 32P, windings of relay 32RR, front contact 268 of relay 24WP, polar contact 269 of relay 24WP in a right hand position, windings of relay 35RR, back contact 270 of relay 35P, to (—).

The energization of the relay 32P from (B+) causes its polar contacts to be operated to right hand positions, so that the response of the relay 32RR closes an energizing circuit for the relay 32BG from (+), through a circuit including front contact 271 of relay 32RR, front contact 272 of relay 32P, polar contact 273 of relay 32P in a right hand position, front contact 274 of relay 24T, front contact 275 of relay 24WP, polar contact 276 of relay 24WP in a right hand position, windings of relay 32BG, to (—).

The picking up of the contacts of the relay 32BG opens the energizing circuit for the red or stop lamp of signal 32B at back contact 207 and energizes the proceed indicator of signal 32B through front contact 207. As this is the diverging route, presumably requiring low speed, the signal energized by the front contact 207 will preferably give a caution indication. It is for this reason that the polarity on the relay 31HD is not reversed upon the clearing of signal 32B, but if the signal 32B displays high speed proceed indication such as green, then the relay 32BG would also be adopted to reverse the polarity on the relay 31HD.

As soon as the signal 31A indicates proceed, the train passes from section 20 over the sections 21, 22, 23, 24 on to the section 27 in succession. The deenergization of the track relay 21T opens the energizing circuit of the relay 31AG at front contact 260 so that the signal 31A is caused to display stop as soon as the train has accepted such signal. The train proceeds onto the section 22 deenergizing track relay 22T which opens the energizing circuit of the relay 31HD at contacts 239 and 242. This deenergization of relay 31HD opens the energizing circuit for relay 31AG at front contact 263. Likewise, the train on the track section 23 opens the energizing circuit for the relay 31HD at contacts 238 and 243. Thus, it is seen that the signal 31A is maintained at stop until the train passes beyond the signal 32.

It will be noted that with the signal lever 31SL in a right hand proceed position resulting in the energization of the relays 31RR and 36RR in series, the circuit for the control of relays EF and WF by the directional lever DR is broken at back contact 228. The energization of the relay 32P opens the circuit controlling the relays EF and WF at back contact 231 and closes it through front contact 231 to (CN).

Thus, it is readily apparent that the directional lever DR, if operated under these circumstances, is ineffective to disturb the signal 31A from its clear position so long as the control lever for such signal is in clearing positions, although the initial clearing of the signal is dependent upon the directional lever being in the proper position.

After the train passes onto the track section 27, and when the signal levers have been returned to stop, the system returns to its normal condition as illustrated.

Directional time release.—Let us assume that the operator has set up the route as above described but with 24TS in a normal position in anticipation of the train approaching the signal 31A, but for some reason he desires to reverse the direction of traffic and allow a train to pass from the signal 33A onto the sections 24 and 23. This route is established after the operation of signal levers 31SL and 32SL, to stop.

Such reversal of traffic direction is delayed for a predetermined time in accordance with the time measured by the thermal relay 31TR. This delay is provided by the present disclosure of Figs. 2A and 2B irrespective of whether a train is approaching the signal 31 on section 20 or not. However, the usual approach locking type of release may be employed in connection with the relay 31S so that it is dependent for its pick up through the elapse of a time measured by relay 31TR only when the track section 20 is occupied. Such an arrangement would then permit reversal of traffic direction in the section including track sections 22 and 23 without the elapse of time providing there was no train approaching the signal 31.

However, in accordance with the present disclosure, in order to establish traffic in a west bound direction the operator must first return the levers 31SL and 32SL to their stop positions, then actuate the direction lever DR to a left hand dotted line position after which he operates the lever 33SL to its left hand dotted line position. As soon as the relay 36RR becomes deenergized closing back contact 228 and relays 32P and 32RR become deenergized closing back contacts 231 and 232, the direction relays EF and WF actuate their contacts to left hand positions in response to the application of energy from (B—).

The actuation of the lever 33SL to a left hand position closes a circuit for relay 33P from (B+), through a circuit including lever 33SL in a left hand position, winding of relay 33P, back contact

277 of relay 33RR, to (CN). As soon as the relay 33P picks up, a stick circuit is closed from (B+), through a circuit including lever 33SL in a left hand position, winding of relay 33P, front contact 278 of relay 33P, to (CN).

With the relay 33P picked up and the polar contact 280 of the relay WF actuated to its left hand position, the route circuit for the relays 33RR and 32RR in series is closed from (+), through a circuit including front contact 279 of relay 33P, windings of relay 33RR, polar contact 269 of relay 24WP in a left hand position, front contact 268 of relay 24WP, windings of relay 32RR, back contact 267 of relay 32P, polar contact 280 of relay WF in a left hand position, to (—).

The picking up of the relay 33RR with the relay 33P picked up tends to close a circuit for energizing the relay 33AG, but the relay 33AG cannot be energized until the relay 33HD is energized which in turn is dependent upon the closure of contact 281 of relay 21ES which is not picked up until after the predetermined time measured by the relay 31TR.

For example, the deenergization of the relays 31RR and 31P deenergizes the relay 31AG which completes an energizing circuit for the winding of the thermal relay 31TR from (+), through a circuit including back contact 212 of relay 31AG, back contact 213 of relay 31CG, winding of relay 31TR, back contact 214 of relay 31S, to (—). After a time the front contact 282 of the thermal relay 31TR is closed which shunts out the contact 214 causing the relay 31S to be energized. The picking up of relay 31S opens back contact 214 causing the relay 31S to be stuck up, as previously pointed out. The current in this stick winding is of course insufficient to cause the thermal contacts of the relay 31TR to remain actuated so that they return to their normal deenergized back positions.

After the thermal relay 31TR has heated and cooled, a pick up circuit is closed for the relay 21ES from (+), through a circuit including back contact 222 of relay 31P; back contact 223 of relay 31TR, front contact 224 of relay 31S, front contact 225 of relay 21T, windings of relay 21ES, to (—). The response of the relay 21ES shunts out the track relay contact 225 by front contact 227, as previously mentioned.

The closure of front contact 281 then closes the energizing circuit for the relay 33HD, as previously pointed out, after the predetermined time thus measured, so that the relay 33AG can then be energized by a circuit closed from (+), through a circuit including front contact 283 of relay 33RR, front contact 284 of relay 33P, polar contact 285 of relay 33P in a left hand position, front contact 286 of relay 24T, front contact 287 of relay 33HD, windings of relay 33AG, to (—).

This energization of the relay 33AG deenergizes the stop indicator red lamp of the signal 33A at back contact 209 and closes the circuit for energizing a caution or clear indicator depending upon the position of polar contact 288 of relay 33HD. If the operator has not actuated the lever 36SL to clear the signal 36, and such signal therefore remains at stop then the polar contact 288 will remain in its position as shown causing a caution or slow speed indication to be given by the signal 33A. On the other hand, if the operator actuates the lever 36SL and the signal 36A is cleared after the predetermined time measured by the relay 31TR, then the polarity will be reversed on the relay 33HD by contacts 249 and 248 of relay 36AG thereby allowing a high speed indication to be given by the signal 33A.

It may be well to note at this point the manner in which the thermal relay 31TR also delays the clearing of the signal 36A.

The actuation of the lever 36SL to a left hand dotted line position applies energy to the relay 36P through a circuit closed from (B+), through a circuit including a lever 36SL in a left hand position, windings of relay 36P, back contact 300 of relay 36RR, to (CN). The response of the relay 36P closes front contact 301 which closes a stick circuit from (B+), through a circuit including lever 36SL in a left hand position, windings of relay 36P, front contact 301 of relay 36P, to (CN).

The picking up of the relay 36P tends to close a route circuit for the relay 36RR and 31RR in series, but this route circuit cannot be closed unless the thermal relay 31TR is in a normal deenergized position and the relay 31S is picked up. Thus, upon the restoration of the signal lever 31SL to a stop position and the actuation of the lever 36SL, the signal 36A can not be cleared until after the predetermined time measured by the relay 31TR.

Assuming that the relay 31S is picked up, as above described, and that the thermal relay 31TR has cooled to its normal position, then the route circuit for the relays 31RR and 36RR is closed from (+), through a circuit including front contact 255 of relay 36P, windings of relay 36RR, polar contact 254 of relay 21WP in a left hand position, front contact 253 of relay 21WP, windings of relay 31RR, back contact 252 of relay 31P, back contact 302 of relay 31TR, front contact 303 of relay 31S, to (—).

The response of the relay 36RR with the relay 36P picked up closes an energizing circuit for the relay 36AG dependent on traffic conditions in advance as repeated by the relay 36HD, the control of which is not shown but may be in accordance with the usual practice. This energizing circuit for the relay 36AG is closed from (+), through a circuit including front contact 304 of relay 36RR, front contact 305 of relay 36P, polar contact 306 of relay 36P in a left hand position, front contact 307 of relay 36HD, windings of relay 36AG, to (—). The picking up of contact 203 of relay 36AG deenergizes the stop indicator of the signal 36A and energizes the caution or clear indicator of the signal 36A depending upon the position of polar contact 308 of relay 36 HD in accordance with the usual control.

Let us consider that this train accepts the signal 33A and proceeds over the track sections 24, 23 and 22 to accept the signal 36A. The sections 22 and 23 may represent quite a distance so that the train in advancing in a west bound direction may be wholly located within the section 22. It might readily happen under such circumstances that the operator would desire to move a switching engine and its cars from section 27 to section 25.

All that is necessary to do in a case of this type is to put the lever 33SL at stop, reverse the track switch 24TS and actuate the signal lever 35SL to its proceed position. The signal 35 will then respond, in a manner analogous to the control already described, and allow the train to proceed on to track section 23 after which the signal lever 35SL is restored and the lever 32SL is actuated to clear the signal 32A. As the train switching movement onto the section 23 requires appreciable time, it is assumed that such time would be

greater than the time required to pick up the relay 33S and restore the relay 33TR to normal so that the picking up of the relay 32P closes a route circuit from (+), through circuit including front contact 267 of relay 32P, windings of relay 32RR, front contact 268 of relay 24WP, polar contact 269 of relay 24WP in a left hand position, windings of relay 33RR, back contact 279 of relay 33P, front contact 309 of relay 33S, back contact 310 of relay 33TR, to (—). The energization of the relays 32P and 32RR causes the signal 33A to be cleared by reason of an energizing circuit closed from (+), through a circuit including front contact 271 of relay 32RR, front contact 272 of relay 32P, front contact 273 of relay 32P in a right hand position, front contact 274 of relay 24T, front contact 275 of relay 24WP, polar contact 276 of relay 24WP in a normal position, front contact 311 of relay 32HD, windings of relay 32AG, to (—). The energization of relay 32AG and the opening of its back contact 206 causes the stop indicator of such signal 32A to be extinguished and such signal to indicate caution or proceed dependent upon polar contact 312 of relay 32HD which is controlled in accordance with traffic conditions in advance of such signal.

From the above it is apparent that with a train having passed into the sections 23 and 22 and in a west bound direction ready to accept the signal 36 and pass beyond it, the operator may clear the signal 35, which is a low speed signal independent of track circuit control, and allow a train to be switched into the section 23 and then move out into the section 25 all in response to signal control. It is to be understood in this connection that movements under signal control when such signals are of the type which may be termed call-on signals, that is, signals which are independent of track signal control, trains move under specific oral or written instructions, as well as signal indication, so that the acceptance of signal 35 does not mean that the train will necessarily follow the train which is to accept signal 36.

With reference to Figs. 2A and 2B and the above description, it will be seen that, when the signal 31A is cleared and a train accepts such signal, the signal 31A is put to stop as soon as the train enters the track section 21 deenergizing the track relay 21T by reason of opening front contact 260. The signal 31A is maintained at stop as the train passes through the sections 22, 23 and 24 by reason of the track relays 22T, 23T and 24T as repeated by the relay 24WS opening front contact 235. Similar control is effective for the opposite direction. Therefore, so long as a train is on any track section between signals 31A and signal 33A, the direction of traffic cannot be reversed with regard to the high speed signals, such as signals 31A and 33A. For example, as soon as a train enters the section 21 in response to signal 31A cleared, the front contact 225 of relay 21T maintains the relay 21ES deenergized irrespective of the return of the signal 31A to stop. As front contact 281 of relay 21ES is included in the energizing circuit for the relay 33HD, it is apparent that the signal 33A could not be cleared as the front contact 287 of 33HD cannot be closed under such circumstances.

In brief, the directional stick relays 21ES serve to repeat the track relays both for the purpose of controlling the HD circuits and for the purpose of providing rear release locking for the track switches, which latter feature has not been disclosed in detail in this application, but it may be considered as a possible adjunct of the present disclosure in accordance with the present invention.

Also, from the above it will be apparent that it is necessary to have the direction lever DR operated in a direction corresponding to that direction in which traffic is to enter sections 22 and 23, but the lever DR does not have to be in a position corresponding to the direction in which trains are leaving such sections.

Opposing call-on signal movements.—In accordance with the present invention, call-on signals are provided which are controllable by the operator independently of track circuit conditions but such call-on signals are made subject to the traffic direction lever DR. In order to best understand how the call-on signals are particularly useful as well as the manner in which they are made subject to the traffic direction lever, a particular set of circumstances best brings out the situation.

Let us assume that a train, that is, a car or two is standing upon the track section 22 and a switching engine desires to connect with such cars in order to take them into another part of the interlocking plant, and that such switching engine comes from the track section 20. Also, at the same time the operator desires to move a switching engine from the track section 25 onto the section 23 and from thence into the section 27.

Inasmuch as there is a train standing on the section 22, the signal 31A cannot be cleared so it is necessary for the operator to clear the call-on signal 31C. He operates the lever 31SL to a left hand dotted line position which closes energizing circuit for relay 31P from (B—), through a circuit including lever 31SL in a left hand position, windings of relay 31P, back contact 250 of relay 31RR, to (CN). The response of the relay 31P closes front contact 251 completing a stick circuit. The current which flows in the pick up and stick circuits of the relay 31P causes its polar contacts to be operated to left hand positions.

As soon as the relay 31P responds, it tends to close a circuit for the relays 31RR nad 36RR in series, but it is apparent that such circuit is dependent on the polar contact 256 of relay EF. This means that the direction lever DR must have been operated to a right hand position. This allows the relays 31RR and 36RR to be energized through a circuit previously pointed out.

With relays 31P and 31RR picked up an energizing circuit is closed from (+), through a circuit including front contact 257 of relay 31RR, front contact 258 of relay 31P, polar contact 259 of relay 31P in a left hand position, windings of relay 31CG, to (—). The energization of relay 31CG opens back contact 202 and closes front contact 202 which causes the stop indicator of call-on signal 31C to be extinguished and the proceed indicator to be illuminated.

The engine then moves past the signal 31C to couple with the train standing on the section 22. The clearing of such signal 31C causes the relay 31S to drop by the opening of contact 213, so that, when the operator puts the lever 31SL to stop and actuates the lever 36SL to the right, the signal 36A will clear only after lever 31SL has been at stop for a predetermined period of time, as measured by the thermal relay 31TR. The clearing of signal 36A allows the

switching engine and train to which it is now coupled to move westward.

While the lever 31SL is in a clear position energizing the relays 31RR and 36RR in series, the directional lever DR may be operated to the left but does not effect the opposite energization of relays EF and WF by reason of open contact 228. However, as soon as the lever 31SL is put to stop, the contact 228 closes and allows the reversal of relays EF and WF, as will also the picking up of the relay 36P and closure of front contact 229.

Assuming that the train on the section 22 has not yet moved, and either back contacts 228 and 229 are both closed or front contact 229 is closed. Then the relays EF and WF have responded to the operation of lever DR to the left so that the signal 33C may be cleared by the actuation of the lever 33SL to the right. Under these circumstances, the signal 33A cannot be cleared at this time with the train on section 22, as the deenergization of track relay 22T opens contacts 239 and 242 which deenergizes the relay 33HD although the polar contacts of the relays EF and WF are in left hand positions. Thus, the operator moves lever 33SL to the right closing a pick up circuit for the relay 33P by applying (B—). The response of relay 33P closes a route circuit for relays 33RR and 32RR in series which is completed as the polar contact 280 is in a left hand position.

With both the relays 33RR and 33P picked up, the relay 33CG is energized by a circuit closed from (+), through front contact 283 of relay 33RR, front contact 284 of relay 33P, polar contact 285 of relay 33P in a right hand position, windings of relay 33CG, to (—). The energization of relay 33G causes the signal 33C to be cleared and the train can then pass onto the section 23.

When the train has passed the signal 33C the lever 33SL may be put to stop and after the train passes the track switch 24TS, it may be reversed and the signal 32A may be cleared as previously described without the actuation of the direction lever DR.

From this it is apparent that two trains may be moved in opposing directions into a traffic section such as sections 22 and 23 under call-on signals only when the traffic direction lever DR is operated in accordance therewith, and even then the call-on signal can be cleared for only one direction at a time.

Fig. 4 illustrates the directional control circuit for relays EF and WF of Figs. 2A and 2B in a modified form in which such circuit is rendered subject to track circuit control and to the time release control provided for the signals which govern the entrance of trains into the associated traffic section.

The directional lever DR as well as the various relays illustrated in Figs. 2A and 2B have been given the same reference characters in this Fig. 4 with the only new reference characters being those of the additional contacts employed. For example, the track relays 22T and 23T are illustrated as having front contacts 401 and 402 respectively included in the circuit for relays EF and WF. Likewise, the relays 21ES and 24WS have front contacts 403 and 404 respectively included in the circuit for relays EF and WF.

With this arrangement, whenever a train is on either or both of the track circuits 22 and 23, the direction of traffic in such section cannot be reversed. For example, if an east bound train has entered the traffic section the entering signals governing such train cannot be put to stop followed by the clearing of the entering signals for a west bound train. This is true both for the high speed signals and for the call-on signals. In Figs. 2A and 2B such track circuit locking was provided with respect to the high speed signals but not with respect to the call-on signals. The reason for this is apparent inasmuch as with a train on either or both of the track circuits 22 and 23, either or both of the front contacts 401 or 402 are opened which prevents the reversal of the contacts of the relays EF and WF by the directional lever DR.

In Figs. 2A and 2B the direction of traffic was not permitted to be reversed in sections 22 and 23 except after a predetermined time in the control of the high speed entering signals, but such time release control was not included in the control of the call-on signals. In this Fig. 4 where the contacts 403 and 404 of the relays 21ES and 24WS are included in the circuit for relays EF and WF, such relays EF and WF cannot be reversed or actuated to opposite positions except after the predetermined times measured by the relays 31TR and 33TR as such timing control is in the control of the relays 21ES and 24WS respectively, as heretofore pointed out. As relays EF and WF control both high speed and call-on signals, both types of signals are therefore subject to the same control.

Thus, Fig. 4 furnishes a modification of Figs. 2A and 2B in which the direction of traffic cannot be reversed except after a predetermined time for all types of signals. Also, track circuit locking is provided in which the reversal of traffic direction in a check locking section is positively prevented so that two trains cannot enter such sections in opposite directions under any circumstances whatsoever.

Summary

An interlocking system has therefore been provided in accordance with the present invention which discloses the manner that two interlocked groups may be interconnected both for situations where the interconnecting traffic section is of very short distance and where the interconnecting section is of considerable length.

In the first case, the present invention illustrates the manner in which the time element release for the traffic locking within such traffic section provides both for the release of the section within the same interlocked group and for the release of the adjacent interlocked group up to the opposing signal in such adjacent interlocked group.

In the second case, the present invention illustrates the manner in which a traffic lever is employed to register the potential traffic direction last established in the interconnecting traffic section with the control resulting from such lever so organized that the operation of the lever is required for the entrance of traffic into the section but is not required for the exit of traffic from such section. Also, the operation of the traffic lever, after a signal has once been cleared dependent upon the traffic lever, is ineffective to disturb such cleared signal.

The time release for one interlocked group is not only effective to prevent a reversal of traffic direction within its group until after a predetermined time but also is effective in the next adjacent group with respect to the high speed signals (see Figs. 2A and 2B). The call-on sig-

nals are controllable independently of the time control with regard to separated interlocked groups, but such call-on signals within any one group are also dependent upon the time release means (see Figs. 2A and 2B). However, in Fig. 4 the call-on signals are also subject to time release for reversal of traffic direction.

It is therefore believed that the present invention has clearly set forth a new and novel manner in which traffic locking may be accomplished and which time release means may be employed therewith where all operating controls originate in a single central control office.

Having thus described an interlocking system as one specific embodiment of the present invention, it is to be understood that various modifications, adaptations, and alterations may be applied to meet the requirements of practice without in any manner departing from the spirit or scope of the invention except as limited by the appended claims.

What I claim is:

1. In a traffic controlling system for railroads, a stretch of trackway, a signal at each end of said stretch for governing the entrance of traffic into said stretch from that end, a signal control lever for each of said signals, means governed by each of said control levers for at times clearing its respective signal, a directional control lever associated with said stretch, means allowing each signal control lever to initially clear its respective signal only provided said directional control lever is operated to a position corresponding to the direction governed by its respective signal, and means allowing each signal control lever to maintain its respective signal cleared independently of said directional control lever.

2. In a traffic controlling system for railroads, a stretch of trackway, a signal at each end of said stretch for governing the entrance of traffic into said stretch from that end, a signal control lever for each of said signals, means governed by each of said control levers for clearing its respective signal, a directional control lever associated with said stretch and having two positions corresponding to opposite directions of traffic in said stretch, a polarized directional control circuit having current flowing in one direction or the other depending upon the position of said directional control lever, relay means in said polarized directional control circuit distinctively responsive to the direction of current flow therein, means allowing each signal control lever to initially clear its respective signal only when said relay means has distinctively responded to a direction of current flow corresponding to the direction of traffic governed by its respective signal and for maintaining such signal in its clear condition when once cleared irrespective of the condition of such relay means, and means opening said polarized directional control circuit when one of said signals is cleared, whereby each signal control lever can maintain its respective signal clear independently of said directional control lever and whereby said relay means cannot be changed while a signal is clear.

3. In a traffic controlling system for railroads, a stretch of trackway, a signal at each end of said stretch for governing the entrance of traffic into said stretch from that end, a signal control lever for each of said signals and having clearing and stop positions, a traffic direction lever associated with said stretch and having two positions corresponding to the opposite directions of traffic in said stretch, means causing each signal control lever to clear its respective signal when such lever is in a clearing position only provided said traffic direction lever is in a position corresponding to the direction of traffic governed by such signal, and means allowing either of said signals to be responsive to its said signal control lever and said traffic direction lever only a predetermined time after the signal control lever for the other of said signals has been put to a stop position.

4. In a traffic controlling system for railroads, a stretch of railroad track divided into two sections, first and second signals for governing the entrance of traffic into said sections respectively in one direction, a third signal for governing the entrance of traffic into said sections in the opposite direction, a separate signal control lever for each of said signals with each of said levers provided with clear and stop positions, means associated with each of said levers and its respective signal for clearing such signal when said lever is in its clear position, interlocking means for allowing said signals to be cleared for only one direction at a time, and means allowing said first and second signals to be cleared in response to their respective levers only a predetermined time after said lever for said third signal has been put to its stop position.

5. In a traffic controlling system for railroads, a stretch of trackway, a signal at each end of said stretch for governing the entrance of traffic into said stretch from that end, a signal control lever for each of said signals, means governed by each of said control levers for clearing its respecetive signal, a directional control lever associated with said stretch and having two positions corresponding to the opposite directions of traffic in said stretch, directional relay means operable to either of two conditions corresponding to opposite directions of traffic through said stretch, means allowing each signal control lever to initially clear its respective signal only when said directional relay means assumes a condition corresponding to the direction of traffic governed by the signal for that lever, means causing said directional relay means to assume one or the other of its two conditions in accordance with the position of said directional control lever only when said signals are at stop and said stretch of track is unoccupied by traffic.

6. In a traffic controlling system for railroads, a stretch of railroad track including a track switch, signals governing the entrance of traffic into said stretch in both directions, a control lever for each of said signals, means governed by each of said control levers for clearing its respective signal, interlocking means for allowing only one direction of traffic to be established in said stretch at the same time, releasing means allowing said track switch to be operated only a predetermined time after said signals have been put to stop irrespective of the presence of a train approaching such signal, and means including said releasing means for allowing the direction of traffic to be reversed in said stretch only after said predetermined time.

7. In a traffic controlling system for railroads, a stretch of railroad track, signals governing the entrance of traffic into said stretch in both directions, an individual control lever for each of said signals, means governed by each of said control levers for clearing its respective signal, interlocking means for allowing said signals to be cleared for only one direction at a time, timing means for said signals, means for setting said timing means into operation to measure a predetermined time whenever a signal is returned to

stop from a clear condition, and means effective through the medium of said interlocking means to prevent the clearing of each signal in response to its respective control lever until after the other signal has been put to stop for the predetermined time measured by said timing means.

8. In a traffic controlling system for railroads, a stretch of railroad track, first and second signals for governing the entrance and exit of traffic into and from said stretch respectively in one direction, a third signal for governing the entrance of traffic into said stretch in the opposite direction, a separate signal control lever for each of said signals, signal control means governed by each of said levers for clearing its respective signal, interlocking circuit means for allowing said signal control means to clear the signals for only one direction at a time, and timing means automatically controlled by said signal control means for said third signal for allowing said first and second signals to be cleared in response to their respective levers only a predetermined time after said third signal has been put to stop.

9. In a traffic controlling system for railroads, a stretch of railway track, signals for governing the entrance of traffic in both directions over said stretch of track, an individual control lever for each of said signals, means governed by each of said control levers for clearing its respective signal when actuated, a directional control lever associated with said stretch of track, means allowing the response of one of said entering signals to its respective control lever only provided the other of said entering signals is at stop and said directional control lever has been operated to a position corresponding to the direction of traffic governed by said one entering signal while said stretch of track is unoccupied by a train, and means preventing the operation of said directional control lever from interrupting a cleared entering signal.

10. In a traffic controlling system for railroads, a stretch of railway track, signals for governing the entrance and exit of traffic in both directions over said stretch of track, an individual control lever for each of said signals, means governed by each of said control levers for clearing its respective signal when actuated, a directional control lever associated with said stretch of track, means allowing the response of each one of said entering signals to its respective control lever only provided the other of said entering signals is at stop and said directional control lever has been operated to a position corresponding to the direction of traffic governed by said one entering signal while said stretch of track is unoccupied by a train, means allowing the response of said leaving signals to their respective control levers only provided the entering signal for the corresponding end of said stretch of track is at stop, said means acting independently of said directional control lever, and means preventing the operation of said directional control lever from interrupting a cleared entering signal.

11. In an interlocking system for railroads; two interlocked groups, each group including a track switch and signals governing traffic in opposite directions with manual control means for each of said signals; a stretch of track interconnecting said two interlocked groups; a traffic direction control lever; and means for preventing the clearing of either of said opposing signals of said two interlocked groups in response to their respective manual control means when said track switches are positioned to allow the passage of traffic into said stretch of track if said traffic direction lever is not positioned for the same direction of train movement and if the opposing signal is cleared, said means acting to allow the contemporaneous clearing of the respective leaving signals for said stretch of said two interlocked groups in response to their respective manual control means irrespective of the position assumed by said traffic direction lever.

12. In an interlocking system for railroads; two interlocked groups, each group including a track switch, signals governing traffic in opposite directions over said track switch, a route circuit for each route over said track switch and associated with said signals governing traffic over the corresponding route, manual control means for each signal, means for energizing a particular route circuit in response to the actuation of the manual control means for a signal governing traffic in one direction over the corresponding route only when the manual control means for the signal governing traffic in the opposite direction over such route is at stop, means for clearing each signal in response to its said manual control means only when its associated route circuit is energized; a stretch of track interconnecting said two interlocked groups; a directional control lever for said stretch of track; and means preventing the energization of a route circuit in one of said groups in response to the actuation of said manual control means for the signal in that group governing traffic over the corresponding route into said stretch of track unless said directional control lever has been operated to a proper position for the direction of traffic governed by said manual control means while the corresponding route circuit of the other group is deenergized or is energized by the actuation of the manual control means for the signal in that other group for establishing the same direction of traffic in such other group as the said signal of the said one group.

13. In combination with a stretch of railway track including a plurality of track sections, a track relay for each section, two signals including one at each end of the stretch for governing the movement of traffic in opposite directions into the stretch, a signal relay and a manually controllable signal control relay for each signal, a manually controllable traffic direction relay for each direction, and an energizing circuit for each signal relay controlled by front contacts of the associated signal control relay and of the traffic direction relay for the corresponding direction and by front contacts of each of said track relays.

14. In combination, a single track section connecting two multiple track portions, a signal at each end of said section for governing the movement of traffic into said section, a stick relay for each of said signals, a manually operable contact for each stick relay, a pick-up circuit for each stick relay including its manually operable contact and a back contact of the other stick relay, a holding circuit for each stick relay including its own front contact and its manually controlled contact, and a control circuit for each of said signals at times controlled by its corresponding stick relay.

15. In combination, a single track section connecting two multiple track portions, two signals including one at each end of said section for governing the movement of traffic into said sec-

tion, two directional relays each having an active and an inactive condition one of which when in its active condition permitting one of said signals to be cleared and the other of which when in its active condition permitting the other of said signals to be cleared, a direction lever, means for controlling a direction relay to an active condition by movement of said direction lever to a corresponding position only when said section is unoccupied but maintaining it in its then condition irrespective of the occupancy of said section, and separate manually controlled means for clearing one of said signals only if its direction relay is in its active condition and if said section is unoccupied.

16. In combination with a single track section connecting two groups of interlocked switches and signals, a plurality of signals at each end of said section for governing the movement of traffic into said section, two direction relays each having an active and an inactive condition one of which when active permitting clearing of signals at one end of said section and the other when active permitting clearing of signals at the other end of said section said direction relays being interconnected so that only one direction relay can be operated to its active condition at one time, a direction lever, means for controlling a direction relay to an active condition by movement of said direction lever to a corresponding position only when all of the plurality of signals at each end of said section are at stop but maintaining it in its then condition irrespective of the indicating condition of any of said plurality of signals, and separate manually controlled means for clearing one of said signals at one end of said section only if the direction relay for that direction of travel is in its active condition.

17. In combination with a single track section connecting two groups of interlocked switches and signals, a plurality of signals at each end of said section for governing the movement of traffic into said section, two direction relays each having an active and an inactive condition one of which when active permitting clearing of signals at one end of said section and the other when active permitting clearing of signals at the other end of said section said direction relays being interconnected so that only one direction relay can be operated to its active condition at one time, a direction lever, means for controlling a direction relay to an active condition by movement of said direction lever to a corresponding position only when all of the plurality of signals at each end of said section are at stop and said section is unoccupied but maintaining it in its then condition irrespective of the occupancy of said section or the indicating condition of any of said plurality of signals, and separate manually controlled means for clearing one of said signals at one end of said section only if the direction relay for that direction of travel is in its active condition and if said section is unoccupied.

18. In combination with a stretch of railway track, signals for governing the movement of traffic in both directions into said stretch, a first means manually operable only when the stretch is unoccupied and all said signals are at stop to control the direction of traffic movements into said stretch, and other manually operable means controlled from a distant point independently of said first means, both said manually operable means cooperating to control the direction of traffic into said stretch.

19. In a centralized traffic controlling 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, direction selecting means, signal control means for manually governing said signals from a remotely located control office in accordance with the condition of said direction selecting means, means for manually controlling said direction selecting means in accordance with the condition of said signals, and means controlled by said track relays for preventing a change in the condition of said direction selecting means when any portion of said stretch is occupied.

20. In an interlocking system for railroads; two interlocked groups, each group including a track switch and signals governing traffic in opposite directions over said track switch for that group; and control apparatus for each group comprising; a route circuit for each route over the track switch and including a route relay for each signal; a manually controlled means associated with each signal for applying potential of one polarity to one end of said route circuits of the routes over which the corresponding signal governs traffic, the route circuit supplied with said potential of one polarity upon the operation of the manual control means of a given signal governing traffic toward the other group being connected to potential of the other polarity through a back contact of the manually controlled means of the opposing signal of the corresponding group and including a back contact of a route relay in the other group belonging to a signal governing traffic in the same direction; and means for shunting said back contact of said route relay upon energization of the manual control means for said signal of said other group.

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