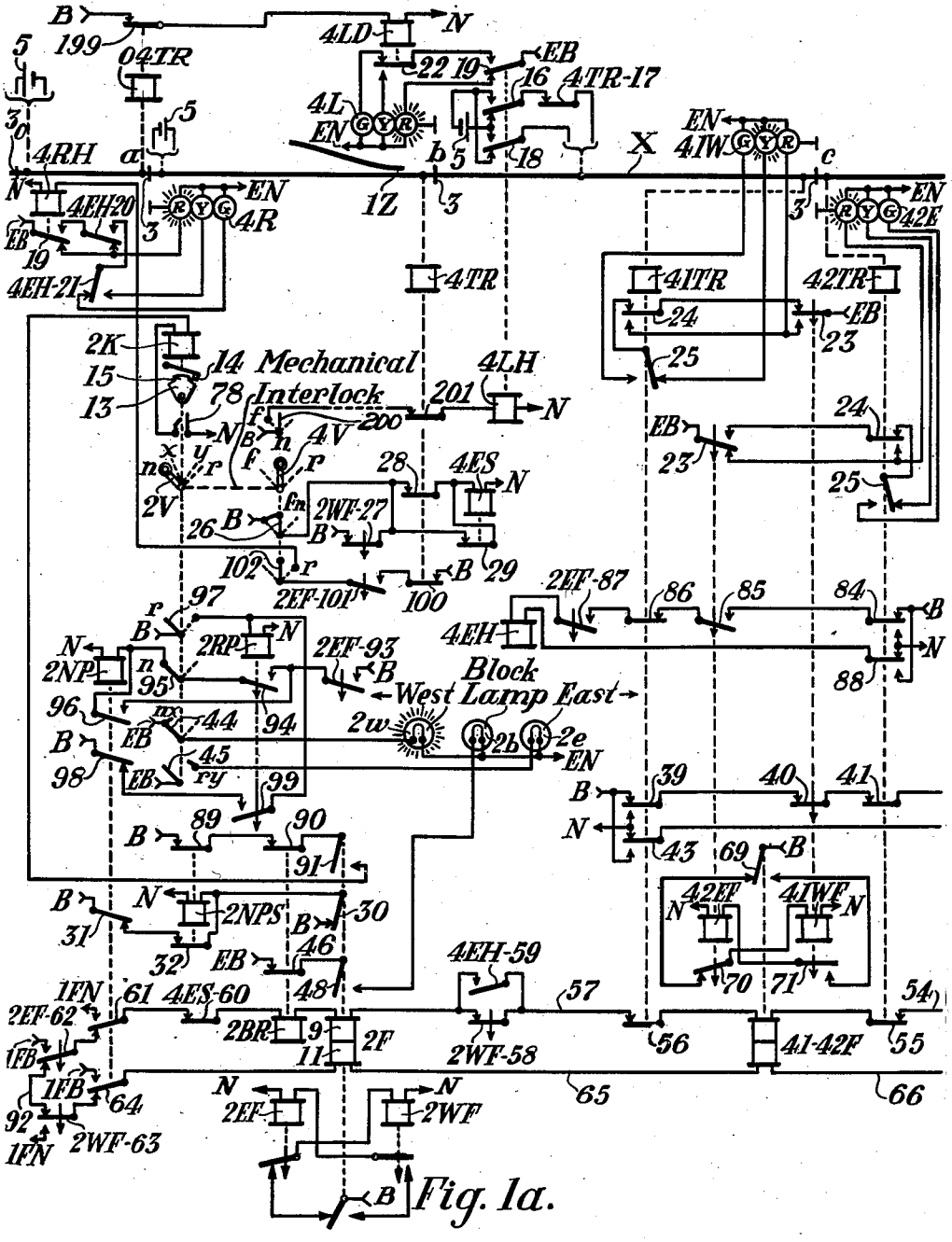
Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 1



INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 2

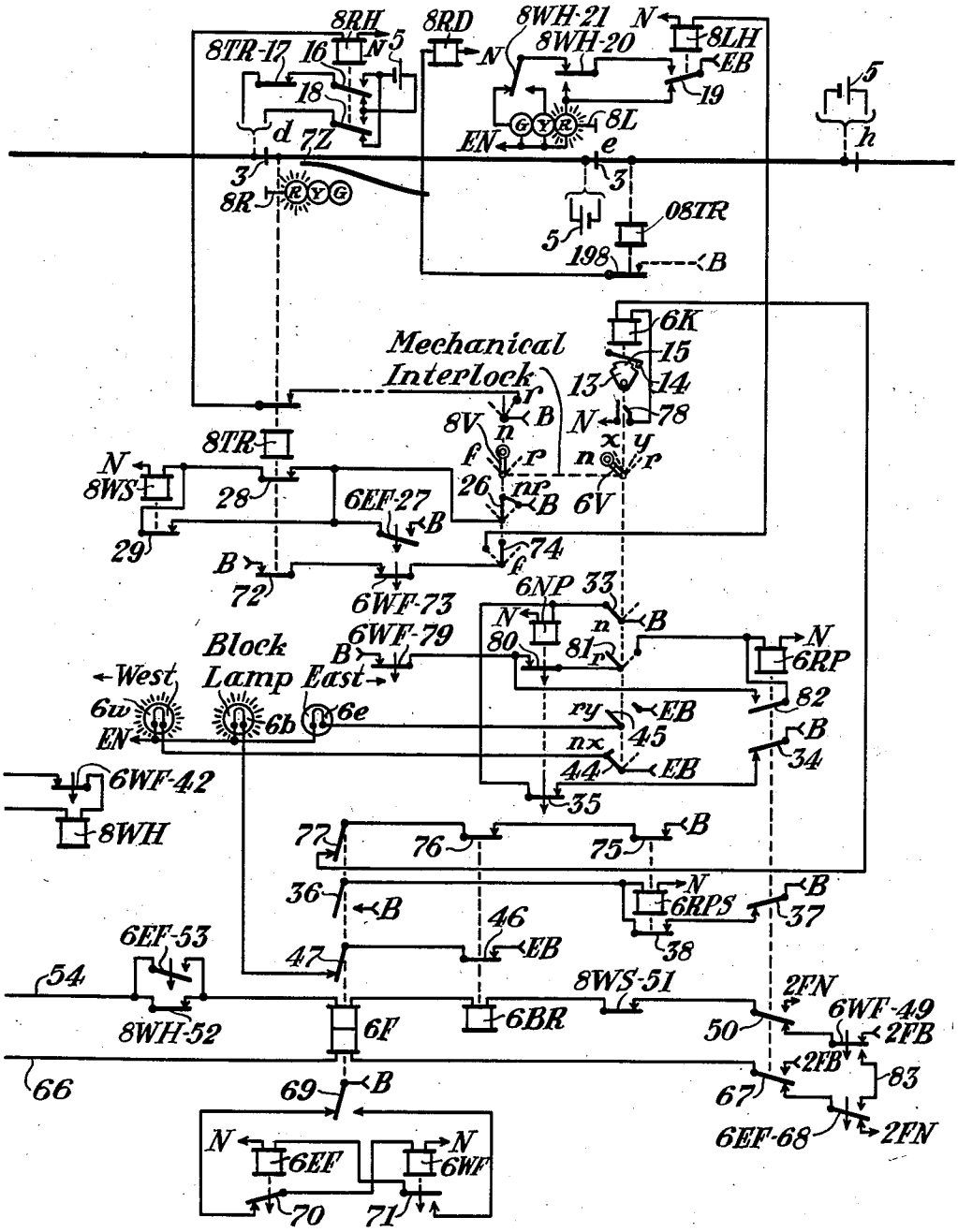


Fig. 1b.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 3

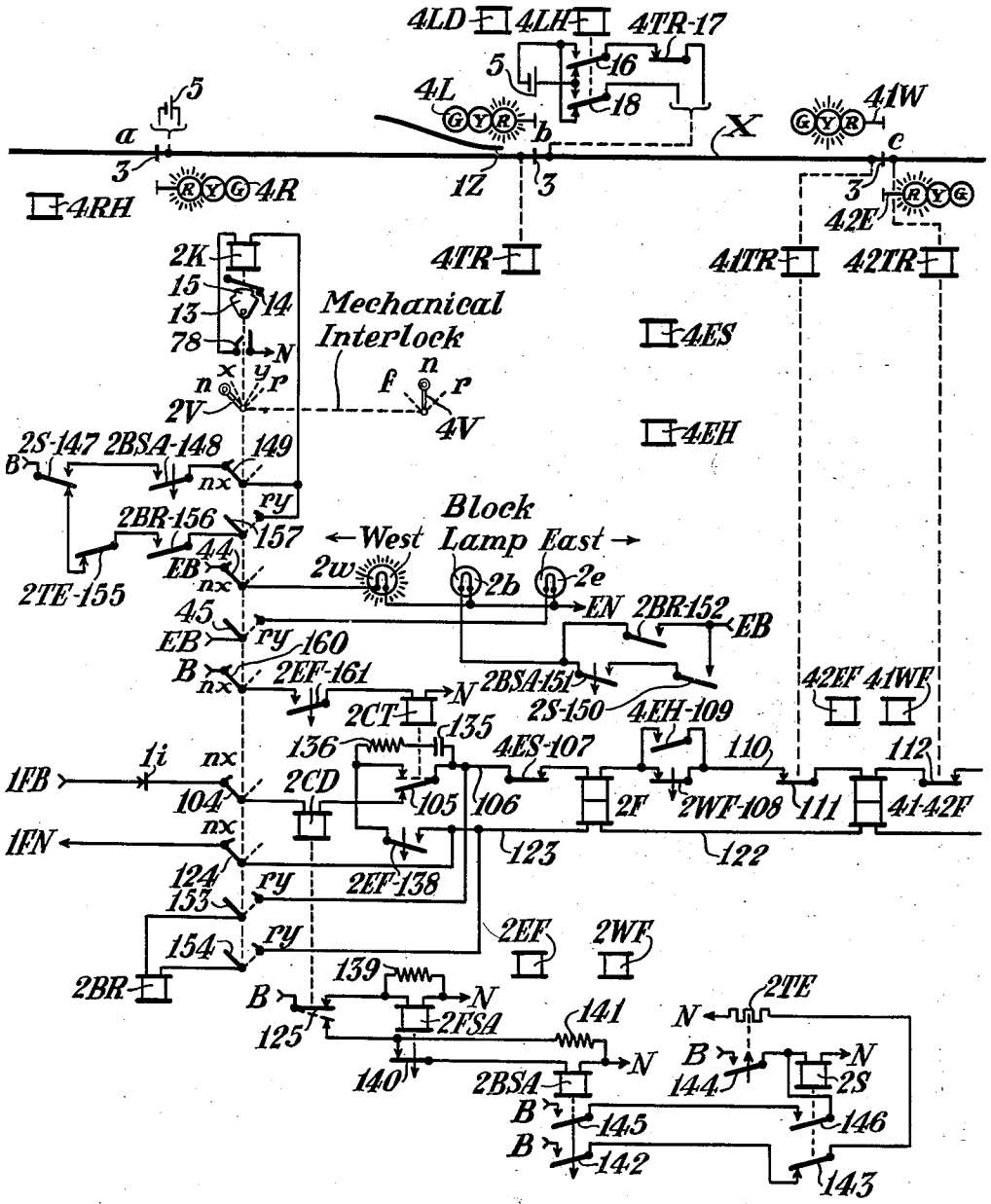


Fig. 2a.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 4

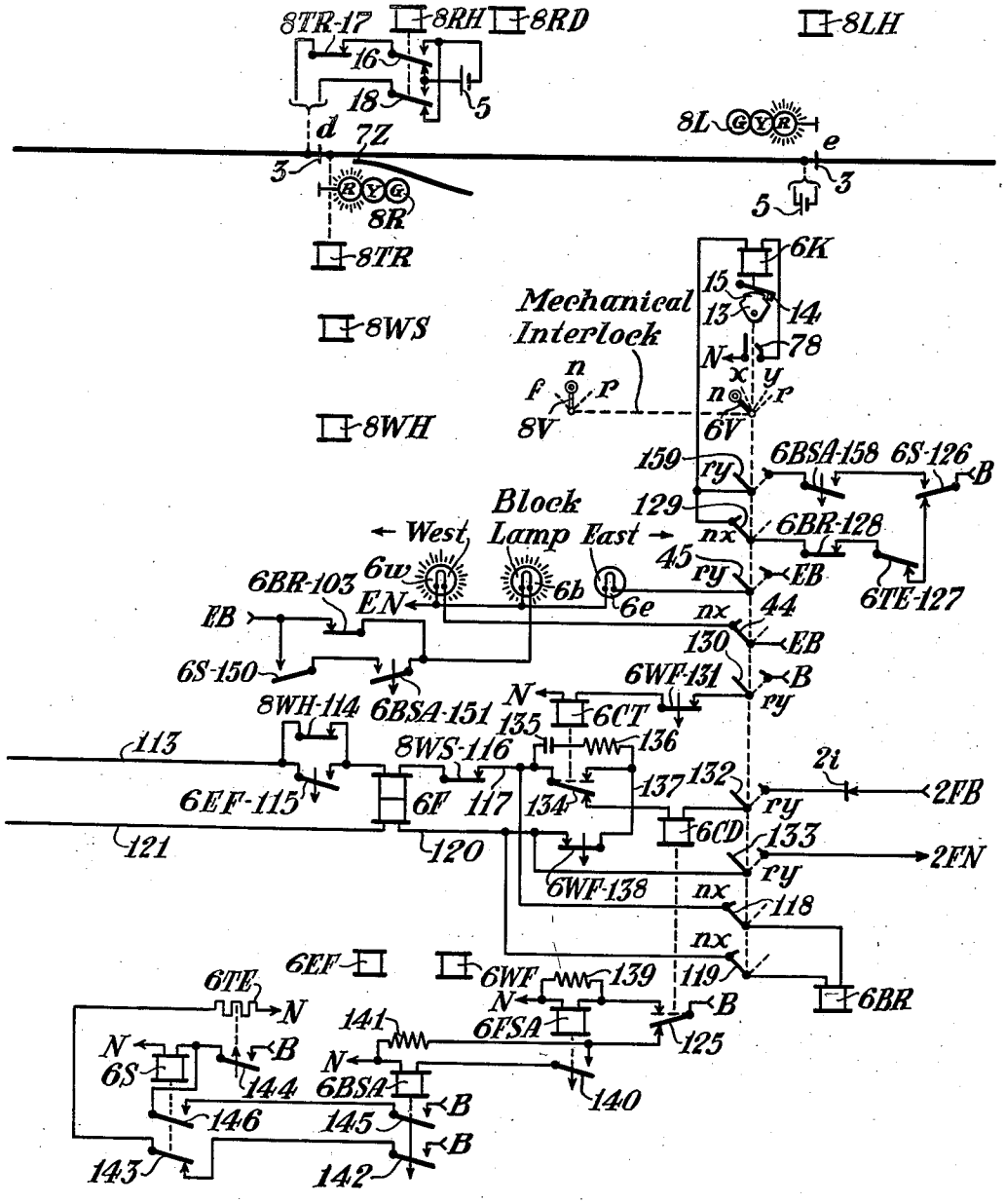


Fig. 2b.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 5

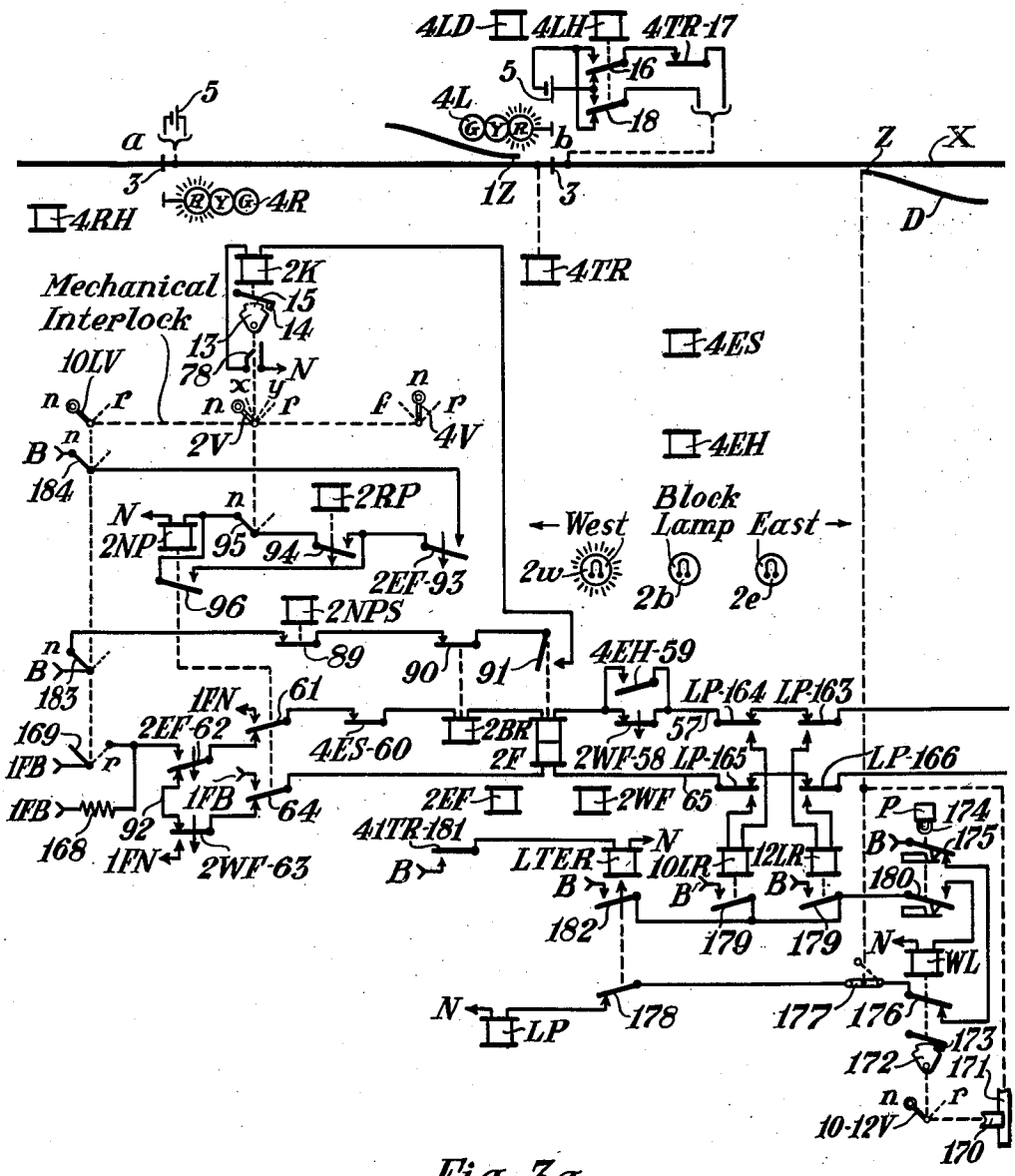


Fig. 3a.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 6

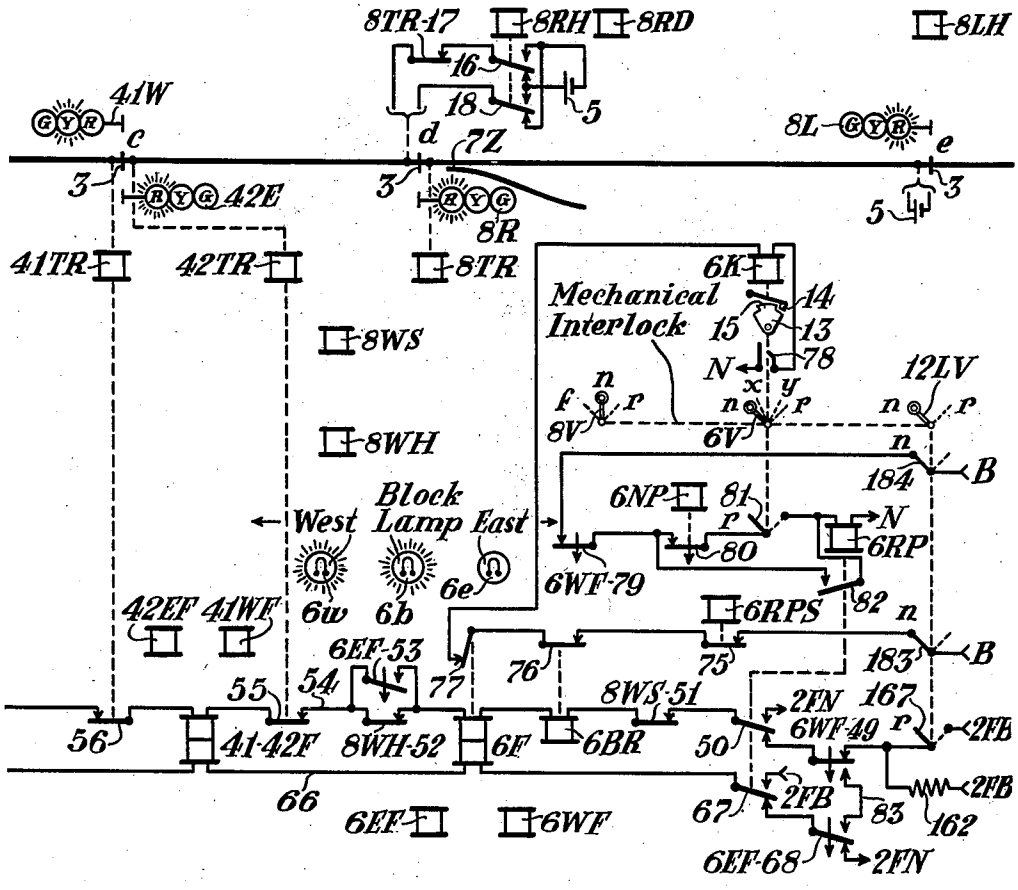


Fig. 3b.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 7

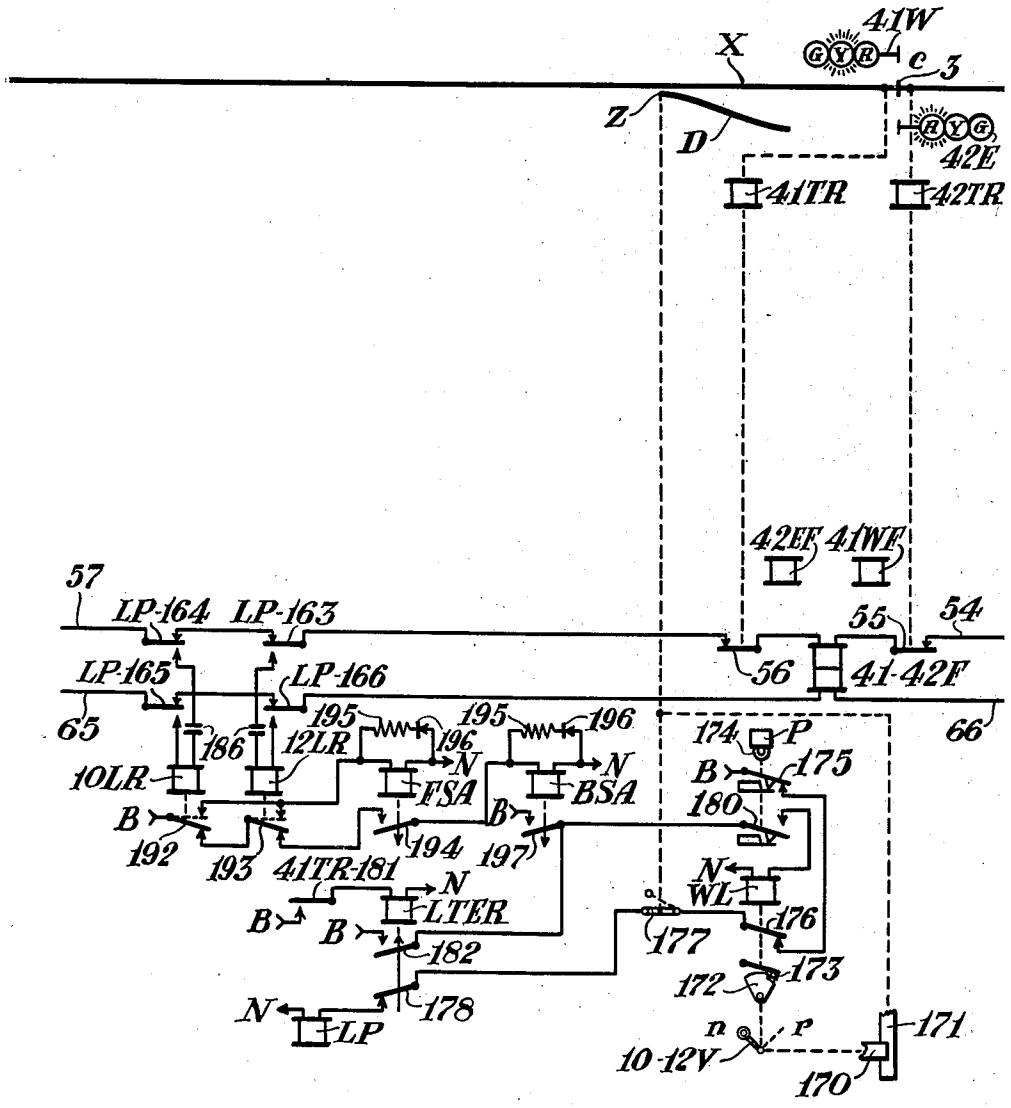


Fig. 4a.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Feb. 19, 1952 C. W. FAILOR 2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 28, 1947 8 Sheets-Sheet 8

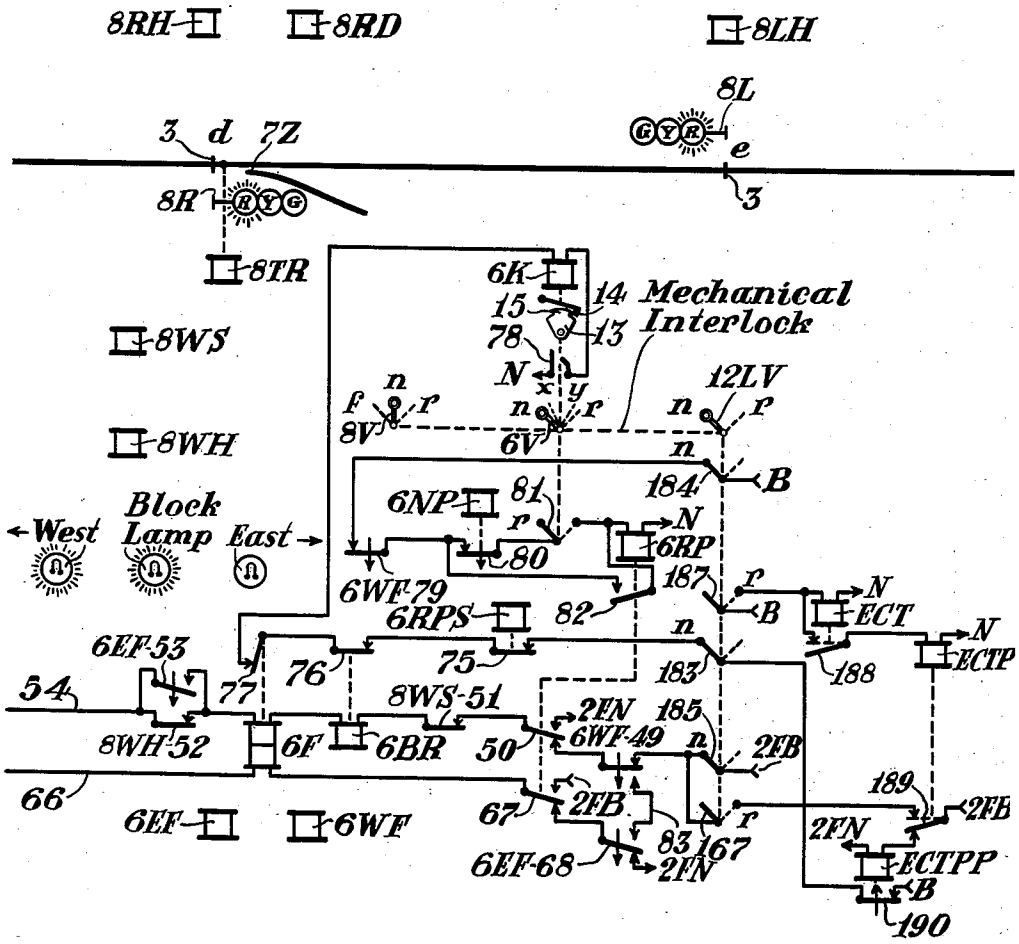


Fig. 4b.

INVENTOR.
Charles W. Failor
BY
HIS ATTORNEY

Patented Feb. 19, 1952

2,586,458

UNITED STATES PATENT OFFICE

2,586,458

RAILWAY TRAFFIC CONTROLLING APPARATUS

Charles W. Failor, Forest Hills, Pa., assignor to Westinghouse Air Brake Company, a corporation of Pennsylvania

Application November 28, 1947, Serial No. 788,586

18 Claims. (Cl. 246—26)

1

My invention relates to railway traffic controlling apparatus, and particularly to the type known as traffic locking apparatus which requires joint action by persons at two different control stations for manually controlling traffic movements in both directions over a stretch of railway track.

Each of the two control stations may be provided with an interlocking machine, and each of the interlocking machines may be equipped with a traffic lever which is mechanically interlocked with a signal lever which controls a signal for governing traffic movements into the corresponding end of the stretch of railway track.

One feature of my invention is the provision of novel and improved means for electrically controlling a traffic lever for each of such two control stations by the traffic lever at the other control station and by traffic conditions on the stretch of track.

Another feature of my invention is the provision of novel and improved means, including the traffic controlling apparatus of my invention, for controlling an electric lock for a track switch at an intermediate point in the stretch of track.

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

In the accompanying drawings, Figs. 1*a* and 1*b*, when placed side by side with Fig. 1*a* on the left, constitute a diagrammatic view showing one form of apparatus embodying my invention, in which polar stick traffic relays and traffic lever lock relays are controlled in series by traffic control circuits, and in which the traffic control circuits are controlled by normal and reverse stick relays controlled by the traffic levers in conjunction with normal and reverse contacts of the polar stick traffic relays; Figs. 2*a* and 2*b*, when placed side by side with Fig. 2*a* on the left, constitute a diagrammatic view showing a modified form of the apparatus of Figs. 1*a* and 1*b*, in which an electric lock for each of the traffic levers is controlled in part by code transmitting means at the opposite end of the stretch of track; Figs. 3*a* and 3*b*, when placed side by side with Fig. 3*a* on the left, constitute a diagrammatic view showing another modified form of the apparatus of Figs. 1*a* and 1*b*, by which an electric switch lock may be manually controlled from either end of the stretch of track over the traffic control circuits, or may be automatically controlled; and Figs. 4*a* and 4*b*, when placed side by side with Fig. 4*a* on the left, constitute a diagrammatic view

2

showing a modified form of the apparatus of Figs. 3*a* and 3*b* for energizing a switch lock control relay from one end or the other of the stretch of track by code controlled means.

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

In each of the views, contacts operated by the various relays or other devices are identified by numbers, such numbers having distinguishing prefixes from which they are separated by a dash when the contacts are shown apart from the relay from which they are operated. The prefix for each of these contact numbers comprises the reference character for the relay by which the contact is operated. For example, contact 2EF–87 in the control circuit for relay 4EH in the central portion of Fig. 1*a* is identified by the number 87 separated by a dash from the prefix 2EF which is the reference character for relay 2EF by which this contact is operated.

In order to simplify the drawings, each track, comprising two parallel series of track rails, is represented by a single line.

Referring first to Figs. 1*a* and 1*b*, a stretch of single track railway X is shown extending between two interlocking layouts, one of which includes a switch 1Z and signals 4L and 4R, and the other of which includes a switch 7Z and signals 8L and 8R. A pair of intermediate automatic signals 41W and 42E is located between these two interlocking layouts.

Track X is divided by insulated joints 3 to form sections *o—a*, *a—b*, *b—c*, *c—d*, *d—e* and *e—h*. Each of these track sections is provided with a track circuit including a suitable source of current, such as a battery 5, connected across the rails adjacent one end of the section, and a track relay, designated by the reference character TR with a distinguishing numerical prefix, connected across the rails adjacent the opposite end of the section. Relays 04TR, 4TR, 8TR and 08TR are of the neutral type, whereas relays 41TR and 42TR are of the polarized type.

Traffic movements toward the left, as shown in the drawings, which I shall assume is the westbound direction, are governed by signals 4L, 41W and 8L, whereas traffic movements in the opposite or eastbound direction are governed by signals 8R, 42E and 4R. These signals may be of any suitable design, such, for example, as the color light type, comprising a green or proceed lamp G, a yellow or caution lamp Y, and a red or stop lamp R as shown in the drawings.

Signal 4R is controlled by a neutral home relay 4RH and by a polarized signal relay 4EH. Relay

4RH is controlled by a signal lever 4V and by a reverse traffic repeater relay 2EF and by relay 4TR. Relay 4EH is controlled by pole-changing contacts of relay 42TR and also by relays 2EF and 41TR, and by a second reverse traffic repeater relay 42EF.

Signal 8L is controlled similarly to signal 4R by relays 8LH and 8WH which are controlled for westbound traffic movements similarly to the manner in which relays 4RH and 4EH are controlled for eastbound traffic movements.

Signal 4L is controlled by a home relay 4LH and by a distant relay 4LD. Relay 4LH may be controlled in part by lever 4V, as shown in Fig. 1*a*. Relay 4LD may be controlled in any suitable manner by traffic conditions west of signal 4L, and is shown controlled by a circuit which includes a contact 199 of a track relay 04TR.

Signal 8R is controlled similarly to signal 4L by relays 8RH and 8RD which may be controlled similarly to relays 4LH and 4LD respectively.

Each of the signal levers has a normal position *n*, a reverse position *f* to the left, as shown in the drawings, for controlling westbound signals and a reverse position *r* to the right for controlling eastbound signals.

Signal 41W is controlled by relay 41TR and by a normal traffic repeater relay 41WF. Signal 42E is controlled similarly to signal 41W by relay 42TR and by reverse traffic repeater relay 42EF.

A traffic lever 2V is provided in an interlocking machine for the interlocking layout at the west end of the stretch of track X, and a second traffic lever 6V is provided in a second interlocking machine for the interlocking layout at the east end of the stretch of track X. Each of the traffic levers 2V and 6V has a normal position *n* and a reverse position *r* and also a normal lock position *x* and a reverse lock position *y*.

Signal lever 8V is mechanically interlocked with traffic lever 6V in the interlocking machine for the east end of the stretch of track X, which I shall refer to hereinafter as the east interlocking machine, so that lever 6V must be in the normal position *n* before lever 8V can be moved to its reverse position *f* for clearing signal 8L, and lever 6V must remain in its position *n* while lever 8V is in its position *f*. Signal lever 4V is mechanically interlocked with traffic lever 2V in the interlocking machine for the west end of the stretch of track X, which I shall refer to hereinafter as the west interlocking machine, so that lever 2V must be in its *r* position before lever 4V can be moved to its reverse position *r* for clearing signal 4R, and lever 2V must remain in its reverse position *r* while lever 4V is in its reverse position *r*.

Lever 2V is provided with an electric lock comprising a lock segment 13 which is mechanically operated by lever 2V and a lock magnet 2K which controls a locking dog 14. When magnet 2K is deenergized, locking dog 14 engages a projection 15 on segment 13 if lever 2V is moved from its normal position *n* to its normal lock position *x* or from its reverse position *r* to its reverse lock position *y*, thus preventing movement of lever 2V from either of its extreme positions to the other unless magnet 2K is energized. Lever 6V is provided with an electric lock which is similar to the electric lock just described for lever 2V.

A latch contact 78, operated in conjunction with each of the traffic levers 2V and 6V, is normally open but becomes closed when the lever latch for its lever is operated preparatory to moving its lever from one of the extreme positions to the other.

Each of the traffic and signal levers operates a plurality of contacts, and the reference character placed beside each of these contacts indicates the position or positions of its lever in which the contact is closed. Contact 102 of lever 4V, for example, is closed only when lever 4V is in its *r* position, as indicated by reference character *r* adjacent contact 102, and contact 26 of lever 4V is closed only when lever 4V is in its *f* position or its *n* position or at any point between these two positions, as indicated by reference character *fn* adjacent contact 26.

An eastbound route locking relay 4ES is controlled by lever 4V and by a normal traffic repeater relay 2WF so that relay 4ES is deenergized when lever 4V is moved to its *r* position while relay 2WF is deenergized. A westbound route locking relay 8WS for the interlocking at the opposite end of the stretch is controlled for westbound traffic movements similarly to the manner in which relay 4ES is controlled for eastbound traffic movements.

A reverse stick relay 2RP, of the slow release type, has a pick-up circuit controlled by a reverse contact of lever 2V, and has a stick circuit controlled by a back contact of a normal stick relay 2NP. Relay 2NP has a pick-up and a stick circuit, both of which are controlled by reverse traffic repeater relay 2EF, and the pick-up circuit is also controlled by a normal contact of lever 2V and by a front contact of relay 2RP. A second normal stick relay 2NPS has a pick-up circuit controlled by a normal contact of a polar stick traffic relay 2F, and has a stick circuit controlled by a back contact of relay 2NP.

A normal stick relay 6NP, of the slow release type, for the interlocking at the opposite end of the stretch, has a pick-up circuit controlled by a normal contact of lever 6V, and has a stick circuit controlled by a back contact of reverse stick relay 6RP. Relay 6RP has a pick-up and a stick circuit, both of which are controlled by a normal traffic repeater relay 6WF, and the pick-up circuit is also controlled by relay 6NP and by a reverse contact of lever 6V. A second reverse stick relay 6RPS has a pick-up circuit controlled by a reverse contact of polar stick traffic relay 6F, and has a stick circuit controlled by a back contact of relay 6RP.

Normal and reverse or westbound and eastbound traffic lamps 2*w* and 2*e*, respectively, are controlled by *nx* and *ry* contacts of lever 2V in the interlocking for the west end of stretch of track X. A block lamp 2*b* is controlled by block indication or traffic lever lock relay 2BR and by a reverse polar contact of relay 2F. In the interlocking at the east end of stretch of track X, westbound and eastbound traffic lamps 6*w* and 6*e*, respectively, are controlled by *nx* and *ry* contacts, respectively, of lever 6V. Block lamp 6*b* is controlled by traffic lever lock relay 6BR and by a normal contact of polar stick traffic relay 6F.

A westbound traffic control circuit is supplied, at the east interlocking, with current from a source having terminals 2FB and 2FN, and includes the traffic lever lock relays 2BR and 6BR and polar stick traffic relays 2F, 41—42F and 6F all in series, and also includes two control conductors one of which is divided into sections such as sections 54 and 57 between signals 8R and 4L, and the other of which is also divided into sections such as sections 65 and 66 between signals 4L and 8R. The westbound traffic control circuit also includes a jumper wire 92 across the two control conductors at the west interlocking. The

eastbound traffic control circuit is similar to the westbound traffic control circuit except that it is supplied with current from a source having terminals 1FB and 1FN, at the west interlocking, and includes a jumper 83 across the control conductors at the east interlocking.

Traffic relays 2F, 41—42F and 6F are of the polar stick type each of which has two windings, such as windings 9 and 11 of relay 2F. When current passes from right to left in winding 9 and from left to right in winding 11, as shown in the drawings, the forces exerted by these two windings on the contacts of the relay are additive, so that the contacts are moved to a corresponding position, whereas if current flows in both windings from right to left or from left to right, the forces exerted by the two windings oppose each other, so that the contacts are not operated.

Lock magnet 2K is controlled by second normal stick relay 2NPS, by traffic lever lock relay 2BR, and by polar stick traffic relay 2F, and also by a latch contact operated in conjunction with lever 2V. Lock magnet 6K in the interlocking machine at the east end of the stretch of track X is controlled similarly to lock magnet 2K in the machine at the west end of the stretch, as just described.

Each of the polar stick traffic relays controls a slow release normal traffic repeater relay and a slow release reverse traffic repeater relay designated by the reference characters WF and EF, respectively with corresponding numerical prefixes.

Referring now to Figs. 2*a* and 2*b*, the track and signal layout here shown is the same as in Figs. 1*a* and 1*b*.

The westbound traffic control circuit, instead of being supplied with current at the east interlocking machine as in Figs. 1*a* and 1*b*, is here supplied with current of normal polarity from the source having terminals 1FB and 1FN at the west interlocking. The traffic control circuit here includes a code following relay 2CD instead of traffic lever lock relay 2BR for the west interlocking, and includes the back point of a contact of a code transmitting device 2CT.

In the form of apparatus shown in Figs. 2*a* and 2*b*, the normal and reverse stick relays employed in the form of apparatus shown in Figs. 1*a* and 1*b* are omitted.

In the westbound traffic control apparatus, lock magnet 6K is controlled by a circuit which includes an *nx* contact of lever 6V and a front contact of relay 6BR. Block lamp 6*b* is here normally lighted by a circuit which includes a front contact of relay 6BR.

In this form of apparatus, lever 6V, upon being moved to its *r* position, disconnects relay 6BR from the westbound traffic control circuit, and effects energization of a code transmitting device 6CT which periodically closes a path through a jumper 137 across conductors 117 and 120 of the westbound traffic control circuit. This causes relays 2CD, 2F, 41—42F and 6F to be periodically energized by current of normal polarity.

During the periods when the back point of contact 134 of code transmitting device 6CT is closed, the source of current at the west interlocking having terminals 1FB and 1FN is now opposed by the source at the east interlocking having terminals 2FB and 2FN, so that relays 2CD, 2F, 41—42F and 6F are deenergized. Asymmetric units 1*i* and 2*i* are provided at the west and east ends, respectively, of the traffic control circuits to prevent any flow of current due to difference in potential of the two sources of current at the times the two sources oppose each other.

Since relay 2F, 41—42F and 6F are of the polar stick type, their contacts will not be moved during periodic energization of these relays by current of normal polarity following previous constant energization by current of normal polarity. Relay 2CD, however, being of the code following type, follows code transmitter 6CT.

During the periods when the front point of the contact relay 2CD is closed, a decoding relay 2FSA is energized, and during the periods when the back point of the contact of relay 2CD is closed, a second decoding relay 2BSA is energized. A resistor is connected in multiple with the winding of each of the relays 2FSA and 2BSA in order to make these relays slow in releasing so as to retain their front contacts closed during the open periods in their control circuits while contact 125 of relay 2CD is being repeatedly operated.

A time element device 2TE is controlled by relay 2BSA, and a traffic lock stick relay 2S is controlled by time element device 2TE and by relay 2BSA. Traffic lever lock magnet 2K is controlled by front contacts of relays 2BSA and 2S, while lever 2V is in its normal position. Block lamp 2*b* is also controlled by relays 2S and 2BSA, and by relay 2BR.

The arrangement and operation of the eastbound traffic control circuit is similar to that just described for the westbound traffic control circuit. The eastbound traffic control circuit is supplied with current from terminals 2FB and 2FN at the east interlocking and includes a second code following relay 6CD. A second code transmitting device 2CT is here controlled by an *nx* contact of lever 2V and by a contact of reverse traffic repeater relay 2EF.

Referring next to Figs. 3*a* and 3*b*, the track and signal layout here shown is also the same as in Figs. 1*a* and 1*b* except that here a track switch Z is shown at an intermediate point in the stretch of track. Switch Z is provided with an electric switch lock having a lock magnet WL, and the traffic control circuits of Figs. 1*a* and 1*b* are here modified for controlling the electric switch lock for switch Z. A switch lock control lever 10LV is provided in the west interlocking machine, and a switch lock control lever 12LV is provided in the east interlocking machine, for controlling the electric lock for switch Z. Each of the switch lock control levers is interlocked with the signal lever for governing traffic movements onto its end of the stretch X so that, when either of the switch lock control levers is reversed, the signal lever controlling the signal for governing traffic movements onto the corresponding end of the stretch cannot be reversed.

The westbound traffic control circuit is here modified to include a resistor 162 and front points of contacts LP–163, LP–164, LP–165 and LP–166 of a switch repeater relay LP. The eastbound traffic control circuit is similarly modified to include a resistor 168 and the contacts of repeater relay LP.

A lock bar 171 is rigidly secured to switch Z for engagement with a dog 170 by means of which the switch may be locked in its normal position, in which it is shown in Fig. 3*a* of the drawings. Dog 170 is actuated by means of a manually operable switch lever which is designated by the reference character 10–12V, and which has

normal and reverse positions designated by the reference characters *n* and *r*, respectively.

Movement of lever 10–12V is controlled by lock magnet WL which has an armature provided with a dog 173 for engagement with notches in a lock segment 172. The armature of magnet WL also operates a back contact 176. Segment 172 is rigidly connected with lever 10–12V, and is therefore operated by lever 10–12V.

A contact 177, operated in conjunction with switch Z, is normally closed, but becomes opened when switch Z is reversed.

Contacts 175 and 180 associated with the switch lock may be operated in any suitable manner such, for example, as by the bow 174 of a padlock P for switch lock lever 10–12V. When padlock P is removed from the switch lock lever, contact 175 becomes opened and contact 180 becomes closed.

When contact 175, operated by bow 174 of padlock P, becomes opened, switch repeater relay LP becomes deenergized, and its contacts LP–163, LP–164, LP–165 and LP–166 in the traffic control circuits become opened at their front points, and become closed at their back points for connecting a high resistance switch lock control relay 10LR with conductors 57 and 65 of the west end of the traffic control circuits and for connecting a second high resistance switch lock control relay 12LR with the east end of the traffic control circuits.

If the westbound traffic control circuits has previously been closed, a circuit will now be closed which includes resistor 162 and the winding of relay 12LR. The apparatus is so proportioned that, when resistor 162 is connected in series with high resistance relay 12LR, the front contacts of relays 6BR and 12LR will be open. If switch lock control lever 12LV is now moved to its reverse position *r*, a circuit for traffic lever lock magnet 6K will be opened at a contact of lever 12LV, and resistor 162 will be by-passed by a reverse contact of lever 12LV, so that relay 12LR will now be energized sufficiently to close its front contacts for effecting energization of switch lock magnet WL.

Switch lock magnet WL may also be similarly controlled manually, by the switch lock control lever 10LV in the west interlocking machine, through high resistance switch lock control relay 10LR, or it may be controlled automatically through a time element device LTER, which may, for example, be a time element relay which is in turn controlled by a back contact of relay 41TR.

Referring finally to Figs. 4*a* and 4*b*, the form of apparatus shown in Figs. 3*a* and 3*b* is here modified to include a normal contact of one of the switch lock control levers in each of the traffic control circuits instead of including a resistor 162 or 168, and to control a code transmitting device by a reverse contact of each of the switch lock control levers. Code transmitter ECT is shown thus controlled by lever 12LV. A code repeating relay ECTP is in turn controlled by code transmitter ECT as well as by lever 12LV. A slow pick-up relay ECTPP is controlled by a back contact of relay ECTP, so that when relay ECTP is being repeatedly energized and deenergized, the front contacts of relay ECTPP will be open.

Switch lock control relays 10LR and 12LR are here of the code following type, and are connected through condensers 186 with the back points of the contacts of relay LP. If lever 12LV is moved to its *r* position when relay LP is deenergized while the westbound traffic control circuit is set up, relay 12LR will be energized by coded current for energizing slow releasing decoding relays FSA and BSA. Relay 10LR may be similarly controlled by lever 10LV for controlling relays FSA and BSA. Electric switch lock magnet WL is controlled by relay BSA.

Having described, in general, the arrangement and control of the apparatus shown by the accompanying drawings, I shall now describe, in detail, its operation.

As shown by the drawings, all parts are in the normal condition, that is, the normal or westbound traffic control circuits are arranged for westbound traffic movements; all signals except signal 41W are indicating stop; signal 41W is indicating caution; relays 4LH and 8RH are deenergized, and hence relays 41TR and 42TR, respectively, are energized by current of reverse polarity; the signal levers, traffic levers and switch lock control levers are in their normal or *n* positions; electric locks for the traffic levers are deenergized; the polar stick traffic relays are energized by current of normal polarity; relay 8WH is energized by current of normal polarity; route locking relays 4ES and 8WS, first normal stick relay 6NP, second normal stick relay 2NPS, second reverse stick relay 6RPS, normal traffic repeater relays 2WF, 41WF and 6WF, distant signal relays 4LD and 8RD, and traffic lever lock relays 2BR and 6BR in Figs. 1*a*, 1*b*, 3*a*, 3*b* 4*a* and 4*b* are energized; relays 2CD, 2FSA and 6BR in Figs. 2*a* and 2*b* are energized; relays LP in Figs. 3*a*, 3*b*, 4*a* and 4*b* are energized; relay ECTPP in Fig. 4*b* is energized; relays 4LH, 4RH, 4EH, 8RH, 8LH, first reverse stick relays 2RP and 6RP, first normal stick relay 2NP, and reverse traffic repeater relays 2EF, 42EF and 6EF are deenergized; relays 2BSA, 6BSA, 6FSA, 2S and 6S, and code transmitters 2CT and 6CT in Figs. 2*a* and 2*b* are deenergized; relays 10LR, 12LR and LTER, and switch lock magnet WL in Figs. 3*a* and 4*a* are deenergized; relays FSA, BSA and ECTP, and code transmitter ECT in Figs. 4*a* and 4*b* are deenergized; normal or westbound traffic lamps 2*w* and 6*w* and block lamp 6*b* are lighted; and reverse or eastbound traffic lamps 2*e* and 6*e* and block lamp 2*b* are unlighted.

In Figs. 1*a* and 1*b* the circuit by which relay 41TR is energized by current of reverse polarity passes from the positive terminal of a battery 5, through the back point of contact 18 of relay 4LH, one of the rails of section *b*—*c*, winding of relay 41TR, the other rail of section *b*—*c*, contact 4TR–17, and back point of contact 16 of relay 4LH back to battery 5. Relay 42TR is energized by a similar circuit.

Lamp R of signal 4R is lighted by a circuit passing from terminal EB of a suitable source of lighting current, through the back point of contact 19 of relay 4RH, and lamp R of signal 4R to terminal EN of the same source of current. Lamps R of signals 4L, 8R and 8L are lighted by circuits which are similar to the circuit just traced for lamp R of signal 4R.

Lamp R of signal 42E is lighted by a circuit passing from terminal EB, through the back point of contact 23 of relay 42EF, and lamp R of signal 42E to terminal EN. Lamp Y of signal 41W is lighted by a circuit passing from terminal EB, through the front point of contact 23 of relay 41WF, front point of contact 24 of relay 41TR, contact 25 of relay 41TR closed in the re-

verse position, and lamp Y of signal 41W to terminal EN.

Two pick-up circuits for relay 4ES are closed, one of which passes from terminal B of a suitable source of current, through contact 26 of lever 4V, and the other of which passes from terminal B, through contact 2WF–27, and both of which then pass through contact 28 of relay 4TR, and the winding of relay 4ES to terminal N of the same source of current. Two stick circuits for relay 4ES are also closed which are the same as the pick-up circuits just traced except that they include contact 29 of relay 4ES instead of contact 28 of relay 4TR.

One of the pick-up circuits for relay 8WS is closed, passing from terminal B, through contact 26 of lever 8V, contact 28 of relay 8TR, and winding of relay 8WS to terminal N. One of the stick circuits for relay 8WS is also closed, and is the same as the pick-up circuit just traced except that it includes contact 29 of relay 8WS instead of contact 28 of relay 8TR.

The pick-up circuit for relay 2NPS is closed, passing from terminal B, through contact 30 of relay 2F, and the winding of relay 2NPS to terminal N. A stick circuit is also closed for relay 2NPS, passing from terminal B, through contact 31 of relay 2NP, contact 32 of relay 2NPS, and the winding of relay 2NPS to terminal N.

Both a pick-up and a stick circuit for relay 6NP are closed, the pick-up circuit passing from terminal B, through contact 33 of lever 6V, and the winding of relay 6NP to terminal N. The stick circuit for relay 6NP passes from terminal B, through contact 34 of relay 6RP, contact 35 of relay 6NP, and the winding of relay 6NP to terminal N.

Relay 6RPS is energized by a stick circuit, passing from terminal B, through contact 37 of relay 6RP, contact 38 of relay 6RPS, and the winding of relay 6RPS to terminal N.

Relay 8WH is energized by current of normal polarity in a circuit passing from terminal B, through the front point of contact 39 of relay 41TR, contact 40 of relay 41WF, contact 41 of relay 42TR, contact 6WF–42, winding of relay 8WH, and the front point of contact 43 of relay 41TR, to terminal N.

Relay 8RD is energized by its circuit which includes contact 198 of relay 08TR. Relay 4LD is energized by its circuit which includes contact 199 of relay 04TR.

Both of the normal or westbound traffic lamps 6*w* and 2*w* are lighted. The circuit for lamp 6*w* passes from terminal EB, through contact 44 of lever 6V, and lamp 6*w* to terminal EN. The circuit by which lamp 2*w* is lighted is similar to the circuit just traced for lamp 6*w*.

Block lamp 6*b* is also lighted by a circuit passing from terminal EB, through contact 46 of relay 6BR, contact 47 of relay 6F, and lamp 6*b* to terminal EN. Lamp 6*b*, being lighted, indicates to the leverman in the east interlocking plant that the block is unoccupied between signals 8L and 4R and that lever 6V can be moved to its *r* position.

The westbound traffic control circuit is closed, passing from terminal 2FB, through the front point of contact 6WF–49, back point of contact 50 of relay 6RP, contact 8WS–51, winding of relay 6BR, upper winding of relay 6F, contact 8WH–52, conductor 54, contact 55 of relay 42TR, upper winding of relay 41—42F, contact 56 of relay 41TR, conductor 57, contact 2WF–58, upper winding 9 of relay 2F, winding of relay 2BR, contact 4ES–60, back point of contact 61 of relay 2NP, back point of contact 2EF–62, jumper wire 92, front point of contact 2WF–63, back point of contact 64 of relay 2NP, lower winding 11 of relay 2F, conductor 65, lower winding of relay 41—42F, conductor 66, lower winding of relay 6F, back point of contact 67 of relay 6RP, and the back point of contact 6EF–68 to terminal 2FN.

With relay 6F energized by current of normal polarity, normal or westbound traffic repeater relay 6WF is energized by a circuit passing from terminal B, through contact 69 of relay 6F in its normal or left-hand position, contact 70 of relay 6EF, and the winding of relay 6WF to terminal N. Relays 2WF and 41WF are also energized by similar circuits.

I shall assume that, with traffic controlling apparatus of the form shown in Figs. 1*a* and 1*b*, a train is to move in the westbound direction over stretch of track X. With lever 6V in its normal position, the mechanical interlocking between levers 6V and 8V permits lever 8V to be moved to its *f* position for clearing signal 8L.

Lever 8V, upon being moved to its *f* position, opens its contact 26, thereby deenergizing westbound route locking relay 8WS. With relay 8WS deenergized, contact 8WS–51 opens the westbound traffic control circuit, thereby deenergizing traffic lever lock relays 2BR and 6BR and traffic relays 2F, 41—42F and 6F.

Since relays 2F, 41—42F and 6F are of the polar stick type, their polar contacts will remain closed in the normal position after these relays become deenergized. When relay 6BR becomes deenergized, its contact 46 opens the circuit for block lamp 6*b* which is thereby extinguished. Contact 76 of relay 6BR in the circuit for lock magnet 6K is also now open. Block lamp 6*b*, on account of being extinguished, indicates to the leverman that lock magnet 6K cannot now be energized by closing latch contact 78 of lever 6V.

Lever 8V, upon being moved to its *f* position, closes a circuit for energizing relay 8LH, this circuit passing from terminal B, through contact 72 of relay 8TR, contact 6WF–73, contact 74 of lever 8V closed in the *f* position, and the winding of relay 8LH to terminal N. With relay 8LH energized, green lamp G of signal 8L becomes lighted by its circuit passing from terminal EB, through the front point of contact 19 of relay 8LH, front point of contact 8WH–20, contact 8WH–21 closed in the normal or left-hand position, and lamp G of signal 8L to terminal EN.

If, now, a westbound train passes signal 8L, deenergizing relay 8TR, relay 8LH will become deenergized by the opening of contact 72 of relay 8TR. With relay 8LH thus deenergized, red lamp R of signal 8L is again lighted by its circuit previously described. With relay 8TR deenergized, its contact 28 is open in the pick-up circuits for relay 8WS, and therefore relay 8WS cannot again become energized until the train has vacated section *d*—*e*.

The train, upon entering section *c*—*d*, deenergizes relay 42TR which then permits its contact 41 to open the circuit for relay 8WH. With relay 42TR deenergized, contact 55 opens the westbound traffic control circuit at another point, this circuit having been previously opened at contact 8WS–51. When relay 8WH becomes deenergized, this relay, at its contact 8WH–52, opens the westbound traffic control circuit at a third point. Relay 6BR therefore remains deenergized while the train is progressing in the westbound direction over the stretch of track X.

When the train leaves section *d*—*e*, relay 8WS can again become energized by its pick-up circuit previously traced, as soon as the leverman restores lever 8V to its *n* position.

When the train enters section *b*—*c*, deenergizing relay 41TR, contact 24 of relay 41TR opens, at its front point, the circuit for lamp Y of signal 41W, thereby extinguishing lamp Y, and contact 24 then closes, at its back point a circuit for lamp R of signal 41W, this circuit passing from terminal EB through the front point of contact 23 of relay 41WF, back point of contact 24 of relay 41TR, and lamp R of signal 41W to terminal EN. When relay 41TR becomes deenergized, its contact 56 opens the westbound traffic control circuit at a fourth point.

If the leverman at the west interlocking moves lever 4V to its *f* position, thereby energizing relay 4LH by its circuit, which includes contact 200 of lever 4V and contact 201 of relay 4TR, while relay 4LD is energizerd, lamp G of signal 4L will be lighted by its circuit passing from terminal EB, through the front point of contact 19 of relay 4LH, front point of contact 22 of relay 4LD, and lamp G of signal 4L to terminal EN. When the westbound train now enters section *a*—*b*, deenergizing relay 4TR, relay 4LH will again become deenergized, causing lamp G to be extinguished and lamp R of this signal to again be lighted by its circuit previously described.

When relay 4TR becomes deenergized, contact 28 opens the pick-up circuits for relay 4ES, but this relay remains energized by its stick circuits previously described.

If the leverman at the east interlocking has returned lever 8V to its *n* position, relay 8WS will be energized and contact 8WS–51 will therefore be closed in the westbound traffic control circuit.

When the train leaves section *c*—*d*, relay 8WH becomes energized by current of reverse polarity in a circuit which is the same as the circuit previously traced for this relay except that it includes the back points instead of the front points of coutract 39 and 43 of relay 41TR. Contact 8WH–52 is therefore also again closed in the westbound traffic control circuit, and with relay 42TR energized, contact 55 of this relay is also closed in the westbound traffic control circuit.

When the train now leaves section *b*—*c* permitting relay 41TR to again become energized, contact 56 of this relay completes the westbound traffiic control circuit, so that traffic lever lock relay 6BR again becomes energized, and block lamp 6*b* again becomes lighted, by its circuit previously traced, and indicates to the leverman at the east interlocking that the block is clear and that lever 6V can now be moved to its *r* position if desired.

It follows that from the time the leverman at the east interlocking moves lever 8V to its *f* position for clearing signal 8L until the westbound train leaves section *b*—*c* and lever 8V is restored to its *n* position, the westbound traffic control circuit is open causing relay 6BR to be deenergized and block lamp 6*b* to be extinguished, and preventing lock magnet 6K from being energized by closing latch contact 78 of lever 6V.

I shall now assume that, after the westbound train has left section *a*—*b* and all parts of the apparatus are again in their normal condition, it is desired to arrange for a traffic movement in the reverse or eastbound direction. The leverman at the east interlocking will therefore close latch contact 78 of lever 6V preparatory to moving lever 6V to its *r* position. Lock magnet 6K will now be energized by its circuit passing from terminal

B, through contact 75 of relay 6RPS, contact 76 of relay 6BR, contact 77 of relay 6F, the winding of lock magnet 6K, and latch contact 78 to terminal N. Lock magnet 6K, upon becoming energized, lifts its dog 14 out of engagement with portion 15 of lock segment 13, so that the leverman can now move lever 6V to its *r* position.

When lever 6V is moved to its *r* position, its contact 33 opens the pick-up circuit for relay 6NP, but this relay remains energized by its stick circuit previously traced. Also, contact 44 of lever 6V opens the circuit for westbound traffic lamp 6*w*, thereby extinguishing this lamp. When lever 6V reaches its reverse lock position *y*, its contact 45 closes a circuit for lighting reverse or eastbound traffic lamp 6*e*, this circuit passing from terminal EB through contact 45 of lever 6V, and lamp 6*e*, to terminal EN. When lever 6V reaches its *r* position, a pick-up circuit is closed for energizing relay 6RP, this circuit passing from terminal B, through contact 6WF–79, contact 80 of relay 6NP, contact 81 of lever 6V, and the winding of relay 6RP to terminal N.

Relay 6RP, upon becoming energized by its pick-up circuit, completes its stick circuit passing from terminal B, through contact 6WF–79, contact 82 of relay 6RP, and the winding of relay 6RP to terminal N. Relay 6RP, upon becoming energized, opens its contact 37 in the stick circuit for relay 6RPS, causing relay 6RPS to be deenergized. Relay 6RPS will remain deenergized until relay 6F closes its contact 36 in the reverse position.

With relay 6RPS deenergized, its contact 75 is open in the circuit for lock magnet 6K, and therefore lever 6V cannot be returned to its *n* position immediately after being moved to its *r* position.

Relay 6RP, upon becoming energized, also opens its contact 34 in the stick circuit for relay 6NP, thereby deenergizing relay 6NP. Relay 6NP, on account of being of the slow releasing type, retains its front contacts closed for a brief period of time after its stick circuit is opened.

With relay 6RP energized, relays 6F, 41—42F and 2F become energized by current of reverse polarity passing from terminal 2FB, through the front point of contact 67 of relay 6RP, lower winding of relay 6F, conductor 66, lower winding of relay 41—42F, conductor 65, lower winding 11 of relay 2F, back point of contact 64 of relay 2NP, front point of contact 2WF–63, jumper 92, back point of contact 2EF–62, back point of contact 61 of relay 2NP, contact 4ES–60, winding of relay 2BR, upper winding 9 of relay 2F, contact 2WF–58, conductor 57, contact 56 of relay 41TR, upper winding of relay 41—42F, contact 55 of relay 42TR, conductor 54, contact 8WH–52, upper winding of relay 6F, winding of relay 6BR, contact 8WS–51, and the front point of contact 50 of relay 6RP to terminal 2FN. The polar stick traffic relays, upon becoming energized by current of reverse polarity, will move their polar contacts to the reverse or right-hand position as shown in the drawings.

Contact 47 of relay 6F is therefore now opened in the circuit for lock magnet 6K. Contact 47 of relay 6F is also opened, causing block lamp 6*b* to be extinguished. With contact 69 of relay 6F also open in its normal position, relay 6WF will be deenergized. Relays 2WF and 41WF are similarly deenergized. With contact 36 of relay 6F closed, relay 6RPS will become energized by its pick-up circuit passing from terminal B, through

contact 36 of relay 6F, and the winding of relay 6RPS to terminal N.

With contact 69 of relay 6F in its reverse or right-hand position, as shown in the drawing, reverse or westbound traffic repeater relay 6EF will be energized by a circuit passing from terminal B, through contact 69 closed in the reverse position, contact 71 of relay 6WF, and the winding of relay 6EF to terminal N. It will be noted that relay 6WF is of the slow releasing type, so that its contact 71 will not become closed until after contact 69 of relay 6F has become closed in its reverse position. Relays 2EF and 42EF will also be energized by circuits which are similar to the circuit just traced for relay 6EF. When relay 6WF becomes deenergized, its contact 6WF–79 opens the pick-up and stick circuits for relay 6RP, causing relay 6RP to become deenergized.

With relays 6RP and 6WF deenergized, and with relay 6EF energized, the east end of the eastbound traffic control circuit is now completed through a jumper 83.

When relay 6WF becomes deenergized, its contact 6WF–42 opens the circuit previously traced for relay 8WH, causing this relay to become deenergized. With relay 8WH deenergized, its contact 8WH–52 is now open in the traffic control circuit, but contact 6EF–53 is now closed around contact 8WH–52.

With relays 2EF and 42EF energized, relay 4EH becomes energized by current of normal polarity passing from terminal B, through the front point of contact 84 of relay 42TR, contact 85 of relay 42EF, contact 86 of relay 41TR, contact 2EF–87, the winding of relay 4EH, and front point of contact 88 of relay 42TR to terminal N.

With relay 2WF now deenergized, its contact 2WF–58 is open in the traffic control circuit, but with relay 4EH now energized, contact 4EH–59 is closed around contact 2WF–58.

With relay 6WF deenergized, its contact 6WF–73 is now open in the circuit previously traced for relay 8LH.

With relay 6EF energized, a second pick-up circuit is closed for relay 8WS which is the same as the pick-up circuit previously traced for this relay except that it includes contact 6EF–27 instead of contact 26 of lever 8V.

With relay 41WF now deenergized, yellow lamp Y of signal 41W is extinguished, and red lamp R of this signal is now lighted by a circuit similar to the circuit previously described for red lamp R of signal 42E. With relay 42EF energized, red lamp R of signal 42E is extinguished, and yellow lamp Y of this signal is lighted by a circuit which is similar to the circuit previously traced for yellow lamp Y of signal 41W.

With relay 2F energized by current of reverse polarity, the pick-up circuit for relay 2NPS is open at contact 30 of relay 2F. Relay 2NPS, however, is still energized by its stick circuit previously traced.

With the contacts of relay 2F closed in their reverse position, block lamp 2*b* is now lighted by a circuit passing from terminal EB, through contact 46 of relay 2BR, contact 48 of relay 2F, and block lamp 2*b* to terminal EN. The lighting of block lamp 2*b* indicates to the leverman at the west interlocking plant that lever 2V can now be moved to its reverse position *r*.

With relay 2EF energized and relay 2WF deenergized, the portion of the westbound traffic control circuit which includes jumper 92 is now open at the back point of contact 2EF–62 and at the front point of contact 2WF–63.

The eastbound traffic control circuit is therefore now completed for energizing the polar stick traffic relays by current of reverse polarity, this circuit passing from terminal 1FB, through the front point of contact 2EF–62, back point of contact 61 of relay 2NP, contact 4ES–60, winding of relay 2BR, upper winding 9 of relay 2F, contact 4EH–59, conductor 57, contact 56 of relay 41TR, upper winding of relay 41—42F, contact 55 of relay 42TR, conductor 54, contact 6EF–53, upper winding of relay 6F, winding of relay 6BR, contact 8WS–51, back point of contact 50 of relay 6RP, back point of contact 6WF–49, jumper 83, front point of contact 6EF–68, back point of contact 67 of relay 6RP, lower winding of relay 6F, conductor 66, lower winding of relay 41—42F, conductor 65, lower winding 11 of relay 2F, back point of contact 64 of relay 2NP, and the back point of contact 2WF–63 to terminal 1FN.

The leverman at the west interlocking plant will now manipulate lever 2V for closing its latch contact 78, thereby completing the circuit for energizing lock magnet 2K, this circuit passing from terminal B, through contact 89 of relay 2NPS, contact 90 of relay 2BR, contact 91 of relay 2F, winding of magnet 2K, and latch contact 78 of lever 2V to terminal N. Lever 2V, upon being moved to its *r* position, opens its contact 95 in the pick-up circuit for relay 2NP, and opens its contact 44 in the circuit for lamp 2*w*, thereby extinguishing lamp 2*w*.

Lever 2V, upon reaching its reverse lock position, completes a circuit for energizing traffic lamp 2*e*, this circuit passing from terminal EB, through contact 45 of lever 2V, and lamp 2*e* to terminal EN.

When lever 2V reaches its *r* position, relay 2RP becomes energized by its pick-up circuit passing from terminal B, through contact 97 of lever 2V, and the winding of relay 2RP to terminal N. Relay 2RP, upon becoming energized, completes its stick circuit passing from terminal B, through contact 98 of relay 2NP, contact 99 of relay 2RP, and the winding of relay 2RP to terminal N.

With lever 2V in its *r* position, the mechanical interlocking between lever 2V and lever 4V permits lever 4V to now be moved to its *r* position for clearing signal 4R for an eastbound traffic movement. With lever 4V in its *r* position, relay 4RH becomes energized by its circuit passing from terminal B, through contact 100 of relay 4TR, contact 2EF–101, contact 102 of lever 4V, and the winding of relay 4RH to terminal N.

In Figs. 2*a* and 2*b*, normal or westbound traffic lamps 2*w* and 6*w* are lighted as in Figs. 1*a* and 1*b*. Block lamp 6*b* is here lighted by a circuit passing from terminal EB, through only contact 6BR–103 and lamp 6*b* to terminal EN.

The westbound traffic control circuit is here energized from the west interlocking instead of from the east interlocking as in Figs. 1*a* and 1*b*. The westbound traffic control circuit which is closed in Figs. 2*a* and 2*b* passes from terminal 1FB, through asymmetric unit 1*i*, contact 104 of lever 2V, winding of code following relay 2CD, back point of contact 105 of code transmitter 2CT, conductor 106, contact 4ES–107, upper winding of relay 2F, contact 2WF–108, conductor 110, contact 111 of relay 41TR, upper winding of relay 41—42F, contact 112 of relay 42TR, conductor 113, contact 8WH–114, upper winding of relay 6F, contact 8WS–116, conductor 117, con-

tact 118 of lever 6V, winding of relay 6BR, contact 119 of lever 6V, conductor 120, lower winding of relay 6F, conductor 121, lower winding of relay 41—42F, conductor 122, lower winding of relay 2F, conductor 123, and contact 124 of lever 2V to terminal 1FN.

With relay 2CD constantly energized, decoding relay 2FSA is constantly energized by its circuit through the front point of contact 125 of relay 2CD, and therefore its contact 140 is closed, but since contact 125 of relay 2CD remains open at its back point relay 2BSA does not become energized.

I shall assume that, with the form of apparatus shown in Figs. 2*a* and 2*b*, an eastbound traffic movement is to be made. With lamp 6*b* lighted, the leverman in the east interlocking knows that the block is unoccupied and that lever 6V can be moved to its *r* position. He, therefore, closes latch contact 78 of lever 6V, thus completing a circuit for energizing lock magnet 6K, this circuit passing from terminal B, through the back point of contact 6S–126, contact 6TE–127, contact 6BR–128, contact 129 of lever 6V, lock magnet 6K, and latch contact 78 of lever 6V to terminal N. Magnet 6K, upon becoming energized, lifts its dog 14 out of engagement with projection 15 of lock segment 13, and the leverman then moves lever 6V to its *r* position.

Lever 6V, upon being moved away from its normal lock position, opens its contact 129 in the normal lock circuit just traced for magnet 6K, and opens its contact 44 in the circuit previously described for westbound traffic lamp 6*w*, causing lamp 6*w* to be extinguished. Also, when lever 6V is moved from its normal lock position *x*, its contacts 118 and 119 open the circuit for relay 6BR, causing relay 6BR to become deenergized.

Lever 6V, upon reaching its reverse lock position *y*, closes its contact 159 in the reverse lock circuit for magnet 6K, and closes its contact 45 in a circuit passing from terminal EB, through contact 45 of lever 6V and lamp 6*e* to terminal EN for lighting eastbound traffic lamp 6*e*. When lever 6V reaches its *y* position, a circuit is completed for energizing code transmitter 6CT, this circuit passing from terminal B, through contact 130 of lever 6V, contact 6WF–131, and the winding of code transmitter 6CT to terminal N. At the same time, the east end of the eastbound traffic control circuit is connected through contacts 132 and 133 of lever 6V with terminals 2FB and 2FN, respectively.

With code transmitter 6CT energized, its contact 134 is repeatedly closing alternately at its front and back points. During the periods when contact 134 of code transmitter 6CT is closed at its front point, a path is completed from conductor 117, through the front point of contact 134 of code transmitter 6CT, jumper 137, and contact 6WF–138, to conductor 120. During the periods when contact 134 of code transmitter 6CT is closed at its front point, code following relay 2CD is energized by a circuit which is the same as the westbound traffic control circuit previously traced except that it includes the path just described from conductor 117 to conductor 120 through jumper 137 instead of the path through the winding of relay 6BR.

When contact 134 of code transmitter 6CT is closed at its back point, current ceases to flow through relay 2CD because at that time the source of current at the west interlocking is opposed by the source of current at the east interlocking. Relay 2CD, therefore, is periodically energized following code transmitting device 6CT.

With relay 2CD following code transmitter 6CT, relay 2FSA is periodically energized by its circuit passing from terminal B, through the front point of contact 125 of relay 2CD, and the winding of relay 2FSA in multiple with a resistor 139 to terminal N. Each time contact 125 of relay 2CD closes at its back point, a circuit is completed for energizing relay 2BSA, this circuit passing from terminal B, through the back point of contact 125 of relay 2CD, and the front point of contact 140 of relay 2FSA and the winding of relay 2BSA in multiple with a resistor 141 to terminal N.

With relay 2BSA energized, time element device 2TE becomes energized by its circuit passing from terminal B, through contact 142 of relay 2BSA, contact 143 of relay 2S, and the control element of device 2TE to terminal N.

Time element device 2TE, upon the lapse of a measured period of time, closes its contact 144, thereby completing a pick-up circuit for relay 2S, passing from terminal B, through contact 144 of time element device 2TE, and the winding of relay 2S to terminal N. Relay 2S, upon becoming energized by its pick-up circuit, completes its own stick circuit passing from terminal B, through contact 145 of relay 2BSA, contact 146 of relay 2S, and the winding of relay 2S to terminal N. Relay 2S, upon becoming energized, opens the circuit traced for time element device 2TE, causing time element device 2TE to become deenergized.

With relays 2S and 2BSA energized, a circuit is completed for lighting block lamp 2*b*, this circuit passing from terminal EB, through contact 2S–150, contact 2BSA–151, and lamp 2*b* to terminal EN. The lighting of lamp 2*b* indicates to the leverman in the west interlocking plant that he can now reverse lever 2V, and that the block is unoccupied. He, therefore, manipulates lever 2V for closing its latch contact 78, thereby completing a circuit for energizing magnet 2K, this circuit passing from terminal B, through the front point of contact 2S–147, contact 2BSA–148, contact 149 of lever 2V, winding of magnet 2K, and latch contact 78 of lever 2V to terminal N.

Lever 2V, upon being moved away from its normal lock position *x*, opens the circuit just traced for energizing magnet 2K, and also the circuit for traffic lamp 2*w*, causing this lamp to be extinguished. At the same time, the source of energy for the westbound traffic control circuit is disconnected at contacts 104 and 124 of lever 2V. Relay 2CD therefore becomes deenergized, causing relay 2FSA to be deenergized, which causes relays 2BSA and 2S in succession to also be deenergized.

When lever 2V reaches its reverse lock position *v*, its contact 157 becomes closed in a second circuit for magnet 2K, and its contact 45 becomes closed in a circuit for lighting eastbound traffic lamp 2*e*. At the same time relay 2BR is connected through contacts 153 and 154 of lever 2V across conductors 106 and 123 at the west end of the eastbound traffic control circuit.

Relays 2BR, 2F, 41—42F, and 6F are therefore energized by current of reverse polarity, during the intervals when contact 134 of code transmitter 6CT is closed at its back point in the eastbound traffic control circuit passing from terminal 2FB, through asymmetric unit 2*i*, contact 132 of lever 6V, winding of relay 6CD, back point of contact 134 of code transmitter 6CT, conductor 117, contact 8WS–116, upper winding of relay 6F,

contact 8WH–114, conductor 113, contact 112 of relay 42TR, upper winding of relay 41—42F, contact 111 of relay 41TR, conductor 110, contact 2WF–108, upper winding of relay 2F, contact 4ES–107, conductor 106, contact 153 of lever 2V, winding of relay 2BR, contact 154 of lever 2V, conductor 123, lower winding of relay 2F, conductor 122, lower winding of relay 41—42F, conductor 121, lower winding of relay 6F, conductor 120, and contact 133 of lever 6V, to terminal 2FN.

Relays 2F, 41—42F and 6F, upon thus being energized by current of reverse polarity, move their polar contacts to the reverse position, thereby deenergizing normal traffic repeater relays 2WF, 6WF and 41WF, and energizing reverse traffic repeater relays 2EF, 6EF and 42EF. With relay 6WF deenergized, code transmitter 6CT becomes deenergized, so that its contact 134 remains constantly closed at its back point.

Contact 2WF–108 in the traffic control circuit is now open, but contact 4EH–109 is closed around this contact, as previously described for contacts 2WF–58 and 4EH–59 in Figs. 1*a* and 1*b*. Similarly, contact 8WH–114 in the traffic control circuit is now open, but contact 6EF–115 is closed around this contact.

With relay 2BR energized, block lamp 2*b* is now energized by a circuit passing from terminal EB, through contact 2BR–152, and lamp 2*b* to terminal EN.

In Figs. 3*a* and 3*b*, a normal or westbound traffic control circuit is closed, and includes the parts of the normal traffic control circuit traced in Figs. 1*a* and 1*b*, and in addition to the normal traffic control circuit of Figs. 1*a* and 1*b*, the normal traffic control circuit of Figs. 3*a* and 3*b* includes a resistor 162 and front points of contacts LP–163, LP–164, LP–165 and LP–166. The eastbound traffic control circuit in Figs. 3*a* and 3*b* differs similarly from the eastbound traffic control circuit of Figs. 1*a* and 1*b* by including a resistor 168 and the front points of the contacts of relay LP.

The circuit by which switch repeater relay LP is energized passes from terminal B, through contact 175 operated by bow 174 of padlock P, contact 176 of switch lock magnet WL, contact 177 operated in conjunction with switch Z, contact 178 of time element device LTER, and the winding of relay LP to terminal N.

I shall assume that, with apparatus of the form shown in Figs. 3*a* and 3*b*, and with the normal or westbound traffic control circuit closed as shown, a train is to move off of siding D onto track X over switch Z in its reverse position. A trainman will remove bow 174 of padlock P from the electric switch lock for switch Z, thereby opening contact 175 and closing contact 180, both of which are operated by bow 174 of padlock P.

With contact 175 thus opened, relay LP becomes deenergized, and completes a circuit passing from terminal 2FB, through resistor 162, front point of contact 6WF–49, back point of contact 50 of relay 6RP, contact 8WS–51, winding of relay 6BR, upper winding of relay 6F, contact 8WH–52, conductor 54, contact 55 of relay 42TR, upper winding of relay 41—42F, contact 56 of relay 41TR, back point of contact LP–163, winding of relay 12LR, back point of contact LP–166, lower winding of relay 41—42F, conductor 66, lower winding of relay 6F, back point of contact 67 of relay 6RP, and the back point of contact 6EF–68 to terminal 2FN.

The apparatus is so proportioned that, with resistor 162 in series with the high resistance of relay 12LR, relay 6BR will release its front contacts and relay 12LR will not pick up its front contacts. With relay 6BR thus deenergized, block lamp 6*b* will be extinguished.

The leverman in the east interlocking will therefore now reverse lever 12LV, thereby closing contact 167 for by-passing resistor 162. With resistor 162 by-passed, relays 12LR and 6BR will both be sufficiently energized to close their front contacts, by a circuit which is the same as the circuit previously traced for relay 12LR except that it includes contact 167 of lever 12LV instead of resistor 162. With relay 12LR thus energized, a circuit will be completed for energizing switch lock magnet WL, this circuit passing from terminal B, through contact 179 of relay 12LR, contact 180 operated by padlock P, and lock magnet WL to terminal N.

With switch lock magnet WL thus energized, it will lift dog 173 out of engagement with lock segment 172, thereby permitting lever 10—12V to be moved to its *r* position for unlocking switch Z by removing dog 170 from engagement with lock rod 171.

Through the mechanical interlocking of levers 6V, 8V and 12LV, lever 8V will be locked in its *n* position by movement of lever 12LV to its *r* position while lever 6V is in its *n* position.

I shall next assume that the stretch of track X, as shown, is again unoccupied, and that the normal traffic control circuit is again closed for a westbound traffic movement. I shall assume further that the leverman in the east interlocking clears signal 8L, and that a westbound train proceeds over track X through sections *d*—*e* and *c*—*d* and then stops on section *b*—*c* in advance of switch Z to enter siding D, and that a trainman then removes padlock P from the electric switch lock for switch Z.

With relay 41TR deenergized by the train on section *b*—*c*, time element relay LTER will be energized by a circuit passing from terminal B, through contact 41TR—181, and the winding of relay LTER to terminal N. Upon the lapse of a measured period of time, relay LTER will close its front contact 182, thereby completing a circuit for energizing switch lock magnet WL, this circuit passing from terminal B, through contact 182 of relay LTER, contact 180 operated by bow 174 of padlock P when the trainman removes padlock P from the switch lock, and the winding of switch lock magnet WL to terminal N, thereby permitting lever 10—12V to be reversed for unlocking switch Z.

I shall next assume that the stretch of track X is again unoccupied, and that the apparatus is again in its normal condition with the westbound traffic control circuit closed. I shall assume further that the leverman then reverses lever 6V for closing the reverse or eastbound traffic control circuit. At the time the leverman closes latch contact 78 for energizing magnet 6K, the circuit for magnet 6K is the same as that previously traced in Figs. 1*a* and 1*b* except that it includes, in addition, contact 183 of lever 12LV.

When lever 6V reaches its *r* position, a pick-up circuit is closed for relay 6RP which is the same as the pick-up circuit previously traced in Figs. 1*a* and 1*b* except that it includes, in addition, contact 184 of lever 12LV. With relay 6RP energized, current of reverse polarity is supplied through the front points of contacts 50 and 67 of relay 6RP to a circuit which is the same as the circuit

previously traced through the front points of these contacts in Figs. 1*a* and 1*b* except that it includes, in addition front points of contacts of relay LP.

With relay 2F now energized by current of reverse polarity, block lamp 2*b* will be lighted, and contact 91 of relay 2F will be closed in a circuit for energizing lock magnet 2K which is the same as the circuit for lock magnet 2K previously traced in connection with Figs. 1*a* and 1*b* except that it includes contact 183 of lever 10LV in addition.

When the leverman at the west interlocking plant now reverses lever 2V, the eastbound traffic control circuit will be completed similarly to the manner described in Figs. 1*a* and 1*b*. With the eastbound traffic control circuit closed, if a train is to move off of siding D onto track X, the leverman at the west interlocking plant will effect energization of relay 10LR, by moving lever 10LV to its *r* position, similarly to the manner described for energizing relay 12LR when the westbound traffic control circuit was closed.

In Figs. 4*a* and 4*b*, the normal or westbound traffic control circuit is closed, and is the same as described for Figs. 3*a* and 3*b* except that it includes a contact 185 of lever 12LV instead of resistor 162. The circuit for switch repeater relay LP is the same as in Figs. 3*a* and 3*b*.

I shall assume that, with apparatus of the form shown in Figs. 4*a* and 4*b*, and with the normal traffic control circuit closed, a train is to move from siding D onto track X. A trainman will, therefore, remove bow 174 of padlock P from the electric switch lock of switch Z, causing relay LP to be deenergized as previously described.

A circuit will therefore be completed for relay 12LR which is the same as the circuit previously traced for relay 12LR in Figs. 3*a* and 3*b* except that it includes contact 185 of lever 12LV instead of resistor 162, and includes a condenser 186 in series with the winding of relay 12LR. With condenser 186 in the circuit, constant direct current will not flow for energizing relay 6BR which will thereupon release its front contacts, and relay 12LR will not pick up its front contacts.

With relay 6BR deenergized, block lamp 6*b* will be extinguished. The leverman in the east interlocking plant will then reverse lever 12LV.

The circuit for energizing lock magnet 6K is the same as previously described in Figs. 3*a* and 3*b* except that it includes, in addition, contact 190 of relay ECTPP.

Lever 12LV, upon leaving its *n* position, opens its contact 184 in the pick-up circuit for relay 6RP, and opens its contact 183 in the energizing circuit for lock magnet 6K. At the same time, contact 185 of lever 12LV is opened in the circuit previously described which includes relay 12LR and condenser 186.

When lever 12LV reaches its *r* position, its contacts 187 and 187 close. Contact 187 completes a circuit for energizing code transmitting device ECT, this circuit passing from terminal B, through contact 187 of lever 12LV, and the winding of code transmitter ECT to terminal N.

During the periods when code transmitter ECT closes its contact 188, the code repeating relay ECTP is energized by a circuit passing from terminal B through contact 187 of lever 12LV, relay 188 of code transmitter ECT and the winding of relay ECTP to terminal N. During the periods when contact 189 of relay ECTP is closed at its back point while relay ECTP is following code transmitter ECT, slow pick-up relay ECTPP is energized by a circuit passing from terminal 2FB, through the back point of contact 189 of relay ECTP, and the winding of relay ECTPP to terminal 2FN. Since relay ECTPP is of the slow pick-up type, its contact 190 remains open while contact 189 of relay ECTP is periodically closing alternately at its front and back points.

During the periods when contact 189 of relay ECTP is closed at its front point, a circuit is completed for energizing relay 12LR, passing from terminal 2FB, through the front point of contact 189 of relay ECTP, contact 167 of lever 12LV, and thence by a circuit path which is the same as the circuit previously traced in Figs. 3*a* and 3*b* beyond resistor 162 except that it includes a condenser 186 in series with the winding of relay 12LR. Relay 12LR, being of the code following type, will periodically close its contact 193 alternately at the front and back points.

During the periods when contact 193 of relay 12LR is closed at its front point, relay FSA becomes energized by a circuit passing from terminal B, through the back point of contact 192 of relay 10LR, front point of contact 193 of relay 12LR, and the winding of relay FSA in multiple with a resistor 195 and an asymmetric unit 196 in the high resistance direction to terminal N. During the periods when contact 193 of relay 12LR is closed at its back point, relay BSA will then be energized by a circuit passing from terminal B, through the back point of contact 192 of relay 10LR, back point of contact 193 of relay 12LR, contact 194 of relay FSA, and the winding of relay BSA in multiple with a resistor 195 and an asymmetric unit 196 in the high resistance direction to terminal N.

With relay BSA energized, a circuit is completed for energizing switch lock magnet WL, this circuit passing from terminal B, through contact 197 of relay BSA, contact 180 operated by bow 174 of padlock P, and lock magnet WL to terminal N. Lever 10—12V can then be moved to its *r* position for unlocking switch Z as previously described.

I have described the operation of the apparatus for a few typical train movements. In view of the foregoing description, it is believed that the operation of the apparatus for any other possible traffic movement can be readily followed by reference to the drawings.

Although I have herein shown and described only a few forms of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In traffic locking apparatus for a stretch of railway track including a traffic lever in an interlocking machine for each end of said stretch each having normal and reverse contacts closed in normal and reverse positions respectively of their lever, the combination comprising, a reverse stick relay and a normal stick relay for each of said traffic levers, a second normal stick relay for one of said traffic levers and a second reverse stick relay for the second traffic lever, a polar stick traffic relay for each of said traffic levers, a pick-up and a stick circuit for the first normal stick relay for said first traffic lever each controlled by a reverse contact of the associated polar stick relay and said pick-up circuit also controlled by a normal contact of said first traffic lever and by a front contact of the associated reverse stick relay, a pick-up circuit for the re-

verse stick relay for said first traffic lever controlled by a reverse contact of said first traffic lever, a stick circuit for the reverse stick relay for said first traffic lever controlled by a back contact of the first normal stick relay for said first traffic lever, a pick-up circuit for said second normal stick relay controlled by a normal contact of the associated polar stick relay, a stick circuit for said second normal stick relay controlled by a back contact of the associated first normal stick relay, an electric lock for said first traffic lever which when deenergized locks said first traffic lever in its normal or its reverse position, means controlled by a front contact of said second normal stick relay and by a reverse contact of the associated polar stick relay for energizing said electric lock, means controlled by said second traffic lever and by its associated polar stick traffic relay for controlling its normal and reverse stick relays, and means controlled by the first normal stick relay for said first traffic lever and by the first reverse stick relay for said second traffic lever for controlling said polar stick traffic relays.

2. In traffic locking apparatus for a stretch of railway track including a traffic lever in an interlocking machine for each end of said stretch each having normal and reverse contacts closed in normal and reverse positions respectively of their lever, the combination comprising, a reverse stick relay and a normal stock relay for each of said traffic levers, a second normal stick relay for one of said traffic levers and a second reverse stick relay for the second traffic lever, a polar stick traffic relay for each of said traffic levers, a pick-up and a stick circuit for the first reverse stick relay for said second traffic lever each controlled by a normal contact of the associated polar stick relay and the pick-up circuit also controlled by a reverse contact of said second traffic lever and by a front contact of the associated normal stick relay, a pick-up circuit for the normal stick relay for said second traffic lever controlled by a normal contact of said second traffic lever, a stick circuit for the normal stick relay for said second traffic lever controlled by a back contact of the first reverse stick relay for said second traffic lever, a pick-up circuit for said second reverse stick relay controlled by a reverse contact of its associated polar stick relay, a stick circuit for said second reverse stick relay controlled by a back contact of the associated first reverse stick relay, an electric lock for said second traffic lever which when deenergized locks said second traffic lever in its normal or its reverse position, means controlled by a front contact of said second reverse stick relay and by a normal contact of the associated polar stick relay for energizing said electric lock, means controlled by said first traffic lever and by its polar stick traffic relay for controlling its normal and reverse stick relays, and means controlled by the first normal stick relay for said first traffic lever and by the first reverse stick relay for said second traffic lever for controlling said polar stick traffic relays.

3. In traffic locking apparatus for a stretch of railway track including a traffic lever in an interlocking machine for each end of said stretch each having normal and reverse contacts closed in normal and reverse positions respectively of their lever, the combination comprising, a reverse stick relay and a normal stick relay for each of said traffic levers, a polar stick traffic relay for each of said traffic levers, a pick-up and a stick circuit for the normal stick relay for a first one of

said traffic levers each controlled by a reverse contact of the associated polar stick relay and said pick-up circuit also controlled by a normal contact of said first traffic lever and by a front contact of the associated reverse stick relay, a pick-up circuit for the reverse stick relay for said first traffic lever controlled by a reverse contact of said first traffic lever, a stick circuit for the reverse stick relay for said first traffic lever controlled by a back contact of the normal stick relay for said first traffic lever, an electric lock for said first traffic lever which when deenergized locks said first traffic lever in its normal or its reverse position, means controlled by a back contact of the normal stick relay for said first traffic lever and by a reverse contact of the associated polar stick relay for energizing said electric lock, means controlled by the second traffic lever and by its polar stick traffic relay for controlling its normal and reverse stick relays, and means controlled by the normal stick relay for said first traffic lever and by the reverse stick relay for said second traffic lever for controlling said polar stick traffic relays.

4. In traffic locking apparatus for a stretch of railway track including a traffic lever in an interlocking machine for each end of said stretch each having normal and reverse contacts closed in normal and reverse positions respectively of their lever, the combination comprising, a reverse stick relay and a normal stick relay for each of said traffic levers, a polar stick traffic relay for each of said traffic levers, a pick-up and a stick circuit for the reverse stick relay for a second one of said traffic levers each controlled by a normal contact of the associated polar stick relay and the pick-up circuit also controlled by a reverse contact of said second traffic lever and by a front contact of the associated normal stick relay, a pick-up circuit for the normal stick relay for said second traffic lever controlled by a normal contact of said second traffic lever, a stick circuit for the normal stick relay for said second traffic lever controlled by a back contact of the reverse stick relay for said second traffic lever, an electric lock for said second traffic lever which when deenergized locks said second traffic lever in its normal or its reverse position, means controlled by a back contact of the reverse stick relay for said second traffic lever and by a normal contact of the associated polar stick relay for energizing said electric lock, means controlled by the first traffic lever and by its polar stick traffic relay for controlling its normal and reverse stick relays, and means controlled by the normal stick relay for said first traffic lever and by the reverse stick relay for said second traffic lever for controlling said polar stick traffic relays.

5. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, a normal stick relay for one of said traffic levers, a reverse stick relay for the other of said traffic levers, means controlled by said one lever in its reverse position for closing a contact which remains closed a brief period of time after said one lever is returned to its normal position, a pick-up circuit for said normal stick relay controlled by said contact and by said one lever in its normal position and also by a reverse contact of the polar stick traffic relay for said one traffic lever, a stick circuit for said normal stick relay controlled by a reverse contact of the polar

stick relay for said one traffic lever, means controlled by said other traffic lever and by its polar stick traffic relay for controlling said reverse stick relay, and means controlled by said normal and reverse stick relays for controlling said polar stick traffic relays.

6. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, a normal stick relay for one of said traffic levers, a reverse stick relay for the other of said traffic levers, means controlled by said other lever in its normal position for closing a contact which remains closed a brief period of time after said other lever is operated to its reverse position, a pick-up circuit for said reverse stick relay controlled by said contact and by said other lever in its reverse position and also by a normal contact of the polar stick relay for said other traffic lever, a stick circuit for said reverse stick relay controlled by a normal contact of the polar stick relay for said other traffic lever, means controlled by said one traffic lever and by its polar stick traffic relay for controlling said normal stick relay, and means controlled by said normal and reverse stick relays for controlling said polar stick traffic relays.

7. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, a normal stick relay for one of said traffic levers, a reverse stick relay for the other of said traffic levers, a normal repeater relay for each of said polar stick relays each controlled by a normal contact of its polar stick relay, a reverse repeater relay for each of said polar stick relays each controlled by a reverse contact of its polar stick relay, a pick-up and a stick circuit for said normal stick relay each controlled by a front contact of the reverse repeater relay for the polar stick relay for said one lever and the pick-up circuit also controlled by said one lever for a brief period of time when said one lever is moved from its reverse to its normal position, a pick-up and a stick circuit for said reverse stick relay each controlled by a front contact of the normal repeater relay for the polar stick relay for said other lever and the pick-up circuit also controlled by said other lever for a brief period of time when said other lever is moved from its normal to its reverse position, and means controlled by said normal and reverse stick relays and by said normal and reverse repeater relays for controlling said polar stick relays.

8. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, a normal stick relay for one of said traffic levers, a reverse stick relay for the other of said traffic levers, a normal repeater relay for each of said polar stick relays each controlled by a normal contact of its polar stick relay, a reverse repeater relay for each of said polar stick relays each controlled by a reverse contact of its polar stick relay, pick-up and stick circuits for said normal stick relay controlled by said one lever and by the reverse repeater for its polar stick relay, pick-up and stick circuits for said reverse stick relay controlled by said other lever and by the normal repeater for its polar stick relay, and normal and reverse control circuits for said polar stick relays controlled by said normal and reverse stick relays and by said normal and reverse repeater relays.

9. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, an electric lock for each of said traffic levers which when deenergized locks its traffic lever in the normal or the reverse position, a code transmitter for one end of said stretch energized by a circuit controlled by a normal contact of the lever for that end of said stretch and by a reverse contact of its polar stick traffic relay, a code transmitter for the other end of said stretch energized by a circuit controlled by a reverse contact of the lever for that end of said stretch and by a normal contact of its polar stick traffic relay, a control circuit path including the windings of said polar stick traffic relays in series, means controlled over said control circuit path by each of said code transmitters for energizing the electric lock for the traffic lever at the opposite end of said stretch, and means controlled by both said levers in the normal position or by both said levers in the reverse position for energizing said polar stick traffic relays by current of normal or reverse polarity respectively.

10. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a pair of control conductors, a polarized traffic relay for each of said traffic levers connected in series with each other through said conductors, an electric lock for each of said traffic levers each of which when deenergized locks its traffic lever in the normal or the reverse position, a source of current connected through normal contacts of one of said levers across one end of said pair of conductors, a second source of current connected through reverse contacts of the other lever across the other end of said pair of conductors in opposition to said first source of current, a first code transmitter controlled by a normal contact of said one lever and by a reverse contact of its polarized traffic relay for at times periodically closing a shunt path across said conductors adjacent said one end of said pair of conductors, a code following relay connected in series with one of said conductors between said shunt path and said one end of said pair of conductors, a second code transmitter controlled by a reverse contact of said other lever and by a normal contact of its polarized traffic relay for at times periodically closing a second shunt path across said conductors adjacent said other end of said pair of conductors, a second code following relay connected in series with one of said conductors between said second shunt path and said other end of said pair of conductors, means controlled by each of said code following relays for energizing the electric lock for the lever for its end of said stretch when the code transmitter for the opposite end of said stretch is being operated, and means controlled by both said levers in the normal position and by both said levers in the reverse position for energizing said polarized relays by current of normal and reverse polarity respectively.

11. In traffic locking apparatus for a stretch

of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a pair of control conductors, a polarized traffic relay for each of said traffic levers connected in series with each other through said conductors, an electric lock for each of said traffic levers each of which when deenergized locks its traffic lever in the normal or the reverse position, a code following relay for each end of said pair of conductors each connected in series with said conductors, a first code transmitter controlled by a normal contact of one of said levers and by a reverse contact of its polarized traffic relay for periodically closing a shunt path across its end of said pair of conductors for effecting operation of the code following relay for the opposite end of said pair of conductors, a second code transmitter controlled by a reverse contact of the other lever and by a normal contact of its polarized traffic relay for periodically closing a second shunt path across said opposite end of said pair of conductors for effecting operation of the code following relay for the first end of said pair of conductors, means controlled by each of said code following relays for energizing the electric lock for the lever for its end of said stretch, and means controlled by said levers in the normal and the reverse positions for energizing said polarized relays by current of normal or reverse polarity respectively.

12. In traffic locking apparatus for a stretch of railway track having a track switch at an intermediate point in said stretch and including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, an electric lock for each of said traffic levers each of which when deenergized locks its lever in the normal or the reverse position, a high resistance switch lock relay, a switch repeater relay, a traffic lever lock relay for each of said traffic levers, a polarized traffic relay for each of said traffic levers, means for energizing said switch repeater relay only if said switch is locked in its normal position, a resistor for each of said traffic lever lock relays, a traffic control circuit controlled by said polarized traffic relays and including one of said resistors and the windings of both of said traffic lever lock relays and said polarized traffic relays and also a front contact of said switch repeater relay all in series, a switch lock relay circuit including one of said resistors and the winding of the traffic lever lock relay for one of said levers and of the polarized traffic relay for the same lever and also of said switch lock relay and including a back contact of said switch repeater relay all in series but proportioned so that the front contacts of said switch lock relay and of said traffic lever lock relay remain open, a switch lock control lever having a normal and a reverse contact, means comprising said reverse contact of said switch lock control lever connected in multiple with said resistor in said switch lock relay circuit for effecting operation of said switch lock relay, a control circuit for the electric lock for said one traffic lever controlled by a normal contact of said switch lock control lever and by a front contact of its traffic lever lock relay, and means controlled by said traffic levers for controlling said polarized traffic relays.

13. In traffic locking apparatus for a stretch of railway track having a track switch at an intermediate point in said stretch and including

a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, an electric lock for each of said traffic levers each of which when deenergized locks its lever in the normal or the reverse position, a high resistance switch lock relay, a switch repeater relay, a traffic lever lock relay for each of said traffic levers, a circuit for normally energizing said switch repeater relay but becoming opened if said switch becomes unlocked, a resistor for each of said traffic levers, a traffic control circuit controlled by said traffic levers and including the resistor for one of said traffic levers and the windings of both of said traffic lever lock relays and a front contact of said switch repeater relay all in series, a switch lock relay circuit including said resistor and the winding of the traffic lever lock relay for said one traffic lever and also of said switch lock relay and including a back contact of said switch repeater relay all in series but proportioned so that the front contacts of said switch lock relay and said traffic lever lock relay are open, a switch lock control lever having a normal and a reverse contact, means comprising said reverse contact connected in multiple with said resistor in said switch lock relay circuit for by-passing said resistor for effecting operation of said switch lock relay, and a control circuit for the electric lock for said one traffic lever controlled by said normal contact and by a front contact of its traffic lever lock relay.

14. In traffic locking apparatus for a stretch of railway track having a track switch at an intermediate point in said stretch and including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, an electric lock for each of said traffic levers each of which when deenergized locks its lever in the normal or the reverse position, a switch lock relay, a switch repeater relay, a traffic lever lock relay for each of said traffic levers, a circuit for normally energizing said switch repeater relay but becoming deenergized if said switch becomes unlocked, a traffic control circuit including a source of current controlled by said traffic levers and including the windings of both of said traffic lever lock relays and a front contact of said switch repeater relay all in series, an electric switch lock which if deenergized locks said switch in its normal position, a switch lock relay circuit including a portion of said traffic control circuit which includes said source of current and the traffic lever lock relay for one of said traffic levers and also including a back contact of said switch repeater relay and the winding of said switch lock relay and impedance means which reduces energization of said switch lock relay, a switch lock control lever having a normal and a reverse contact, means controlled by said reverse contact for increasing energization of said switch lock relay in series with the traffic lever lock relay for effecting energization of said electric switch lock, and a control circuit for the electric lock for said one traffic lever controlled by said normal contact and by a front contact of its traffic lever lock relay.

15. In a traffic locking apparatus for a stretch of railway track having a track switch at an intermediate point in said stretch and including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, an electric lock for each of said traffic levers each of which when

deenergized locks its lever in the normal or the reverse position, a first switch lock relay, a second switch lock relay, a traffic lever lock relay for each of said traffic levers, a switch repeater relay, a circuit for normally energizing said switch repeater relay but becoming deenergized if said switch becomes unlocked, a traffic control circuit controlled by said traffic levers and including the windings of said traffic lever lock relays and a first and a second front contact of said switch repeater relay all in series and supplied with energizing current at a given end of said stretch for governing traffic movements from that end through said stretch, a second traffic control circuit controlled by said traffic levers and including the windings of said traffic lever lock relays and said first and second front contacts of said switch repeater relay all in series and supplied with energizing current at the opposite end of said stretch for governing traffic movements from said opposite end through said stretch, a first switch lock control lever, a control circuit for said first switch lock relay controlled by a reverse contact of said first switch lock control lever and including the portion of said first traffic control circuit which extends from said given end of said stretch to said switch and includes a back contact of said switch repeater relay, a second switch lock control lever, a control circuit for said second switch lock relay controlled by a reverse contact of said second switch lock control lever and including the portion of said second traffic control circuit which extends from said opposite end of said stretch to said switch and includes a second back contact of said switch repeater relay, means controlled by said switch lock relays for unlocking said switch, and a control circuit for the electric lock for each of said traffic levers controlled by a normal contact of the switch lock control lever for its end of said stretch and by a front contact of its traffic lever lock relay.

16. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, an electric lock for each of said traffic levers which when deenergized locks its traffic lever in the normal or the reverse position, means controlled by one of said levers upon being moved to its normal position and by a reverse contact of its polar stick traffic relay for initiating means for energizing said polar stick traffic relays by current of normal polarity and for energizing the electric lock for the other traffic lever, and means controlled by the other traffic lever upon being moved to its reverse position and by a normal contact of its polar stick traffic relay for initiating means for energizing said polar stick traffic relays by current of reverse polarity and for energizing the electric lock for said one traffic lever.

17. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers each having normal and reverse polar contacts which become closed when the corresponding polar stick traffic relay is energized by current of normal or reverse polarity respectively, an electric lock for each of said traffic levers which when deenergized locks its traffic lever in the normal or the reverse position, means controlled by one of said traffic levers when moved from its reverse to its normal position and by a reverse polar contact of its associated polar stick traffic relay for energizing the electric lock for the traffic lever for the other end of said stretch and for conditioning means for energizing said polar stick traffic relays by current of normal polarity, and means controlled by said traffic lever for the other end of said stretch when moved from its normal to its reverse position and by a normal polar contact of its associated polar stick traffic relay for energizing the electric lock for said one traffic lever and for conditioning means for energizing said polar stick traffic relays by current of reverse polarity.

18. In traffic locking apparatus for a stretch of railway track including a traffic lever for each end of said stretch each having a normal and a reverse position, the combination comprising, a polar stick traffic relay for each of said traffic levers, an electric lock for each of said traffic levers which when deenergized locks its traffic lever in the normal or the reverse position, means including one of said traffic levers when moved from its normal to its reverse position and controlled in part by a normal contact of its polar stick traffic relay for energizing both said polar stick relays by current of reverse polarity and for energizing the electric lock for the other of said levers, and means including the other of said levers when moved from its reverse to its normal position and controlled in part by a reverse contact of its polar stick traffic relay for energizing both said polar stick relays by current of normal polarity and for energizing the electric lock for said one lever.

CHARLES W. FAILOR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,316,811	Stephens	Sept. 23, 1919
1,611,184	Griffin	Dec. 21, 1926