March 4, 1941. E. M. ALLEN 2,233,932

RAILWAY SIGNALING

Filed July 24, 1940

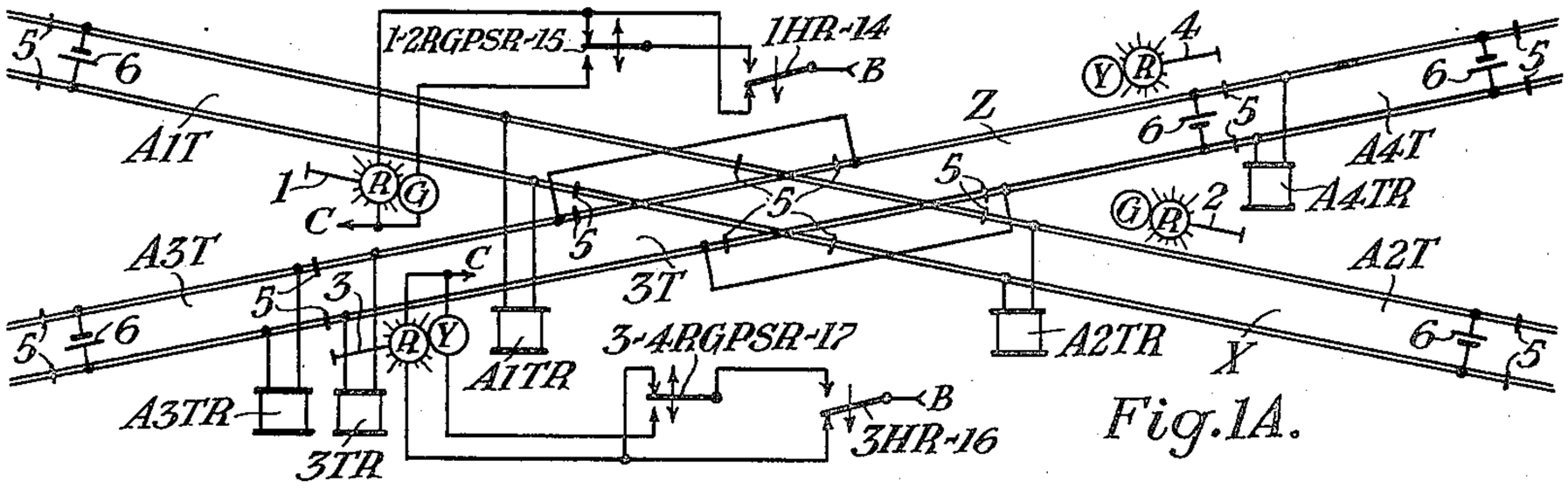

Fig. 1A.

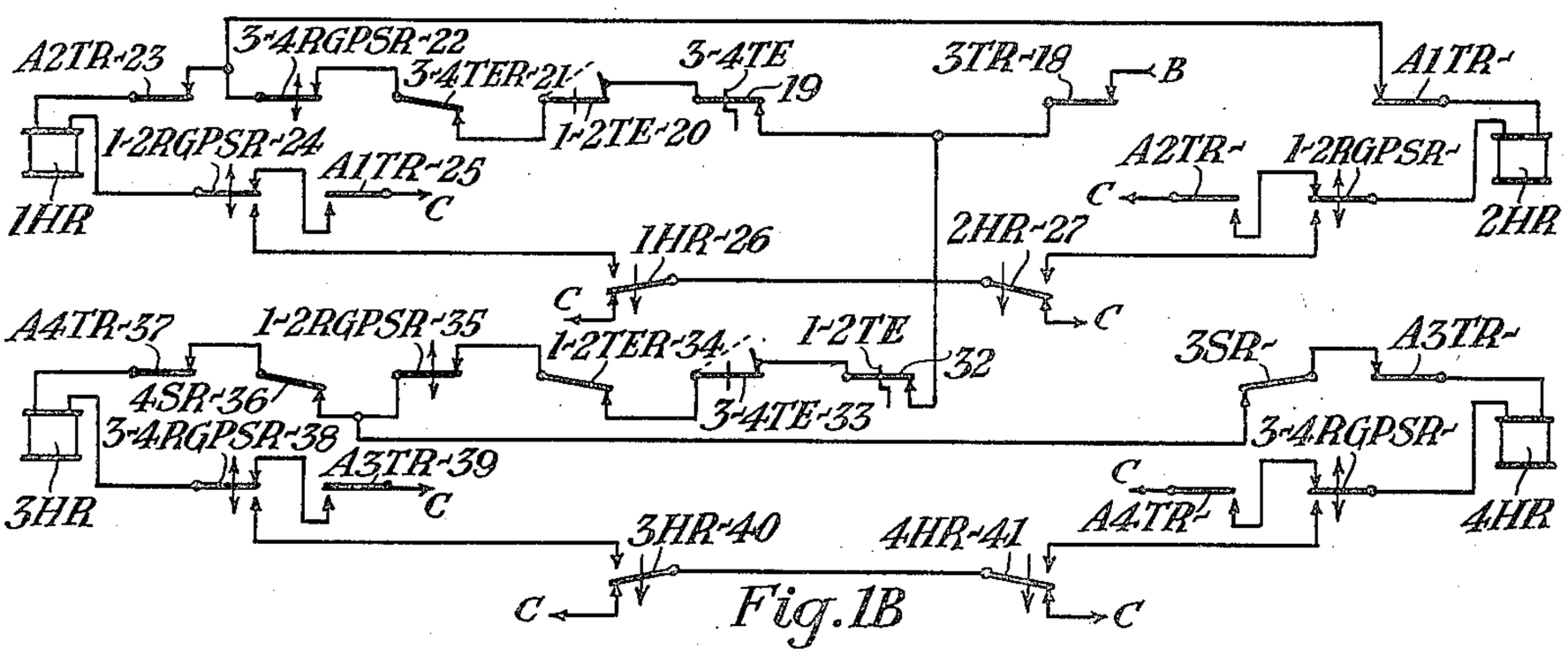

Fig. 1B

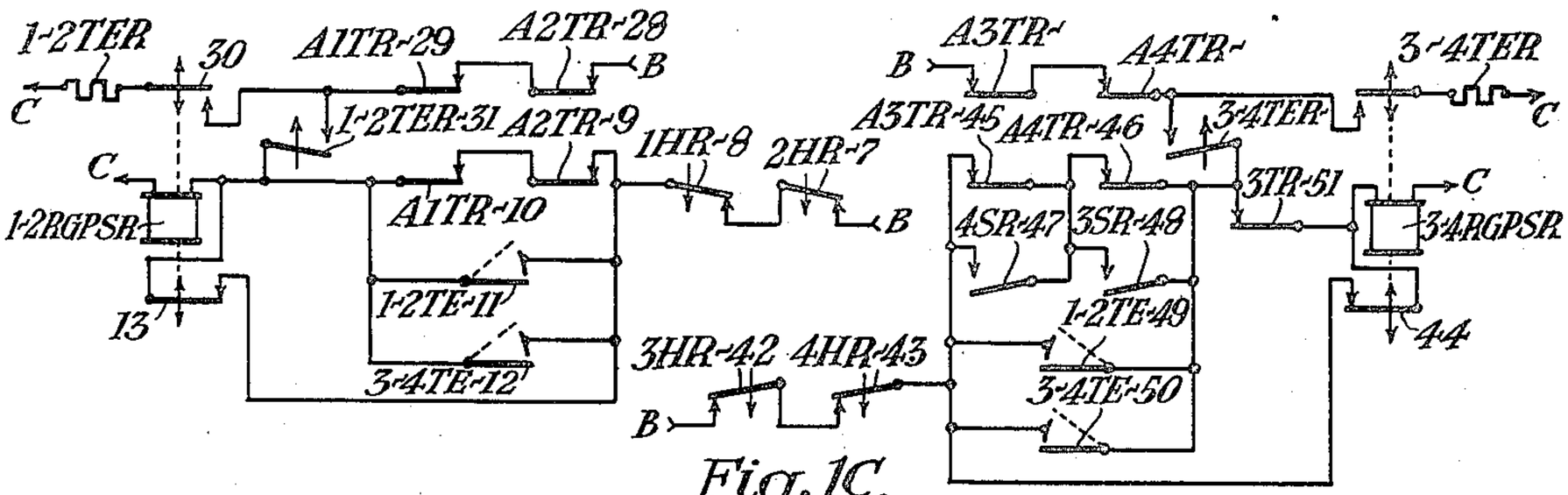

Fig. 1C.

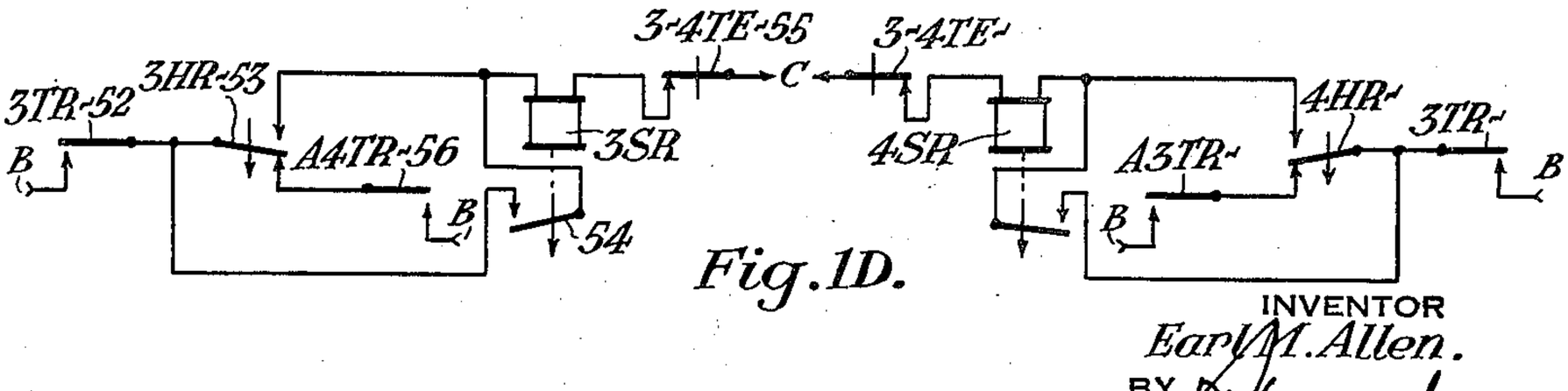

Fig. 1D.

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Patented Mar. 4, 1941

2,233,932

UNITED STATES PATENT OFFICE

2,233,932

RAILWAY SIGNALING

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Application July 24, 1940, Serial No. 347,241

4 Claims. (Cl. 246—114)

My invention relates to railway signaling, and particularly to signaling for the control of traffic movements along intersecting tracks.

A few features of my invention are the provision of a locking relay for each track, a front contact of which is included in a clearing control circuit for each of the opposing signals for its track, and a back contact of which is included in a holding circuit for each of these signals; the locking relays are of a slow acting type to protect against quick changes in the selection of traffic movements; and protection against loss of shunt in an approach section is obtained by retaining a corresponding signal in the clear condition a measured period of time after the loss of shunt occurs, and then preventing a conflicting signal from clearing until after the lapse of a further measured period of time.

The apparatus of my invention is an improvement over that disclosed in my copending application Serial No. 347,972, filed July 27, 1940, for Railway signaling.

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

In the accompanying drawing, Fig. 1A is a diagrammatic view showing two intersecting railway tracks, and two signals for each track, one on each side of the intersection, for governing traffic movements in opposite directions over the intersection; Fig. 1B is a diagrammatic view showing control circuits for a signal control relay for each of the signals; Fig. 1C is a diagrammatic view showing control circuits for two locking relays, one for each track, and for a time element device for each of the locking relays; and Fig. 1D is a diagrammatic view showing circuits for controlling directional stick relays for one of the tracks.

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

In each of the views, the 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 or other device by which they are operated. The prefix for each of these contact numbers comprises the reference character for the respective relay or other device by which the associated contacts are operated. For example, contact 3HR—53 shown in the pick-up circuit for relay 3SR in Fig. 1D is identified by the number 53 separated by a dash from the prefix 3HR which is the reference character for relay 3HR by which this contact is operated. Similarly, contact 3—4TE—55 also shown in the circuits for relay 3SR in Fig. 1D is identified by the number 55 separated by a dash from the prefix 3—4TE which is the reference character for the time element device by which this contact is operated.

Referring first to Fig. 1A, two intersecting railway tracks X and Z are shown, one of which, track X, is a high speed, heavy traffic line, whereas the other, track Z, is a low speed, light traffic line. Track X is divided by insulated joints 5 into sections A1T and A2T one of which, track section A1T, extends from the intersection of tracks X and Z in advance of signal 1 to a point in the rear of signal 1, and the other of which, section A2T, extends from the intersection in advance of signal 2 to a point in the rear of signal 2. Track Z is divided by insulated joints 5 into a detector section 3T extending through the intersection, an approach section A3T adjacent one end of section 3T, and a second approach section A4T adjacent the opposite end of section 3T. A track battery 6 is connected across the rails adjacent one end of each section. A track relay, designated by the reference character R with a prefix comprising the reference character for the associated track section, is connected across the rails adjacent the opposite end of each section.

Signals designated by the reference characters 1 and 2 are located adjacent track X for governing traffic movements in opposite directions on track X across the intersection of the two tracks. Signals designated by the reference characters 3 and 4 are placed adjacent the ends of track section 3T for governing traffic movements in opposite directions on track Z across the intersection of the two tracks. As here shown, each of the signals is of the color light type, but may be of any other suitable design. As shown in the drawing, each of the signals 1 and 2 for track X has a green or proceed lamp G and a red or stop lamp R, whereas each of the signals 3 and 4 for track Z has a yellow or caution lamp Y and a red or stop lamp R. Lighting circuits are shown for signals 1 and 3. The lighting circuits for signals 2 and 4 are similar to those shown for signals 1 and 3, respectively, and are therefore omitted from the drawing.

In Fig. 1B, pick-up and stick circuits are shown for slow release signal control relays 1HR, 2HR, 3HR and 4HR for signals 1, 2, 3 and 4, respectively. Manually controllable time element devices 1—2TE and 3—4TE are shown which may be of the well-known clockwork type. These time element devices have contacts 32 and 19, respective-

ly, shown in the circuits for relays 3HR and 1HR which are closed only when the time element devices are in their normal or "run down" positions. After being wound up, time element device 1—2TE closes a contact 1—2TE—11, shown in a pick-up circuit for relay 1—2RGPSR in Fig. 1C, when the time element device has returned to within 20 seconds of its "run down" position, which remains closed for 15 seconds, opening 5 seconds before the "run down" position is reached. Time element device 1—2TE also closes a contact 1—2TE—20 in the pick-up circuit for relay 1HR when the time element device is within 5 seconds, for example, of the end of its operation upon returning to the normal position. Similar contacts, designated similarly, are operated by time element device 3—4TE.

In Fig. 1C, pick-up and stick circuits are shown for locking relay 1—2RGPSR for track X, and for locking relay 3—4RGPSR for track Z. These locking relays are of the type having slow pick-up and slow release.

Energizing circuits are also shown in Fig. 1C for time element device 1—2TER for relay 1—2RGPSR, and for time element device 3—4TER for relay 3—4RGPSR. Time element devices 1—2TER and 3—4TER are indicated as being of the thermal type.

Fig. 1D shows pick-up and stick circuits for slow release directional stick relays 3SR and 4SR for track Z.

As shown in the drawing, all parts are in their normal condition, that is, the track sections are unoccupied and hence the track relays are energized; relays 1—2RGPSR and 3—4RGPSR are energized; relays 1HR, 2HR, 3HR, 4HR, 3SR and 4SR, and time element devices 1—2TER and 3—4TER are deenergized; and the red lamps of all signals are lighted, and hence the signals are indicating stop.

Both a pick-up and a stick circuit are closed for energizing relay 1—2RGPSR. The pick-up circuit which is closed passes from terminal B of a suitable source of current, through contacts 2HR—7, 1HR—8, A2TR—9, A1TR—10, and the winding of relay 1—2RGPSR to terminal C of the same source of current. The stick circuit for this relay passes from terminal B, through contacts 2HR—7 and 1HR—8, contact 13 of relay 1—2RGPSR, and the winding of relay 1—2RGPSR to terminal C. Relay 3—4RGPSR is energized by similar pick-up and stick circuits.

The circuit by which lamp R of signal 1 is lighted passes from terminal B, through the back point of contact 1HR—14, and lamp R to terminal C. Lamps R of the other signals are lighted by similar circuits.

In describing in detail the operation of the apparatus shown in the accompanying drawing, I shall first assume that, with all parts in the normal condition as just described, a train on track X, moving toward the right as shown in the drawing, which I shall assume is the eastbound direction, enters section A1T, thereby deenergizing track relay A1TR. Relay A1TR, upon becoming deenergized, completes a pick-up circuit for relay 1HR passing from terminal B, through contact 3TR—18, contact 19 of time element device 3—4TE, contacts 1—2TE—20, 3—4TER—21, 3—4RGPSR—22 and A2TR—23, winding of relay 1HR, front point of contact 1—2RGPSR—24, and contact A1TR—25 to terminal C. Relay 1HR, upon becoming energized, opens its contact 1HR—8 in the circuits previously traced for relay 1—2RGPSR, causing this relay to become deenergized. Relay 1—2RGPSR, upon becoming deenergized, completes a stick circuit for relay 1HR which follows the path previously traced for the pick-up circuit for relay 1HR as far as the winding of relay 1HR, and thence passing through the back point of contact 1—2RGPSR—24, front point of contact 1HR—26, and the back point of contact 2HR—27 to terminal C.

Relay 1HR, upon becoming energized while the front contacts of relay 1—2RGPSR are still closed, completes a second lighting circuit for lamp R of signal 1 passing from terminal B. through the front points of contacts 1HR—14 and 1—2RGPSR—15, and lamp R to terminal C. When relay 1—2RGPSR becomes deenergized in response to energization of relay 1HR, the second lighting circuit for lamp R of signal 1 is opened and the lighting circuit for lamp G of this signal completed, passing from terminal B, through the front point of contact 1HR—14, back point of contact 1—2RGPSR—15 and lamp G to terminal C. Signal 1 will then continue to display the proceed indication until the train enters section A2T, causing relay A2TR to open the circuit for relay 1HR at its contact A2TR—23.

On account of relay A2TR being deenergized, relay 1—2RGPSR will not pick up until the train leaves track section A2T, and hence signal 2 will continue to display the stop indication.

As the train proceeds further and leaves section A2T, relay 1—2RGPSR will become energized by its pick-up circuit previously traced. Relay 1—2RGPSR will then complete its stick circuit previously traced.

A front contact 1—2RGPSR—35 is included in the circuits for relays 3HR and 4HR, and hence neither of these relays can become energized as long as the eastbound train on track X occupies section A2T. Signal 3 or 4 can therefore clear for a train on track Z only after the eastbound train on track X has left section A2T.

I shall next assume that, with all parts again in the normal condition, an eastbound train enters section A1T and signal 1 again clears. I shall further assume that a loss of shunt occurs while the train is in section A1T, permitting relay A1TR to become falsely energized. Relay 1HR will then remain energized for a time by its stick circuit previously traced, although its pick-up circuit is open at contact A1TR—25 due to the false energization of relay A1TR.

With relay A1TR falsely energized, time element device 1—2TER will become energized by its circuit passing from terminal B, through contacts A2TR—28 and A1TR—29, contact 30 of relay 1—2RGPSR, and time element device 1—2TER to terminal C. If the loss of shunt in section A1T lasts long enough for time element device 1—2TER to close its front contact 1—2TER—31, relay 1—2RGPSR will become energized by a second pick-up circuit, passing from terminal B, through contacts A2TR—28, A1TR—29 and 1—2TER—31, and the winding of relay 1—2RGPSR to terminal C.

Relay 1—2RGPSR, upon becoming energized, opens the stick circuit for relay 1HR, and if relay A1TR is still falsely energized, the pick-up circuit for relay 1HR will be open and hence relay 1HR will become deenergized, causing signal 1 to indicate stop. If, after the train has entered section A1T, a second train has entered section A3T on track Z, signal 3 will not at once clear after signal 1 is controlled to indicate stop due to loss of shunt in section A1T, but will be de-

layed in clearing until time element device 1—2TER cools off and permits its contact 1—2TER—34 to close in the pick-up circuit for relay 3HR.

I shall again assume that all parts of the apparatus have been returned to the normal condition, and that an eastbound train enters section A1T, causing signal 1 to clear. I shall further assume that, after the train proceeds over the intersection and passes signal 2, it is desired that the train shall back up over the intersection without moving out of section A2T. Signal 2 will not clear, on account of relay 1—2RGPSR being deenergized.

In order to energize this relay, a trainman will operate time element device 1—2TE to the reverse position, thereby opening all of the signal circuits. When this time element device runs down to within 20 seconds of its normal position, relay 1—2RGPSR will become energized by a third pick-up circuit, passing from terminal B, through contacts 2HR—7, 1HR—8 and 1—2TE—11, and the winding of relay 1—2RGPSR to terminal C. The stick circuit previously traced for relay 1—2RGPSR will then become closed.

When the release 1—2TE runs down to within 5 seconds of its normal position, relay 2HR will become energized by its pick-up circuit which is similar to the pick-up circuit previously traced for relay 1HR, and which includes contact 1—2TE—20. Relay 2HR, upon becoming energized, will open the stick circuit for relay 1—2RGPSR, thereby completing a stick circuit for relay 2HR which is similar to the stick circuit previously traced for relay 1HR.

I shall assume that all parts of the apparatus are again in the normal condition and that an eastbound train causes signal 1 to clear, but that the train stops before passing signal 1. If, now, a train arrives on section A3T and if it is desired to let the second train on section A3T proceed over the intersection before the train on section A1T, a trainman will operate time element device 3—4TE to its reverse position, causing signal 1 to at once indicate stop on account of the opening of contact 19 of device 3—4TE in the circuits for relay 1HR. When release 3—4TE runs down to within 20 seconds of its normal position, relay 1—2RGPSR will become energized by a fourth pick-up circuit which is the same as the third pick-up circuit previously traced except including contact 3—4TE—12 instead of contact 1—2TE—11.

When release 3—4TE continues on down to within 5 seconds of its normal position, relay 3HR will become energized by its pick-up circuit including contact 3—4TE—33, and which is similar to the pick-up circuit previously traced for relay 1HR. With relay 3HR energized, relay 3—4RGPSR will become deenergized on account of its circuits being opened at contact 3HR—42, causing signal 3 to display the yellow indication. The stick circuit for relay 3HR will then be completed through the back point of contact 3—4RGPSR—38, and which is similar to the stick circuit previously traced for relay 1HR.

As the train proceeds and enters section 3T, relay 3TR will become deenergized, and its contact 3TR—18 will then open the circuits for relay 3HR. Relay 3HR, however, is of the slow release type, and relay 3SR will therefore become energized by its pick-up circuit passing from terminal B, through contact 3TR—52, front point of contact 3HR—53, winding of relay 3SR, and contact 3—4TE—55 to terminal C. A stick circuit will then be completed for relay 3SR which is the same as the pick-up circuit just traced except including contact 54 of relay 3SR instead of the front point of contact 3HR—53. With relay 3HR deenergized, signal 3 will be caused to indicate stop. When the train enters section A4T, a second stick circuit will be completed for relay 3SR passing from terminal B, through contact A4TR—56, back point of contact 3HR—53, contact 54 of relay 3SR, winding of relay 3SR, and contact 3—4TE—55 to terminal C.

With relay 3SR energized, a pick-up circuit will be completed for relay 3—4RGPSR as soon as the train leaves section 3T, this pick-up circuit passing from terminal B, through contacts 3HR—42, 4HR—43, A3TR—45, 3SR—48 and 3TR—51, and the winding of relay 3—4RGPSR to terminal C. With relay 3—4RGPSR again energized, signal 1 or signal 2 can now clear for a train in section A1T or A2T, respectively, while the train on track Z occupies section A4T.

I shall again assume that all parts of the apparatus are again in the normal condition, and that a train on section A3T causes signal 3 to clear. I shall further assume that while the train is on section 3T, after leaving section A3T and before entering section A4T, a loss of shunt occurs, so that relay 3TR picks up falsely. Relay 3—4RGPSR will then become energized by its pick-up circuit previously traced, and also by a second pick-up circuit which is the same as its pick-up circuit previously traced except including contact A4TR—46 instead of contact 3SR—48, but on account of its being of the slow pick-up type it will not at once close its front contacts. If the loss of shunt in section 3T continues for a long enough time, relay 3SR will release before relay 3—4RGPSR closes its front contacts. If relay 3SR releases before the train enters section A4T, and if relay 3—4RGPSR does not close its front contacts before the train enters section A4T, this relay cannot then become energized until the train on track Z leaves section A4T, and hence a train on track X cannot proceed over the intersection until after the train on track Z has passed clear through section A4T.

Although I have herein shown and described only one form of railway signaling 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. Control apparatus for railway signaling for intersecting tracks in which two signals are provided for each track one on each side of the intersection for governing traffic movements in opposite directions over the intersection, comprising in combination, a signal relay for each of said signals, a locking relay for each of said tracks, a clearing control circuit for energizing each of said signal relays including a front contact of each of said locking relays and a contact closed in response to a train arriving within a given distance in the rear of its signal, a stick circuit for retaining each of said signal relays energized including a front contact of its own and a back contact of the signal relay for the opposite signal as well as a back contact of the locking relay for its track and a front contact of the locking relay for the other track, energizing circuit means for each of said locking relays controlled by back contacts of the signal relays for the correspond-

ing track and also controlled by contacts which are closed only if there is no train within a given distance in the rear of either signal for the corresponding track, and a clearing circuit for each signal controlled by a front contact of its signal relay and by a back contact of the locking relay for its track.

2. Control apparatus for railway signaling for intersecting tracks in which two signals are provided for each track one on each side of the intersection for governing traffic movements in opposite directions over the intersection, comprising in combination, a locking relay for each of said tracks, a clearing control circuit for each of said signals controlled by a front contact of each of said locking relays and by a contact closed in response to a train arriving on its track within a given distance in the rear of the corresponding signal, a holding circuit for each of said signals controlled by a back contact of the locking relay for its track and by a front contact of the locking relay for the other track for retaining the corresponding signal in the clear condition, and energizing circuit means for each of said locking relays controlled by contacts which are closed if the signals for the corresponding track are indicating stop and also controlled by contacts which are closed only if there is no train on the corresponding track within a given distance in the rear of either signal for that track.

3. Control apparatus for railway signaling for intersecting tracks in which two signals are provided for each track one on each side of the intersection for governing traffic movements in opposite directions over the intersection comprising in combination, a locking relay for each of said tracks, energizing circuit means for each of said locking relays including contacts which are closed if the signals for the corresponding track are controlled to indicate stop, a time element device for each of said locking relays, an approach track section for each of said signals each provided with a track circuit including a track relay, an energizing circuit for each of said time element devices each controlled by a back contact of its locking relay and by front contacts of the approach track section relays for the corresponding track, an auxiliary energizing circuit for each of said locking relays controlled by front contacts of the approach track section relays for the corresponding track and by a contact closed by its time element device after its time element device has been energized a measured period of time, a clearing control circuit for each of said signals controlled by a front contact of each of said locking relays and by a back contact of its approach track section relay, and a holding circuit for each of said signals controlled by a back contact of the locking relay for its track and by a front contact of the locking relay for the other track for retaining the corresponding signal in the clear condition.

4. Control apparatus for railway signaling for intersecting tracks in which two signals are provided for each track one on each side of the intersection for governing traffic movements in opposite directions over the intersection, comprising in combination, a locking relay of the slow acting type for each of said tracks, a clearing control circuit for each of said signals controlled by a front contact of each of said locking relays and by a contact closed in response to a train on its track within a given distance in the rear of the corresponding signal, a holding circuit for each of said signals controlled by a back contact of the locking relay for its track and by a front contact of the locking relay for the other track for retaining the corresponding signal in the clear condition, and energizing circuit means for each of said locking relays controlled by contacts which are closed if the signals for the corresponding track are indicating stop and if there is no train on the corresponding track between the signals for that track.

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