Feb. 21, 1939.

E. M. ALLEN ET AL

RAILWAY SIGNALING

Filed Jan. 21, 1938

2,148,005

2 Sheets-Sheet 1

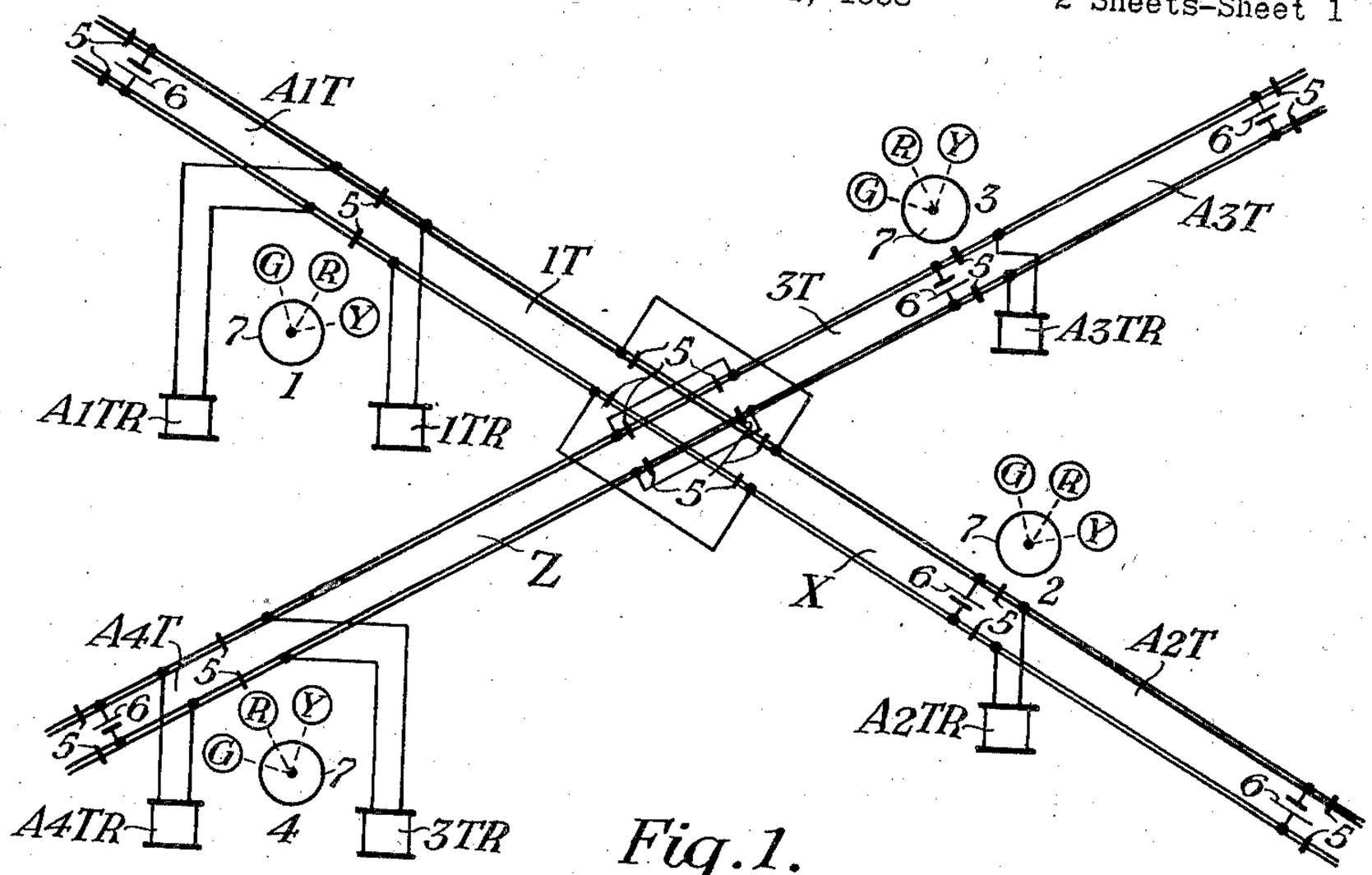

Fig. 1.

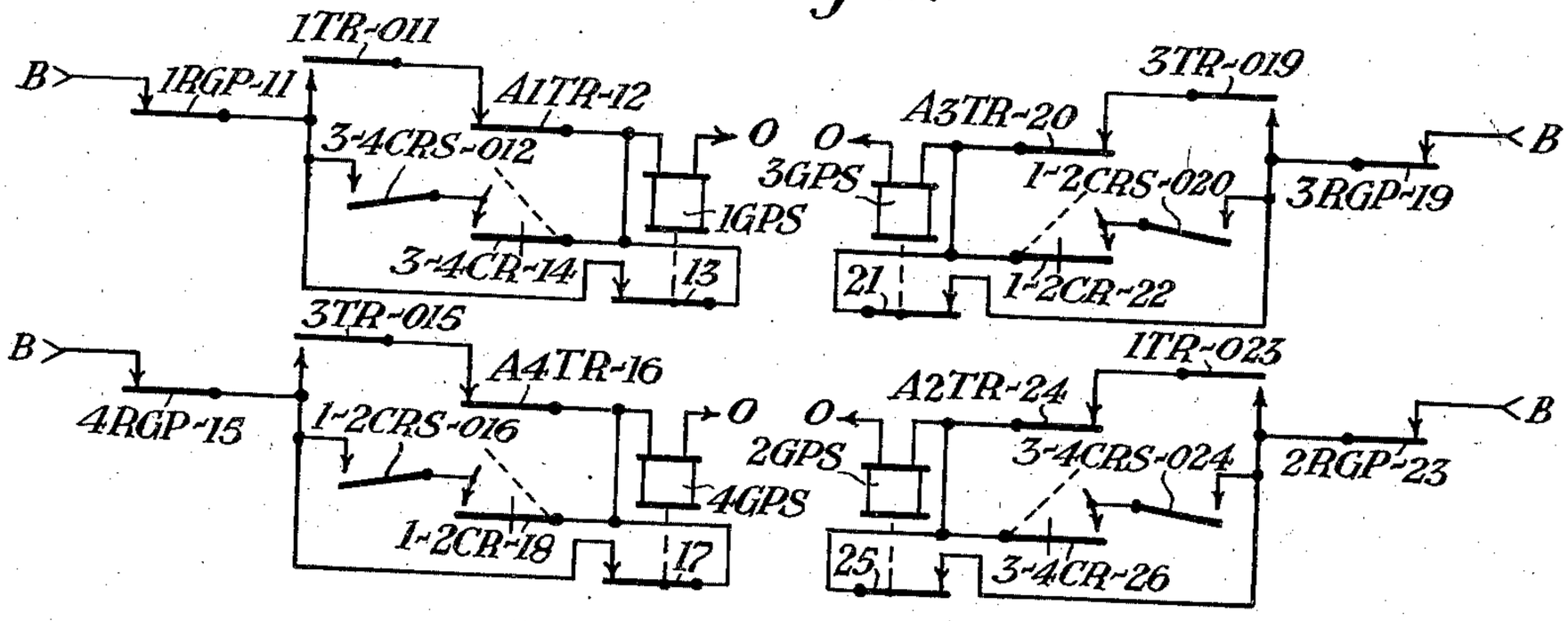

Fig. 3.

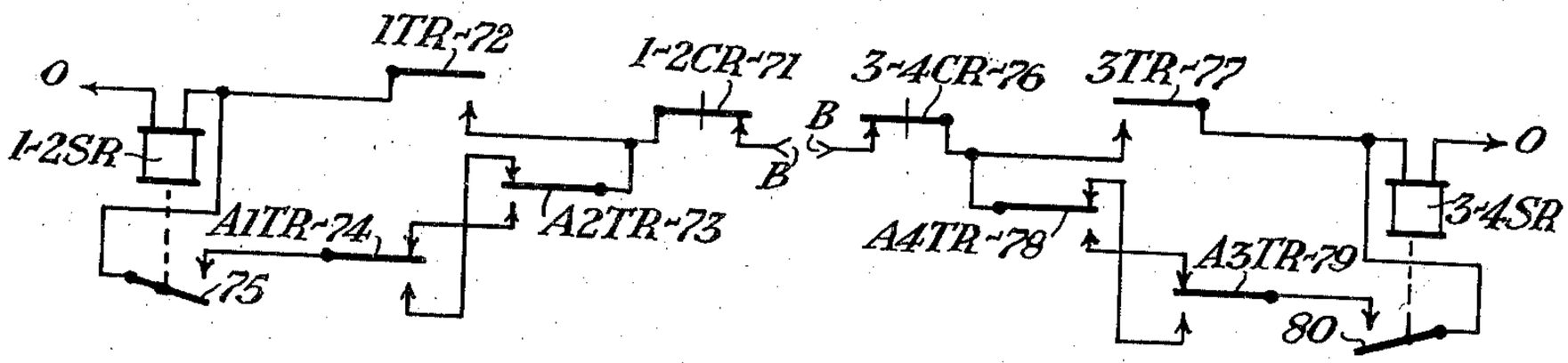

Fig. 4.

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2 Sheets-Sheet 2

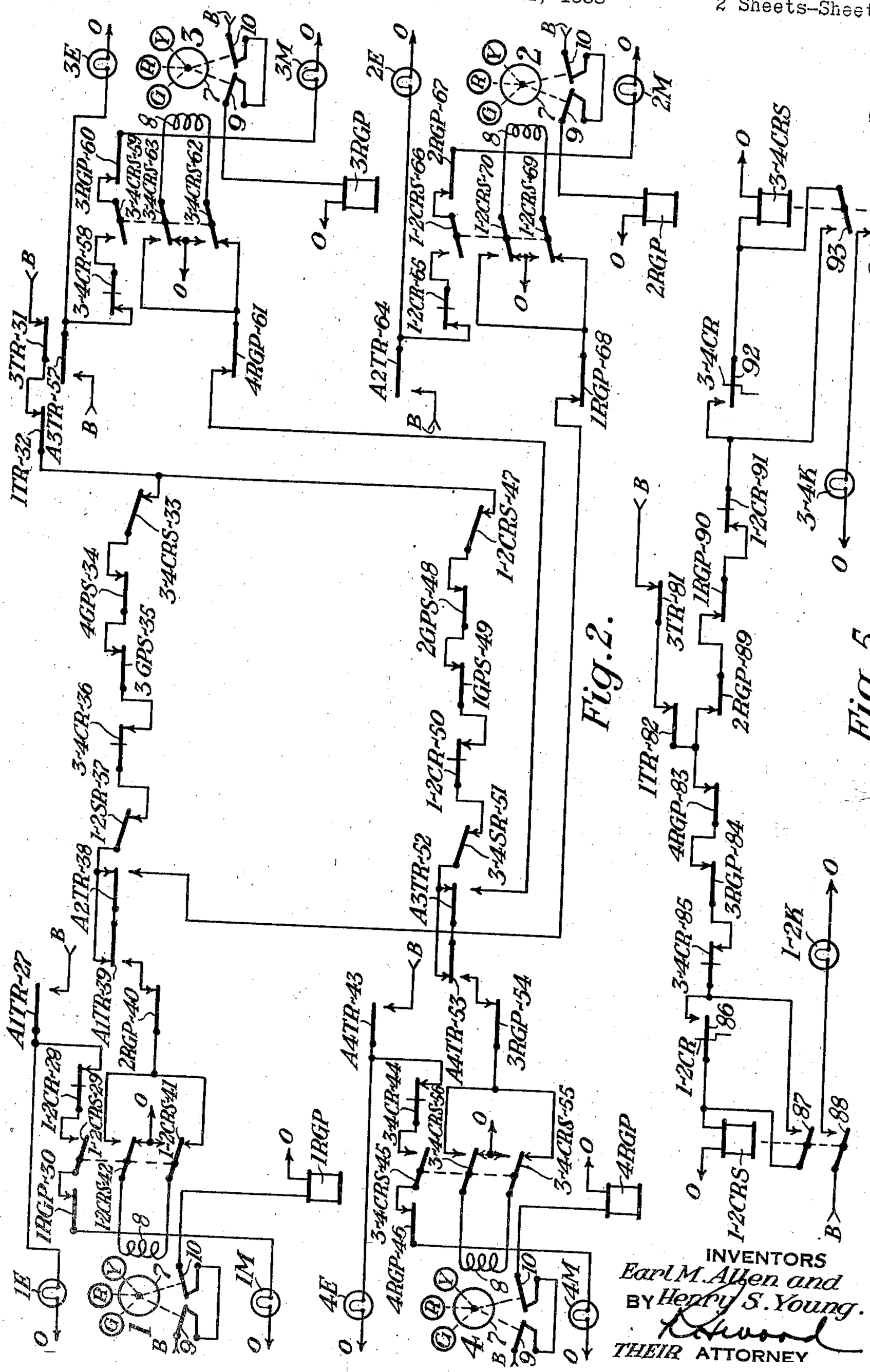

Fig. 2.

Fig. 5.

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RAILWAY SIGNALING

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Application January 21, 1938, Serial No. 186,096

9 Claims. (Cl. 246—114)

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

One feature of our invention is the provision of means for manually controlling the return of a signal for a given track from the proceed indication to the stop indication after the signal has been controlled by an approaching train to display the proceed indication, and for then controlling a second signal for the intersecting track to display a caution indication or a special indication when a train approaches the second signal.

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

In the accompanying drawings, Fig. 1 is a diagrammatic view showing two intersecting tracks and a signal for each direction of traffic movements for each of the tracks for governing traffic movements over the intersection of the two tracks; Fig. 2 is a diagrammatic view showing a control circuit network for the signals; Fig. 3 is a diagrammatic view showing control circuits for a lockout stick relay for each signal; Fig. 4 is a diagrammatic view showing control circuits for an auxiliary stick relay for each of the intersecting tracks; and Fig. 5 is a diagrammatic view showing control circuits for a permissive stick relay for each track.

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 contact is operated. For example, contact A1TR—27, shown in the control circuit for lamp 1E in the upper left-hand corner of Fig. 2, is identified by the number 27 separated by a dash from the prefix A1TR which is the reference character for relay A1TR by which this contact is operated. Similarly, contact 1—2CR—28, shown adjacent contact A1TR—27 in the circuit for lamp 1M in the upper left-hand corner of Fig. 2, is identified by the number 28 separated by a dash from the prefix 1—2CR which is the reference character for a time element device by which this contact is operated.

Referring first to Fig. 1, two intersecting railway tracks X and Z are shown, each of which is divided into sections by insulated joints 5. Track X is divided into sections A1T, 1T and A2T, and track Z is divided into sections A4T, 3T and A3T. A track battery 6 is connected across the rails adjacent one end of each section, and 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. The track sections having reference characters which include the letter A will be referred to as approach sections, and sections 1T and 3T at the intersection of the two tracks will be referred to as detector sections.

Signals designated by the reference characters 1 and 2 are located adjacent the ends of track section 1T 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 these signals is of the searchlight type, but may be of any other suitable design.

Referring now to Fig. 2, each of the signals shown in Figs. 1 and 2 comprises a member 7 mounted to oscillate between two extreme positions, and controlled by a winding 8 shown in Fig. 2 and by a permanent magnet or an electromagnet, not shown, so that, when winding 8 is energized, member 7 will move to one of its extreme positions or the other according as winding 8 is energized by current of normal or reverse polarity. Member 7 is biased to a middle position in which it is shown in the drawings, and which it occupies when winding 8 is deenergized. Member 7 carries three roundels G, R and Y arranged to cooperate with a signal lamp, shown in Fig. 2, designated by the reference character E with a numerical prefix corresponding to the reference character of its signal, in such manner that when member 7 is in the middle position, roundel R is in front of lamp E, whereas when member 7 is swung to the left or to the right, roundel Y or roundel G, respectively, is placed in front of lamp E. As shown in the drawings, lamp E is above the roundels, but the lamp is placed in this location for purposes of illustration, and it is to be understood that in actual practice the lamp is directly behind the roundels.

Each of the signals is also provided with a second lamp called a marker lamp, designated by

the reference character M with a prefix which comprises the reference character of its signal. Light from each marker lamp M is unaffected by the roundels G, R and Y of its signal.

Each of the signals operates a contact 9 which is closed when the member 7 occupies the R or Y position but is open when member 7 occupies the G position. Each of the signals also operates a contact 10 which is closed when the member 7 occupies the R or G position but is open when the member 7 occupies the Y position.

A signal of this type, without a marker lamp M, is disclosed and claimed in Letters Patent of the United States No. 1,864,224 granted to Wesley B. Wells on June 21, 1932, for Light signals.

Circuits are shown in Fig. 2 for energizing winding 8 of each signal and for lighting each of the lamps E and M. Circuits are also shown in Fig. 2 for energizing a signal indication relay for each signal, designated by the reference character RGP with a prefix comprising the reference character of the associated signal.

In Fig. 3, pick-up and stick circuits are shown for energizing a lockout stick relay for each signal. Each of these relays is designated by the reference character GPS with a prefix comprising the reference character for its signal.

Fig. 4 shows pick-up and stick circuits for an auxiliary stick relay 1—2SR for track X, and for an auxiliary stick relay 3—4SR for track Z.

In Fig. 5, pick-up and stick circuits are shown for a permissive stick relay 1—2CRS for track X, and for a permissive stick relay 3—4CRS for track Z. The pick-up circuit for relay 1—2CRS includes contact 86 of a manually controllable time element device which may be of the unlatched clockwork type. The pick-up circuit for stick relay 3—4CRS includes a contact of a similar time element device 3—4CR. Circuits are also shown in Fig. 5 for permissive control indication lamps 1—2K and 3—4K which are controlled by relays 1—2CRS and 3—4CRS, respectively.

As shown in the drawings, all parts are in the normal condition, that is, each track section is unoccupied, and hence the track relays are energized; winding 8 of each signal is deenergized, and hence the member 7 of each signal is in its middle position; each signal lamp E and marker lamp M, and also each permissive indication lamp 1—2K and 3—4K is unlighted; each relay RGP and GPS is energized; and the relays 1—2SR, 3—4SR, 1—2CRS and 3—4CRS are deenergized.

The circuit by which relay 1RGP is energized passes from terminal B of a suitable source of current, not shown in the drawings, through contacts 9 and 10 of signal 1, and the winding of relay 1RGP to terminal O of the same source of current. Relays 2RGP, 3RGP, and 4RGP are energized by similar circuits controlled by contacts 9 and 10 of the corresponding signals.

A stick circuit for relay 1GPS is closed, passing from terminal B, through contact 1RGP—11, contact 13 of relay 1GPS, and the winding of relay 1GPS to terminal O. Similar stick circuits are also closed for relays 2GPS, 3GPS and 4GPS.

In describing in detail the operation of the apparatus shown in the accompanying drawings, we 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 drawings, which we shall assume is the eastbound direction, enters approach section A1T, thereby deenergizing track relay A1TR. Relay A1TR, upon becoming deenergized, permits its contact A1TR—27 to close, thereby completing a circuit including this contact for lighting lamp 1E of signal 1. At the same time, contact A1TR—39 completes a circuit for energizing winding 8 of signal 1 in the normal direction, this circuit passing from terminal B, through contacts 3TR—31, 1TR—32, 3—4CRS—33, 4GPS—34, 3GPS—35, 3—4CR—36, 1—2SR—37, front point of contact A2TR—38, back point of contact A1TR—39, contacts 2RGP—40 and 1—2CRS—41, winding 8 of signal 1, and back point of contact 1—2CRS—42 to terminal O.

With winding 8 of signal 1 energized by current of normal polarity, member 7 of signal 1 will move roundel G in front of lamp 1E, and hence signal 1 will now display the green or proceed indication. Member 7, upon thus moving roundel G, opens contact 9, thereby deenergizing relay 1RGP.

Relay 1RGP, upon becoming deenergized, permits its contact 1RGP—11 to open the stick circuit for relay 1GPS, thereby causing relay 1GPS to become deenergized. Upon the deenergization of relay 1GPS, contact 1GPS—49 of this relay, which is included in the circuits for windings 8 of signals 3 and 4, will open, thus preventing any possibility of signal 3 or signal 4 being operated if a train should enter section A3T or A4T, respectively, while relay 1GPS is deenergized.

When the train passes signal 1 and enters track section 1T, contact 1TR—32 of the track relay for this section will open the circuit previously traced for signal 1, thereby causing winding 8 of signal 1 to become deenergized and member 7 of signal 1 to then return to its middle position.

With relay 1TR deenergized, a pick-up circuit will be completed for auxiliary stick relay 1—2SR, passing from terminal B, through contact 1—2CR—71, contact 1TR—72, and the winding of relay 1—2SR to terminal O. Relay 1—2SR, upon becoming energized, opens its contact 1—2SR—37 which is in the circuit for winding 8 of signal 2 as well as in the circuit previously traced for winding 8 of signal 1, in order to prevent signal 2 from clearing when the train recedes from the intersection through approach track section A2T.

When the train leaves section A1T, permitting relay A1TR to again become energized, relay 1GPS will become energized by a pick-up circuit passing from terminal B, through contacts 1RGP—11, 1TR—O11, A1TR—12, and the winding of relay 1GPS to terminal O. Relay 1GPS, upon becoming energized, closes its contact 13, thereby completing its stick circuit previously traced.

When the train enters section A2T, track relay A2TR will become deenergized, and a stick circuit for relay 1—2SR will thereby be completed if track section A1T is now unoccupied, or as soon as section A1T becomes unoccupied by the rear end of the train this stick circuit passing from terminal B, through contact 1—2CR—71, back point of contact A2TR—73, front point of contact A1TR—74, contact 75 of relay 1—2SR, and the winding of relay 1—2SR to terminal O. Relay 1—2SR will therefore be retained in the energized condition until the train leaves section A2TR unless, meanwhile, a following train enters section A1T.

Contact 1—2SR—37 would also prevent signal 1 from again clearing if the train, instead of proceeding on through section A2T, should back into section A1T. If the train should thus reverse its movement, a second stick-circuit would be completed for relay 1—2SR as soon as the train

had entered section A1T and left section A2T, this circuit passing from terminal B, through contact 1—2CR—71, front point of contact A2TR—73, back point of contact A1TR—74, contact 75 of relay 1—2SR, and the winding of relay 1—2SR to terminal O.

We shall next assume that all parts of the apparatus are again in the normal condition, and that another eastbound train enters section A1T but that, instead of proceeding past signal 1, it stops in section A1T, causing signal 1 to continue to display the green or proceed indication. We shall further assume that a northbound train now arrives on section A4T of track Z, and that it is decided to permit the train on track Z to proceed over the intersection before the train on track X does so.

A trainman or other authorized person will therefore wind time element device 3—4CR. At the beginning of this operation, contact 3—4CR—36 in the circuits for windings 8 of signals 1 and 2 will open, and contact 3—4CR—76 in the circuits for relay 3—4SR will also open. Upon the opening of contact 3—4CR—36, the indication of signal 1 will change from green or proceed to red or stop.

When time element device 3—4CR is fully wound, a pick-up circuit will be completed for relay 3—4CRS, passing from terminal B, through contacts 3TR—81, 1TR—82, 2RGP—89, 1RGP—90, 1—2CR—91, contact 92 of time element device 3—4CR, and the winding of relay 3—4CRS to terminal O. This relay, upon becoming energized, completes its own stick circuit, which is the same as the pick-up circuit just traced, except including its contact 93 instead of contact 92 of time element device 3—4CR. With relay 3—4CRS energized, contact 3—4CRS—33 of this relay will open the circuits for windings 8 of signals 1 and 2 at a second point. Also, with relay 3—4CRS energized, permissive control indication lamp 3—4K will be lighted by its circuit which includes contact 94 of relay 3—4CRS.

Time element device 3—4CR will now be permitted to unwind. Upon the lapse of a period of time after device 3—4CR starts to unwind, contact 3—4CR—14 of this device will close, thereby completing a second pick-up circuit for relay 1GPS, passing from terminal B, through contacts 1RGP—11, 3—4CRS—012 and 3—4CR—14, and the winding of relay 1GPS to terminal O. Contact 3—4CR—14 will again open before contacts 3—4CR—36 and 3—4CR—76 close.

With relay 1GPS energized, relay A4TR deenergized, and relay 3—4CRS energized, a circuit will now be complete for energizing winding 8 of signal 4 by current of reverse polarity, this circuit passing from terminal B, through contacts 3TR—31, 1TR—32, 1—2CRS—47, 2GPS—48, 1GPS—49, 1—2CR—50, 3—4SR—51, front point of contact A3TR—52, back point of contact A4TR—53, contact 3RGP—54, front point of contact 3—4CRS—56, winding 8 of signal 4, and the front point of contact 3—4CRS—55 to terminal O. With winding 8 of signal 4 thus energized by current of reverse polarity, member 7 of signal 4 will move roundel Y in front of signal lamp 4E. With signal 4 now indicating caution, contact 10 of this signal will be open, causing signal indication relay 4RGP to be deenergized. With relay 4RGP deenergized, contact 4RGP—15 of this relay will open the stick circuit for relay 4GPS, causing relay 4GPS to become deenergized. Relay 4GPS, upon becoming deenergized, permits its contact 4GPS—34 to open the circuits for signals 1 and 2 at another point. With signal 4 displaying a caution indication, the train may pass this signal and proceed over the intersection, causing operation of various relays similarly to the manner in which the operation of similar relays is effected, as previously described, for a train moving over track X.

We shall now assume that, after all parts of the apparatus have been again returned to the normal condition, an eastbound train again enters section A1T on track X, and that another train then enters section A4T on track Z, and that a trainman or other person winds time element device 3—4CR in order to permit the train on track Z to proceed over the intersection ahead of the train on track X. We shall further assume that the mechanism of signal 4 fails to respond, and that member 7 of this signal therefore remains in the middle position. Relay 4RGP will therefore continue energized, and hence a circuit will now be complete for lighting marker lamp 4M, passing from terminal B, through contacts A4TR—43, 3—4CR—44, 3—4CRS—45, and 4RGP—46, and lamp 4M to terminal O. With marker lamp 4M lighted, the trainmen of the train on track Z will know that signals 1 and 2 for track X are indicating stop, and that it is safe for the train on track Z to proceed past signal 4 over the intersection.

From the operations just described, it will be understood that time element devices 1—2CR and 3—4CR can also be operated to condition the signals to permit reverse traffic movements on the corresponding tracks. If, for example, an eastbound train should pass through track sections A1T and 1T and should then stop in section A2T, time element device 1—2CR could, if desired, be operated to condition signal 2 to permit the train to reverse its movement through sections 1T and A1T. Similarly, if an eastbound train, after entering section 1T, should, before going through section A2T, back up to signal 1, time element device 1—2CR could be operated to condition signal 1 to again permit the train to continue movement in the eastbound direction.

We shall next assume that, after all parts of the apparatus have been again returned to the normal condition, an eastbound train again enters section A1T on track X, causing signal 1 to clear, and that a northbound train then enters section A4T on track Z. We shall also assume that track relay 1TR becomes momentarily falsely deenergized before the train on track X reaches signal 1, such deenergization of track relay 1TR causing signal 1 to change to the stop indication. Relay 1RGP will then close its contact 1RGP—11 in the pick-up circuit first traced for relay 1GPS, and contact 1TR—011 in this circuit will also be closed on account of the false deenergization of relay 1TR. Contact A1TR—12 is, however, open on account of the train on section A1T, and therefore prevents energization of relay 1GPS, which, if it occurred, would create a dangerous condition by permitting signal 4 to clear without sufficient delay after signal 1 is changed to the stop indication by the momentary false deenergization of relay 1TR.

We shall now assume that all parts of the apparatus are again returned to the normal condition and that an east-bound train again enters section A1T, causing signal 1 to clear, and that a northbound train then enters section A4T. We shall also assume that track relay A1TR becomes falsely energized while the eastbound train is on section A1T and before it reaches signal 1, there-

by causing signal 1 to change to the stop indication. Contacts A1TR—12 and 1RGP—11 are therefore closed in the pick-up circuit first traced for relay 1GPS, but contact 1TR—O11 in this circuit is still open, thereby preventing energization of relay 1GPS, which, if it occurred at this time, would permit signal 4 to clear without safe delay after signal 1 is changed to the stop indication.

From the foregoing description and the accompanying drawings, it follows that, in apparatus embodying our invention for the control of traffic movements over track intersections, each signal will normally display a proceed indication for a train approaching the intersection. If a train stops before passing the signal, thereby retaining the proceed indication of the signal, a manually controllable time element device can be operated to change the indication displayed by the signal from proceed to stop, and to change the indication displayed by a signal for an intersecting track from stop to caution when a train on the intersecting track arrives on a corresponding approach section. If the mechanism of the signal for the intersecting track should fail to respond and indicate caution at this time, a marker lamp for the signal for the intersecting track will become lighted, thus indicating to the trainmen of the train on the intersecting track that it is safe to proceed over the intersection although the signal is not displaying either the yellow or the green indication. By operation of a time element device, each signal can also be conditioned to permit reverse traffic movements or to permit a resumption of traffic movement in a given direction after a reverse traffic movement.

Although we have herein shown and described only one form of railway signaling embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. In combination, two intersecting railway tracks, a signal for each of said tracks capable of displaying a stop indication as well as a first or a second or a third indication for directing traffic movements across the intersection of said tracks, means controlled by a train approaching each of said signals for controlling the corresponding signal to display said first indication, and manually controllable means for each of said tracks for at times restoring the corresponding signal from said first indication to said stop indication and for then controlling the signal for the other intersecting track to display said second indication when a train approaches the signal for said other intersecting track or for controlling the signal for said other intersecting track to display said third indication if it should fail to display said second indication.

2. In combination, two intersecting railway tracks, a signal for each of said tracks capable of displaying a stop indication as well as a first or a second indication for directing traffic movements across the intersection of said tracks, means controlled by a train approaching each of said signals for controlling the corresponding signal to display said first indication, and manually controllable means for each of said tracks for at times restoring the corresponding signal from said first indication to said stop indication and for then controlling the signal for the other intersecting track to display said second indication when a train approaches the signal for said other intersecting track.

3. In combination, two intersecting railway tracks, a signal for each of said tracks capable of displaying a stop indication as well as a first or a second indication for directing traffic movements across the intersection of said tracks, means controlled by a train approaching each of said signals for controlling the corresponding signal to display said first indication, and a manually controllable time element device for each of said tracks for at times restoring the corresponding signal from said first indication to said stop indication and for then controlling the signal for the other intersecting track to display said second indication upon the lapse of a measured period of time after the beginning of an operation of said time element device during which a train approaches the signal for said other intersecting track.

4. In combination, two intersecting railway tracks, a signal for each of said tracks having a red indication as well as a green indication and a yellow indication and also a marker indication, means controlled by a train approaching each of said signals for displaying the green indication of the corresponding signal, and manually controllable means for each of said tracks for at times changing from the green to the red indication of the corresponding signal and for then displaying the yellow indication of the signal for the other intersecting track when a train approaches the signal for said other intersecting track or for displaying the marker indication of the signal for said other intersecting track if the yellow indication is not displayed.

5. In combination, two intersecting railway tracks, a signal for each of said tracks having a red indication as well as a green indication and a yellow indication, means controlled by a train approaching each of said signals for displaying the green indication of the corresponding signal, and manually controllable means for each of said tracks for at times changing from the green to the red indication of the corresponding signal and for then displaying the yellow indication of the signal for the other intersecting track when a train approaches the signal for said other intersecting track.

6. In combination, two intersecting railway tracks, a signal for each of said tracks having a red indication as well as a green indication and a yellow indication, means controlled by a train approaching each of said signals for displaying the green indication of the corresponding signal, and a manually controllable time element device for each of said tracks for at times changing from the green to the red indication of the corresponding signal and for then displaying the yellow indication of the signal for the other intersecting track upon the lapse of a measured period of time after the beginning of a given operation of said time element device when a train approaches the signal for said other intersecting track.

7. In combination, two intersecting railway tracks, a signal for each of said tracks for each direction of traffic movements for governing traffic movements across the intersection of said tracks, a lockout stick relay for each of said signals, a pick-up circuit for each of said lockout stick relays closed only when its signal indicates stop and only when the associated track is unoccupied for a given distance in the rear of its signal, a stick circuit for each of said lockout stick

relays closed only when its signal indicates stop, an auxiliary stick relay for each of said tracks, a pick-up circuit for each of said auxiliary stick relays closed only when the associated track is occupied between its signals at said intersection, stick circuits for each of said auxiliary stick relays each closed only when the associated track is occupied within a given distance in the rear of one of its signals but unoccupied within a given distance in the rear of its other signal, and a control circuit for each of said signals controlled by a back contact of the auxiliary stick relay for the associated track and by front contacts of the lockout stick relays for the signals for the intersecting track.

8. In combination, two intersecting railway tracks, a signal for each of said tracks for each direction of traffic movements for governing traffic movements across the intersection of said tracks, a lockout stick relay for each of said signals, a manually controllable time element device for each of said tracks each having a normally open contact and having a normally closed contact which opens when said time element device is operated to close said normally open contact and which again closes upon the lapse of a measured period of time after said normally open contact again opens, a second normally open contact of said time element device which closes after said first normally open contact becomes opened and which opens before said normally closed contact becomes closed, a pick-up circuit for each of said lockout stick relays closed only when its signal indicates stop and controlled by the second normally open contact of the time element device for the intersecting track, a stick circuit for each of said lockout stick relays closed only when its signal indicates stop, a permissive stick relay for each of said tracks, a pick-up circuit for each of said permissive stick relays controlled by the first normally open contact of the time element device for its track, a stick circuit for each of said permissive stick relays closed only when the signals for the intersecting track are indicating stop, a proceed control circuit for each of said signals controlled by back contacts of both permissive stick relays and by front contacts of the lockout stick relays for the signals for the intersecting track and also controlled by the normally closed contact of the time element device for the intersecting track, and a caution control circuit for each of said signals which is controlled similarly to its proceed control circuit except that it is controlled by a front contact instead of by a back contact of the permissive control relay for its track.

9. In combination, two intersecting railway tracks, a signal for each of said tracks for governing traffic movements toward the intersection of said tracks, a lockout stick relay for each of said signals, a manually controllable time element device for each of said tracks, a circuit responsive to an operation of each of said time element devices for energizing the lockout relay for a signal for the intersecting track if the signal for the intersecting track is indicating stop, a circuit for retaining each lockout stick relay in the energized condition as long as its signal continues to indicate stop, a permissive stick relay for each of said tracks, a circuit responsive to an operation of each of said time element devices for energizing the permissive stick relay for the corresponding track if the signal for the intersecting track is indicating stop, a circuit for retaining each of said permissive stick relays in the energized condition if the signal for the intersecting track continues to indicate stop, a proceed control circuit for each of said signals controlled by back contacts of both permissive stick relays and by a front contact of the lockout stick relay for the signal for the intersecting track and also controlled by the time element device for the intersecting track in its normal position, and a caution control circuit for each of said signals controlled similarly to the proceed control circuit except controlled by a front contact of the permissive stick relay for its track.

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