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Oct. 5, 1943. H. S. YOUNG 2,331,262

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Aug. 19, 1942 2 Sheets-Sheet 1

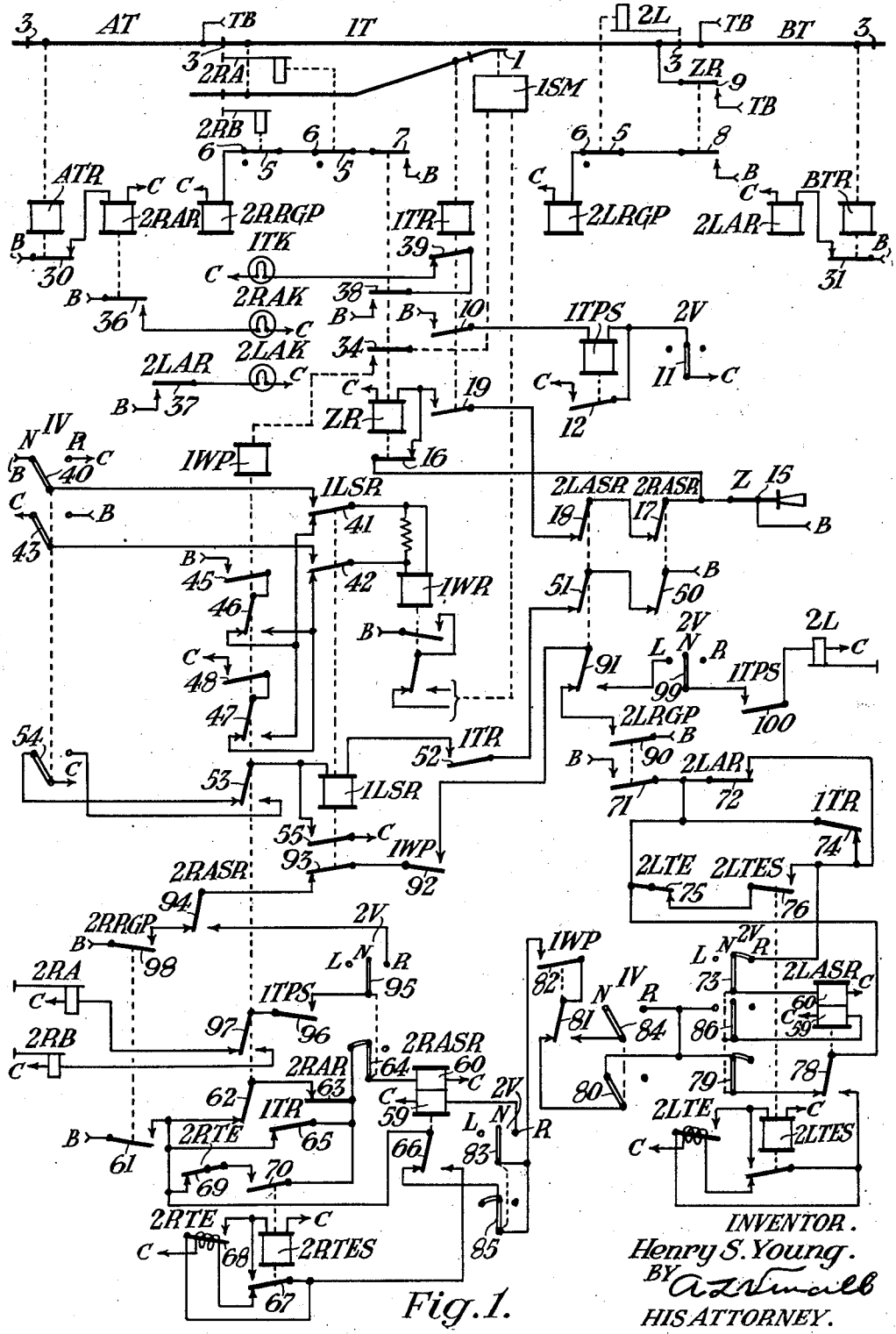


Fig. 1.

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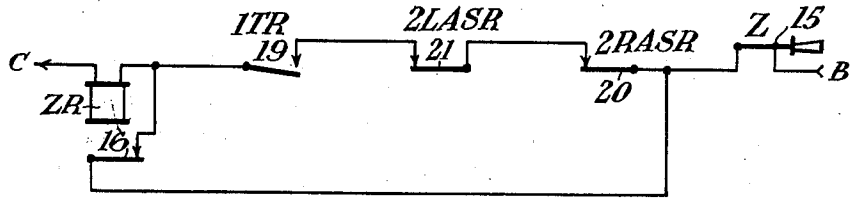


Fig. 2.

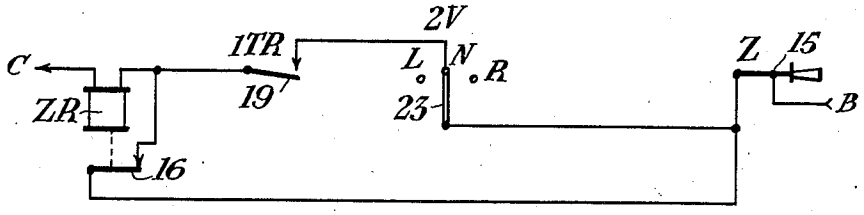


Fig. 3.

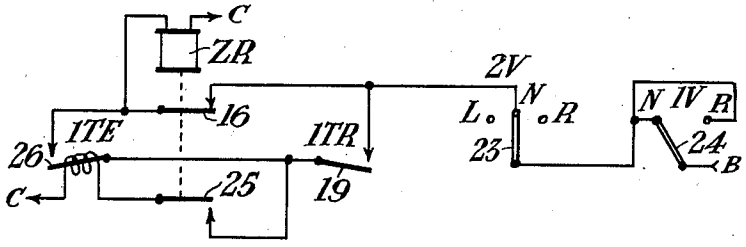


Fig. 4.

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UNITED STATES PATENT OFFICE

2,331,262

RAILWAY TRAFFIC CONTROLLING APPARATUS

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Application August 19, 1942, Serial No. 455,277

7 Claims. (Cl. 246—134)

My invention relates to railway traffic controlling apparatus, and it has particular reference to the organization of such apparatus into interlocking control apparatus for controlling from a centrally located control point the switches and signals of a track layout comprising a plurality of traffic routes.

The apparatus of my invention is an improvement upon that disclosed in Letters Patent of the United States No. 2,141,074, granted to me on December 20, 1938, for Railway traffic controlling apparatus. In the patent system and others of related character, a railway track layout is provided with normally energized track circuits arranged to cooperate in the control of the switches and signals and to reflect traffic conditions in the layout. In certain applications it is desirable to employ normally deenergized track circuits, thereby to avoid undue power consumption, and it is accordingly an object of my invention to provide interlocking systems incorporating normally deenergized track circuits.

Another object of my invention is the provision of apparatus for controlling the application of energy to interlocking apparatus, including track circuits, in such manner as to permit removal of energy therefrom only when the apparatus is in its normal condition wherein all possible dangerous conditions are avoided.

An additional object is the provision of interlocking control apparatus employing two position retained armature relays to provide approach locking.

A further object is the provision of interlocking control apparatus in which approach locking is effected through the medium of two position retained armature relays which also serve as signal control relays.

In practicing the invention, the above-mentioned and other important objects and characteristic features of my invention which will become readily apparent from the following description, are attained by providing a power control relay normally energized over a stick circuit which includes its own front contact and a manually controlled contact, and which relay when released applies energy to the track circuits of the track layout and to auxiliary interlocking apparatus associated therewith. The power control relay is provided with a pick-up circuit controlled by the manually operated contact, by track circuits, and by the associated interlocking apparatus and which circuit is arranged to be effective to pick up the power control relay provided that the track circuits and the associated interlocking apparatus are in the condition that obtains when the interlocking track circuits are vacant and the associated apparatus is in its normal condition.

The invention further contemplates the use of normally deenergized approach locking apparatus. To insure the release of such approach locking when in its normally deenergized position, the locking is established through the medium of two position retained armature relays, that is, relays of the type that when deenergized retain their armatures in the position to which they were last operated by energy. These relays may, for example, be of the polar stick type or may be of the type disclosed in Letters Patent of the United States No. 2,164,822, granted July 4, 1939, to Arthur G. Kershaw et al., having an armature operated by solenoids and latched in either of its two positions.

In the application of relays of the type mentioned to approach locking, contacts of the relays are interposed not only in the switch locking circuits to provide approach locking, but also in the signal control network to provide a check upon the proper operation of the relays. A further check upon such relays is obtained by interposing contacts of the switch locking relays in the signal control circuits.

I shall describe one form of apparatus embodying my invention, together with several modifications of a portion thereof, and shall then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a diagrammatic view illustrating one form of apparatus embodying my invention. Figs. 2, 3 and 4 are each diagrammatic views showing modifications of one portion of the apparatus illustrated in Fig. 1, and also embodying my invention. In each of the several views, similar reference characters have been employed to designate corresponding parts.

Referring to Fig. 1, the apparatus embodying my invention is represented applied to a simple track layout shown in the single line diagram and comprising a portion of a main track connected by a track switch 1 to a siding track, but it is to be understood that my invention may be applied to other track layouts involving entirely different combinations of switches and signals, the simple layout disclosed being employed as an example to illustrate the principles of the invention. The movements of traffic over the several routes through the track layout are governed by means of signals bearing the reference character 2 with distinguishing suffixes R and L indicating the direction of traffic governed by such

signals. Specifically, traffic moving from left to right on the main track is governed by signal 2RA; traffic moving from left to right on the siding track is governed by signal 2RB; and traffic moving from right to left on the main track is governed by signal 2L. Each of these signals is provided with a contact member 5 which is operated into engagement with another contact element 6, to form a circuit controlling contact 5—6, when and only when the signal displays its most restrictive or stop aspect. Contacts 5—6 of signals 2RA and 2RB control a back locking relay 2RRGP over a circuit that extends from one terminal B of a suitable source of current, such as a battery not shown but having its two terminals designated by the reference characters B and C, through back contact 7 of a power control relay ZR, hereinafter referred to, contacts 5—6 of signals 2RA and 2RB, respectively, and the winding of relay 2RRGP, to terminal C. Contact 5—6 of signal 2L controls a back locking relay 2LRGP, which relay is energized over a circuit that extends from terminal B through back contact 8 of relay ZR, contact 5—6 of signal 2L and the winding of relay 2LRGP to terminal C.

The rails of the tracks comprising the layout are divided by insulated joints 3, as indicated in the drawings, into sections AT, 1T and BT. Section 1T includes switch 1 and will be termed hereinafter a detector section, while sections AT and BT will be termed eastbound and westbound approach sections, respectively. Each of the sections is provided with a track circuit comprising a track relay, designated by the reference character TR with a distinguishing prefix, and a source, such as a track battery not shown but indicated by the reference character TB, connected to the rails at opposite ends of the section, these connections being indicated conventionally in the drawing. The track circuits for the two approach sections AT and BT are arranged in the customary manner so as to be normally energized and hence each relay ATR and BTR is energized and picked up whenever its associated section is vacant. The track circuit of section 1T is arranged in accordance with my invention to be normally deenergized and hence relay 1TR is normally released. Relay 1TR is picked up whenever power control relay ZR closes its back contact 9 to apply energy from source TB to the track rails, and when energized this circuit then functions on the closed circuit principle in that the relay is deenergized by a train shunting energy away from its winding.

In order to simplify the drawings, certain contacts of relays have been represented in the drawings at points remote from the relays operating such contacts, but each of such contacts bears not only an identifying reference character but also is designated by the reference character corresponding to the relay operating the contact. Thus, for example, contact 9 interposed in the track circuit of section 1T bears the reference character ZR to indicate that this contact is operated by relay ZR.

Track relay 1TR is provided with a stick repeater relay 1TPS which has a pick-up circuit which extends from terminal B through front contact 10 of relay 1TR, the winding of relay 1TPS, and contact 11 closed in the normal position of a manually operable lever 2V, hereinafter mentioned, to terminal C. After relay 1TPS picks up, contact 11 of lever 2V is bridged by front contact 12 of relay 1TPS which connects to terminal C, so that relay 1TPS is not released as a result of a subsequent movement of lever 2V.

Power control relay ZR is normally energized over a stick circuit that extends from terminal B through contact 15 of a manually operable contact member, herein shown as a knife switch Z, front contact 16 and the winding of relay ZR to terminal C. In the particular form of invention represented in Fig. 1 wherein normally deenergized two position retained armature relays are employed to establish approach locking, relay ZR is provided with a pick-up circuit which may be traced from terminal B through contact 15 of switch Z, normal contacts 17 and 18 of relays 2RASR and 2LASR, respectively, which relays will be described in detail hereinafter, front contact 19 of relay 1TR and the winding of relay ZR to terminal C. In a modification of this apparatus, represented in Fig. 2, the relay ZR is represented arranged for use in an interlocking system of the class such as is shown in the aforesaid Patent No. 2,141,074, wherein normally energized stick relays are employed as approach locking relays. In such a system, relay ZR may be picked up over a circuit shown in Fig. 2 and extending from terminal B through contact 15 of switch Z, front contact 20 of relay 2RASR, front contact 21 of relay 2LASR, front contact 19 of relay 1TR and the winding of relay ZR to terminal C. In another modification of the invention applicable to lever controlled interlocking systems involving stick control of the signals, relay ZR may be picked up over a circuit represented in Fig. 3 and which passes from terminal B through contact 15 of switch Z, contact 23 closed in the normal position of signal control lever 2V, front contact 19 of relay 1TR and the winding of relay ZR to terminal C. In still another form of the invention, represented in Fig. 4, relay ZR is illustrated arranged for use in a lever controlled interlocking system employing non-stick control of the signals. In this form of the invention, relay ZR is normally energized over a stick circuit which extends from terminal B through contact 24 closed in either the normal or the reverse position of switch control lever 1V, contact 23 closed in the normal position of signal control lever 2V, front contact 16 and the winding of relay ZR to terminal C; and is provided with a pick-up circuit completed at the end of the predetermined time interval of a time element device 1TE that becomes energized over a circuit extending from terminal B through contact 24 closed in either the normal or reverse position of lever 1V, contact 23 closed in the normal position of lever 2V, front contact 19 of relay 1TR, back contact 25 of relay ZR and the winding of time element device 1TE to terminal C. When relay 1TE closes its contact 26 at the end of its predetermined time interval, relay ZR may be picked up over a circuit which includes normal or reverse position contacts of contact 24 of lever 1V, lever contact 23 in the normal position of lever 2V, front contact 19 of relay 1TR, front contact 26 of time element device 1TE and the winding of relay ZR to terminal C. The levers 1V and 2V, in accordance with the usual custom, will be provided with lever locks, not shown, arranged to prevent a movement of lever 1V unless traffic and locking conditions are favorable; and to prevent a movement of lever 2V unless the position of the switch governed by lever 1V is favorable for such lever movement. In such an arrangement, the movement of lever 2V is thus made dependent upon an operation of a device (a track switch) con-

trolled by lever 2V, hence relay 1TE functions to retain the interlocking energized following a movement of lever 1V, for an interval sufficient to enable the operator to move the other lever 2V, thereby avoiding the possibility of deenergizing the interlocking system between lever movements.

The reference characters AR with suitably distinguishing prefixes designate approach relays for indicating the approach of traffic to the signals governing traffic on the main line portion of the layout. Relay 2RAR reflects approaching eastbound traffic and is controlled over a circuit which may be traced from terminal B through front contact 30 of relay ATR and the winding of relay 2RAR to terminal C. Relay 2LAR reflects westbound traffic operating in approach of signal 2LAR and is controlled over an obvious circuit including a source of current, front contact 31 of relay BTR and the winding of relay 2LAR.

Switch 1 is actuated by a power actuated switch machine of the usual type, designated in the drawing by the reference character 1SM, provided with a motor, not shown, having an operating circuit controlled by contacts of a polar switch control relay WR, as indicated conventionally by a dotted line in the drawings. The local switch machine circuits have been omitted to simplify the drawings, but these may be arranged, for example, as shown in Letters Patent of the United States No. 2,046,049, granted June 30, 1936, to Earl M. Allen for Railway traffic controlling apparatus.

The position of switch 1 is repeated or indicated by means of a polarized switch repeating relay 1WP, represented as being controlled by the switch machine through a local circuit not shown but indicated conventionally in the drawing. The circuit is normally open at back contact 34 of relay ZR and hence is effective to operate relay 1WP only when that contact is closed. For the purposes of the present description it is deemed sufficient to state that when back contact 34 of relay ZR is closed and switch 1 is in its normal position to permit traffic to move over the switch on the main line track, relay 1WP is caused to pick up and to position its polar armature in its normal or left-hand position, as viewed in the drawing, whereas when back contact 34 of relay ZR is closed and switch 1 is in its reverse position, the polar armature of relay 1WP is then positioned in its reverse or right-hand position.

The reference characters V with suitably distinguishing prefixes designate manually operable control levers for controlling the switches and signals of the track layout. It is to be understood that in actual practice these levers will be mounted on a panel located at the control office and containing a miniature representation of the track layout, not shown. Associated with the levers and track layout diagram there are a plurality of indication lamps, such as lamps 1TK, 2RAK and 2LAK, for indicating track conditions to the operator and for guiding him in the operation of the control levers. Lamp 2RAK is controlled over an obvious circuit including back contact 36 of relay 2RAR and it provides an indication of traffic conditions in eastbound approach section AT; lamp 2LAK is controlled over an obvious circuit completed at back contact 37 of relay 2LAR and it reflects traffic conditions in westbound approach section BT; while lamp 1TK is energized over an obvious circuit including back contact 38 of relay ZR and back contact 39 of relay 1TR and it reflects traffic conditions in section 1T.

Switch control lever 1V, for example, controls the relative polarity of current supplied to the operating circuit for switch control relay 1WR, while the continuity of this circuit is controlled by the contacts of a switch locking relay 1LSR. The normal circuit for relay 1WR may be traced from terminal B through contact 40 of lever 1V closed in its normal position, front contact 41 of relay 1LSR, the winding of relay 1WR, front contact 42 of relay 1LSR and contact 43 of lever 1V closed in its normal position to terminal C. The reverse circuit for relay 1WR includes reverse contacts 40 and 43 of lever 1V arranged to energize relay 1WR in the opposite direction, as is readily apparent from an inspection of the drawing. Relay 1WR is also provided with holding circuits for maintaining it energized in its last operated position when relays 1LSR and ZR are deenergized. A normal holding circuit for relay 1WR may be traced from terminal B through front contact 45 of relay 1WP, normal contact 46 of relay 1WP, back contact 41 of relay 1LSR, the winding of relay 1WR, back contact 42 of relay 1LSR, normal contact 47 of relay 1WP and front contact 48 of relay 1WP to terminal C.

The reverse holding circuit for relay 1WR is similar but it includes reverse polar contacts 46 and 47 of relay 1WP, as will be obvious from the drawing.

Switch locking relay 1LSR is picked up to close an operating circuit for switch control relay 1WR only when detector track relay 1TR is picked up, switch repeating relay 1WP and switch lever 1V are in corresponding relative positions, and approach locking relays 2RASR and 2LASR are in their respective normal positions. A pick-up circuit for relay 1LSR extends from terminal B through normal contacts 50 and 51 of relays 2RASR and 2LASR, respectively, front contact 52 of relay 1TR, the winding of relay 1LSR, normal polar contact 53 of relay 1WP, and contact 54 of lever 1V closed in its normal position, to terminal C. When lever 1V and relay 1WP are in their respective reverse positions, then an alternate circuit path is completed for relay 1LSR through reverse polar contact 53 of relay 1WP and contact 54 of lever 1V closed in the reverse lever position. After relay 1LSR has picked up, contacts 53 and 54 of relay 1WP and lever 1V, respectively, are bridged by front contact 55 of relay 1LSR which also connects to terminal C, so that relay 1LSR is not released as a result of a subsequent movement of lever 1V. It follows, therefore, that a movement of lever 1V while relay 1LSR is released is without effect, and that this lever operation is not stored to become effective automatically upon removal of the condition which causes relay 1LSR to release, but rather requires a switch lever movement, to be effective, to be made at the time the switch locking is effective and relay 1LSR is energized.

Signal lever 2V controls signals 2RA, 2RB and 2L through the medium of two circuit networks, comprising a route circuit network which includes the approach locking relays 2RASR and 2LASR, and a signal control network which includes the mechanisms of the signals controlled by lever 2V and by the approach locking relays.

The approach locking relays 2RASR and 2LASR are of the two position retained armature

armature type, that is, each relay has an armature which is operable to either of two positions and which is retained at its last operated position when the relay is deenergized. These relays are incorporated into the route circuit network where they are controlled by signal lever 2V in such manner that relay 2RASR may be operated from its normal or left-hand position to its reverse or right-hand position only when lever 2V is moved to its right-hand position and the other approach locking relay 2LASR is in its normal position, whereas relay 2LASR may be operated from its normal or left-hand position to its reverse position only when lever 2V is moved to its left-hand position and the other approach locking relay 2RASR is in its normal position. The approach locking relays 2RASR and 2LASR further are controlled by lever 2V in such manner that relay 2RASR may be operated from its reverse back to its normal position only when lever 2V is in or intermediate its normal and left positions, while relay 2LASR may be operated from its reverse back to its normal position only when lever 2V is in or intermediate its normal and right positions.

Specifically, relay 2RASR comprises a two-winding two-position relay having a normal winding 60 provided with an energizing circuit which extends from terminal B through front contact 61 of relay 2RRGP, normal polar contact 62 of relay 1WP, front contact 63 of relay 2RAR, contact 64 of lever 2V closed in or intermediate its normal and left positions, and the winding 60 of relay 2RASR to terminal C. The energization of normal winding 60 of relay 2RASR is effective to cause its polar armature to swing to its normal or left-hand position. It will be noted that this circuit is not available when switch 1 is reversed, since normal polar contact 62 of relay 1WP is then open, and that this circuit is also unavailable when section AT is occupied since approach relay 2RAR is then released. The normal winding of relay 2RASR may be energized when switch 1 is reversed and/or section AT is occupied, if a train occupies section 1T and releases relay 1TR to complete a branch circuit path, including back contact 65 of relay 1TR, around contact 62 of relay 1WP and contact 63 of relay 2RAR. Under other conditions, the normal winding 60 of relay 2RASR may be energized at the end of a predetermined time interval established through the medium of a time element relay 2RTE and time element stick relay 2RTES. Relay 2RTE is provided with an energizing circuit which extends from terminal B through front contact 61 of relay 2RRGP, polar contact 66 of relay 2RASR closed in its reverse or right-hand position, back contact 67 of relay 2RTES and the winding of relay 2RTE to terminal C. When relay 2RTE picks up at the end of its predetermined time interval, its front contact 68 closes and relay 2RTES then becomes energized over a circuit extending from terminal B through front contact 61 of relay 2RRGP, reverse polar contact 66 of relay 2RASR, front contact 68 of relay 2RTE and the winding of relay 2RTES to terminal C. Relay 2RTES then closes its front contact 67 and completes for itself a stick circuit in which the front point of its contact 67 bridges front contact 68 of relay 2RTE. The back point of contact 67 of relay 2RTES is now open and relay 2RTE accordingly becomes deenergized and at the end of a predetermined time interval closes back checking contact 69 of relay 2RTE to complete a branch circuit path, including that contact and front contact 70 of relay 2RTES, around normal polar contact 62 of relay 1WP and front contact 63 of relay 2RAR, whereupon relay 2RASR becomes energized.

Normal winding 60 of relay 2LASR may be energized over a normal circuit extending from terminal B through front contact 71 of relay 2LRGP, front contact 72 of relay 2LAR, contact 73 closed in or intermediate the normal and right-hand positions of lever 2V, and winding 60 of relay 2LASR to terminal C. This circuit has two branch paths around front contact 72 of relay 2LAR, one branch path comprising back contact 74 of relay 1TR and the other comprising back or checking contact 75 of time element relay 2LTE and front contact 76 of relay 2LTES. The time element relay 2LTE and time element stick relay 2LTES are controlled by operating circuits which include reverse polar contact 78 of relay 2LASR, and front contact 71 of relay 2LRGP, and which circuit elements are arranged in circuits substantially corresponding to the circuits previously traced for relays 2RTE and 2RTES.

The reverse winding 59 of relay 2RASR may be energized over a circuit that extends from terminal B through front contact 71 of relay 2LRGP, normal contact 73 of relay 2LASR, contact 79 closed in or intermediate the normal and right-hand positions of signal control lever 2V, contact 80 closed in the normal position of switch lever 1V, normal polar contact 81 and front contact 82 of relay 1WP, contact 83 closed in the right-hand position of signal control lever 2V, and winding 59 of relay 2RASR to terminal C. If switch lever 1V is reversed so that its normal contact 80 and normal polar contact 81 of relay 1WP are open, an alternate path is then established in this circuit through reverse polar contact 81 of relay 1WP and contact 84 closed in the reverse position of lever 1V. An energizing circuit for reverse winding 59 of relay 2LASR may be traced from terminal B through front contact 61 of relay 2RRGP, normal contact 66 of relay 2RASR, contact 85 closed in or intermediate the normal and left-hand position of lever 2V, front contact 82 and normal polar contact 81 of relay 1WP, contact 80 closed in the normal position of switch control lever 1V, contact 86 closed in the left-hand position of signal control lever 2V and winding 59 of relay 2LASR to terminal C. This circuit also has a branch path including reverse polar contact 81 of relay 1WP and contact 84 closed in the reverse position of lever 1V.

Signal 2RA may be cleared, when switch 1 is in its normal position, over a circuit extending from terminal B through front contact 90 of relay 2LRGP, normal contact 91 of relay 2LASR, front contact 92 of relay 1WP, back contact 93 of relay 1LSR, reverse contact 94 of relay 2RASR, contact 95 closed in the right-hand position of signal control lever 2V, front contact 96 of relay 1TPS, normal polar contact 97 of relay 1WP and the operating element of signal 2RA to terminal C. When switch 1 is reversed, signal 2RB may be cleared over a circuit corresponding to the circuit of signal 2RA but including reverse polar contact 97 of relay 1WP and the operating element of signal 2RB in the place of normal polar contact 97 of relay 1WP and the operating element of signal 2RA, respectively. Signal 2L may be cleared over a circuit which may be traced from terminal B through front contact 98 of relay 2RRGP, normal contact 94 of relay 2RASR, back contact 93 of relay 1LSR, front contact 92 of relay 1WP, reverse contact 91 of relay 2LASR, contact 99 closed in the left-hand position of signal control lever 2V, front contact 100 of relay

1TPS and the operating element of signal 2L to terminal C. It is to be noted that signals 2RA and 2RB can be cleared only when approach locking relay 2RASR is in its reverse position to close its reverse contact 94 while signal 2L may be cleared only if approach locking relay 2LASR is in its reverse position and closes its reverse contact 91. Furthermore, it is to be noted that the circuits for clearing all of the signals include back contact 93 of switch locking relay 1LSR and accordingly such circuits are unavailable if relay 1LSR is picked up.

In the normal condition of the apparatus, as represented in Fig. 1, relay ZR is held energized over its stick circuit, track relays ATR and BTR and the associated approach relays 2RAR and 2LAR are energized; while all of the other relays in the interlocking are deenergized; levers 1V and 2V, switch 1, and approach locking relays 2RASR and 2LASR are in their respective normal positions.

To energize the interlocking system of Fig. 1, the operator opens switch Z, thereby deenergizing power control relay ZR. Relay ZR accordingly releases and as a result, relays 1TR, 2RRGP and 2LRGP pick up, while relay 1WP has its operating circuit completed at back contact 34 of relay ZR and hence is placed under the control of switch 1 and switch machine 1SM. When relay 1TR picks up, switch locking relay 1LSR and stick repeater relay 1TPS become energized, while when back locking relays 2RRGP and 2LRGP become picked up, the normal windings of relays 2RASR and 2LASR are respectively energized.

With switch 1 in its normal position, signal 2RA or 2L will be cleared according as the operator moves lever 2V to its right or its left position, respectively. If the lever is moved to its right position, the reverse winding of relay 2RASR then becomes energized over its previously traced circuit including front contact 71 of relay 2LRGP, normal contact 78 of relay 2LASR, right-hand contact 83 of lever 2V and reverse winding 59 of relay 2RASR. The reverse energization of relay 2RASR causes its normal contact 50 to open and deenergize switch locking relay 1LSR; normal contact 17 interposed in the pick-up circuit of power control relay ZR also opens; while reverse contact 94 of relay 2RASR closes to complete the operating circuit previously traced for signal 2RA, which circuit includes front contact 90 of relay 2LRGP, back contact 93 of relay 1LSR, and lever contact 95 closed in the right-hand position of lever 2V, whereupon signal 2RA clears and as a result relay 2RRGP releases. If, on the other hand, lever 2V had been operated from its normal to its left-hand position, then relay 2LASR would have been reversed and signal 2L would have cleared, as is obvious from an inspection of the drawings.

In the event that either main line signal 2RA or 2L is cleared, the signal may be put to stop by restoring lever 2V to its normal position. When signal 2RA is put to stop, the normal winding 60 of the associated approach locking relay 2RASR becomes energized and that relay is operated to its normal position provided that approach section AT is vacant so that front contact 63 of relay 2RAR is closed. If, however, section AT is occupied, then relay 2RAR is released and relay 2RASR is retained in its reverse position until time element relays 2RTE and 2RTES operate to provide a time release circuit. When this time release circuit, previously traced, is established, relay 2RASR is restored to its normal condition, thus enabling locking relay 1LSR to be picked up to unlock switch 1. The switch may then be operated to establish a different route through the layout, it being noted that operation of the switch is delayed for the predetermined time interval of the time element device to prevent a switch movement in front of an approaching train and to enable the train to be brought to a stop short of the switch. The other approach locking relay 2LASR is similarly controlled by relays 2LAR, 2LTE and 2LTES, as is obvious from the drawing and the previous description of the circuits.

A track circuit release of the approach locking is provided when lever 2V is restored to its normal position after a train passes the cleared signal and enters detector section 1T. For example, if signal 2RA is cleared, the signal is placed at stop when the train enters section 1T because relay 1TR releases to in turn release relay 1TPS and open front contact 96 interposed in the operating circuit of signal 2RA. Back locking relay 2RRGP accordingly closes its front contact 61 and if lever 2V is restored to its normal position, then normal winding 60 of relay 2RASR becomes energized and relay 2RASR is restored to its normal condition to release the approach locking. Switch locking relay 1LSR is at this time held deenergized, however, at front contact 52 of relay 1TR and hence operation of the switch will be prevented.

When switch 1 is reversed, either signal 2RB or 2L is cleared according as lever 2V is operated to its right or to its left position, respectively. In this position of the switch, the approach locking may be released after signal 2RB is set to stop, only by the train accepting signal 2RB and entering section 1T, or at the end of the previously traced time interval of device 2RTE. That is to say, no normal release of the approach locking effected through a front contact of the approach relay is provided for signal 2RB. Signal 2L, however, is provided with the usual normal release as well as track circuit and time release.

When the interlocking apparatus is restored to its normal condition, relay ZR may be picked up over its pick-up circuit. This circuit includes front contact 19 of relay 1TR and hence requires the associated track circuit to be vacant in order for relay ZR to be picked up. In addition, this circuit includes normal contacts 17 and 18 of relays 2RASR and 2LASR, which relays in turn require lever 2V to be in its normal position so that all signals are at stop. It follows, therefore, that when switch Z is closed, power control relay ZR will be picked up only if all of the interlocking apparatus is in its normal condition wherein all possible dangerous conditions are avoided. When relay ZR picks up, it is held energized over its stick circuit, while all other relays, except track relays ATR and BTR and the associated approach relays 2RAR and 2LAR, become deenergized. It is to be seen, therefore, that the interlocking apparatus is energized when and only when its use is desired, and that at other times the apparatus may be deenergized and hence may be arranged to require a minimum of energy.

Although I have herein shown and described only a few forms of railway traffic controlling 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 combination with a railway track layout, two opposing signals one at each end of a traffic route through said layout, a two position retained armature relay for each of said signals, means controlled by each of said relays when in a first of its two positions for clearing its associated signal, a control lever having a normal and two extreme positions, circuit means governed by said lever and effective in its said normal position for positioning each of said relays in the second of two positions, and means for positioning one of said relays in its said first position over a circuit including a second position contact of the other of said relays and a contact of said control lever closed in one of the extreme positions thereof and for positioning said other relay in its said first position over a circuit including a second position contact of said one relay and a contact of said control lever closed in the other extreme position thereof.

2. In combination, a railway track layout including a track switch, two opposing signals one at each end of a traffic route over said switch, a two position retained armature relay for each of said signals, means controlled by each of said two position relays when in a first of its positions for clearing its associated signal, a control lever having a normal and two extreme positions, circuit means governed by said lever and effective in its normal position for positioning each of said two position relays in the second of its two positions, means for positioning one of said two position relays in its said first position over a circuit including a contact closed in the second position of the other of said two position relays and a contact of said lever closed in one of the extreme positions of said control lever and for positioning the said other two position relay in its said first position over a circuit including a contact closed in the second position of said one two position relay and a contact of said lever closed in the other extreme position of said control lever, a switch locking relay, an energizing circuit for said switch locking relay including a contact of each of said two position relays closed in said second position thereof, and switch control means including a front contact of said switch locking relay for operating said switch.

3. In combination, a railway track layout including a track switch, a pair of two position retained armature relays one for each direction of traffic over said switch, means governed by a manually controlled contactor in a normal position for positioning each of said two position relays in a normal position, means governed by said manually controlled contactor in one operated position for positioning one of said two position relays in an operated position over a circuit including a contact of the other of said two position relays closed in said normal position thereof, means governed by said manually controlled contactor in another operated position for positioning the said other two position relay in its operated position over a circuit including a contact of said one two position relay closed in said normal position thereof, a switch locking relay, an energizing circuit for said switch locking relay including a normal position contact of each of said two position relays, and switch operating means governed by a front contact of said switch locking relay for operating said switch.

4. In a railway interlocking system, a track section including a track switch, a power control relay normally energized over a stick circuit including its own front contact and a manually controlled contact, a track circuit for said section including a track relay and a back contact of said power control relay, an approach locking relay having a normal and an operated position, manually controlled means for operating said approach locking relay to its operated position, an approach relay responsive to traffic approaching said switch, a time element device having a time contact closed at the end of a predetermined time interval, means governed by said approach relay for operating said approach locking relay to its normal position when no traffic approaches said switch, other means governed by said time contact of said time element device for operating said approach locking relay to its normal position when traffic is approaching said switch, a pick-up circuit for said power control relay including said manually controlled contact and a normal position contact of said approach locking relay and a front contact of said track relay, and means governed by a front contact of said track relay and a normal position contact of said approach locking relay for operating said switch.

5. In combination, a stretch of railway track having a track section including a track switch, a retained armature two position relay having a normal and an operated position, means governed by a manually controlled contact for operating said two position relay to its operated position, a signal governing traffic in one direction over said switch, means governed by an operated position contact of said two position relay for clearing said signal, a power control relay normally energized over a stick circuit including its own front contact and another manually controlled contact, a track circuit for said section including a track relay and a back contact of said power control relay, a pick-up circuit for said power control relay including a normal position contact of said two position relay and a front contact of said track relay and said other manually controlled contact, an approach relay governed by traffic on said stretch approaching said switch, a circuit for operating said two position relay to its normal position including a third manually operated contact and a contact closed when said signal is at stop and a contact of said approach relay closed when said stretch is vacant, an alternate path around said contact of said approach relay comprising a back contact of said track relay, a time element device energized over a circuit including said contact closed when said signal is at stop and an operated position contact of said two position relay, another alternate path around said contact of said approach relay comprising a contact closed at the end of a predetermined time interval after said time element relay becomes energized, and switch control means governed by said two position relay and rendered effective when said two position relay is in its said normal position.

6. In combination, a stretch of railway track having a track section including a track switch, a retained armature two position relay having a normal and an operated position, means governed by a manually controlled contact for operating said two position relay to its operated position, a signal governing traffic in one direction over said stretch, means governed by an operated position contact of said two position relay for clearing said signal, a power control relay nor-

mally energized over a stick circuit including its own front contact and another manually controlled contact, a track circuit for said section including a track relay and a back contact of said power control relay, a pick-up circuit for said power control relay including a normal position contact of said two position relay and a front contact of said track relay and said other manually controlled contact, an approach relay governed by traffic on said stretch approaching said switch, a circuit for operating said two position relay to its normal position including a third manually operated contact and a contact closed when said signal is at stop and a contact of said approach relay closed when said stretch is vacant, a time element device energized over a circuit including said contact closed when said signal is at stop and an operated position contact of said two position relay, another alternate path around said contact of said approach relay comprising a contact closed at the end of a predetermined time interval after said time element relay becomes energized, and switch control means governed by said two position relay and rendered effective when said two position relay is in its said normal position.

7. In combination, a track section including a track switch, two opposing signals governing movements over said switch, a two position retained armature relay for each of said signals, means controlled by each of said two position relays when in a selected one of its positions for clearing its associated signal, a control lever having a normal and two extreme positions, circuit means governed by said lever and effective in its normal position for positioning each of said two position relays in its other position, means for positioning one of said two position relays in its said one position over a circuit including a contact closed in said other position of the other two position relay and a contact closed in one extreme position of said lever, means for positioning said other two position relay in its said one position over a circuit including a contact closed in said other position of said one two position relay and a contact closed in the other extreme position of said lever, a power control relay normally energized over a stick circuit including its own front contact and a manually controlled contact, a track circuit for said track section including a track relay and a back contact of said power control relay, a pick-up circuit for said power control relay including said manually controlled contact and a front contact of said track relay and contacts closed in said other position of each of said two position relays, a switch locking relay, an energizing circuit for said switch locking relay including a front contact of said track relay and a contact of each of said two position relays closed in the said other position of that relay, and means including a front contact of said switch locking relay for operating said switch.

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