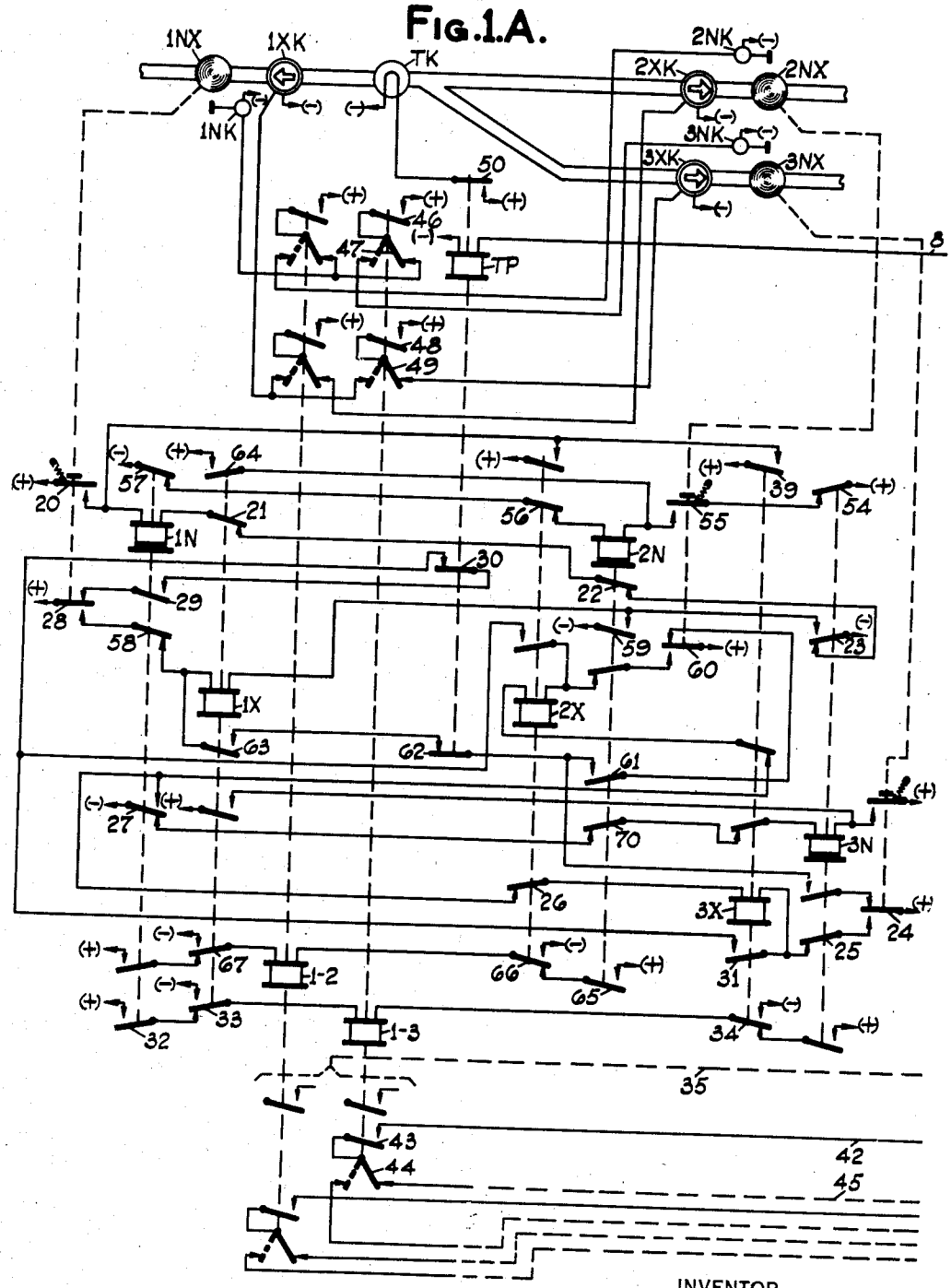
May 16, 1939. F. BENEDICT 2,158,975

INTERLOCKING SYSTEM FOR RAILROADS

Filed July 10, 1937 2 Sheets-Sheet 1

FIG. 1.A.



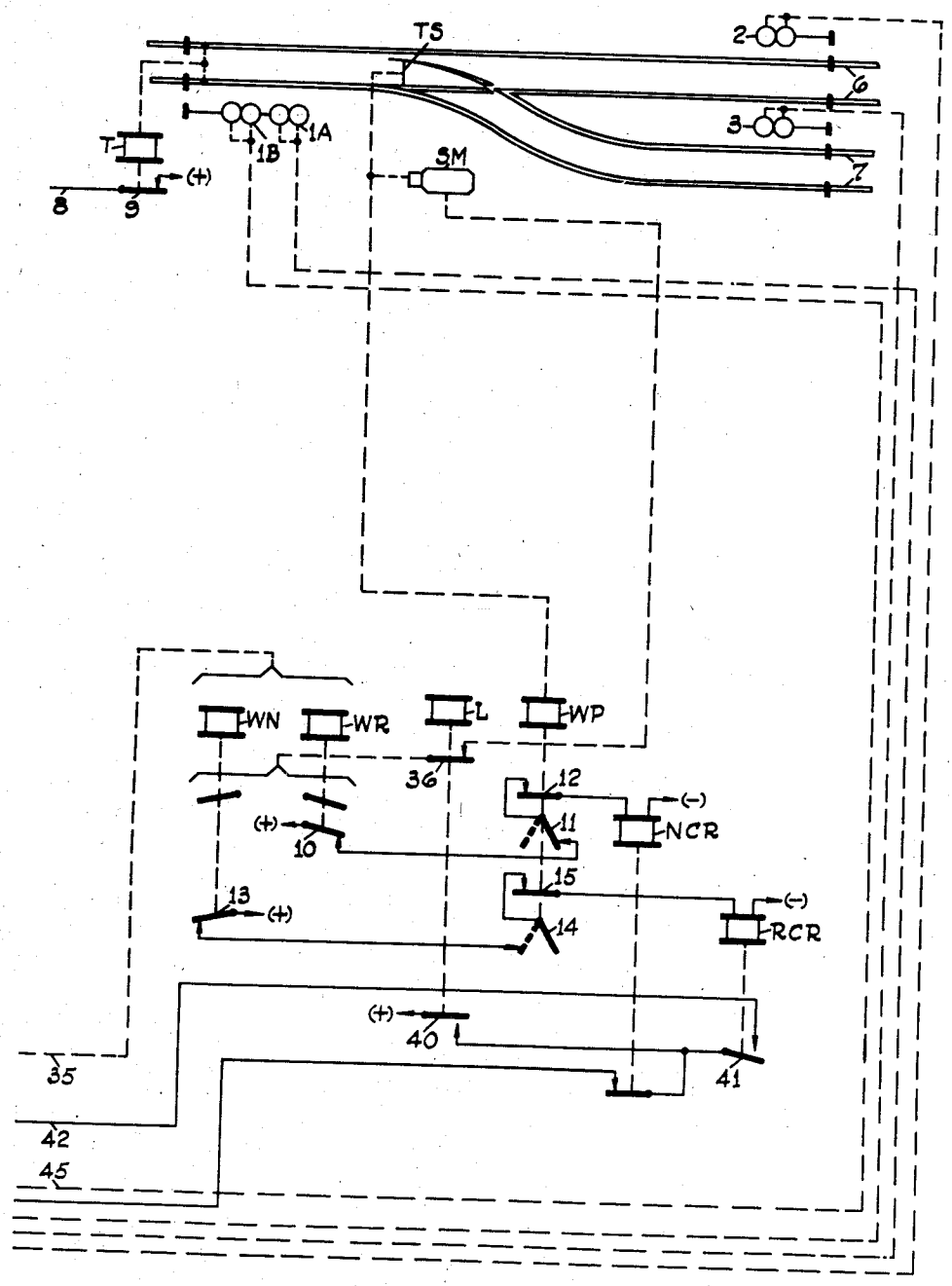
INVENTOR
F. Benedict
BY
Neil W. Preston
his ATTORNEY

May 16, 1939. F. BENEDICT 2,158,975

INTERLOCKING SYSTEM FOR RAILROADS

Filed July 10, 1937 2 Sheets-Sheet 2

FIG. 1B.



INVENTOR
F. Benedict,
BY his Neil H. Galston,
ATTORNEY

Patented May 16, 1939 2,158,975

UNITED STATES PATENT OFFICE

2,158,975

INTERLOCKING SYSTEM FOR RAILROADS

Frank Benedict, Rutherford, N. J., assignor to General Railway Signal Company, Rochester, N. Y.

Application July 10, 1937, Serial No. 152,976

10 Claims. (Cl. 246—134)

This invention relates to electric interlocking systems for railroads, and more particularly pertains to an interlocking system employing an entrance-exit type of manipulation.

The system of the present invention is to be considered an improvement over my prior application Ser. No. 93,432 filed July 30, 1936, and no claim is made herein to subject matter shown in such prior application.

In an interlocking system of this type, the track switches and signals of the interlocking plant are controlled from a central office by the manipulation of control buttons suitably located on a control panel having the actual track layout represented thereon in miniature. The present invention proposes to provide self-restoring push buttons at the ends of the routes represented on the miniature track diagram. These push buttons are arranged to control the track switches and signals in such a manner that the sequence in which the buttons for the opposite ends of any particular route are operated, determines the direction of traffic to be established in the corresponding route of the actual track layout.

With such an arrangement, it is apparent that these control buttons at the ends of the routes may be conveniently termed entrance-exit buttons, because each button may at times be an entrance button and at other times may be an exit button dependent upon the time of its operation with respect to the time of the operation of the control button located at the opposite end of an associated route. The sequence of operation of the entrance-exit buttons for the opposite ends of a particular route not only accomplishes the establishment of that route and the clearing of its governing signal, but also provides distinctive indications upon the control panel to definitely advise the operator of the particular route set up and the direction of traffic in such route. This is accomplished by the illumination of an entrance indicator for the entering end of each route, which symbolizes the signal for that end, and also the illumination of an exit indicator for the leaving end of each route. A suitable arrow on each exit indicator is indicative of the direction of traffic with which it is associated.

A further object of the present invention is to provide means responsive to the manual operation of the entrance-exit control buttons to effect the setting up of the routes, which means maintains the route clear only until the passage of a train over such route at which time it is then automatically restored to normal "at stop" conditions. There are, of course, situations in which a train does not pass over an established route, and under such circumstances the present invention provides that a route may be restored to stop conditions merely by the actuation of the entrance-exit control button at the entering end of such route. In other words, the second operation of a control button at the entrance to a route effects the restoration of that route to stop.

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

In describing the invention in detail, reference will be made to the accompanying drawings; in which like letters in the reference characters designate similar functions or relationships with the distinctiveness between such reference characters provided by the use of distinctive preceding numerals; in which like preceding numerals in the reference characters when applied to different letters represent the inclusion of such devices within a particular group; and in which:

Figs. 1A and 1B, when placed side by side diagrammatically illustrate the control office and field station apparatus included within an interlocking system of the present invention as applied to a single track switch.

For the purpose of simplifying the illustrations and facilitating in the description thereof, the parts and circuits constituting the embodiment of the invention have been shown diagrammatically and certain conventional illustrations have been employed, the drawings having been made more with the idea of making clear the purposes and principles of the invention together with its mode of operation, than with the idea of illustrating the specific construction and arrangements of parts that would probably be employed in practice.

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

The symbols (+) and (—) are employed to indicate the positive and negative terminals respectively of suitable batteries or other sources of electric energy; and the terminals with which these symbols are used are presumed to have current flowing from the positive terminal des-

ignated (+) to the negative terminal designated (—).

The symbols employed with any one circuit are considered to designate the terminals of the same batteries or other suitable source, but it is to be understood that as many separate sources may be provided as found necessary, or as many sources may be combined into a single source as found expedient in the practice of the invention. If alternating current is employed, then the symbols should be considered as representing the instantaneous relative polarities of the respective terminals.

Where groups of devices are referred to in a general way such devices will be designated by the letters or preceding numerals characteristic of such groups instead of mentioning each specific reference character in such groups.

APPARATUS

Track layout.—In Fig. 1B of the accompanying drawings, the invention has been shown applied to a track layout including a stretch of main track having rails **6** connected by a track switch TS to a turnout track having rails **7**.

A main signal **1A** governs main line traffic over the track switch TS in an east bound direction while signal **2** governs west bound traffic over the main track. Similarly, signal **1B** governs east bound traffic over the track switch TS in a reverse position onto the turnout track, while signal **3** governs westbound traffic off the turnout track onto the main track. These signals **1A**, **1B**, **2** and **3** are assumed to be color light signals giving the usual indications of green for clear and red for danger or stop, and yellow, if an added indication is desired for caution. However, these signals may be of the search light type, the semaphore type, or any other suitable type, instead of the particular type chosen for the embodiment of the present invention.

The track switch TS has been shown as operated by a switch machine SM, which may be of any suitable type, such as shown, for example, in the patent to W. K. Howe, Patent No. 1,466,903, dated September 4, 1923. It should be understood that the invention is not limited, as thus shown, to the control of a single track switch and its governing signals, but may be extended for any desired number of switches, crossovers, and the like, with suitable governing signals.

The track layout has been shown as divided into track circuits by suitable insulated joints of which only the track circuit associated with the track switch TS has been shown as having the usual track battery and the track relay T. This track circuit is wired in the usual manner to provide for fouling protection and to provide for the insulation of the track switch TS, such details of wiring having been omitted for the sake of simplicity in the disclosure. The occupied condition of this track circuit is indicated in the control office by a track repeating relay TP which is controlled over the line wire **8** by contact **9** of the track relay T in an obvious manner.

The track switch TS is provided with the usual switch position repeating relay WP of the usual polar-neutral type. This relay WP is energized with one polarity or the other in accordance with the normal or reverse locked position of the track switch TS in correspondence with the switch machine SM, and is deenergized whenever the track switch is unlocked or is in operation. The polarized circuit for controlling such a switch position relay may govern through the medium of a point-detector contact mechanism, as shown, for example, in the patent to C. S. Bushnell, Patent No. 1,517,236 dated November 25, 1924.

Normal and reverse correspondence relays NCR and RCR are associated with the switch position repeating relay WP and the switch machine control relays WN and WR. When there is no reverse switch control present for the switch machine SM as indicated by the energized or picked up condition of the relay WR, the relay NCR is energized, providing the relay WP indicates the track switch to be in a normal locked position, by a circuit closed from (+) through a circuit including back contact **10** of relay WR, polar contact **11** of relay WP in a right hand position, front contact **12** of relay WP, windings of relay NCR, to (—). When there is no normal control present for the switch machine SM as indicated by the energized or picked up condition of the relay WN, providing the track switch TS is in a reverse locked position as indicated by the relay WP, the relay RCR is energized by a circuit closed from (+), through a circuit including back contact **13** of relay WN, polar contact **14** of relay WP in a left hand position, front contact **15** of relay WP, windings of relay RCR, to (—).

In other words, the correspondence indicated by these relays NCR and RCR is of the indirect type. When the track switch TS is in a normal locked position, the relay NCR is energized irrespective of whether a normal control for the switch machine SM is present or not, but the presence of a reverse control immediately deenergizes such relay NCR. Similarly, when the track switch TS is in a reverse position, the relay RCR is energized irrespective of whether there is a reverse control present or not, but the presence of a normal control immediately deenergizes this relay RCR. Obviously, both of the relays NCR and RCR are deenergized when the track switch TS is operated to a new position.

The switch machine control relays WN and WR are considered to be governed from the central office by route relays **1—2** and **1—3** in a manner disclosed in detail in the prior application of A. Langdon, Ser. No. 91,932, filed July 22, 1936.

Associated with the switch machine control is a lock relay L, which is contemplated as controlled as shown and described in the above mentioned application Ser. No. 91,932, so as to provide what has been conveniently termed the electric lever lock equivalent. Such control has not been shown in detail as it is believed to be sufficient for an understanding of the present invention to know that the lock relay L is normally energized, but is deenergized initially only when a switch machine control is present, as indicated by the picked up condition of either the relay WN or the relay WR and the track switch is in correspondence with such control. When such lock relay is once deenergized, it is maintained deenergized by the clearing of the governing signal. This lock relay L is also deenergized whenever the associated detector track section is occupied as indicated by the dropped away condition of the track relay T.

Such lock relay inserted between the switch machine and control relays WN and WR allows the establishment of a new route whenever the detector track section is unoccupied, providing such relays WN and WR have been deenergized subsequent to the last occupied condition of such detector track section. In other words, if a new

route is to be established following the acceptance of a route already established, the operator must wait until the new route can be set up before endeavoring to cause its establishment, because the new route will not become automatically set up upon the passage of the train beyond the first route established. All such features of control have been described in detail in the prior application Ser. No. 91,932.

Control machine.—A control machine is located in the central office having a control panel on which a miniature track diagram corresponding to the actual track layout is located. With reference to Fig. 1A, the control panel is shown as having entrance-exit buttons 1NX, 2NX and 3NX at the opposite ends of the route over the track switch TS. These buttons are of the self-restoring push button type and actuate the contacts to which they are connected by dotted lines. Adjacent each of these entrance-exit control buttons are located suitable indicators 1NK, 2NK and 3NK representative of the associated signals.

Included in alignment with the miniature trackway are suitable exit route indicators 1XK, 2XK and 3XK upon which suitable arrows have been provided to indicate the direction of traffic in the route when such exit indicators are illuminated.

A track occupancy indicator is located on the miniature track diagram preferably at a point where it may be representative of the occupied condition of the detector track circuit irrespective of whether a train is passing over the main track or over the turnout track.

Each of the entrance-exit buttons NX have associated entrance and exit relays N and X, which relays are readily identified with their respective buttons by their distinctive preceding numerals. The entrance relays N are of the slow acting type, preferably much slower to release than to pick up, while the exit relays X are the usual neutral type relays.

Suitable route relays 1—2 and 1—3 are controlled by the entrance and exit relays N and X so that the picking up of an entrance relay for one end of a route, and the picking up of the exit relay X for the opposite end of that route causes the energization of the proper route relay to cause the setting up of that route over the track switch TS and the clear of the associated governing signal. These route relays 1—2 and 1—3 are of the usual polar-neutral type.

Although the present invention does not specifically disclose the auxiliary control of the track switch TS by an individual control lever, it is to be understood that such auxiliary control lever SML (not shown) may also be provided for the control of the switch machine SM as described and shown in detail in the above mentioned prior application Ser. No. 91,932.

It is believed that the remaining features of the present invention will be best understood by considering the detailed operation of the system.

Operation

Normal conditions.—Although the track switch TS is usually left in its last operated position, it has been shown in a position for the passage of main line traffic. The signals are, of course, normally "at stop" with the lower or red indicator of each signal normally illuminated, unless approach lighting features are employed in accordance with the usual practices.

With the signals "at stop" and the detector track section unoccupied or indicated with the track relays T and TP picked up, the lock relay L is also picked up. As there are no controls for the track switch, as indicated by the deenergized condition of both of the relays WN and WR, the correspondence relay NCR is normally energized, but if the track switch TS had been left in a reverse position, then the relay RCR would be energized.

All of the entrance and exit relays N and X in the central office are assumed to be deenergized, as well as the route relays 1—2 and 1—3. Under such circumstances, the indicators on the control panel are normally deenergized to provide what has been conveniently termed "a normally dark board".

Setting up a route.—Let us assume that the operator desires to set up a route from the signal 1B to the signal 3 with the track switch TS in a reverse position. He first operates the control button 1NX followed by the actuation of the control button 3NX.

During the actuation of the control button 1NX, a pick up circuit for the entrance relay 1N is closed from (+), through a circuit including control button contact 20 in an operated position, windings of relay 1N, back contact 21 of relay 1X, back contact 22 of relay 2N, back contact 23 of relay 3N, to (—).

The picking up of the entrance relay 1N prepares a pick up circuit for the exit relay 3X so that it can be closed upon the actuation of the control button 3NX from (+), through a circuit including back contact 24 of control button 3NX, back contact 25 of relay 3N, windings of relay 3X, back contact 26 of relay 2X, front contact 27 of relay 1N, to (—).

As soon as the relay 3X picks up, its stick circuit is closed from (+), through a circuit including front contact 28 of control button 1NX, front contact 29 of relay 1N, front contact 30 of relay TP, front contact 31 of relay 3X, windings of relay 3X, back contact 26 of relay 2X, front contact 27 of relay 1N, to (—).

The picking up of the relay 3X also closes a holding circuit for the relay 1N from (+), through a circuit including front contact 39 of relay 3X, windings of relay 1N, back contact 21 of relay 1X, back contact 22 of relay 2N, back contact 23 of relay 3N, to (—).

From the above description, it will be noted that the stick circuit for the exit relay 3X includes a front contact of the control button 1NX, so that the method of manipulation must be the sequential operation of the buttons 1NX and 3NX leaving the button 1NX in a self-restored normal position upon the picking up of the relay 3X to immediately provide it with a stick circuit. If the button 1NX should be held down, then the relay 3X would drop away upon the release of the button 3NX, so that the controlling manipulations would fail to set up a route. The time which elapses between the release of the control button 1NX and the picking up of the exit relay 3X is adequately bridged by the slow release characteristics of the relay 1N. However, the actuation of the button 3NX must occur within the time release period of relay 1N, or the entrance manipulation is lost and must be repeated before a route can be set up. Such slow release characteristics are provided for each of the entrance relays N.

It will also be observed that the actuation of the control button 3NX following the actuation of the control button 1NX can not possibly pick up the entrance relay 3N by reason of the inclu-

sion of back contact 21 of relay 1N in the pick up circuit of the entrance relay 3N. In other words, the response of the relay 1N to the operation of the control button 1NX prevents the picking up of an opposing entrance relay but permits the picking up of the exit relay for any route emanating from the point which such entrance relay 1N represents. This adequately provides protection against the clearing of opposing signals.

With the entrance relay 1N and the exit relay 3X both picked up, the route relay 1—3 is energized by a circuit closed from (+), through a circuit including front contact 32 of relay 1N, back contact 33 of relay 1X, windings of route relay 1—3, front contact 34 of relay 3X, to (—).

As soon as the route relay 1—3 picks up, closing its neutral contacts, the reverse switch machine control relay WR is picked up over its control wires indicated by the dotted line 35 so as to cause the reverse operation of the switch machine SM through circuits indicated as including front contact 36 of lock relay L.

The picking up of the relay WR opens back contact 10 causing the correspondence relay NCR to be immediately deenergized. During the operation of the track switch, the relay WP is of course deenergized, opening front contacts 12 and 15 so that both correspondence relays NCR and RCR must remain deenergized. Upon the completion of the reverse operation of the track switch TS, the relay WP is energized with the opposite polarity so that its polar contacts are actuated to the left and its neutral contacts are picked up, thus completing the energizing circuit for the reverse correspondence relay RCR.

As soon as the reverse correspondence relay RCR has been picked up, indicating the track switch to be in correspondence with the relay WR, then the lock relay L is dropped away (by means not shown), so that an energizing circuit is closed for the signal 1B by a circuit closed from (+), through a circuit including back contact 40 of relay L, front contact 41 of relay RCR, wire 42, front contact 43 of route relay 1—3, polar contact 44 of relay 1—3 in a right hand position, over the control line wire indicated by dotted line 45 (through such selections as are usually required in practice) to the signal 1B. This causes the signal 1B to change its indication from stop to clear.

Indications.—As soon as the manipulation of the control buttons on the control machine has caused the energization of the route relay 1—3, indications at the ends of the route thus to be set up are given to the operator by the energization of the indicators 1NK and 3XK. Indicator 1NK is energized by a circuit closed from (+), through a circuit including front contact 46 of relay 1—3, polar contact 47 of relay 1—3 in a right hand position, indicator 1NK, to (—). At the same time, the exit indicator 3XK is illuminated by a circuit closed from (+), through a circuit including front contact 48 of relay 1—3, polar contact 49 of relay 1—3 in a right hand position, indicator 3XK, to (—).

Inasmuch as the entrance and exit relays N and X for conflicting routes and opposing directions are completely interlocked, it is unnecessary to interlock the route relays of conflicting routes. Also, when a route relay is picked up, it is indicative of the fact that there is no conflicting route established on the control panel so that the illumination of the indicators immediately advises the operator that he has done nothing contrary to his prior manipulations. The passage of a train is indicated by the illumination of the track occupancy indicator TK. For example, the occupied condition of the detector track section for the track switch TS deenergizes the track relay T opening front contact 9 to deenergize the relay TP which closes back contact 50 to energize the track indicator TK by an obvious circuit.

Automatic restoration.—The deenergization of the track repeating relay TP upon the passage of a train past the signal 1B opens front contact 30 which is included in the stick circuit for the exit relay 3X so that this relay 3X immediately drops away and in so doing opens front contact 39 which in turn deenergizes the entrance relay 1N. The dropping of these relays, of course, deenergizes the route relay 1—3 thereby returning the signal 1B to stop and restoring the system to normal. The dropping away of the route relay 1—3 deenergizes the indicators 1NK and 3XK which indicates to the operator that the route is no longer clear.

However, a train may still be on such route as indicated by the illuminated condition of the track indicator TK, and the route is protected during the time that the train remains in the detector track section; as the deenergized condition of the track relay T maintains the lock relay L deenergized which in turn positively prevents the operation of the switch machine SM at open front contact 36.

Manual restoration.—Let us assume that the route above described is established with the signal 1B cleared, and that for one reason or another, the operator desires to return such route to "at stop" conditions before it is accepted by a train. All that is necessary on the part of the operator to accomplish this result is for him to actuate the control button 1NX which opens front contact 28 included in the stick circuit for the relay 3X. As soon as the relay 3X drops away, the route relay 1—3 is obviously deenergized. Also, the entrance relay 1N is again released. In other words, the opening of front contact 39 of relay 3X upon its dropping away does not deenergize the relay 1N at that time as the back contact 20 of the control button 1NX is closed, but upon the release of the self-restoring control button 1NX the entrance relay 1N drops away according to its slow acting characteristics. Thus, the system is restored to normal conditions by merely the operation and release of the governing entrance button.

Conflicting route protection.—Let us consider the system to be at normal and that the operator sequentially actuates the control buttons 2NX and 1NX in that order. The actuation of the control button 2NX closes a pick up circuit for the relay 2N from (+), through a circuit including back contact 54 of relay 3N, back contact 55 of control button 2NX, windings of relay 2N, back contact 56 of relay 2X, back contact 57 of relay 1N, to (—).

The picking up of the relays 2N and 1X closes an energizing circuit for the route relay 1—2 from (+), through a circuit including front contact 65 of relay 2N, back contact 66 of relay 2X, windings of relay 1—2, front contact 67 of relay 1X, to (—). Such energization of the route relay 1—2 actuates its polar contacts to the left and picks up its neutral contacts so that the track switch TS is controlled to a normal position and the signal 2 is cleared, in a manner analogous to that described for the route from signal 1B to signal 3.

Under such conditions it is obviously impossible to establish a route from the signal 1A to the signal 2. In the first place, this is prevented by the fact that the relay 1N can not be picked up with the relay 1X energized by reason of open back contact 21.

Neither can a route be cleared from the signal 1B to the signal 3 because the relay 1N can not be picked up upon the actuation of the control button 1NX under such circumstances, nor can the actuation of the control button 3NX cause the picking up of the relay 3N inasmuch as the back contact 70 of the relay 2N is open and the relay 3X can not be picked up because it requires the closure of front contact 27 of relay 1N in order to receive energy upon the actuation of the control button 3NX.

From the above consideration of conflicting routes, it is apparent that the entrance and exit relays are adequately interlocked to prevent the establishment of a conflicting route.

The occupied condition of the detector track section not only prevents the operation of the track switch TS by deenergizing the lock relay L (through means not shown, but well understood in the art), but also prevents the registration of an entrance-exit manipulation by the relays N and X. This is because the open front contacts 30 and 62 of relay TP, prevent the closure of the stick circuits for th exist relays X. Thus, any actuation of the buttons NX is only temporarily repeated by the relays N and X and then immediately drop away so that such route is not consummated upon the detector track section becoming unoccupied.

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

What I claim is:

1. In a control system for a railway track layout having a plurality of routes each including at least one track switch and having signals for governing traffic over such routes, a control panel, self-restoring control buttons for the ends of said routes, an entrance relay and an exit relay associated with each control button, circuit means for energizing an entrance relay upon the actuation of its associated control button only provided there is no entrance relay picked up for the opposite ends of the routes emanating from such point, circuit means for energizing each exit relay upon the actuation of its control button only provided an entrance relay is energized for the opposite end of a route with which it is associated, and route establishing means for setting up each route and clearing a signal for allowing the passage of traffic thereover in response to the energization of an entrance relay for one end of that route and an exit relay for the opposite end of that route.

2. In an interlocking system for a railway track layout having a plurality of routes with signals for governing traffic over such routes, a self-restoring control button for each end of each route there being but one button for those routes having common ends, a slow acting entrance relay for each control button, an exit relay for each control button, circuit means for energizing each slow acting entrance relay upon the actuation of its associated control button only provided there is no entrance relay energized for the opposite ends of the routes associated therewith, circuit means for energizing each exit relay only provided there is an entrance relay energized for the opposite end of an associated route, a holding circuit for each of said slow acting relays closed provided an associated exit relay is picked up while said slow acting relay is still picked up, and route establishing means associated with each of said routes and responsive to the joint operation of an entrance relay at one end of its route and an exit relay at the opposite end of its route to set up such route and clear the signal for the end of the route having its entrance relay picked up.

3. In an interlocking system for a railway track layout having a plurality of routes with signals for governing traffic over such routes, a self-restoring control button for each end of each route there being one button for those routes having common ends, a slow acting entrance relay for each control button, an exit relay for each control button, circuit means for energizing each slow acting entrance relay upon the actuation of its associated control button only provided there is no entrance relay energized for the opposite ends of the routes associated therewith, circuit means for energizing each exit relay only provided there is an entrance relay energized for the opposite end of an associated route, holding circuit means for maintaining energized a picked up entrance relay and picked up exit relay dependent upon said entrance button for said picked up entrance relay in a non-actuated position said holding circuit means being rendered effective only providing the exit relay is picked up while such entrance relay is still picked up.

4. In a system for the control of railway track switches and signals, a track layout having a plurality of routes each including at least one track switch with signals for governing the passage of traffic thereover, self-restoring control buttons for the ends of said routes, an entrance and an exit relay associated with each of said control buttons, circuit means for energizing an entrance relay upon the actuation of its associated control button only providing there is no entrance relay for an opposite signal in a picked up condition, circuit means for energizing an exit relay upon the actuation of its associated control button only provided in an entrance relay for the opposite end is picked up and only provided there is no exit relay for a conflicting route picked up, a route relay for each of said plurality of routes, circuit means for energizing a route relay only when an entrance relay at one end of its route is picked up and an exit relay for the opposite end of its route is picked up, and means controlled by each route relay to establish such route by the operation of said track switch and to clear the signal at the end of such route having its entrance relay picked up.

5. In a control system for an interlocking plant having track sections interconnected by a track switch to form a plurality of different routes and having signals for governing traffic in opposite directions over the different routes, self-restoring control buttons for the ends of said routes, an entrance relay and an exit relay associated with each of said control buttons and distinctively energized thereby in accordance with the sequence of operation of its control button with respect to the control button for the opposite end of an associated route to thereby designate the entrance and exit ends of such route by energizing the entrance relay only for the entrance

end and the exit relay only for the exit end, circuit means for maintaining distinctively energized said entrance relay and said exit relay for the opposite ends of each route dependent upon the unoccupied condition of the associated route, route establishing means for each of said routes controlled by the distinctive energization of the relay means at the opposite ends of its route and effective to set up that route and clear the signal for the end of such route designated as the entrance end by the distinctive energization of said relay means for that end, whereby the passage of a train through a particular route causes the deenergization of the relay means for the opposite ends of such route to thereby restore said signal at the entrance end of such route to stop.

6. In a control system for an interlocking plant having track sections interconnected by a track switch to form a plurality of different routes and having signals for governing traffic in opposite directions over the different routes; self-restoring control buttons for the ends of said routes; relay means associated with each of said control buttons and distinctively controlled thereby in accordance with the sequence of actuation of its control button with respect to the control button for the opposite end of an associated route to thereby designate the entrance and exit ends of such route; circuit means for maintaining distinctively energized the relay means for the opposite ends of each route dependent upon the unoccupied condition of the associated route, and also dependent upon the control button for the entrance end of such route remaining in a non-actuated position and not being again actuated in the same way; and route establishing means for each of said routes controlled by the distinctive energization of the relay means at the opposite ends of its route and effective to set up that route and clear the signal for the end of such route designated as the entrance end by the distinctive energization of said relay means for that end; whereby the passage of a train through a particular route causes the deenergization of the relay means for the opposite ends of such route to thereby restore said signal at the entrance end of such route to stop; and whereby a route set up and signal cleared therefor can be restored to stop by another actuation of the control button at the entrance to such route in the same way which effected the distinctive control of its associated relay means for designating it as the entrance end of said route.

7. In a control system for an interlocking plant having track sections interconnected by a track switch to form a plurality of different routes and having signals for governing traffic in opposite directions over the different routes; self-restoring control buttons for the ends of said routes; separate entrance and exit relays associated with each of said control buttons and distinctively controlled thereby in accordance with the sequence of operation of its control button with respect to the control button for the opposite end of an associated route to energize the entrance relay for one end and the exit relay for the other end and thereby designate the entrance and exit ends of such route; circuit means for maintaining distinctively energized the relays for the opposite ends of each route only provided the associated route is unoccupied, said circuit means being rendered inactive by a second operation in the same direction of the button for the entrance end; and route establishing means for each of said routes controlled by the distinctive energization of the relays at the opposite ends of its route and effective to set up that route and clear the signal for the end of such route designated as the entrance end by the distinctive energization of said relay for that end; whereby the passage of a train through a particular route causes the deenergization of the relays for the opposite ends of such route to thereby restore said signal at the entrance end of such route to stop.

8. In a switch and signal control system for railroads; a track layout having a plurality of routes between signal locations; a control panel having a miniature track diagram of said track layout; self-restoring manually operable buttons on said track diagram at points corresponding to said signal locations, there being a single button for each signal; an entrance relay and an exit relay for each of said buttons; circuit means for energizing an entrance relay at the entrance end of a route upon the actuation of its associated button; means responsive to the energization of an entrance relay for opening the energizing circuit means of the entrance relays for all routes leading to the route end with which such energized entrance relay is associated; circuit means for energizing an exit relay at the entrance end of a route upon the actuation of its button following the actuation of the button for the entrance end of such route only if the associated entrance relay for such exit end is maintained deenergized by reason of the open condition of its energizing circuit; and route establishing means responsive to the energization of an entrance relay for one end of a route and the exit relay for the other end of the route for setting up that route and clearing the signal at that end of such route having its entrance relay picked up, whereby the sequential actuation of the buttons at the opposite ends of any given route causes the clearing of the signal at that end of such route having its button first actuated.

9. In a switch and signal control system for railroads; a track layout having a plurality of routes between signal locations, each route including at least one track switch; a control panel having a track diagram representing said track layout; manually operable control buttons on said track diagram for the ends of said routes, there being only one button for each signal and each button being of the self-restoring type; an entrance relay and an exit relay for each of said control buttons, said entrance relays being relatively slower acting than said exit relays; circuit means for energizing an entrance relay upon the actuation of its associated control button; circuit means for energizing an exit relay upon the manual operation of its corresponding control button dependent upon the energized condition of an entrance relay for the opposite end of an associated route; means responsive to the energization of an exit relay for opening the energizing circuit means for the corresponding entrance relay; and route establishing means responsive to the energization of the entrance relay for one end of a route and the exit relay for the other end of the route for setting up that route and clearing a signal at the entrance end thereof.

10. In a control system for power-operated track switches and signals; a track layout having a plurality of routes each including at least one track switch and such routes having signals at the opposite ends thereof; a control panel having a miniature track diagram of said track layout; a single self-restoring manually operable

control button for each of said signals and located on said track diagram at points corresponding to said signal locations; an entrance relay and an exit relay for each of said control buttons; circuit means for energizing the entrance relay at one end of a route and the exit relay at the other end of the route when the control buttons for the ends of such route are operated in that sequence; route establishing means controlled by the energization of the entrance relay at one end of a route and the energization of the exit relay at the opposite ends of that route for setting up the route and clearing the signal at the end for which the entrance relay is energized; stick circuit means for each entrance relay for maintaining such entrance relay energized dependent upon the energized condition of the exit relay at the opposite end of the route for which the entrance relay is then energized; and stick circuit means for each exit relay for maintaining such exit relay energized dependent upon the unoccupied condition of the route with which it is then associated and including a normally closed contact of the control button at the entrance end of such route.

FRANK BENEDICT.