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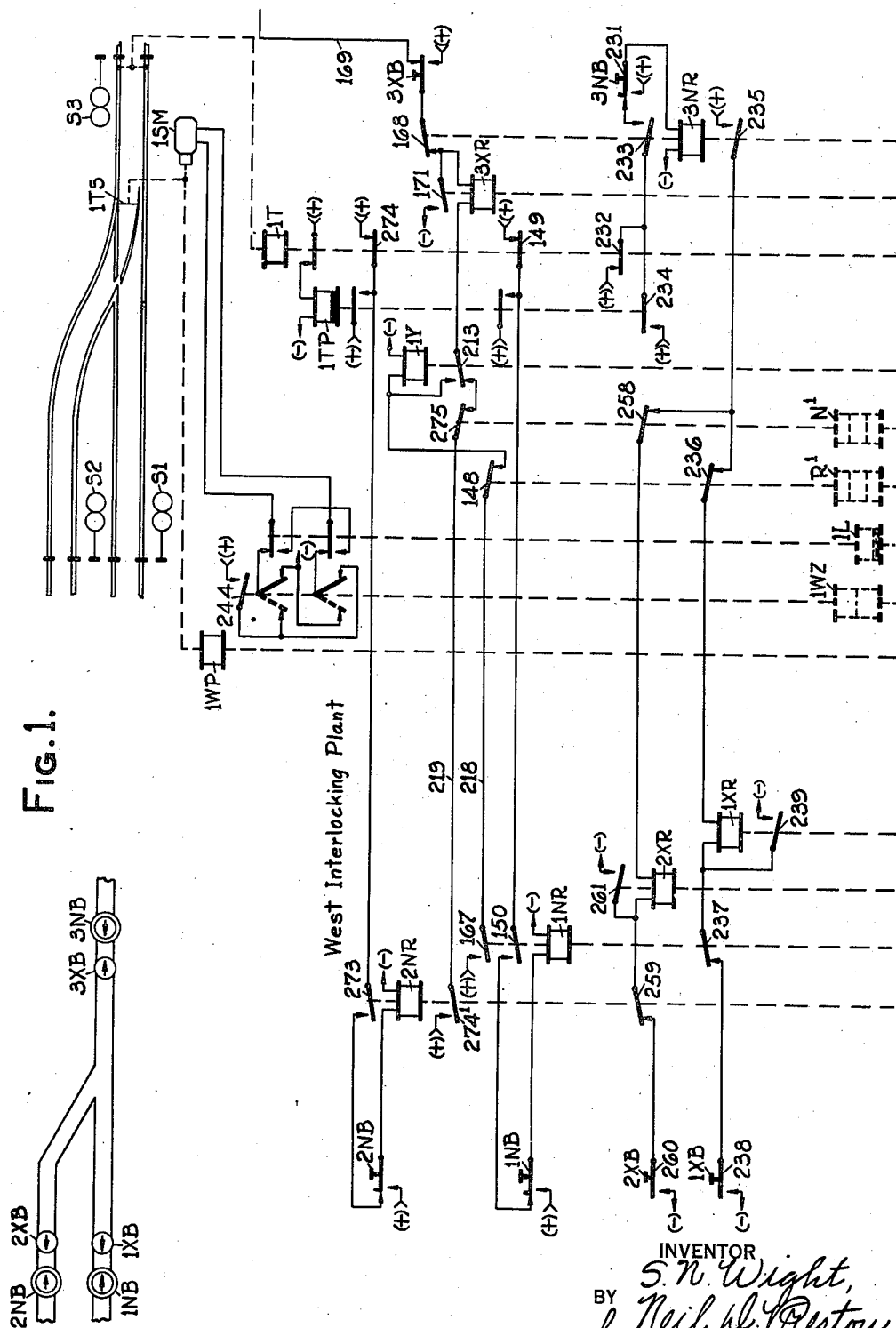
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2,255,142

INTERLOCKING SYSTEM FOR RAILROADS

Filed Sept. 21, 1939

7 Sheets-Sheet 1



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Sept. 9, 1941.

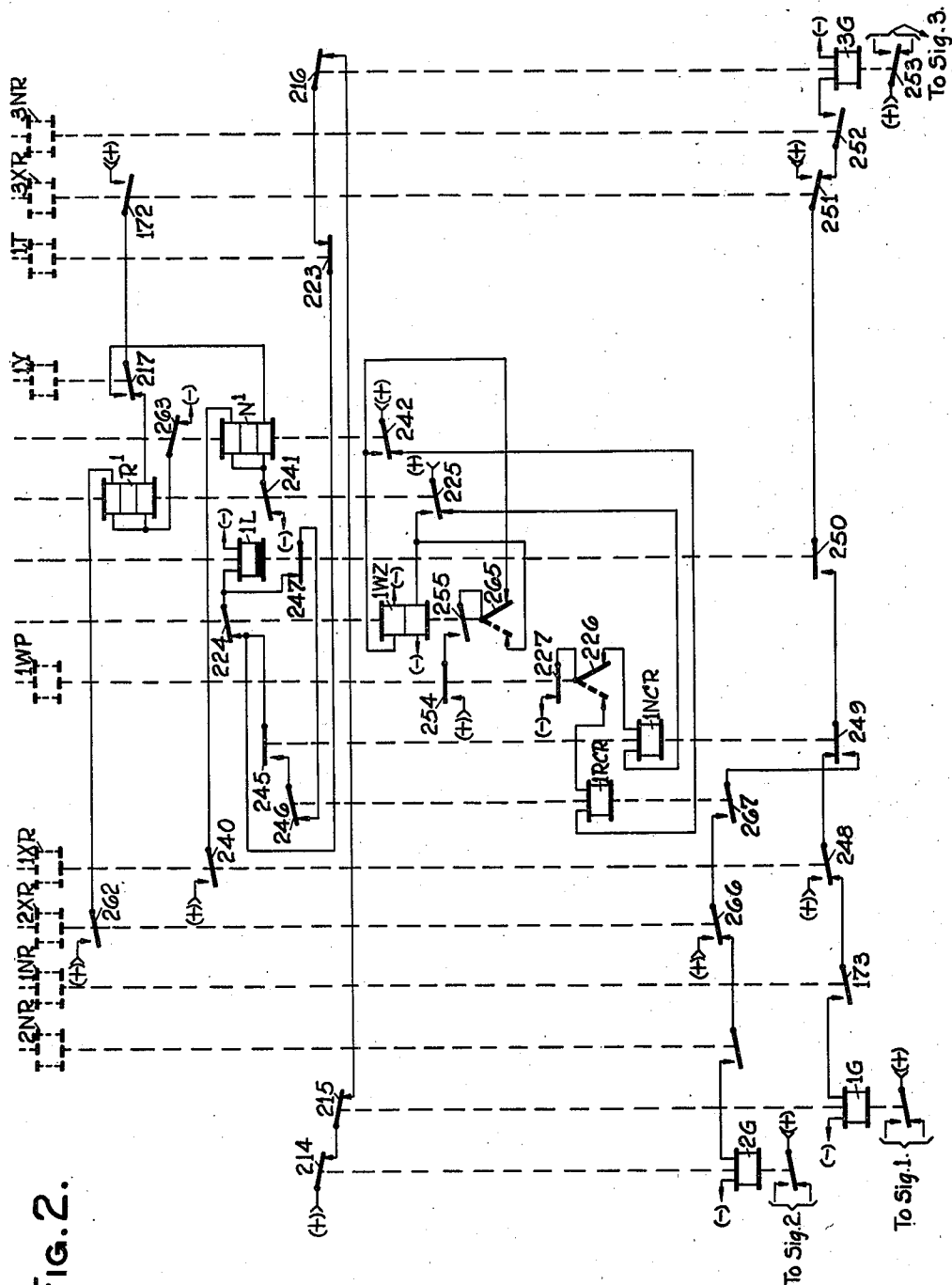
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INTERLOCKING SYSTEM FOR RAILROADS

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7 Sheets-Sheet 2



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INTERLOCKING SYSTEM FOR RAILROADS

Filed Sept. 21, 1939

7 Sheets-Sheet 3

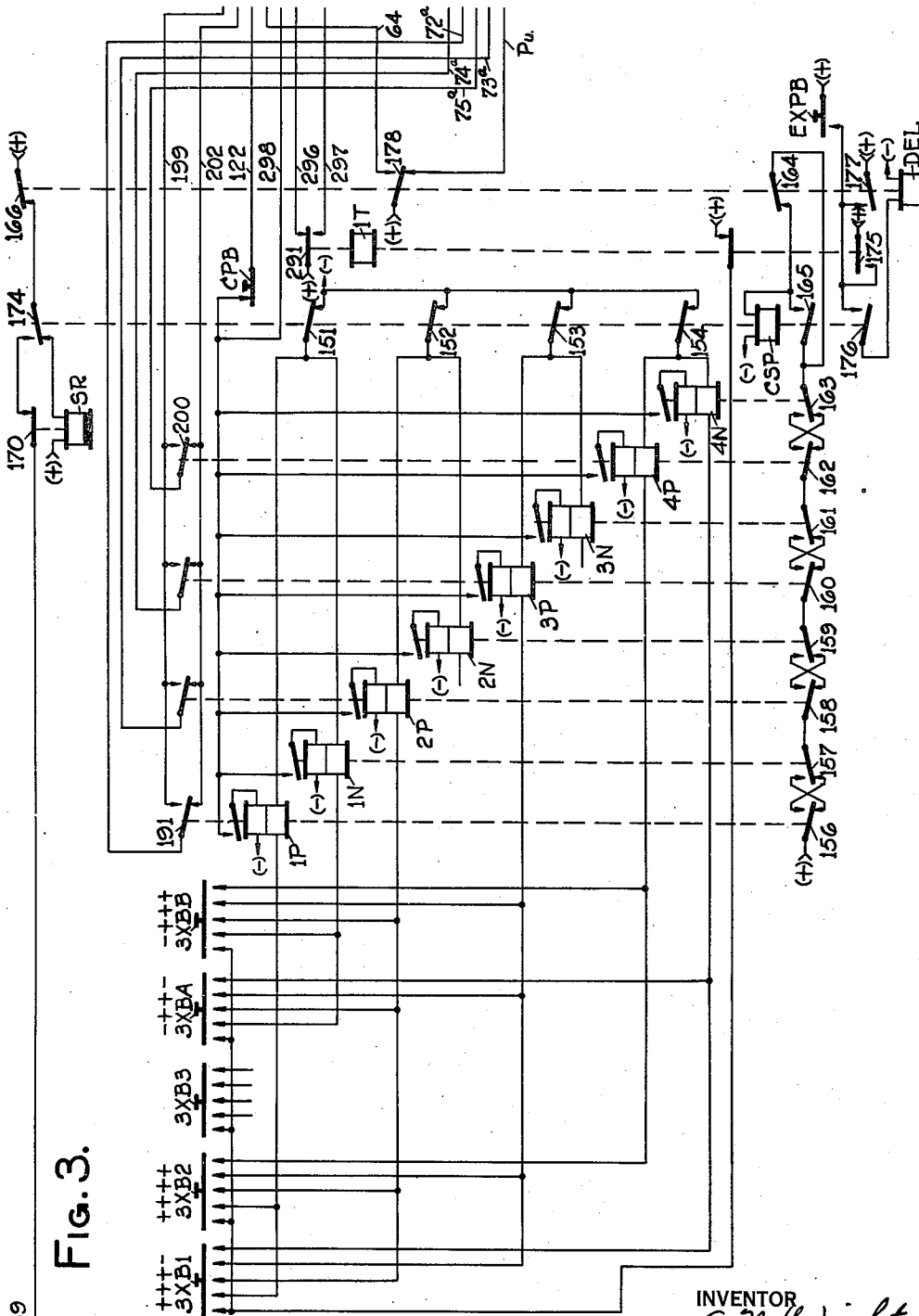


Fig. 3.

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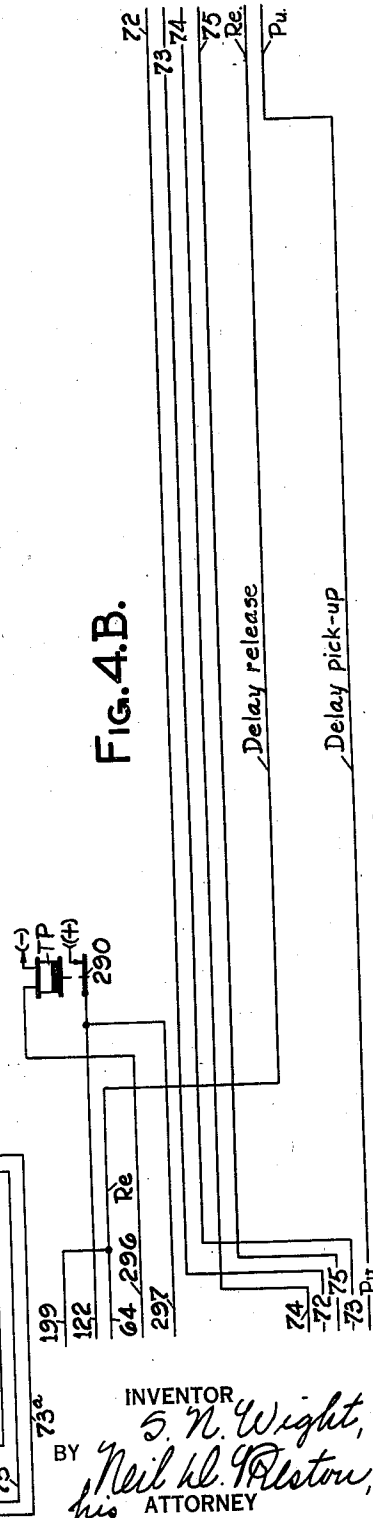
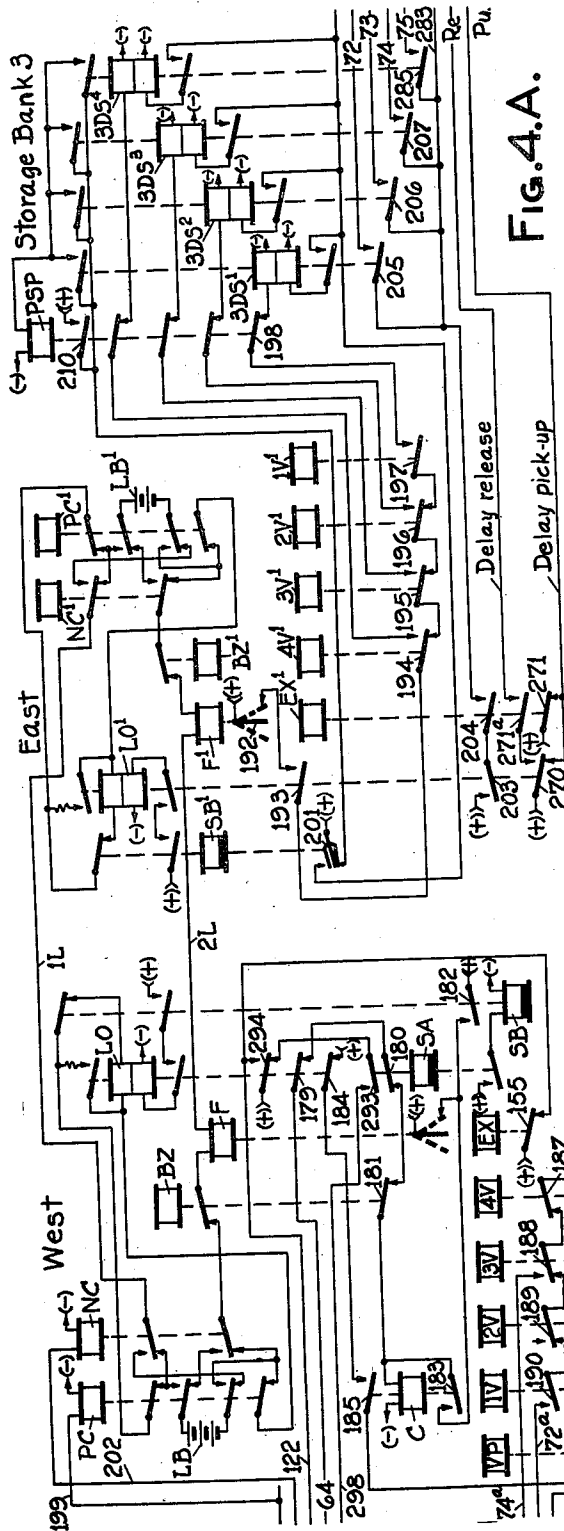
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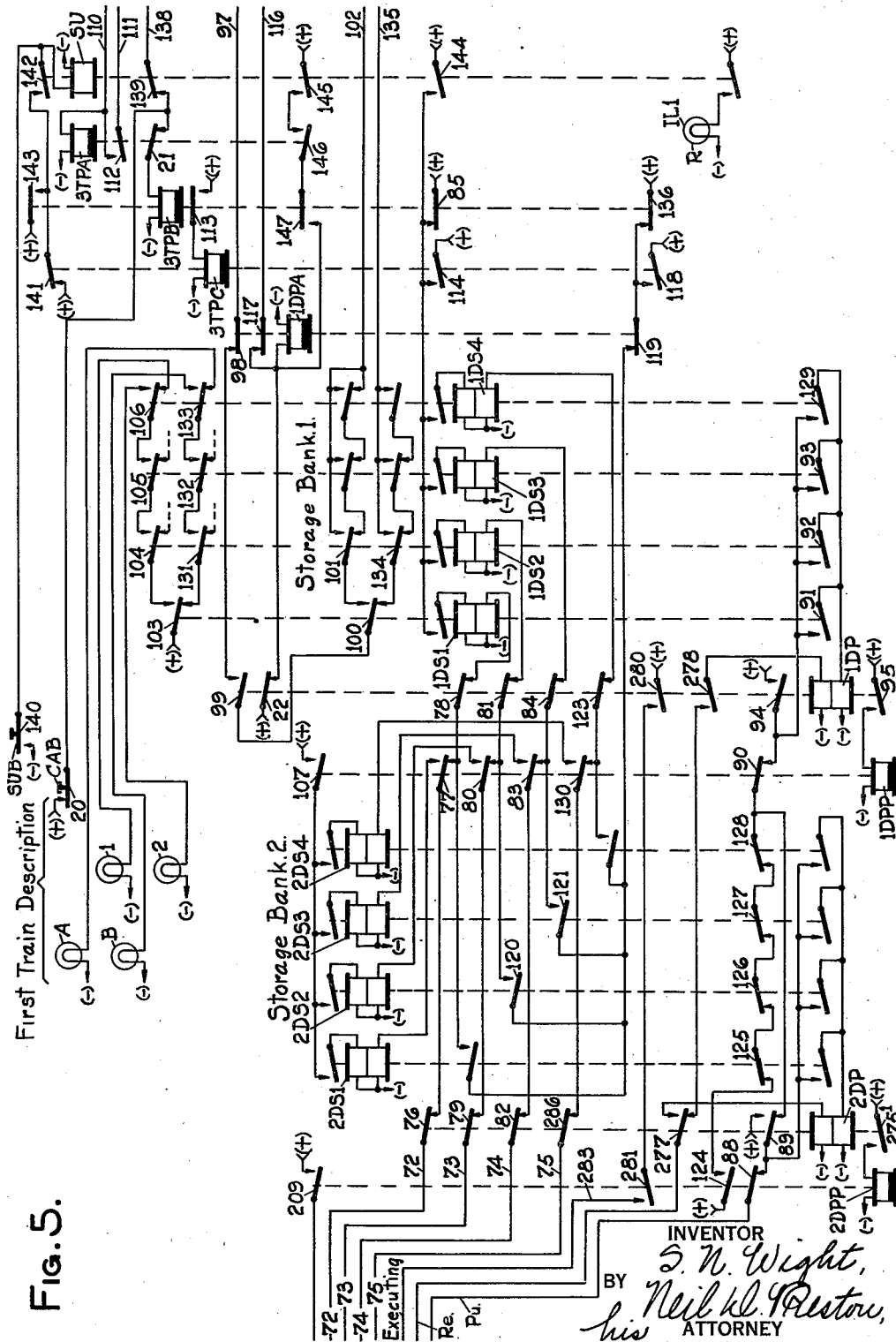
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INTERLOCKING SYSTEM FOR RAILROADS

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7 Sheets-Sheet 5



Sept. 9, 1941.

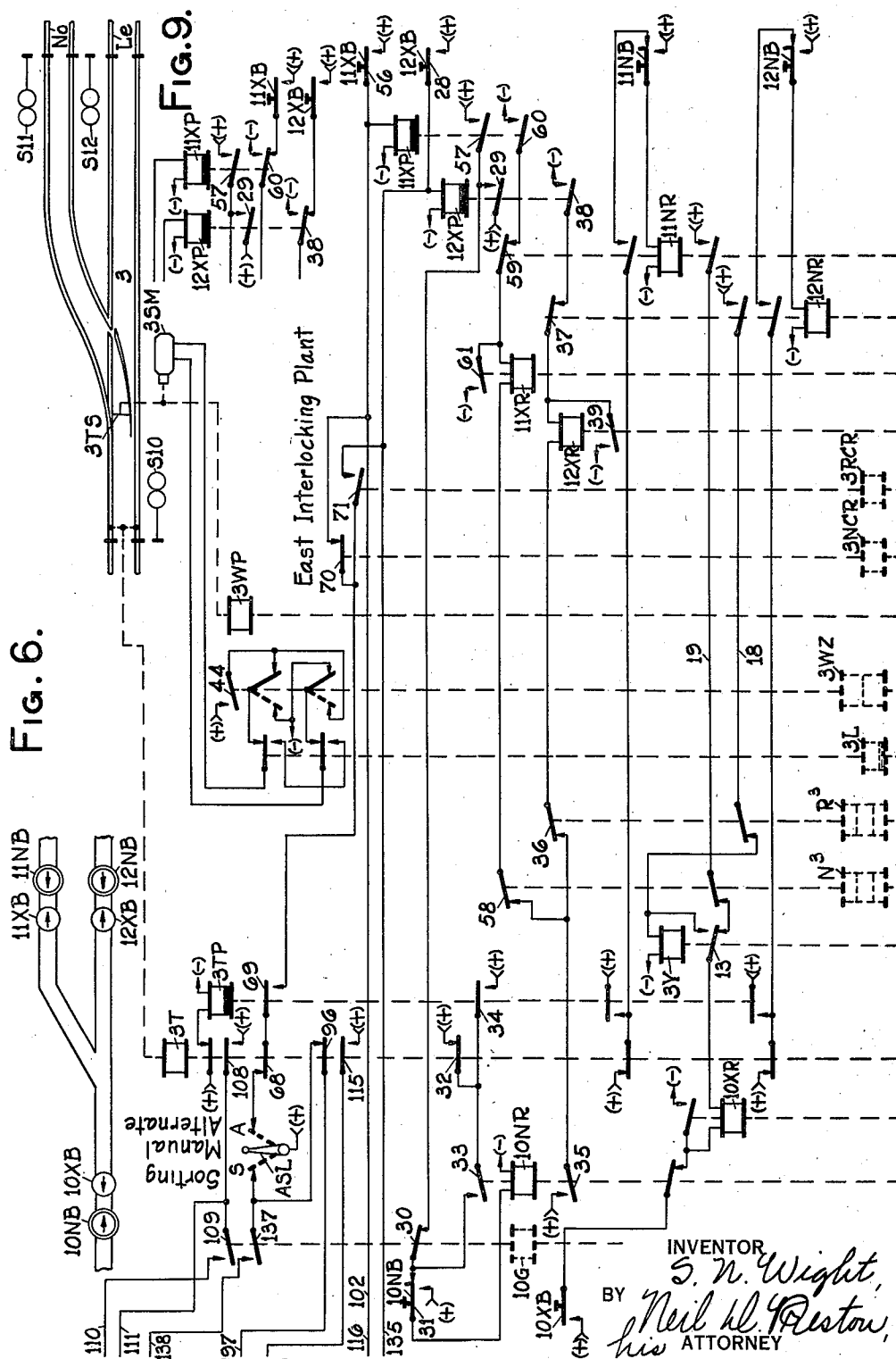
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INTERLOCKING SYSTEM FOR RAILROADS

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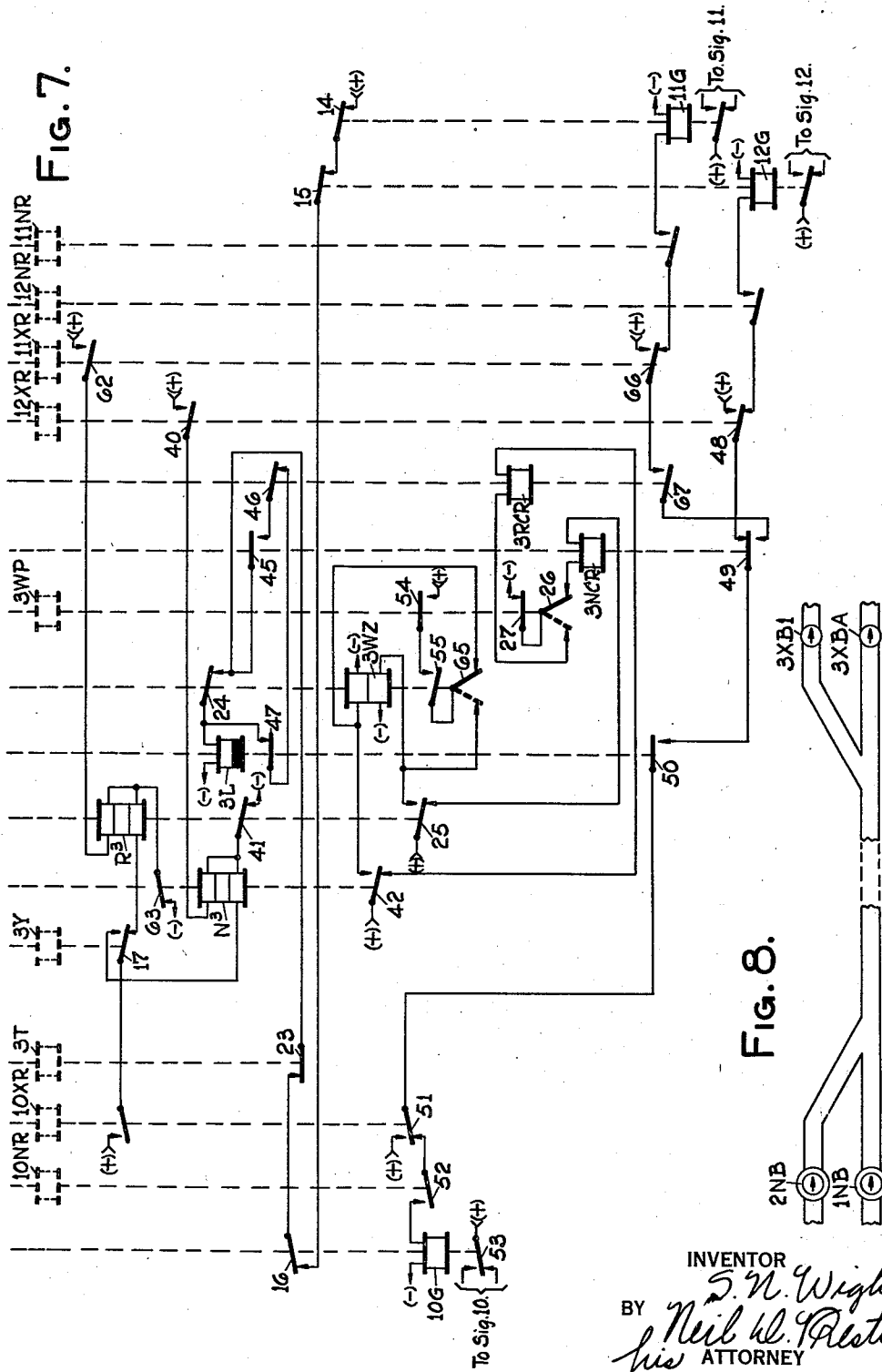
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INTERLOCKING SYSTEM FOR RAILROADS

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7 Sheets-Sheet 7



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2,255,142

INTERLOCKING SYSTEM FOR RAILROADS

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Application September 21, 1939, Serial No. 295,937

31 Claims. (Cl. 246—134)

This invention relates to interlocking systems for railroads, and it more particularly pertains to an interlocking system in which the setting up of routes for trains can be effected manually immediately for certain track switches and can be deferred through the medium of train describer apparatus for other track switches until the particular train for which the control is intended has reached such other track switch or switches. This application is a continuation-in-part of my prior application Ser. No. 245,383 filed December 13, 1938, which was later abandoned in favor of the instant application.

There are conditions encountered in railroad practice in which trains are to be sorted over one or more facing track switches at the far end of a stretch of single track in accordance with the particular kind or class of such trains. That is, trains of one class are routed over the first track switch in a normal position, and trains of another class are routed over the first track switch of a group in a reverse position. As an example, the present invention is particularly applicable where a single track section leads from an interlocking plant and at its far end branches into two or more track branches, each branch of which may constitute a separate railroad, the single track section being so long that a plurality of trains may follow each other and occupy the section at the same time. Since there is only one, or only a few, classifying track switches at the far end of the section it may not be desirable to have an operator there at all times or if there is an operator present it may be desirable to at times relieve him of the duty of operating these leaving or classifying track switches; and the present invention contemplates the operation of these classifying track switches in accordance with route control means of the entrance-exit type operated to set up routes in the interlocking plant located at the entering end of the single track section, the operation of the classifying track switches at the far end of the single track section in each instance being deferred through the medium of train describer apparatus until the train for such track switch operation has reached the exit end of the single track section or at least is not preceded by another train on such section.

An object of the present invention is therefore to provide apparatus controlled by a "west interlocking plant" for setting up train descriptions in a train describer, which describer may store a plurality of train descriptions one for each train in the single track section, which descriptions

are transferred during the progress of trains so that the order of the descriptions at all times conforms to the order of the trains which they describe, and to provide means to operate the track switch or switches of an "east interlocking plant" at the leaving end of the single track section to direct each train to its proper branch track upon its arrival. Although the interlocking systems may be of any suitable type, they are preferably of the entrance-exit or NX type. When traffic is heavy, it may be desirable, under some conditions encountered in railroad practice, to dispense with the train describer apparatus and to alternate train movements over a track switch at the leaving end of the single track section; for example, the operator at the "east interlocking plant" may allow the trains to depart in such order, that is, alternate, that one train must be sent over the first track switch at the leaving end of the single track section in a normal position, and the next following train must be sent over that track switch in a reverse position, and so on; and another object of the present invention resides in the provision of means for alternating the position of the first track switch at the classifying end of the track section for each train moving thereover. Thus, varying traffic conditions during the day may require that traffic over the first track switch at the classifying end is sorted in accordance with the class of train described in the train describer at a particular time, is alternated over that track switch in its two positions at another particular time, and is directed over that track switch at the discretion of an operator at still another time.

Another object of the present invention is to provide optional selecting means for controlling a track switch or group of track switches at the leaving end of the single track section in order to satisfy the above described means for dispatching trains. Thus, it is proposed to provide a manual selecting lever having three positions to select the manual control only of the leaving end or "east interlocking plant" when in a first position, to select the automatic control of such interlocking plant in accordance with descriptions of approaching trains stored in a train describer when in a second position, and to select automatic control of the interlocking plant so as to send trains alternately over the first track switch in its normal and reverse positions when in a third position. It is also proposed that the "east interlocking plant" be subject to manual

control, irrespective of the position of the control lever.

The manual control of the interlocking plant at both the entering end and the leaving end of the single track section is preferably accomplished in accordance with the entrance-exit system of control. That is, an operator has only to actuate a button for an entrance point, together with a button for an exit point for any particular route he wishes to set up, irrespective of the number of track switches included between the entrance and exit points thus designated. The entrance-exit system employed in this invention is to be considered an improvement over the system shown in prior Langdon application, Ser. No. 119,641, filed January 8, 1937, and Patent No. 2,148,865, dated February 28, 1939.

The train describer system used in the automatic sorting of trains at the leaving end of the single track section, in accordance with controls set up at the other interlocking system can be of any suitable type, such, for example, as the type shown in the prior application of R. M. Phinney, Ser. No. 111,671, filed November 19, 1936. Although descriptions communicated in that system are characteristic of approaching trains, it is to be understood that descriptions communicated in such a system can as well be characteristic of desired destinations or routes for approaching trains.

Another object of the present invention resides in the provision of a code type selector system incorporated in the train describer system and for transmitting the train description from one interlocking system to the other over a comparatively few line wires, it is however to be understood that in a modified construction the descriptions are transmitted over a larger number of wires without the utilization of code.

Another object of the present invention is to provide a plurality of exit control levers or buttons at the exit point of the interlocking plant located at the entering end of the single track section which plurality of buttons may each describe a particular train or may each define the exit point for a particular train at the interlocking system located at the leaving end of the single track section or may do both.

Another object of the present invention resides in the provision of means whereby during the setting up of a train description in a train describer the exit control of the NX interlocking system at the entrance end of the single track section is not effected until the train description has been fully set up in the train describer system.

It is also proposed that when the selecting lever is in a position so that the system is under automatic control in accordance with train descriptions transmitted, the routes are set up for the approaching trains by the selective energization of the entrance and exit relays of the self-selecting network of the NX system at the exit end of the single track section. It is proposed to set up a route for a first approaching train as soon as the description is received, but when a description for a second train is received before the first train has left the detector track section, the self-selecting network is rendered effective to cause the setting up of a route for the second train, only after the first train has left the detector track section. Thus, the automatic sorting of trains in accordance with train descriptions conditions the self-selecting network only when a route is available.

When the system is under automatic control for the alternation of routes for approaching trains, it is proposed to have the route for the first approaching train set up manually, or it must have been previously set up by automatic train describer control. When the first train leaves the detector track section, a different route is proposed to be set up for the next following train. Thus the automatic control for the alternation of routes conditions the self-selecting network only when a route is available.

Another feature of the interlocking system at the leaving end of the single track section provided by the present invention is that the self-selecting network can be conditioned by manual control at any time, even when the detector track section is occupied by a train. Such mode of operation provides that an operator can pre-condition a route while the detector track section is occupied, and that the energization of the self-selecting network under such conditions renders the automatic control ineffective for changing the route thus preconditioned until the passing train leaves the detector track section.

Another object of the present invention is to provide that the designation of routes by automatic control is only momentary, thus allowing an operator to restore to normal a route already set up by automatic control, and to set up another route by manual control, all without operating the selecting lever to the "manual control only" position.

A further object of the present invention is to provide that, in setting up a route by manual control, it is necessary to actuate the control button for the exit end of the proposed route only. Such mode of operation is particularly adaptable to conditions where a single entrance point is common to a plurality of routes fanning out in a particular direction from that entrance point, particularly where traffic moves normally in one direction only over the route.

Another object of this invention with respect to the train describer system for controlling an interlocking plant, is to provide means by which an operator can cause the suppression of the automatic cancellation of train descriptions stored, such suppression being effective only until one train has passed through the interlocking plant in the direction of traffic for which the train descriptions are received. Such suppression is desirable when an undescribed train is dispatched over a track switch automatically governed by the train describer system.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawings and will in part be 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 letter reference characters designate parts of a similar character, those parts being made distinctive by preceding and succeeding numerals or exponents, and in which:

Figs. 1 and 2 when laid one above another illustrate the NX type interlocking system located at the entrance end of the single track section into which traffic is governed by the signals S1 and S2;

Fig. 3 illustrates some of the exit push buttons for the NX system shown in Figs. 1 and 2 together with their associated storage relays etc. which may be considered part of the train describer system:

Fig. 4A illustrates a code type communication system for transmitting a train description from the storage relays shown in Fig. 3 to the storage relays shown at the right hand end of Fig. 4A;

Fig. 4B illustrates a track repeater relay and line wires for transmitting a train description from the storage relays shown in Fig. 3 to the storage relays of the "storage bank 2" shown in Fig. 5;

Fig. 5 illustrates a part of a train describer system showing the train description storage banks 1 and 2 and associated relays;

Figs. 6 and 7 when laid one above another illustrate the track layout at the leaving end of the single track section for operation of which the train describer was provided, together with self-selecting NX network relays and associated relays and devices provided for controlling traffic over the track layout;

Fig. 8 shows a miniature track layout of a modified form of the present invention; and

Fig. 9 shows a portion of the circuit construction of Fig. 6 modified.

The various parts constituting the embodiment of the present invention have been shown diagrammatically and certain conventional illustrations have been employed for the purpose of simplifying the illustration and facilitating in the disclosure of the invention, the drawings having been made more for the purpose of disclosure of the principles and mode of operation of the system, than with the idea of illustrating the specific construction and arrangement of parts that would be employed in practice. Thus, certain details well known to those familiar with the art are illustrated in a conventional manner and by dotted lines, and symbols are used to indicate connections to the terminals of batteries or other source of electric current, instead of showing all of the wiring connections to those terminals.

In order to simplify the disclosure of the present invention, reference is made from time to time to functions common to all parts of a similar nature by use of letter reference characters without preceding or succeeding numerals or exponents. It is to be understood that such a reference applies to any parts designated in the drawings by reference characters that are similar except for numerals and exponents associated therewith.

The symbols (+) and (−) are employed to indicate the positive and negative terminals respectively of suitable batteries or other sources of direct current, and the circuits with which those symbols are used always have current flowing in the same direction.

Apparatus

Track layout.—With reference to Figs. 1, 2, 6 and 7 a main or single track has been shown between signals S3 and S10 of two separated interlocking plants in a manner to form at least four possible routes for trains passing from left to right.

The track switches ITS and 3TS are positioned by power operated switch machines ISM and 3SM of a suitable type such, for example, as the switch machine shown in the patent to W. K. Howe, No. 1,466,903 dated September 4, 1923. The motor of the switch machine SM is controlled in a suitable manner preferably to provide overload protection and other desirable features usually employed in the control of switch machine motors such as is shown for example, in the patent to W. H. Hoppe, et al., No. 1,877,876,

dated September 20, 1932. If the switch machine motor is controlled in accordance with this Hoppe et al. patent, the relay CR is controlled by relay WZ illustrated in Figs. 2 and 7 of the present disclosure.

The track switches are provided with the usual polar-neutral relays WP for repeating the locked position thereof. These relays are energized with current of a particular polarity when the switch points of the track switch TS are locked in a normal position in correspondence with the normal locked position of the switch machine SM, and they are energized with current of the opposite polarity when the switch points are locked in the reverse position in correspondence with the reverse locked position of the switch machine SM. The WP relays are picked up only when energized under either of the above conditions.

Signals have been illustrated for governing traffic through the track layout in both directions, signal S1, S2 and S10 having been provided for governing east bound traffic (to the right), and signals S3, S11 and S12 having been provided for governing west bound traffic (to the left). Additional signals, not shown, are preferably employed in the single track section connecting signals S3 and S10. Although a number of different types of signals can be used, such as semaphore type signals and search light signals, the signals illustrated in the present embodiment of the invention are of the type having separate color light units for danger and clear indications. A danger indication is normally displayed by the illumination of a red lamp, and a clear indication is displayed by the entering signal for a route set up when a green lamp is illuminated. It is to be understood that a caution indication can as well be provided if such indication is required in practice.

A detector track circuit is provided for each track switch in the usual manner for the energization of the track relays such as 1T and 3T, the details of such track circuit have not been shown in order to simplify the present disclosure, because those details are well known to those familiar with the art.

Control machines.—Control machines are provided at opposite ends of the single track section one for each interlocking plant for governing traffic through the track layouts illustrated in Figs. 1 and 6 each of which includes a control panel upon which is constructed a miniature track diagram representative of the track layout for which the system is provided. Upon the track diagrams are located an entrance button NB for each entrance point in the track layout and an exit button XB for each exit point in the track layout. Additional exit buttons shown in Fig. 3 are also employed. The buttons are located at positions representative of the respective entrance and exit points of the track layout for which they are provided. Buttons 1NB, 2NB, 3NB, 10NB, 11NB and 12NB have been provided for entrance points at signals S1, S2, S3, S10, and S12 respectively, and buttons 1XB, 2XB, 3XB, 10XB, 11XB and 12XB have been provided for exit points at signals S1, S2, S3, S10, S11 and S12, respectively. Special train describing exit buttons 3XB1, 3XB2, 3XB3, 3XBA and 3XBB have also been provided as shown in Fig. 3. These latter buttons are preferably located directly below the exit button 3XB on the miniature track layout.

Each entrance button NB is of the push-pull type, and is automatically restored to a normal

position after being depressed or pulled out. Each entrance button NB has a contact which is normally closed and remains closed when the button is depressed, but which is opened when the button is pulled out, and has another contact closed only when the button is in a depressed position. Whenever the button is pulled out from its normal position the normally closed contact is opened. These control buttons may be of a construction, for example, as shown in the application of J. F. Merkel, Ser. No. 158,720, filed August 12, 1937.

Each exit button XB is of the self-restoring push button type, having a contact associated therewith closed only when that button is depressed.

It is to be understood that other forms of control buttons or switches could as well be substituted for those illustrated, and that the entrance and exit button contacts for each signal location could as well be combined on one button having distinctive positions or circuit means for distinguishing between actuation for an entrance or for an exit point.

Suitable indicator lamps (not shown) are provided on the miniature track diagram at various points to clearly indicate routes set up through the interlocking plant, the condition of occupancy of the track sections, and the indication displayed by the various signals at the track layout.

Train describer lamps are also provided on the control panel to keep the operators informed as to the description of the trains leaving one and approaching the other interlocking plant. The illumination of the lamps is governed in accordance with train descriptions set up in the multiple indicating train describer. These train describer lamps are provided to keep the operators informed as to the description of one leaving and several approaching trains, the lamps for each storage bank being similar to the lamps illustrated in Fig. 5. These lamps describe the last train to leave one interlocking plant and a first and second train approaching the other interlocking plant. The lamp associated with the push button relays of Fig. 3 are controlled by relays 1P, 2P, 3P and 4P in exactly the same way as the lamps of Fig. 5 are controlled by relays 1DS1, 1DS2, 1DS3 and 1DS4, respectively. It is assumed that lamps A and B (see Fig. 5) are provided for describing trains of different kinds but of a particular class which all take the same route over the track switch shown in Fig. 6 in one position, and that lamps 1 and 2 are provided for describing trains of different kinds of another class which all take a route over the track switch of Fig. 6 when assuming the opposite position. Although only two lamps for each class have been illustrated, it is to be understood that other lamps are provided in accordance with the number of different trains of each class to be described.

The lever ASL (Fig. 6) is provided within convenient reach of an operator, preferably on the control panel, for providing manual selection between the various means provided by the present invention for governing the "east interlocking plant" located at the leaving end of the single track section. When the lever ASL is in a center position, the interlocking plant is under manual control only; when the lever ASL is in a left hand position the plant is under automatic control in accordance with the description in the train describer of approaching trains, the man-

ual control still being effective; and when the lever ASL is in a right hand position the interlocking plant is governed by approaching trains in such a manner as to alternate the trains over the track switch in normal and reverse positions, manual control of the interlocking plant also being effective when the lever is in that position.

Self-restoring cancelling push button CPB (see Fig. 3) and CAB (see Fig. 5) are provided on the control panels for cancellation of a stored description, and a self-restoring suppression push button SUB (see Fig. 5) is provided on the control panel for suppression of the automatic cancellation by a train of stored train descriptions.

Self-selecting network relays.—An entrance relay NR is provided for each entrance point, and that relay is energized when the entrance button NB for that point is depressed in setting up a route. The control of the entrance relay 10NR is such that it is also picked up whenever an exit point is designated, either by automatic or manual control, for signals S11 and S12. This is, however, not the case of the other entrance buttons shown in Figs. 1 and 6.

A relay XR is associated with each exit point and this relay is picked up only when a route is called for between a designated entrance point and a designated exit point associated with that XR relay and then only if no conflicting route has already been set up.

Associated with exit points at signals S11 and S12 are exit repeater relays 11XP and 12XP respectively, each of which is momentarily energized in setting up a route including that exit point by either automatic or manual control.

Relay Y is provided as a selector relay to select the control of self-selecting network relays N and R which are provided for causing the positioning of the track switch TS when setting up route.

Train describer relays.—Although there are several types of train describer systems which could be used in accordance with the present invention, the present invention has been illustrated as applied to an interlocking plant associated with a train describer system such as is shown, for example, in the application of R. M. Phinney, Ser. No. 111,671 filed November 19, 1936. Parts having control circuits different from that train describer system have been shown in detail in this disclosure and certain of the relays of the system have been shown in this disclosure in such a manner as to correspond in arrangement and nomenclature with that prior application to which reference can be made for a more detailed disclosure of the train describer system.

The code type communicating system includes impulse relays PC and NC, lock-out relays LO, line relays F, cycle marking relays SA and SB, incomplete code relays BZ, a starting relay C, a half-step relay VP, an execution relay EX and stepping relays 1V, 2V, 3V and 4V and a storage bank including relays 3DS and PSP, all more fully described in the Phinney application above referred to.

The relays 1DS constitute a storage relay bank, which stores a description code for the first train approaching the interlocking plant. Such description codes are transmitted from the interlocking plant located at the entering end of the single track section by the code type communication system. It is to be understood, however, that the descriptions could as well be designated by lamps in a dispatcher's office, or at

any other particular point where the description of the approaching trains can conveniently be designated, and that the code type communication system is required only to save line wires.

The relays 2DS provide a storage bank for storing the description codes received for the second train approaching the "east interlocking plant." The descriptions stored for the second train approaching are transferred to the storage relays 1DS when the first train enters the detector track section containing track relay 3T.

Relays 3TPA, 3TPB and 3TPC are slow acting relays provided for the release of the storage relays 1DS upon the passage of the first train approaching the interlocking plant and for transferring the train description stored in "storage bank 2" to "storage bank 1."

Relays DP and DPP are provided to aid in the transfer of a description from one storage bank to another, when the first train enters the detector track section. Relay 1DP and slow acting relay 1DPA in combination provide an execution period for the automatic setting up of each route selected in accordance with the description stored by the relays 1DS.

A relay SU is provided for the suppression of the automatic cancellation of descriptions, stored in the storage relays 1DS, upon passage of a train through the interlocking plant.

The train describer also includes push button relays P and N, a complete-code relay CSP and a slow acting relay SR. The relays P denote positive and when up signify that the corresponding code storage relay, such as relay 3DS¹, will be picked up and the relays N denote negative and when up signify that the corresponding code storage relay, such as relay 3DS¹, will not be picked up. The push button EXPB is an execution push button and is used for transmitting a code stored in relays P and N if that is desired while the track circuit containing track relay 1T is not occupied.

System devices.—A polar-neutral switch control relay WZ is provided for controlling the switch machine 1SM and 3SM in accordance with the normal or reverse control selected by the self-selecting relays N and R.

The lock relays L have slow drop away characteristics and are provided to allow the operation of the track switch TS only under safe and desirable traffic conditions. Although it has been assumed that approach locking is not required for the specific embodiment shown, it is to be understood that additional route locking relay contacts and approach locking relay contacts are included in the control circuit for the lock relay L where such additional locking is required in practice.

Correspondence relays NCR and RCR are provided for repeating the position of the track switch in correspondence with the last initiated controls for that track switch.

A signal contral relay G is provided for controlling each signal. Relay G provides energy for the red lamp of its associated signal when in a dropped away position and provides energy for the green lamp of its associated signal when in a picked up position.

The indicating lamp IL¹ in Fig. 5 is provided to indicate that the suppression relay SU is energized and upon being extinguished signifies that the track circuit containing track relay 3T has just been vacated.

Having thus considered the apparatus provided in accordance with this specific embodi-

ment of the present invention, it is believed that the mode of operation of the system can best be considered by assuming various operating conditions which would be encountered in practice.

Operation

Normal conditions.—Under normal conditions it is assumed that the signals display a red indication, and that the track switches 1TS and 3TS are in their normal straight track position. It is also assumed that the normal conditions provide that the track relays 1T and 3T are picked up in accordance with the unoccupied conditions of the detector track circuits, and that no descriptions have been registered in the train describer.

The relays associated with the self-selecting networks of Figs. 1, 2, 6 and 7 are normally deenergized because it is assumed that there are no routes set up in the interlocking plants. Such a condition is obvious to an operator by the indications of the indicator lamps (not shown) on the control panel. These lamps are assumed under normal conditions to be extinguished to provide what is conveniently called a "normally dark board."

The manual selecting lever ASL (Fig. 6) for selecting the different types of control for the "east interlocking plant" is assumed under normal conditions to be in a center position to provide that the setting up of routes through the interlocking plant can be accomplished only by manual control.

The relays associated with the train describer or train description storing system are normally deenergized with the exception of relays 3TPB and 1DPA.

The relay 3TPB (see Fig. 5) is normally energized by a circuit closed from (+), through contact 20 of cancel button CAB in a normal position, back contact 21 of relay 3TPA and winding of relay 3TPB, to (-). Relay 1DPA is normally energized by an obvious circuit closed at back contact 22 of relay 1DP. In the code type selector system shown in Fig. 4A all of the relays are normally deenergized.

The lock relay 3L (see Fig. 7) is energized under normal conditions by a circuit closed from (+), through back contacts 14, 15 and 16 of signal relays 11G, 12G and 13G respectively, front contact 23 of relay 3T, back contact 24 of relay 3WZ, and winding of relay 3L, to (-). Similarly lock relay 1L (see Fig. 2) is energized through back contacts 214, 215 and 216 of signal relays 2G, 1G and 3G, respectively, and through front contact 223 of relay 1T and back contact 224 of relay 1WZ.

In order to simplify the present disclosure, approach locking has not been shown, but it is to be understood that such locking can be provided as required in practice, for example, the circuit for the lock relay L can include front contacts of east and west stick relays corresponding to the relays ES and WS shown in the patent to C. F. Stoltz, Patent No. 2,115,511, dated April 26, 1938.

A circuit is normally closed for the correspondence relay 3NCR (Fig. 7) from (+), through a back contact 25 of relay R³, winding of relay 3NCR, polar contact 26 of relay 3WP, in a right-hand position, and front contact 27 of relay 3WP, to (-). Similarly a circuit is normally closed for the correspondence relay 1NCR (Fig. 2) from (+) through a back contact 225 of relay R¹, winding of relay 1NCR, polar

contact 226 of relay IWP in its right-hand position and front contact 227 of relay IWP, to (—).

Manual control of NX interlocking plant of Figs. 6 and 7.—Assuming the normal conditions of the system to exist as shown and heretofore described, an operator can proceed to set up either of the routes through the interlocking plant in either direction. To consider how routes are set up by manual control for traffic in the assumed normal east-bound direction, assume an operator to cause the setting up of a route from signal S10 to signal S12 by the depression of the exit button 12XB.

When button 12XB is depressed, an obvious circuit is closed for the energization of relay 12XP at back contact 28 of button 12XB in a depressed position. The picking up of relay 12XP closes a circuit for the energization of relay 10NR from (+), through front contact 29 of relay 12XP, back contact 30 of relay 10G, normally closed contact 31 of button 10NB, and winding of relay 10NR, to (—). The picking up of that relay closes a stick circuit from (+), through front contact 32 of relay 3T, front contact 33 of relay 10NR, normally closed contact 31 of button 10NB, and winding of relay 10NR, to (—). Connected in multiple in that circuit with front contact 32 of relay 3T is back contact 34 of relay 3TP.

As soon as relay 10NR is picked up, a circuit is closed for the energization of relay 12XR, from (+), through a front contact 35 of relay 10NR, back contact 36 of relay R³, winding of relay 12XR, back contact 37 of relay 12NR, and front contact 38 of relay 12XP, to (—). When relay 12XR is picked up as the result of the energization of that circuit a stick circuit is closed to maintain that relay picked up dependent upon the relay 10NR for the entrance point of the route being set up. Such a stick circuit is closed from (+), through front contact 35 of relay 10NR, back contact 36 of relay R³, winding of relay 12XR, and front contact 39 of relay 12XR, to (—).

The picking up of relay 12XR causes the picking up of relay N³ (see Fig. 7) when a circuit is closed from (+), through front contact 40 of relay 12XR, upper winding of relay N³, and back contact 41 of relay R³, to (—).

After relay N³ is picked up, relay 3WZ is picked up when its circuit is energized from (+), through front contact 42 of relay N³, and upper winding of relay 3WZ, to (—).

The switch machine 3SM is energized for operation to its normal position, if it is not already in that position, by an obvious circuit closed at front contact 44 (Fig. 6) of relay 3WZ. If the switch machine 3SM is already in a normal position as illustrated, when setting up such a route, the lock relay 3L, normally energized, is dropped away when relay 3WZ is picked up to open back contact 24 in the control circuit for that lock relay. If, however, the track switch 3TS were in a reverse position prior to the initiation of the proposed route as described above, the relay 3RCR would have been energized at that time by a circuit closed from (+), through back contact 42 of relay N³, winding of relay 3RCR, polar contact 26 of relay 3WP in a left-hand position, and front contact 27 of relay 3WP, to (—).

Thus, when relay N³ is picked up in setting up a route from signal S10 to signal S12 when the track switch 3TS is in a reverse position, the picking up of that relay N³ opens the circuit for relay 3RCR at back contact 42 to cause that relay to drop away. Relay 3NCR is in a dropped away

position at that time because its circuit is open at polar contact 26 of relay 3WP, so a stick circuit would be closed to maintain relay 3L picked up until the track switch has completed its operation, from (+), through back contacts 14, 15 and 16 of signal relays 11G, 12G and 10G respectively, front contact 23 of relay 3T, back contact 45 of relay 3NCR, back contact 46 of relay 3RCR, front contact 47 of relay 3L, and winding of relay 3L, to (—). As soon as the track switch 3TS is operated to a normal locked position, relay 3NCR is picked up when energized by a circuit heretofore described, and the picking up of this relay 3NCR opens the stick circuit for relay 3L at back contact 45 to cause the relay 3L to drop away because its pick-up circuit had already been opened by the picking up of relay 3WZ at back contact 24.

The dropping away of relay 3L, in setting up a route from signal S10 to signal S12, causes the picking up of relay 10G when a circuit is closed for that relay from (+), through front contact 48 of relay 12XR, front contact 49 of relay 3NCR, back contact 50 of relay 3L, back contact 51 of relay 10XR, front contact 52 of relay 10NR, and winding of relay 10G, to (—). The picking up of relay 10G causes the energization of the green lamp in signal S10 as a result of a circuit closed including front contact 53 of relay 10G. The picking up of the relay 10G also opens its back contact 16 to prevent energization of the lock relay 3L due to closing of back contact 24 of relay 3WZ if this should occur.

If, for some reason, the operator were to cause the restoration of relay N³ in a manner to be hereinafter described, before the track switch would have had time to complete its operation to a normal position, the relay 3WZ would have been maintained picked up to provide energy for the switch machine SM to complete its operating stroke, as a result of the energization of a stick circuit closed from (+), through back contact 54 of relay 3WP, front contact 55 of relay 3WZ, polar contact 65 of relay WZ in a right-hand position, and upper winding of relay 3WZ, to (—). This latter stick circuit is broken at back contact 54 of relay 3WP when the switch machine has completed its stroke.

A similar mode of operation is employed in setting up a route from signal S10 to signal S11. To consider how a route is set up between those route ends, assume an operator to depress button 11XB (see Fig. 6), when the heretofore described normal conditions of the system exist. The depression of button 11XB causes the picking up of relay 11XP when an obvious circuit is closed at back contact 55 of button 11XB in a depressed position.

The picking up of relay 11XP causes the picking up of relay 10NR by the energization of a circuit closed from (+), through front contact 57 of relay 11XP, back contact 30 of relay 10G, normally closed contact 31 of button 10NB and winding of relay 10NR, to (—). The picking up of relay 10NR closes a stick circuit for that relay as heretofore described.

When relay 10NR is picked up, under such conditions, a circuit is closed for the exit relay 11XR from (+), through front contact 35 of relay 10NR, back contact 58 of relay N³, winding of relay 11XR, back contact 59 of relay 11NR, and front contact 60 of relay 11XP, to (—). The picking up of relay 11XR closes a stick circuit for that relay from (+), through front contact 35 of relay 10NR, back contact 58 of relay N³,

winding of relay 11XR, and front contact 61 of relay 11XR, to (-).

When relay 11XR is picked up, in setting up a route from signal S10 to signal S11, relay R3 (see Fig. 7) is picked up when a circuit for the upper winding of that relay is closed from (+), through front contact 62 of relay 11XR, upper winding of relay R3, and back contact 63 of relay N3, to (-).

The picking up of relay R3 causes the dropping away of relay 3NCR, if the track switch was last operated to a normal position, by opening its circuit at back contact 25. When front contact 25 of relay R3 is closed, relay 3WZ is picked up by the energization of a circuit closed from (+), through front contact 25 of relay R3, and lower winding of relay 3WZ, to (-). The picking up of relay 3WZ, with relay 3L picked up, causes the energization of an obvious circuit for the switch machine 3SM closed at front contact 44, for the operation of the track switch 3TS to a reverse position.

The relay 3L, is obviously, maintained picked up until the track switch 3TS is in a position in correspondence with the route being set up by the energization of its stick circuit as heretofore described.

If relay R3 is dropped away prior to the completion of the operation of the switch machine 3SM, relay 3WZ is maintained picked up to complete the operation of the switch machine by a stick circuit closed from (+), through back contact 54 of relay 3WP, front contact 55 of relay 3WZ, polar contact 65 of relay 3WZ in a left-hand position, and lower winding of relay 3WZ, to (-).

The dropping away of relay 3L upon the completion of the operation of the track switch 3TS to a reverse locked position, closes a circuit for relay 10G, from (+), through front contact 66 of relay 11XR, front contact 67 of relay 3RCR, back contact 49 of relay 3NCR, back contact 50 of relay 3L, back contact 51 of relay 10XR, front contact 52 of relay 10NR, and winding of relay 10G, to (-). The closing of front contact 53 of relay 10G causes the clearing of signal S10.

Having thus described the mode of operation in setting up routes for east-bound trains, it is to be understood that a similar mode of operation is effected in setting up routes for west-bound trains. The setting up of routes for west-bound trains, however, requires the joint actuation of an entrance and an exit button for each route to be set up, and the mode of operation of the self-selecting network in setting up these routes is similar to the mode of operation described in the above-mentioned patent to Langdon, No. 2,148,865, dated February 28, 1939, to which reference is to be made for further details relative to the self-selecting network. It may, however, be pointed out that the relay 3Y performs several important functions. It prevents energy from feeding from one to the other of the two wires 18 and 19 and gives preference to the wire 18 if both of wires 18 and 19 are energized at the same time, in that picking up of relay 3Y opens the circuit including wire 19 at contact 13 and determines the position of track switch 3TS by its contact 17. These functions become more important as the track layout becomes more complicated and have been more fully described in the patent to Langdon, No. 2,148,865, dated February 28, 1939.

Restoration to normal.—To manually cause the restoration of a signal to stop, and the relays

associated with setting up that route to a normal position, an operator pulls out the entrance button NB associated with the entrance point at the signal to be restored.

To consider an example of how such restoration is effected, assume a route to be set up as heretofore described from signal S10 to signal S12, and assume the operator to pull out button 10NB (see Fig. 6) to complete the restoration of that route prior to the passage of a train. The pulling out of button 10NB opens the stick circuit for relay 10NR at normally closed contact 31 of that button, and the dropping away of relay 10NR effects the dropping away of relay 10G (see Fig. 7) by opening the circuit for that relay at front contact 52. The dropping away of relay 10G opens the circuit for the green lamp in signal S10 at front contact 53 and closes the circuit for the red lamp in signal S10 at back contact 53.

When relay 10NR is dropped away, the stick circuit for relay 12XR (see Fig. 6) is opened at front contact 35 to cause the release of that relay, which in turn, causes the dropping away of relay N3 (see Fig. 7) by opening its circuit at front contact 40. The dropping away of relay N3 causes the dropping away of relay 3WZ by opening its circuit at front contact 42, and the dropping away of relay 3WZ closes at its back contact 24 the normally energized circuit for relay 3L to cause this relay 3L to pick up and complete the restoration to normal of the circuits associated with the signal S10 and the parts of the system associated with setting up of a route from signal S10 to signal S12.

Restoration upon passage of a train.—An entering signal and the parts of the system associated with a route already set up are automatically restored to normal upon passage of a train in a much similar manner to their restoration to normal by manual control. The only difference in the mode of operation is that the entrance relay NR is automatically dropped away when the train enters the route set up instead of that relay being dropped away as a result of the actuation of the associated entrance button.

To consider an example of how an entrance relay is automatically restored upon the passage of a train, assume relay 10NR to be picked up and stuck up for a route set up from signal S10 to signal S12. Relay 12XP is down, because the relay was only momentarily energized at the time when a route was set up, thus the pick-up circuit for relay 10NR is open at front contact 29 of relay 12XP. As soon as an approaching train enters the detector track section 3, relay 3T is dropped away, and the dropping away of that relay opens the stick circuit for relay 10NR at front contact 32. Because of the slow action of track repeater relay 3TP, back contact 34 of relay 3TP is not closed until relay 10NR has had time to drop away. The closing of back contact 34 of relay 3TP provides the feature that the stick circuit for relay 10NR can be closed if an operator sets up a route for a following train while the first train is still in the detector track section.

The restoration of each of the other signals to stop, and the restoration of the parts of the system associated with routes set up for traffic governed by those signals, is automatically effected upon the passage of a train in a similar manner.

Automatic setting up of routes alternately, by

NX interlocking plant of Figs. 6 and 7.—It has been pointed out that a momentary energization of either of the exit repeater relays 11XP or 12XP is all that is necessary for the setting up of a route for east-bound traffic over switch 3TS. It has also been pointed out that such momentary energization can be effected by the depression of the exit button associated with each relay XP, and it is obvious when considering the circuit by which relay XP is energized when its associated exit button is depressed, that each relay XP can at any time be picked up by manual control, irrespective of the position of the control lever ASL.

If an operator wishes to provide that trains are automatically sorted alternately over the track switch, he operates the control lever ASL to position "alternate" to the right. To start the automatic control of the interlocking plant with the lever in that position he must set up a route manually after the operation of that control lever to a right-hand position, if the proper route is not already set up for east-bound traffic at the time the control lever is operated to that position. In view of the fact that the system for setting up routes alternately is provided for east-bound traffic only, it is preferably that the selecting lever ASL be left in a right-hand "alternate" position only when routes are set up for that direction of traffic.

To provide automatic control with the selecting lever ASL in a right-hand position, one or the other of the relays XP is momentarily energized when a first east-bound train leaves the detector track section 3. If the route of the first train includes the track switch 3TS in a normal position, relay 11XP is energized through the circuit selected by the correspondence relay 3NCR. If the route of the first train includes the track switch 3TS in a reverse position, relay 12XP is energized through the circuit selected by the correspondence relay 3RCR. Thus, it is provided that the routes are automatically set up alternately between signal S10 and signal S11, and between signal S10 and signal S11.

To consider an example of such mode of operation, assume a route to be set up from signal S10 to signal S12, and the selecting lever ASL to be operated to a right-hand position. The route set up could have been set up by either manual or automatic sorting control. Also assume a train to enter that route to cause the restoration to normal of signal S10, and the relays associated with the setting up of that route. The presence of the train in the detector track section 3 causes the dropping away of relays 3T and 3TP, and when that train leaves the detector track section the relay 3T is picked up prior to the picking up of relay 3TP. The picking up of relay 3T, under such conditions, provides momentary energization for relay 11XP, when a circuit is closed for relay 11XP from (+), through selecting lever ASL in a right-hand position, front contact 68 of relay 3T, back contact 69 of relay 3TP, front contact 70 of relay 3NCR, and winding of relay 11XP, to (-). The picking up of relay 11XP, due to such energization, effects the setting up of a route from signal S10 to signal S11 by the energization of the route control relays in a manner heretofore described. Relay 3TP is picked up after sufficient time has been provided for the picking up of relay 11XP, and the above described pick-up circuit for relay 11XP is opened at back contact 69 to cause relay 11XP to again drop away, after sufficient time is provided by its slow

acting characteristics for the setting up of the route from signal S10 to signal S11.

The next approaching east-bound train, in accepting signal S10, causes the restoration to normal of the relays associated with setting up the route from signal S10 to signal S11, and the restoration of signal S10 to stop. As that train leaves the detector track section at the exit point at signal S11 for the route previously set up, an energizing impulse is provided for relay 12XP, when a circuit is closed from (+) through lever ASL in a right-hand position, front contact 68 of relay 3T, back contact 69 of relay 3TP, front contact 71 of relay 3RCR, and winding of relay 12XP, to (-). As a result of such energization a route is set up, for the next following train, from signal S10 to signal S12. Thus the two routes are set up alternately for east-bound trains, irrespective of the number of trains approaching as long as the selecting lever ASL remains in a right-hand or "alternate" position.

Manual control of NX interlocking system of Figs. 1 and 2.—The interlocking system shown in Figs. 1 and 2 is for a single switch similar to that shown in Figs. 6 and 7, but has its switch point facing in the opposite direction. This switch has been designated 1TS and the signals governing traffic thereover have been designated S1, S2 and S3. The wiring for the system of Figs. 1 and 2 is the same as that of Figs. 6 and 7 except for relays which would have been designated 1XP and 2XP (not shown) and corresponding to relays 11XP and 12XP of Fig. 6. It also differs in that the exit push buttons 1XB and 2XB when depressed pick up the relays 1XR and 2XR directly instead of accomplishing such function through the medium of relays 1XP and 2XP (not shown). For this reason all of the relays illustrated in Figs. 1 and 2 have been designated by the same reference letters with distinctive prefixes as corresponding relays of Figs. 6 and 7 and all of the contacts have been designated by the same reference number with a prefix 2. Except for the function performed by the circuits including back contact 30 of relay 10G in Fig. 6 the manual operation of the interlocking system of Figs. 1 and 2 is the same as that of the system shown in Figs. 6 and 7, already described, when the exit buttons 1XB or 2XB are used in combination with and after depressing entrance button 3NB, but is somewhat different when one of the exit push buttons 3XB1, 3XB2, 3XB3, 3XBA or 3XBB of Fig. 3 are used in combination with entrance button 1NB or 2NB. This latter operation will be pointed out hereinafter.

Train describer system.—Inasmuch as the train describer system used in this embodiment of the present invention is in general mode of operation the same as that shown in the above mentioned prior Phinney application Ser. No. 111,671, filed November 19, 1936, the system has been shown somewhat abbreviated. It is believed, however, that enough of the train describer system is shown and described in this disclosure to enable those familiar with the art to readily understand its application to the present invention. For a more detailed disclosure of this train describer system, reference is to be made to the Phinney application above referred to.

Referring to Figs. 3, 4A and 5 when these figures are laid end-to-end in that order illustrate the train describer system when a code type communicating system, such as shown in said Phinney application, is incorporated therein. If, however, Figs. 3, 4B and 5 are laid end-to-end in

that order they illustrate the same train describer system exclusive of the code type communication portion and employing instead six line wires for transmitting the train description from the push button relay bank shown in Fig. 3 to one of the storage relay banks shown in Fig. 5.

Referring to Fig. 3 it will be noted that the push button relays are divided to comprise pairs of relays 1, 2, 3 and 4 of which each pair includes a relay P and a relay N. Each relay P denotes a positive code element and each relay N denotes a negative code element, from which it is apparent that for each code description set up on these relays one relay of each pair must be energized and the other relay of each pair must be deenergized. It will also be noted that the depression of any one of the exit push buttons 3XB1, 3XB2, 3XBA and 3XBB will cause one relay of each pair of the push button relays to be energized. For instance, depression of the push button 3XB1 causes energization of the relays 1P, 2P, 3P and 4N so that this code is + + + -; that the depression of push button 3XB2 causes the relays 1P, 2P, 3P and 4P to be energized so that the code for this push button is + + + +. Similarly, depression of the push button 3XBA causes the relays 1N, 2P, 3P and 4N to be energized from which it is apparent that this transmits a code of - + + -; and the depression of push button 3XBB causes the relays 1N, 2P, 3P and 4P to be energized, thereby resulting in a code of - + + +. The relay CSP may be said to be a complete-code relay which is energized only when one and only when one relay of each pair is energized providing that the delivery relay DEL is then deenergized.

Referring now to Fig. 4A, in this figure has been illustrated conventionally a code type communicating system of the type more fully described in the application of Phinney, Ser. No. 111,671 filed November 19, 1936, to which attention is directed for a detailed description thereof. Briefly stated this system comprises line wires 1L and 2L extending along the single track section from the "west interlocking plant" shown in Figs. 1 and 2 to the "east interlocking plant" shown in Figs. 6 and 7. The line wire 2L has included in series therein line relays F and F¹ located at these interlocking plants, respectively. At the "west" station is located a line battery LB and at the "east" station is located a line battery LB¹. In practice the line battery LB has a larger number of cells than the line battery LB¹ so that if both of these batteries are included in the line circuit in opposition at the same time the line battery LB will dominate the line battery LB¹, this difference in voltage is resorted to so that if both the "east" and the "west" station attempt to transmit a code to the other station at the same time the battery LB¹ will be overpowered by the battery LB resulting in giving the "west" station priority as to the use of the line circuit, all as described in detail in the Phinney application above referred to.

The code type communication system illustrated is one of the types in which if a code is transmitted from the "west" station to the "east" station the lock-out relay LO¹ at the "east" station will be energized and the lock-out relay LO at the "west" station will be deenergized. In other words, the lock-out relay locks out the transmission of an indication and renders the station at which such lock-out relay is energized capable of receiving such indication. The relay C is a starting relay which if energized will start

the transmission of a code from the station "west" to the station "east." The relays BZ and BZ¹ are employed to signify that an incomplete code has been transmitted as more fully described in the above mentioned Phinney application. At the right-hand end of Fig. 4A has been illustrated relays 3DS¹, 3DS², 3DS³ and 3DS⁴. These relays may be said to be storage relays associated with the code type transmitting system shown in this Fig. 4A and are used for the purpose of storing a code which has been transmitted by the code communication system for temporarily storing this code until such code can be stored in one of the storage relay banks illustrated in Fig. 5 of the drawings.

Referring to Fig. 5, this figure illustrates two code storage banks, designated "storage bank 2" and "storage bank 1," for storing the train destination or train description of two trains following each other through the single track section. The first train will be stored in the storage relays 1DS¹, 1DS², 1DS³ and 1DS⁴ of "storage bank 1," whereas the second train will be stored in the storage relays 2DS¹, 2DS², 2DS³ and 2DS⁴ of "storage bank 2." Each of these code storage units is provided with a transfer relay DP and a transfer repeater relay DPP. The transfer relay DP in each case when energized prevents the transfer of a train description code to the storage bank with which it is associated and the transfer repeater relay DPP is used to enable a code to be stored in the train describer bank next in the rear. Although only two train describing banks have been illustrated in Fig. 5 it should be understood that there should be as many train describing relay banks as the maximum number of trains that will be able to occupy the single track section-connecting the two interlocking plants at one time. In order to determine when the "storage bank 1" including storage relays 1DS shall control the "east interlocking plant" located at the east end of the single track section and also when the train description stored therein shall be cancelled, suitable track repeating relays repeating the action of the track relay 3T are employed. These track repeater relays have been designated 3TPA, 3TPB and 3TPC. The "storage bank 1" has also associated therewith an executing relay 1DPA. This relay 1DPA is employed to allow a momentary impulse of current to flow only over its front contact 98 for the purpose of controlling the NX interlocking system located at the east end of the single track section and for determining the transfer of a train destination from "storage bank 2" to "storage bank 1" through the medium of its contact 119 in a manner more fully described hereinafter.

Operation of the system of Figs. 1, 2, 3, 4A, 5, 6 and 7.—Let us assume that there is a class No. 1 numbered train to the rear of the signal S1 of the "west interlocking plant" illustrated in Figs. 1 and 2, and that the operator wishes this train to pass on to the track No of the "east interlocking plant" illustrated in Figs. 6 and 7. The operator will depress the entrance push button 1NB (see Fig. 1) resulting in the energization of the relay 1NR through an obvious circuit. Picking up of the relay 1NR closes its stick contact 150 as a result of which the relay 1NR is stuck up, through a stick circuit including the front contact 149 of the track relay 1T and the stick contact 150 in series. With the relay 1NR energized the relay 1Y is energized through a circuit including

front contact 167 of relay INR and back contact 148 of relay IR. The operator could now depress the exit push button 3XB and thereby cause operation of the track switch ITS to its normal position, if it has not already assumed that position, to cause clearing of the signal S1, but since the operator is desirous of also controlling the NX interlocking plant at the east end of the single track section he will not depress the push button 3XB but will depress the proper exit push button illustrated in Fig. 3 of the drawings. Since the operator desires to send a class 1 numbered train to the track No. used only for numbered trains, he will depress the exit push button 3XB1 (see Fig. 3).

Depression of this push button 3XB1 causes the push button storage relays 1P, 2P, 3P and 4N to be picked up through obvious pick-up circuits including back contacts 151, 152, 153 and 154 of the complete-code relay CSP. With these push button storage relays once picked up they are stuck up through stick circuits including their stick contacts and including a contact of the cancelling push button CPB, wire 122 and back contact 155 of the executing relay EX (see Fig. 4A). With the relays 1P, 2P, 3P and 4N picked up the complete-code relay CSP is picked up through a pick-up circuit including front contact 156, back contact 157, front contact 158, back contact 159, front contact 160, back contact 161, back contact 162, and front contact 163 of relays 1P, 1N, 2P, 2N, 3P, 3N, 4P and 4N, respectively, and then passing through back contact 164 of the delivery relay DEL to the winding of relay CSP. The relay CSP will therefore be energized and will then be stuck up through a stick circuit including its own front contact 165 in multiple with back contact 164 of relay DEL.

With the relay CSP normally in its deenergized position the slow acting relay SR is energized through a circuit including back contact 166 of delivery relay DEL, and back contact 174 of the relay CSP. Picking up of the relay CSP in response to a complete code stored in the push button storage bank, as just explained, causes a momentary flow of current through the following circuit: beginning at the terminal (+), front contact 167 of the relay INR, wire 210, back contact 148 of the relay R1, front contact 213 of the relay 1Y, winding of the exit relay 3XR, back contact 168 of relay 3NR, normally closed push button contact 3XB, wire 169, front contact 170 of the relay SR, front contact 174 of the relay CSP, and back contact 166 of the delivery relay DEL to the other terminal (-). Current will flow through this circuit only during the drop-away period of the slow dropping relay SR. The momentary flow of current in the exit relay 3XR causes this relay to pick up, after which it is stuck up through a stick circuit including contact 167 of relay INR, contact 148 of relay R1, contact 213 of relay 1Y and contact 171 of relay 3XR in series. Relays 3XR and 1Y now being energized causes the normal relay N1 to be energized through a circuit including the front contact 172 of relay 3XR, front contact 217 of the relay 1Y, and back contact 241 of the relay R1 in series. Picking up of the relay N1 causes energization of the switch control relay 1WZ and the operation of the switch machine 1SM through front contact 244 of relay 1WZ, all in a manner as already described in connection with the "east in-

terlocking plant" illustrated in Figs. 6 and 7 of the drawings.

The completion of the movement of the track switch to its normal position causes opening of the back contact 245 of the correspondence relay INCR as a result of which the lock relay 1L is deenergized. Dropping of the lock relay 1L closes its back contact 250 which in turn closes an energizing circuit for the signal relay 1G, which circuit includes front contact 251 of the relay 3XR, back contact 250 of the relay 1L, front contact 249 of the relay INCR, back contact 248 of the relay 1XR, and front contact 173 of the relay INR, through winding of the relay 1G, to (-). Energization of the relay 1G results in clearing of the signal S1. With the signal S1 now cleared the train in question may proceed into the single track section over the track switch ITS in its normal position.

Entrance of the train upon the track circuit containing track relay 1T causes deenergization of this track relay 1T, which, among other things, results in the opening of its front contact 223 included in the energizing circuit for the lock relay 1L. This dropping of the track relay 1T also causes it to close its back contact 175 (see Fig. 3) which results in energization of the delivery relay DEL through a circuit including its back contact 175 and including front contact 176 of the relay CSP. With the delivery relay DEL once energized it is stuck up through a stick circuit including its own front contact 177 and also including the front contact 176 of relay CSP.

Picking up of the delivery relay DEL causes closure of its front contact 178, and also causes the opening of its back contact 164 shunted around the stick contact 165 of the relay CSP, thereby leaving the relay CSP only energized through its stick circuit heretofore traced. Closure of the front contact 178 of the delivery relay DEL causes initiation of the code type communicating system illustrated in Fig. 4A by closing the following initiating circuit of the communication system: beginning at the terminal (+), front contact 178 of the relay DEL, wire 64, back contact 179 of the lock-out relay LO, back contact 180 of the cycle demarking relay SA, back contact 181 of the incomplete code relay BZ, through the winding of the starting relay C to the other terminal (-). Picking up of the starting relay C will cause the communicating system to be set into operation, resulting in the energization of the lock-out relay LO1 at the east end of the code communication system and also resulting in the energization of the cycle demarking relays SA, SB and SB1. With the relay SB energized the starting relay C is stuck up through a stick circuit including the front contact 182 of the relay SB, and the stick contact 183 of the relay C.

During operation of the code type communicating system and during the period of energization of the first stopping relays 1V and 1V1 at opposite ends of the line circuit 1L-2L is energized by current of positive polarity, because the pole changing relay PC is energized during this period. The energizing circuit for this relay PC with the relays VP and 1V energized may be traced as follows: starting at the terminal (+), back contact 184 of the relay LO, front contact 185 of the relay C, front contact 186 of the relay VP, back contact 187 of the relay 4V, back contact 188 of the relay 3V, back contact 189 of the relay 2V, front contact 190

of the relay 1V, wire 72^a, front contact 191 of the relay 1P, wire 199, through the winding of the pole changer relay PC to the terminal (-). As already stated energization of the pole changer relay PC causes the line circuit 1L-2L to be energized by current of positive polarity resulting in operation of the line relay F¹ to its right-hand position, resulting in turn in the energization of the storage relay 3DS¹ during the first energized period of the line circuit with the stepping relay 1V¹ energized. This circuit may be traced as follows: starting at the terminal (+), polar contact 192 of the relay F¹ in its right-hand position, front contact 193 of the relay LO¹, back contacts 194, 195 and 196 of relays 4V¹, 3V¹ and 2V¹, respectively, front contact 197 of the relay 1V¹, back contact 198 of the relay PSP, through the winding of the storage relay 3DS¹ to the other terminal (-). In a similar manner the energized condition of relays 2P and 3P results in the picking up of the relays 3DS² and 3DS³ during the second and third impulse periods of the code communication system during which the stepping relays 2V¹ and 3V¹ are energized, respectively. Since the storage relay 4P is deenergized and its contact 200 is in its retracted condition the pole changer relay NC will be energized during the fourth stepping period of the communicating system through the medium of back contact 200 of relay 4P and wires 75^a and 202 which results in movement of the polar contact 192 of the line relay F¹ to its left-hand position as a result of which the code storage relay 3DS⁴ remains deenergized.

Each of the code storage relays 3DS¹, 3DS² and 3DS³ as it is energized is stuck up through a stick circuit including its stick contact and also including the front make-before-break contact 201 of the cycle demarking relay SB¹. During the fifth step of operation of the code type communication system the execution relay EX¹ picks up and this causes an execution circuit to be closed including the front contact 203 of the lock-out relay LO¹ and front contact 204 of the execution relay EX¹. The closure of this execution contact 204 causes the (+) terminal of the battery to be connected to each of the front contacts 205, 206, 207 and 208 of the storage relays 3DS¹, 3DS², 3DS³ and 3DS⁴, respectively. Since both the "storage bank 1" and the "storage bank 2" are empty and the transfer relays 1DP, 1DPP and 2DP are deenergized, the storage relays 1DS¹, 1DS² and 1DS³ (see Fig. 5) will be energized during this fifth step through the following three pick-up circuits: (1) the circuit including contacts 203 of relay LO¹, front contact 204 of relay EX¹, front contact 205 of relay 3DS¹, wire 72, back contact 76 of relay 2DP, and back contact 77 of relay 1DPP, back contact 78 of relay 1DP through winding of relay 1DS¹; (2) a circuit including front contact 203 of relay LO¹, front contact 204 of relay EX¹, front contact 206 of relay 3DS², wire 73, back contact 79 of relay 2DP, back contact 80 of relay 1DPP, back contact 81 of relay 1DP, through winding of relay 1DS²; and (3) the circuit including front contact 203 of relay LO¹, front contact 204 of relay EX¹, contact 207 of relay 3DS³, wire 74, back contact 82 of relay 2DP, back contact 83 of relay 1DPP, back contact 84 of relay 1DP, winding of relay 1DS³. With these storage relays 1DS¹, 1DS² and 1DS³ of storage bank 1 now energized they will be stuck up through stick circuits including their stick contacts and

including front contact 85 of the track repeater relay 3TPB. With the storage relays 1DS¹, 1DS² and 1DS³ energized the train describer lamp 1 will be energized through a circuit including front contacts 103, 104 and 105 of relays 1DS¹, 1DS² and 1DS³, respectively, and including back contact 106 of storage relay 1DS⁴.

Upon completion of the cycle of operation of the code type communication system shown in Fig. 4A this system will be returned to its normal position, in which position the cycle marking relays SA, SB and SB¹ will all be returned to their deenergized position, in a manner more fully described in the Phinney applications. Dropping of the cycle demarking relay SB¹ results in the opening of its front contact 201 thereby opening the stick circuits for the storage relays 3DS¹, 3DS² and 3DS³, unless the stick circuits for these relays 3DS¹, 3DS² and 3DS³ are maintained closed at front contact 209 of the relay 2DPP. The closure of the back make-before-break contact 201 of relay SB¹ will result in the energization of the relay PSP in the event that the storage relays 3DS¹, 3DS² and 3DS³ are still in their energized condition, and this relay PSP will then be stuck up through a stick circuit including its own front contact 210.

During the fifth step of operation of the code communication system, namely, during the time that the execution relays EX and EX¹ are energized the lifting of the back contact 155 of the relay EX caused the stick circuits for the relays 1P, 2P, 3P and 4N, heretofore traced, to be broken at this back contact 155. This, of course, resulted in the deenergization of these relays P and N and in turn resulted in the deenergization of the complete-code relay CSP, which in turn resulted in the deenergization of the delivery relay DEL irrespective of whether the train in question is still occupying the detector track circuit containing track relay 1T or not.

As heretofore pointed out in the NX type interlocking system shown in Figs. 6 and 7 as well as in the NX interlocking system shown in Figs. 1 and 2, the passage of a train over the detector track circuit causes the particular NX interlocking system to return to its normal condition, except that the track switch will remain in the last operated position. The train in question is now occupying the single track section and has not yet reached the "east interlocking plant" located at the east end of the single track section and illustrated in Figs. 6 and 7 of the drawings. The class 1 numbered train is however registered in storage bank 1 by the energized condition of relays 1DS¹, 1DS² and 1DS³. With these relays 1DS¹, 1DS² and 1DS³ energized the following energizing circuit is closed for the transfer relay 1DP: beginning at the terminal (+), back contact 270 of relay LO¹ (see Fig. 4A), or back contact 271 of relay EX¹, delay pick-up wire Pu, back contact 89 of relay 2DPP, back contact 89 of relay 2DP, back contact 90 of relay 1DPP, front contacts 91, 92 or 93 of relays 1DS¹, 1DS² or 1DS³ through the lower winding of the relay 1DP. With this relay 1DP once energized it is maintained energized through a stick circuit including its own front contact 94 so long as any one of the relays 1DS remains energized.

Let us assume that the operator at the "east interlocking plant" is absent or for some other reason it is desired to have this interlocking plant, controlled by the operator located at the "west interlocking plant" illustrated in Figs. 1

and 2, and for this reason the operator at the "east interlocking plant" has moved his selecting lever ASL to its left-hand "sorting" position. With the selecting lever ASL in its left-hand position and with the code + + + - stored in storage bank 1 the following circuit for energizing the relay 1IXP is closed the moment the transfer relay 1DP was picked up in response to the reception of the train description in storage bank 1; and before the executing relay 1DPA, which is slow dropping, had sufficient time to drop away: starting at the terminal (+), contact of the selecting lever ASL closed in its left-hand position, front contact 96 of the track relay 3T, wire 97, front contact 98 of the executing relay 1DPA, front contact 99 of the transfer relay 1DP, front contact 100 of the storage relay 1DS1, front contact 101 of the storage relay 1DS2, wire 102, through the winding of the relay 1IXP to the other terminal (-). Picking up of the relay 1IXP will close an energizing circuit for the normal relay 10NR, including front contact 57 of the relay 1IXP, back contact 30 of the signal control relay 10G, normally closed contact 31 of the push button 10NB, winding of the relay 10NR. With the relays 1IXP and 10NR now energized the following energizing circuit is closed for the exit relay 1IXR: beginning at the terminal (+), front contact 35 of relay 10NR, back contact 58 of relay 3N, back contact 59 of relay 11NR, and front contact 60 of relay 1IXP. The entrance relay 10NR is of course stuck up through a stick circuit including its own front contact 33 and the front contact 32 of the track relay 3T, and the exit relay 1IXR is stuck up through a stick circuit including the front contact 35 of the entrance relay 10NR and including the stick contact 61 of the relay 1IXR. With these relays 10NR and 1IXR energized the switch machine 3SM will be operated to its reverse position all in a manner as already described hereinbefore. When the track switch has been fully operated to its reverse position and has been locked the signal S10 will be cleared through the medium of energization of the signal relay 10G.

With the transfer 1DP energized as above pointed out the repeater transfer relay 1DPP is energized through front contact 95 of the relay 1DP. Picking up of the transfer repeater relay 1DPP transfers the code message wires 72, 73, 74 and 75 from the "storage bank 1" to the "storage bank 2" through the medium of contacts 77, 80, 83 and 130 of this relay 1DPP, so that the reception of a second train description will be stored in the "storage bank 2" instead of the "storage bank 1."

Let us now assume that the operator wishes to send a class A lettered train from the track directly in the rear of the signal S2 (see Fig. 1) into the lettered track Le shown in Fig. 6 of the drawings. In order to accomplish this the operator must depress the entrance button 2NB followed by depression of one of the lettered exit buttons 3XBA or 3XBB. Since it is however assumed to be a class A lettered train, he will depress the push button 3XBA. Depression of the push button 3XBA results in energization of the relays 1N, 2P, 3P and 4N, signifying code - + + -, which in turn results in the energization of the relay CSP, all in a manner as already described. Depression of the push button 2NB resulted in energization of the relay 2NR, which relay 2NR was then stuck up through a stick circuit including its stick contact 273 and front contact

274 of the track relay 1T. Picking up of the complete-code relay CSP results in the closure of the following circuit for the exit relay 3XR, beginning at the terminal (+), front contact 274¹ of the relay 2NR, wire 219, back contact 275 of the relay N¹, back contact 213 of the relay 1Y, winding of the relay 3XR, back contact 168 of the relay 3NR, normally closed push button contact 3XB, wire 169, front contact 170 of the relay SR, front contact 174 of the relay CSP, back contact 166 of the relay DEL, to the other terminal (-). The relay 3XR will of course then be stuck up through a stick circuit including its stick contact 171. With relays 2NR and 3XR energized and with the relay 1Y deenergized the reverse relay R¹ is energized through a circuit including front contact 172 of the relay 3XR, back contact 217 of the relay 1Y and back contact 263 of the relay N¹. Energization of the relay R¹ will, of course, through the medium of relay 1WZ operate the switch machine SM to a reverse position in a manner as already described in connection with "east interlocking plant" shown in Figs. 6 and 7.

As the second train progresses past the signal S² and treads upon the detector track circuit containing track relay 1T, the closure of back contact 175 of this track relay (see Fig. 3) will result in the energization of the delivery relay DEL and will result in the initiation of the code type communication system shown in Fig. 4A to result in energization of the storage relays 2DS2 and 2DS3 (see Fig. 5) all in a manner as already described in connection with the first train which is occupying the single track section. Storage of the train description of the second train in the storage bank causes energization of the transfer relay 2DP through an obvious circuit including back contacts 279 or relay LO¹, or 271 of relay EX¹, all in a manner as already described for storage bank 1. With the transfer relay 2DP now energized and stuck up through its front contact 89 the transfer repeater relay 2DPP is energized through the front contact 275¹ of the relay 2DP. Picking up of the transfer repeater relay 2DPP causes closure of its front contact 209 so that if a third train description is transmitted by a code type communication system while the "storage bank 1" and the "storage bank 2" both have a train destination description stored therein, the third train will be described in the storage relays 3DS shown in Fig. 4A of the drawings, and one or more of these relays 3DS will be stuck up through stick circuits including this front contact 209 of relay 2DPP.

Let us now assume that the first and the second train are still occupying the single track section and that the operator at the "west interlocking plant" desires to have a third train enter the single track section. Let us further assume that this third train is a B class lettered train and that for that reason the operator depresses an entrance button 1NB or 2NB and the exit push button 3XBB. This will result in the transmission of a code of - + + + all in a manner as already described, and will result in the energization of the relays 3DS², 3DS³ and 3DS⁴ (Fig. 4A) and with these relays once energized they will be stuck up through a stick circuit including their respective stick contacts and including the front contact 209 of the transfer repeater relay 2DPP.

Reviewing for a moment, there are now three trains occupying the single track section and the code + + + - is stored in "storage bank 1", the code - + + - is stored in "storage bank 2", and the code - + + + is stored in the "storage bank

3", and the lamps 1, A and B (lamps A and B not being shown) of storage banks 1, 2 and 3, respectively, are illuminated.

With the signal S10 now clear as above pointed out the first train of the three trains moving from west to east over the single track section may accept the signal S10 and pass into the numbered track No. As soon as this first train treads upon the detector track circuit containing track relay 3T the front contact 32 of this track relay 3T is opened thereby deenergizing the entrance relay 10NR and in turn deenergizing the exit relay 11XR as a result of which the signal S10 is returned to its stop position. The track switch 3TS will, of course, remain in its reverse position until again operated.

Another function performed by the dropping of the track relay 3T in response to entrance of the first train upon the detector track circuit associated with track switch 3TS resides in the cancellation of the code stored in "storage bank 1" and in the transfer of the train description stored in storage bank 2 to storage bank 1 and in the transfer of the train description stored in the "storage bank 3" to the "storage bank 2".

Taking these operating functions up in the order just given, dropping of the track relay 3T will result in closing of its back contact 115, but the closure of this contact 115 will produce no effect because the executing relay IDPA was deenergized in response to the picking up of the transfer relay IDP. Since the train entered upon the track section 3 while the signal S10 was in its clear position and while the front contact 109 of the signal relay 10G was closed this dropping of the track 3T causes energization of the track repeater relay 3TPA through a pick-up circuit including front contact 108 of relay 3T, front contact 109 of signal relay 10G and wire 110. With this track repeater relay 3TPA once picked up it will remain stuck up through a stick circuit including back contact 108 of track relay 3T, wire 111 and the stick contact 112 of the track repeater relay 3TPA. Picking up of the track repeater relay 3TPA results, by reason of opening of its back contact 21, in deenergization of the track repeater relay 3TPB. Dropping of the track repeater relay 3TPB results in the opening of its front contact 85 and in the cancellation of the code + + + - stored in "storage bank 1", it being understood that the transfer relay IDP is now energized and the storage relays of storage bank 1 are wholly dependent upon their stick circuits for energy. Also, the dropping of track repeater relay 3TPB opens the executing circuit for transferring a train description from "storage bank 2" to "storage bank 1" at the front contact 136 of the relay 3TPB. This opening of the stick circuits for the storage relays of "storage bank 1" and the opening of the execution circuit just mentioned is, however, only momentary because the dropping of the track repeater relay 3TPB results in energization of the track repeater relay 3TPC through back contact 113 and results in closure of its contact 114 which may be included in the stick circuits for the storage relays of "storage bank 1" and also results in the closure of its front contact 118 which may supply energy to the execution circuit just mentioned. This execution circuit can, however, not be closed at this time because front contact 119 of relay IDPA is now open.

Cancellation of the train description from the "storage bank 1" results in dropping of all of the storage relays IDS and in extinguishment of

the lamp 1, and this also results in the dropping of the transfer relay IDP, because the transfer relay 2DP is now energized and at its back contact 277 prevents the stick circuit including the stick contact 278 of relay IDP from being closed. Dropping of the transfer relay IDP results in picking up of the executing relay IDPA through its pick-up circuit including the back contact 22 of transfer relay IDP. Since the detector track relay 3T is still deenergized this executing relay IDPA is stuck up through a stick circuit including the back contact 115 of the track relay 3T, the wire 116 and the stick contact 117 of the executing relay IDPA. With this executing relay IDPA now energized the following executing circuit will transfer the code - + + - stored in "storage bank 2" to the "storage bank 1", through the following two pick-up circuits: (1) starting at the front contact 118 of the track repeater relay 3TPC, front contact 119 of the executing relay IDPA, front contact 120 of the storage relay 2DS2, and back contact 81 of the transfer relay IDP, through the lower winding of the storage relay IDS2; and (2) starting at the terminal (+), through front contact 118 of the track repeater relay 3TPC, front contact 119 of the executing relay IDPA, front contact 121 of the storage relay 2DS3, and back contact 84 of the transfer relay IDP, through the winding of the storage relay IDS3. These storage relays IDS2 and IDS3 will then be stuck up through stick circuits including their respective stick contacts and including the contacts 114 of the track repeater relay 3TPC. The train description lamp A is now energized through a circuit including back contact 103 of storage relay IDS1, front contacts 131 and 132 of storage relays IDS2 and IDS3, respectively, and back contact 133 of storage relay IDS4. The transfer of the train description from the "storage bank 2" to the "storage bank 1" took place between the time that the transfer relay IDP assumed its deenergized position to close its back contacts 78, 81, 84 and 123 and the time when the transfer repeater relay IDPP opened its front contact 107. In other words, as soon as the train destination has been transferred from "storage bank 2" to "storage bank 1" and upon dropping of the transfer relay IDPP and the opening of its front contact 107, the storage relays of "storage bank 2" are deenergized to wipe out the train destination description stored therein.

It will be noted that the transfer relay IDP must be picked up through the back contact 90 of the transfer repeater relay IDPP as a result of which the picking up of the transfer relay IDP will be delayed a short time after energization of the storage relays IDS2 and IDS3. When the transfer relay IDP becomes energized to close its front contact 280 and before the transfer repeater relay 2DPP has become deenergized to open its contact 281, in response to the dropping of the storage relays of "storage bank 2" and in turn the dropping of the transfer relay 2DP, an execution circuit is closed for transferring the train description stored in "storage bank 3" to the "storage bank 2". This execution circuit may be traced from (+), through front contact 280 of relay IDP, front contact 281 of relay 2DPP, executing wire 283 through the following three branches: (1) front contact 206 of relay 3DS2, wire 73, back contact 79 of relay 2DP, and front contact 80 of relay IDPP through the lower winding of the storage relay 2DS2; (2) through front contact 207 of relay 3DS2, wire 74, back contact

82 of transfer relay 2DP, and front contact 83 of transfer repeater relay 1DPP, through the lower winding of storage relay 2DS2; and (3) through front contact 285 of storage relay 3DS4, wire 75, back contact 286 of transfer relay 2DP, front, contact 130 of transfer repeater relay 1DPP, through the lower winding of the storage relay 2DS4. These storage relays of "storage bank 2" will obviously remain stuck up through stick circuits including the front contact 107 of the transfer repeater relay 1DPP.

Reviewing for a moment, we now have the second train description — + + — stored in "storage bank 1", and we have the third train description — + + + stored in "storage bank 2", the lamp A of "storage bank 1" is energized, the lamp B (not shown) of "storage bank 2" is energized and the track relay 3T is still maintained deenergized by the first train occupying the track section 3.

As heretofore pointed out the dropping of the track relay 3T resulted in the deenergization of the entrance relay 10NR and the exit relay 11XR. Let us now assume that the first train is moving off of the track section 3 resulting in the picking up of the track relay 3T. Picking up of the track relay 3T results in the opening of its back contact 115 and in the deenergization of the executing relay 1DPA. This executing relay 1DPA is, however, slow dropping and before it can open its front contact 98 the following execution circuit is closed for the relay 12XB: beginning at the terminal (+), contact of the selecting lever ASL in its left-hand position, front contact 96 of the track relay 3T, wire 97, front contact 98 of the executing relay 1DPA, front contact 99 of the transfer relay 1DP, back contact 100 of the storage relay 1DS1 (the code — + + + being stored therein), front contact 134 of relay 1DS2, wire 135, winding of the relay 12XP to the other terminal (—). Picking up of the relay 12XP through the medium of its front contact 29 results in energization of the entrance relay 10NR. Picking up of the entrance relay 10NR, which is then stuck up through its front contact 33 and front contact 32 of relay 3T will then result through the medium of closure of its front contact 35 in the energization of the exit relay 12XR through a circuit including front contact 35 of relay 10NR, back contact 36 of relay R3, winding of the relay 12XR, back contact 37 of relay 12NR, and front contact 38 of relay 12XP. With the exit relay 12XR energized the normal relay N3 is energized through a circuit including front contact 40 of relay 12XR and back contact 41 of reverse relay R3. Energization of the relay N3 with the lock relay 3L energized will result through the medium of relay 3WZ in the operation of the track switch 3TS to its normal position and will result in the clearing of the signal S10, all in a manner as already described. The "east interlocking plant" will therefore have its switches and its signals set to direct the second train, which is a class A lettered train, into the track section Le.

In the same manner the third train to approach will, through the medium of the train describer, have the "east interlocking plant" set up to direct this third train, which is a lettered train of class B, to the track section Le.

It is important that a new train description should not be transmitted from the "storage bank 3" to either of the storage banks 1 or 2, while such storage bank 1 or 2 is performing a transfer or cancelling operation, this in order

that the "storage bank 1", for instance, will not receive a train description before the former train description is cancelled or simultaneously receive a train destination from both of the storage banks 2 and 3, which of course might result in setting up a jumbled code, which would identify some other train which has not actually been passing the entering point of the single track section. In order to avoid such a jumbled up code a delay release bus Re and a delayed pick-up bus Pu (see Figs. 4A, 4B and 5) have been provided. The functioning of this delay release bus and delay pick-up bus will now be explained.

Delay release bus.—This delay release bus Re is capable of providing a special stick circuit for each of the transfer relays 1DP and 2DP including the contacts 278 and 277, respectively. This release bus Re is energized through front contacts 270 and 271^a when the lock-out relay LO¹ and the executing relay EX¹ are both energized. That is, this release bus Re is only energized when an indication is being executed by the code type communication system, namely, when the contacts 203 and 204 of the relays LO¹ and EX¹ are simultaneously energized to transmit an indication stored in the "storage bank 3" to the storage banks 2 or 1, as the case may be. Let us assume that the "storage bank 1" has a train description stored therein, and that in view of this fact the transfer relay 1DP is energized. Let us further assume that this train description is being cancelled because the track circuit containing track relay 3T has just become occupied. This cancellation of the train description stored in storage bank 1 would of course tend to drop the transfer relay 1DP because the stick circuit for its lower winding is broken. If, however, the code type communication system shown in Fig. 4A is at this time closing the executing circuit including contacts 203 and 204 of relays LO¹ and EX¹ to transmit a train description to the "storage bank 2" or the "storage bank 1", the delay release bus Re is also energized through front contacts 270 and 271^a of these relays LO¹ and EX¹ as a result of which the transfer relay 1DP has its stick circuit including its front contact 278 closed, and will remain energized and hold execution circuits for "storage bank 1" open at back contacts 78, 81, 84 and 123. If the "storage bank 2" also had had a train description stored therein then the delay release bus Re would have held the transfer relay 2DP energized through a stick circuit including the front contact 277 of this relay 2DP. It is thus seen that the first transfer relay DP, from left to right, to be energized while the code type communication system performs an execution function will be maintained energized through a special stick circuit which is maintained intact until this execution function has been completed.

Delay pick-up bus.—The delay pick-up bus Pu is normally supplied with current of (+) polarity through the back contacts 270 and 271 of the relays LO¹ and EX¹ in multiple, and this pick-up bus is used for supplying current to the pick-up circuits for the transfer relays 1DP and 2DP. If, however, these pick-up circuits are closed at front contacts of storage relays at a time when the code communication system is performing an execution function by the closing of its contacts 203 and 204 of relays LO¹ and EX¹, this pick-up bus is deenergized by reason of the open back contacts 270 and 271 of these relays LO¹ and EX¹, so that these transfer relays DP cannot be picked up except under one condition, namely,

that relay IDP may be picked up when an auxiliary pick-up circuit for such transfer relay IDP is available. Referring to Fig. 5 it will be seen that there is such an auxiliary pick-up circuit for the relay IDP, which auxiliary pick-up circuit includes the front contact 124 of transfer repeater relay 2DPP, back contacts 125, 126, 127 and 128 of the storage relays of "storage bank 2", back contact 90 of the transfer repeater relay IDPP, and front contacts in multiple of the storage relays of the storage bank 1. The significance of this pick-up circuit for the relay IDP is that this transfer relay IDP may be picked up in spite of the fact that back contacts 270 and 271 of relays LO¹ and EX¹ are both open if at that time the storage relays of "storage bank 2" are all deenergized, but the transfer relay 2DPP has not yet been deenergized to open its contact 124 in response to the dropping of the storage relays of storage bank 2, possibly because the transfer relay 2DP has been stuck up temporarily through the medium of the delay release bus Re and has thereby maintained energized the transfer repeater relay 2DPP. Putting this in other words, the transfer relay IDP may be picked up in spite of the deenergized condition of the delay pick-up bus Pu if at that time the delay release bus Re is maintaining the transfer relay 2DP energized through a stick circuit which in turn is maintaining the transfer repeater relay 2DPP energized.

By the study of this delay release bus Re and this delay pick-up bus Pu it is apparent that these busses bring about an orderly transfer of train descriptions from one storage bank to another in proper sequence and not in over-lapped relation.

Operation of the system illustrated in Figs. 1, 2, 3, 4B, 5, 6 and 7.—The operation of the system when the unit line wires and track repeater relay TP of Fig. 4B is substituted for the code communication system shown in Fig. 4A is substantially the same as that of the system when the code communication portion is employed, but differs therefrom by reason of the fact that when separate line wires are employed the train description code stored in the push button storage relays of Fig. 3 will be cancelled by the picking up of the detector track relay IT instead of being cancelled by the termination of the cycle of operation of the code communication system. In order, however, to get a more clear understanding of the operation of the system when Fig. 4B is substituted for Fig. 4A, one train movement will be considered when the unit line wires of Fig. 4B are employed.

Let us assume that the system comprising Figs. 1, 3, 4B, 5 and 6 laid end-to-end with Figs. 2 and 7 laid below Figs. 1 and 6, respectively, is now under consideration and let us further assume that it is desired to move a train which is located just to the rear of the signal S1 (see Fig. 1) over the single track section and on to the numbered track No (see Fig. 6). To accomplish this result the operator will first depress the entrance push button INB which will result in the energization of the entrance relay INR (Fig. 1) which upon return of the push button INB to its normal position will be stuck up through a stick circuit including the front contact 149 of the track relay IT and the stick contact 150. Picking up of the relay INR will result in the energization of the relay IY through an obvious pick-up circuit. The operator then instead of depressing the exit button 3XB will depress the

exit button 3XB2 (see Fig. 3). Depression of the exit button 3XB2 will result in the transmission of a code character + + + + to the push button relays resulting in the energization of the relays IP, 2P, 3P and 4P. These relays IP, 2P, 3P and 4P will then be stuck up through stick circuits including their respective stick contacts and also including the normally closed push button contact CPB, wire 122 and the front contact 290 of the track repeater relay TP (see Fig. 4B). Picking up of the relays IP, 2P, 3P and 4P will of course result in the energization of the complete-code relay CSP. Picking up of this relay CSP will result in deenergization of the slow acting relay SR, but before this relay SR has had time enough to assume its deenergized position a circuit is momentarily closed for the exit relay 3XR which may be traced from the terminal (+), through front contact 167 of relay INR, back contact 148 of relay IR, front contact 213 of relay IY, winding of the relay 3XR, back contact 168 of the relay 3NR, normally closed contact of the exit push button 3XB, wire 169, front contact 170 of the relay SR, front contact 174 of the relay CSP, and back contact 166 of the delivery relay DEL. Relay 3XR upon assuming its energized position will close a stick circuit therefore including its own front contact 171. With the relays INR, IY and 3XR now energized the track switch ITS will be operated to its normal position, unless it already assumes that position, after which the signal S1 will be cleared in response to energization of the relay IG. The train in question will now be free to move over the track switch ITS as a result of which the track relay IT is deenergized.

Deenergization of the track relay IT will through the medium of its back contact 175 (see Fig. 3) result in the energization of the delivery relay DEL, the relay CSP remaining energized in spite of opening of back contact 164 through its stick contact 165. Picking up of the delivery relay DEL closes an executing circuit through the medium of the circuit traced from the terminal (+), through a front contact 178 of the delivery relay DEL, wire 64, wire 199, through the front contacts of the storage relays IP, 2P, 3P and 4P to the four code wires 72^a, 73^a, 74^a, 75^a and 72, 73, 74, 75, respectively, which pass through the back contacts 76, 79, 82 and 286, respectively, of the relay 2DP (see Fig. 5) then pass through the back contacts 77, 80, 83 and 130, respectively, of the relay IDPP, which then pass through the back contacts 78, 81, 84 and 123, respectively, of the transfer relay IDP and then pass through the lower windings of the code storage relays IDS1, IDS2, IDS3 and IDS4, respectively, thereby causing all of the code relays of the storage bank 1 to be energized. These storage relays IDS will then of course be stuck up through stick circuits including the front contact 85 of the track repeater relay 3TPB.

Dropping of the track relay IT also results in the deenergization of the track repeater relay ITP due to the opening of the front contact 291 of the track relay IT included in the wire 296. This deenergization of the track repeater relay TP will, however, not result in the opening of the stick circuits for the relays IP, 2P, 3P and 4P, because these relays are now held up through an auxiliary stick circuit including the back contact 291 of relay IT and wire 297 instead of including the front contact 290 of the track repeater relay TP.

Let us now assume that the train in question

has passed over the track switch 1TS and has vacated the track circuit containing the track relay 1T. Picking up of the track relay 1T results in the energization of the track repeater relay 1TP, but before this track repeater relay 1TP had had sufficient time to close its front contact 230, the auxiliary stick circuits for the relays 1P, 2P, 3P and 4P are opened at the back contact 291 of track relay 1T for a sufficient time to deenergize these relays P. Dropping of the relays 1P, 2P, 3P and 4P will result in deenergization of the complete-code relay CSP which in turn by the opening of its contact 176 will result in dropping of the delivery relay DEL. Dropping of the delivery relay DEL will result in the application of current to the pick-up bus Pu to energize a pick-up circuit for the transfer relay 1DP (see Fig. 5) which may be traced as follows: beginning at the terminal (+), back contact 178 of the delivery relay DEL, delay pick-up bus Pu, back contact 88 of the transfer repeater relay 2DPP, back contact 89 of the transfer relay 2DP, back contact 90 of the transfer repeater relay 1DPP, through the four front contacts 91, 92, 93 and 129 of the storage relays 1DS of storage bank 1 all in multiple, through the lower winding of the transfer relay 1DP. Picking up of this transfer relay 1DP will cause closure of a stick circuit including its own front contact 94, so that if a second code should be transmitted to the "storage bank 2" it cannot be immediately transmitted to "storage bank 1." Picking up of the transfer relay 1DP results in the opening of its back contact 22 and in the deenergization of the executing relay 1DPA. This executing relay 1DPA is, however, slow dropping and during its drop-away period an energizing circuit for the relay 11XP will be closed which may be traced as follows: starting at the terminal (+), lever ASL in its left-hand "sorting" position, front contact 96 of the track relay 3T, wire 97, front contact 98 with executing relay 1DPA, front contact 99 of the transfer relay 1DP, front contact 100 of the storage relay 1DS1, front contact 101 of the storage relay 1DS2, through the wire 102 and the winding of the relay 11XP to the terminal (-). Energization of the relay 11XP will of course cause the relays 19NR and 11XR to be picked up resulting in the operation of the track switch 3TS to its reverse position and in the clearing of the signal S10 in a manner as heretofore fully described. The train under consideration may now pass through the single track section and when it reaches the signal S10 it will find it in a clear condition with the track switch 3TS in its reverse position so that the train in question may pass upon the track No to which all numbered trains should pass.

It should be understood that the four storage relays of each storage bank are capable of receiving fifteen different kinds of train destination indications as is readily obvious to those skilled in the art of code creation and determination relay banks, and as illustrated in the Phinney application above referred to. In practice there will be fifteen indicating lamps instead of only the four indicating lamps 1, 2, A and B illustrated. It should also be understood that in practice there will be as many storage banks as the maximum number of trains which may occupy the single track section. The additional storage banks will of course be identical to the storage bank 2 except for the addition of indicating lamps.

It should also be understood that these indi-

cating lamps 1, 2, A, B, etc. may be used to inform the operator at the "east interlocking plant" of Figs. 6 and 7 as to the destination of the numbered trains when they have reached the track No and the lettered trains when they have reached the track Le, and if they are passenger trains at which platform they are to stop. It should also be understood that if desired the "storage bank 1" may control a plurality of track switches to set up any one of a large number of routes instead of operating only a single track switch 3TS. In this event a large number of XP relays would be employed one for each route, and these XP relays would control a single entrance relay and the exit relays of a NX system such as shown in the Langdon application and patent above referred to.

Reviewing some of the preceding operation when the first approaching train enters the detector track section as described above, signal S10 is restored to stop, and the relays of the self-selecting network associated with the setting up of the route from signal S10 to signal S11 are restored to their normal position as has been heretofore described.

When the first train proceeds through the interlocking plant and leaves the detector track section to cause relay 3T to be picked up, relay 3TPA is dropped away after its circuit is opened at back contact 108 of relay 3T. Relay 3TPB is picked up when its circuit is closed at back contact 21 of relay 3TPA, and relay 3TPC is dropped away when its circuit is opened at back contact 113 of relay 3TPB. The picking up of relay 3TPB prior to the dropping away of relay 3TPC maintains stick energy for relays 1DS at front contact 85 of relay 3TPB to cause those storage relays to remain stuck up.

The picking up of relay 3T, under such conditions, causes the momentary picking up of relay 12XP when a circuit for that relay is closed from (+), through a contact of the lever ASL closed in a left-hand position, front contact 96 of relay 3T, wire 97, front contact 98 of relay 1DPA, front contact 99 of relay 1DP, back contact 100 of relay 1DS1, front contact 134 of relay 1DS2, wire 135, and winding of relay 12XP, to (-). After relay 12XP has had sufficient time to pick up, relay 1DPA is dropped away because its stick circuit is open at back contact 115 of relay 3T and its pick-up circuit is open at back contact 22 of relay 1DP. The momentary energization of relay 12XP causes the setting up of a route from signal S10 to signal S12 in the same manner as has been heretofore described. Thus a route is completely set up for the next approaching train which has been designated as of a class to cause the illumination of the lamp B, and the setting up of a route from signal S10 to signal S12.

As the next approaching train, described by the illumination of lamp B, enters the detector track section, the storage relays 1DS are released, and the transfer of stored descriptions is effective as heretofore described if storage for description of other approaching trains has been effected. If there are no more descriptions stored for approaching trains, all of the relays of the system are restored to their normal positions as shown and described as soon as the passing train has left the interlocking plant to allow the relay 3T to pick up.

From the above described example of the mode of operation of the system in setting up routes in accordance with train descriptions transmitted,

it is believed that the general mode of operation of the system is clearly understood. That is, in setting up of routes by train describer control, the reception of a first description code for a first approaching train effects the setting up of a route for that train as soon as the description is received; however, the setting up of a route for a following approaching train is effected only after the preceding train has left the detector track section. Thus, with respect to the self-selecting network, the route establishing means is never conditioned by automatic control for a following train until the preceding train has left the detector track section.

Upon considering the above description and also the means for suppressing cancellation of descriptions and suppressing execution of automatic control as hereinafter described, it will be readily apparent that an operator may operate the lever ASL to the automatic sorting position under a number of conditions other than the normal condition heretofore considered. One of such conditions can be, for example, at a time when there is a description stored for the first approaching train and there is no route set up. Under such conditions, after the lever ASL is operated to a left-hand position, the route for the first approaching train must be set up by manual designation of such route because at that time relay IDPA (see Fig. 1) is dropped away because of the opening of its circuit at back contact 22 of relay IDP. The stick circuit for relay IDPA is of course open at such time at back contact 115 of relay 3T. After the route is set up manually for the first train automatic control will be effective for following trains as heretofore described.

A general rule for an operator to follow in operation of the lever ASL to a left-hand position is to check his indicator lamps each time to see if a route is automatically set up for the first train described, if not he should set up a route for that train by manual control.

Preconditioning of network.—It will be noted that the self-selecting network is deenergized while the detector track section is occupied when automatic control is being used for setting up routes. That is, the self-selecting network relays are automatically restored to normal upon the entering of a train into the detector track section, and the setting up of another route by automatic control is not effected until the passing train leaves the detector track section. Thus, due to the fact that the "east interlocking plant" can be governed by manual control irrespective of the effectiveness of automatic control, an operator can condition the network for a route for a following train while the detector track section is occupied. The network, when conditioned in that manner, is maintained energized until it is restored upon passage of a train, thus rendering the automatic control ineffective for changing a route which is set up by manual control, because of the general characteristics of the self-selecting network which, however, does not allow two conflicting routes to be set up at the same time, the first route designated maintaining preference over the designation of conflicting routes.

Such a mode of operation provides that an operator can, when the plant is under automatic control, cause the setting up of a route manually that does not correspond with the route that would be set up by automatic control. This method of manual dominance of control may be necessary where a work train not described in the

train described is to be manually routed through the "east interlocking plant." In this case it will be necessary to suppress cancellation of a train description by the work train in a manner as explained hereinafter under the heading "Suppression of automatic cancellation."

Manual cancellation of description storage.—In order to provide that an operator can manually cancel descriptions received, cancel buttons CPB and CAB are provided. Depression of cancel button CPB (Fig. 3) causes deenergization of all of the push button relays P and N providing the code communication system of Fig. 4A is at rest. If a code is however being transmitted from west to east and the cycle marking relay SA is energized while the relay LO is deenergized the push button CPB is shunted by front contact 293 of relay SA and back contact 294 of relay LO in series through wire 298. The cancel push button CPB (Fig. 3) is, however, always effective when the unit line wire communication system of Fig. 4B is used.

The depression of the cancel button CAB (Fig. 5) opens the normally closed contact 20 included in the normally energized circuit for relay 3TPB to cause that relay to drop away and open the stick circuit for the relays IDS at front contact 85. After button CAB is again restored to its normal position, relay 3TPB is again picked up, and relay 3TPC is dropped away, thus restoring stick energy for the relays IDS which are energized either upon transfer of a train description from the storage relays 2DS, or upon reception of the next description over the code communication system of Fig. 4A or the unit line communication system of Fig. 4B. If relays IDS are energized upon transfer of a description from relays 2DS, the pick-up energy for these relays is supplied through a circuit including front contact 118 of relay 3TPC.

It is provided that cancellation of description storage codes for the description of the first approaching train can be effected with lever ASL in a left-hand position only if signal S10 is at stop. If signal S10 is clear, relay 3TPB is maintained energized irrespective of the cancellation button CAB by a circuit closed from (+), through a contact of lever ASL closed in a left-hand position, front contact 137 of relay 10G, wire 138, back contact 139 of relay SU, back contact 21 of relay 3TPA, and winding of relay 3TPB, to (—).

Such control for the relay 3TPB provides that manual cancellation of stored description codes cannot take place when this train description has already caused the automatic sorting of a train over the track switch in accordance with train descriptions stored by relays IDS. That is, if a description is cancelled when there is no route set up and the track section is unoccupied, the transfer of a stored description to the relays IDS causes the picking up of relay IDP to cause the execution of the automatic control for the self-selecting network. If the track section is occupied at the time the cancellation button CAB is depressed, the stick circuit for relay IDPA will be closed at back contact 115 of relay 3T (see Fig. 2) to provide that execution will be effected when the train leaves the track section to automatically set up a new route as heretofore described.

Suppression of automatic cancellation.—In most conditions encountered in practice where train describer systems are used, it is desirable to be able to send an undescribed train through the interlocking plant without effecting the auto-

matic cancellation of train descriptions stored for other approaching trains. Such an undescribed train could, for example, be a work train.

It is also desirable to be able to use a track switch such as the track switch 3TS in the present embodiment of this invention for switching moves, without effecting the automatic cancellation of stored train descriptions for approaching trains.

Thus a suppression button SUB is provided to suppress cancellation of descriptions upon passage of an undescribed train. To consider an example of such suppression, assume an undescribed train to approach signal S10 in a normal direction of traffic (west to east), and also assume a description code to be stored for a following train by storage relays IDS.

To suppress automatic cancellation upon passage of the first approaching train of the code stored by relays IDS, an operator depresses the button SUB (see Fig. 5). The depression of button SUB causes the picking up of relay SU by the energization of a circuit closed from (+), through contact 140 of button SUB closed in a depressed position, and winding of relay SU, to (-). The picking up of that relay closes a stick circuit from (+), through back contact 141 of relay 3TPC, front contact 142 of relay SU, and winding of relay SU, to (-). Energy is also applied to that stick circuit at back contact 143 of relay 3TPB when track section 3 is occupied by a train, and that stick circuit is maintained, upon passage of a train in the normal direction of traffic, until that train leaves the detector track section, because relay 3TPB is dropped away prior to the picking up of relay 3TPC, and is picked up prior to the dropping away of relay 3TPC.

Thus, it is provided that relay SU, when once picked up, is maintained energized until a train leaves the detector track section proceeding in the normal direction of traffic, and stick energy is maintained for relays IDS as long as relay SU is picked up to close front contact 144 of relay SU.

The entrance of a train (assumed to be undescribed) into track section 3, when the automatic cancellation of description codes is suppressed, causes the picking up of relay 3TPA as heretofore described when considering passage of other trains, and the picking up of that relay causes the dropping away of relay 3TPB and the picking up of relay 3TPC. The dropping away of relay 3TPB causes the picking up of relay IDPA by the energization of a circuit closed from (+), through front contact 145 of relay SU, front contact 146 of relay 3TPA, back contact 147 of relay 3TPB, and winding of relay IDPA, to (-). The picking up of relay IDPA closes a stick circuit as has been heretofore described.

Thus, it is provided that relay 12XP or relay 12XP, dependent upon the description stored by relays IDS, is momentarily energized, if lever ASL is in a left-hand position, when the passing undescribed train leaves track section 3 after suppression of the automatic cancellation of the description code has been effected. Such a mode of operation, together with the feature of the automatic control that provides only a momentary execution period for automatically setting up routes, allows an operator to manually restore a route previously set up by automatic control, suppress cancellation of the description stored by relays IDS, and set up another route for an undescribed train approaching ahead of

the train for which the description stored by relays IDS is provided, all with lever ASL remaining in a left-hand automatic control position. Upon the undescribed train leaving track section 3, the route is again set up in accordance with the train description code stored by relays IDS, because relay IDP is picked up to close front contact 99, and relay IDPA remains picked up after relay 3T is picked up, long enough, because of slow action of relay IDPA, to provide that the route is automatically set up for the particular class of train associated with the description code stored by the relays IDS.

It is also provided that train movements against the normal direction of traffic do not effect the cancellation of stored descriptions. Thus, for example, the passage of a west-bound train over the route from signal S11 to signal S10 does not require the actuation of the suppression button SUB to prevent the automatic cancellation of descriptions. Such a mode of operation is provided in the control of relay 3TPA which can by reason of contacts 109 and 108 be picked up only when signal S10 is clear and relay 3T is dropped away. It is obvious that contact 109 is closed only when a route is set up for east-bound traffic.

If the lever ASL is in a left-hand position at a time when an operator wishes to send a train against the normal direction of traffic as mentioned above he must, if he wishes the next route for a described train to be set automatically, depress the suppression button SUB, before setting up the west-bound route by manual control. This is necessary in order to energize the relay IDPA so that it may be held energized through its stick circuit so long as track relay 3T remains deenergized by the west-bound train so that the new route is automatically set up after the west-bound train has left the route set up for that train. In other words, the reason for suppression under such conditions is to provide a pick-up circuit for relay IDPA through front contact 145 when the train enters track section 3 so that the route previously set up by automatic control will again be set up when the undescribed west-bound train leaves the detector track section 3.

If it is undesirable to cause a signal to clear immediately in the rear of west-bound train under such conditions, the operator can set up the route for the west-bound train without actuation of the suppression button, and, after that west-bound train has left the interlocking plant, set up the route by manual actuation of an exit button for the train described in the "storage bank 1."

Attention is directed to the fact that if the suppression feature is used and the suppression relay is picked up that it will be restored by the first east-bound train moving over the track switch when such train vacates the track circuit. This is accomplished by the opening of contact 143 in its stick circuit prior to the closing of contact 141. It is thus seen if the suppression feature is used for a west-bound train the cancelling button CAB must be depressed during the passage of such west-bound train. In this latter case no cancellation of train description takes place but merely cancellation of the suppressing feature takes place, the train description being cancelled during passage of the next east-bound train.

If an operator wishes to cause a west-bound switching move over track switch 3TS at a time when a different route is already set up by train

description control, with lever ASL in a left-hand position, he can restore the route set up by pulling out button 10NB and can then proceed to set up a route for an east-bound train, such, for example, as from signal S10 to signal S11. After the train approaching signal S10 has passed through that route, the operator can set up a route from signal S10 to signal S12 for the train the description of which was stored in but has since been cancelled from "storage bank 1" by the depression of button 12XB. In view of that fact that the train making the switching move from west to east was undescribed, and the fact that a train description is stored by the storage relays IDS, an operator may, on the other hand, depress the suppression button SUB to suppress cancellation upon passage of the undescribed east-bound train over the route set up for that train from signal 10 to signal 12. When the undescribed train leaves track section 3, the route is again set up in accordance with the train description code stored by relays IDS in a manner heretofore described after which such train description is automatically cancelled from "storage bank 1."

Fig. 8 modification.—If the train describer shown in this application is to be used only for automatically setting up the routes at the "east interlocking plant" and if normal traffic is to move only from left to right, and if no operator is to be employed at such "east interlocking plant" the push buttons 10NB, 10XB, 11NB, 11XB, 12NB and 12XB and the selecting lever ASL may be entirely omitted from Fig. 6, the push buttons 3NB, 1XB, 2XB and 3XB may be entirely omitted from Fig. 1 and the exit train describer push buttons 3XB2, 3XB3 and 3XB4 may be omitted from Fig. 3, in which event only one miniature track layout will be necessary on which the remaining push buttons 1NB, 2NB, 3XB1 and 3XBA will be mounted as shown in Fig. 8 of the drawings.

The modified construction as conventionally illustrated in Fig. 8, really comprises a single entrance-exit type system of interlocking including a long section of single track which is capable of receiving a large number of trains at the same time and which interlocking system is so constructed that the east end of the interlocking plant will have its track switch positioned to the proper position only when all trains ahead of the train in question have passed over the track switch or switches. In other words, the NX interlocking system shown in Fig. 8 is of a construction wherein the track switch at the entering end is positioned when the entrance and exit push buttons are operated and in which the track switch at the exit end of the system is operated only when all preceding trains operating over the interlocking plant have actually passed beyond the track switch or switches at the exit end of the system and have vacated its detector track circuit.

Fig. 9 modification.—If it is desirable in practice that an operator be required to designate both the entrance and exit ends of each route set up by manual control, the back contacts 56 and 28 of buttons 11XB and 12XB respectively should be removed from the circuits in which they are shown in Fig. 5, and instead be used to close circuits for their respective XR relays rather than the XP relays. That is, instead of closing pick-up circuits for the exit relays 11XR and 12XR (see Fig. 6) through the medium of the relays 11XP and 12XP by push buttons 11XB

and 12XB, these relays 11XR and 12XR may have their pick-up circuits directly closed through the push button contacts 11XB and 12XB as illustrated in Fig. 9 of the drawings. In this modified construction the relays 11XB and 12XB will perform the same function as they perform in Fig. 6 but in this modified construction of Fig. 9 when it is desired to set up a route manually the operator must first press the entrance button 10NB after which he must press the proper exit button 11XB or 12XB in order to set up a route, it being remembered that in the Fig. 6 construction it is unnecessary for the operator to depress the entrance button 10NB when a route is set up in an east-bound direction manually.

Having shown and described interlocking plants provided for a particular track layout as one specific embodiment of the present invention, and several modifications thereof, it is desired to be understood that the forms shown were selected to facilitate in the disclosure of the invention rather than to limit the number of forms which the invention may assume; and, it is to be further understood that various modifications, adaptations and alterations may be applied to the specific forms shown to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention except as limited by the appending claims.

What I claim is:

1. In an interlocking system of the character described in which train movements through a track layout, providing a plurality of conflicting routes between an entrance point and a plurality of exit points, are governed in accordance with descriptions received of destinations for approaching trains, circuit means for storing descriptions of a destination for a first train approaching said entrance point, an entrance relay for the entrance point, an exit relay for each of the exit points, circuit means for energizing the entrance relay and one of the exit relays when a description of an approaching train is stored by said storing means, that exit relay being selected in accordance with the described destination for that first approaching train, and route establishing means responsive to the picking up of said entrance relay and one of said exit relays for setting up a route between those entrance and exit points.

2. In an interlocking system, a track layout including at least one track switch and having a signal located at an entrance point facing the points of said switch for governing traffic over such switch in its different positions, a detector track section associated with said track switch, a manually operable control button for said signal location and for the exit end of each route over said track switch, an entrance relay for said entrance control button, an exit relay for each of said exit control buttons, circuit means controlled by said buttons for picking up its corresponding relay when actuated, stick circuit means for said entrance relay for maintaining such entrance relay picked up dependent upon the unoccupied condition of said detector track section, stick circuit means for each exit relay for maintaining its exit relay energized only when said entrance relay is picked up, route establishing means rendered active in response to the operation of said entrance relay and any given exit relay for causing the operation of the track switch and clearing the signal for govern-

ing traffic thereover, said means preventing the setting up of any conflicting route, a train description receiving apparatus for receiving descriptions of trains from a remote point, and circuit means controlled by said train description receiving apparatus and rendered effective upon the reception of a train description for only momentarily energizing said entrance relay and that particular exit relay of the route required for the train having its description received by said apparatus, said circuit means being effective only if said route establishing means is inactive at the time of the reception of a train description by said train description apparatus.

3. In an interlocking system for railroads, a track layout providing a plurality of conflicting routes between an entrance point and a plurality of exit points, a manual control lever having two operated positions, route establishing means for setting up routes between said entrance and exit points when rendered effective but allowing only one of such conflicting routes to be established at any one time, designating means for manually designating an exit point, means for storing train descriptions, circuit means for automatically rendering effective said route establishing means for setting up routes selected in accordance with stored descriptions stored in said means for storing train descriptions only if said control lever is in a first operated position, and circuit means for rendering effective said route establishing means when said control lever is in a second position upon the manual designation of an exit point by said designating means.

4. In an interlocking system for railroads of the character described for setting up routes through a track layout between an entrance point and a plurality of exit points; a manual control lever having three operated positions; storing means for storing train descriptions; route establishing means for setting up routes between the entrance and exit points when rendered effective, only one route being set up at any one time; circuit means for automatically rendering effective said route establishing means for setting up routes selected in accordance with stored descriptions in said storing means of destinations for trains approaching the entrance point, only if said control lever is in a first operated position; circuit means for automatically rendering effective said route establishing means upon the exit of each train from the track layout at one exit point for setting up a route for a following train between the entrance point and another exit point, only if said control lever is in a second operated position; exit means for manually designating an exit point; and circuit means for rendering effective said route establishing means, when said control lever is in said first, said second or a third operated position, upon the manual designation of an exit point by said exit means for a route between the entrance point and the exit point thus designated.

5. In an interlocking system of the entrance-exit type for governing track switches and signals associated with a track layout providing a plurality of routes between a common entrance point and a plurality of exit points, manually operable contact means for each exit point, an entrance relay for the entrance point, circuit means for energizing said entrance relay whenever said contact means is actuated for either of the exit points, and route establishing means responsive to the picking up of said entrance relay and the actuation of the contact means for

any given exit point for setting up a route between said entrance point and the exit point for which said contact means is actuated.

6. In an interlocking system, a track layout having two routes between an entrance point and two exit points with signals for governing traffic over such routes, a detector track section associated with said track layout, an entrance relay for said entrance point, an exit relay for each of said exit points, means for initially energizing said entrance relay and one of said exit relays, route establishing means responsive to the operation of said entrance relay and any given exit relay for setting up the corresponding route and clearing a signal governing traffic thereover, and means controlled by said detector track section upon the leaving of a train from either one of said two routes for causing the energization of said entrance relay and that particular exit relay required to set up the other of said two routes, whereby the passage of trains over said detector track section effects the setting up of said two routes alternately.

7. In an interlocking system, a track layout having a plurality of routes between a single entrance point and an exit point for each route with a signal for governing traffic over such routes from said entrance point, an entrance relay for said entrance point, an exit relay for each of said exit points, a manually operable button for said entrance point, a manually operable button for each of said exit points, circuit means associated with each of said buttons and responsive to the operation of its button for energizing its corresponding entrance or exit relay, route establishing means rendered active in response to the picking up of said entrance relay and the picking up of the exit relay for the exit end of any given route for setting up the corresponding route and clearing a signal governing traffic thereover, said route establishing means preventing the setting up of more than one of said routes at the same time, whereby the joint operation of the manually operable button for said entrance point and the manually operable button for an exit point alone accomplishes the setting up of the designated route, a plurality of route control relays there being one for each of the routes through said track layout and energizable from a remote point, and circuit means controlled by said route controlling relays for energizing said entrance relay and that particular exit relay required to set up the route corresponding to such route control relay, said circuit means being effective only if said route establishing means is at that time inactive.

8. In an interlocking system, a track layout including a track switch and a signal located at the facing point of said track switch for governing traffic over such switch in its two positions, a detector track section associated with said track switch, a manually operable control button for said signal and for the exit end of each route over said track switch, an entrance relay for said entrance control button, an exit relay for each of said exit control buttons, circuit means for each route controlled by its entrance button and its exit button for picking up its corresponding exit relay, stick circuit means for said entrance relay including a front contact of the track relay for said detector track section, a stick circuit for each of said exit relays for maintaining its exit relay energized only when said entrance relay is picked up, route establishing means rendered active in response to the picked

up condition of said entrance relay and the picked up condition of the exit relay for any given route over the track switch for causing the operation of the track switch to the position required to set up that route and cause the clearing of the signal for governing traffic over such route, a train describer for receiving and storing the descriptions of trains as transmitted from a remote point, said train describer being so arranged as to effect the cancellation of the train description of the first order upon the entrance of a train into said detector track section and cause the transfer of the train description of each of the successive orders to the next lower order, circuit means controlled by said train describer for momentarily effecting energization of said entrance relay and that particular exit relay of the route required for the train having its description of the first order as stored in said describer, said circuit means being effective at the time of the reception of a train description of the first order if said route establishing means is inactive at that time but being effective only upon the leaving of a train from said detector track section upon the reception of a train description of said train describer during the occupied condition of said detector track section.

9. In an interlocking system for railroads, a track layout having a plurality of routes between a single entrance point and a corresponding number of exit points with signals for governing traffic over such routes from said entrance point, a manually operable control button for each of said entrance and exit points, route establishing means initially rendered active in response to the operation of a control button for said entrance point and the control button for any given exit point for setting up a route between the corresponding entrance and exit points and clearing a signal therefor, said means remaining active until a train passes into the established route, a train description apparatus for receiving and storing train descriptions in the order received from a remote point, means acting on said train description apparatus to effect the cancellation of the description of the lowest order and transferring each remaining description to the next lower order automatically upon an entrance of a train into the corresponding route, means controlled by said train description apparatus and effective, upon the storing of a new train description of the lowest order following the cancellation of the old description of the lowest order, for initially causing said route establishing means rendered active to set up a route corresponding to the new description of the lowest order, said means being only momentarily effective, means acting on said train description apparatus for manually causing the cancellation of the description of the lowest order, and means for preventing the manual cancellation of a description of the lowest order whenever a train is present in any one of said routes and whenever said entering signal is cleared.

10. In an interlocking system, a track layout having an entering signal from which a plurality of routes diverge, a detector track section associated with said signal, a manually operable control button for said entering signal and for the exit end of each of said routes, route establishing means rendered active in response to the actuation of said entrance control button and any given exit control button alone for setting up a route between the corresponding points and clearing said entering signal, a train description

receiving and storing apparatus for storing descriptions in the order received and transferring each description to the next lower order upon the cancellation of the description of the lowest order, means effective to cancel the description of the lowest order upon the entrance of a train into said detector track section, execution circuit means controlled by said train description apparatus for only momentarily controlling said route establishing apparatus to set up a route in accordance with the description of the lowest order stored in said train description receiving and storing apparatus, and circuit means controlled in accordance with traffic conditions and the condition of said entering signal for delaying the control of said route establishing means by said execution circuit means upon the storage of a description in the position of the lowest order if said entering signal is cleared, said means remaining effective until said entering signal is returned to stop and said detector track section is unoccupied.

11. In an interlocking system, a track layout having an entering signal from which a plurality of routes diverge, a detector track section associated with said signal, a manually operable control button for said entering signal and for the exit end of each of said routes, route establishing means rendered active in response to the actuation of said entrance control button and any given exit control button alone for setting up a route between the corresponding points and clearing said entering signal, a train description receiving and storing apparatus for receiving and storing descriptions in the order received and transferring each description to the next lower order upon the cancellation of the description of the lowest order, automatic cancellation means controlled by the occupied and unoccupied condition of said detector track section and acting to cancel the description of the lowest order upon the entrance of a train into said detector track section, execution circuit means controlled by said train description apparatus for only momentarily controlling said route establishing apparatus to set up a route in accordance with the description of the lowest order then stored in said train description receiving and storing apparatus, and suppressing circuit means rendered effective in response to manual actuation to act on said automatic cancellation means to prevent the cancellation of a description of the lowest or any other order upon the passage of a train into said detector track section, said suppression circuit means being automatically rendered ineffective upon the passage of such train out of said detector track section.

12. In an interlocking system, a track layout having a plurality of routes diverging from a common entrance point at which an entering signal is located for governing traffic over such routes, a detector track section located immediately in advance of said entering signal, a control panel having a miniature track diagram of said track layout, a manually operable control button located at a point on said control panel corresponding to said entrance point, said button being self-restoring from an operated position and also from a cancelling position to a normal position, a manually operable exit control button of the self-restoring type for the exit end of each of said routes, an entrance relay for said entrance control button, a pick-up circuit for said entrance relay closed when said entrance control button is in an operated position, a stick

circuit for said entrance relay including said entrance control button in its normal position and in its operated position and also including a contact closed only when said detector track section is unoccupied whereby the operation of said entrance control button to its cancelling position or the entrance of a train into said detector track section opens the stick circuit for said entrance control relay, route establishing means initially rendered active in response to the operation of said entrance relay and any given exit control button for causing the establishment of the corresponding route and the clearing of said entering signal, said route establishing means remaining active so long as said entrance relay remains picked up, a train description receiving and storing apparatus for receiving and storing descriptions in the order received the first received being of the lowest order and transferring each description to the next lower order upon the cancellation of the description of the lowest order, circuit means controlled by the entrance of a train into said detector track section for cancelling the description of the first order, and circuit means controlled by said train description receiving apparatus, so as to be rendered effective only momentarily upon the storage of a new description of the first order, for initially energizing said entrance relay and acting the same as the operation of a particular one of said exit control buttons for causing the response of said route establishing means to set up the corresponding route, whereby a route set up automatically by said train description apparatus may be cancelled by actuation of said entrance control button to a cancelling position and a different route may be subsequently set up by manual operation of said entrance control button and one of said exit buttons irrespective of the continued storage of that train description in said train description receiving apparatus.

13. In a switch and signal control system, a track layout having a plurality of conflicting routes extending between a common entrance point and a plurality of exit points, manually operable contact means for designation of each of said exit points, circuit means for storing descriptions of destinations for successively approaching trains in their successive orders, a detector track section in advance of said entrance point, automatic means for designating each of said exit points in accordance with a corresponding stored description for the destination of the first train approaching said entrance point, such designation being rendered effective momentarily only when said detector track section becomes unoccupied, route establishing means responsive to the designation of an exit point by said manual contact means or by said automatic means for setting up a route between the exit point thus designated and said entrance point, such route establishing means being effective only if there is no conflicting route established and circuit means for maintaining said route establishing means effective until restored upon the entrance of a train at said entrance point, whereby the designation of an exit point by manual control prior to the designation of another exit point by automatic control is superior to the designation by automatic control if such manual designation is effected when said detector track section is occupied.

14. In an interlocking system of the entrance-exit type as described for governing train move-

ments through a track layout providing a plurality of routes between an entrance point and a plurality of exit points; manually operable contact means of the self-restoring type for each of the entrance and exit points; a detector track section associated with said entrance point; route establishing means initially rendered effective in response to the momentary actuation of said contact means for any given exit point alone for setting up a route between said entrance point and said given exit point, said route establishing means remaining effective dependent upon the unoccupied condition of said detector track section; means restoring said route establishing means to normal when such detector track section becomes occupied; and means responsive to the momentary actuation of said contact means for said entrance point for restoring said route establishing means to normal for any of the routes emanating from that entrance point.

15. In a switch and signal control system, a track layout having at least one track switch for providing at least two routes between an entrance point and two exit points, an entering signal at said entrance point, a detector track section associated with said track switch, manually operable control buttons associated with said entrance and exit points, route establishing means initially rendered effective in response to the operation of said control button for said entrance point and the control button for any given exit point for setting up the route between such entrance and exit point and for clearing said entering signal, said route establishing means remaining effective until said detector track section becomes occupied at which time it is restored to normal, and means controlled by said detector track section upon the leaving of a train from either one of said two routes for causing said route establishing means to be effective to set up the other of said two routes the same as if said control buttons had been actuated, whereby the passage of trains over said detector track section effects the setting up of said two routes alternately.

16. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a switch machine for each of said track switches, a train describer system including a plurality of storage banks of relays each storage bank by the condition of energization of its relays describing a train destination for a particular exit point and including means for transferring a train description from a higher order storage bank to a lower order storage bank upon cancellation of the description from the lower order storage bank, a detector track circuit including a track relay for each track switch, signal means for governing traffic over the track switch at the entrance end, means responsive to the actuation of one entrance button and one exit button to cause operation of said entrance switch machine in accordance with the particular entrance button operated and to set up a train description in said train describer in accordance with the exit button operated and to cause clearing of said signal means and upon dropping of the track relay for such entrance switch due to occupancy of its track circuit causing operation of said switch machine at the exit end to

a position dependent on the train description stored in the lowest order bank of said train describer provided all preceding trains have vacated said single track section, and means responsive to dropping of the track relay for the track switch at the exit end of said single track section to cancel the train description from the lowest order bank in said train describer.

17. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a switch machine for each of said track switches, a train describer system including a plurality of storage banks of relays each storage bank by the condition of energization of its relays describing a train destination for a particular exit point and including means for transferring a train description from a higher order storage bank to a lower order storage bank upon cancellation of the description from the lower order storage bank, a detector track circuit including a track relay for each track switch, signal means for governing traffic over the track switch at the entrance end, means responsive only to the operation of one entrance button and one exit button to store a train description in one of said storage banks in accordance with the exit button operated, means responsive to the storing of a new description in said train describer to cause operation of the switch machine for the track switch at the entrance end of said single track section in accordance with the entrance button operated and to cause clearing of said signal means, and means responsive to the occupancy of the detector track circuit associated with the track switch at the entrance end of said single track section to cause operation of the switch machine at the exit of said single track section in accordance with said train description only when all preceding trains have vacated both said single track section and the detector track circuit associated with the track switch at the exit end of said single track section.

18. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, a detector track circuit for each track switch, an entrance button for each entrance point and an exit button for each exit point, a signal for each entrance point and a signal at the exit end of the single track section, a train describer comprising a push button storage bank and a plurality of storage relay banks for storing a plurality of train descriptions in the order in which they are received and for maintaining these descriptions in that order and for allowing automatic cancellation of said descriptions only in that order, means for power operating the track switch at the exit end of said single track section to a position in accordance with the first described uncanceled train description stored in the storage banks of said train describer end for clearing the signal at the exit end of said single track section provided the detector track circuit associated with said track switch at the exit end of said single track section is not then occupied, means responsive only to the joint operation of an entrance button and an exit button to first register a train descrip-

tion in said push button bank in accordance with the particular exit button operated and when a complete description has been stored in said push button bank to operate the track switch at the entrance end of said single track section in accordance with particular entrance button operated and to clear the signal corresponding to that entrance button if the detector track circuit associated with that track switch is not occupied, and means responsive to entrance of a train upon that detector track circuit to transfer the train description stored in said push button storage bank to the first vacant storage relay bank of said train describer.

19. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a train describer for storing a plurality of train descriptions in the order in which they are received and for maintaining these descriptions in that order and for allowing automatic cancellation of said descriptions only in that order, means for power operating the track switch at the exit end of said single track section to a position in accordance with the first described uncanceled train description stored in said train describer if the track circuit associated with this track switch at the exit end of said single track section is not then occupied, and means responsive only to operation of an entrance button and an exit button to power operate the track switch at said entrance end in accordance with the particular entrance button operated and to register a train description in said train describer in accordance with the particular exit button operated.

20. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a train describer for storing a plurality of train descriptions in the order in which they are received and for maintaining these descriptions in that order and for allowing automatic cancellation of said descriptions only in that order, means for power operating the track switch at the exit end of said single track section to a position in accordance with the first described uncanceled train description stored in said train describer if the track circuit associated with this track switch at the exit end of said single track section is not then occupied, and means responsive only to operation of an entrance button and an exit button to first register a train description in said train describer in accordance with the particular exit button operated and when a complete description has been stored therein to power operate the track switch at said entrance end in accordance with the particular entrance button operated.

21. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a signal for each entrance point, a train describer for storing a plurality of train descriptions in the order in which they are received and for maintaining these descriptions in that order

and for allowing automatic cancellation of said descriptions only in that order, means for power operating the track switch at the exit end of said single track section to a position in accordance with the first described uncanceled train description stored in said train describer if the track circuit associated with this track switch at the exit end of said single track section is not then occupied, and means responsive only to operation of an entrance button and an exit button to first register a train description in said train describer in accordance with the particular exit button operated and when a complete description has been stored therein to power operate the track switch at said entrance end in accordance with the particular entrance button operated and to clear the signal corresponding to the entrance button operated.

22. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a train describer for storing a plurality of train descriptions in the order in which they are received and for maintaining these descriptions in that order and for allowing automatic cancellation of said descriptions only in that order, means for power operating the track switch at the exit end of said single track section to a position in accordance with the first described uncanceled train description stored in said train describer if the track circuit associated with this track switch at the exit end of said single track section is not then occupied, an entrance relay for each entrance button, means responsive only to joint operation of an entrance button and an exit button to register a train description in said train describer in accordance with the exit button operated, and means controlled by said train describer and by said entrance button to power operate the track switch at said entrance end in accordance with the particular entrance relay operated.

23. In an interlocking system, a track layout having a plurality of routes between an entrance point and a plurality of exit points with signals for governing traffic over such routes, train description apparatus for storing the description of one or more train destinations at one time, manually operable devices one for each destination for setting up train destinations in said train description apparatus, an entrance relay for said entrance point, an exit relay for each of said exit points, circuit means controlled by said train description apparatus for energizing said entrance relay and that particular exit relay of the route required for the train having its description stored in said storing apparatus, and route establishing means responsive to the operation of said entrance relay and any given exit relay for setting up the corresponding route and clearing a signal governing traffic thereover, said means preventing the setting up of any other of said routes.

24. In an interlocking system of the character described in which train movements through a track layout, providing a plurality of conflicting routes between an entrance point and a plurality of exit points, are governed in accordance with descriptions received of destinations for approaching trains, code responsive means for receiving said descriptions of destinations of approaching trains, circuit means for storing such

descriptions of destinations for trains approaching said entrance point, an entrance relay for the entrance point, an exit relay for each of the exit points, circuit means for energizing the entrance relay and one of the exit relays when a description of an approaching train is stored by said storing means, that exit relay being selected in accordance with the described destination for that first approaching train, and route establishing means responsive to the picking up of said entrance relay and said selected exit relay for setting up a route between those entrance and exit points.

25. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a switch machine for each of said track switches, a train describer system including a plurality of storage banks of relays each storage bank by the condition of energization of its relays describing a train destination for a particular exit point and including means for transferring a train description from a higher order storage bank to a lower order storage bank upon cancellation of the description from the lower order storage bank, a code type communication system for transmitting train descriptions to said train describer system, a detector track circuit including a track relay for each track switch, signal means for governing traffic over the track switch at the entrance end, means responsive to the actuation of one entrance button and one exit button to cause operation of said entrance switch machine in accordance with the particular entrance button operated and to set up a train description in said train describer in accordance with the exit button operated and to cause clearing of said signal means and upon dropping of the track relay for such entrance switch due to occupancy of its track circuit causing operation of said switch machine at the exit end to a position dependent on the train description stored in the lowest order bank of said train describer provided all preceding trains have vacated said single track section, and means responsive to dropping of the track relay for the track switch at the exit end of said single track section to cancel the train description from the lowest order bank in said train describer.

26. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points, an entrance button for each entrance point and an exit button for each exit point, a signal for each entrance point, a train describer for storing a plurality of train descriptions in the order in which they are received and for maintaining these descriptions in that order and for allowing automatic cancellation of said descriptions only in that order, a communication system of the code type for transmitting train descriptions to said train describer, means for power operating the track switch at the exit end of said single track section to a position in accordance with the first described uncanceled train description stored in said train describer if the track circuit associated with this track switch at the exit end of said single track section is not then occupied, and means responsive only to operation of an entrance button and an exit button to first transmit a train de-

scription through the medium of said communication system in accordance with the particular exit button operated and when a complete description has been transmitted by said communication system to power operate the track switch at said entrance end in accordance with the particular entrance button operated and to clear the signal corresponding to the entrance button operated.

27. In an interlocking system of the entrance-exit type provided for governing train movements through a track layout providing a plurality of routes between an entrance point and a plurality of exit points and which establishes no route under normal conditions; manually operable contact means for the entrance point and for each of the exit points; route establishing means responsive either to the actuation of said contact means for said entrance point and an exit point or to the actuation of said contact means for the exit point alone, for setting up a route between the entrance point and that designated exit point for governing traffic in a direction from said entrance point toward said designated exit point if no conflicting route is set up; and means responsive to the actuation of said contact means for the entrance point to a particular position for restoring to normal the route establishing means for any route emanating from that entrance point irrespective of whether such route was set up by the actuation of contact means at both said entrance point and said exit point or by actuation of the contact means at said exit point only.

28. In an interlocking system of the entrance-exit type; the combination with a track layout having a plurality of entrance points and a plurality of exit points; manually operable contact means for each of said entrance points and for each of said exit points; route storing means initiated in response to successive operation of pairs of contact means to store descriptions of one or more conflicting routes in the same order as said pairs of contact means are operated, where the first contact means operated of each pair constitutes the contact means for the entrance end and the second contact means of each pair operated constitutes the contact means for the exit end of a route through said track layout; route establishing means controlled by said route storing means to set up any particular route in accordance with its stored description; and means for interlocking said route establishing means to allow a route to be set up only after the preceding description of a route has been cancelled, said route establishing means functioning to set up routes one at a time and in succession in the same order in which said pairs of contact means were operated even though the second pair of contact means is operated before an occupied route set up by the operation of the first pair of contact means is vacated.

29. In an interlocking system of the entrance-exit type; the combination with a track layout having a plurality of entrance points and a plurality of exit points; a signal for each entrance

point to govern traffic into a route emanating from such point; manually operable contact means for each of said entrance points and for each of said exit points; route storing means controlled to store route descriptions in the order in which pairs of said contact means are operated, each pair of contact means defining the ends of a route; and route establishing means controlled by said route storing means to set up routes, and clear the signal for each route only after the preceding route has been vacated and its description cancelled and the new route has been set up, in succession in the same order in which said pairs of contact means were operated, even though the third pair of contact means is operated before an occupied route set up in response to the operation of the first pair of contact means is vacated or the route set up in response to the operation of the second pair of contact means is vacated.

30. In an interlocking system of the entrance-exit type; the combination of an actual track layout having a plurality of entrance points and a plurality of exit points constituting the ends of conflicting routes; a signal at the entrance to each route on the actual track layout to govern traffic into such route; a miniature track layout having a plurality of entrance points and a plurality of exit points and conforming to said actual track layout; manually operable contact means at each entrance point and at each exit point of said miniature track layout; route storing means to store route descriptions in the same order in which pairs of contact means, defining the ends of the routes defined by such route descriptions, are operated; and route establishing means controlled by said route storing means to establish routes in the same order as corresponding route descriptions are stored only after the preceding route has been vacated and its description cancelled even though the second pair of contact means is operated before the route on the actual track layout set up by the operation of the first pair of contact means is vacated.

31. An interlocking system comprising a single track section connecting two track switches to provide a plurality of routes in one direction from a plurality of entrance points to a plurality of exit points; an entrance button for each entrance point and an exit button for each exit point; route storing means for storing route descriptions in the order in which pairs of buttons, each pair comprising the entrance button and the exit button for a particular route, are operated; and route establishing means controlled by said route storing means to set up a new route upon the vacating of the preceding route, and cancellation of its description, in accordance with the next route description stored in said storing means, to set up such routes in succession in the same order in which said pairs of buttons were operated even though the second pair of buttons is operated before an occupied route set up by the operation of the first pair of buttons is vacated.

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