

Dec. 26, 1939.

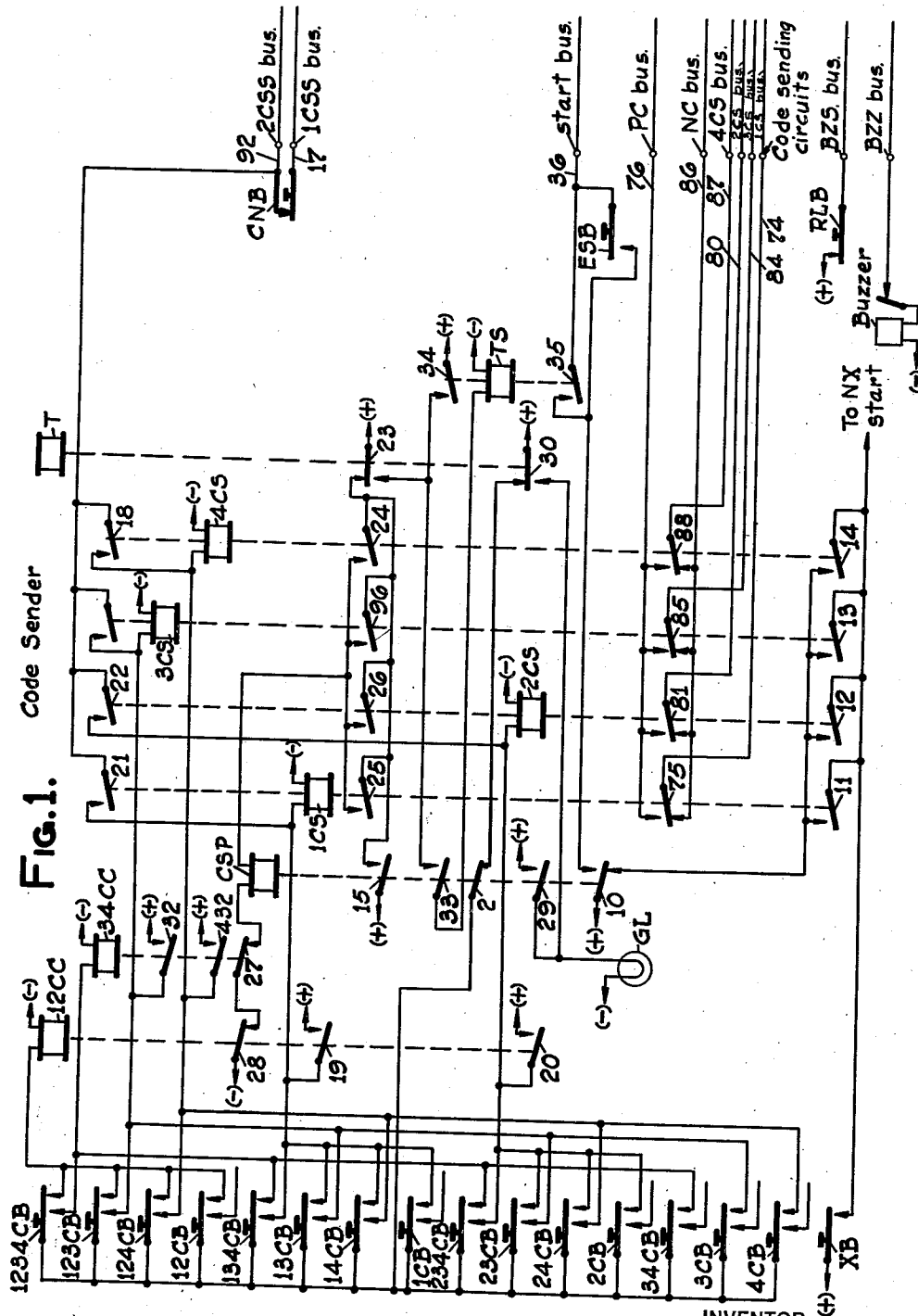
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2,184,702

TRAIN DESCRIBER SYSTEM

Filed Nov. 19, 1936

7 Sheets-Sheet 1



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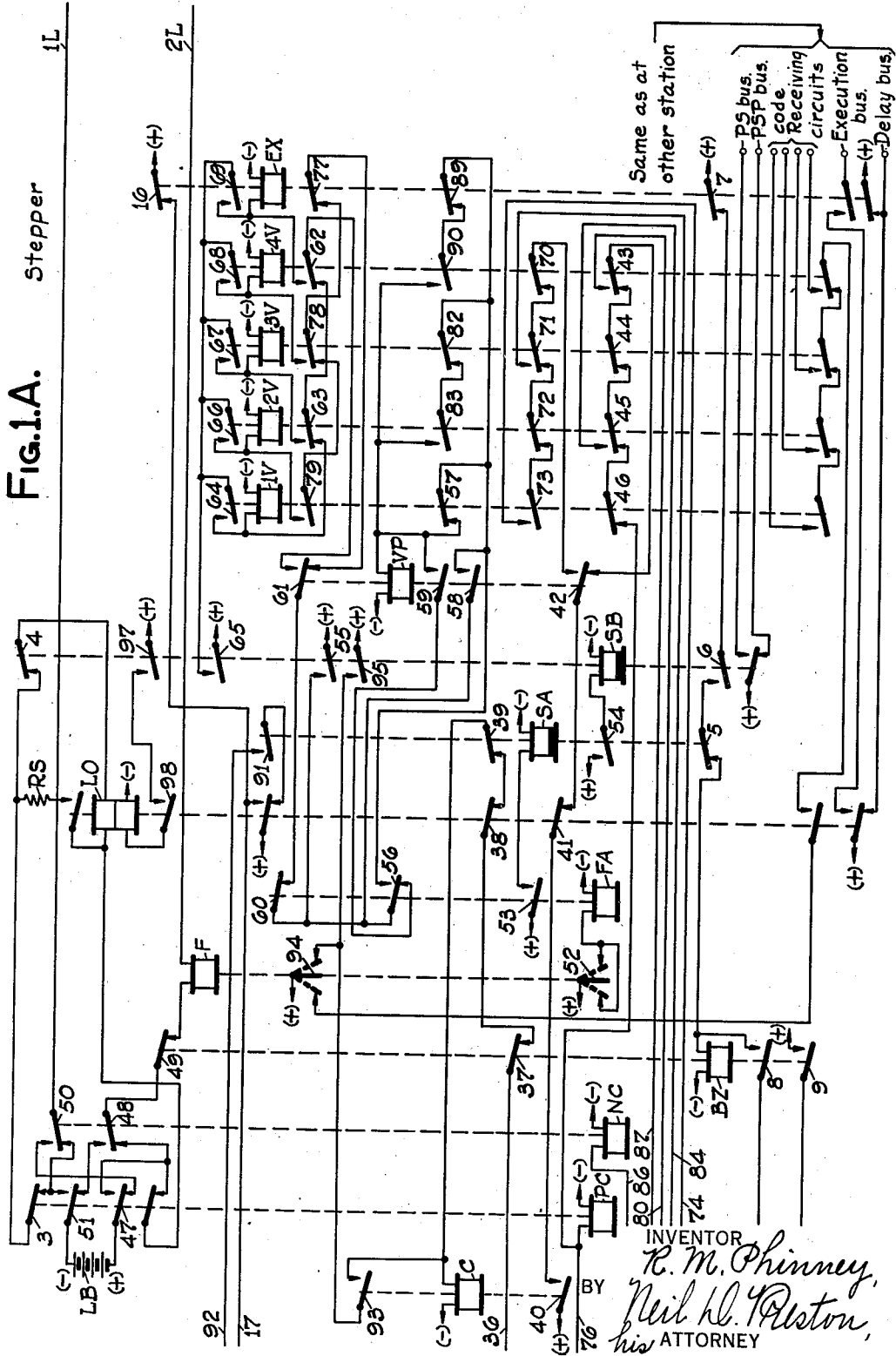
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TRAIN DESCRIBER SYSTEM

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7 Sheets-Sheet 2



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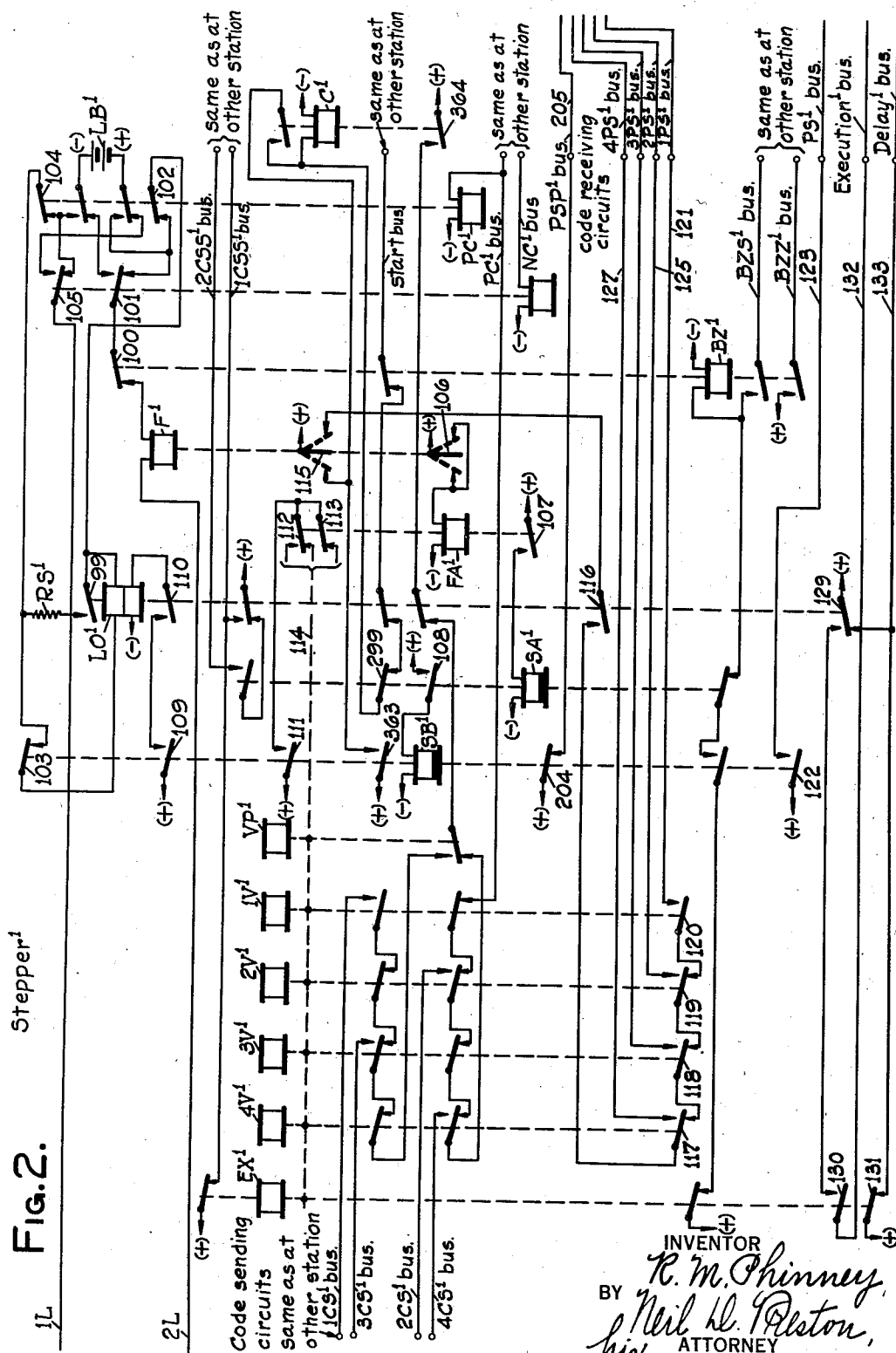
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TRAIN DESCRIBER SYSTEM

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7 Sheets-Sheet 3



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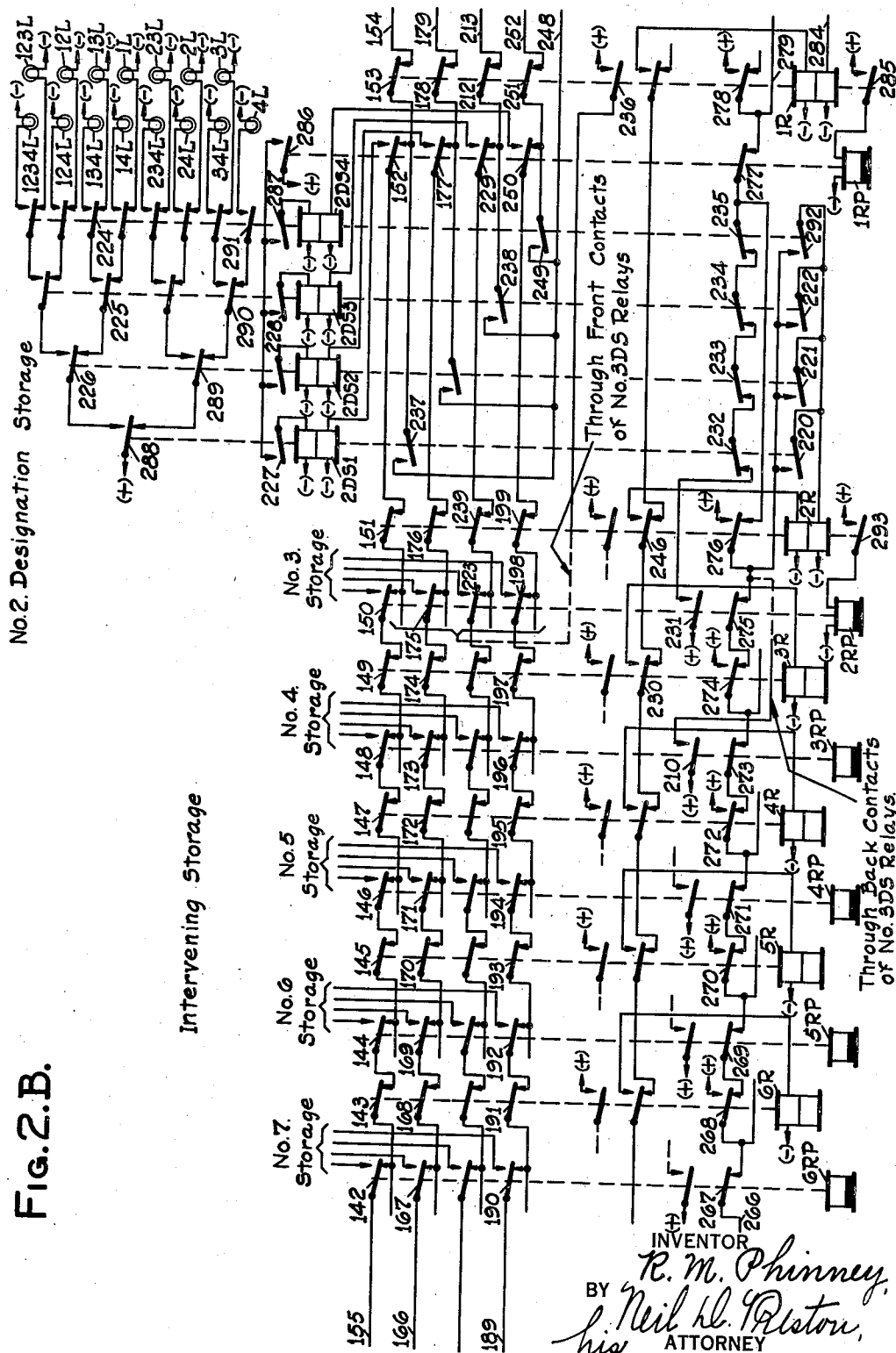
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TRAIN DESCRIBER SYSTEM

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7 Sheets-Sheet 5



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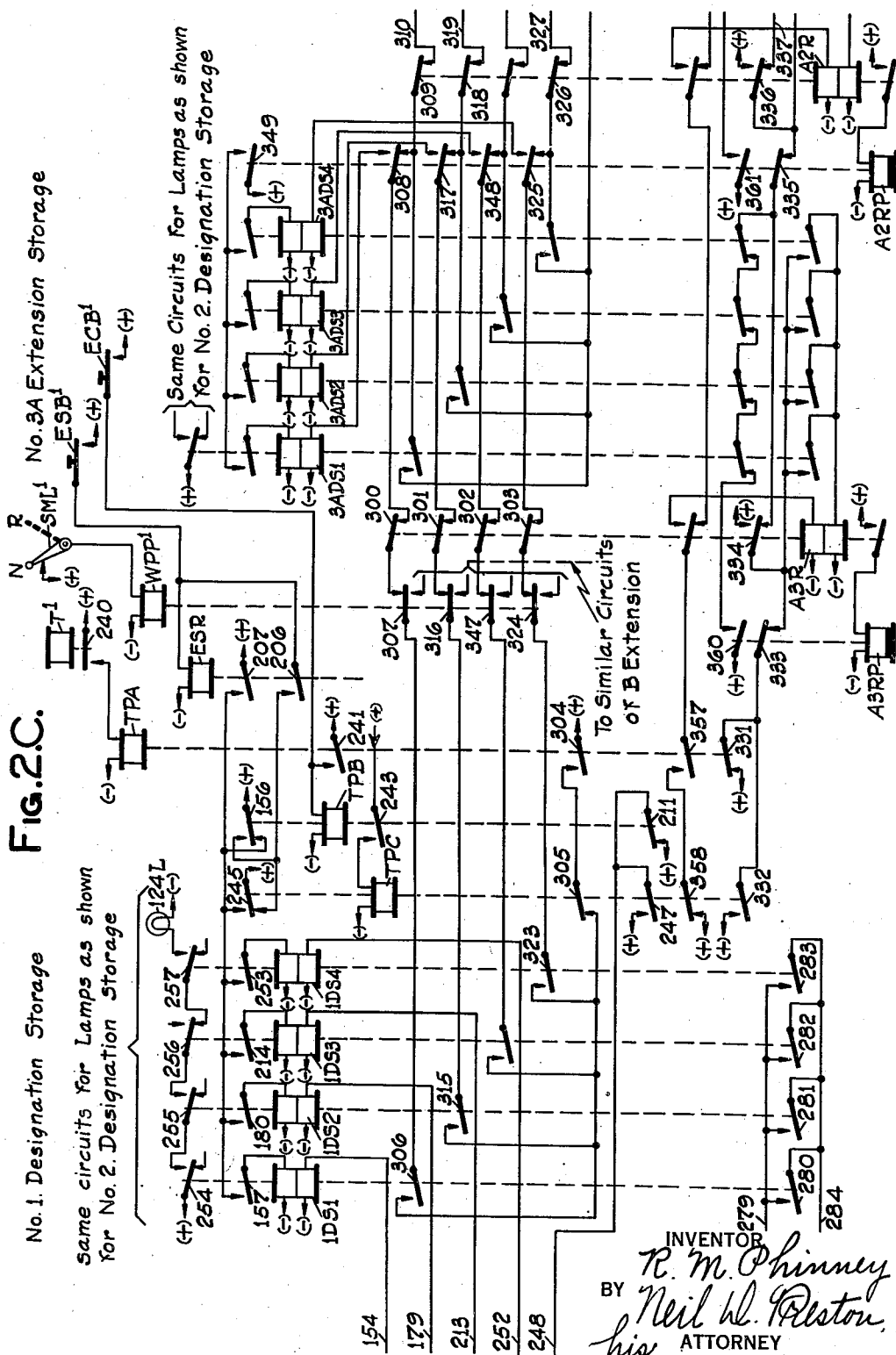
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TRAIN DESCRIBER SYSTEM

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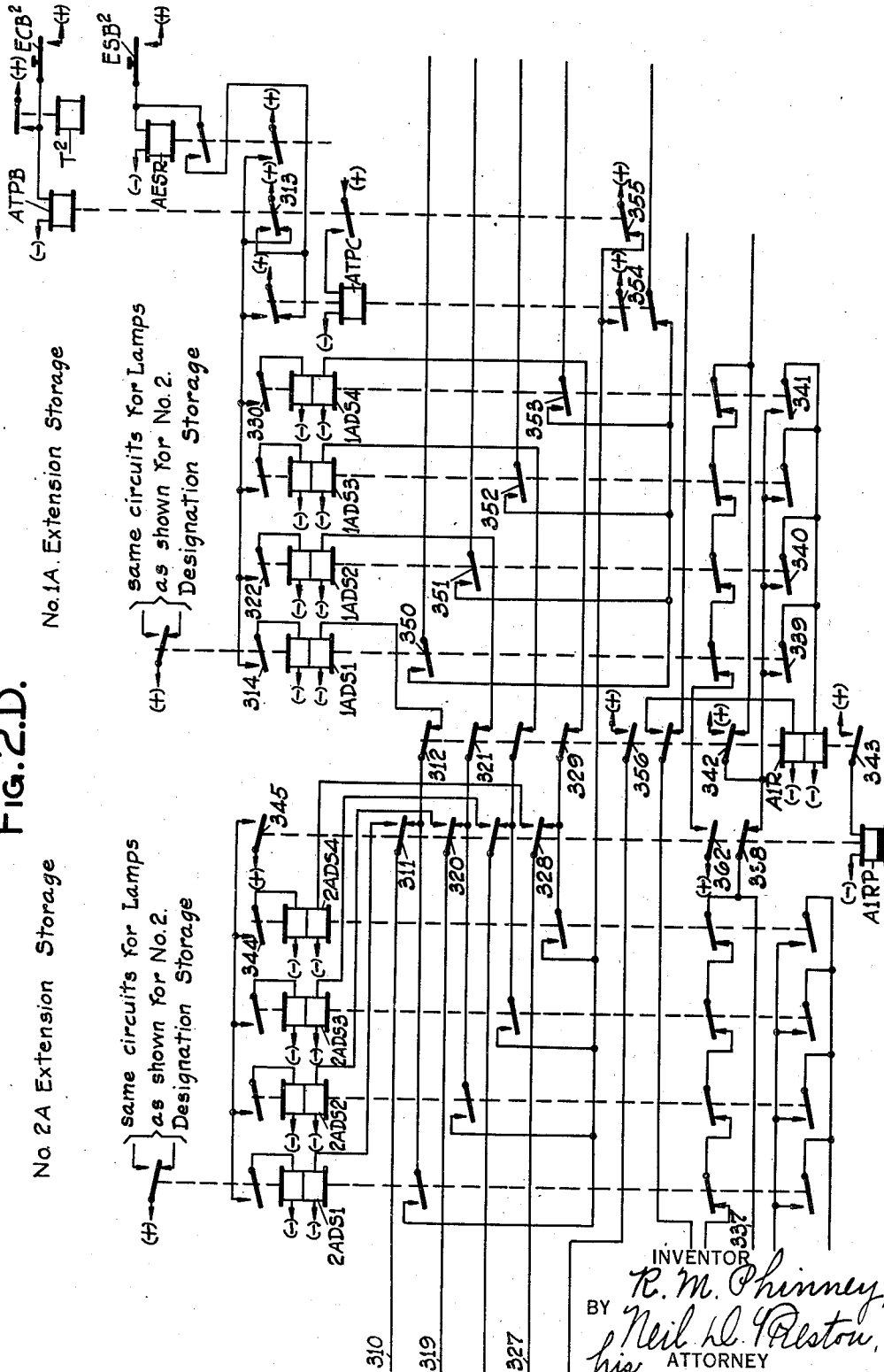
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TRAIN DESCRIBER SYSTEM

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FIG. 2.D.



UNITED STATES PATENT OFFICE

2,184,702

TRAIN DESCRIBER SYSTEM

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Application November 19, 1936, Serial No. 111,671

17 Claims. (Cl. 246—2)

This invention relates to apparatus and circuits for so called train describer systems, in which distinctive indications of the destination or other identification of approaching trains are displayed at a tower or other location for the information of an operator, or for other purposes.

The present disclosure shows the invention applied to a train describer system of the so called entrance-exit, or NX route, type interlocking system, such as disclosed in the prior application of S. N. Wight, Ser. No. 69,905, filed March 20, 1936.

The organization of an entrance-exit type system to which the train describer features of the present invention is applied, contemplates a miniature track diagram associated with an interlocking plant, which track diagram corresponds to the actual track layout in the field. The track diagram has initiating or entrance buttons at each of the route determining points and completion or exit buttons for each of the points to which traffic may go. In other words, for each signal location there is an entrance button, which button requires the cooperation of an exit button for the end of a proposed route in order to establish movement of traffic in a particular direction over a particular route.

In accordance with the present invention a plurality of auxiliary train describer buttons are associated with certain of the exit buttons which, when actuated, complete the setting up of the route in the same way as the regular exit button and in addition condition circuits for transmitting indications relating to the classes of trains traversing the route.

An important feature of the present invention relates to the cooperation of the circuits controlled by the auxiliary train describer exit buttons in such a way that a single manual operation for the completion of a particular route is effective to not only complete the desired route but also to transmit indications relating to the destination or identification of trains traversing the route.

For convenience in illustrating and describing the operation of the system of the present invention it will be assumed that the NX interlocking system is applied to an interlocking plant at each end of a large bridge, over which a large number of trains are routed in both directions. It will also be assumed that train identification or designations are transmitted both ways over a single line circuit for identifying at each end of the bridge a comparatively large number of approaching trains.

It is assumed that the NX interlocking system

disclosed in the above mentioned Wight application Ser. No. 69,905, is used at the plants at each end of the bridge and, in accordance with the present invention, a regular completion button is provided for completing traffic over the bridge when certain trains are not to be identified, this regular button being used for train moves that either do not cross the bridge or are not to be announced at the other side. The auxiliary completion buttons are provided to designate or classify each of a comparatively large number of trains when the last route before entering the bridge is completed, these auxiliary buttons furthermore serving to complete the NX route in the same manner as if the regular NX button were operated.

The present invention is applied to a simplex type system, with train identifications being transmitted both ways over a single line circuit between the plants at each end of the bridge, but transmission being effective only one way during a single cycle of operations of the system.

The communicating apparatus which controls the transmission is started as soon as the entering block located at the entrance to the bridge is occupied, providing that there is a code set up by the auxiliary exit buttons. If a message is being transmitted in the opposite direction at this time the transmission of the message above mentioned will be delayed until the next cycle. The messages are received at the leaving block of the bridge and stored on storage relays, there being a separate group of storage relays for each train to be indicated.

For convenience in describing the operation of the present invention it will be assumed that indications for 10 trains are to be stored in the order in which they enter the bridge and that the classes or designations of the first three trains are indicated by lighting a separate or individual lamp corresponding to the class of each train, as stored in each group of storage relays. It is also proposed to light a single lamp for each of the other seven trains which may be simultaneously traversing the route between the two ends of the bridge, by lighting a single lamp for each train irrespective of its class instead of a particular lamp to characterize the class of the train. In other words, the indication for the first three approaching trains will be selected and displayed to identify these three trains, while the indications for the seven remaining trains will show up as one light per train to indicate that there is a train of some kind approaching.

When the train represented by the first indica-

tion arrives at the leaving end of the bridge and enters a particular block, the indication for the first train is extinguished and the indications for the following trains are transferred in the storage relay groups, so that at all times the lamp indicators will show in detail the classification for the first three trains to arrive at the leaving end of the bridge and as many more indications as there are trains arriving.

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

In describing the invention in detail reference will be made to the accompanying drawings, in which like reference characters designate the same or similar parts in the several views and in which like letters designate similar functions, with the preceding numerals associated with these reference characters representing the inclusion of such devices within a particular group. Exponent¹ has been applied to those devices located at the distant or receiving end of the bridge, it being assumed for purposes of description that transmission takes place from one end, conveniently referred to as the entering end, to the other end, conveniently referred to as the leaving end of the bridge.

Figs. 1, 1A, 2, 2A, 2B, 2C and 2D should be placed end to end, in the order named, with corresponding lines in alinement for conveniently following the operation of the system. It will be assumed that the transmitting end is at the location illustrated in Figs. 1 and 1A and that this location is connected by line wires 1L and 2L to the receiving apparatus at the distant location illustrated in Figs. 2, 2A, 2B, 2C and 2D.

It will be understood that receiving apparatus similar to that illustrated at the receiving station, will be provided at the sending station and connected to the buses illustrated in the lower right hand portion of Fig. 1A, this receiving apparatus being responsive to codes transmitted from the distant end in exactly the same manner as will be described in connection with the receiving apparatus illustrated in Figs. 2 to 2D inclusive. Therefore, the receiving apparatus at the entering end has been omitted for the sake of simplifying the drawings. Likewise, the same transmitting apparatus and circuits illustrated in Figs. 1 and 1A are assumed to be provided at the distant location and connected to the buses illustrated in Fig. 2 so indicated.

Apparatus at sending location.—At the sending location, assumed to be that illustrated in Figs. 1 and 1A, the regular completion or exit button XB is illustrated, which button corresponds to any one of the exit buttons illustrated in the above mentioned Wight application Ser. No. 69,905, and being effective to start the NX completion operation in exactly the same manner as described in this prior application.

Associated with button XB are 15 auxiliary buttons indicated by reference letters CB preceded by a numeral or numerals, which indicates the code which the associated button causes to be transmitted over the line circuit. For example, the top button indicated 1234CB means that the actuation of this button causes a coded impulse to be applied to the line circuit at all four of the steps of the operating cycle, which cycle is effected in response to the operation of any of the auxiliary buttons. The operation of the lowermost auxiliary button 4CB causes a coded impulse to be applied at step 4 of such a cycle.

Other buttons cause corresponding coded impulses to be applied at the steps indicated by the preceding numerals.

Relays 12CC and 34CC are code combination relays operated in response to the actuation of the buttons to which they are connected, relay 12CC when picked up effecting the energization of code storage relays 1CS and 2CS and relay 34CC when picked up effecting the energization of code storage relays 3CS and 4CS. These code storage relays, 1CS and 4CS inclusive, are also energized by the actuation of certain of the push buttons.

Relay T is the track relay associated with the entering block at the entering end of the bridge and relay TS is a track stick relay controlled by track relay T under certain conditions, as will be pointed out in detail. Code storage repeating relay CSP repeats the operation of any of the code storing relays, but is not energized until both of the code combination relays are de-energized in response to the release or restoration of any code button which has been actuated.

A guard lamp or "hands off" lamp GL is lighted to indicate that it is useless to attempt to set up a designation on the code buttons. An attempt to set up a combination on these code buttons when lamp GL is lighted is ineffective. Emergency start button ESB is provided for starting the system into operation when there is no train present. Such an emergency start may be conveniently used for test purposes and the like. Cancellation button CNB is for the purpose of cancelling a designation set up on the storage relays to correct an error in setting up a train identification. The buzzer illustrated in the lower right hand portion of Fig. 1 and buzzer relay BZ illustrated in Fig. 1A, are for the purpose of calling the operator's attention to an incomplete cycle, which may be due to some standard condition. Relay BZ will be picked up if an incomplete cycle occurs and the buzzer will be sounded to call the operator's attention to this fact.

Referring to Fig. 1A, relay C is a cycle controlling relay and is picked up at the sending end for controlling the code selecting circuits. Relays PC and NC are positive and negative code sending relays respectively for applying positive or negative impulses to the line circuit, as determined by the code to be transmitted at each step of a cycle. Relay F is a polar, biased to neutral line relay and is for the purpose of repeating the polarity of the impulses applied to the line circuit. Relay FA repeats the operations of relay F and is for the purpose of controlling the stepping relay bank. Relays SA and SB are of the slow releasing type and are for the purpose of defining the bounds of an operating cycle, these relays being picked up in sequence at the beginning of a cycle and dropped out in sequence at the end of the cycle.

A stepping relay bank is provided comprising half-step relay VP and stepping relays 1V, 2V, 3V and 4V. These stepping relays step through a cycle in response to a series of impulses applied to the line circuit and select local channel circuits at each step. Executing relay EX is picked up in response to the last impulse applied to the line and is for the purpose of executing the conditions set up on the decoding relays at the receiving end, by selectively operating the train designation storage relays in accordance with the code decoded by the decoding relays. Relay EX

performs other detailed functions which will be pointed out in the detailed description.

Lockout relay LO is for the purpose of determining the location from which transmission takes place, this relay being picked up at the receiving location and remaining down at the sending location. The picking up of the lockout relay at the receiving location disables the code sending circuits and renders the executing bus for the code receiving circuits effective. Resistance RS is inserted in the line in place of the upper winding of relay LO for the purpose of maintaining the line circuit resistance uniform after the upper winding of relay LO has been disconnected from the line.

Apparatus at receiving location.—The apparatus at the receiving location comprises a bank of stepping relays including half-step relay VP¹ and stepping relays IV¹, 2V¹, 3V¹ and 4V¹, which bank of stepping relays operate in synchronism with the stepping relays at the sending end. In other words, during sending or receiving operations the stepping relays at both locations operate through the cycle in synchronism. Executing relay EX¹ corresponds to relay EX of Fig. 1A. Lockout relay LO¹ corresponds to lockout relay LO illustrated in Fig. 1A.

Line relay F¹ and repeater relays FA¹, SA¹ and SB¹ correspond to relays F, FA, SA and SB of Fig. 1A. Code sending relays PC¹ and NC¹ correspond to relays PC and NC of Fig. 1A. Cycle determining relay C¹ corresponds to relay C of Fig. 1A. Buzzer relay BZ¹ corresponds to relay BZ of Fig. 1A.

Referring to Fig. 2A, the code receiving or decoding relays comprise relays 1PS¹, 2PS¹, 3PS¹ and 4PS¹, which relays are picked up or not at the four steps of a cycle as determined by whether or not the impulse at each step is a (+) impulse. Repeating relay PSP¹ associated with the code receiver group is for the purpose of disconnecting the pickup circuits of the decoding relays under certain conditions, as will be later pointed out.

Referring to Figs. 2A, 2B and 2C, ten banks of train designation storage relays are provided, each bank comprising four relays which are picked up in accordance with the particular decoding relays picked up when the transfer is made from the decoding relays to the designation storage relays. This transfer is effected by means of the exciting circuit when the communicating apparatus has completed its four steps and the message has been stored in the decoding relays. The four relays for the train designation storage groups No. 10, No. 2 and No. 1 have been shown, while the four conductors leading to these relays for the other seven groups have only been indicated and the relays for these other seven groups omitted.

The groups of train designation storage relays have an associated transfer relay 1R to 10R inclusive and each of these transfer relays controls an associated repeater relay 1RP to 10RP inclusive, the purpose of these latter relays being to delay the dropping out of the train designation storing relays while delivering the message from the associated to the next group and to prevent the picking up of the transfer relay while a new message is being received.

The 15 train designation lamps for the No. 2 group are shown connected to the pyramid circuits controlled by the four relays of this group and it will be understood that the train designation storage relays of groups 1 and 3 also control similar groups of indicator lamps by means

of similar circuits, which circuits are not shown for the sake of simplicity in the drawing. It will also be understood that, in the event that it is desired to indicate the class of more than three approaching trains, then additional groups of indicator lamps may be connected to additional train designation storage relays as required.

A lamp indicated "train No. 10" is shown controlled by the train designation storage relays of group No. 10, which lamp when lighted indicates that a tenth train is approaching, it not being required to indicate the class of this train. It will be understood that similar lamps are controlled by the No. 9, the No. 8, the No. 7, the No. 6, the No. 5 and the No. 4 train designation storage relay groups, for indicating the number of trains approaching, in addition to those which are identified by the train identification lamps associated with the first three groups.

Track relay T¹ (see Fig. 2C) is associated with the leaving block and, by means of its repeater relays TPA, TPB and TPC, the clearing out and transfer operations of the train designations stored are effected.

Relay WPP¹ is illustrated as controlled by switch machine lever SML¹, this relay controlling extension circuits to an extension receiver illustrated in the right hand portion of Fig. 2C and in Fig. 2D. With relay WPP¹ in its normal position, as indicated, the first three indications on the train designation storage relays are transferred to another arrival point and registered on train designation storage extension relay groups 3A, 2A and 1A. These extension relay groups comprise train designation storage relays similar to those previously referred to and comprise transfer relays A1R, A2R, A3R and their associated repeater relays A1RP, A2RP and A3RP, which function in a manner similar to corresponding relays associated with the groups of train designation storage relays. It will be understood, as indicated by the note associated with the back contacts of relay WPP¹, that the circuits connected to these contacts may lead to B extension storage groups for transferring train identities to a second arrival point when relay WPP¹ is deenergized by lever SML¹ in its reverse position.

Relay T² of Fig. 2D is associated with the block at the extension arrival point, this track relay controlling repeater relays ATPB and ATPC for purposes which will be later described. Emergency suppression buttons ESB¹ and ESB² and emergency clearing buttons ECB¹ and ECB² are associated with the clearing sections illustrated in Figs. 2C and 2D and are for the purpose of bringing the system into step with the trains, in the event of the systems getting out of step. These buttons are also provided for test and maintenance purposes.

Although the present disclosure and the description relates only to the transmission from the entering block to the leaving block, it will be understood that the circuits and apparatus, including the transmitting and receiving equipment at both ends, are substantially the same so that train designations may be transmitted either way over the line. The direction of transmission is determined by the conditions of the C and LO relays, the LO relays effecting the locking out of the apparatus in the event that an attempt is made to transmit both ways at the same time, this lockout feature being described later.

It is believed that the characteristic features

of the present invention will be best understood by further description being given from the standpoint of operation.

OPERATION

Setting up a route.—Since the train identification feature of the present invention is applied to the exit end of a route, for example, a route completed by the operation of button XB of Fig. 1 or the operation of some one of the 15 auxiliary completion buttons, and since the completion of the setting up of a route in the so called NX type system is fully illustrated in the above mentioned prior application Ser No. 69,905, it is believed unnecessary to point out the operations relating to the completion of such a route, except to mention that the closure of the contact by the operation of button XB applies (+) energy to the NX start wire, which is effective to complete the setting up of the desired route. Of course the operation of button XB completes the setting up of the route without the transmission of any sort of train identification.

When the route is completed by operating some one of the 15 auxiliary buttons, then one or more of the code storage relays 1CS to 4CS inclusive will be picked up and (+) energy is applied to the NX start wire over a circuit extending through back contact 10 of relay CSP and some one of front contacts 11, 12, 13 or 14 of relays 1CS to 4CS inclusive, to the NX start conductor. Since it only requires a momentary energization of the NX start conductor, this circuit is opened when relay CSP is picked up following the picking up of one or more of the code storage relays, as will be later described.

Registration of train identities.—Considering the function of registering train identity by the operation of one of the auxiliary completion buttons illustrated in the left hand portion of Fig. 1, it is contemplated that each of 15 trains will have a particular code designation. These code designations may be of any form desired such as letters or numerals, but for convenience in describing the operation of the system, the 15 auxiliary buttons are given reference numerals preceding the reference characters CB, which refer to the code transmitted. For example, the top button is designated 1234CB, which indicates that a code impulse is transmitted at each of the four steps of an operating cycle for picking up four decoding relays at the receiving end. The third button from the top is designated 124CB, which indicates that a coded impulse is transmitted to the receiving end for picking up decoding relays 1, 2 and 4 at the first, second and fourth steps of the operating cycle. For convenience in describing the operation of the system, it will be assumed that button 124CB is actuated to complete the setting up of a route through the interlocking plant.

The operation of button 124CB closes a circuit for picking up relay 12CC which extends from (+), front contact 30 of relay T, back contact 2 of relay CSP, right hand contact of button 124CB and winding of relay 12CC, to (—). Another circuit extends through the left hand contact of button 124CB and the winding of relay 4CS for picking up this relay. Relay 4CS closes a stick circuit for itself which extends from (+), back contact 16 of relay EX (Fig. 1A), conductor 17, normally closed contact of button CNB, front contact 18 and winding of relay 4CS, to (—).

The picking up of relay 12CC closes obvious circuits for picking up relays 1CS and 2CS at

front contacts 19 and 20. Relays 1CS and 2CS close stick circuits for themselves at their front contacts 21 and 22 to (+), over the previously described circuit including back contact 16 of relay EX.

When button 124 is released, relay 12CC is de-energized and a circuit is closed for picking up relay CSP which extends from (+), front contact 23 of relay T, front contact 24 of relay 4CS (also front contacts 25 and 26 of relays 1CS and 2CS in multiple) winding of relay CSP, back contacts 27 and 28 of relays 34CC and 12CC respectively, to (—). Relay CSP completes a stick circuit for itself at front contact 15, which is independent of front contact 23 of relay T. The opening of back contact 2 of relay CSP removes energy from the auxiliary push buttons, so that an operation of any one of these buttons during the time that the guard lamp GL is lighted will be ineffective. Lamp GL is energized over a circuit closed at front contact 29 of relay CSP and at back contact 30 of relay T, this latter contact lighting lamp GL as long as the entering block is occupied to indicate to the operator that it is useless to actuate a code button.

From the above example it is believed obvious how other combinations of the code storing relays are energized in response to the operation of the different code buttons. Code combination relay 34CC is picked up in the event that either one of buttons 1234CB, 134CB, 234CB or 34CB is actuated and this relay in turn closes circuits at its front contacts 31 and 32 for picking up relays 3CS and 4CS. Relay 12CC is energized when code buttons 1234CB, 123CB, 124CB or 12CB are operated. It will be understood that the purpose of relays 12CC and 34CC is to reduce the number of push button contacts required to set up all of the necessary combinations on the code storage relays.

Cycle of stepper operations.—After the code combination has been stored as above described, it remains stored on the storage relays until the corresponding train enters the entering block, at which time relay T is dropped and relay TS is picked up over a circuit extending from (+), back contact 23 of relay T, front contact 33 of relay CSP and winding of relay TS, to (—). Relay TS closes a stick circuit for itself at its front contact 34 which is independent of back contact 23 of relay T.

Cycle determining relay C is now picked up over a circuit extending from (+), front contact 19 of relay CSP, front contact 35 of relay TS, conductor 36, back contact 37 of relay BZ, back contact 38 of relay LO, back contact 39 of relay SA and winding of relay C, to (—).

It might be well to mention at this time that the system can be started through a cycle of operations by the operation of emergency start button ESB, which completes the above described circuit at the contact of this button instead of front contact 35 of relay TS. Such an emergency start condition is desirable to operate the system when there is no train present for test and emergency purposes.

Relay PC is now picked up over a circuit extending from (+), front contact 40 of relay C, back contact 41 of relay LO, back contacts 42, 43, 44, 45 and 46 of relays VP, 4V, 3V, 2V and 1V respectively and winding of relay PC, to (—).

The picking up of relay PC energizes the line circuit with a positive impulse which will be conveniently referred to as a conditioning impulse, since it conditions the apparatus at both

ends of the line in readiness for response to the succeeding impulses of the cycle. The circuit for energizing the line extends from the (+) terminal of line battery LB, front contact 47 of relay PC, back contact 48 of relay NC, back contact 49 of relay BZ, winding of relay F, line conductor 2L, winding of relay F¹, back contact 100 of relay BZ¹, back contact 101 of relay NC¹, back contact 102 of relay PC¹, upper winding of lockout relay LO¹, back contact 103 of relay SB¹, back contact 104 of relay PC¹, back contact 105 of relay NC¹, line conductor 1L, back contact 50 of relay NC and front contact 51 of relay PC, to the (-) terminal of battery LB.

The positive energization of the line circuit positions line relays F and F¹ to the right and picks up lockout relay LO¹. Relay FA is now picked up over a circuit closed at contact 52 of relay F in its right hand dotted position. It will be pointed out at this time that, during the intermittent operation of relay F during the following cycle, relay FA is intermittently operated by contact 52 in either its right or left hand positions. In other words, relay FA is a direct repeater of relay F. Relay SA is picked up over a circuit closed at front contact 53 of relay FA, relay SB is picked up over a circuit closed at front contact 54 of relay SA and these two relays remain up during the intermittent operations of relay FA during the cycle.

A similar series of operations takes place at the distant location illustrated in Fig. 2, by relay F¹ energizing and deenergizing relay FA¹ at contact 105. Relay SA¹ is energized by the closure of front contact 107 of relay FA¹ and relay SB¹ is energized by the closure of front contact 108 of relay SA¹. The picking up of relay SB¹ closes a stick circuit for relay LO¹ including front contacts 109 and 110 of these two relays. It will be understood that relay FA¹ follows the intermittent operations of relay F¹ during the cycle.

Referring back to Fig. 1A, relay VP is now picked up over a circuit extending from (+), front contact 55 of relay SB, front contact 56 of relay FA, back contact 57 of relay IV and winding of relay VP, to (-). Relay VP closes a first stick circuit for itself at its front contact 58, which is independent of front contact 56 of relay FA. The picking up of relay VP opens the above described circuit for relay PC at back contact 42, so that relay PC drops and deenergizes the line to mark the end of the conditioning period.

In response to the deenergization of the line, relays F, F¹, FA and FA¹ are dropped and a second stick circuit is closed for relay VP extending from (+), front contact 55 of relay SB, back contact 56 of relay FA, front contact 59 and winding of relay VP, to (-).

Relay IV is now picked up over a circuit extending from (+), front contact 55 of relay SB, back contact 60 of relay FA, front contact 61 of relay VP, back contact 62 of relay 4V, back contact 63 of relay 2V and winding of relay IV, to (-). Relay IV closes a stick circuit for itself at its front contact 64 to (+), at front contact 65 of relay SB. It will be pointed out at this time that relays 2V, 3V, 4V and EX, which are operated during additional steps of the cycle, close similar stick circuits for themselves at front contacts 66, 67, 68 and 69.

The picking up of relay IV completes the first code selecting circuit for determining the first code to be transmitted over the line. It will be recalled that relay ICS is picked up, so that this

first code selecting circuit extends from (+), front contact 40 of relay C, back contact 41 of relay LO, front contact 42 of relay VP, back contacts 70, 71 and 72 of relays 4V, 3V and 2V, front contact 73 of relay IV, conductor 74, front contact 75 of relay ICS, conductor 76 and winding of relay PC, to (-). The picking up of relay PC again energizes the line with a positive impulse over the previously described circuit and relays F and F¹ are actuated to the right and relays FA and FA¹ are picked up.

The picking up of relay FA deenergizes relay VP, because its first stick circuit is open at back contact 57 of relay IV and its second stick circuit is opened at back contact 56 of relay FA. The dropping of relay VP opens the above described circuit for relay PC at front contact 42.

Relay PC drops, deenergizes the line and relays F, FA, F¹ and FA¹ are deenergized. Relay 2V is now picked up over a circuit extending from (+), front contact 55 of relay SB, back contact 60 of relay FA, back contact 61 of relay VP, back contact 77 of relay EX, back contact 78 of relay 3V, front contact 79 of relay IV and winding of relay 2V, to (-). The picking up of relay 2V completes the second code selecting circuit and since relay 2CS is picked up, this code selecting circuit effects the picking up of relay PC over a circuit extending from (+), front contact 40 of relay C, back contact 41 of relay LO, back contact 42 of relay VP, back contact 43 of relay 4V, back contact 44 of relay 3V, front contact 45 of relay 2V, conductor 80, front contact 81 of relay 2CS, conductor 76 and winding of relay PC, to (-).

The picking up of relay PC again applies a positive impulse to the line for positioning relays F and F¹ to the right and for picking up relays FA and FA¹. Relay VP is now picked up over a circuit extending from (+), front contact 55 of relay SB, front contact 56 of relay FA, back contact 82 of relay 3V, front contact 83 of relay 2V and winding of relay VP, to (-).

The picking up of relay VP drops relay PC because of open back contact 42 and the dropping of relay PC deenergizes the line, which in turn effects the dropping of relays F, FA, F¹ and FA¹. Relay 3V is now picked up over a circuit extending from (+), front contact 55 of relay SB, back contact 60 of relay FA, front contact 61 of relay VP, back contact 62 of relay 4V, front contact 63 of relay 2V and winding of relay 3V, to (-).

The picking up of relay 3V selects the third code to be applied to the line and since relay 3CS is down, this will be a negative code due to relay NC being picked up over a circuit extending from (+), front contact 40 of relay C, back contact 41 of relay LO, front contact 42 of relay VP, back contact 70 of relay 4V, front contact 71 of relay 3V, conductor 84, back contact 85 of relay 3CS, conductor 86 and winding of relay NC, to (-). With relay NC up and relay PC down, pole changing contacts 48, 50, 47 and 51 are effective to reverse the connection of batteries LB to the line from that previously described in connection with the picking up of relay PC. This negative energization of the line positions the polar contacts of relays F and F¹ to the left and relays FA and FA¹ are picked up.

Relay VP is now dropped because its first stick circuit is open at back contact 82 of relay 3V and its second stick circuit is opened at back contact 56 of relay FA. Relay NC is now deenergized because the above described circuit in-

cluding conductor 84 is open at front contact 42 of relay VP.

The dropping of relay NC deenergizes the line circuit and relays F, F¹, FA and FA¹ are dropped.

Relay 4V is now picked up over a circuit extending from (+), front contact 55 of relay SB, back contact 60 of relay FA, back contact 61 of relay VP, back contact 77 of relay EX, front contact 78 of relay 3V and winding of relay 4V, to (-).

The picking up of relay 4V makes the fourth code selection and since relay 4CS is picked up, relay PC is picked up over a circuit extending from (+), front contact 40 of relay C, back contact 41 of relay LO, back contact 42 of relay VP, front contact 43 of relay 4V, conductor 87, front contact 88 of relay 4CS, conductor 76 and winding of relay PC, to (-). The picking up of relay PC applies a positive impulse to the line circuit for positioning relays F and F¹ to the right and for picking up relays FA and FA¹.

Relay VP is now picked up over a circuit extending from (+), front contact 55 of relay SB, front contact 56 of relay FA, back contact 89 of relay EX, front contact 90 of relay 4V and winding of relay VP, to (-). The first and second stick circuits for relay VP are completed as previously described.

The picking up of relay VP opens the above described circuit for relay PC at back contact 42, so that relay PC drops and deenergizes the line circuit and relays F, F¹, FA and FA¹ are dropped. Relay EX is now picked up over a circuit extending from (+), front contact 55 of relay SB, back contact 60 of relay FA, front contact 61 of relay VP, front contact 62 of relay 4V and winding of relay EX, to (-). Since relay EX selects no circuit for picking up either relay PC or NC, these two relays remain down and the line remains deenergized for a sufficiently long period of time to effect the dropping of relay SA, because of open front contact 53 and the dropping of relay SB because of open front contact 54.

The code storage relays are now deenergized because their stick circuit is open at back contact 16 of relay EX and at front contact 91 of relay SA, which front contact was closed at the beginning of the cycle for applying (+) to the stick circuit for the code storage relays by way of conductor 92. The dropping of the code storage relays effects the release of relay CSP because all of the contacts 24, 25, 26 and 96 are open. Relay TS drops because of open front contact 33 of relay CSP and relay C is dropped because its stick circuit is open at front contact 95 of relay SB and contact 94 of relay F, which stick circuit includes front contact 93 of relay C and was completed at the beginning of the cycle. Relay VP, stepping relays 1V to 4V inclusive and relay EX are now deenergized because of open front contacts 55 and 65 of relay SB.

The stepping relay bank at the distant location, illustrated in Fig. 2, is operated in synchronism with the stepping relay bank illustrated in Fig. 1A, by means of a circuit completed at front contact 111 of relay SB¹ and contacts 112 and 113 of relay FA¹, this circuit being merely indicated by dotted line 114 and these stepping relays, as well as relays SA¹ and SB¹, are dropped out in the same manner described in connection with the operation of Fig. 1A.

When the train leaves the entering block, relay T is picked up and lamp GL is extinguished as an indication to the operator that the next code can be set up for transmission. It will be understood that the designations for additional

trains are set up and transmitted to the distant end in a manner similar to that described in connection with the designation corresponding to the actuation of button 124CB. It will be assumed that designations for the classes of 10 separate trains are simultaneously stored on the train designation storage relay groups in response to 10 separate trains being in the territory between the entering block and the leaving block of the bridge. This is of course accomplished by 10 successive cycles of operation of the steppers of Figs. 1A and 2.

Storage and display.—Each time the stepper of Fig. 1A and stepper¹ of Fig. 2 are operated through a cycle, the code stored on the code storage relays of Fig. 1 is transferred to the code receiving relays of Fig. 2A, comprising relays 1PS¹ to 4PS¹ inclusive, these code receiving relays being conditioned during the cycle in accordance with the condition of the code storage relays. At the end of each cycle the code receiving relays are restored to normal ready for the next cycle, by deenergizing their stick circuits (including conductor 123) at open front contact 122 of relay SB¹.

For example, when code 124 is transmitted as above described, code receiving relays 1PS¹, 2PS¹ and 4PS¹ are picked up. Relay 1PS¹ is picked up because the first coded impulse is positive, over a circuit which extends from (+), contact 115 of relay F¹ in its right-hand dotted position, front contact 116 of relay LO¹, back contacts 117, 118 and 119 of relays 4V¹, 3V¹ and 2V¹ respectively, front contact 120 of relay 1V¹, conductor 121, back contact 200 of relay PSP¹ and upper winding of relay 1PS¹, to (-). Relay 1PS¹ closes a stick circuit for itself extending from (+), front contact 122 of relay SB¹, conductor 123, front contact 124 and lower winding of relay 1PS¹, to (-).

Relay 2PS¹ is energized because the second coded impulse is positive, over a circuit which includes contacts 115, 116, 117 and 118 as before, but in this case it extends through front contact 119 of relay 2V¹, conductor 125, back contact 201 of relay PSP¹ and upper winding of relay 2PS¹, to (-). Relay 2PS¹ closes an obvious stick circuit for itself at its front contact 126.

Relay 3PS¹ is not energized because the third coded impulse is negative, causing contact 115 of relay F¹ to be actuated to the left instead of to the right, when relay 3PS¹ is selected by front contact 118 of relay 3V¹.

Relay 4PS¹ is energized by the fourth coded impulse because this impulse is positive. The circuit for energizing relay 4PS¹ is the same as that previously described, except that it extends through front contact 117 of relay 4V¹, conductor 127, back contact 203 of relay PSP¹ and upper winding of relay 4PS¹, to (-). Relay 4PS¹ closes an obvious stick circuit for itself at its front contact 128.

At the end of the cycle, the picking up of relay EX¹ executes or transfers the code received by the code receiver to the No. 1 designation storage relay group. The picking up of relay EX¹ applies (+) energy to execution¹ bus by way of front contact 129 of relay LO¹ and front contact 130 of relay EX¹. With relay LO¹ picked up and its back contact 129 open, the picking up of relay EX¹ and the consequent opening of its back contact 131 removes (+) energy from delay¹ bus for a purpose which will be later described. At the end of the clearing-out period at the end of the cycle, the dropping of relay EX¹

removes (+) energy from execution¹ bus and again applies (+) energy to delay¹ bus.

The (+) energy applied to conductor 132 is effective to pick up relays 1DS1, 1DS2 and 1DS4.

5. The circuit for picking up relay 1DS¹ extends from (+) on conductor 132, front contact 134 of relay 1PS¹, back contact 135 of relay 1OR, back contact 136 of relay 9RP, back contact 137 of relay 9R, back contact 138 of relay 8RP, back contact 139 of relay 8R, back contact 140 of relay 7RP, back contact 141 of relay 7R, conductor 155, back contact 142 of relay 6RP, back contact 143, of relay 6R, back contact 144 of relay 5RP, back contact 145 of relay 5R, back contact 146 of relay 4RP, back contact 147 of relay 4R, back contact 148 of relay 3RP, back contact 149 of relay 3R, back contact 150 of relay 2RP, back contact 151 of relay 2R, back contact 152 of relay 1RP, back contact 153 of relay 1R, conductor 154 and lower winding of relay 1DS1, to (-). Relay 1DS1 closes a stick circuit for itself extending from (+), back contact 156 of relay 1PB, front contact 157 and upper winding of relay 1DS1, to (-).

25 Relay 1DS2 is picked up because relay 2PS¹ is up, over a similar circuit extending through front contact 158 of relay 2PS¹ and back contacts 159, 160, 161, 162, 163, 164, 165, conductor 166, back contacts 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, conductor 179 and lower winding of relay 1DS2, to (-). Relay 1DS2 closes an obvious stick circuit for itself at its front contact 180.

35 Relay 1DS3 is not picked up because relay 3PS¹ of the code receiver was not picked up.

Relay 1DS4 is picked up because relay 4PS¹ of the code receiver was picked up. The circuit for picking up relay 1DS4 is similar to those previously described and extends through front contact 181, back contact 182 to 188, inclusive, conductor 189, back contacts 190 to 199, inclusive, back contacts 250 and 251, conductor 252 and lower winding of relay 1DS4, to (-). Relay 1DS4 closes an obvious stick circuit for itself at its front contact 253.

45 Lamp 124L is lighted over a circuit extending from (+), front contact 254 of relay 1DS1, front contact 255 of relay 1DS2, back contact 256 of relay 1DS3, front contact 257 of relay 1DS4 and lamp 124L, to (-).

Although not shown on the drawings, it will be understood that pyramid contacts on relays 1DS1 to 1DS4, inclusive, are arranged in the same manner as shown in connection with the No. 2 designation storage relay group, comprising relays 2DS1 to 2DS4, inclusive, for selecting any one of the fifteen indicator lamps in accordance with the code received. Likewise, a similar set of pyramid contacts (not shown) is associated with the No. 3 designation storage group of relays, so that the first three trains may be indicated by selectively energizing an indicator lamp of each of the first three designation storage groups. It will also be understood that any number of designation storage groups of relays may be provided with indicator lamps and pyramid contacts for indicating any number of approaching trains up to the capacity of the system.

When (+) energy is removed from execution¹ bus and again applied to delay¹ bus, transfer relays 1R and 1RP are picked up for transferring the above described circuits, leading from the contacts of the code receiver relays, from the No. 1 designation storage group of relays to the No. 2 designation storage group of relays, in

readiness for registering the designation of the second approaching train.

Relay 1R is picked up over a circuit extending from (+) on delay¹ bus, conductor 133, back contacts 258 to 265, inclusive, conductor 266, back contacts 267 to 277, inclusive, conductor 279, front contact 280 of relay 1DS1 (or front contacts 281, 282, 283 of any one of the other relays of the No. 1 designation storage group), conductor 284 and lower winding of relay 1R, to (-). Relay 1R closes a stick circuit for itself at its front contact 278, which excludes the series circuits including the back contacts of the R and RP relays of the other groups. Relay 1RP is picked up over a circuit closed at front contact 285 of relay 1R. The picking up of relay 1RP and the consequent opening of its back contact 277 opens the above described pick-up circuit for relay 1R, so that this relay is now dependent upon its stick circuit for its energization.

It will now be assumed that a second train enters the entering block. This is effective to cause the steppers to operate through another cycle in synchronism as before, and in this case the line will be energized or not energized at the four steps of the cycle in accordance with the code transmitted, as determined by the class of the train.

Assuming that this second train requires the energization of lamp 4L associated with the No. 2 designation storage group, it will be obvious that this requires the picking up of relay 2DS4, which in turn requires that code receiving relay 4PS¹ be picked up. The above combination requires a positive impulse on the fourth step only and in response to the negative impulses on the first three steps, relays 1PS¹, 2PS¹ and 3PS¹ are not picked up. Relay 4PS¹ is picked up on the fourth step in the manner previously described.

During the execution period at the end of the cycle, relays 2DS1, 2DS2 and 2DS3 are left down and relay 2DS4 is picked up over a circuit previously described and including front contact 181 of relay 4PS¹, the lower set of selecting back contacts on the R and RP relays, up to contact 250 of relay 1RP and then by way of front contact 250 and the lower winding of relay 2DS4, to (-). Relay 2DS4 is stuck up over a circuit extending from (+), front contact 286 of relay 1RP, front contact 287 and upper winding of relay 2DS4, to (-).

Lamp 4L is now lighted over a circuit extending from (+), back contacts 288, 289 and 290 of relays 2DS1, 2DS2 and 2DS3, respectively, front contact 291 of relay 2DS4 and lamp 4L, to (-).

At the end of the execution period for the second cycle, relay 2R is picked up over the same circuit previously described for picking up relay 1R, up to back contact 275 of relay 2RP and then by way of front contact 292 of relay 2DS4 to the lower winding of relay 2R. The picking up of relay 2R closes a stick circuit for itself at its front contact 276 and at its front contact 293 it closes a circuit for picking up relay 2RP. The opening of back contact 275 of relay 2RP opens the pick-up circuit for relay 2R, so that this relay is dependent on its stick circuit for its energization.

Assuming that the third train to enter the entering block requires that lamp 13L (not shown) of the No. 3 storage group to be lighted, it will be obvious that this requires the picking up of relays 3DS1 and 3DS3, and that relays 3DS2 and 3DS4 of this group (not shown) remain down. It is believed unnecessary to show the designa-

tion storage relays of the other groups, including group No. 3, since an understanding of the operation of these groups of relays in response to succeeding codes transmitted over the line may be had by analogy to the operation of the first two groups previously explained.

The picking up of the first and third designation storage relays of the No. 3 group effects the lighting of lamp 13L of this group, over circuits which will be understood by considering the circuit for lamp 13L of the No. 2 group as an example.

The transfer relays 3R and 3RP are picked up after the end of the execution period of the third cycle in the same manner as described for the first and second groups. From the above examples it will be apparent how ten succeeding trains may have their classes registered on the ten designation storage groups of relays, in response to their codes transmitted over the line circuit during ten cycles of operations of the steppers, with the codes for registering these train classes being provided in sequence by the operation of the exit buttons, shown in the left-hand portion of Fig. 1, in different combinations.

Storage transfer.—The above description specifically sets forth the manner in which the first three trains to enter the entering block have their classes stored on the first three designation storage relay groups and how these relay groups selectively energize individual lamps corresponding to the classes of these first three trains. From this explanation and considering that the R and RP transfer relays are picked up in response to a designation stored on each group of storage relays, it will be apparent that additional trains, up to ten, will be stored on the storage groups numbered 3 to 10 inclusive, the No. 10 group of relays being illustrated in detail in Fig. 2A.

Any one of the designation storage relays of the No. 10 group closes a circuit at front contact 294, 295, 296 or 297 for lighting lamp 298 as an indication that there is a tenth train in the intervening section of track and it will be obvious that similar contacts may be provided on the designation storage relays of groups 4 to 9 inclusive for indicating the number of trains which are in the intervening section of track. In other words, lamps similar to 298 indicate that there is a train of some class approaching for each lamp which is lighted, while the indicator lamps associated with the first three designation storage groups of relays indicate the class of each of the first three trains approaching.

Since the first, second and third approaching trains are distinctively indicated on the first, second and third designation storage groups of lamps, it becomes necessary to transfer or step up the class indications from each higher numbered group to the next lower numbered group when a train enters the leaving block associated with the exit end of the bridge. It will now be pointed out in detail how the indication for the third train is transferred to the second group and the indication for the second train is transferred to the first group when the first train enters the leaving block with which track relay T¹ (Fig. 2C) is associated. From this explanation it is believed that it will be obvious how the transfer is made from any other group to the next lower numbered group in the series.

When the first train enters the leaving block, relay T¹ is dropped and a circuit is closed at its back contact 240 for picking up relay TPA. Re-

lay TPA closes a circuit at its front contact 241 for picking up relay TPB and relay TPB completes a circuit for picking up relay TPC, which extends from (+), front contact 243 of relay TPB and winding of relay TPC, to (—).

The picking up of relay TPB opens the stick circuit for the relays of the No. 1 designation storage group at back contact 156 and, in the example assumed, relays 1DS1, 1DS2 and 1DS4, which were picked up, are released. It will be understood that these relays release during the interval between the opening of back contact 156 of relay TPB and the closure of front contact 245 of relay TPC, which latter contact is for the purpose of applying energy to the stick circuit, so that these relays will be stuck up when picked up in response to the transfer operation.

The dropping of relay 1DS4 opens the above described circuit for lamp 124L and this lamp is extinguished.

Relay 1R is now dropped because the circuit for its lower winding is open at open front contacts 280 to 283 inclusive and the circuit for its upper winding is open at back contact 246 of relay 2R. The dropping of relay 1R and the consequent opening of its front contact 285 de-energizes relay 1RP which, due to its slow acting characteristics, drops after a short interval of time.

The dropping of relay 1R completes a transfer circuit for transferring the indication stored on the No. 2 group to the No. 1 group. Recalling that relay 2DS4 of the No. 2 group is picked up, this circuit extends from (+), front contact 247 of relay TPC, conductor 248, front contact 249 of relay 2DS4, back contact 25 of relay 1R, conductor 252 and lower winding of relay 1DS4, to (—). Relay 1DS4 closes its stick circuit at front contact 253, which is completed at front contact 245 of relay TPC. With relay 1DS4 picked up and the other relays of this group down, the pyramid circuit is completed for lighting lamp 4L of this group, in the same manner as indicated for the lighting of lamp 4L of the No. 2 group.

The dropping of relay 1RP is effected after the above transfer is made, due to its slow acting characteristics, and relay 2DS4 is dropped because its stick circuit is opened at front contact 286 of relay 1RP and because its pick-up circuit is open at front contact 250 of relay 1RP. This extinguishes lamp 4L of the second group. Relay 2R is now dropped because the circuit to its lower winding is open at front contact 292 of relay 2DS4 and the circuit to its upper winding is open at back contact 230 of relay 3R. Relay 2RP is now dropped because of open front contact 293 of relay 2R.

The dropping of relay 2DS4 completes a circuit for again picking up relay 1R which extends from (+), front contact 231 of relay 2RP, back contacts 232, 233, 234 and 235 of relays 2DS1 to 2DS4 inclusive, back contact 277 of relay 1RP, conductor 279, front contact 283 of relay 1DS4, conductor 284 and lower winding of relay 1R, to (—). Relay 1R closes a stick circuit for itself at its front contact 278, which is independent of the above described pick-up circuit including back contact 277 of relay 1RP, which pick-up circuit will be opened by the picking up of relay 1RP in response to the closure of front contact 285 of relay 1R.

The picking up of relay 1RP completes the circuit for effecting the transfer from the No. 3 group to the No. 2 group and, since relays 3DS1

and 3DS3 of the third group (not shown) are picked up, corresponding relays 2DS1 and 2DS3 of the No. 2 group will be picked up in response to the transfer operations.

5 Relay 2DS1 is picked up over a circuit extending from (+), front contact 236 of relay 1R through the front contacts of the No. 3 designation storage relays which are picked up (assumed to be 3DS1 and 3DS3 which have contacts corresponding to front contacts 237 and 238 of relays 2DS1 and 2DS3 respectively), back contacts 151 and 239 of relay 2R, front contacts 152 and 229 of relay 1RP and lower windings of relays 2DS1 and 2DS3, to (-). The picking up of these two 15 relays of the No. 2 group complete obvious stick circuits for themselves at their front contacts 227 and 228 to (+), at front contact 286 of relay 1RP.

20 The picking up of relays 2DS1 and 2DS3 complete a circuit for lighting lamp 13L which extends from (+), front contact 288 of relay 2DS1, back contact 226 of relay 2DS2, front contact 225 of relay 2DS3, back contact 224 of relay 2DS4 and lamp 13L, to (-). This completes the transfer from the No. 3 to the No. 2 group.

25 The dropping of relay 2RP, as previously described, causes the dropping of relays 3DS1 and 3DS3 (not shown) because of open front contacts 150 and 223 of relay 2RP and because the stick circuit for these relays is open at a front contact of relay 2RP similar to front contact 286 of relay 1RP. The dropping of these two relays of the No. 3 group extinguishes lamp 13L of this group and effects the dropping of relay 3R, because its 35 lower winding will be open at the front contacts of the storage relays of this group, similar to contacts 220, 221, 222 and 292 illustrated in connection with the relays of the No. 2 group. It will be understood that the upper winding of relay 3R is not energized at this time, since it requires the energization of execution¹ bus, including conductor 132, for energizing the winding. The dropping of relay 3R effects the dropping of relay 3RP because relay 3RP is a direct repeater 45 of relay 3R.

Relay 2R is picked up in response to the dropping of relays 3DS1 and 3DS3 (not shown), over a circuit extending from (+), front contact 210 of relay 3RP (this circuit being effective before the dropping of relay 3RP due to its slow acting characteristics), through back contacts of the No. 3 group of designation storage relays (similar to back contacts 232 to 235 inclusive of relays 2DS1 to 2DS4 inclusive), front contact 220 of 55 relay 2DS1 (in multiple with front contact 222 of relay 2DS3) and lower winding of relay 2R, to (-). Relay 2R effects the picking up of relay 2RP by the closure of front contact 293.

60 This completes the transfer from the No. 2 group to the No. 1 group and from the No. 3 group to the No. 2 group, with the storage relays of the No. 3 group being restored to normal in condition for storing the next approaching train, in a manner which will be obvious from the above description.

65 The transfer from one group to another cannot take place while a new message is being stored. The prevention of a transfer under this condition is due to the removal of (+) energy from delay¹ bus conductor 133 during the execution period, when a message is being registered on the code receiver. The opening of back contact 129 of relay LO¹ (effected during the receiving of a code) and the opening of back contact 131 of 75 relay EX¹ (effected during the execution of a

code) removes (+) from conductor 133, which (+) is required for picking up a transfer relay, such as relay 2R over a circuit including conductor 133, back contacts 258 to 265 inclusive, conductor 266, back contacts 267 to 275 inclusive and one or more of the front contacts 220, 221, 222 and 292, to the lower winding of relay 2R. By means of this arrangement the transfer operation is held off until the receiving apparatus is in a condition when no code is being executed. 10

Clearing out operation.—When the first train leaves the leaving block the picking up of relay T¹ effects the dropping of relays TPA, TPB and TPC and since back contact 156 of relay TPB is closed before front contact 245 of relay TPC is opened, (+) energy is maintained on the stick circuits for the relays of the No. 1 designation storage group. Likewise, since back contact 211 of relay TPB is closed before front contact 247 of relay TPC is opened, (+) energy is maintained on conductor 248, so that the transfer may be made from the No. 2 group to the No. 1 group at the instant that the first train leaves the leaving block. 20

25 When the second train enters the leaving block, relay T¹ is again dropped and relays TPA, TPB and TPC are again picked up. Relay 1DS4 is now dropped because its stick circuit is momentarily opened at back contact 156 of relay TPB before it is reclosed at front contact 245 of relay TPC as previously described. This extinguishes lamp 4L. Relay 1R is again dropped because all of the contacts 280 to 283 inclusive are open and relay 1RP is dropped because of open front contact 285 of relay 1R. 35

Relays 1DS1 and 1DS3 are now picked up in response to the transfer from the No. 2 to the No. 1 group. Relay 1DS1 is picked up over a circuit extending from (+), front contact 247 of relay TPC, conductor 248, front contact 237 of relay 2DS1, back contact 153 of relay 1R, conductor 154 and lower winding of relay 1DS1, to (-). Relay 1DS3 is picked up (because relay 2DS3 is up) over a circuit extending from (+), front contact 247 of relay TPC, conductor 248, front 45 contact 238 of relay 2DS3, back contact 212 of relay 1R, conductor 213 and lower winding of relay 1DS3, to (-). These two relays are stuck up over the previously described circuits including front contact 245 of relay TPC and front contacts 157 and 214 of relays 1DS1 and 1DS3 respectively. Lamp 13L is now lighted by means of pyramid circuits for this lamp controlled by the No. 1 designation storage group of relays, which circuits are similar to those illustrated for the 55 No. 2 group.

The dropping of relay 1RP drops relays 2DS1 and 2DS3 because of open front contact 286 of relay 1RP. This extinguishes lamp 13L of the No. 2 group. 60

Relay 2R is now dropped because front contacts 220, 221, 222 and 292 of the No. 2 group of storage relays are all open and relay 2RP is dropped because of open front contact 293 of relay 2R. 65

The dropping of relays 2DS1 and 2DS3 close a circuit for picking up relay 1R which extends from (+), front contact 231 of relay 2RP, back contacts 232 to 235 inclusive of the No. 2 group of relays, back contact 277 of relay 1RP, conductor 279, front contacts 280 and 282 in multiple of relays 1DS1 and 1DS3, conductor 284 and lower winding of relay 1R, to (-). Relay 1R completes its above described stick circuit and effects the picking up of relay 1RP by closing 75

front contact 285. This completes the second transfer operation, which transfers the designation from the second group to the first group.

When the second train leaves the leaving block, relay T¹ is picked up and relays TPA, TPB and TPC are dropped as previously described. When the third train enters the leaving block relay T¹ is again dropped and relays TPA, TPB and TPC are again picked up. Relays IDS¹ and IDS³ are dropped out when their stick circuits are opened at back contact 156 of relay TPB as previously described. Lamp 13L of the first group is now extinguished and relay IR is dropped because all of the contacts 230 to 233, inclusive, are opened and relay IRP is dropped because of open front contact 255 of relay IR.

When the third train leaves the leaving block, relay T¹ is picked up and relays TPA, TPB and TPC are dropped as previously described. This places all apparatus and circuits in normal condition.

The purpose of relay PSP¹ of Fig. 2A will now be explained. Ten trains and their classes can be stored on the ten groups of designation storage relays. With the ten groups loaded, the class of the eleventh train can be registered on the code receiver relay group, (illustrated in the upper left-hand portion of Fig. 2A) held and stepped up to group No. 10 when this group is unloaded, by means of the circuit including front contact 215 of relay 9R, front contact 216 of relay 10RP and the lowermost front contacts of the code receiver relays. When this operation is effected, a twelfth code is kept away from the code receiver by the picking up of relay PSP¹ and the consequent opening of its back contacts 200 to 203, inclusive. Relay PSP¹ is picked up over a circuit extending from (+), back contact 204 of relay SB¹, conductor 205 and any one or more of front contacts 218, 219, 208 and 209 and the winding of relay PSP¹, to (-). Relay PSP¹ is stuck up over a circuit closed at its front contact 217, which stick circuit is effective until the code is unloaded from the code receiver and loaded onto the No. 10 designation storage group. This stick circuit of course includes any one or more of the above mentioned front contacts of the relays of the code receiver.

Extension receiver.—The extension receiver is for the purpose of transferring the indication stored on the No. 1 designation storage group to another arrival point, when track relay T¹ unloads this indication from the No. 1 group. Provision has been made for three successive transfers onto the No. 1A, 2A and 3A extension storage groups in response to three successive unloadings of the No. 1 storage group.

With the three designations above assumed, that is, train classes 124, 4 and 13, successively indicated by the No. 1 designation group, it will be explained how these indications are successively, transferred to the three extension groups, stored and displayed until cleared out by the three trains entering the extension block. It will first be assumed that track switch repeater relay WPP¹ is picked up in response to switch control lever SML¹ being in its normal position.

It will be recalled that code 124 was the first code stored in the No. 1 group, effecting the picking up of relays IDS¹, IDS² and IDS⁴. When relay TPA picks up in response to the first train entering the leaving block as above described and before relay TPC picks up, a circuit is closed for picking up relays ADS¹, ADS² and ADS⁴ of the No. 1A extension storage group.

The circuit for picking up relay ADS¹ extends from (+), front contact 304 of relay TPA, back contact 305 of relay TPC, front contact 306 of relay IDS¹, front contact 307 of relay WPP¹, back contact 309 of relay A3R, back contact 308 of relay A2RP, back contact 309 of relay A2R, conductor 310, back contact 311 of relay A1RP, back contact 312 of relay A1R and lower winding of relay ADS¹, to (-). Relay ADS¹ closes a stick circuit for itself extending from (+), back contact 313 of relay ATPB, front contact 314 and upper winding of relay ADS¹, to (-).

Relay ADS² is picked up over a circuit including contacts 304 and 305 above described, front contact 315 of relay IDS², front contact 316 of relay WPP¹, back contact 301 of relay A3R, back contact 317 of relay A2RP, back contact 318 of relay A2R, conductor 319, back contact 320 of relay A1RP, back contact 321 of relay A1R and lower winding of relay ADS², to (-). Relay ADS² closes a stick circuit for itself at its front contact 322.

Relay ADS⁴ is picked up over a similar circuit including front contacts 323 and 324 of relays IDS⁴ and WPP¹, back contacts 303, 325 and 326 of relays A3R, A2RP and A2R, conductor 327, back contacts 328 and 329 of relays A1RP and A1R and lower winding of relay ADS⁴, to (-). Relay ADS⁴ closes a stick circuit for itself at its front contact 330.

The picking up of relay TPA and the consequent opening of its back contact 331 prevents the picking up of relay A1R until sufficient time has elapsed for picking up the required relays of the No. 1A extension storage group, after which the closure of front contact 332 of relay TPC completes a circuit through back contacts 333, 334, 335 and 336 of relays A3RP, A3R, A2RP and A2R, conductor 337, back contact 338 of relay A1RP and front contacts 339, 340 and 341 in multiple of relays ADS¹, ADS² and ADS⁴ and lower winding of relay A1R, to (-). Relay A1R completes a stick circuit for itself at its front contact 342 and at its front contact 343, it closes a pick-up circuit for relay A1RP.

When the second train enters the leaving block the operation of relays T¹, TPA, TPB and TPC transfers the next indication, which is stored on the No. 1 designation storage group, to the No. 2A extension storage group in a manner which will be understood by analogy to the above described transfer operations. It will be obvious that the energization of the lower winding of relay 2ADS⁴ is effected (since relay IDS⁴ is assumed to be picked up) over a circuit including front contact 323 of relay IDS⁴ and the previously described circuit, which now extends through front contact 328 of relay A1RP to the lower winding of relay 2ADS⁴. Relay 2ADS⁴ is stuck up because of closed front contacts 344 and 345. Relays A2R and A2RP operate in a manner similar to that described in connection with relays A1R and A1RP for selecting the No. 3A extension storage group of relays.

When the third train enters the leaving block, relays T¹, TPA, TPB and TPC operate as before and, since it is assumed that relays IDS¹ and IDS³ are picked up, obvious circuits are completed through front contacts 307 and 347 of relay WPP¹ and front contacts 308 and 348 of relay A2RP for picking up relays 3ADS¹ and 3ADS³. These relays are stuck up over a circuit including front contact 349 of relay A2RP.

Relays A3R and A3RP are now operated in a manner similar to the operation of relays 75

A1R and A1RP and the circuits to the extension storage groups are opened at back contacts 300 to 303, inclusive.

It will be understood that the four relays of each extension storage group have pyramid contacts and circuits for selecting and energizing a group of lamps for each group, in a manner similar to that disclosed in connection with the No. 2 designation storage group of Fig. 2B.

The circuits including front contacts 350, 351, 352 and 353 of the relays of the No. 1A extension storage group are shown leading off to the right, which indicates that additional storage groups may be provided if desired.

When the trains enter the extension block, relay T² is dropped and relays ATPB and ATPC are picked up for effecting the transfer operation over a circuit controlled at contacts 354 and 355, which operation is similar to that described in connection with the transfer from one of the designation storage groups to the other and which need not be described in detail. It will be apparent that the transfer from the No. 3A extension storage group to the No. 2A extension storage group is effected over a circuit closed at front contact 356 of relay A1R and that the transfer from the No. 2A extension storage group to the No. 1A extension storage group is effected over a circuit closed at front contact 354 of relay ATPC.

When a train leaves the leaving block, relays TPA, TPB and TPC are dropped in sequence, the stick circuit for the A1R, A2R and A3R relays is opened at front contact 357 of relay TPA, after which it is closed at back contact 358 of relay TPC. This effects the release of the highest numbered AR relay, in the event that its lower winding is not energized at this time due to one or more of the storage relays of the associated group being picked up and their front contacts, such as contacts 339, 340 and 341 of the No. 1A group, being closed.

The circuits including front contacts 360, 361 and 362 of relays A3RP, A2RP and A1RP are for a purpose similar to that described in connection with front contact 231 of relay 2RP, that is, they provide pick-up circuits for picking up a lower numbered AR relay when its associated storage relay group has a code stored thereon, after the storage relays of the next higher numbered group have been dropped out.

From the above description it will be apparent that the dropping of relay WPP¹, in response to the operation of lever SML¹ to its reverse position, may select circuits at back contacts 307, 316, 347 and 324 leading to another extension group, such as a B extension group of storage relays. Since the operation of a B group will be the same as that described in connection with the A group, it is believed unnecessary to show the circuits or point out the detailed operation of such an additional group of storage relays.

Auxiliary operations.—An emergency cancelling button ECB¹ is illustrated in Fig. 2C for the purpose of picking up relay TPB at the leaving end of the block by a manual operation, in order to clear out or cancel a storage designation independent of the entrance of a train into this block. This may be desirable if it becomes necessary, for any reason, to bring the system into step with the trains between the entering and the leaving blocks, which might be occasioned by a train leaving or entering the track between the two ends of the bridge, thus resulting in the system getting out of step because such

a train is not registered in and registered out as it should be.

An emergency suppression button ESB¹ is provided, which effects the picking up of relay ESR in response to a manual operation for preventing the opening of stick circuits for storage relays 1DS1, 1DS2, 1DS3 and 1DS4 by the closure of contact 207 of relay ESR in multiple with back contact 156 of relay TPB. The energization of relay ESR completes a stick circuit for itself at its front contact 206, and at its front contact 207 (+) energy is applied to the stick circuit for the No. 1 designation storage group of relays.

More specifically, this suppression relay ESR if once picked up is stuck up through a stick circuit including back contact 245 of relay TBC, and will by reason of this back contact and front contact 156 of relay TPB remain energized until relays TPB and TPC are sequentially deenergized in that order. This can only occur if relay TPB is first energized long enough to pick up relay TPC and is then deenergized long enough to open its own front contact 156. In other words, either occupancy followed by vacancy of the track circuit containing track relay T¹ or depression and release of push button ECB¹ is required to deenergize the suppression relay ESR. If the operator has therefore depressed push button ESB¹ to render the suppression relay ESR effective he can cancel this action by depressing the push button ECB¹ and then releasing it, but if the operator has picked up the suppressing relay ESR and then wishes to cancel the train description stored in storage relays 1DS1, 1DS2, 1DS3 and 1DS4 he will have to depress the push button ECB¹ twice separated by a time interval. Also, if suppression relay ESR has been picked up manually, the first train that passes over the detector track circuit containing relay T¹ will drop relay ESR and the second train that passes over this track circuit will cause the train description to be cancelled by dropping of the storage relays. The operation of this relay ESR, therefore, prevents the unloading of the No. 1 designation storage group in response to a train entering the leaving block, which may be desirable for testing purposes and for cooperation with button ECB¹ for bringing the system into step.

The communication portion of the present system is of the two-wire simplex type, that is, messages are transmitted both ways over the two-wire line circuit, but only one way during each cycle of operations. The above description explained the transmission from the transmitter illustrated in Fig. 1A to the receiver illustrated in Fig. 2. With the system in its normal condition, transmission may be effected in the other direction over the line circuit and although the sending apparatus is not shown at the end of the system illustrated in Figs. 2 to 2D, inclusive, it will be understood that these sending circuits will be the same as illustrated in Fig. 1 and connected to the system at the bus wire connections illustrated in Fig. 2, to which the legend "same as at other station" is applied. Similarly, a code receiver and any desired number of designation storage groups, as well as extension storage groups, may be provided at the end of the system illustrated in Fig. 1A by connecting similar receiving circuits illustrated in Figs. 2 to 2D, inclusive, to the bus connections illustrated in the lower right-hand portion of Fig. 1A bearing the legend "same as at other station."

Lock out.—When a cycle of operations is ini-

tiated from the end of the system illustrated in Fig. 1A, relays C and PC are picked up for applying positive energy from line battery LB to the line circuit, which energy picks up the line relays and lockout relay LO¹ at the receiving end in the manner previously described. The picking up of relay SB at the transmitting end and the consequent opening of its back contact 4 maintains the pick up circuit of relay LO at the transmitting end open, which pick up circuit was previously opened at back contact 3 of relay PC, so that relay LO is ineffective during such a cycle.

Similarly, when transmission is effective the other way over the line circuit, relays C¹ and PC¹ are picked up to apply positive energy from line battery LB¹ to the line circuit which picks up the line relays and lockout relay LO of Fig. 1A. Front contact 27 of relay SB is closed to stick relay LO before its pick up circuit is opened at back contact 4. The picking up of relay SB¹ and the consequent opening of its back contact 103 opens the pick up circuit for relay LO¹, so that this relay will not be picked up during such a cycle.

The so called over-powering method of lockout is employed in the present system, that is, battery LB is of considerably higher potential than battery LB¹. In the event of a simultaneous start at both ends of the system, relays C, PC, C¹ and PC¹ will be picked up at the same time. Since the potential of battery LB is higher than that of battery LB¹, current will flow from the (+) terminal of battery LB over the line circuit in such a direction that polar contact 94 of relay F and polar contact 115 of relay F¹ will be positioned to the right. Relays FA and FA¹ will be picked up, after which relays SA, SA¹, SB and SB¹ will be picked up in the manner previously described.

The picking up of relay SA and the consequent opening of its back contact 29 opens the pick up circuit of relay C, but this relay is stuck up because contact 94 of relay F is in its right hand dotted position. The picking up of relay SA¹ and the consequent opening of its back contact 299 opens the pick up circuit of relay C¹ and since the stick circuit for this relay is open (contact 115 of relay F¹ being in its right hand dotted position and front contact 363 of relay SB¹ not yet closed), relay C¹ will drop out.

Since relay C remains picked up, the circuit including its front contact 43 remains closed for energizing relay PC, but since relay C¹ drops out the circuit including its front contact 364 is opened so that relay PC¹ is dropped out. This removes battery LB¹ from the line, connects lockout relay LO¹ in the line and maintains the line energized from battery LB of Fig. 1A. The system then steps through its cycle, with the location illustrated in Figs. 1 and 1A transmitting.

Incomplete cycle.—A BZ relay is provided at each end of the system for opening up the line and sounding an alarm in the event of an incomplete cycle. The operation of relay BZ of Fig. 1A will be explained and this explanation will be typical of the operation of relay BZ¹ of Fig. 2.

An incomplete cycle (which may be due to a trouble condition) will fail to pick up relay EX, then when relay SA drops and before relay SB drops a circuit is closed for picking up relay BZ which extends from (+), back contact 7 of relay EX, front contact 6 of relay SB, back

contact 5 of relay SA, and winding of relay BZ, to (—). The closure of front contact 9 of relay BZ completes a circuit for the buzzer alarm and the closure of front contact 2 closes a stick circuit for relay BZ. The opening of back contact 43 opens up the line and the opening of back contact 37 opens up the start circuit. The operators at each end of the system now confer over a telephone line, or the like, and take steps to remedy the trouble, after which the BZ relays are released by the actuation of buttons RLB and RLB¹, the latter not shown.

Having thus described a train describer system as one specific embodiment, it is to be understood that various modifications, adaptations and alterations may be applied to meet the requirements of practice without in any manner departing from the spirit or scope of the invention, except as limited by the appended claims.

What I claim is:

1. In combination; a plurality of train describer units; each unit comprising a plurality of storage relays which by being energized or de-energized describe the destination of a train, and a transfer relay having contacts in the in-put transfer pick-up circuits of said storage relays for allowing or not allowing a train description to be registered in such unit; of a two-position multiple contact switch connecting the out-put transfer wires of one unit to the in-put wires of one or the other of the two other units depending on its position, said two-position multiple contact switch by its position reflecting the position of a track switch over which said train moves; and means including a track relay associated with said track switch and one of said transfer relays for transferring a train destination stored in one of said units to one or the other of the other two of said train describer units depending on the position of said two-position multiple contact switch.

2. In combination, three train describer units each including a first and a second bank of storage relays each bank including a plurality of storage relays of which each bank will describe a train class by the condition of energization of its storage relays, a transfer relay between successive banks of storage relays of each describer for opening or leaving closed circuits for picking up storage relays of the first bank in accordance with the condition of energization of storage relays of the second bank, a set of double throw contacts one contact for each storage relay which contacts by their position reflect the position of a track switch over which said train moves for connecting front contacts of the first bank of storage relays of one describer unit to the storage relays of the second bank of one or the other of the remaining two describer units depending on the position assumed by said double throw contacts, a detector track relay associated with said track switch, and transfer circuits for transferring a train description from the first bank of storage relays of one describer to the storage relays of the second bank of one or the other of the two remaining describers depending on the position of said double throw contacts each including a front contact of a storage relay of the first bank of said one describer, one of said double throw contacts and a contact closed when said detector track relay is deenergized, whereby the train descriptions stored in the storage relays of the two banks in one of said describer units may be transferred to either one or both of the other

two describers in any order depending upon the position assumed by said double throw contact at the time each particular transfer of description is made.

5 3. In combination; a track switch connecting a lead section to two diverging track sections; a detector track circuit associated with said track switch; three train describer units each comprising a plurality of storage relays, and a transfer relay one associated with each of said sections; a front contact on each of said storage relays; switch repeater contacts reflecting the position of said track switch; a pick-up circuit for each storage relay of the unit associated with one of said diverging sections including a front contact of the corresponding storage relay of the unit of the lead section, said switch repeater contacts closed when said lead section is connected by said track switch to that diverging section and also including back contacts of the transfer relay of the unit associated with that diverging section; a pick-up circuit for each storage relay of the unit associated with the other of said diverging sections including the same front contact of the corresponding storage relay of the lead section, said switch repeater contacts closed when said lead section is connected by said track switch to the other of said diverging sections and also including back contacts of the transfer relay of the unit associated with the other of said diverging sections; each of said pick-up circuits including contact mechanism closed only momentarily each time said detector track becomes occupied; whereby a train description is transferred from one describer unit to another in accordance with the route over which such described train moves.

4. In combination; a first train describer unit for describing a first train; a second train describer unit for describing a second train and a third train describer unit for describing a third train; each of said units including a plurality of storage relays, a transfer relay and a transfer repeater relay controlled by a front contact of the transfer relay; said storage relays by their condition of energization defining the train stored therein; pick-up circuits for the storage relays of said second unit each including a front contact of the corresponding storage relay of the third unit, back contacts of the transfer relay of such second unit and front contacts of the transfer repeater relay of said first unit; a pick-up circuit for the transfer relay of said first unit including in multiple front contacts of the storage relays of said first unit and in series back contacts of the storage relays of said second unit; and two stick circuits for the transfer relay of said first unit one including in multiple said front contacts of the storage relays of said first unit and its own stick contact and the other including in series back contacts of the transfer relay of said second and said third units and its own stick contact; whereby a train description cannot be registered in said first describer unit immediately after it is vacated without having first been registered in either the second or third of said train describer units.

5. In a train describer; the combination with a train describer unit including a plurality of storage relays, a transfer relay and a repeater transfer relay; a traffic relay which by its condition of energization manifests occupancy of a track circuit; a first repeater traffic relay controlled by said traffic relay; a second repeater

traffic relay controlled by said first repeater traffic relay; stick circuits for said storage relays each including a normally closed contact of said first repeater traffic relay, whereby operation of said first repeater traffic relay will deenergize said storage relays to cancel the train description stored therein; means including a normally open contact of said traffic relay and a normally closed contact of said second repeater traffic relay for when actuated transferring the train description stored in said train describer to a subsequent train describer; and means for suppressing such cancellation including a manually controllable normally open contact in multiple with said normally closed contact of said first repeater traffic relay.

6. In a train describer; the combination with a train describer unit including a plurality of storage relays, a transfer relay and a repeater transfer relay; a traffic relay which by its condition of energization manifests occupancy of a track circuit; a first repeater traffic relay controlled by said traffic relay; a second repeater traffic relay controlled by said first repeater traffic relay; stick circuits for said storage relays each including a normally closed contact of said first repeater traffic relay, whereby operation of said first repeater traffic relay will deenergize said storage relays to cancel the train description stored therein; means including a normally open contact of said traffic relay and a normally closed contact of said second repeater traffic relay for when actuated transferring the train description stored in said train describer to a subsequent train describer; a normally deenergized stick suppression relay which if energized suppresses such cancellation having a front contact connected in multiple with said normally closed contact of said repeater traffic relay; a manually operable contact included in the pick-up circuit of said stick suppression relay; and a stick circuit for said stick suppression relay including its own stick contact and also including in multiple a normally closed contact of said second repeater traffic relay and a normally open contact of said first repeater traffic relay; whereby the actuation of said traffic relays in response to the entrance of a first train upon a track circuit causes deenergization of said stick suppression relay and the second actuation of said traffic relays in response to the entrance of a second train upon such track circuit causes cancellation of a train description to take place.

7. In combination, two stations connected by a pair of line wires, a source of current at each station, a line relay at each station included in series with one of said line wires, a lock relay at each station, contacts at each station for normally connecting said line relays and said lock relays in series which contacts for a particular station if actuated disconnect the lock relay at that station from the line wires and connect the source of current at that station in series in said line wires, a contact on each lock relay effective to prevent the source of current at its associated station being connected to said line wires when such lock relay is energized, and indicating means controlled by said line relays.

8. In combination; two line wires connecting two spaced stations, a source of current at each station; a polar line relay at each station included in series in one of said line wires; a lock relay at each station; contacts at each station for normally connecting said polar line relays and said lock-out relays in series with said line

wires and which if operated apply current of one polarity or another polarity to the line circuit including said line wires, said polar line relays and the lock-out relay at the opposite station in series; a contact on each lock relay effective when such lock relay is energized to prevent the source of current at that station from being connected to the line wires; whereby only one of said stations can energize a line circuit including a lock relay at the opposite station in said line wires at one time; and indicating means controlled by each polar line relay and in a manner depending on the polarity of current applied to such polar line relay.

9. In combination; two line wires connecting two spaced stations, a source of current of high potential at one station and a source of current of low potential at the other station; a polar line relay at each station included in series in one of said line wires; a lock relay at each station; contacts at each station for normally connecting said polar line relays and said lock-out relays in series with said line wires and which if operated apply current of one polarity or another polarity to the line circuit including said line wires, said polar line relays and the lock-out relay at the opposite station in series; a contact on each lock relay effective when such lock relay is energized to prevent the source of current at that station from being connected to the line wires; whereby if the contacts at both stations are operated simultaneously to apply current of the same polarity from said sources to said line wires one of said sources will dominate and cause current to flow in a corresponding direction in the line wires and whereby the polar position assumed by the polar line relays causes the contacts at the station having the source of low potential to return to normal and reinsert its lock relay in the line wires as a result of which the polar line relays are controlled from the station having the source of high potential; and indicating means controlled by each polar line relay effective only when its associated lockout relay is energized.

10. In combination; a first train describer unit for describing a first train; a second train describer unit for describing a second train and a third train describer unit for describing a third train; each of said units including a plurality of storage relays, a transfer relay and a transfer repeater relay controlled by a front contact of the transfer relay; said storage relays by their condition of energization defining the train stored therein; pick-up circuits for the storage relays of said second unit each including a front contact of the corresponding storage relay of the third unit, back contacts of the transfer relay of such second unit and front contacts of the transfer repeater relay of said first unit; a pick-up circuit for the transfer relay of said first unit including in multiple front contacts of the storage relays of said first unit and in series back contacts of the storage relays of said second unit; and a stick circuit for the transfer relay of said first unit including in series back contacts of the transfer relay of said second and said third units and its own stick contact; whereby a train description cannot be registered in said first describer unit immediately after it is vacated without having first been registered in either the second or third of said train describer units.

11. In a train describer system, a first station and a second station connected by a line circuit, a train class transmitter at said first station, a

train class transmitter at said second station, a train class receiver at said second station, a train class receiver at said first station, a plurality of train class indicators associated with the receiver at said second station, a plurality of train class indicators associated with the receiver at said first station, means for causing either the transmitter at said first station or the transmitter at said second station to transmit a plurality of series of coded impulses over said line circuit representative of trains of different classes, indicating means at said first station and indicating means at said second station both rendered active when either transmitter sends an incomplete code, means responsive to said series of code impulses for causing either the receiver at said second station or the receiver at said first station to successively actuate the associated train class indicators to distinctively indicate the order and classes of said trains, train controlled means at said second station and at said first station for causing the associated train class indicators to shift their indications from one to another so as to always indicate the class of the next train approaching the associated station, and lock-out means for preventing the transmission of a code in one direction over said line circuit when there is a code being transmitted in the other direction over said line circuit.

12. In a train describer system, a first station and a second station connected by a line circuit, a train class transmitter at said first station, a train class transmitter at said second station, a train class receiver at said second station, a train class receiver at said first station, a plurality of train class indicators associated with the receiver at said second station, a plurality of train class indicators associated with the receiver at said first station, means for causing either the transmitter at said first station or the transmitter at said second station to transmit a plurality of series of coded impulses over said line circuit to the receiver at the other end of said line circuit each representative of a train of a particular class and registered on one of the plurality of train class indicators of such receiver only if a complete code has been transmitted thereto, and indicating means at said first station and indicating means at said second station both rendered active when either transmitter sends an incomplete code.

13. In combination; a first train describer unit at a sending location and a second train describer unit at a receiving location, each of said train describer units including a plurality of storage relays which by their condition of energization in combination describe the class or destination of a particular train moving from said sending location to said receiving location; manually operable means associated with said first train describer unit for closing pick-up circuits for one or more of the storage relays of said first train describer unit to identify a particular train; stick circuits for the storage relays of said first train describer unit; a line circuit connecting said transmitting and said receiving locations; a code transmitter at said sending location for transmitting a plurality of distinctive impulses from said sending location to said receiving location over said line circuit and for opening said stick circuits, the character of said impulses depending on the condition of energization of the storage relays of said first train describer unit; an indicating lamp at said sending location; a track

5 relay at said sending location included in a track
circuit traversed by a train upon its departure
for said receiving location; and an energizing
circuit for said indicating lamp including a con-
10 tact closed when said first train describer unit
has a train description stored therein included in
multiple with a back contact of said track relay,
whereby said indicating lamp is energized if
either said track circuit is occupied or said first
15 train describer has a train description stored
therein to advise the operator not to operate said
manually operable means.

14. In combination; a first train describer unit
for describing a first train; a second train de-
15 scriber unit for describing a second train and a
third train describer unit for describing a third
train; each of said units including a plurality of
storage relays, and a transfer relay; said storage
relays by their condition of energization defin-
20 ing the train stored therein; pick-up circuits for
the storage relays of said second unit each includ-
ing a front contact of the corresponding storage
relay of the third unit, back contacts of the
transfer relay of such second unit and front con-
25 tacts of the transfer relay of said first unit; a
pick-up circuit for the transfer relay of said first
unit including in multiple front contacts of the
storage relays of said first unit and in series back
contacts of the storage relays of said second
30 unit; and two stick circuits for the transfer relay
of said first unit one including in multiple said
front contacts of the storage relays of said first
unit and its own stick contact and the other
including in series back contacts of the transfer
35 relay of said second and said third units and its
own stick contact; whereby a train description
cannot be registered in said first describer unit
immediately after it is vacated without having
first been registered in either the second or third
40 of said train describer units.

15. In combination; a first train describer unit
for describing a first train; a second train de-
scriber unit for describing a second train and a
45 third train describer unit for describing a third
train; each of said units including a plurality of
storage relays, and a transfer relay; said storage
relays by their condition of energization defining
the train description stored therein; pick-up cir-
50 cuits for the storage relays of said second unit
each including a front contact of the correspond-
ing storage relay of the third unit, back contacts
of the transfer relay of such second unit and
front contacts of the transfer relay of said first
55 unit; a pick-up circuit for the transfer relay of
said first unit including in multiple front con-
tacts of the storage relays of said first unit and
in series back contacts of the storage relays of
said second unit; and a stick circuit for the
60 transfer relay of said first unit including in series
back contacts of the transfer relays of said second
and said third units and its own stick contact;
whereby a train description cannot be registered

in said first describer unit immediately after it is
vacated without having first been registered in
either the second or third of said train describer
units.

16. In combination; a first train describer unit 5
for describing a first train; a second train de-
scriber unit for describing a second train and a
third train describer unit for describing a third
train; each of said units including a plurality of
10 storage relays, a transfer relay and a transfer re-
peater relay controlled by a front contact of the
transfer relay; said storage relays by their con-
dition of energization defining the train descrip-
tion stored therein; pick-up circuits for the stor-
15 age relays of said second unit each including a
front contact of the corresponding storage relay
of the third unit, back contacts of the transfer
relay of such second unit and front contacts of
the transfer relay of said first unit; a pick-up
20 circuit for the transfer relay of said first unit
including in multiple front contacts of the stor-
age relays of said first unit and in series back
contacts of the storage relays of said second unit
and a front contact of the repeater transfer relay of
25 said second unit; and a stick circuit for the trans-
fer relay of said first unit including in series back
contacts of the transfer relay of said second and
said third units and its own stick contact;
whereby a train description cannot be registered
30 in said first describer unit immediately after it
is vacated without having first been registered in
either the second or third of said train describer
units.

17. In combination; a first train describer unit 35
for describing a first train; a second train de-
scriber unit for describing a second train and a
third train describer unit for describing a third
train; each of said units including a plurality
of storage relays, and a transfer relay; said stor-
40 age relays by their condition of energization defin-
ing the train description stored therein; pick-
up circuits for the storage relays of said second
unit each including a front contact of the corre-
sponding storage relay of the third unit, back con-
45 tacts of the transfer relay of such second unit and
front contacts of the transfer relay of said first
unit; a pick-up circuit for the transfer relay of
said first unit including in multiple front contacts
of the storage relays of said first unit and in
50 series back contacts of the storage relays of said
second unit; a stick circuit for the transfer relay
of said first unit including in series back contacts
of the transfer relays of said second and said third
units and its own stick contact; whereby a train
55 description cannot be registered in said first de-
scriber unit immediately after it is vacated with-
out having first been registered in either the sec-
ond or third of said train describer units, and
manually controlled means for vacating said first
unit.

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