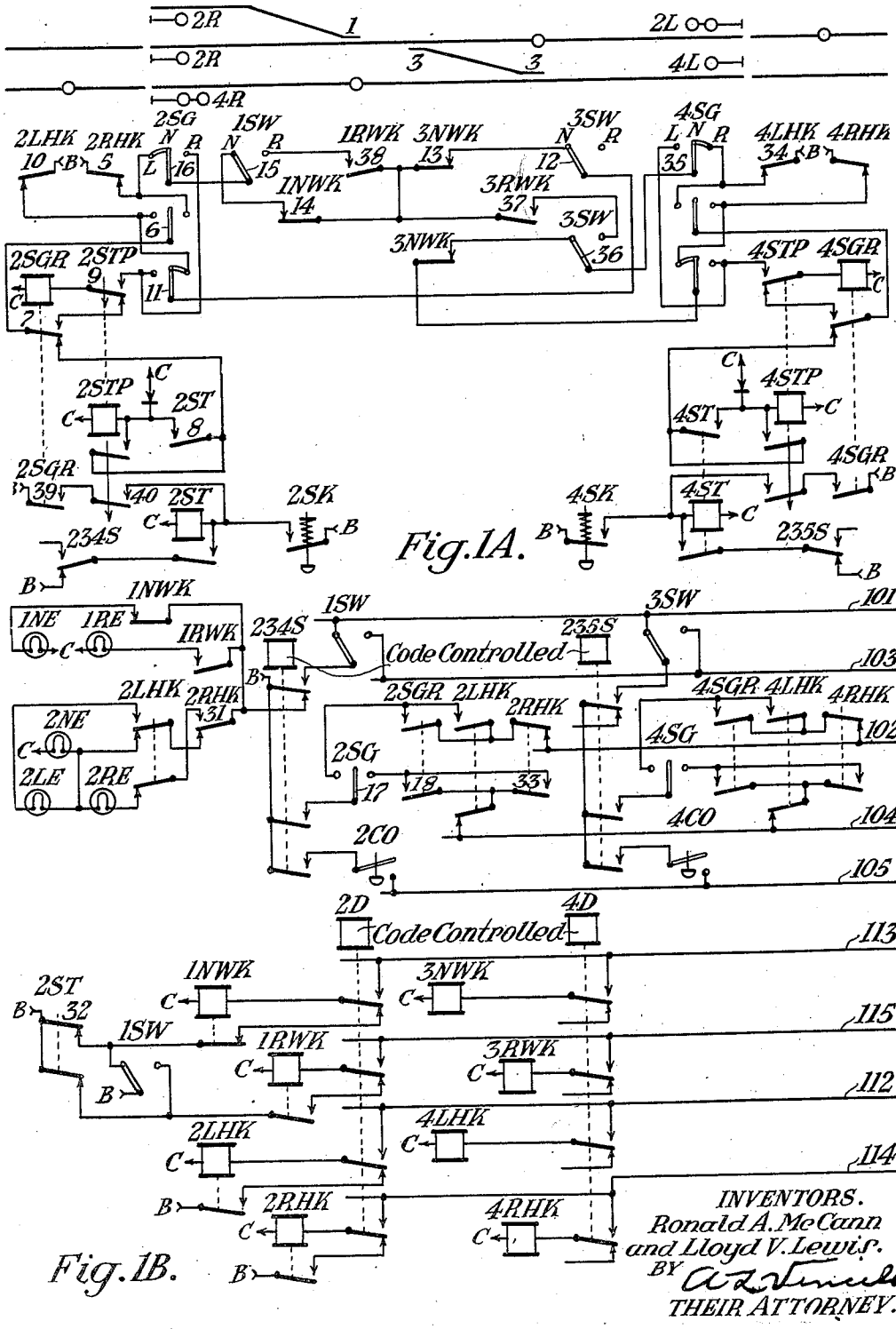
March 7, 1944. R. A. McCANN ET AL 2,343,784

CENTRALIZED TRAFFIC CONTROLLING SYSTEM

Filed July 8, 1942 3 Sheets-Sheet 1



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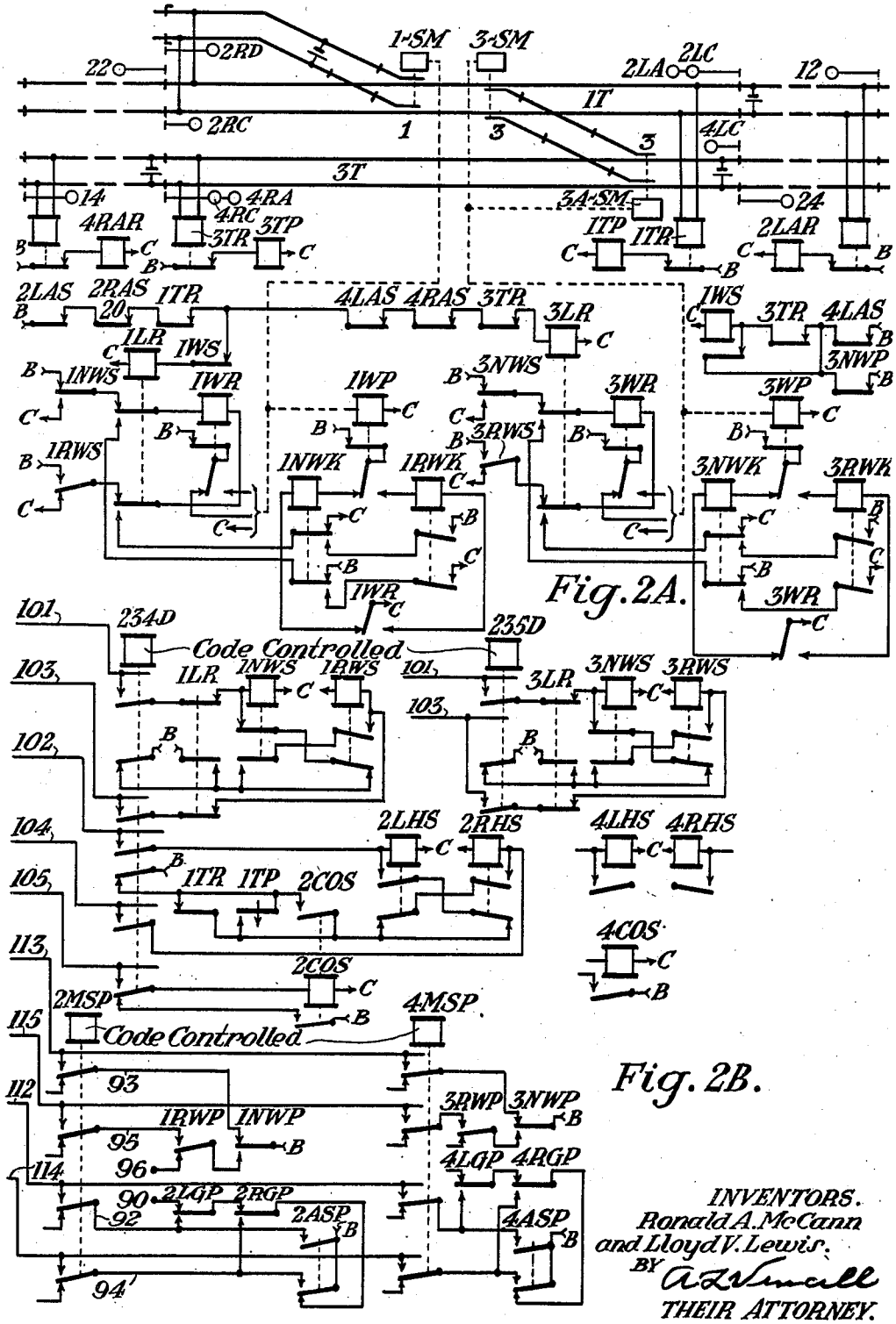
CENTRALIZED TRAFFIC CONTROLLING SYSTEM

Filed July 8, 1942 3 Sheets-Sheet 2



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CENTRALIZED TRAFFIC CONTROLLING SYSTEM

Filed July 8, 1942 3 Sheets-Sheet 3

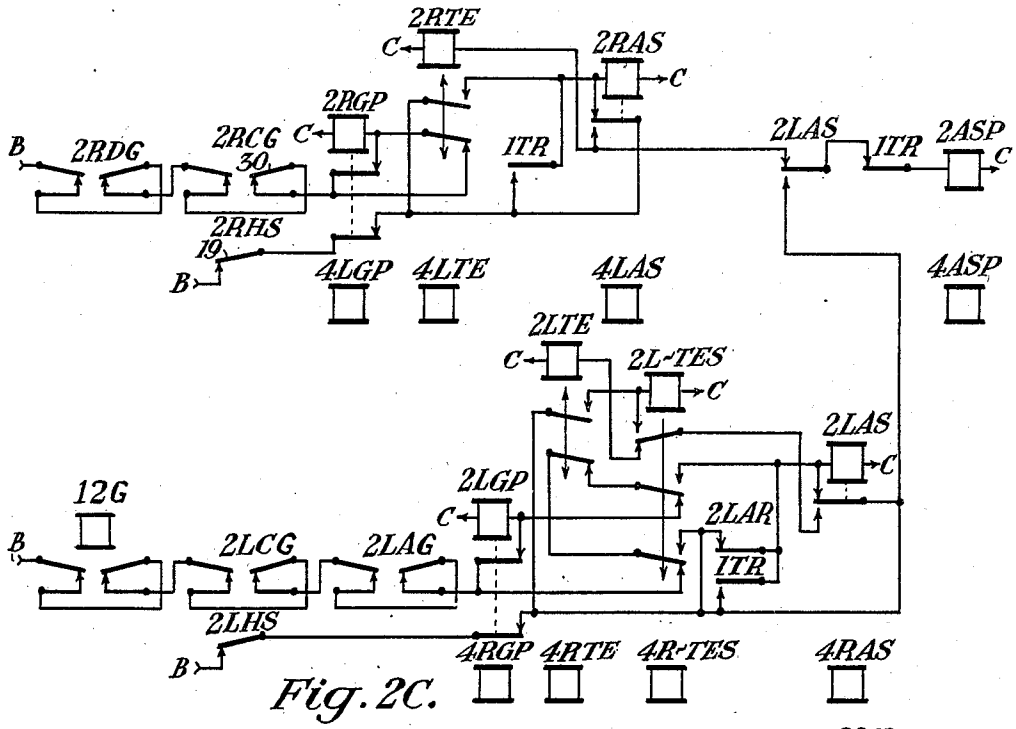

Fig. 2C.

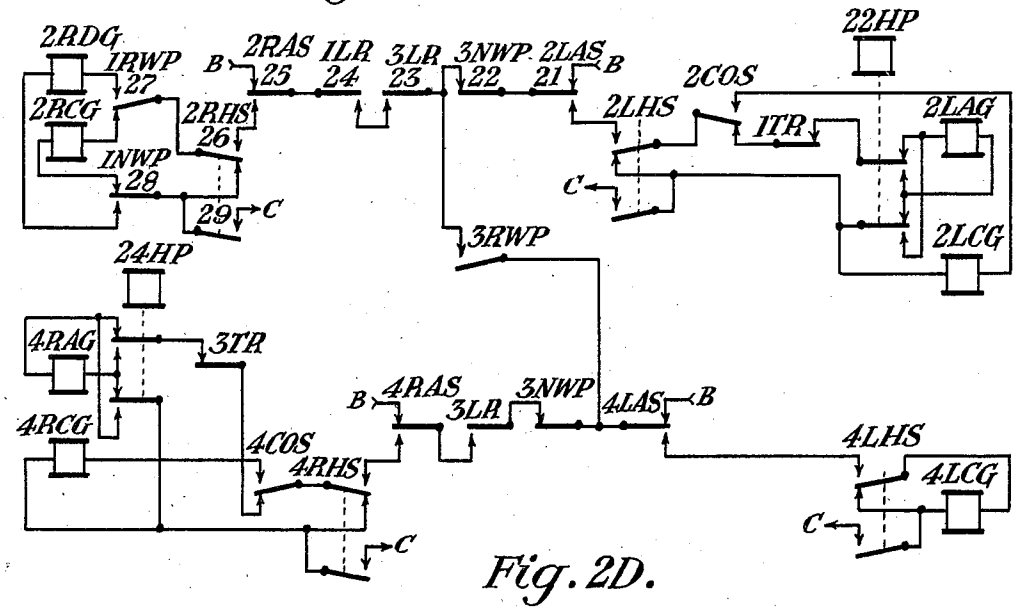

Fig. 2D.

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CENTRALIZED TRAFFIC CONTROLLING SYSTEM

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Application July 8, 1942, Serial No. 450,100

14 Claims. (Cl. 246—5)

This invention relates to centralized traffic controlling systems for railways, and more particularly to railway traffic controlling apparatus for use in remote control systems for controlling a track layout including electrically interlocked track switches and railway signals from a central office.

Our invention contemplates the use of a selective communication system, preferably of the code type such, for example, as is shown in Letters Patent of the United States No. 2,229,249, granted January 21, 1941, to Lloyd V. Lewis, for Remote control systems, for the purpose of effecting the manual control of the switches and signals from the control office and for indicating their condition at the office.

One object of our invention is the provision of improved means for insuring that a series of controls transmitted by a communication system of this character for performing a related sequence of operations in a given order, such as for operating track switches to set up a desired route and then clearing a signal governing traffic movements over the route, will be transmitted in the required order regardless of the relative superiority of the different codes. It is to be understood that for the purpose of preventing interference, the communication system is so arranged that the codes are ordinarily transmitted one at a time in a given order of code superiority, when several are stored for transmission. In respect to this feature, our invention is an improvement upon the system shown in Fig. 11 of the above-mentioned patent.

Our invention also contemplates the use of circuits in the field for electrically interlocking the track switches and signals, employing switch locking relays which must be energized to permit operation of the track switches and must occupy their deenergized positions in order to permit a signal governing traffic movements over the respective track switches to be cleared. Such an arrangement is illustrated, for example, by the relays LS of Letters Patent of the United States No. 2,141,074, granted December 20, 1938, to Henry S. Young for Railway traffic controlling apparatus.

Heretofore it has been the practice to provide route relays in the field, in addition to the code-controlled signal control relays, such, for example, as the route relays LH and RH of this Young patent, for the control of such locking relays, and to so control the route relays by the track switches as to insure that the switches of a route being set up will not become locked until all have assumed the required positions.

An object of our invention is to provide suitable circuits at the control office for preventing the transmission of codes for energizing the signal control relays in the field, corresponding to the code-controlled relays LHS and RHS of the Young patent, except when conditions are proper, so that these code-controlled relays may be used to release the switch locking relays and for clearing the signals in place of the route relays, thereby eliminating the latter and the route circuits therefor with a resultant decrease in cost and increase in reliability of the system.

Other objects, purposes and features of our invention will be pointed out as the description proceeds.

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

Referring to the accompanying drawings, Figs. 1A and 1B, taken together, show circuits and apparatus located at the control office and embodying our invention as applied to a typical track layout corresponding to the miniature track diagram at the top of Fig. 1A, this apparatus comprising a modification of the office equipment of the system of the above-mentioned Lewis patent. More particularly, the circuits of Fig. 1A comprise a route circuit network for governing the transmission of codes for clearing the signals, replacing Fig. 11 of the Lewis patent, and Fig. 1B shows circuits for two office storage units, each corresponding to Fig. 5 of the Lewis patent except as modified to conform with the requirements of our invention. Figs. 2A to 2D, inclusive, show the corresponding field station apparatus, in which Fig. 2A shows the track plan for a typical layout chosen to illustrate our invention and comprising a stretch of track including a single switch 1 and a crossover 3 over which traffic movements are governed by the signals 2RC, 4LC, etc., and also shows the circuits for the usual track and approach relays and for controlling, indicating and locking the power switch machines SM for operating the track switches. Fig. 2B shows typical circuits for two station storage units, each corresponding to the one shown in Figs. 7 and 8 of the Lewis patent, but arranged in accordance with our invention. Fig. 2C shows typical circuits for approach locking relays LAS and RAS controlled by the signals and by the signal control relays, while Fig. 2D shows the signal circuit network over which the signal mechanisms G are controlled.

Similar reference characters refer to similar parts in each of the several views.

Referring to Fig. 1B, it is to be understood that each office storage unit is adapted to control and indicate one track switch and a related group of signals at a selected station and to also indicate two track circuits, and that as shown, a unit having the code number 234 controls and indicates switch 1 and signals 2, and that a second unit having the code number 235 controls and indicates the crossover 3 and signals 4, the circuits and relays by which the track circuits in the field control the lamps of the track diagram of Fig. 1A being omitted. It will be understood that except for the modifications described herein the communication system operates as described in the Lewis patent, but in order to make it unnecessary to consider the coding operations as described in the patent in detail the various communication channels which the codes provide are indicated herein as individual wires, numbered to correspond with the wires over which the code elements are delivered to or received from the coding apparatus in Fig. 5 of the patent, but as here shown, extending directly to the corresponding station devices in Fig. 2B, in order to enable the connection between corresponding office and station devices to be more readily visualized. Actually, of course, the control elements are transmitted one at a time over a single line and then stored for simultaneous delivery to the selected stick relays at the end of the code. Relay 2ST is a starting relay like relay 234 of the patent, operated by pressing a starting button 2SK to initiate a control code thereby temporarily energizing a selector relay 234S at the office and the corresponding delivery relay 234D in the field. It will be understood that the effect of the transmission of code 234 is the same as if temporary connections were established directly over wires 101 to 105 to govern the stick relays shown connected to these wires in Fig. 2B, over contacts of relay 234D, in accordance with the positions of the switch and signal levers 1SW and 2SG and of the call-on button 2CO, of the corresponding office panel in Fig. 1A. Similarly, it is to be understood that the starting relay 4ST is operated by pressing button 4SK and initiates a different code to temporarily energize relays 235S and 235D to govern the stick relays of the second unit in Fig. 1B in accordance with the positions of levers 3SW and 4SG and button 4CO, of a second office panel in Fig. 1A.

The selective energization of relay 2MSP or 4MSP, controlling the energization of wires 112 to 115, inclusive, corresponds to the transmission of an indication code. Each such code is initiated following a control code or upon a change in position of an indicating relay in the field having an indication to transmit, resulting in the energization of relay 2MSP or 4MSP of the station storage unit, and also in the temporary energization of the associated delivery relay 2D or 4D of the corresponding office storage unit. Each indication code positions the switch and signal indication relays NWK, RWK, LHK and RHK shown in the lower portion of Fig. 1B, in accordance with the positions of the corresponding switch and signal repeating relays NWP, RWP, LGP and RGP in the field, these repeating relays being controlled as shown in Figs. 2A and 2C, respectively. The code starting circuits in the field involve connections over wires 90 and 92 to 96, as described in the Lewis patent in connection with Fig. 7 of the patent. It will be understood that the indication lamps shown at the left in Fig. 1B are those for levers 1SW and 2SG, and that similar lamps, not shown, are to be provided for the levers 3SW and 4SG of the second unit.

In Fig. 2A, the switch control, locking and indication circuits and likewise the designations of the various relays are generally similar to those of Fig. 1A of the Young patent as modified for code control by the stick relays of Young's Fig. 2A, likewise the signal circuits of Fig. 2D correspond generally to Young's Fig. 1E, so that a detailed explanation of those circuits in the present application is deemed unnecessary.

The indication circuits as shown herein differ in several respects from those of the above-mentioned Lewis patent as will now be pointed out. The signal indications use only the two channels 112 and 114, relay 2LHK or 2RHK being energized by the code to light the corresponding signal clear indication lamp 2LE or 2RE when one wire, 112 or 114, is energized, while these relays are released by the code to cause lamp 2NE to become lighted, when neither wire 112 or 114 is energized. A fourth indication is provided over the same channels to indicate the operation of time locking devices in the field, by energizing both wires, in which case relays 2LHK and 2RHK are both energized and all three signal indication lamps are extinguished. When a signal is manually put to stop, the energization of the associated approach locking relay 2LAS or 2RAS of Fig. 2C will ordinarily be delayed for a time interval. Under this condition an indicating relay 2ASP is picked up, to effect the transmission of the fourth indication referred to thereby extinguishing lamp 2LE or 2RE and delaying the lighting of lamp 2NE until the corresponding approach locking relay becomes energized and relay 2ASP releases. Relay 4ASP functions similarly, and lamps NE thus serve as lock indication lamps, since the switches are non-responsive to code control except when the lamps NE for the signals governing traffic movements over the switches are lighted. A further feature is that all the lamps of a panel are extinguished momentarily when a code is being transmitted from the corresponding storage unit, due to the control of the lamp circuits over a back contact of the associated selector relay, such as relay 234S.

The approach and time locking circuits of Fig. 2C correspond generally to those of Fig. 1D of the above-mentioned Young patent, and in certain details, to those of Letters Patent of the United States No. 2,198,712, granted April 30, 1940, to H. C. Vantassel, for Railway traffic controlling apparatus, but differ in that back contacts of the code-controlled signal relays LHS and RHS have been substituted for the contacts of Young's route relays LH and RH. The details of operation of the approach and time locking circuits may be ascertained from these patents, but for an understanding of our invention it is believed that it will suffice to point out that when a slow speed signal 2R or 4L is manually put to stop the corresponding approach locking relay becomes energized after a relatively short time interval measured by the heating time of a thermal relay 2RTE or 4LTE, but in the case of one governing traffic in the normal direction of movement, 2L or 4R, the time interval is longer, being measured by the operation of relay 2LTE or

4RTE through a complete heating and cooling cycle under the control of a stick relay TES. The circuit for energizing the indicating relay 2ASP will be readily apparent from Fig. 2C, as it comprises a branch of the circuit for relay 2RTE or 2LTE, depending upon which of the two approach locking relays for the signals 2 is released, and also includes a front contact of the track relay 1TR so that relay 2ASP is not operated when a train enters section 1T to reenergize the approach locking relay automatically.

Referring now to Fig. 1A, the circuits connecting the contacts of the two signal levers SG constitute a route circuit network comprising a route circuit for each route each of which includes corresponding switch lever and indication relay contacts and a back contact of the opposing signal indication relay, as well as a signal lever contact which is open when the lever occupies a position for clearing the opposing signal. The purpose of these circuits is to govern the signal clearing relays SGR and the code storing relays STP provided in accordance with our invention, the general plan of operation of this apparatus being as follows:

In Fig. 1B, each relay SGR, jointly with the signal indication relays, controls the connection of the associated signal lever contacts to wires 102 and 104 in such manner that a signal clear code cannot be transmitted when the time locking indication is in effect, and at other times not unless relay SGR is picked up or the signal already indicates clear. With a signal lever SG in position L or R, the operation of the corresponding starting relay ST by pressing its button SK picks up the associated storing relay STP, and relay STP connects the associated relay SGR to the route circuit network, relay SGR however remaining released until the route is completely set up and indicated.

After a switch lever has been moved to a new position, the next following operation of the starting relay ST associated therewith releases the switch indication relay corresponding to the old position of the switch, thereby preventing the relay SGR for the signal to be cleared from becoming energized until a new route is set up. This novel arrangement attains the desired result that the transmission of a code for changing the position of the switch prevents the closing of the old route circuit if the switch lever is subsequently merely returned to its former position without the transmission of another code; in other words, the switch lever position must correspond with the switch code last transmitted if the signal clearing relay SGR is to be energized.

Each storing relay STP when picked up remains energized until the associated relay SGR becomes energized, as occurs when the route is fully indicated. When relay SGR picks up, a circuit is closed momentarily to pick up the associated starting relay ST to initiate a new code; relay STP then releases, disconnecting relay SGR from its route circuit and establishing a holding circuit therefor, relay SGR releasing upon receipt of the corresponding signal clear indication or upon restoration of the signal lever SG to normal.

The operation of the apparatus of our invention under different assumed conditions will now be described in detail.

Assuming first that the apparatus is in the normal condition, as shown, and that the operator moves lever 2SG to its right-hand position R, and then presses the starting button 2SK, with the object of clearing signal 2RC for a train movement from left to right over switch 1 normal and crossover 3 normal.

The closing of the contact of button 2SK completes a circuit from one terminal B of the local source of current through relay 2ST to the other terminal C of the same source, and relay 2ST picks up to initiate the transmission of the code for selectively energizing relays 234S and 234D, releasing when relay 234S picks up. Relay 2ST also completes a circuit which may be traced in Fig. 1A from terminal B at back contact 5 of relay 2RHK, right-hand contact 6 of lever 2SG, back contact 7 of relay 2SGR, front contact 8 of relay 2ST through relay 2STP to terminal C. Relay 2STP picks up and since the desired route is already set up, the route circuit is complete and relay 2SGR becomes energized at once, that is to say, at the beginning of the code being transmitted, before relay 234S picks up. The route circuit for relay 2SGR extends in this case from terminal B at back contact 10 of relay 2LHK, right-hand contact 11 of lever 2SG, normal contact 12 of lever 3SW, front contacts 13 and 14 of relays 3NWK and 1NWK, normal contact 15 of lever 1SW, right-hand contact 16 of lever 2SG, front contact 9 of relay 2STP, relay 2SGR to terminal C. Relay 2SGR picks up, and by opening its back contact 7, deenergizes relay 2STP, and relay 2STP releases to disconnect relay 2SGR from the route circuit network, completing a holding circuit therefor extending to terminal B over contacts 5, 6, 7 and 9.

When the code-controlled relays 234S and 234D pick up in response to the code, the normal switch control relay 1NWS is held energized over channel 101 and the signal control relay 2RHS is picked up over channel 104, which is now closed, being connected to terminal B at the front contacts of relay 234S over right-hand contact 17 of lever 2SG and front contact 18 of relay 2SGR.

In Fig. 2C, relay 2RHS opens its back contact 19, releasing relay 2RAS, and in Fig. 2A, relay 2RAS opens its contact 20, releasing relays 1LR and 3LR to lock the switches of the route. In Fig. 2B, the release of the relays 1LR and 3LR disconnects the relays NWS and RWS from the wires over which they are operated by code and locks the relays NWS energized. In the signal circuit network of Fig. 2D, the release of relays 1LR and 3LR completes a circuit for the signal mechanism 2RCG which may be traced from terminal B at front contact 21 of relay 2LAS, over contacts 22 to 29, inclusive, of various relays as indicated on the drawings, through mechanism 2RCG to terminal C. Mechanism 2RCG becomes energized to cause signal RC to indicate proceed at slow speed, and in Fig. 2C, opens contact 30, releasing relay 2RGP. Terminal B of the local source of current is thereby connected to wire 94, in Fig. 2B, at the back contact of relay 2RGP, completing a starting circuit as explained in the Lewis patent to cause the initiation of an indication code for selectively energizing relays 2MSP and 2D. When these relays pick up in response to this code, relay 1NWK is held energized over channel 113 and relay 2RHK picks up over wire 114. In Fig. 1B, contact 31 of relay 2RHK picks up to extinguish lamp 2NE and to light lamp 2RE, while in Fig. 1A contact 5 opens to release relay 2SGR. In Fig. 1B, contact 33 closes to maintain the connection from right-hand contact 17 of lever 2SG to wire 104 after relay 2SGR releases. It follows that any repetition of code 234, due to re-operation of the starting button 2SK, will result in no change in conditions in the

field, as long as lever 2SG remains in its right-hand position and relay 2RHK remains picked up, and that the signal cannot be put to stop by the operation of any lever other than its control lever.

It will be noted that the system includes no means for preventing the sending of switch control codes for controlling switches which are locked, this being unnecessary since the switch control relays NWS and RWS are rendered non-responsive to the code control by the release of the locking relays LR.

Assuming now that the signal is put to stop by a train entering section 1T, relay 2RGP will be reenergized initiating an indication code to deenergize relay 2RHK, extinguishing lamp 2RE and lighting lamp 2NE. The operator will then restore lever 2SG to normal, whereupon all the apparatus will occupy its normal condition as shown.

In the foregoing example only one code was transmitted by the office coding unit controlling switch 1 and signals 2 for the reason that the desired route was already set up when button 2SK was operated. The next example involved a change in route, in which case two successive codes are transmitted by the same coding unit in response to a single operation of the starting button.

Assuming that the apparatus is in its normal condition, as shown, and the operator moves levers 1SW, 3SW and 2SG, each to its R position, and then presses buttons 2SK and 4SK, to clear signal 2RD for a train movement from left to right over switch 1 reversed and crossover 3 reversed. Relays 2ST and 4ST become energized, and when relay 2ST picks up, relay 2STP becomes energized over contact 8, and relay 1NWK releases due to the opening of contact 32. When relay 4ST picks up, relay 3NWK releases, due to the opening of a similar circuit, not shown, but relay 4STP does not become energized because lever 4SG is in its normal position N, as shown. Relay 2SGR is now connected to the route circuit network over front contact 8, but cannot be picked up at this time because the route circuits for both the new and the old routes are open at the indication relay contacts and cannot be closed by any further manipulation of the switch levers as already explained. This is also the case in the first example given above.

Code 234 takes precedence over code 235 when both starting buttons are operated, and will be transmitted first, but both codes will include stop signal control elements, wire 103 only being energized. It will be noted that if either code included an element for clearing the signal as in the first example, the switch locking relays would be released by the operation of the signal control relay, to prevent the establishment of the desired route. This, however, does not occur and in the field, relays 1NWS and 3NWS release and relays 1RWS and 3RWS become energized, operating the track switches to reverse in the usual manner thereby initiating indication codes to pick up the indication relays 1RWK and 3RWK, lighting the reverse indication lamps such as 1RE as each switch completes its operation.

The route circuit for the route defined by the position of the switch levers now becomes closed. This may be traced from terminal B at back contact 34 of relay 4LHK, normal contact 35 of lever 4SG, reverse contact 36 of lever 3SW, front contacts 37 and 38 of relays 3RWK and 1RWK, reverse contact 15 of lever 1SW, right-hand contact 16 of lever 2SG, front contact 9 of relay 2STP, relay 2SGR to terminal C. Relay 2SGR therefore picks up when the route is indicated complete and the opposing signal indicates stop, deenergizing relay 2STP.

Relay 2STP is made slow to release, as shown, and before it releases a circuit is completed momentarily from terminal B over front contacts 39 and 40 of relays 2SGR and 2STP to pick up relay 2ST, thereby initiating a second code No. 234, which code, as in the first example given, will include an element for clearing the signal, in this case signal 2RD.

The remaining operations are generally similar to those already described in the first example, and it is believed they will be readily understood without further description.

Since the circuits are generally symmetrical for opposite directions of traffic movement, it will be apparent that the proper signal would have been cleared by the first code transmitted, as in the first example given, in the case of a movement of lever 2SG to the left, or of lever 4SG to the left or right, with no change in route, while in any of these instances if one or more switch levers had been moved to change the route, the signal clearing code would have been stored as in the second example given until the switch operating codes had been transmitted, and then would have been transmitted automatically upon receipt of the proper indications at the office showing that the route designated by the last switch codes to be transmitted had been fully set up. In other words, the signal clearing code is the last of a series of control codes to be transmitted, regardless of the normal order of transmission of the different codes. It will also be apparent that the apparatus may be operated properly without taking advantage of the code storing feature; that is, in setting up a new route, the operator may reverse the signal lever 2SG after the corresponding starting relay 2ST has released, assuming that relay to have been operated to transmit a code for operating switch 1, and he may then operate the starting button to clear the signal, after the route is fully set up, as in the first example.

Although we have herein shown and described only one form of railway traffic controlling apparatus embodying our invention, it will be understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of our invention.

Having thus described our invention, what we claim is:

1. In combination with a code type communication system connecting an office and a station, a railway track switch and a signal governing traffic movements over said switch located at said station, a normal and a reverse indication relay at the office for indicating the position of the switch, means for initiating the transmission of an indication code by the communication system in response to the operation of the track switch to normal or reverse to energize the corresponding normal or reverse indication relay, a switch lever, a signal lever, and a starting button at the office, means for initiating the transmission of a control code by the communication system in response to an operation of said starting button to control the switch and signal in accordance with the positions of their respective levers, such code being effective to clear

the signal only if the normal or reverse indication relay is energized and the switch lever occupies a corresponding normal or reverse position when the code is initiated, and means for deenergizing the normal or reverse indication relay upon the initiation of a control code provided the switch lever has been moved to a position out of correspondence with the position of the switch indicated by that relay.

2. In combination with a code type communication system connecting an office and a station, a railway track switch and a signal governing traffic movements over said switch located at said station, a normal and a reverse indication relay at the office for indicating the position of the switch, means for initiating the transmission of an indication code by the communication system in response to the operation of the track switch to normal or reverse to energize the corresponding normal or reverse indication relay, a switch lever, a signal lever, and a starting button at the office, means for initiating the transmission of a control code by the communication system in response to an operation of said starting button to control the switch and signal in accordance with the positions of their respective levers, such code being effective to clear the signal only if the normal or reverse indication relay is energized and the switch lever occupies a corresponding normal or reverse position when the starting button is operated, and means for deenergizing the normal or reverse indication relay in response to the operation of said starting button provided the switch lever then occupies a position out of correspondence with the position of the switch indicated by that relay.

3. In combination with a railway track switch, a normal and a reverse indication relay for indicating the position of the switch, an indication code transmitter adapted to be initiated in response to the operation of the track switch to normal or reverse to transmit a code to energize the corresponding normal or reverse indication relay; a switch lever and a manually controllable starting relay, a control code transmitter adapted to be initiated when said starting relay is picked up to transmit a control code for operating the track switch to normal or reverse in accordance with the position of said switch lever, and stick circuits for said normal and reverse indication relays including respectively a normal and a reverse contact of said switch lever, each such contact being bridged by a back contact of said starting relay.

4. In combination with a railway track switch, a normal and a reverse indication relay for indicating the position of the switch, an indication code transmitter adapted to be initiated in response to the operation of the track switch to normal or reverse to transmit a code to energize the corresponding normal or reverse indication relay; a switch lever and a starting button, a control code transmitter adapted to be initiated when said starting button is operated to transmit a control code to operate the track switch to normal or reverse in accordance with the position of said switch lever, and a stick circuit for each indication relay rendered effective when such relay is picked up by an indication code to hold it energized only until a code for operating the track switch to its opposite position is transmitted by said control code transmitter.

5. In combination with a railway track switch and a signal governing traffic movements over the switch, a normal and a reverse indication relay for indicating the position of the switch, an indication code transmitter adapted to be initiated in response to the operation of the track switch to normal or reverse to transmit a code to energize the corresponding normal or reverse indication relay, a switch lever, a signal lever, and a manually controllable starting relay, a control code transmitter adapted to be initiated when said starting relay is picked up to transmit a control code for operating the track switch to normal or reverse and to also control the signal to its stop or clear position in accordance with the positions of said levers, stick circuits for said normal and reverse indication relays including respectively a normal and a reverse contact of said switch lever, each such contact being bridged by a back contact of said starting relay, and circuit means rendering a control code transmitted when said signal lever is reversed ineffective to clear the signal unless transmitted when said normal or reverse indication relay is picked up and the switch lever occupies the corresponding normal or reverse position.

6. In combination with a railway track switch and a signal governing traffic movements over the switch, a normal and a reverse indication relay for indicating the position of the switch, an indication code transmitter adapted to be initiated in response to the operation of the track switch to normal or reverse to transmit a code to energize the corresponding normal or reverse indication relay, a switch lever, a signal lever, and a starting button, a control code transmitter adapted to be initiated when said starting button is operated to transmit a control code for operating the track switch to normal or reverse and to also control the signal to its stop or clear position in accordance with the positions of said levers, a stick circuit for each indication relay rendered effective when such relay is picked up by an indication code to hold it energized only until a control code for operating the track switch to its opposite position is initiated, circuit means rendering a control code transmitted when said signal lever is reversed ineffective to clear the signal if transmitted when the indication relays are released, and means rendered effective upon the subsequent energization of that normal or reverse indication relay which when energized indicates the response of the track switch to such control code, to automatically initiate the transmission of a second control code for clearing the signal.

7. In combination with a railway track switch and a signal governing traffic movements over the switch, a switch lever, a signal lever, a manually controllable starting relay, a storing relay, and a signal clearing relay, a code transmitter adapted to be initiated in response to the operation of said starting relay to transmit control codes including elements for controlling both the switch and the signal, effective when said signal clearing relay is deenergized to transmit a first code to operate the track switch to normal or reverse in accordance with the position of said switch lever and when said signal clearing relay is energized to transmit a second code to control said signal to its stop or clear position according to the position of said signal lever, means for energizing said storing relay when said starting relay is operated provided said signal clearing relay is denergized, and for maintaining said storing relay energized until said signal clearing relay becomes energized, indication means con-

trolled by the track switch effective to energize said signal clearing relay if said storing relay is energized and the track switch is in a position in agreement with that of said switch lever, and means effective to reenergize said starting relay provided it is deenergized when said signal clearing relay becomes energized to initiate the transmission of said second code.

8. In combination, a railway signal for governing traffic movements over a route including one or more track switches, a signal lever, a signal clearing relay, a code transmitter adapted when initiated to transmit control codes including elements for controlling said signal to its clear or stop position in accordance with the position of said lever, switch indication means for indicating the position of the switches, a signal indication relay for indicating the condition of said signal, circuit means controlled jointly by the signal clearing relay and signal indication relay for preventing the inclusion of elements for clearing the signal in codes transmitted when said signal lever is reversed unless said signal clearing relay is energized or said signal indication relay indicates that the signal is already in its clear position, and means for energizing said signal clearing relay only when said switch indication means indicates that said track switches occupy the positions required to establish said route.

9. In combination, a railway signal governing traffic movements over routes including one or more track switches, switch levers for controlling said switches to establish the different traffic routes over which such signal governs traffic movements, indication means for indicating the positions of the switches and signals, a signal lever, a signal clearing relay, a code transmitter adapted when initiated to transmit control codes including elements for controlling said signal to its clear or stop position in accordance with the position of said signal lever, circuit means for preventing the inclusion of elements for clearing the signal in codes transmitted when said signal lever is reversed unless said signal clearing relay is energized or the signal is indicated clear by said indication means, and means for energizing said signal clearing relay effective only when the position of each track switch indicated by said indication means corresponds with the position of the switch lever for controlling that switch.

10. In combination, a railway signal governing traffic movements over routes including one or more track switches, switch levers for controlling said switches to establish the different traffic routes over which such signal governs traffic movements, indication means for indicating the positions of the switches and signals, a signal lever, a signal clearing relay, a code transmitter adapted when initiated to transmit control codes including elements for controlling said signal to its clear or stop position in accordance with the position of said signal lever, circuit means for preventing the inclusion of elements for clearing the signal in codes transmitted when said signal lever is reversed unless said signal clearing relay is energized or the signal is indicated clear by said indication means, means for picking up said signal clearing relay effective only when the position of each track switch indicated by said indication means corresponds with the position of the switch lever for controlling that switch, and means for holding said signaling relay energized following the transmission of a control code governed thereby independently of the position of said switch levers but only until the signal is indicated clear by said indication means in response to such code.

11. In combination, a railway signal for governing traffic movements over routes including one or more track switches, a signal lever, a signal clearing relay, a code transmitter adapted when initiated to transmit control codes including elements for controlling the signal to its clear and stop positions, switch indication means controlled by the track switches for indicating when the route governed by the signal is available, signal indication means at the remote point for indicating when the signal has been cleared, two circuits for conditioning said code transmitter to transmit a code for clearing the signal each including a reverse contact of the signal lever, one including a front contact of the signal clearing relay and the other including a contact closed when the signal is indicated clear by the signal indication means, a pick-up circuit for the signal clearing relay closed only when an available route is indicated by said switch indication means, and a holding circuit for the signal clearing relay closed when said relay picks up until the signal is indicated clear by said signal indication means.

12. In combination, a track switch and a railway signal for governing the movement of traffic over the switch, a code-controlled signal stick relay for controlling the signal, code-controlled switch stick relays for controlling the switch, a normally energized switch locking relay, switch and signal levers, a code transmitter adapted when initiated to transmit control codes including elements for controlling the switch and signal stick relays in accordance with the positions of said levers, said switch control elements being effective to control the switch stick relays only when the switch locking relay is energized, circuit means for releasing said switch locking relay when the signal stick relay becomes energized, indication means for indicating the positions of the switch and signal, means preventing the transmission of elements for clearing the signal in the transmitted code unless the switch indication means indicates that the switch position corresponds with that of its lever or the signal indication means indicates that the signal has been cleared, and means for clearing the signal rendered effective upon the release of the switch locking relay when said signal stick relay becomes energized.

13. In combination, a railway signal for governing traffic movements over a route including one or more track switches, a code-controlled signal stick relay for controlling the signal, a code transmitter adapted when initiated to transmit control codes including elements for selectively picking up or releasing said signal stick relay, a normally energized locking relay for each switch effective when deenergized to prevent operation of the switch, circuit means for releasing the locking relay for each switch of said route when said signal stick relay becomes energized, switch indication means for indicating the positions of said switches, signal indication means for indicating the condition of said signal, means preventing said code element for picking up said signal stick relay from being included in a code being transmitted unless the switch indication means indicates that said route is established or said signal indication means indicates that the signal has already been cleared, and means for clearing the signal rendered effective upon the release of the

switch locking relay when said signal stick relay becomes energized in response to the transmission of a code including such code element.

14. In a centralized traffic control system for railroads, a code transmitter adapted when initiated to transmit control codes from an office to a remote station to operate a railway signal at said station, indication means for indicating at said office when a route governed by said signal is available, a signal lever having a proceed and a stop position, a starting button, a signal clearing relay, a storing relay, a route circuit network including a route circuit portion closed when a route governed by said signal is fully established, a starting relay responsive to the operation of said starting button effective when energized to initiate the operation of said code transmitter, said starting relay being also effective if energized when the signal lever is in its proceed position to energize said storing relay, means effective when said storing relay is energized for connecting said signal clearing relay to said route circuit network to effect its energization if said route circuit portion is closed, means effective if said signal clearing relay becomes energized to release said storing relay and to render the transmitted code effective to clear the signal, and a holding circuit for said signal clearing relay closed upon the release of said storing relay for maintaining said signal clearing relay energized irrespective of the condition of said route circuit portion, said holding circuit including a contact which opens when said signal lever is restored to its stop position.

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