SINGLE TRACK RAILWAY SIGNAL SYSTEMS USING NORMALLY DEENERGIZED CODED TRACK CIRCUITS

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Application September 6, 1951, Serial No. 245,284

11 Claims. (Cl. 246—3)

My invention relates to single track railway signal systems using normally deenergized coded track circuits, and more particularly to such a signal system wherein the direction of traffic is established and the signals are controlled through a centralized traffic control or other remote control system.

An object of my invention is the provision of an improved single track two direction railway signal system using normally deenergized coded track circuits.

Another object of my invention is the provision of a single track two direction railway signal system using normally deenergized coded track circuits which enable the direction of traffic to be established and the signals to be controlled by means of a simplified or modified form of centralized traffic control system.

A further object of my invention is the provision of a railway signal system of the type here involved wherein the control and indication codes of selected signals associated with a field station of a centralized traffic control system are transmitted through coded track circuits.

A more specific feature of my invention is the provision of a railway signal system of the type contemplated, incorporating novel means for control and indication of a passing sidings leaving signal and a take siding signal from a field station of a centralized traffic control system through coded track circuits.

Other objects, features and advantages of my invention will appear as the specification progresses.

The foregoing objects, features and advantages of my invention are attained by the provision of a single track two direction signal system having normally deenergized reversible coded track circuits arranged to permit the cascading of a control from one track circuit to the next. A stretch of a single track two direction signal block which preferably includes a given end of a passing siding, the main track along this passing siding and the stretch of single track to the near end of the next passing siding. This block is formed in track sections which are provided with coded track circuits that are arranged in such a manner as to enable the direction of traffic through the block to be established by a modified or so-called "single end control" form of centralized traffic control system. That is, the given end of the passing siding is provided with the conventional group of four wayside signals and a power switch operating mechanism of an associated field station of a centralized traffic control system. The other end of this passing siding is not provided with the conventional signals but is provided with a spring switch mechanism, a take siding indicator or signal and a sidings leaving signal. The spring switch mechanism here contemplated is of the type wherein the switch points are positively locked in their normal position for facing point moves over the switch and which become automatically unlocked when a train travels through the switch. Also, this switch mechanism includes a lever whereby the switch can be thrown to its normal and reverse positions manually. These spring switch mechanisms are well known in the art and in wide commercial use. One such type of spring switch mechanism is shown and described in Letters Patent of the United States No. 1,976,827, granted October 16, 1934, to Herbert L. Bone. The sidings leaving signal is of a standard type adapted to display clear, approach and stop indications for governing train movements from the sidings through the spring switch and track block. The take sidings signal comprises a lamp which is normally dark and which when illuminated causes the display of a symbol, preferably in the form of the letter "S" to convey the instruction to an approaching train applicable to a train approaching the spring switch to stop and reverse the switch by hand and move into the siding. It is to be understood that instead of the spring switch mechanism the switch may be provided with a mechanism governed by an approaching train.

According to my invention no field station and associated apparatus of the centralized traffic control are provided at the spring switch end of the passing sidings and the sidings leaving signal and the take sidings signal are controlled and indicated through the field station located at the selected end of the passing sidings by means of codes transmitted through coded track circuits.

The stretch of track between the passing sidings is provided with intermediate wayside signals which are automatically controlled by the coded track circuits in such a manner as to permit following moves.

I shall describe one form of apparatus embodying my invention when used in a signal system for a stretch of single track railway extending from a selected end of a passing siding along the passing siding and through the stretch of single track to the near end of the next adjacent passing siding, and shall then point out the novel features thereof in claims.

The accompanying drawings, Figs. 1a to 1d, inclusive, when placed end to end with Fig. 1a at the left, are schematic views showing one form of apparatus embodying my invention when applied to a stretch of single track railway which, as stated hereinbefore, includes a selected end of a passing siding, the main track along this passing siding and the stretch of track to the near end of the next adjacent passing siding.

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

In the drawings, the reference characters 1a and 1b designate the track rails of a stretch of single track railway extending from location 2 at the left-hand or west end of a passing siding 2PS to a location 6 at the left-hand or west end of the next passing siding 6PS to the east. This stretch of track forms a track block through which traffic moves in both directions under the direction of wayside signals the control apparatus for which embodies my invention.

The track rails 1a and 1b of the main track of this block are formed by the usual insulated rail joints with track sections 2T, 3T, 4T, 5T and 6T. The sections 2T and 6T include the track switches at the west end of the sidings 2PS and 6PS, respectively, and are relatively short. The sections 3T, 4T and 5T are relatively long and may be of the maximum length permissible for track circuits of the type here involved.

It is to be noted that the track rails of the siding 2PS are formed by insulated rail joints with a short track section 4AT which provides approach control of a siding leaving signal 4R to be described hereinafter.

Each track section is provided with a track circuit. The track circuits for the short sections 2T and 6T are of the conventional normally energized direct current type and each circuit is provided with a track battery connected across the rails at one end of the section and a direct current track relay connected across the rails at the other end of the section as will be apparent from an inspection of the drawings. The track section 4AT for
the passing siding 2PS is preferably provided with a normally open track circuit which includes a track battery B4 and a relay 4ATR connected in series across the rails, this relay being normally deenergized and energized and picked up when a train occupies this section to shunt the track rails.

The track circuits for the sections 3T, 4T and 5T are of the reversible direct current coded type and each circuit is provided with a track battery, a code following track relay, and a coding or code transmitting relay at each end of the section. Each of the code following track relays is identified by the reference character CF plus a prefix corresponding to the section and direction of traffic with which the relay is related. Each of these code following relays is of the polar biased type well known in the art and it is sufficient for this application to point out that these polar code following relays are provided with an armature which is biased to a released position and when current flows in the relay winding in one direction, and the armature is picked up closing front contacts only when current flows in the relay windings in the other direction. In the drawings each of the polar biased code following relays assumes a picked up position only when current flows from the positive terminal of the track battery through the relay winding in the direction indicated by an arrow placed on the relay winding. Each of the coding or code transmitting relays is a direct current relay having a contact operable to a first and a second position at a rate corresponding to the rate of code pulses supplied to the relay winding. These code transmitting relays of the track circuits are identified by the reference character CTP plus a prefix corresponding to the track section and the direction of traffic with which the relay is associated.

The wayside signals provided for governing traffic through the block may be any standard type of wayside signal and the signals are identified by a number corresponding to its location plus a suffix L or R to correspond to the direction of traffic, left or right, governed by the signal. These wayside signals are shown as being of the searchlight type each having a three position mechanism identified by the reference character C or prefixed by the corresponding signal identification number. It is to be noted that these signal mechanisms are so polarized and connected to controller contacts, which are operatively connected to the mechanism as indicated in the drawings by dotted lines, for a left-hand contact as viewed in the drawing to close a front contact when the signal is operated to display a green or clear signal indication, and a right-hand contact to close a front contact when the signal is operated to display a yellow or approach signal indication. Also the two contacts are moved to a lower position closing back contacts when the mechanism is deenergized and the signal displays a red or stop signal indication.

It is to be pointed out that a wayside signal 4L, to be referred to more fully hereinafter, is mounted on the same mast as a signal 5L. The signal 4L comprises a lamp which is normally dark and which when illuminated causes the display of an illuminated letter "S" for a "take siding" signal, this signal being used to convey the instruction to a train that it is to move to the siding 2PS by hand throwing the switch 3W.

Inasmuch as my invention relates to the wayside signal apparatus, the centralized traffic control system by means of which the track circuits and signals are controlled from a central office is shown only conventionally because such a traffic control system may be any one of several well-known arrangements by which control relays at different wayside field stations along a railway are selectively controlled from a central office. For a full understanding of my invention it is sufficient to point out only that currents of different codes are transmitted from a central office to different field stations. These codes preselect the field station and also preselect the control to be effected at the selected station and these controls are carried out at the field station by certain terminals being supplied with positive energy. In the drawings a field station 2FS is located at the location 2 and a field station 6FS is provided at the location 6. Furthermore, each field station apparatus includes means by which indication codes are generated and transmitted from that field station to the central office in response to positive energy being applied to certain other terminals of the apparatus. The transmitting medium between the office and these field stations is usually a two wire line circuit but it is apparent that transmission may be effected by space radio and my invention is not limited to any specific form of transmitting medium between the remote office and the different field stations of the remote control system here involved.

The codes for the different track circuits are generated by code transmitters or coders designated by the reference character CT plus a numeral 75, 120, or 180 to designate the code rate of its operation. These code transmitters may take different forms and preferably are of the pentadrum type which when energized operate contacts periodically at a rate of 75, 120 or 180 times per minute. It is to be understood that these code rates are used by way of illustration and other code rates can be used. These code transmitters are used to periodically interrupt a circuit by which current pulses are supplied to the coding or code transmitting relays referred to hereinbefore and thereby cause the corresponding code rate of operation of these relays.

It is to be noted that current sources other than the track batteries are provided at the different locations. These current sources are preferably batteries not shown but which are identified in the drawings by the positive and negative terminals of the sources being identified by the reference characters B and N, respectively.

The apparatus employs slow release relays at many places as will appear from time to time in the specification. These slow release relays may be provided with slow release characteristics in any of the several ways known to the art and in the drawings the slow release characteristic is indicated by an arrow at the relay contact.

Furthermore, the apparatus includes decoding units which are selectively responsive to the different code rates of the track circuit current. These decoding units are indicated in the drawings by the numerals 5D with an identification numeral 120 or 180 to indicate the corresponding code rate to which the unit responds. These decoding units are shown conventionally because their specific structure forms no part of my invention and the structure may be of any of the standard arrangements known to the art. It is sufficient for this application to point out that these decoding units include inductance and capacitance tuned to resonate at the frequency of the code rate to which it responds so that a direct current relay connected to the output of the decoding unit is effectively energized and picked up only when the unit is supplied with current pulses at the corresponding frequency.

The power switch machines at the locations 2 and 6 for operating the track switches for the corresponding end of the passing sidings 2PS and 6PS, respectively, are shown conventionally at 2WM and 6WM by the symbol commonly employed to designate such mechanism, and the circuits for these mechanisms are not shown. These specific arrangement forms no part of my invention. It is sufficient for the present application to point out that these mechanisms are under the control of the centralized traffic control system and the track circuits each includes motor driven apparatus for moving the switch points to the normal or reverse position and to lock the switch points in these positions.
It is believed that the wayside apparatus embodying my invention as thus described can be fully understood from a description of the operation of the apparatus under different assumed traffic conditions. In describing the operation of the apparatus, I shall assume first that the apparatus is in its normal condition, that is, the condition it occupies when no train occupies the track block. Under this normal condition, the apparatus is positioned as shown in the drawings and the track circuits for the sections 3T, 4T and 5T are deenergized but the track circuits for the short sections 2T and 6T are constantly energized and their corresponding track relays 2TR and 6TR are picked up. Furthermore, the code transmitters 75CT, 120CT and 180CT at location 6 are constantly supplied with power and operating.

I shall next assume that with the apparatus in its normal condition it is desired to establish the direction of traffic from left to right, that is, eastbound, and to clear the signal 2RA to permit a train to move east through the block. The first step would be for the operator of the centralized traffic control system to send from the office to the field station 2FS and 6FS control codes which at field station 2FS prepare a circuit for control of the signal 2RA and which at field station 6FS cause coded energy to be supplied to the track circuit for cascading through the track circuits to the location 2 to check the nonoccupancy of the block. This control at station 2FS will cause positive energy to appear at a terminal 11 of the field station and to which terminal a relay 2RGZ is connected with the result that the relay is picked up. Subsequent to the control energy at terminal 11, the relay 2RGZ is controlled by a stick circuit which includes its own front contact 12 and terminal 13 of the field station apparatus and to which terminal energy is applied by the usual circuit network, not shown. With the relay 2RGZ picked up closing front contact 12, a control circuit network is prepared for governing the signal 2RA and which network will be referred to shortly.

At the field station 6FS this control code will cause positive energy to appear at a terminal 20 of the field station unit and to which terminal a relay 6WFR is connected with the result that this relay is picked up. Subsequent to the control energy at terminal 20 the relay 6WFR is retained energized by the usual stick circuit which includes its own front contact 21 and terminal 22 of the field station unit and to which terminal positive energy is supplied in the usual manner.

Since the signal 6RA which governs eastbound traffic at location 6 is normally set to display stop, a relay 6RGY connected to contacts of the controller of this signal is deenergized and a circuit is prepared by which pulses of the 75 code rate are supplied to a code transmitting relay 5WCTP for the track circuit of section 5T, this circuit including terminal B of the power source, contact 23 of the code transmitter 75CT at location 6, back contact 24 of relay 6RGY, front contact 25 of the now energized directional relay 6WFR, winding of relay 5WCTP and terminal N of the power source. It follows that this code transmitting relay is now operated at the 75 code rate so that pulses of current from a battery 85E are supplied to the track circuit of the section 5T, the circuit being completed from the positive terminal of battery 85E through resistor 26, front contact 27 of the coding relay 5WCTP, front contact 28 of the directional relay 6WFR, lead wire 29 to rail 1a of section 5T and section 3 of the line by lead wire 30 to the negative terminal of the track battery 85E.

These track circuit pulses are transmitted to the left-hand end of the section 5T and flow through a connection that can be traced from rail 1a of section 5T over back contact 31 of a relay 5EFR, winding of code following relay 5ECF, through the direction of the track battery 85E to rail 1b. Consequently the code following relay 5ECF is now operated at the 75 code rate causing a relay 5RH to be energized through a decoding transformer 5DT. Specifically, current pulses are alternately supplied to the two portions of primary winding 35 of the transformer 5DT through front and back contacts 7 of the code following relay 5ECF, and induce corresponding voltages in secondary winding 33 of the transformer. These voltages are rectified by the operation of contact 34 of the code following relay and rectified current is supplied to energize the relay 5RH as will be apparent by an inspection of the drawing.

Since the control relay 5RH is provided with slow release characteristics, it is retained picked up by this code operation of the code following relay 5ECF and the closing of front contacts 36 and 37 of the relay 5RH completes a circuit for energizing the mechanism 5RG of a signal 5R, the circuit for the mechanism 5RG being completed through pole changing contacts 38 and 39 of a relay 5RD, to be referred to shortly. The polarity of the current causes the mechanism 5RG to be operated for signal 5R to display an approach signal indication when the corresponding front contact 36 of the signal is lighted in a manner to appear hereinafter.

The picking up of the relay 5RH also completes a circuit for a directional relay 5WFR at this location, the circuit extending from terminal B through back contact 43 of relay 5EFR, from contact 44 of relay 5RH and winding of relay 5WFR to terminal N. With the directional relay 5WFR energized closing front contact 45, a simple circuit is closed for energizing a code transmitter 180CT.

A circuit for a code transmitting relay 4WCTP for the track circuit of section 4T is now completed and current pulses flow from terminal B through contact 46 of the 180CT coder, front contact 42 of relay 5GY, front contact 48 of relay 5WFR and winding of relay 4WCTP to terminal N. It is to be noted that relay 5GY which is controlled over front contact 41 of the controller of signal 5R is energized at this time due to the operation of the signal mechanism 5RG.

With the coding relay 4WCTP operated at the 180 code rate, current pulses of the corresponding rate are supplied from track battery 84E to the track circuit of section 4T, the connection extending from the positive terminal of battery 84E through resistor 49, winding of an approach relay 4EA, front contact 50 of coding relay 4WCTP, front contact 51 of directional relay 5WFR, and lead wire 52 to rail 1a, the other side of the circuit extending from rail 1b to the negative terminal of battery 84E over lead wire 53.

It is to be pointed out that these track circuit pulses flow in the winding of the approach relay 4EA in the direction indicated by the arrow and energize the relay in the proper direction to pick up the relay but the relay is adjusted so that the magnitude of the current pulses is ineffective to pick up the relay when the section is unoccupied and the relay is effectively energized and picked up only when the current impulses are increased in their magnitude in a manner to appear later.

These pulses of track circuit current supplied at the right-hand end of the section 4T are received at the left-hand end of the section and flow through a connection to the rails of section 3T, one side of the connection including lead wire 54, back contact 55 of the section by lead wire 56 to rail 1a of the track section 3T. The other side of the connection extends from the rail 1b of section 4T to rail 1b of section 3T through wire 58, back contact 59 of relay 41T, and wire 60. It follows that the track circuit pulses of the 180 code rate supplied to section 4T are by-passed around the insulated joints between section 4T and section 3T and are supplied to the rails of the section 3T. It should be pointed out that a portion of the current supplied from the section 4T to the section 3T flows through back contact 61 of a relay 3WCTP, to be referred to later, and the winding of a polar code following relay 3ECF, which is effectively con-
connected across the rails of section 4T at this time, but that the current flows in the winding of this code following relay in the direction opposite to that to which the relay responds.

The current pulses supplied to the section 3T in the manner just described flow in the rails to the left-hand end of the section 3T and there flow in a connection that can be traced from rail 1a through lead wire 1b, back contact 14 of a relay 4GZP, to be referred to, back contact 9 of a relay 2EFR, winding of a code following relay 2RCF in the direction indicated by the arrow, back contact 6 of relay 2EFR, back contact 16 of relay 4GZP, and lead wire 17 to rail 1f. Thus these current pulses cause the code following relay 2RCF to be operated at the 180 code rate. Operation of the contact 62 of this code following relay causes current pulses to be alternately supplied to the two portions of winding 63 of decoding transformer 3DT and corresponding voltages are induced in secondary winding 64 of the transformer. These voltages are rectified by the operation of contact 65 of the code following relay 2RCF and applied to a relay 2RAH, with the result the relay 2RAH is energized and picked up and retained picked up due to its slow release characteristics. Furthermore, operation of contact 62 of the code following relay 2RCF causes current pulses of the 180 code rate to be applied to the 180DU decoding unit at location 2 with the result the relay 180UP connected to that unit is effectively energized and picked up, closing its front contact and causing the relay 2RAD to be energized by a simple circuit easily traced. With both relays 2RAH and 2RAD picked up, a circuit is completed for supplying current to the mechanism 2RAG of the signal 2RA, the current being of normal polarity due to relay 2RAD being picked up, so that the signal is operated to indicate a clear signal aspect. Specifically, the circuit network of the signal mechanism 2RAG includes terminal B of the power source, front contact 18 of the remote controlled relay 2RGZ, wire 5, the approach locking and other controls usually provided but which are not shown but indicated by a dotted portion of wire 5 due to these controls not forming a part of my present invention, front contacts 66 and 69 of relays 2RAH and 2RAD, respectively, signal mechanism 2RAG, front contacts 68 and 67 of relays 2RAD and 2RAH, respectively, and terminal N of the power source. At this time the lamp 70 of the signal 2RA is provided with an energizing circuit not shown, but which would be of the standard form and signal 2RA displays a green light as a clear signal to permit a train to enter the block.

For an indication of this position of signal 2RA, it is to be pointed out that with the mechanism 2RAG moved to its clear position, the closing of contact 71 of its controller completes a simple circuit for an indication relay 2RAGY. With relay 2RAGY picked up closing its contact 72, a connection by which energy is applied to a terminal 73 of the centralized traffic control apparatus at station 2FS is completed and the centralized traffic control system is caused to transmit an indication code to the office for indicating this clear position of signal 2RA.

As the eastbound train moves past signal 2RA to enter the section 2T, the track relay 2TR is shunted and this relay on releasing would open the circuit control previously mentioned for the signal mechanism 2RAG, with the result the signal is deenergized and set to display a stop indication. When the head end of the train enters section 3T, the shunting of this track circuit causes the code following relay 2RCF to cease operation with the result the two relays 2RAH and 2RAD are deenergized and released opening the circuit for the signal mechanism 2RAG at other points.

This eastbound train moves from section 3T into section 4T, the code pulses are still shunted and no further action takes place at the location 2.

When the head end of the train reaches a reasonable distance from the signal 5R, the magnitude of the track circuit pulses supplied to the section 4T at the right-hand end is increased due to the shunting out of the impedance of the track rails with the result the approach relay 4AE is effectively energized and begins to follow the code and causes a repeater relay 4EAP to be energized and picked up by a simple circuit including front contact 127 of relay 4EQA, the relay 4EAP being retained picked up due to its slow release characteristic. The closing of front contact 123 of the repeater 4EAP completes a simple circuit for the lamp 40 of the signal 5R and the signal 5R displays an approach indication to the eastbound train.

The closing of front contact 74 of the approach relay 4EAP prepares a circuit for a directional stick relay 5RSR so that when the train passes into the section 5T to shunt the code pulses causing the code following relay 5EFC to cease code operation and the relay 5SRH is deenergized and the signal 5R set at stop, the stick relay 5SR is provided with a pickup circuit that includes terminal B, back contact 75 of a relay 5LSR, front contact 74 of relay 4EAP, back contact 76 of relay 5SRH, winding of relay 5RSR, and terminal N. The relay 5SR when picked up is retained energized over a stick circuit including its own front contact 77 and back contact 76 of relay 5SRH. Since the directional stick relay 5SR is retained energized while the train occupies the section 5T, it follows that when the train enters the section 4T the directional relay 5WFR is retained energized by a circuit completed at back contact 43 of relay 5EFR and front contact 78 of the stick relay 5SR. From this it is to be seen that a coder 75CT at the location of signal 5R is provided with an energizing circuit completed at front contact 45 of relay 5WFR and the code transmitting relay 4WCTP is energized by pulses of the 75 code rate due to a circuit completed from terminal B through front contact 79 of coder 75CT, back contact 42 of relay 5GY, front contact 48 of directional relay 5WFR, and winding of relay 4WCTP to terminal 78.

This results in the track circuit for the section 4T and in turn the section 3T being supplied with current pulses of the 75 code rate and the code following relay 2RCF at the location 2 is operated at the 75 code rate causing the relay 2RAH to be picked up closing front contacts 66 and 67. This prepares the energizing circuit for the signal mechanism 2RAG so that the signal 2RA can be operated to permit a following train to enter the block in the event a control code is sent to the field station 2FS through the centralized traffic control system to again pick up relay 2RGZ, this relay having been deenergized in the usual manner when the first train entered the block.

I shall assume, however, that no following train movements are made and the first train advances east through the section 5T. Furthermore, I shall assume that conditions in advance of the signal 6RA east of the block here involved are such that the signal 6RA can be cleared and is cleared to permit the train to move out of the block through the section 6T. It will be recalled that to set up the traffic through the block the directional relay 6WFR at location 6 is energized through the centralized traffic control station and the relay 6WFR energized, causes this relay to be energized until the train has vacated the section 6T. This condition causes the signal 75 of the 75 code to be applied to the section 5T while the rear of the train is passing through section 6T due to the operation of the coding relay 5WCTP by current pulses supplied through back contact 24 of relay 6GY and contact 23 of the coder 75CT. That is, coded current is supplied to section 5T for a brief period subsequent to the train vacating section 5T. This 75 code applied to the track section 5T...
causes the code following relay 5ECF at the signal 5R to be operated and the relay 5RH to be picked up for a brief period. While relay 5RH is picked up, then the stick circuit for the stick relay 5RSR is opened at back contact 76 of relay 5RH and relay 5RSR is released to remove the supply of coded track circuit current from the section 4T and thus the track circuits for the section 4T and in turn for the section 3T are restored to their normal deenergized condition. Then, subsequent to the release of the relay 6WF at location 6 the operation of the coding relay 5WCTP is discontinued and the track circuit for section 5T is restored to its normal deenergized condition.

It should be pointed out in connection with the operation of the apparatus for eastbound traffic that in the event the signal 6RA is cleared prior to the clearing of the signal 2RA to permit a train to move through the block, then the energizing of the relay 6RG at location 6, due to the clearing of either contact 124 or 125 of the controller of the mechanism 6RAG, selects the code transmitter 180CT and operation of contact 126 of this code transmitter causes corresponding operation of coding relay 5WCTP with the result current pulses of the 180 code are supplied to the track circuit of section 5T. With the code following relay 5ECF at signal 5R operated from the track circuit section 4T, the coded current is trolled through the 180DU decoding unit is picked up and the signal mechanism 5RG for the signal 5R is energized by current of normal polarity and this signal is operated to display a clear signal indication. With the signal mechanism 5RG energized by normal polarity closing front contact 47, then the circuit for operating the coding relay 4WCTP for the section 4T includes the contact 46 of the 180CT code transmitter and the current pulses supplied to the section 4T and its opposite section 3T are of the 180 code rate the same as previously explained.

I shall next assume that with the apparatus in its normal condition the signal 4R is to be cleared to permit a train on the siding 2PS to trail through the spring switch 3W and move through the block. The operator of the centralized traffic control system sends codes which at the field station 6FS cause the relay 6WF to be picked up in the same manner as described for the first train and the track circuit current is applied to the section 5T in the manner previously described. This time the code sent to the field station 2FS causes positive energy to appear at terminal 80 to which a relay 4RGZ is connected and this relay is picked up closing front contacts 81 and back contacts 82 of which two stick relays 4GZP and 4GRZP are energized and picked up. To provide the relay 4RGZ with a stick circuit for retaining the relay energized subsequent to the remote control which energizes relay 4GRZ, a relay 4G1 is provided and which relay is energized by means of a circuit completed at front contact 83 of relay 4G1Z and back contact 84 of an indication relay 4GK to be referred to later, and relay 4G1 completes its front contact 140 a stick circuit for the relay 4GRZ, this circuit including front contact 144 of relay 4GRZ, back contact 145 of a relay 4G1Z, front contact 140 of relay 4G1 and back contact 141 of a relay 4GS to be referred to later. The relays 4GZP and 4GRZP are provided also with stick circuits which are similar and which for relay 4GZP includes front contact 85 of that relay, front contact 86 of relay 4GK, and back contact 146 of relay 4GS. The stick circuit for the other relay 4GRZ is similar and includes its own front contact 147 and the previously traced stick circuit for the relay 4GZP.

With the two relays 4GZP and 4GRZP picked up due to the remote control of relay 4GRZ, a coding relay 3ECTP at location 2 is operated at the 75 code by the 75CT code transmitter, the circuit connection including terminal B, contact 185 of coder 75CT, front contact 186 of relay 4GRZP, front contact 87 of relay 4GZP, front contact 88 of an approach locking relay 2MR which is preferably provided at location 2 in accordance to general practice but the control of which is not part of my invention, front contact 89 of relay 2TR, winding of relay 3ECTP and terminal N. This operation of the coding relay 3ECTP causes current impulses of the 75 code to be supplied from battery 83W to the track circuit for the section 3T, the connection extending from the positive terminal of battery 83W through front contact 90 of the coding relay 3ECTP, winding of code following relay 3WCF in the direction reverse to that indicated by the arrow, front contact 91 of relay 4RGZP, front contact 16 of relay 4GZP, front contact 16 of relay 4GZP and wire 17 to rail 1b of section 3T and the connection extending from rail 1a over wire 19, front contact 14 of relay 4GZP, front contact 92 of relay 4GRZP and to the negative terminal of battery 83W. These track circuit impulses are of reverse polarity, that is, they are of a polarity wherein the rail 1b is positive with respect to the rail 1a, whereas the current pulses cascaded through the block cause rail 1a to be the positive rail.

At the right-hand end of the section 3T, that is, at the location of the track switch 3W, these track circuit impulses of the reverse polarity fall in the connection extending from rail 1b through the code following relay 3ECF in the direction indicated by the arrow, back contact 61 of relay 3WCTP and wire 57 to rail 1a. This operation of the relay 3ECF causes current to be alternately supplied to the two portions of winding 192 of decoding transformer 4DT through contact 148 of the code following relay and the voltages induced in the winding 93 of that transformer to be rectified at contact 128 of the code following relay and applied to relay 4WTP to pick up that relay, the relay being retained picked up due to its slow release characteristics. This energizing of the relay 4WTP switches the connection of the track circuit for section 4T from the rails of the section 3T to a code following relay 4RCF with the result that the coded track circuit current applied to the section 5T at location 6 and cascaded through the track circuits of the block in the manner described for the first train are now applied from the rails of section 4T to the code following relay 4RCF, the connection including wire 54 leading from rail 1a through front contact 55 of relay 4WTP, winding of relay 4RCF, from contact 59 of relay 4WTP and wire 58 to rail 1b of section 4T. Consequently, the code following relay 4RCF is now operated in response to the coded current cascaded through the block and operation of the relay 4RCF causes current to be alternately supplied to the two half portions of winding 95 of decoding transformer 4ADT through contact 94 with the result a corresponding voltage is induced in secondary winding 96 of that transformer. This induced voltage is rectified at contact 97 of the code following relay and rectified current applied to relay 4RH causing that relay to be picked up and retained picked up due to its slow release characteristics.

Furthermore, the voltages induced in transformer winding 96 are also applied to the 180DU decoding unit at this location and the corresponding relay 180CP is energized and picked up closing front contact 197 to complete a simple circuit for energizing a signal control relay 4RD. With the two relays 4RH and 4RD picked up then the signal mechanism 4RG is provided with a control circuit that includes the front contacts 98 and 99 of relay 4RH and front contacts 100 and 101 of the relay 4RD with the result the mechanism 4RG is energized at normal polarity and the mechanism operated to its clear position. When the train on the siding 2PS moves to occupy the approach section 4AT so that the track relay 4ATR is energized closing front contact 193 a simple circuit for lighting lamp 102 of signal 4R is closed and the signal 4R displays a clear signal indication to permit the
train to move through the spring switch and the track block.

It is to be pointed out that when the signal mechanism 4RG operates to its clear position closing contact 105 of its control relay 24GR. This circuit is provided for the signal relay 4RGY and that relay is picked up closing front contact 105 with the result that voltage induced in the winding 106 of the decoding transformer 4DT due to operation of the code following relay 3ECF causes current to flow in primary winding 107 of a transformer and a voltage induced in secondary winding 108 which is applied to relay 3WCTP picking up that relay. The relay 3WCTP being a code following relay, it is operated in step with the 75 code current applied to the section 3T. With relay 3WCTP operated to close its contacts 61 and 110, then an inverse or feed back code pulse is supplied from battery B3E to the rails of the section 3T, the current pulse flowing from the positive terminal of battery B3E through front contacts 61 and 110 in series and wire 69 to rail 1b and thence from rail 1o back by wire 57 to the negative terminal of battery B3E. This inverse code thus supplied to the rails of section 3T is received at the left-hand end of the section 3T to flow from rail 1b through wire 17, front contacts 16 and 91 of the relays 4GZP and 4RGZP, respectively, winding of relay 3WCF, back contact 90 of relay 3ETCP closed during the off period of the normal code, front contacts 92 and 14 of the two relays 4RGZP and 4GZP and wire 19 to rail 1o. Then, with the code following relay 3WCTP operated at the 75 code the relay 4GK is energized through the decoding transformer 4RDT due to current being alternately supplied to the primary winding of the decoding transformer through contact 111 of relay 3WCF and the voltages induced in the secondary winding of this decoding transformer being picked up at contact 112 of the following relay. With relay 4GK pick up energy is supplied to terminal 114 of the central traffic control equipment of station 2FS through the connection including front contact 113 of the relay 4GK and front contact 115 of relay 4RGZP so that the central traffic control equipment is made active to provide an indication code from station 2FS to the office of the centralized traffic control system for indicating that the signal 4R has been cleared.

It follows from the foregoing that the side line leaving signal 4R is controlled and indicated from the field station 2FS to the gate by means of the central traffic control system by use of normal and inverse coded track circuit current of the 75 code, the polarity of the track circuit current being opposite from that used for cascading through the block.

The operation of the apparatus as the train from the siding moves through the block to the location 6 is substantially the same as that described for the train advancing through this block from the main track at location 2.

It is to be pointed out, however, that as the train from the siding moves past signal 4R and enters the section 3T the code following relay 3ECF is shunted so that the relay 4WTP is deenergized and the code following relay 4RCF is no longer operated by the coded current supplied from section 4T with the result the signal 4R is restored to its stop position. Also, as this train travels through the spring switch 3W, a contact 116 operatively connected to the switch as indicated by a dotted line is opened, causing a relay 4RG to be deenergized opening its front contact 117 and thus turn deenergizing the relay 4RM. When this train has moved east and has vacated the section 3T and the spring switch has assumed its normal position, the closing of the controller contact 116 causes energy to be applied to a time element relay 2ER, the circuit extending from terminal B through battery B3W and contact 115 of the controller of the signal mechanism 4RG, contact 116, heater element 119 of the relay TER and back contact 120 of relay 4RG/ to terminal N. In a selected time interval the relay TER closes its contact 121 and completes a connection for picking up the relay 4RGR which opens the circuit for the heater element of relay TER and completes the stick circuit for relay 4RGR through the heater element, the arrangement being such that this current can energize relay 4RGR picked up but insufficient to cause operation of the relay TER. Then, after the relay TER has assumed its normal position a circuit is completed for the relay 4RM through the check contact 125 of relay TER and front contact 117 of the relay 4RGR. It follows that in a short period of time after the train has cleared the line through the spring switch the apparatus is restored to its normal position whereas the apparatus is not restored to its normal position during the short interval that the spring switch may move toward its normal position between the car tracks.

I shall next assume that with the apparatus in its normal position the signal 6LA is to be cleared to permit a westbound train to move through the block. Also, the take sliding signal 4L is to be operated to convey to this train the instruction that it is to stop at switch 3W and hand throw the switch and move to the siding 2PS. Under this condition the operator sends a control code which at station 6FS causes positive energy to be applied to a terminal 133 to which a signal control relay 6LAGZ is connected so that this relay is picked up in response to this control code and then retained energized due to a stick circuit including its own front contact 134 and terminal 135 of the central traffic control system to which terminal energy is supplied through the usual form of circuit network. With the picking up of front contact 136 of the relay 6LAGZ, a circuit is prepared for the signal mechanism 6LAG so that this mechanism is made ready to respond to coded track circuit energy cascaded through the track circuits of the block.

This code of the central traffic control system when received at the station 2FS causes positive energy to be applied at terminal 137 to which relay 4LGZ is connected and this relay is picked up and then retained energized over a circuit which includes its own front contact 138, back contact 139 of relay 4LGZ, front contact 140 of relay 4G1 and back contact 141 of relay 4GS.

With the relay 4LGZ thus selected, the relay 4GZP is energized by the circuit including front contact 142 of the relay 4LGZ. The picking up of the relay 4GZP completes the circuit for relay 4G1 as previously explained and a circuit by which the code control relay 3ECTP is operated by the 128CT code at this location, the circuit extending from terminal B, through contact 143 of the coder 120CT, back contact 186 of relay 4GZP, front contact 87 of relay 4GZP, front contact 88 of relay 2MR, front contact 89 of relay 2TR and winding of relay 3ECTP to terminal N. The operation of the code control relay 3ECTP causes current pulses of the 120 code rate to be supplied from battery B3W to the track circuit for the section 3T through front contacts 14 and 16 of relay 4GZP and back contacts 91 and 92 of the relay 4GZP. This coded current is of the polarity that causes the rail 4R to be positive with respect to the rail 1b.

This track circuit current is by-passed from section 3T to section 4T by the connection previously described. At the location of signal 5L, the coded track circuit current is applied to the code following relay 4ECF through a connection that includes wire 52, back contact 44 of relay 5WR, winding of relay 4ECF from right to left, front contact 178 of relay 4CTP, and wire 53 to rail 1b, the relay 4ECF being operated at the 120 code rate. Operation of the contact member 149 of relay 4ECF causes current to be alternately supplied to the two portions of winding 156 of decoding transformer 4LD of voltage induced in winding 151 which are rectified by operation of the contact member 152 of the code following relay and applied to a relay 5LS whereas that relay is energized and picked up and retained picked up due to its slow release characteristics. Operation of the contact member 149 of the code following relay 4ECF.
at the 120 code rate causes pulses to be supplied to a decoding unit 12BDU so that a relay 4LH connected to that unit is energized. A similar circuit is now formed from terminal B through front contact 153 of relay 4LH, winding of relay 4LGP and the lamp of signal 4L to terminal N. The parts are proportioned for the lamp of the signal 4L to be illuminated and for the relay 4LGP to be picked up. With the relay 4LGP picked up, clamping of contact 454, in connection 155, is completed by which voltages induced in winding 155 of the decoding transformer 4LD are applied to winding 156 of another transformer 4LDP causing corresponding voltages to be induced in winding 157 of this latter transformer with the result that relay 4CTF is energized. In the meantime, relay and the relay is picked up only when the magnitude of the voltage is increased in a manner to be described shortly.

The normal track circuit pulses of the 75 code rate thus supplied to the section 5T are received at the right-hand end of that section to operate the code following relay 5ECF, the connection to the right-hand end of the relay 5ECF being that previously traced. Operation of contacts 168 and 169 of the code following relay 5ECF at the 75 code rate causes energy to be applied to the signal control relay 6LH through the decoding transformer 6LDT in the manner well understood and the relay 6LH is picked up and retained picked up due to its slow release feature.

Since the remote control relay 6LAGZ is picked up closing front contact 136 as previously explained, the energization of the transformer is retained by its front contacts 170 and 171 completes a circuit for the signal mechanism 6LAG, the circuit being completed over the back contacts 172 and 173 of relay 6LD with the result that the signal 6L is operated for the signal to display an approach indication and thereby permit the train to move past signal 6L into the block.

When this westbound train enters the section 5T and is within a given distance of the signal 5L, the code pulses supplied to the rails of the section 5T are increased in magnitude due to the shunting out of the rail impedance and this increased magnitude of the track circuit shows up to the code following relay 5WAP and that relay is picked up and retained picked up. The closing of front contact 175 of the approach relay 5WAP completes in turn a simple circuit for the lamp 176 of the signal 5L and this lamp is illuminated causing the signal 5L to display a red light, as the train approaches signal 5L it displays a red light.

But, as previously explained, the lamp for signal 4L is illuminated and there is conveyed to the train information that the train is to stop at the switch 3W and hand-throw the switch and move to the passing siding.

When the head end of the train enters the section 4T, both the normal and inverse code pulses of the 120 code rate that are being supplied to the section 4T are shunted. This causes the operation of the code following relay 4ECF to cease and relays 4LH and 5LH to be released.

At location 2 the discontinuing of the inverse code pulses of the 120 code rate causes the code following relay 3WCF to be no longer operated with the result that the indication relay 4GK is deenergized and released. The opening of front contact 86 of indication relay 4GK opens the stick circuit by which the relay 4GZP is retained energized and this relay is operated to close front contacts 14 and 16 with the result that the connection by which normal code pulses are being supplied to the section 3T from the battery B3W is open and the supply of the pulses is discontinued.

It follows that when the train has moved to the passing siding 2FS and the switch is returned to its normal position, the apparatus is automatically restored to its normal condition.

The operation of the apparatus for clearing the signal 6LA to permit a train on the main track to move through the block without taking siding at switch 3W is substantially the same as the operation of the apparatus for an eastbound train and the operation of the apparatus for the westbound train will be apparent from an inspection of the drawings taken in connection with the description of the operation of the apparatus for the eastbound train.

It should be pointed out that when current pulses of the 180 code rate are received at location 2 from the track section 3T causing the relay 180CP to be picked up closing its front contact 181 in the manner previously explained, a simple circuit is formed by which energy is applied to terminal 182 of the centralized traffic control field station 2FS and which in turn would cause the centralized traffic control system to transmit a clear block indication to the office of the centralized traffic control
Similarly, at location 6, the reception of current pulses of 180 code rate from the track section 5T causes the relay 180CP of the decoding unit at the location to be energized and picked up by operation of a normally open push button 179 and relay 4GS on picking up opening back contacts 141 and 146 opens the stick circuits for the relays 4LZG, 4RGZ, 4GZP and 4RGZP. Thus this push button provides means by which the signals 4R and 4L can be restored to their normal position in case of an emergency.

Although I have herein shown and described but one form of single track railway signal system using normally deenergized coded track circuits embodying my invention, it is to 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 my invention.

Having thus described my invention, what I claim is:

1. In combination, a main track having a passing siding including a first and a second track switch, a siding leaving signal positioned to govern traffic moving from the siding through said first switch and having means operable to display a different indication for each of a plurality of different traffic conditions, said main track formed with a first and a second track section which extend in opposite directions from said first switch, traffic controlled means including a current source and code transmitting means operable to supply current of a selected code, means including a circuit controller at times connect said supply means to said first track section at the end remote from said first switch, supply means including a current source and another code transmitting means operable to supply current of selected code, and circuit means including contacts of said control relays to govern said siding leaving signal.

2. In combination, a main track having a passing siding including a first and a second track switch, a siding leaving signal positioned to govern traffic moving from the siding through said first switch and having means operable to display a different indication for each of a plurality of different traffic conditions, said main track formed with a first and a second track section which extend in opposite directions from said first switch, traffic controlled means including a current source and code transmitting means operable to supply current of a selected code, and circuit means including contacts of said control relays to govern said siding leaving signal.

3. In combination with a stretch of main track over which traffic moves at times to the east and having a passing siding and adjacent the siding with a track section, said section being provided with a track circuit including a polar code following relay and an associated decoding means at each end of the section, a main track signal located at the west end of said section and disposed to govern traffic through the section and to the east on the main track, a siding leaving signal located at the east end of the siding and disposed to govern traffic moving from the siding to the section and east on the main track, each said signal having means operable to display a different indication for each of a plurality of different traffic conditions, traffic controlled means including a power source and code transmitting means having connections to the rails of the main track east of said section and operative to supply current of a selected polarity coded at different code rates according to different traffic conditions, circuit means including contacts of the decoding means at the east end of said section and including the decoding means is disposed to interconnect the rails east of the section to the rails at the east end of the section to supply said coded current to the rails of the section, said code following relays being poled for the relay at the west end of the section to respond and the relay at the east end of the section not to respond to the polarity of the coded current of traffic codes thus supplied to said section, means including another power source, another code transmitting means and a remotely controlled contact connected across the rails at the west end of the section and operative to supply at times current coded at a rate different from the traffic codes; said another source being poled to operate the relay at the east end of the section but not the relay at the west end of the section, another pole code following relay and associated decoding means, other circuit connections including contacts of the decoding means at the east end of the section closed when that decoding means is energized to connect the rails east of said section, said another code following relay being poled to respond to the polarity of said current of traffic codes, means including contacts of the decoding means at the west end of the section to govern said main track signal, and means including contacts of said decoding means associated with said another code following relay to govern said siding leaving signal.

4. In combination with a stretch of main track over which traffic moves at times to the east and having a
passing siding and formed adjacent the siding with a track section which is provided with a track circuit including a code following relay and an associated decoding means, said relay being connected across the rails at the east end of the section, a siding leaving signal located at the east end of the siding and disposed to govern traffic moving from the siding to the main track and east on said main track, said signal having means for display of an individual indication for each of a plurality of different traffic conditions, traffic controlled means including a power source and code transmitting means having connections to the rails of the main track east of said section and operative to supply current of different code rates according to different traffic conditions; means including a remotely controlled contact, another power source and another code transmitting means connected across the rails at the west end of said section and operative to supply current of a normal code and having a code rate different from said traffic code rates when said contact is closed; said code following relay being responsive to the code of said normal code current, another code following relay and an associated decoding means including control relays, said control relays being selectively energized according to the traffic code rate at which said another code following relay is operated, means including contacts of the first mentioned decoding means and closed when that decoding means is energized to connect said another code following relay to said rails east of said section to selectively energize said control relays according to the traffic code of the current supplied by the traffic controlled means, and means including contacts of said control relays to operate said signal to display the indication corresponding to the traffic code of the current supplied.

5. In combination with a stretch of main track over which traffic moves at times from the east and having a passing siding and formed adjacent the siding with a track section which is provided with a track circuit including a code following relay and an associated decoding means, said relay being connected across the rails at the east end of the section, a siding leaving signal located at the east end of the siding and disposed to govern traffic moving from the siding to the main track and east on said main track, said signal having means operable to display an individual indication for each of a plurality of different traffic conditions, traffic controlled means including a power source and code transmitting means having connections to the rails of the main track east of said section and operative to supply current of different code rates according to different traffic conditions; means including a remotely controlled contact, another power source and another code transmitting means connected across the rails at the west end of said section and operative to supply current of a normal code and having a code rate different from said traffic code rates when said contact is closed; said code following relay being responsive to the code of said normal code current, another code following relay and an associated decoding means including control relays, said control relays being selectively energized according to the traffic code rate at which said another code following relay is operated, means including contacts of the first mentioned decoding means and closed when that decoding means is energized to connect said another code following relay to said rails east of said section to selectively energize said control relays according to the traffic code of the current supplied by said traffic controlled means, means including contacts of said control relays to operate said signal to display the indication corresponding to the traffic code of the current supplied; a station at the west end of the siding and disposed to govern traffic moving from the siding to the main track and east toward the west end of said section and operative to supply code current of a selected polarity of a first code rate to the track circuit of said first section; said code following relay of the first section poised to respond to the polarity of the current of said first code rate, circuit means including connecting contacts closed when said code following relay of the first section is operated to operate said siding leaving signal; other means including said current source, said second remotely controlled relay and said second code transmitter connected across the rails at the west end of said second section and operative to supply current of a second code rate and of a polarity to which the code following relay of the first section does not respond, means including contacts closed when the first section code following relay is not operated to energize the track circuit of the first section to the track circuit of the second section, said code following relay of the second section poised to respond to the polarity of the current of said second code rate, and means governed by the second section code following relay when operated to operate said take siding signal.

6. In combination with a stretch of main track over which traffic may move either east or west and having a passing siding and formed with a first and a second track section which extend along the siding and east thereof, the east end of which is provided with a spring switch mechanism, a siding leaving signal located along the siding and disposed to govern traffic moving from the siding through said spring switch and east on the main track, a take siding signal located at the east end of said second section and disposed when displayed to instruct a train to hand-throw the switch and move into the siding, a track circuit for each of said sections including a polar code following relay connected across the rails at the east end of the associated section; a station at the west end of the siding and provided with a current source, a first and a second code transmitter and a first and a second remotely controlled relay; means including said first code transmitter, said current source and a contact of said first remotely controlled relay and connected across the rails at the west end of said first section and operative to supply coded current of a selected polarity of a first code rate to the track circuit of said first section; said code following relay of the first section poised to respond to the polarity of the current of said first code rate, circuit means including connecting contacts closed when said code following relay of the first section is operated to operate said siding leaving signal; other means including said current source, said second remotely controlled relay and said second code transmitter connected across the rails at the west end of said second section and operative to supply current of a second code rate and of a polarity to which the code following relay of the first section does not respond, means including contacts closed when the first section code following relay is not operated to energize the track circuit of the first section to the track circuit of the second section, said code following relay of the second section poised to respond to the polarity of the current of said second code rate, and means governed by the second section code following relay when operated to operate said take siding signal.

7. In combination with a stretch of main track over which traffic may move either east or west and having a passing siding and formed with a first and a second track section which extend along the siding and east thereof, the east end of which is provided with a spring switch mechanism, a siding leaving signal located along the siding and disposed to govern traffic moving from the siding through said spring switch and east on the main track, a take siding signal located at the east end of said second section and disposed when displayed to instruct a train to hand-throw the switch and move into the siding, a track circuit for each of said sections including a polar code following relay at the east end of each of the sections, said track circuits being interconnected by contacts closed when the code following relay for the east end of the first section is not operated; a station at the west end of the siding and including a first and a second remotely controlled relay, a first and a second indication relay, a first and a second code transmitter and a current source; means including said current source, contacts of said remotely controlled relays and a contact of said first code transmitter connected to the track circuit of said first section and operative to supply a first code and of a polarity selected to be effective to operate the code following relay at the east end of the first section; means controlled by said code following relay at the east end of the first section when operated to control said siding leaving signal; other means including said current source, other contacts of said remotely controlled relays and a contact of
said second code transmitter connected to the track circuit of the first section and operative to supply coded current of a second code and of a polarity selected to be ineffective to operate the code following relay at the east end of the first section but effective to operate the code following relay at the east end of said second section due to said interconnection of the track circuits; means controlled by the code following relay at the east end of the second section when operated to control said take siding signal, circuit controlling contacts one operative to control the associated with each said signal and closed when the associated with each said signal is operated; a first indication means including a current source, said circuit controlling contact of the siding leaving signal and a contact operated by the code following relay at the east end of said first section; said second indication means connected across the rails of said first section and operative to supply an inverse code current of the first code rate, a second indication means including a current source, said circuit controlling contact of the track circuit to determine the code of the circuit for the adjacent section, wayside stations one adjacent each end of said block and each station provided with remotely controlled relays whose a selectively energized, a siding leaving signal located at the end of said first siding opposite said given end and disposed to govern traffic moving from the first siding through said block, said signal having means operable to display an individual signal aspect for each of a plurality of different traffic conditions, means including a selected one of the remotely controlled relays at the station for the end of the block at said second siding effective when energized for causing current of a selected traffic code to be supplied to the track circuit adjacent that end of the block and cascaded therefrom, means including a selected one of the remotely controlled relays at the station at said given end of said first siding effective when energized for causing current of a code different from said traffic codes to be supplied to the track circuit for the section adjacent that end of the block and cascaded therefrom, means including a code following relay and a first decoding means connected to the track circuit for the section adjacent said opposite end of the first siding responsive to said different code and having contacts in the interconnection of the track circuits to arrest the cascading of said traffic code, a second code following relay and a second decoding means, means including contacts of the first decoding means to connect the code following relay to the track circuit at said opposite end of the first passing siding, said second decoding means being responsive to said traffic codes, and means governed by said second decoding means to control said siding leaving signal.

8. In combination with a stretch of main track over which traffic may move in either direction and having passing sidings and which stretch is formed with a block extending from a given end of a first siding along said siding and to a second passing siding, said block being formed with track sections provided with coded track circuits which use different codes selected to reflect different traffic conditions, track circuits being interconnected to enable the code for the track circuit of a section to be cascaded and govern the code of the track circuit for the adjacent section in either direction, wayside stations one adjacent each end of said block and each station provided with remotely controlled relays which are selectively energized, a siding leaving signal having means operable to display a clear and an approach signal indication located at the end of said first siding opposite said given end and disposed to govern traffic moving from said first siding to the main track and through said block, means including a selected one of the control relays of the station for the end of the block at said given end of the first siding effective when energized for causing current of a code preselected to be different from said traffic codes to be supplied to the track circuit adjacent that end of the block and cascaded therefrom, means including a selected one of the control relays of the track circuit for the section adjacent said opposite end of the first siding responsive to said preselected code and having contacts interposed in the interconnections of the track circuits to arrest the cascading of said traffic code current, and a second code following relay and a second decoding device connected to the track circuit for the section adjacent said opposite end of the first siding by contacts of said first decoding device, and means including contacts of said second decoding device for controlling said signal.

10. In combination with a stretch of main track over which trains may move in either direction and having passing sidings and which stretch is formed with a block extending from a given end of a first passing siding along that siding and to a second passing siding, said block being formed with track sections provided with coded track circuits which use different codes selected to reflect different traffic conditions, track circuits being provided with interconnections operable in either direction for the code of one track circuit to determine the code of the circuit for the adjacent section, wayside stations one adjacent each end of said block and each station provided with remotely controlled relays which are selectively energized, a siding leaving signal located at the end of said first siding opposite said given end and disposed to govern traffic moving from the first siding through said block, said signal having means operable to display an individual signal aspect for each of a plurality of different traffic conditions, means including a selected one of the remotely controlled relays at the station for the end of the block at said second siding effective when energized for causing current of a selected traffic code to be supplied to the track circuit adjacent that end of the block and cascaded therefrom, means including a selected one of the remotely controlled relays at the station at said given end of said first siding effective when energized for causing current of a code different from said traffic codes to be supplied to the track circuit for the section adjacent that end of the block and cascaded therefrom, means including a code following relay and a first decoding means connected to the track circuit for the section adjacent said opposite end of the first siding responsive to said different code and having contacts in the interconnection of the track circuits to arrest the cascading of said traffic code, a second code following relay and a second decoding means, means including contacts of the first decoding means to connect the code following relay to the track circuit at said opposite end of the first passing siding, said second decoding means being responsive to said traffic codes, and means governed by said second decoding means to control said siding leaving signal.
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extending from a given end of a first siding along said siding and to a second passing siding, said block being formed with track sections provided with coded track circuits which use different code rates selected to reflect different traffic conditions, said track circuits being interconnected to enable the code for the track circuit of a section to be cascaded and govern the code rate of the track circuit for the adjacent section in either direction, wayside stations one adjacent each end of said block and each station provided with control relays which are selectively energized and with indicating devices effective to provide an indication when energy is applied thereto, a siding leaving signal having means operable to display a clear and an approach indication located at the end of said first siding opposite said given end and disposed to govern traffic moving from said first siding to the main track and through said block, means including a selected one of the control relays of the station for the end of the block at said second siding effective when energized for causing current coded according to traffic conditions to be supplied to the track circuit adjacent that end of the block and cascaded therefrom, means including a selected one of the relays of the station at said given end of the first passing siding effective when energized for causing current of a normal code having a code rate different from said traffic codes to be supplied to the track circuit adjacent that end of the block and cascaded therefrom, means including a first code following relay and a first decoding device connected to the track circuit for the section adjacent said opposite end of the first siding responsive to said different normal code and having connections interposed in the interconnection for the track circuits to arrest the cascading of said traffic codes, a second code following relay and a second decoding device connected to the track circuit adjacent said opposite end of the first passing siding by contacts of said first decoding device and responsive to said traffic code, means including contacts of said second decoding device to control said signal, means including a contact operatively connected to said signal and a contact of said first code following relay to generate and supply to the track circuit at said opposite end of the first passing siding current of an inverse code for said normal code, means including another code following relay and another decoding device connected to the track circuit adjacent said given end of the first section responsive to said inverse code, and means including contacts of said another decoding device to supply indication energy to the station at said given end of the first siding.

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