

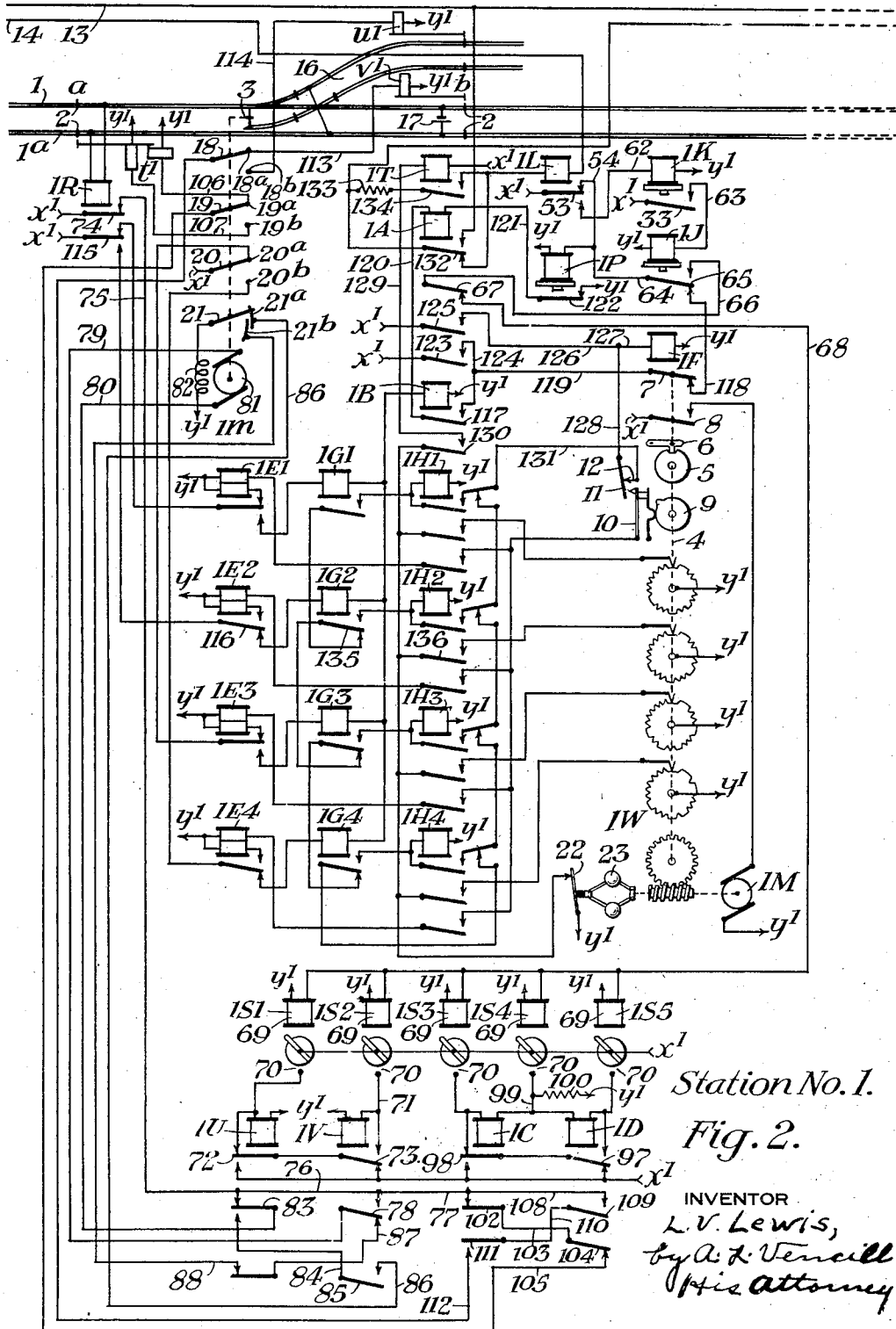
March 28, 1939.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Original Filed Feb. 16, 1928 3 Sheets-Sheet 2



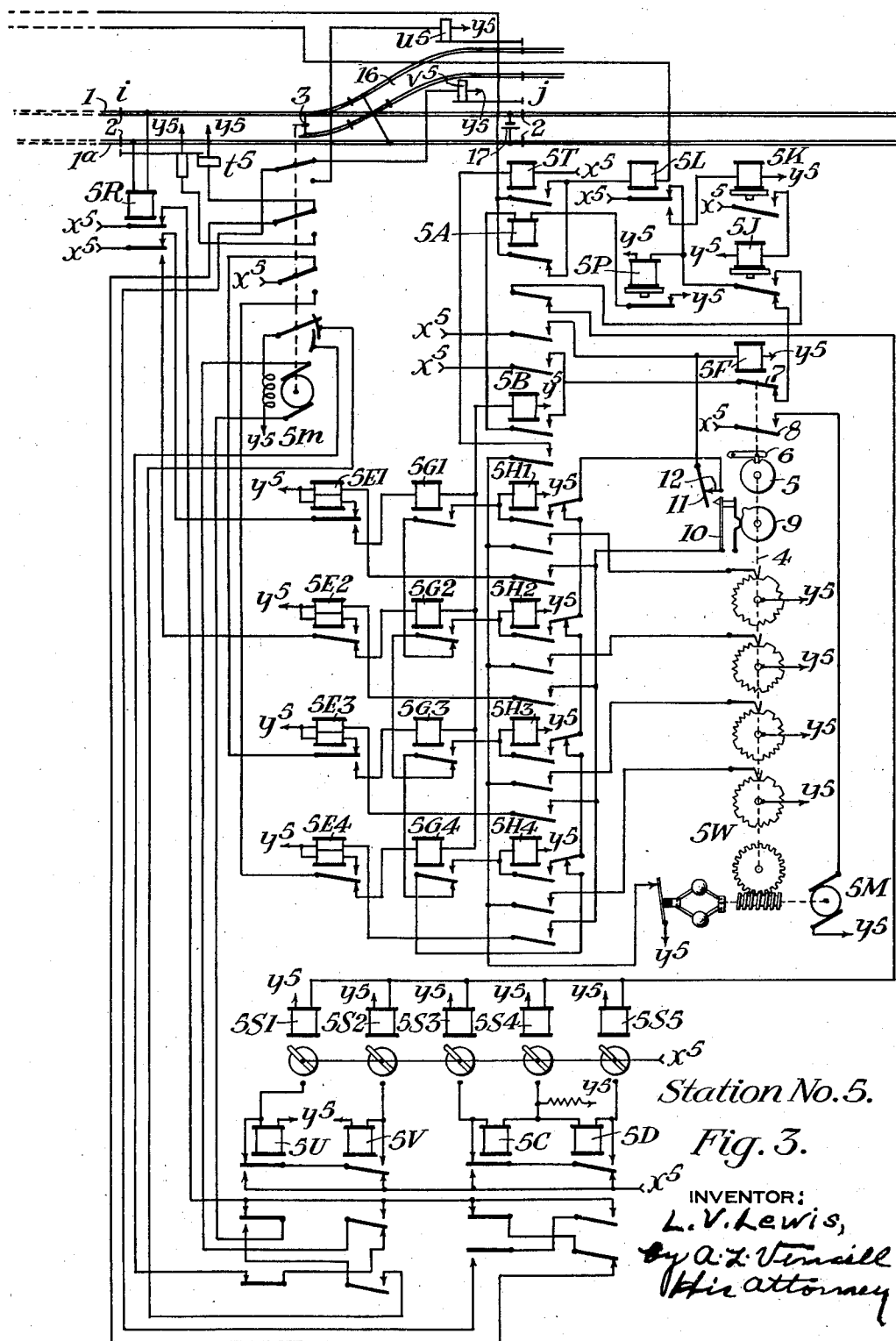
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UNITED STATES PATENT OFFICE

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RAILWAY TRAFFIC CONTROLLING
APPARATUS

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Application February 16, 1928, Serial No. 254,690
Renewed May 12, 1931

68 Claims. (Cl. 246—5)

My invention relates to railway traffic controlling apparatus, and particularly to apparatus for safely controlling traffic governing devices, such as railway switches and signals, from a remote point, such for example, as a dispatcher's office, and for also indicating the condition of such devices at such office.

In the present application, apparatus embodying my invention is incorporated in a centralized traffic controlling system for railroads in which the indication and control functions are performed by codes, which operate selectors but this arrangement is not essential.

I will describe one form and arrangement of railway traffic controlling apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Figs. 1, 2 and 3, when placed end to end in the order named, comprise a diagrammatic view illustrating one form of railway traffic controlling apparatus embodying my invention.

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

Referring to the drawings, the apparatus comprises a control station which may be a train dispatcher's office, and a plurality of field stations, here shown as five in number; stations Nos. 1 and 5 only being shown complete in the drawings. These stations are all connected together by a normally closed communication circuit comprising two line wires 13 and 14 which extends from the dispatcher's office to the most remote field station, and which is supplied with energy from a single source which as illustrated comprises a line battery Q. Located at the office is a transmitting device OW for delivering control codes formed by repeatedly interrupting the line circuit including wires 13 and 14, to the various stations. Located at each station is apparatus which is selectively responsive to these control codes to actuate traffic governing devices. A transmitting device is also located at each station for delivering indication codes over the same two line wires 13 and 14 to the office, where indication apparatus, selectively responsive to these indication codes informs the operator of the condition of the governing devices located at the several stations.

The system and apparatus herein disclosed is an improvement upon that disclosed and claimed in a copending application Serial No. 362,948, filed May 14, 1929, by Clarence S. Snively, for Remote controlling apparatus.

The office is provided with a plurality of panels one for each station but only two of which are

shown complete in the drawings. The office is also provided with a line relay designated by the reference character OL, a slow-acting locking relay OP controlled over a front contact of relay OL, a slow-acting relay OK controlled over a back contact of relay OL, a slow acting repeating relay OJ controlled over a front contact of relay OK, a transmitting relay OT, a master relay OA, and a delivery relay OB. Each of the stations is also provided with relays similar to those just named and designated by reference characters similar to those applied to corresponding relays at the office with prefixes corresponding to the locations. Furthermore, each panel at the office and each station is provided with a series of stop relays, a series of start relays, and a series of send relays. The stop relays at each station are designated by the reference character E with a prefix corresponding to the location and a distinguishing exponent. The stop relays at the office are each designated by the reference character e with a distinguishing exponent and a prefix corresponding to the panel with which such relay is associated. In similar manner, the start relays at the stations are designated by the reference character G and the start relays at the office are designated by the reference character g, and the send relays at the stations are designated by the reference character H, while the send relays at the office are designated by the reference character h.

Each transmitting device referred to above, is designated by the reference character W with a prefix corresponding to the location, and each such device comprises a rotatable shaft 4, operatively connected with a driving motor designated by the reference character M with a prefix corresponding to the location. The shaft 4 of each device W carries a plurality of code generating devices or code wheels, each controlling a contact which is arranged to be alternately opened and closed when the shaft 4 rotates. The apparatus is arranged in such manner that the circuit including a contact controlled by one of the code wheels receives one complete code when the shaft 4 makes one complete revolution. The shaft 4 is normally locked in a predetermined position by a latch 6 which co-operates with a cam 5. Referring particularly to the device OW located at the office, this device is controlled by a motor relay OF. As shown in the drawings, relay OF is de-energized. When relay OF becomes energized, however, current flows from terminal x⁰ of a source of energy not shown in the drawings, through front contact 8 of relay OF, wire

15, and motor OM to terminal y^0 of the same source. The latch 6 is also lifted when relay OF is energized and the motor therefore drives the shaft 4 to rotate all of the code wheels associated therewith. It should be noted that as soon as the rotation of the shaft 4 has commenced, cam 5 moves to a position in which the latch 6 holds the contacts of relay OF in their energized position. It follows that if relay OF becomes de-energized, after the device OW has started, contact 8 of the relay will be held closed mechanically by latch 6 so that the operation of the device will continue for one complete operation until the latch 6 again drops to lock the shaft 4 in its initial position. Each transmitting device W also comprises a normally closed contact 11—12 operated by a cam 9 on the shaft 4. When the shaft is rotated, cam 9 operates, just before the shaft returns to its initial position, to open contact 11—12 and to close contact 10—11 for a brief interval of time. The transmitting device W located at each station is controlled by an associated motor relay F in a manner similar to the control of device OW by relay OF. In addition, however, the transmitting device W located at each station is provided with a contact designated by the reference character 22 and operated by a centrifuge 23 driven from the shaft 4. When the shaft 4 is at rest, contact 22 is closed but when the shaft is being rotated by the associated motor M, the centrifuge 23 opens contact 22.

The equipment located at each station may be utilized to control traffic governing devices of any suitable form, but for purposes of explanation, I have illustrated the apparatus embodying my invention as applied to the control of railway switches and signals associated with a stretch of railway track having rails 1 and 1^a divided by means of insulated joints 2 to form a plurality of track sections. Section $a-b$ is located adjacent station 1 and section $i-j$ is located adjacent station 5, it being understood that each of the remaining stations control apparatus similar to that illustrated for these two stations. Referring particularly to the apparatus located at station 1, the reference character 3 designates a railway switch of the usual and well known form, by means of which the rails of section $a-b$ are connected with a siding 16. A track relay designated by the reference character 1R is connected across the rails adjacent the left-hand end of section $a-b$, and a track battery 17 is connected across the rails adjacent the opposite end of this section. The rails of the siding 16 to the left of point b are connected with the rails of section $a-b$ in accordance with the usual practice.

Eastbound traffic over switch 3 is controlled by a signal t^1 and westbound traffic over this switch is controlled by signals u^1 and v^1 . The switch 3 is controlled by a motor 1M which is in turn controlled by two switch relays 1U and 1V. The switch 3 controls a plurality of contacts in such manner that when the switch occupies its normal position, in which it is shown in the drawings, contacts 18—18^a, 19—19^a and 20—20^a are closed. When the switch is reversed, however, contacts 18—18^b, 19—19^b and 20—20^b are closed. Furthermore, contact 21—21^a is closed at all times except when the switch occupies its reverse position and contact 21—21^b is closed at all times except when the switch occupies its normal position. The signals t^1 , u^1 and v^1 are controlled in part by contacts actuated by the switch 3, and in part by two signal relays 1C and 1D. The ap-

paratus located at each of the remaining stations is similar to that just described in connection with station 1.

Associated with each panel in the office is a track indication relay designated by the reference character X with an exponent corresponding to the panel. Each track indication relay X controls a lamp 24 in such manner that the lamp is connected with terminals x^0 and y^0 over back contact 25 of the associated relay X when this relay is de-energized. As will be described in detail, hereinafter, each track indication relay X is de-energized when the section of track associated with the corresponding station is occupied. When one of the lamps 24 is lighted, therefore, the operator is informed that the corresponding section of track is occupied. Furthermore, each panel is provided with two switch indication relays designated by the reference characters Y and Z with exponents corresponding to the panel. Each panel also includes movable control members or keys comprising a manually operable switch lever and a manually operable signal lever designated by the reference characters r and k , respectively, with exponents corresponding to the panel.

As shown in the drawings, each section of track is unoccupied and each switch 3 occupies its normal position. Furthermore, the upper blade of each signal t indicates proceed and the remaining signals are at stop. The track indication relay X for each panel at the office is energized, so that all lamps 24 are extinguished and each switch indication relay Y is energized but each relay Z is de-energized. Each switch lever r occupies its normal position and each signal lever k occupies its left-hand position. At the office the stop relays $e1$ and $e3$ associated with each panel are energized, but the remaining stop relays are all de-energized and all the start relays g and send relays h are also de-energized. In similar manner at each station the stop relays E1 and E3 are energized but all other stop relays are de-energized and all stop and send relays G and H are de-energized. Furthermore, at the office and at each station all transmitting relays T, master relays A, delivery relays B, and slow-acting relays J and K are de-energized. Each motor relay F is also de-energized and all transmitting devices W are at rest. At each station, relays U and C are energized but relays V and D are de-energized.

Under normal conditions, it will be seen that a closed line circuit is completed over line wires 13 and 14 which includes battery Q at the office and also includes the line relay L at the office and at each field station, so that all line relays L and all locking relays P are energized. Commencing with this normal condition of all of the apparatus, I will explain the operation of the system by first assuming that the operator wishes to change the condition of a device located at one of the stations. For purposes of explanation, I will assume that he wishes to reverse switch 3 at station 1. To accomplish this result, he moves lever r^1 of panel 1 in the office to its reverse position. This extinguishes lamp 26 and completes a circuit from terminal x^0 , over reverse contact of lever r^1 , wire 28, back contact 29 of stop relay 1e2, wire 30, winding of start relay 1g2, wires 31 and 32, and winding of delivery relay OB, to terminal y^0 . Relays 1g2 and OB therefore become energized and the closing of front contact 39 of relay OB completes a pick-up circuit for relay OA which passes from x^0 , over back contact 33 of relay OK, wire 34, back contact 35 of relay OJ, wire 36, back contact 7 of 75

relay OF, wires 37 and 38, front contact 39 of relay OB, wire 40, and winding of relay OA to terminal y^0 . Relay OA then becomes energized and is thereafter stuck up over a circuit from terminal x^0 , front contact 41 of relay OA, wires 42 and 36, front contact 39 of relay OB, wire 40, and winding of relay OA to terminal y^0 . Back contact 39 of relay OA is connected in parallel with front contact 90 of relay OT in the normally closed line circuit by means of which current is supplied from battery Q to the line relays L at the office and at each station, but relay OT is now de-energized so that when relay OA becomes energized, the line circuit is opened to initiate the control code and all relays L become de-energized. The opening of relay OL breaks the circuit for relay OP from terminal x^0 , through front contact 53 of relay OL, wires 54 and 55, and winding of relay OP to terminal y^0 . Relay OP therefore becomes de-energized, but due to the slow acting characteristics of this relay, a time interval elapses after the opening of relay OL and prior to the closing of back contact 57 of relay OP. At the expiration of the time interval required for relay OP to drop, back contact 57 of this relay closes, whereupon current flows from terminal x^0 , through front contact 43 of relay OA, wire 44, back contact 57 of relay OP, wire 58, and winding of relay OF to terminal y^0 . The motor relay OF then becomes energized, thereby completing, at front contact 8 thereon, the circuit previously traced for motor M of the transmitting device OW. Shaft 4 therefore commences to operate and by the operation of the latch 6, the rotation of this shaft continues for one complete operation, even though relay OP may be subsequently energized to interrupt the circuit just traced for relay OF.

When relay OA became energized, the closing of front contact 43 completed a circuit from terminal x^0 , over front contact 43 of relay OA, wires 44 and 45, contact 11—12 operated by cam 9 of device OW, wire 46, thence through a normally closed contact 47 on each of the sending relays h in series, wire 48 and thence through a back contact of each of the start relays g in series to front contact 49 of relay 1g2, wires 50 and 51, and winding of relay 1h2 to terminal y^0 . Relay 1h2 therefore picks up, thereby completing a stick circuit for this relay which passes over the path just traced to front contact 52 of relay 1h2, thence through wire 51 and winding of relay 1h2 to terminal y^0 . When relay 1h2 becomes energized, the opening of the associated contact 47 opens the pick-up circuits for all send relays h below 1h2. Furthermore, the energization of relay 1g2 opens the circuit for all send relays h above 1h2. It will be plain therefore that only one send relay h can be energized at a time.

Since relay 1h2 is now energized, a circuit is completed from terminal x^0 , through the winding of relay OT, wire 59, front contact 60 of relay 1h2, and wire 61 through the code wheel of the transmitting device OW associated with relay 1h2 to terminal y^0 , so that relay OT picks up to close the line circuit. This terminates the first element of the control code, which is thus a relatively long line open period. This initial element is employed as a locking element, in a manner hereinafter pointed out, to prevent interference with a control code by the stations. As the transmitting device OW operates, the code wheels rotate, and therefore, the circuit for relay OT is periodically opened and closed in

accordance with a predetermined code. As a result, relay OT is periodically energized and de-energized in accordance with this code. Each time relay OT becomes energized, the closing of front contact 90 of this relay closes the line circuit including the battery Q and all of the line relays at the several stations. It follows therefore that under the conditions just described, the periodic operation of relay OT impresses upon the line wires 13 and 14 a control code which may be utilized to actuate traffic governing means at one of the stations.

Located at each of the stations is a group of selectors of any suitable type each designated by the reference character S with a distinguishing suffix and a prefix corresponding to the station. As here shown each selector comprises a winding 69 and a contact 70 which is arranged to be closed for a brief interval of time when the associated winding is supplied with a predetermined code. Referring particularly to station 1, when a control code is impressed upon line wires 13 and 14 by operation of transmitting relay OT at the office, relay 1L at station 1 is periodically energized and de-energized in synchronism with relay OT. The first time the relay 1L becomes de-energized, current flows from terminal x^1 , through back contact 53 of relay 1L, wire 62, and winding of relay 1K to terminal y^1 . Relay 1K therefore becomes energized. Of course the circuit for relay 1K is opened when relay 1L next becomes energized, but due to the slow acting characteristics of relay 1K, this relay holds its front contacts closed during the brief intervals that relay 1L is energized while this relay is receiving a control code. When relay 1K is energized, current flows from terminal x^1 , over front contact 33 of relay 1K, wire 63, and winding of relay 1J to terminal y^1 so that relay 1J is also energized. It will be seen therefore that the first de-energization of relay 1L in response to a code received from the office picks up both relays 1K and 1J. When relay 1L next becomes energized, current flows from terminal x^1 , over front contact 53 of relay 1L, wires 54 and 64, front contact 65 of relay 1J, wire 66, back contact 67 of relay 1A, wire 68, thence through windings 69 of all of the selectors 1S at station 1 in parallel to terminal y^1 . It will be plain from the foregoing, that as a result of the intermittent operation of line relay 1L, due to the reception of a control code from the office, energy is intermittently supplied to the windings 69 of the selectors in accordance with this code. Selector 1S2 is responsive to the control code delivered to the line wires when relay 1h2 is energized as hereinbefore described. At the conclusion of the code, selector 1S2 operates to close its contact 70, but the remaining selectors are unaffected. The closing of contact 70 of selector 1S2 completes a pick-up circuit however, for switch relay 1V which thereupon becomes energized and breaks the stick circuit for relay 1U. When relay 1U is de-energized, a stick circuit is completed for relay 1V over back contact 72 of relay 1U and front contact 73 of relay 1V. Relay 1V is therefore maintained in its energized condition, even though contact 70 of selector 1S2 reopens.

When relay 1V becomes energized, the motor 1m actuating switch 3 is energized. In the form here shown this motor comprises an armature 81 and a field 82 and is provided with a circuit which passes from terminal x^1 , over front contact 74 of relay 1R, wires 75 and 76, front contact 78 of

relay IV, wire 79, armature 81 of motor 1m, wire 80, back contact 83 of relay IU, wire 84, front contact 85 of relay IV, wire 86, contact 21—21^a operated by switch 3, and field 82 of motor 1m to terminal y¹. As a result, the motor 1m operates to move the switch 3 toward its reverse position. When the switch has attained its reverse position, contact 21—21^a opens to de-energize motor 1m. It should be pointed out that the control code delivered to the line wires 13 and 14 is supplied to the selectors located at each of the stations in the same manner as has already been described in connection with station number 1, but that selector IS2 is the only one which is responsive to the control code which is delivered when relay 1h2 is energized at the office.

Just before the conclusion of the control code, cam 9 of transmitting device OW moves contact 10 into engagement with contact 11. As a result, current flows from terminal x⁰, over front contact 43 of relay OA, wires 44 and 45, contact 11—10 operated by cam 9, wire 91, front contact 92 of relay 1h2, wire 93, winding of stop relay 1e2 to terminal y⁰. Relay 1e2 therefore becomes energized to interrupt the circuit for start relay 1g2. Relay 1e2 is stuck up over its own contact and a reverse contact of lever r¹. At the same time, contact 11—12 is opened by cam 9 so that the stick circuit for relay 1h2 is interrupted and this relay becomes de-energized. If no other lever at the office has been operated to energize the start relay, all of the parallel circuits for relay OB are now open, so that this relay becomes de-energized, breaking the stick circuit for relay OA and causing the latter relay to become de-energized. This de-energizes the circuit for motor relay OF so that when the shaft 4 has completed its rotation, latch 6 engages the cam 5 to lock the shaft in its initial position. Furthermore, the closing of back contact 89 of relay OA again closes the line circuit, energizing relay OL, causing relay OP to pick up, and restoring the apparatus to its original condition.

In similar fashion, at the station, when the line circuit is continuously closed, relay 1L is continuously energized. Under these conditions, relays 1K and 1J both become de-energized so that the apparatus at the station is also restored to its initial condition. The operation of the apparatus in moving the switch from the reverse to the normal position, will be understood without further explanation, lever r¹ being moved to the left-hand position to pick up selector IS1 at station 1 for this purpose. It should be understood that the operation of the apparatus located at each of the remaining stations is similar to the operation of the apparatus located at station 1.

I will now assume that prior to the completion of the code delivered by send relay 1h2, another start relay g at the office was energized, as by movement of lever k¹ to its middle position to set all the signals at station 1 at stop. Under these conditions, current from terminal x⁰ flows through lever k¹ in its middle position, wire 94, back contact 95 of relay 1e4, wire 96, winding of relay 1g4, wire 32, and winding of relay OB to terminal y⁰. It will be plain, therefore, that with lever k¹ in its middle position, relay 1g4 is energized in series with relay OB, so that when stop relay 1e2 becomes energized to open the circuit first traced for relay OB in series with relay 1g2, relay OB remains energized by virtue of current supplied thereto in series with relay 1g4. Relay OB therefore holds closed the stick circuit for relay OA

and this relay in turn holds closed the circuit for motor relay OF. Under these conditions, the transmitting device OW does not stop at the conclusion of the first rotation but continues to operate for a second rotation during which the code wheel associated with relay 1h4 operates to supply a control code to the line wires 13 and 14 in the same manner as has already been described in connection with the supply of a control code to these line wires by the code wheel associated with the sending relay 1h2 when start relay 1g2 associated therewith is energized. When relay 1h4 is energized to deliver a control code to the line wires, contact 70 of selector IS4 at station 1 is closed for a brief interval, but none of the other selectors is affected. The closing of contact 70 of selector IS4 connects terminal x¹ with a common terminal of relays 1C and 1D. The free terminals of these relays are at times also connected with terminal x¹ and it follows that when contact 70 of selector IS4 is closed, both terminals of relays 1C and 1D are at the same potential so that these relays become de-energized. If contact 70 of selector IS3 is closed, relay 1C becomes energized and is thereafter stuck up over back contact 97 of relay 1D and front contact 98 of relay 1C, winding of relay 1C, wire 99, and resistor 100 to terminal y¹. In similar manner if contact 70 of selector IS5 is closed, relay 1D is picked up, and this relay is subsequently stuck up by current which flows from terminal x¹, over back contact 93 of relay 1C, front contact 97 of relay 1D, winding of relay 1D, wire 99, and resistor 100 to terminal y¹. Selector IS3 may be closed by moving lever k¹ on panel number 1 at the office to the left-hand position, whereupon the energization of relay 1h3 delivers a control code to the line wires, which actuates selector IS3. Furthermore, selector IS5 may be actuated to pick up relay 1D by moving lever k¹ of panel number 1 at the office to the right-hand position, whereupon a sending relay 1h5 is actuated to deliver a control code to the wires to operate selector IS5.

As has already been explained, either of the signal relays 1C or 1D may be de-energized by actuating selector IS4 by placing lever k¹ in panel number 1 in the middle position. If relay 1C is energized, when switch 3 at station 1 occupies its normal position, as shown in the drawings, current flows from terminal x¹, over front contact 74 of relay 1R, wires 75, 76 and 77, front contact 102 of relay 1C, wire 103, back contact 104 of relay 1D, wire 105, contact 19—19^a operated by switch 3, wire 106, and operating mechanism of the upper blade of signal t¹ to terminal y¹. Under these conditions, the upper blade of signal t¹ indicates proceed. If switch 3 is reversed, when relay 1C is energized current flows over the circuit just traced as far as wire 105, thence through contact 19—19^b, wire 107, and operating mechanism of the lower blade of signal t¹ to terminal y¹, thereby causing the lower blade of signal t¹ to indicate proceed. If, however, relay 1D is energized, signal u¹ or signal v¹ may be cleared, depending upon the condition of switch 3. The circuit for signal v¹ may be traced from terminal x¹, over front contact 74 of relay 1R, wires 75, 76, 77 and 108, front contact 109 of relay 1D, wire 110, back contact 111 of relay 1C, wire 112, contact 18—18^a operated by switch 3, wire 113, and operating mechanism of signal b¹ to terminal y¹. If switch 3 is reversed, however, current flows over the circuit just traced as far as wire 112, thence over contact 18—18^b, wire 114, 75

and operating mechanism of signal u^1 to terminal y^1 . Although I have referred particularly to the apparatus located at station 1, it should be understood that the apparatus at the remaining stations operates in similar manner, the selectors S at the several stations being separately responsive to the control codes delivered to the line wires when the code wheels associated with the corresponding panels at the office are utilized to supply the codes.

In addition to the transmission of control codes from the office to the several stations, the apparatus is arranged to transmit indication codes from the several stations to the office. In explaining this feature of the apparatus, I will assume that a train enters section $a-b$ at station 1, thereby de-energizing track relay 1R. The closing of back contact 115 of this relay picks up relay 1G2 and 1B in series, over back contact 116 of stop relay 1E2, the circuit being clear from the drawings without tracing it in detail. When relay 1B becomes energized, the closing of front contacts 117 and 130 thereon completes pick-up circuit for relays 1A and 1T. The pick up circuit for relay 1A may be traced from terminal x^1 , over front contact 53 of relay 1L, wires 54 and 64, back contact 65 of relay 1J, wire 118, back contact 7 of motor relay 1F, wire 119, front contact 117 of relay 1B, wire 120, winding of relay 1A, wire 121, and front contact 122 of relay 1P, to terminal y^1 . It will be plain that this circuit is closed only if the line circuit is completed so that relay 1L is energized, and if relay 1P is also energized. The circuit for relay 1T may be traced from terminal x^1 , relay 1T, wire 129, front contact 130 of relay 1B, contact 22, which is closed when motor 1M is at rest, to terminal y^1 . When relay 1A becomes energized, the normal line circuit through its back contact 132 is interrupted, and the line beyond station 1 is shunted by a connection from that portion of line wire 14 at the right of the station to line wire 13, over front contact 132 of relay 1A, so that the portion of the line circuit to the right of station 1 is short-circuited. At the same time, the portion of line wire 14 to the left of station 1 and including relay 1L is connected with line wire 13 through a resistance 133 over front contacts 132 and 134 of relays 1A and 1T. The resistance 133 is proportioned to compensate for that portion of the line which has been shunted by closing of front contact 132 of relay 1A. When relay 1A becomes energized, a stick circuit is closed for this relay from terminal x^1 , over front contact 123 of relay 1A, wire 124, front contact 117 of relay 1B, wire 120, winding of relay 1A, wire 121, and front contact 122 of relay 1P to terminal y^1 . After relay 1A has once been energized, therefore, over back contact 7 of relay 1F, the relay is subsequently held closed as long as relays 1B and 1P are picked up even though motor relay 1F subsequently becomes energized. When front contact 125 of relay 1A closes, current flows from terminal x^1 , over front contact 125 of relay 1A, wires 126 and 127, and winding of relay 1F to terminal y^1 . It should also be noted that the closing of front contact 125 connects terminal x^1 , through contact 11—12 operated by cam 9 of transmitting device 1W, with wire 131 and thence through the normally closed contacts of send relays H and back contacts of start relays G to front contact 135 of relay 1G2, now energized, thereby picking up relay 1H2 and preventing the energization of any other H relay. The energization of relay 1F sets the transmitting device 1W into operation,

so that contact 22 opens, thereby de-energizing relay 1T, so that the line circuit is opened to initiate the indication code. Relay 1H2 is now energized, however, so that the code wheel associated with this send relay is included in the circuit for relay 1T over front contact 136 of relay 1H2. It follows that as the transmitting device 1W operates, relay 1T is again energized by a circuit through the code wheel. The opening of the contact 22 therefore deenergizes relay 1T to open the line circuit for only a very brief time interval which is terminated as soon as the code wheel has commenced its operation. During the subsequent rotation of the code wheel, relay 1T is periodically energized in accordance with the indication code determined by the code wheel associated with relay 1H2. Each time relay 1T becomes energized, the line circuit is closed to energize relay 1L and also to energize relay 1O at the office. Each time front contact 53 of relay 1L opens, relay 1P is de-energized, but this relay is slow acting and holds its front contact 122 closed for the duration of each of the line open intervals between impulses in the indication code delivered to the line, so that relay 1A remains energized.

The first time relay 1O at the office becomes de-energized in response to an indication code, the closing of back contact 53 of this relay completes a circuit for relay 1OK, which thereupon closes its front contact 33 to energize relay 1OJ. Relays 1OK and 1OJ, due to their slow releasing characteristics, are subsequently held energized during the periodic energization of relay 1OL, corresponding to the code received from station 1. Each time relay 1OL becomes energized, current flows from terminal x^0 , over front contact 53 of relay 1OL, wires 54 and 137, back contact 138 of relay 1OA, wire 139, front contact 140 of relay 1OJ, and thence to wire 141 which is connected with the windings 69 of all of the selectors N at the office. Each of the panels is provided with a set of these selectors N which are similar to selectors S at the stations and are selectively responsive to the indication codes received from the stations. Selector 1N2 is responsive to the code delivered to the line when sending relay 1H2 at station 1 is energized, so this selector now closes its contact 70 for a brief interval. When contact 70 of selector 1N2 becomes closed terminal x^0 is connected with the right-hand terminal of relay x^1 , and since the potential of the two terminals of this relay are then equal, the relay becomes de-energized and remains de-energized after contact 70 of selector 1N2 opens. With relay x^1 de-energized, the lamp 24 is lighted to indicate to the operator that a train occupies section $a-b$ at station 1.

When the transmitting device 1W has completed one rotation, contact 10—11 closes and contact 11—12 opens. Stop relay 1E2 then picks up, and assuming that no other relay G at station 1 is energized, the energization of stop relay 1E2 breaks the circuit for relay 1B at back contact 116 of relay 1E2. The relay 1E2 is subsequently held closed by its stick circuit over back contact 115 of relay 1R, and front contact 116 of relay 1E2. When relay 1B becomes a de-energized, relay 1A opens, thereby re-establishing the normal line circuit and de-energizing relay 1F. The transmitting device 1W stops when latch 6 engages cam 5 to lock the device in its initial position. It should be pointed out that the opening of contact 11—12 de-energizes relay 1H2 and

that the apparatus is now restored to its normal condition.

If the line relay remains open during transmission of the code, as would be the case, for example, if the line circuit were opened due to a line break, relay 1P opens its front contact. When this happens, relay 1A, of course, becomes de-energized. This opens the circuit for the send relay then energized and immediately discontinues the supply of code to the line circuit. Contact 8 of relay 1F is now held closed mechanically however, and the transmitter is restored to its initial position so that when the line break is repaired, the transmitter starts from the proper position to deliver a perfect code to the line circuit.

If track relay 1R now becomes energized, the closing of front contact 115 of this relay picks up relays 1G1 and 1B, whereupon the operation of the apparatus located at station 1 is similar to that already described in connection with the de-energization of relay 1R, with the exception that when relay 1H1 becomes energized the code wheel associated with this relay determines the code delivered to the office. The indication code transmitted under these conditions, picks up selector 1N1 at the office and when contact 70 of this selector closes, current is supplied to relay x^1 and this relay is subsequently stuck up over its own front contact 25, thereby extinguishing the lamp 24 to indicate to the operator that the train has passed out of section $a-b$ at station 1.

Furthermore, the contacts 20-20^a and 20-20^b operated by switch 3 at station 1 control send relays 1H3 and 1H4, respectively, so that indication codes governed by the code wheels associated with these relays can be delivered to the office to actuate selectors 1N3 and 1N4, respectively. As shown in the drawings, relay Y¹ is energized by current which flows from terminal x^0 , over a normal contact of lever r^1 , back contact 140^a of relay Z¹, a front contact 141 of relay Y¹, and through the winding of relay Y¹ to terminal y^0 . Under these conditions, current also flows over a front contact 141 of relay Y¹ to an indicator lamp 26. When lamp 26 is lighted, therefore, the operator is informed that the switch occupies its normal position. If the operator moves lever r^1 to its reverse position, thereby transmitting the control code to actuate motor 1M at station 1 to reverse switch 3, contact 20-20^b at station 1 will be closed, whereupon the apparatus at station 1 will be actuated to transmit to the office an indication code which picks up selector 1N4. It should be noted as soon as the lever r^1 was moved away from its normal position the stick circuit for relay Y¹ was opened and lamp 26 was extinguished. When contact 70 of selector 1N4 closes, a pick up circuit is closed for relay Z¹, and this relay is subsequently stuck up over its own front contact 140, back contact 141^a of relay Y¹, and the reverse contact of lever r^1 . Under these conditions, current is supplied to lamp 27 to indicate that switch 3 at station 1 occupies its reverse position.

Attention should be drawn to the fact that the switch indication lamps 26 and 27 can be lighted only when the position of the switch corresponds to the position of the control lever at the office.

The apparatus located at each station is arranged to permit the storing of indications in the same manner as has already been described in connection with the apparatus at the office. That is to say, if relay 1B at station 1 has been picked up in series with relay 1G2, to deliver to the office

the indication code corresponding to the sending relay 1H2, and if prior to the completion of this code another start relay G is energized, as for example, start relay 1G4, the transmitting device 1W does not stop at the end of its first rotation but continues for a second rotation or for successive rotations until the codes corresponding to all start relays G1 which are energized are delivered in succession to the office.

It will be apparent from the above description that the start relays G at each station are de-energized by picking up the associated stop relay E and in similar manner the start relays g at the office are de-energized by picking up the associated stop relay e . Each stop relay e remains energized, after it has once been picked up, until the device which controls it is moved to a different position. For example, as shown in the drawings, the stop relays $e1$ and $e3$ associated with each panel at the office are energized as a result of the fact that the control codes last transmitted from each of these panels were the codes corresponding to the normal position of lever r and the left-hand position of lever k . In similar manner, the stop relays 1E1 and 1E3 at station 1 are energized as a result of the fact that the energization of track relay 1R and the movement of the switch 3 to its normal position initiated the transmission of the indication codes which were last transmitted by device 1W. As soon as one of the levers associated with a panel in the office is moved from the position in which it is illustrated in the drawings, the corresponding stop relay will become de-energized, and if the lever is quickly returned to its original position, the control code corresponding to that position may be delivered to the stations without first sending another code. At the stations, it is, of course, impossible to repeat an indication code until the indication code corresponding to the opposite position of the related function has been delivered to the office. For example, after track relay 1R has been energized to pick up selector 1N1 at the office, stop relay 1E1 is energized and relay 1G1 cannot again be energized until stop relay 1E1 is de-energized by de-energization of relay 1R.

It will be observed from the drawings that the selectors N at the office can be actuated only when relay OJ is energized and when relay OA is de-energized. But when a control code is being delivered from the office to the stations, relay OA is energized so that under these conditions all of the selectors at the office are de-energized. Furthermore, the selectors S at each station are disconnected when the corresponding relay A is energized but this relay must be energized when an indication code is being delivered from such station to the office. With this arrangement it will be seen that all selectors located at the office and at each station are disconnected when a code is being delivered to the line from that location. One advantage of this feature is that it results in economy of codes necessary to operate the system. That is to say, selectors associated with panel number 1 can be operated upon codes which are the same, except for the character of the initial locking element which distinguishes a control code from an indication code, as the codes which operate the selectors located at station 1 without interference between the two sets of selectors because when selectors N associated with the office are connected with the line wires to receive indication codes from the code wheels at station

1, selectors S at this station are always disconnected from the line wires.

It has already been pointed out that after one of the transmitting devices W has been set into operation, the motor will continue to operate to rotate the shaft until the wheels have been restored to their initial positions, irrespective of changes in the circuits which first set the device into operation. It is therefore assured that the devices W will always come to rest in their initial position.

At each of the stations and at the office the pick up circuit for the associated relay A is carried over a back contact of the motor relay F. It is therefore impossible to energize a relay A until the corresponding motor relay is de-energized, as will be the case only when the transmitting device is at rest. With these arrangements, since the relay A must be energized before codes can be transmitted, it is impossible to start the sending of a code from a location unless all of the code wheels at that location occupy their initial positions.

It will be remembered that when the office starts to send a control code, the line is opened for a relatively long time interval, and that all line relays L become de-energized as soon as relay OA picks up, and do not become re-energized until after the time interval required to release relay OP, start the transmitting device OW, and energize relay OT to begin the first line closed impulse of the code. At each of the stations, the de-energization of the line relay L at that station picks up the associated relays K and J in cascade, so that the pick-up circuit for relay A at such station is opened at the beginning of the control code at front contact 53 of relay L, and is then held open for the duration of the code at back contact 65 of the associated relay J. Since no station can commence to send, until the associated relay A is energized, it follows that no station can send an indication code while a control code is being delivered to the line wires from the office.

Furthermore, when any field station is sending, the relays J at all remaining stations will be energized to prevent such other stations from sending indication codes until the first station has completed its codes. If two stations start to send simultaneously, front contact 132 of relay A at the station nearest the office sectionalizes the line circuit as already described and so causes the line relays at more remote stations to release and to remain deenergized for the duration of the indication code. The locking relay P at each more remote station will therefore release, opening its contact 122 in the stick circuit for the associated relay A to release relay A if energized, thereby preventing such remote stations from sending until the normal line is again closed at all stations.

When a code originates at a station, the line is opened only for a brief interval as explained hereinbefore, and if a station and the office start to send at the same time, the initial long line open period during which the line is held open at the office allows the locking relay P at each station to release to open the stick circuit for the associated relay A. It follows that any station relay A that is energized will be released during the initial locking element of a control code, so that the office takes command of the line for sending its codes before any station can send.

Finally, the office can start to send only when

the line is closed and no code is being received.

Thus if an indication code is being received from a station, the release of relay OL at the beginning of the code energizes relay OK to open back contact 33 in the pickup circuit for relay OA, and then relay OJ picks up, opening contact 35 to hold the pickup circuit for relay OA open for the duration of the code. Under these conditions, even though one or more of the start relays g and the delivery relay OB become energized, relay OA can not pick up to start sending control codes until the indication codes have been received and the line is again steadily closed for a time sufficient to pick up relay OL and to allow relays OK and OJ to release. It will be apparent from the foregoing that the line circuits are so arranged that it is impossible for two stations to send codes at the same time and it is therefore impossible for codes to be confused by simultaneous operation of more than one of the transmitting devices W.

Although I have herein shown and described only one form of railway traffic controlling apparatus embodying my invention, it is 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. Railway traffic controlling apparatus comprising an office and a remote station, a line relay at the office, a normally closed line circuit including said line relay and extending to said station, a slow releasing relay arranged to be energized when said line relay is de-energized, a manually operable lever, means controlled by said lever and effective when said slow releasing relay is released to initiate the delivery of a control code to said circuit, means for completing the delivery of said control code after said slow releasing relay becomes energized, means at said station selectively responsive to said control code, means also at the station for at times periodically opening and closing said circuit in accordance with an indication code, and a selector at the office selectively responsive to said indication code and controlled by said line relay when and only when said slow releasing relay is energized.

2. Railway traffic controlling apparatus comprising an office and a station, a line relay at said station, a normally closed line circuit including said line relay and extending to said office, a slow releasing locking relay controlled by a front contact of said line relay, means responsive to traffic conditions adjacent said station and operating when said locking relay is picked up to periodically interrupt said circuit in accordance with an indication code, means located at the office and responsive to said periodic interruptions of said circuit in accordance with said indication code, means also located at the office for at times opening said circuit for a time interval greater than the release time of said locking relay, and for subsequently delivering a control code to said circuit, and a selector at said station controlled by said line relay and selectively responsive to said control code.

3. A centralized traffic controlling system for railroads comprising a line circuit, a movable member, a start relay, a stop relay, a send relay, means effective upon operation of said member to energize said start relay provided said stop relay is de-energized, means for energizing said send relay when said start relay is energized,

transmitting means for delivering a distinctive code to said line circuit when said start and send relays are both energized, means for energizing said stop relay at the conclusion of said code, and
 5 means for subsequently maintaining said stop relay in its energized condition until said member is again operated.

4. A centralized traffic controlling system for railroads comprising a line circuit, a movable member, a start relay, a stop relay, a send relay, means effective upon operation of said member to energize said start relay provided said stop relay is de-energized, means for energizing said send relay when said start relay is energized
 10 provided said line circuit is clear, transmitting means for delivering a distinctive code to said line circuit when said start and send relays are both energized, and means for energizing said stop relay at the conclusion of said code.

5. A centralized traffic controlling system for railroads comprising a line circuit, a movable member, a start relay and a delivery relay arranged to be energized when said member is operated, means effective when said delivery relay
 20 is energized to include a transmitting contact in said line circuit provided the line circuit is clear, a send relay arranged to be energized when said start relay is energized provided said transmitting contact is included in the line circuit,
 30 means effective when said send relay is energized to operate said transmitting contact to deliver a distinctive code to said line circuit, and means for deenergizing said start and delivery relays at the conclusion of said code.

6. A centralized traffic controlling system for railroads comprising a line circuit, a plurality of code wheels each having a contact operated in accordance with a distinctive code when the wheel is rotated, a plurality of start relays one
 40 for each said wheel, means for selectively energizing said start relays, means set into operation when any start relay is energized for operating all of said code wheels, a plurality of send relays one for each said start relay, means for
 45 energizing in a definite sequence all send relays having the associated start relays energized, and means operating when any send relay is energized to supply said line circuit with a distinctive code under the control of the contact operated
 50 by the associated code wheel.

7. In combination with a line circuit, a plurality of manually operable levers; a start relay, a send relay and a stop relay for each position of each such lever; means for energizing each
 55 such start relay when the associated lever is moved to the position corresponding to such start relay provided the corresponding stop relay is de-energized, a circuit for each send relay including a front contact of the associated start relay, means operating when any send relay is
 60 energized to deliver a distinctive code to said line circuit, means for energizing each stop relay momentarily at the conclusion of the corresponding code, and means for subsequently holding such stop relay energized until the associated lever is moved away from the corresponding position.
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8. In combination with a line circuit, a plurality of manually operable levers, a plurality of code wheels each having a contact operated in accordance with a distinctive code when the wheel is rotated, means set into operation upon a movement of any of said levers for driving all said code wheels, and means for delivering to
 75 said line wires a distinctive code under the con-

trol of a selected one of said code wheels depending upon the new position of the operated lever.

9. In combination, a movable lever, a line circuit, means responsive to a movement of said lever for delivering a control code to said line
 5 circuit, a device controlled in accordance with said control code, means responsive to the condition of said device for delivering an indication code to said line circuit, a relay selectively controlled in accordance with said indication code,
 10 and indication means controlled jointly by said lever and said relay.

10. In combination with an office and a plurality of stations, a plurality of line relays one at the office and one at each said station, a single
 15 source of energy, a line circuit including said source and all said line relays, means at the office for delivering codes to said line circuit, sectionalizing means at each station for at times closing the portion of said circuit between such station
 20 and the office through a resistance to compensate for the portion of the line circuit then eliminated, means at each station effective when the associated sectionalizing means is effective to deliver codes to that portion of the line circuit between
 25 such station and the office, and code receiving means controlled by each line relay.

11. In combination with an office and a plurality of stations, a single source of energy located at said office, a plurality of line relays one at
 30 said office and one at each station, a line circuit including said source and all said line relays in series, a transmitting contact at each station, means at each station for at times closing the portion of said line circuit between such station
 35 and the office through the associated line relay and transmitting contact and a resistance to compensate for the portion of the line circuit then eliminated, means controlled by the line relay at such station for subsequently operating the corresponding transmitting contact to deliver a code to the portion of the line circuit between such station and the office, and code receiving means at the office controlled by the line relay there located.
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12. In combination, an office and a plurality of stations, a plurality of line relays one at the office and one at each station, a single source of energy, a normally closed line circuit including said source and all said line relays in series, sectionalizing means at each station for at times closing the portion of the line circuit between such station and the office through the associated line relay and for short circuiting the line circuit portion extending to all stations more remote from said office, transmitting means at each station controlled by the associated sectionalizing means and line relay for delivering codes to the portion of the line circuit between such station and the office and code receiving means at the office controlled by the line relay there located.
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13. In combination with a line circuit, a transmitter relay for controlling said line circuit, a code wheel, a motor for driving said code wheel, means effective if and only if said motor is at rest for causing a preliminary operation of said transmitter relay, means responsive to said preliminary operation of said transmitter relay to operate said motor, and means for subsequently controlling said transmitter relay by said code wheel to deliver a code to said line circuit.
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14. In combination with a normally closed line circuit including a source of energy and a line relay, time measuring means arranged to be op-
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erated if said line relay remains deenergized for more than a definite time interval, a movable device, a stop relay normally agreeing in position with said device, transmitting means set into operation upon a disagreement between said device and said stop relay to periodically open said line circuit to produce a complete code, and means controlled by said time measuring means and effective upon the completion of said code to move said stop relay into agreement with said device.

15. In combination with an office and a plurality of stations, a plurality of line relays one at the office and one at each station, a normally closed line circuit including a source and all said line relays in series, transmitting means at the office and at each station for delivering codes to at least a portion of said line circuit, and code receiving means at the office and at each station arranged to be controlled by the associated line relay and means for modifying the control of each receiving means by the associated line relay when the corresponding transmitting means is delivering a code to the line circuit.

16. In combination with a normally closed line circuit including a source of energy and a line relay, time measuring means arranged to be operated if said line relay remains deenergized for more than a definite time interval, a start relay, transmitting means actuated when said start relay is operated to periodically open said line circuit to produce a complete code, means for operating said start relay, means controlled by said time measuring means for maintaining said transmitting means in operation until said code is completed, and means controlled by the last named means effective upon the completion of said code to restore said start relay to its original condition.

17. Remote controlling apparatus comprising a normally closed line circuit extending from an office to a plurality of remote stations and including in series a line relay at each station, means for supplying current to said line circuit, a delay relay for each remote station arranged to be energized when the corresponding line relay is deenergized, a code transmitting contact at each station, means for each station effective only if the associated line relay is energized and the associated delay relay is deenergized for at times closing the portion of said line circuit between said station and the office through the associated transmitting contact and for disconnecting said current supplying means from the line circuit portion extending to all stations more remote from the office, means for subsequently operating said transmitting contact to deliver a code to the line circuit portion extending to the office provided such portion is closed, and means operating upon the completion of such code to restore the normal line circuit.

18. Remote controlling apparatus comprising a normally closed line circuit extending from a control station to a plurality of remote stations and including in series a line relay at each station, means for supplying current to said line circuit, storing contacts at each remote station, means operating when a storing contact is closed at any remote station to deliver a code to the portion of the line circuit between such remote station and the control station and including the line relay at such control station, means effective when any station is delivering a code to the line circuit to disconnect said current supplying means from all stations more remote from the control station, and means for preventing the de-

livery of code from each remote station until the associated line relay is energized and the line circuit between such station and the control station is closed.

19. In combination, a normally closed line circuit, a plurality of transmitting stations each comprising a circuit controller for sending a signal over said circuit by successive brief interruptions of the circuit, a slow releasing relay at each station for preventing operation of the circuit controller at such station while the armature of the relay is released, the time required for said relay to release being greater than the interval between interruptions in the signals, a line relay at each station included in said line circuit and having a front contact, and a circuit for each slow releasing relay including the front contact of the line relay at the same station.

20. In combination with a line circuit, a code transmitter for repeatedly interrupting said line circuit, a line relay in said line circuit, a first slow release relay controlled by a front contact of said line relay, a second slow release relay controlled by a back contact of said line relay, means for starting said transmitter effective only when said first slow release relay is energized and the second slow release relay is deenergized.

21. In combination with a line circuit, a code transmitter for repeatedly interrupting said line circuit, a line relay in said line circuit, a first slow release relay controlled by a front contact of said line relay, a second slow release relay controlled by a back contact of said line relay, means requiring one of said slow release relays to be energized for starting said transmitter, and means requiring the other relay to be energized to complete the operation of said transmitter.

22. Means for transmitting code over a line circuit to a remote station comprising a transmitter for interrupting said line circuit, a line relay in said line circuit at said transmitter station, a first slow release relay energized during each code operation of said line relay, a second slow release relay controlled by a front contact of said first slow release relay, and means for starting said transmitter effective only if both of said slow release relays are deenergized.

23. In combination with a line circuit including a source of energy and a line relay, transmitting means for periodically opening said line circuit to produce a code, apparatus for setting said transmitting means into operation, a slow acting relay controlled by said line relay for maintaining said transmitting means in operation to complete said code, and a stop relay controlled by said slow acting relay for stopping said transmitting means upon the completion of said code.

24. In combination with a line circuit including a source of energy and a line relay, time measuring means arranged to be operated if said line relay remains deenergized for more than a definite time interval, transmitting means arranged when operated to periodically open said line circuit to produce a complete code, and means controlled by said time measuring means and effective upon the completion of said code to discontinue the operation of said transmitting means.

25. In combination with a line circuit including a source of energy and a line relay, time measuring means arranged to be operated if said line relay remains deenergized for more than a definite time interval, a start relay, transmitting means actuated when said start relay is operated to periodically open said line circuit to produce

a complete code, means for operating said start relay, and means controlled by said time measuring means and effective upon the completion of said code to restore said start relay to its original condition.

26. In combination, a plurality of receiving stations connected by a line circuit supplied with codes, a line relay at each station in said line circuit, receiving means at each station selectively responsive to a selected sequence of operations of the line relay at the corresponding station in response to a particular code, and means at each station responsive to a first operation of said line relay to place said receiving means under the control of said line relay, said last-named means being responsive to a cessation of the operation of said line relay to remove said receiving means from the control of said line relay.

27. In combination with a line circuit including a source of energy and a line relay, transmitting means for periodically opening and closing said line circuit to produce a code, receiving means selectively responsive to said code, means responsive to the first operation of the line relay to place the receiving means under the control of said line relay, and means effective if the line relay is energized for more than a definite time interval to remove the receiving means from control by said line relay.

28. In combination with a line circuit including a source of energy and a line relay, means for controlling said line circuit to produce a code, time measuring means arranged to be operated if said line relay remains deenergized for more than a definite time interval, receiving means, and means controlled by said time measuring means for placing said receiving means under the control of said line relay.

29. In a centralized traffic controlling system for railroads, means for selectively transmitting a plurality of code signals over a line circuit comprising a series of manually operable keys, one for each code to be transmitted, a starting relay for each key, means for starting transmission of a code when any starting relay is actuated and the line is clear, means controlled by each starting relay when actuated for selecting a particular code for transmission so arranged that the codes corresponding to a plurality of starting relays actuated simultaneously are transmitted consecutively in predetermined order, a circuit for actuating each starting relay when the corresponding key is operated, and means for releasing each starting relay at the completion of the transmission of the code determined by such starting relay.

30. A centralized traffic controlling system for railroads comprising in combination, a line circuit, means for transmitting code signals to said line circuit; a plurality of individual transmitting units each comprising a movable member and normally deenergized start, send, and stop relays; means effective upon operation of any said member to energize the corresponding start relay, means effective when any start relay is energized to energize the corresponding send relay and to start said transmitter provided said line relay and said transmitter are at rest, means controlled by each said send relay for selecting a particular code for transmission, means for energizing said stop relay at the end of such code, means controlled by said stop relay for releasing said start and send relays and to thereby stop said transmitter, and holding means effective to main-

tain said stop relay energized until said movable member moves to a new position.

31. In combination with a line circuit, a starting circuit including a start relay, control means having at least two positions and effective in one position to close said starting circuit, means effective when said starting relay is energized to transmit a code to said line circuit, means effective momentarily at the conclusion of said code for opening said starting circuit, and means controlled by said control means for subsequently holding said starting circuit open as long as said control means occupies said one position.

32. A code transmitter for selectively transmitting a plurality of codes over a line circuit, comprising a series of starting relays one for each code to be transmitted, a series of sending relays one for each starting relay, means for independently actuating said starting relays; means for energizing each sending relay when the corresponding starting relay is actuated, provided no succeeding starting relays, and no preceding sending relays of the series have been actuated; and means effective when a sending relay becomes energized to transmit a selected code to said line circuit.

33. In a centralized traffic controlling system for railroads comprising an office and a station located at spaced points and connected by a line circuit, a plurality of movable devices at one said point, a series of starting mechanisms each having normal and reverse contacts and each controlled by a particular one of said devices, a series of sending relays one for each said starting mechanism, a circuit for each sending relay including a reverse contact of the associated starting mechanism and a back contact of each succeeding sending relay in said series, a master relay, means for operating said master relay when any starting mechanism is moved to its reverse position, transmitting means effective when said master relay is operated to deliver to the line circuit a distinctive code the character of which depends upon the particular sending relay then energized, and receiving means at the other said point selectively responsive to said code.

34. In a centralized traffic controlling system for railroads comprising an office and a station located at spaced points and connected by a line circuit, a plurality of movable devices at one said point, a series of starting mechanism each having normal and reverse contacts and each controlled by a particular one of said devices, a series of sending relays one for each said starting mechanism, a circuit for each sending relay including a reverse contact of the associated starting mechanism, a normal contact of each preceding starting mechanism, and a back contact of each succeeding sending relay, a master relay, means for operating said master relay when any starting mechanism is moved to its reverse position, transmitting means effective when said master relay is operated to deliver to the line circuit a distinctive code the character of which depends upon the particular sending relay then energized, and receiving means at the other said point selectively responsive to said code.

35. In a centralized traffic controlling system for railroads comprising an office and a station located at spaced points and connected by a line circuit, a plurality of movable devices at one said point, a series of starting mechanisms each having normal and reverse contacts and each controlled by a particular one of said devices, a series of sending relays one for each said starting

mechanism, a circuit for each sending relay including a reverse contact of the associated starting mechanism, a normal contact of each preceding starting mechanism, and a back contact of every sending relay in said series, a master relay, means for operating said master relay when any starting mechanism is moved to its reverse position, transmitting means effective when said master relay is operated to deliver to the line circuit a distinctive code the character of which depends upon the particular sending relay then energized, and receiving means at the other said point selectively responsive to said code.

36. In a centralized traffic controlling system for railroads comprising an office and a station located at spaced points and connected by a line circuit, a plurality of movable devices at one said point, a series of starting mechanisms each having normal and reverse contacts and each controlled by a particular one of said devices, a series of sending relays one for each said starting mechanism, a pick-up circuit for each sending relay including a reverse contact of the associated starting mechanism, a holding circuit for each sending relay including its own front contact, a master relay, means for operating said master relay when any starting mechanism is moved to its reverse position, transmitting means effective when said master relay is operated to deliver to the line circuit a distinctive code the character of which depends upon the particular sending relay then energized, and receiving means at the other said point selectively responsive to said code.

37. In a centralized traffic controlling system for railroads comprising an office and a station located at spaced points and connected by a line circuit, a plurality of movable devices at one said point, a series of starting mechanisms each having normal and reverse contacts and each controlled by a particular one of said devices, a series of sending relays one for each said starting mechanism, a pick-up circuit for each sending relay including a reverse contact of the associated starting mechanism, holding means for subsequently maintaining said sending relay in its energized condition, a master relay, means for operating said master relay when any starting mechanism is moved to its reverse position, transmitting means effective when said master relay is operated to deliver to the line circuit a distinctive code the character of which depends upon the particular sending relay then energized, means effective upon the conclusion of such code to disable the holding means for the sending relay then energized, and receiving means at the other said point selectively responsive to said code.

38. In combination, a control lever, a line circuit, and a movable device, means for delivering a control code to said line circuit to actuate said device to a position determined by the position of said lever, indication means associated with said lever, means controlled by said device when actuated for delivering an indication code to said line circuit, means responsive to the delivery of a control code to said line circuit to deenergize said indication means, and means responsive to said indication code to reenergize said indication means to indicate the position of said device.

39. In combination, a railway switch, a line circuit, a control lever for the remote control of said switch, means associated with said lever for indicating the position of the switch, means controlled by said lever for transmitting a control code signal over said line circuit to operate said switch and for simultaneously deenergizing said

indication means, means actuated by said control code for moving said switch, means responsive to the completion of the movement of said switch for transmitting an indication code signal over said line circuit, and means controlled by said indication code for energizing said indication means to indicate the position of said switch.

40. In combination with a line circuit, a movable device having at least two positions, two starting circuits arranged to be closed when the device is moved to said two positions respectively, code transmitting means, starting means in said starting circuits energized by the closing of either such circuit to operate the transmitting means to deliver a distinctive code to the line circuit, means effective momentarily at the conclusion of a code to deenergize said starting means, and means controlled by said device for subsequently holding said starting means deenergized as long as the device remains in the position it then occupies.

41. Field station apparatus for a remote control system comprising a line circuit and having means for delivering codes to said line circuit having initial locking elements of selected characters, comprising transmitting means at said station for at times delivering to said line circuit codes all having initial locking elements of the same one of said characters, a master relay arranged to be energized during operation of said transmitting means, means for releasing said master relay rendered effective upon the delivery to said line circuit of an initial locking element which is not of said one character, and receiving means at said station effective when said master relay is deenergized to respond selectively to codes having locking elements not of said one character.

42. In combination with a line circuit, a code sending relay, transmitting means effective when said relay is energized to alternately open and close said line circuit for brief time intervals to produce a code, means for energizing said code sending relay, a slow release relay, means for energizing said slow release relay each time said line circuit is closed during a code, and means controlled by a front contact of said slow release relay for maintaining said code sending relay in its energized condition.

43. In combination with a line circuit including a source of energy, a contact and a line relay, transmitting means for controlling said contact to produce a series of alternate periods of open and closed circuit in said line circuit, and a slow acting relay controlled by said line relay and operating if the line relay fails to pick up when said contact is closed to discontinue operation of said transmitting means.

44. In combination with a line circuit including a source of energy and a line relay, a slow release relay, means energizing said slow release relay when said line relay is released, transmitting means for controlling the line circuit to produce a series of alternate periods of open and closed circuit therein, and means requiring said slow release relay to be released to start operation of said transmitting means.

45. In combination with a line circuit including a source of energy and a line relay, a slow release relay, means energizing said slow release relay when said line relay is picked up, and transmitting means effective only when said slow release relay is picked up to control the line circuit to produce a series of alternate periods of open and closed circuit therein.

46. In combination with a line circuit including a source of energy and a line relay, transmitting means for controlling the line circuit to produce a series of alternate periods of open and closed circuit therein, means for discontinuing the control of said line circuit by said transmitting means if said line relay fails to pick up when the line circuit is closed, and means for stopping said transmitter at the conclusion of said series.
47. In combination, a line circuit connecting a plurality of receiving stations, a line relay in said circuit at each station, means for controlling said line circuit to produce a series of alternate periods of open and closed circuit therein, receiving apparatus at each station controlled selectively by the associated line relay, and means at each station responsive to a first operation of the associated line relay for placing the receiving apparatus at that station under the control of the corresponding line relay and responsive to a cessation of the operation of said line relay to remove the receiving apparatus from the control of the line relay.
48. In combination, a line circuit connecting a plurality of receiving stations, a line relay in said circuit at each station, a transmitter for controlling said line circuit to cause repeated operation of all said line relays, receiving apparatus at each station controlled selectively by the associated line relay, and means at each station responsive to a first operation of the associated line relay for placing the receiving apparatus at that station under the control of the corresponding line relay and responsive to a cessation of the operation of said line relay to remove the receiving apparatus from the control of the line relay.
49. In combination, a line circuit connecting a plurality of receiving stations, a line relay in said circuit at each station, a transmitter for controlling said line circuit to cause repeated operation of all said line relays, receiving apparatus at each station controlled selectively by the associated line relay, a slow acting relay at each station controlled by the associated line relay, and means at each station controlled by the associated slow acting relay and responsive to a first operation of the associated line relay for placing the receiving apparatus at that station under the control of the corresponding line relay and responsive to a cessation of the operation of said line relay to remove the receiving apparatus from the control of the line relay.
50. In combination, a line circuit connecting a plurality of receiving stations, a line relay in said circuit at each station, a transmitter for controlling said line circuit to cause repeated operation of all said line relays, receiving apparatus at each station controlled selectively by the associated line relay, a slow acting relay at each station controlled by the associated line relay and arranged to be picked up in response to a first operation of the line relay but to be released upon the cessation of said repeated operation of the line relay, and means at each station controlled by the associated slow acting relay for placing the receiving apparatus at that station under the control of the associated line relay.
51. In combination, a movable lever, a line circuit, means responsive to a movement of said lever for delivering a control code to said line circuit, a device controlled in accordance with said control code, means responsive to the condition of said device for delivering an indication code to said line circuit, a relay having a pickup circuit controlled selectively in accordance with said indication code, a stick circuit for said indication relay controlled by said lever, and indication means controlled by said relay.
52. In combination, a movable lever, a line circuit, means responsive to a movement of said lever for delivering a control code to said line circuit, a device controlled in accordance with said control code, means responsive to the condition of said device for delivering an indication code to said line circuit, an indication relay, means responsive to said indication code for briefly energizing said indication relay, a stick circuit for said relay, and an indicator controlled jointly by said relay and by said lever.
53. In combination with a movable device having two positions, a lever capable of assuming two positions, two indication relays one for each position of said device, a code system set into operation by a movement of the lever from one position to another to position the device in agreement with said lever and effective upon a movement of said device to either position to briefly energize the corresponding indication relay, and a stick circuit for each indication relay including a back contact of the other indication relay and a contact controlled by said lever.
54. In combination with a line circuit, a manually operable key, a start relay, means for energizing the start relay when said key is operated, a send relay having a circuit including a front contact of said start relay, a code transmitter effective when said send relay is energized to deliver a distinctive code to said line wires, and a stop relay picked up at the conclusion of said code to deenergize said start relay to prevent further supply of code to said line wires from said transmitter.
55. In combination with a line circuit, a manually operable key, a start relay, means for energizing the start relay when said key is operated, a send relay having a circuit including a front contact of said start relay, a code transmitter effective when said send relay is energized to deliver a distinctive code to said line wires, and a stop relay picked up at the conclusion of said code to deenergize said send relay to prevent further supply of code to said line wires from said transmitter.
56. In combination with a line circuit, a plurality of manually operable contacts, a series of start relays one for each said contact, means for energizing each said start relay when the corresponding contact is closed, a series of send relays one for each said start relay, means effective when any of said start relays is energized to energize the corresponding send relay provided no preceding start relay is energized, transmitting means including a code wheel for each send relay effective when the corresponding send relay is energized to deliver a complete code to said line wires, and means effective upon the completion of any such code to deenergize the corresponding start relay, whereby the operation of a plurality of said contacts will cause the corresponding codes to be delivered one at a time in a predetermined sequence.
57. In combination with a line circuit, a plurality of manually operable contacts, a series of start relays one for each said contact, means for energizing each said start relay when the corresponding contact is closed, a series of send relays one for each said start relay, means effective when any start relays are energized to ener-

gize the first send relay in said series having its start relay energized, transmitting means including a code wheel for each send relay effective when the corresponding send relay is energized to deliver a complete code to said line wires, and means effective upon the completion of any such code to deenergize the corresponding start relay to permit the energization of the next send relay in said series having its start relay energized.

58. In a centralized traffic control system for railroads, a line circuit, a section of railway track, a first relay having a pickup circuit closed when said track circuit is occupied, means controlled by said first relay for transmitting over said line circuit a track occupied indication when said first relay is energized and a track clear indication when said first relay is deenergized, a second relay, a holding circuit for said first relay controlled by said second relay, and means controlled by said transmitting means to actuate said second relay to open said holding circuit.

59. In a centralized traffic control system for railroads, a line circuit, a section of railway track, a first relay having a pickup circuit closed when said track circuit is occupied, means controlled by said first relay for transmitting over said line circuit a track occupied indication when said first relay is energized and a track clear indication when said first relay is deenergized, a stick relay controlled by said transmitting means, and a stick circuit for said first relay controlled by said stick relay.

60. In a centralized traffic controlling system for railroads and comprising an office and a station, the combination with a transmitter at said station for transmitting indications to said office, of a relay which if energized causes the transmission of an indication of one character and if deenergized causes the transmission of an indication of a different character, means at said station for selectively controlling said relay, and means effective when said relay is energized for preventing deenergization thereof until an indication of said one character has been transmitted.

61. In a centralized traffic controlling system for railroads and comprising an office and a station, the combination with a transmitter at said station for transmitting indications to said office, of a relay which if energized causes the transmission of an indication of one character and if deenergized causes the transmission of an indication of a different character, a holding circuit for said relay including a front contact of said relay, a pickup circuit for said relay controlled by traffic conditions adjacent said station, and means for preparing said holding circuit when an indication of said different character is transmitted and for opening said holding circuit when an indication of said one character is transmitted.

62. In a centralized traffic controlling system for railroads and comprising an office and a station, the combination with a transmitter at said station for transmitting indications to said office, of a relay which if energized causes the transmission of an indication of one character and if deenergized causes the transmission of an indication of a different character, a track section at said station provided with a track relay, a pickup circuit for said relay controlled by said track relay and closed when said section is occupied, and a holding circuit for said first relay including its own front contact and a contact controlled by said transmitter.

63. In a remote control system comprising an office and a plurality of stations connected by a line circuit, a single source of energy included in said line circuit at said office, a plurality of line relays one at the office and one at each station and all connected in series in said line circuit, means at the office for delivering control codes to said line circuit, means at each station controlled by the associated line relay and selectively responsive to said control codes, means at each station for shunting said line circuit through the associated line relay and subsequently transmitting an indication code to the portion of the line circuit between such station and the office, and means at the office controlled by the associated line relay and selectively responsive to said indication code.

64. In combination, an office and a station, a normally energized track relay which when released manifests the presence of a train in a track section adjacent said station, apparatus at said station for transmitting a code to the office indicating when the track relay is released, a starting relay, means effective when said starting relay becomes energized for initiating the operation of said apparatus, a stick relay which becomes energized upon the completion of said code, means energizing said starting relay when said track relay releases, said means maintaining said starting relay energized only until said stick relay becomes energized, and means effective when said stick relay becomes energized for holding said relay energized until the track relay again picks up.

65. In a centralized traffic controlling system for railroads, a control office, a field station, a transmitting means at the control office and at the field station for delivering a series of code elements, means at the control office for selecting one character and means at the field station for selecting a different character for the first element of a series of code elements, means for determining whether the succeeding elements of a series are to be transmitted by the transmitting means at the control office or by the transmitting means at the field station, and means selectively controlled by the first element of each series for imparting selected characters to the succeeding elements of such series of elements.

66. In a centralized traffic controlling system for railroads, a control office, a plurality of field stations, a transmitting means at the control office and at each field station for delivering a series of code elements, means at the control office for selecting one character and means at each field station for selecting a different character for the first element of a series of code elements, means for determining whether the succeeding elements of a series are to be transmitted by the transmitting means at the control office or by the transmitting means at such field station, means at the control office for imparting selected characters to the succeeding elements of the series when the transmitting means at the control office is delivering the succeeding elements to thereby designate the field station at which the series of code elements is to become effective, and means at each field station for imparting selected characters to the succeeding elements of a series when the transmitting means at such field station is delivering the succeeding elements to thereby designate the field station at which the series of code elements is originating.

67. In a system of the type in which any one of a large number of traffic controlling devices at a way station of a railway system may be controlled from a central office through a normally at rest selector system, of a first relay which must be energized to permit operation of said selector system and which is de-energized at the end of an operating cycle of such selector system, a plurality of stick relays each of which if energized closes contacts to transmit a particular code through the medium of said selector system, levers for energizing said stick relays, and a front

contact of said first relay included in the stick circuits of said stick relays.

68. In combination, a line circuit, means for impressing a plurality of different codes on said line circuit, each of said codes including a series of time spaced impulses, means for manually selecting and storing the condition that any one of said codes is to be transmitted, and means preventing a change in said stored condition during the transmission of a code to thereby prevent its mutilation.

LLOYD V. LEWIS.

CERTIFICATE OF CORRECTION.

Patent No. 2,152,384.

March 28, 1939.

LLOYD V. LEWIS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 9, second column, line 35, claim 21, for "energized" read deenergized; page 10, second column, line 51, claim 34, for the word "mechanism" read mechanisms; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of May, A. D. 1939.

Henry Van Arsdale

Acting Commissioner of Patents.

(Seal)