

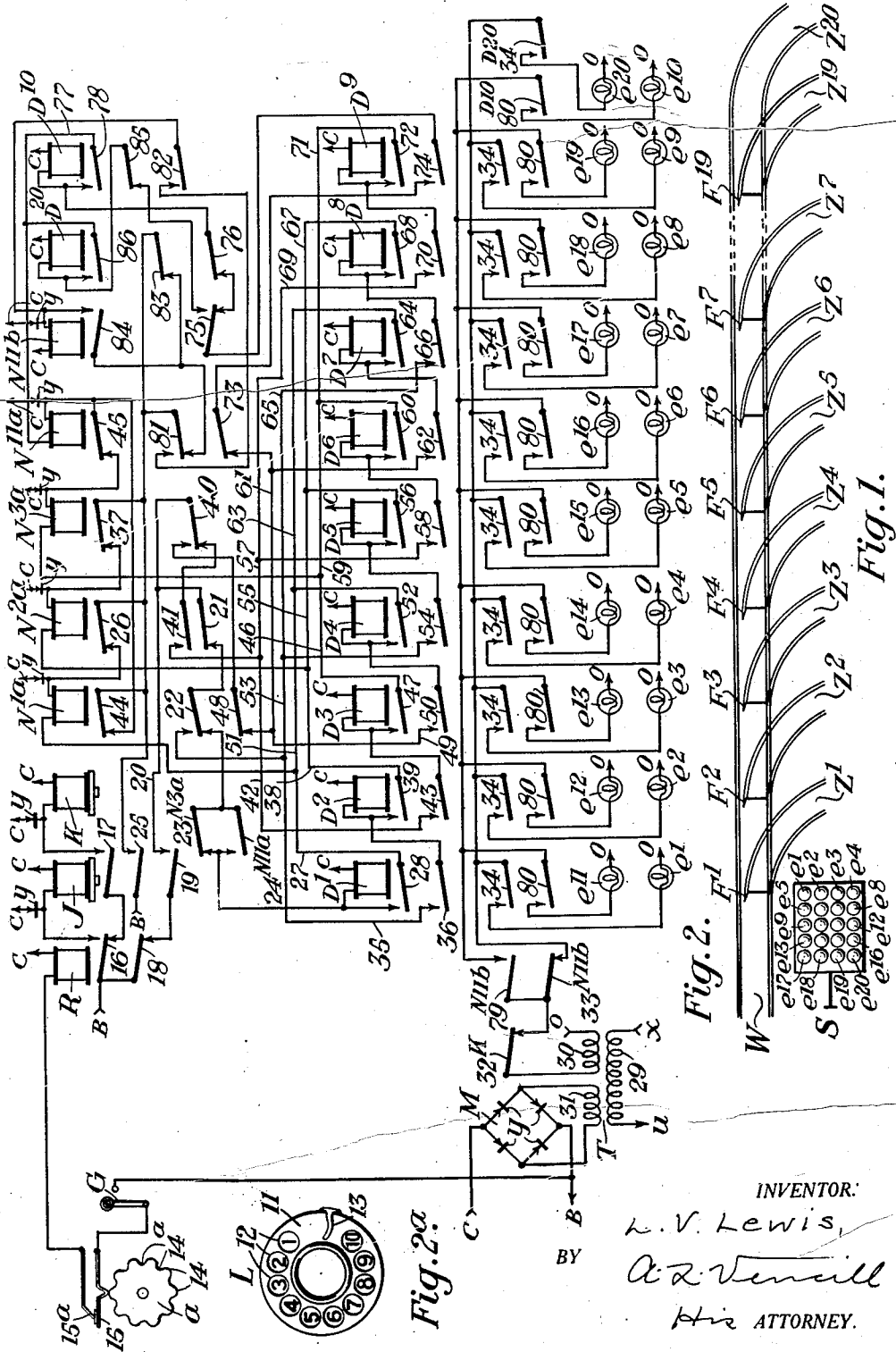
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RAILWAY SIGNALING

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RAILWAY SIGNALING

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My invention relates to railway signaling, and particularly to signaling for railroad yards such as classification yards and distribution yards.

More particularly, my invention relates to apparatus for controlling yard track indicators for informing trainmen on which of a plurality of yard tracks to place their train.

I will describe one form of signaling embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view showing a portion of a railroad yard provided with an indicator embodying my invention. Fig. 2 is a diagrammatic view showing one form of apparatus for controlling the indicator of Fig. 1. Fig. 2^a is a detail view showing one form of dial switch for operating wheel *a* of Fig. 2.

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

Referring first to Fig. 1 of the drawing, the reference character *W* designates a main yard track, and the reference character *Z* with distinguishing exponents designates auxiliary yard tracks which are connected with main track *W* by switches designated by the reference character *F* with corresponding exponents.

A yard signal, known also as a yard track indicator, designated by the reference character *S*, comprises a plurality of indicators one for each auxiliary yard track *Z*. Each of these indicators, as here shown, comprises an electric lamp designated by the reference character *e* with an exponent corresponding to that for the auxiliary yard track with which it is associated. Signal *S*, as here shown, comprises twenty indicators for twenty tracks. For the sake of simplicity, I have shown in Fig. 1 only auxiliary tracks *Z*¹⁹, *Z*²⁰, and *Z*¹ to *Z*⁷, inclusive, and have omitted tracks *Z*⁸ to *Z*¹⁸, inclusive.

When a train is to be put onto a given auxiliary track, for example, track *Z*⁵, the operator will cause lamp *e*⁵ for that track to be lighted, thus instructing the trainmen to place their train on track *Z*⁵. The indicators *e* are controlled from a yard office or an interlocking tower by means of a dial switch *L*, shown in Fig. 2^a, and by a separate contact *G* shown in Fig. 2.

Dial switch *L* is of the well known type used for automatic telephone work, and comprises the usual rotatable disc 11, in which are circular openings 12, back of which are fixed numbers 1 to 10, inclusive, the number "10" having been added by me to replace the "0" that ordinarily appears

in the last position of the dial as constructed for use in dialing the digits of a number. In order to actuate switch *L*, the operator places a finger in one of the openings 12, and rotates disc 11 in a clockwise direction until his finger engages a stop 13. He then withdraws his finger from the opening in disc 11, whereupon, switch *L* rotates a notched wheel *a*, shown in Fig. 2, a distance corresponding to the opening 12 in which the operator placed his finger. The notches 14^a of wheel *a* cause a movable contact member 15 to repeatedly move away from a fixed contact member 15^a, thus repeatedly opening contact 15—15^a, whereas, teeth 14 of wheel *a* cause contact 15—15^a to repeatedly close. When switch *L* is in its normal condition, wheel *a* is at rest in a position to cause contact 15—15^a to be closed.

Contacts *G* and 15—15^a control a main relay *R* which, through the front point of its contact 16, controls a second relay *J* which is slow-releasing. Contact *G* is normally open, and hence relay *R* is normally deenergized. A third relay *K*, also slow-releasing, is controlled by a front contact of relay *J* and by the back point of contact 16 of relay *R*. The two terminals of each of the relays *J* and *K* are connected together through an asymmetric unit *y*. By this means, each of these relays *J* and *K* is made slower releasing.

Relays *R* and *J* together control a chain of counting relays *D* and transfer relays *N*. The right-hand terminal of each transfer relay *N* is connected to terminal *C* through an asymmetric unit *y* the purpose of which is to serve as a spark arrester when a circuit through a relay *N* in series with a relay *D* becomes opened as will be hereinafter described. Relay *K*, transfer relay *N*11b, and counting relays *D* control indicator lamps *e*.

As here shown, lamps *e* are energized by alternating current, whereas, the relays are energized by direct current. Both forms of current are supplied by a transformer *T* having a primary winding 29 and two secondary windings 30 and 31. Primary winding 29 is constantly supplied with alternating current from terminals *x* and *u* of a source not shown in the drawing. Alternating current for lamps *e* is supplied by secondary winding 30 of transformer *T*. Direct current for the relays is provided by a rectifier *M* which, as here shown, is of the type comprising four asymmetric units *y*, and which is interposed between secondary winding 31 of transformer *T* and the various relays.

In the drawing, the contacts operated by the various relays are identified by numbers, such numbers having distinguishing exponents when

the contacts are not shown adjacent the respective relays by which they are operated. The exponent for each of these contact members comprises the reference character and the exponent for its relay. For example, the exponent N11b for contact 79^{N11b}, shown in the circuits for lamps e, comprises the reference character N and the exponent 11b for relay N11b which operates contact 79^{N11b}.

10 Having thus described, in general, the arrangement and operation of the apparatus comprising my invention, I will now trace in detail the operation of the various parts.

15 As shown in the drawing, all parts of the apparatus are in their normal condition, that is, contact G is open, contact 15—15^a is closed, all relays are deenergized, and all of the lamps e are extinguished.

I will assume that the operator desires to direct 20 a train to track Z². He will therefore close contact G, thus completing a pick-up circuit for relay R passing from terminal B of rectifier M, through contact G, contact 15—15^a of switch L, and the winding of relay R to terminal C of rectifier M. 25 Relay R, upon becoming energized, closes its contact 16 at the front point, thereby completing a pick-up circuit for relay J passing from terminal B, through front point of contact 16, and the winding of relay J to terminal C.

30 The operator will now dial the number 2 on switch L, causing contact 15—15^a to be opened two times by wheel a, and thus causing the circuit for relay R to be interrupted two times. Relay J, being slow-releasing, does not open its front 35 contact 17 during these interruptions in the circuit for relay R. The first time relay R becomes deenergized, a pick-up circuit is completed for relay K passing from terminal B, through the back point of contact 16 of relay R, front contact 40 17 of relay J, and the winding of relay K to terminal C. At the same time that the pick-up circuit is also completed for the first counting relay D¹ passing from terminal B, through contact 18 of 45 relay R, contact 19 of relay J, wire 20, contact 21 of relay N^{2a}, back point of contact 22 of relay N^{1a}, contact 23^{N3a}, and the winding of relay D¹ to terminal C. The right-hand terminal of relay N^{1a} is connected to terminal B of rectifier M, through 50 contact 25 of relay J, and contact 26 of relay N^{2a}. The left-hand terminal of relay N^{1a} is also connected to terminal B of rectifier M, through the pick-up circuit just traced for relay D¹ as far as 55 contact 23^{N3a}, and thence passing through contact 28 of relay D¹, and wire 27 to relay N^{1a}. On account of the two terminals of relay N^{1a} being at the same potential, relay N^{1a} does not pick up.

When relay R opens its back contact 18, however, the left-hand terminal of relay N^{1a} becomes 60 disconnected from terminal B of rectifier M, and is now connected in series with relay D¹ in a circuit passing from terminal B of rectifier M, through contact 25 of relay J, contact 26 of relay N^{2a}, winding of relay N^{1a}, wire 27, contact 28 of 65 relay D¹, and the winding of relay D¹ to terminal C. Relay N^{1a}, being thus energized, opens its back contacts, and closes contact 22 at the front point.

70 When relay R becomes deenergized the second time, a pick-up circuit is therefore completed for relay D² passing from terminal B, through contact 18 of relay R, contact 19 of relay J, wire 20, contact 21 of relay N^{2a}, front point of contact 22 of relay N^{1a}, wire 35, contact 36 of relay D¹, and 75 the winding of relay D² to terminal C. The two

terminals of relay N^{2a} are now at the same potential, as already described for relay N^{1a}, and hence relay N^{2a} does not pick up.

80 Relay R, upon becoming energized at the completion of the second interruption to the circuit for relay R, opens its contact 18, thereby disconnecting the left-hand terminal of relay N^{2a} from terminal B and permitting relay N^{2a} to become 85 energized by a circuit in series with relay D² and passing from terminal B, through contact 25 of relay J, contact 37 of relay N^{3a}, winding of relay N^{2a}, wire 38, contact 39 of relay D², and the winding of relay D² to terminal C. Relay N^{2a}, upon becoming energized, opens, at its contact 26, the 90 circuit previously traced for relays D¹ and N^{1a}, causing these relays to become deenergized.

The dialing operation being now completed, the circuit for relay R will remain closed until the operator takes further action. Upon the lapse of 95 a brief period of time, after the last opening of contact 16 of relay R at its back point, relay K will permit its contact 32^K to close, thereby completing a lighting circuit for lamp e² passing from secondary winding 30 of transformer T, through 100 contact 32^K, contact 33^{N11b}, contact 34 of relay D², and lamp e² to terminal O of secondary 30 of transformer T. The lighting of lamp e² informs the trainmen that they are to place their train on track Z².

I will now assume that the operator desires to 105 send a second train to track Z⁴. To do this, he can light lamp e⁴ by either dialing the difference between numbers 2 and 4, or by opening contact G to restore the apparatus to the normal condition and then dialing number 4 on switch L. If 110 the operator merely dials the difference between the numbers 2 and 4, he will repeat the previous dial operation, that is, he will dial number 2, causing the circuit for relay R to be interrupted two more times. Upon the first of these interruptions 115 to the circuit for relay R, relay K again becomes energized by its pick-up circuit previously traced, thereupon opening its contact 32^K and thus extinguishing lamp e². When contact 18 of relay R 120 closes, a pick-up circuit is completed for relay D³ passing from terminal B, through contact 18 of relay R, contact 19 of relay J, wire 20, back point of contact 40 of relay N^{3a}, contact 41 of relay N^{2a}, wire 42, contact 43 of relay D², and the winding of relay D³ to terminal C. Both terminals of 125 relay N^{3a} are now connected to the same terminal B of rectifier M as previously described for relay N^{1a}, and hence relay N^{3a} does not pick up.

When relay R next becomes energized, however, the left-hand terminal of relay N^{3a} is disconnected, 130 at contact 18 of relay R, from terminal B, and relay N^{3a} now becomes energized by a circuit in series with relay D³, passing from terminal B, through contact 25 of relay J, contact 44 of relay N^{1a}, contact 45 of relay N^{1a}, winding of relay N^{3a}, 135 wire 46, contact 47 of relay D³, and the winding of relay D³ to terminal C. Relay N^{3a}, upon becoming energized, opens, at its contact 37, the circuit previously traced for relays D² and N^{2a} in series and therefore causes these two relays to become 140 deenergized.

When relay R becomes deenergized the second time, a pick-up circuit is completed for relay D⁴, 145 passing from terminal B, through contact 18 of relay R, contact 19 of relay J, wire 20, front point of contact 40 of relay N^{3a}, contact 48 of relay N^{1a}, wire 49, contact 50 of relay D³, and the winding of relay D⁴ to terminal C. Upon the energization of relay D⁴, both terminals of relay N^{1a} are again 150 connected to terminal B.

When relay R becomes energized after the second interruption to its circuit, relay N^{1a} becomes energized in series with relay D⁴ by a circuit passing from terminal B, through contact 25 of relay J, contact 26 of relay N^{2a}, winding of relay N^{1a}, wire 51, contact 52 of relay D⁴, and the winding of relay D⁴ to terminal C. Relay N^{1a}, upon becoming energized, opens at its contact 44 the circuit previously traced for relays D³ and N^{3a} in series, causing these relays to become deenergized.

The dialing operation being now completed, relays R, J, N^{1a} and D⁴ will continue energized until the operator takes further action. Relay K, after the lapse of a brief period, permits its contact 32^K to again close. The closing of contact 32^K now completes a lighting circuit for lamp e⁴, passing from the left-hand terminal of secondary 30 of transformer T, through contact 32^K, contact 33^{N11b}, contact 34 of relay D⁴, and lamp e⁴ to terminal O. Lamp e⁴, by being lighted, instructs the trainmen to run their train onto track Z⁴.

If the operator now wishes to extinguish lamp e⁴ and return the apparatus to normal, he will open switch G. This deenergizes relay R, which closes its back contact 16 and energizes relay K. Contact 32^K opens and extinguishes lamp e⁴. Contact 19 of relay J is closed, so that a circuit for relay D⁵ is closed, similar to that described for relay D² so that relay D⁵ picks up. Relay J is now deenergized and releases. This deenergizes relays K, D⁴ and N^{2a}. When relay K releases, relay D⁵ is deenergized and releases.

I will next assume that the operator has returned the apparatus to the normal condition by opening switch G, and that he desires to now send a train to track Z²⁰. He will therefore dial number 10 on switch L two times in succession. Each of these dialing operations causes the circuit for relay R to be interrupted ten times at contact 15—15^a, making a total of twenty interruptions to the circuit for relay R. The first four interruptions cause relays D¹ to D⁴, inclusive, to become energized as already traced. Subsequent relay operations, similarly accomplished by subsequent operations of contact 15—15^a, are in the following order:

R becomes deenergized,—D⁵ becomes energized.
 R becomes energized,—N^{2a} becomes energized,—D⁴ and N^{1a} become deenergized.
 R becomes deenergized,—D⁶ becomes energized.
 R becomes energized,—N^{3a} becomes energized,—D⁵ and N^{2a} become deenergized.
 R becomes deenergized,—D⁷ becomes energized.
 R becomes energized,—N^{1a} becomes energized,—D⁶ and N^{3a} become deenergized.
 R becomes deenergized,—D⁸ becomes energized.
 R becomes energized,—N^{2a} becomes energized,—D⁷ and N^{1a} become deenergized.
 R becomes deenergized,—D⁹ becomes energized.
 R becomes energized,—N^{3a} becomes energized,—D⁸ and N^{2a} become deenergized.

When relay R becomes deenergized the tenth time, relay D¹⁰ becomes energized by a circuit passing from terminal B, through contact 18 of relay R, contact 19 of relay J, wire 20, front point of contact 40 of relay N^{3a}, contact 48 of relay N^{1a}, wire 61, contact 73 of relay N^{11a}, contact 74 of relay D⁹, back point of contact 75 of relay N^{11b}, contact 76 of relay D²⁰, and the winding of relay D¹⁰ to terminal C.

When relay R next becomes energized, relay N^{11a} becomes energized by a circuit through relays N^{11a} and D¹⁰ in series, passing from terminal B, through contact 25 of relay J, contact 44 of

relay N^{1a}, winding of relay N^{11a}, wire 77, contact 78 of relay D¹⁰, and the winding of relay D¹⁰ to terminal C. Relay N^{11a}, upon becoming energized, completes a pick-up circuit for relay N^{11b} passing from terminal B, through contact 25 of relay J, front point of contact 81 of relay N^{11a}, contact 82 of relay D¹⁰, and the winding of relay N^{11b} to terminal C. The energization of relay N^{11a} also opens, at its contact 45, the circuit for relays D⁹ and N^{3a} which then become deenergized.

Upon the second release of the dial switch relay R becomes deenergized for the eleventh time, and relay D¹ again becomes energized by a circuit which is the same as the pick-up circuit first traced for this relay, except passing through contact 24^{N11a} instead of through contact 23^{N3a}. The reason for using contact 24^{N11a} is that when relay R closes its back contact 18 the eleventh time, relay N^{3a} has not had sufficient time to close its back contact 23^{N3a} following the interruption of the circuit for relay N^{3a} by the opening of contact 45 of relay N^{11a}.

Relay R, upon next becoming energized, causes relay N^{1a} to become energized by its circuit in series with relay D¹ as previously traced. Relay N^{1a}, upon becoming energized, opens, at its contact 44, the circuit previously traced for relays N^{11a} and D¹⁰, causing these relays to become deenergized. Relay N^{11b}, however, continues energized by a stick circuit passing from terminal B, through contact 25 of relay J, contact 83 of relay D²⁰ in multiple with the back point of contact 81 of relay N^{11a}, contact 84 of relay N^{11b}, and the winding of relay N^{11b} to terminal C.

Relays D² to D⁹, inclusive, now become successively energized as previously described.

Upon the twentieth deenergization of relay R, relay D²⁰ becomes energized by a pick-up circuit passing from terminal B, through contact 18 of relay R, contact 19 of relay J, wire 20, front point of contact 40 of relay N^{3a}, contact 48 of relay N^{1a}, wire 61, contact 73 of relay N^{11a}, contact 74 of relay D⁹, front point of contact 75 of relay N^{11b}, contact 85 of relay D¹⁰, and the winding of relay D²⁰ to terminal C.

When relay R becomes energized following the twentieth interruption to its circuit, relay N^{11a} becomes energized by a circuit passing from terminal B, through contact 25 of relay J, contact 44 of relay N^{1a}, winding of relay N^{11a}, contact 86 of relay D²⁰, and the winding of relay D²⁰ to terminal C. With both relays N^{11a} and D²⁰ energized, the stick circuit for relay N^{11b} is opened at the back point of contact 81 of relay N^{11a} and at contact 83 of relay D²⁰. Relay N^{11b} is therefore deenergized.

Relays R, J, N^{11a} and D²⁰ now continue energized until the operator takes further action. After the lapse of a brief period, relay K releases its contact 32^K, thereby completing the lighting circuit for lamp e²⁰ passing from secondary 30 of transformer T, through contact 32^K, contact 33^{N11b}, contact 34^{D20}, and lamp e²⁰ to terminal O. By the lighting of lamp e²⁰, the trainmen are instructed to place their train on track Z²⁰.

It will be noted that all of the relays are now in the same condition as when switch G was closed in preparation for the first dialing operation, except that relays D²⁰ and N^{11a} are energized, and that these relays will become deenergized by the opening of contact 44 of relay N^{1a} upon the receipt of the first of a series of additional impulses. It follows that the operator may now light any of the lamps by transmitting addi-

tional impulses, without opening switch G to restore the apparatus to normal. In other words, the transmission of a 21st impulse has exactly the same effect as the transmission of a first impulse.

It will be noted that, if the operator should dial any number from 10 to 19, inclusive, the circuit for the desired lamp having a number from e^{10} to e^{19} , respectively, will pass through front contact 79^{N11b}. The circuits for any lamp from e^1 to e^9 , inclusive, and for lamp e^{20} , on the other hand, pass through back contact 33^{N11b}.

The counting relays D, moreover, may thus be operated through repeated cycles by repeated dialing, and during each alternate cycle a contact 34 of each of the relays in turn will be closed to complete selected circuits over contact 33, while during each intervening cycle a contact 80 of each of the relays in turn will be closed to complete other selected circuits over contact 79.

I have described for a few typical examples, the operation of the apparatus embodying my invention. From this description, the operation of the apparatus for any other condition will be readily understood by reference to the drawing.

From the foregoing description and the accompanying drawing, it follows that when the operator desires to light one of the lamps from e^1 to e^{10} , inclusive, he will dial the corresponding number once on dial switch L. The circuit for relay R will then be opened a number of times corresponding to the number dialed. If, for example, the operator dials number 5, the circuit for relay R will be opened at contact 15—15^a five times. Upon the completion of the dialing operation, a corresponding counting relay D⁵, a corresponding transfer relay N^{2a}, and relays R and J will remain energized. Relay K, however, will open after a brief period following the final opening of the back point of contact 16 of relay R. Relay K will therefore permit its back contact 32^K to close and cause the desired lamp e^5 to become lighted and remain lighted until the operator takes further action.

To light a lamp having a higher number than 10, the operator will operate dial switch L two times in succession so that the sum of the numbers dialed will be the number for the desired lamp. If, for example, the operator wishes to light lamp e^{12} , he will first dial number 10 and will then immediately dial number 2. If he wishes to light lamp e^{20} , he will dial number 10 two times.

The slow-releasing feature of relay K prevents the lighting of any of the lamps e until the dialing operation is completed and wheel a has come to rest with movable contact member 15 engaging fixed contact member 15^a. In this way, none of the intermediate lamps e will be lighted, but only the desired lamp will become lighted by a given dialing operation.

To extinguish a lamp and return the control apparatus to the normal condition for dialing a new number, the operator will open contact G. The arrangement is such, however, that the operator after lighting a given lamp, can light a lamp having a higher number by dialing the difference between the numbers for the two lamps. The operator can also, if he desires, light a lamp having a lower number by dialing the difference between the number for the lamp which is already lighted and number 20 plus the number for the desired lamp.

Transfer relays N^{1a}, N^{2a} and N^{3a} are used first

with counting relays D¹, D² and D³, respectively, then with counting relays D⁴, D⁵, and D⁶, respectively, then with counting relays D⁷, D⁸ and D⁹, respectively, next with counting relays D¹, D², and D³ again, then with counting relays D⁴, D⁵ and D⁶, and then with counting relays D⁷, D⁸ and D⁹. Transfer relay N^{11a} is used only with counting relays D¹⁰ and D²⁰. Lamps e^1 to e^9 , inclusive, and e^{20} are controlled through a back contact of relay N^{11b}, and lamps e^{10} to e^{19} , inclusive, are controlled through a front contact of relay N^{11b}.

In apparatus embodying my invention, contact G in the control circuit for relay R is normally open, and hence all relays and lamps are normally deenergized. Dial switch L produces open and closed periods of the control circuit for relay R approximately equal in length to each other. Selection between the various lamps is effected by the number of open periods of the circuit for relay R determined by the dial switch L.

Although I have herein shown and described only one form of railway signaling 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. In combination, a plurality of indicators, a normally open manually operable key, an impulse transmitter comprising a contact, means whereby said contact is caused to open and close repeatedly, when the transmitter is actuated, to transmit a group of impulses less in number than the number of indicators, a series of counting relays, means rendered effective by the closing of said manually operable key for operating said counting relays one at a time in sequence through repeated cycles when said impulse transmitter is actuated repeatedly, a stick relay, means controlled by said counting relays for energizing said stick relay at the end of each alternate cycle and for deenergizing it at the end of each intervening cycle of operation of said counting relays, means for selectively energizing said indicators comprising a circuit for each indicator including a front contact of a particular counting relay of said series, certain of said circuits including a back contact and the remainder a front contact of said stick relay, whereby said indicators may be repeatedly energized one at a time in sequence each in accordance with the total number of impulses transmitted after said manually operable key is closed, and means selectively responsive to the opening of said manually operable key to release all of the relays energized at a given time.

2. In combination, a plurality of indicators, a normally open manually operable key, an impulse transmitter comprising a contact, means whereby said contact is caused to open and close repeatedly, when the transmitter is actuated, to transmit a group of impulses less in number than the number of indicators, a series of relays, including counting relays operable one at a time in sequence through repeated cycles and a pair of auxiliary relays, one auxiliary relay being operated at the end of each alternate cycle and the other at the end of each intervening cycle of operation of said counting relays, means rendered effective by the closing of said manually operable key for operating said relays one at a time in sequence through repeated cycles when said impulse transmitter is actuated repeatedly, comprising pick up circuits for the first counting re-

lay closed when all of the relays are deenergized or when one or the other of the auxiliary relays is energized, and a pick up circuit for each remaining relay closed when the next preceding relay of the series is energized, means for releasing each relay when the next succeeding relay of the series is energized, a stick relay controlled by said auxiliary relays and arranged to be energized during each alternate cycle but to be deenergized during each intervening cycle of operation of said counting relays, means for selectively energizing said indicators comprising two series of circuits each including contacts closed one at

a time in sequence as said relays are operated through a cycle, one of said series of circuits including a front contact and the other a back contact of said stick relay, whereby said indicators may be repeatedly energized, one at a time in sequence, each in accordance with the total number of impulses transmitted after said manually operable key is closed, and means selectively responsive to the opening of said manually operable key to release all of said relays energized at a given time.

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