

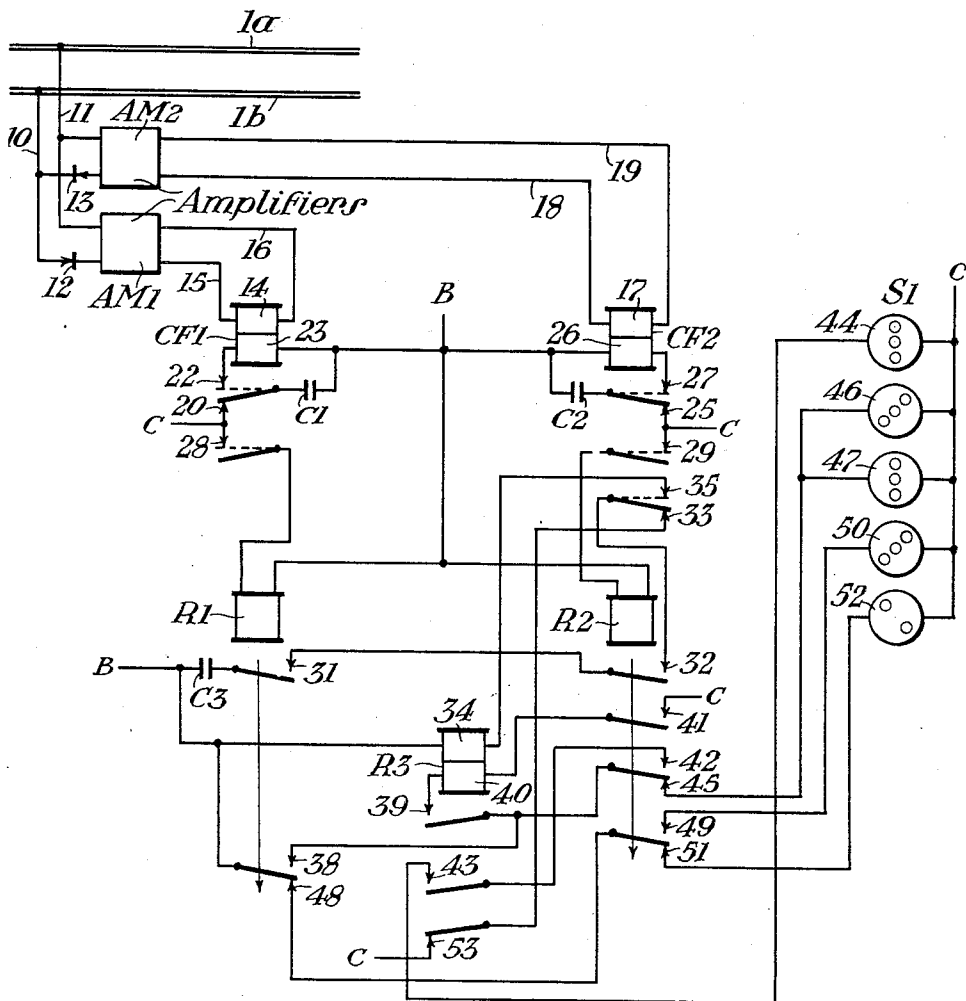
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RAILWAY TRAFFIC CONTROLLING APPARATUS

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RAILWAY TRAFFIC CONTROLLING
APPARATUS

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My invention relates to railway traffic controlling apparatus, and more particularly to apparatus for providing control of signals in wayside and/or cab signal systems.

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

A feature of my invention is the provision in apparatus of the type here involved of novel and improved means selectively responsive to signalling currents of different polarity codes. Another feature of my invention is the provision in apparatus of the type here contemplated of novel and improved means for control of the different indications of a signal wherewith a change from the display of one indication to the display of another indication is made with no false flashing of an indication. Other features and advantages of my invention will appear as the specification progresses.

For a better understanding of my invention reference may be had to the accompanying drawing which is a diagrammatic view of one form of apparatus embodying the invention.

Referring to the drawing, the reference characters *1a* and *1b* designate the two conductors of a circuit capable of transmitting different signalling currents of the polarity code type. That is to say, under one control condition such as, for example, clear traffic condition, the signalling current transmitted over the circuit comprising conductors *1a* and *1b* consists of a periodically interrupted current in which the current impulses are alternately positive and negative in polarity. Under a second control condition such as, for example, approach-restricting traffic condition, the signalling current transmitted over this circuit consists of a periodically interrupted current in which the current impulses are all of positive polarity. Again, under a third control condition such as, for example, approach traffic condition, the signalling current transmitted over the circuit consists of a periodically interrupted current in which the current impulses are all of negative polarity. As will later appear, a fourth control condition such as, for example, stop or slow speed traffic condition, is reflected by virtue of no current being transmitted over the circuit. The periodically interrupted current can be either direct or alternating in character.

The means by which such code signalling currents are selectively supplied to the circuit comprising conductors *1a* and *1b* is immaterial and is not shown since such apparatus is well known and forms no part of my present invention. One

form of apparatus that may be used is that disclosed in the United States Letters Patent No. 2,021,654, granted November 19, 1935, to R. R. Kemmerrer and R. M. Gilson for Railway traffic controlling apparatus.

The conductors *1a* and *1b* are connected over wires *10* and *11* with the input terminals of two amplifiers *AM1* and *AM2* in parallel, an asymmetric unit *12* being interposed in the connection to the amplifier *AM1* and an asymmetric unit *13* being interposed in the connection to amplifier *AM2*. The asymmetric unit *12* is disposed to pass only current of positive polarity to the amplifier *AM1* and the unit *13* is disposed to pass only current of negative polarity to the amplifier *AM2*. As here shown, the amplifiers *AM1* and *AM2* are conductively coupled with the conductors *1a* and *1b* by virtue of wires *10* and *11*. It is clear, however, that if desired a transformer may be interposed in this connection and energy transferred inductively from the circuit comprising conductors *1a* and *1b* to the amplifiers, or a condenser may be used and energy transferred by electrostatic coupling. The amplifiers *AM1* and *AM2* may be of any one of several well-known types, among them being the electron tube type. These amplifiers are shown conventionally for the sake of simplicity since their specific structural forms no part of my present invention.

Two code following relays are governed by the amplifiers *AM1* and *AM2*. The top or operating winding *14* of a first code following relay *CF1* is connected over wires *15* and *16* with the output terminals of amplifier *AM1*. Likewise, the top or operating winding *17* of a second code following relay *CF2* is connected over wires *18* and *19* with the output terminals of amplifier *AM2*. The relays *CF1* and *CF2* are preferably of the neutral type. It follows that a signalling current consisting of recurrent impulses of current of positive polarity when supplied to the circuit comprising conductors *1a* and *1b* is passed by the asymmetric unit *12* and amplified by amplifier *AM1*, and relay *CF1* is energized and picked up once for each such impulse. A signalling current consisting of recurrent impulses of current of negative polarity when supplied to conductors *1a* and *1b* is passed by the asymmetric unit *13* and amplified at amplifier *AM2*, and relay *CF2* is energized and picked up once for each such impulse. A signalling current consisting of recurrent impulses of current alternately positive and negative in polarity is effective to operate both relays *CF1* and *CF2*, relay *CF1* being energized and picked up for each positive

impulse and the relay CF2 being energized and picked up for each negative impulse. When no signalling current flows in conductors 1a and 1b, both relays CF1 and CF2 remain in engagement with their back contacts. It is apparent that if the signalling currents are of relatively high energy level the amplifiers AM1 and AM2 may be omitted.

The impulses of such signalling currents may be of relatively short duration so that the "off" period of the code following relay CF1 or CF2, that is, the period the relay remains in engagement with its back contact, is greater than the "on" period of the relay, that is, the period the relay remains in engagement with its front contact. To equalize such "off" and "on" periods, each of the code following relays CF1 and CF2 is provided with a second winding and a condenser. Looking at relay CF1, when the relay is released closing its back contact 20, a condenser C1 is charged from a source of current whose terminals are B and C. When the relay CF1 is energized by virtue of an energizing impulse of current supplied to its top winding 14 and the relay is picked up closing front contact 22, the condenser C1 discharges through the lower winding 23 of that relay with the result that the relay is held picked up for an appreciable interval after the impulse through the top winding 14 ceases. In like fashion, a condenser C2 is charged from the source whose terminals are B and C over a back contact 25 of relay CF2, and the condenser C2 discharges through lower winding 26 of relay CF2 when relay CF2 is picked up closing its front contact 27.

The code following relays CF1 and CF2 govern three decoding relays R1, R2 and R3, relays R1 and R2 being slow release in character and relay R3 being of the ordinary acting type preferably provided with two energizing windings. Relay R1 is controlled over front contact 28 of relay CF1, and relay R2 is controlled over front contact 29 of relay CF2. Hence, when relay CF1 is picked up the relay R1 is supplied with an energizing impulse of current which picks up that relay, and when relay CF1 is operated in response to a code signalling current consisting of recurrent impulses of current of positive polarity supplied to the amplifier AM1, relay R1 is provided with an energizing impulse for each impulse of the code signalling current and the relay remains picked up from one impulse to the next by virtue of its slow release characteristics. That is to say, the relay R1 is provided with a slow release period slightly greater than the interval between successive impulses of the code signalling current. When relay CF2 is picked up, relay R2 is supplied with an energizing impulse, and when relay CF2 is operated in response to a code signalling current of recurrent impulses of current of negative polarity supplied to the amplifier AM2, the relay R2 is periodically energized and remains picked up from one impulse to the next since its slow release period is slightly greater than the interval between successive impulses of the signalling current.

The decoding relay R3 is provided with a pick-up circuit and a stick circuit and has associated therewith a reactance device here shown in the form of a condenser C3. The condenser C3 acquires, under conditions to be shortly described, a charge by virtue of a circuit which can be traced from terminal B through condenser C3, front contact 31 of relay R1, front contact 32 of relay R2, back contact 33 of relay CF2, back contact 53 of relay R3 and terminal C. Con-

denser C3 discharges through a pick-up circuit for relay R3 to pick up that relay, which circuit can be traced from the left-hand terminal of condenser C3 through the top winding 34 of relay R3, front contact 35 of relay CF2, front contact 32 of relay R2, front contact 31 of relay R1 and to the right-hand terminal of condenser C3. The stick circuit for relay R3 involves terminal B of the current source, front contact 38 of relay R1, front contact 39 and lower winding 40 of relay R3, front contact 41 of relay R2 and terminal C.

The decoding relays R1, R2 and R3 control operating circuits for a signal S1 which as here shown is of the position light type capable of displaying four different indications. The manner by which the relays R1, R2 and R3 control the operating circuits for signal S1 in response to the different code signalling currents supplied to the circuits comprising conductors 1a and 1b can best be understood by a description of the operation of the apparatus.

I shall assume at the start that the relays are all deenergized and the control condition (clear traffic condition) exists so that the code signalling current supplied to the circuit comprising conductors 1a and 1b consists of recurrent impulses of current alternately positive and negative in polarity. If the first current impulse is one of negative polarity the code following relay CF2 is operated and relay R2 is energized and picked up. The next current impulse is one of positive polarity and the code following relay CF1 is operated and relay R1 is energized and picked up, the code following relay CF2 being now released. Condenser C3 is charged over the circuit including front contacts 31 and 32 of relays R1 and R2, respectively and back contact 33 of relay CF2 as previously described. The next current impulse is one of negative polarity and relay CF2 is operated to supply relay R2 with a new energizing impulse of current. Condenser C3 now discharges through the top winding 34 of relay R3 to pick up that relay. The next impulse of current is one of positive polarity and relay CF1 is operated to supply a new energizing impulse of current to relay R1. From this point on the relays R1 and R2 are periodically and alternately energized in response to the alternate operation of relays CF1 and CF2, while relay R3 is retained energized by virtue of its stick circuit as long as both relays R1 and R2 remain picked up.

It is to be observed that to energize decoding relay R3 requires relays R1 and R2 to be picked up by consecutive operations of relays CF1 and CF2, and relay CF2 to be operated a second time. Thus, with the parts connected as illustrated in the drawing, three consecutive impulses are required before relay R3 is energized if the first impulse is one of negative polarity, the first and third of these pulses being of negative polarity and the second impulse being of positive polarity. If the first impulse is one of positive polarity then four consecutive impulses are required to energize relay R3, the first and third impulses being of positive polarity and the second and fourth impulses being of negative polarity. In other words, with apparatus embodying my invention the decoding relays are effectively energized in response to the code signalling current consisting of impulses of current alternately positive and negative in polarity only after two reversals in the polarity of the impulses. It is obvious, of course, that the circuit connections for the apparatus can be reversed from that illustrated in the

drawing and relay R3 energized in response to three consecutive impulses the first and third of which are of positive polarity and the second impulse of negative polarity.

When all three of the decoding relays R1, R2 and R3 are energized an operating circuit is formed from terminal B over front contact 38 of relay R1, front contact 42 of relay R2, front contact 43 of relay R3, lamp 44 of signal S1 and terminal C, and lamp 44 is illuminated to display a clear signal indication.

In the event the control condition is one that corresponds to approach-restricting traffic condition and the code signalling current supplied to the transmitting circuit is one of recurrent impulses of current of positive polarity, the code following relay CF1 only is operated, relay R1 is picked up, relay R2 is released at the end of its slow release period and relay R3 is released immediately after relay R2. Under this condition of the decoding relays, an operating circuit is formed from terminal B over front contact 38 of relay R1, back contact 45 of relay R2, lamps 46 and 47 of signal S1 in multiple and to terminal C, and lamps 46 and 47 are illuminated to display an approach-restricting signal indication.

Again, if the control condition corresponds to approach traffic condition and the code signalling current supplied to the conductors 1a and 1b consists of recurrent impulses of current of negative polarity, the code following relay CF2 only is operated and relay R2 picked up while relays R1 and R3 are released. An operating circuit is formed from terminal B over back contact 48 of relay R1, front contact 49 of relay R2, lamp 50 of signal S1 and terminal C, and lamp 50 is illuminated to display an approach signal indication. Again, if no signalling current is supplied to the conductors 1a and 1b so that both code following relays CF1 and CF2 are inactive, then relays R1, R2, and R3 are deenergized and an operating circuit is formed from terminal B over back contact 48 of relay R1, back contact 51 of relay R2, lamp 52 of signal S1 and terminal C, and lamp 52 is illuminated to display a slow speed signal indication.

When a change in the control conditions causes a change in the code signalling current from that of impulses of positive polarity to impulses alternately positive and negative in polarity, the action of the decoding relays is as follows. Relay R1 is already picked up and on the first operation of relay CF2 the relay R2 becomes energized, but without energizing relay R3 because condenser C3 contains no charge. The next operation of relay CF1 does not cause relay R3 to be picked up because the front contact 35 of relay CF2 interposed in the pick-up circuit of relay R3 is now open. Condenser C3 is, however, now charged and at the next operation of relay CF2 closing front contact 35, the condenser C3 discharges and picks up relay R3, and relay R3 is then retained energized over its stick circuit. Consequently, two reversals in the polarity of the signalling current impulses are required before the decoding relay R3 is operated and the lamp 44 of signal S1 is illuminated. If the change in the control conditions is such as to change the code signalling current from impulses of current of negative polarity to impulses of current alternately positive and negative in polarity, a similar delay is interposed in the energizing of relay R3 and the illumination of the clear signal lamp 44. Again, if the change in the control conditions changes the code signalling current from impulses of cur-

rent of positive polarity to impulses of current of negative polarity, the relay R1 remains picked up for an interval after relay R2 is picked up because the release period of relay R1 is slightly greater than the interval between two consecutive impulses of the signalling currents. Thus, there is a brief interval during which both relays R1 and R2 are picked up. Relay R3 is not picked up, however, because condenser C3 is not charged. Likewise, if the control conditions change the code signalling current from impulses of current of negative polarity to impulses of current of positive polarity there is a brief interval during which both relays R1 and R2 are picked up but relay R3 is not picked up because condenser C3 has no charge.

It is to be seen, therefore, that in apparatus embodying my invention the clear signal indication cannot be displayed until after the corresponding code signalling current has been in effect for a predetermined period. Furthermore, in passing from one signal condition to another the overlapping slow release periods of the decoding relays cannot effect a false flash of the clear signal indication. Again, when apparatus embodying my invention is used in wayside or cab signal systems, the delay interposed in establishing the clear signal indication adds to the safety of the system in case of the short train passing from one track section to the next, because it increases the length of time required for the track section in the rear to assume the clear traffic condition.

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. In combination, receiving means selectively responsive to the polarity of each impulse of different signalling currents of the polarity code type and which currents consist of uniformly recurrent impulses of current; decoding means controlled by said receiving means operated to a first position when such recurrent impulses of current of positive polarity are supplied to said receiving means, operated to a second position when such recurrent impulses of current of negative polarity are supplied to said receiving means and operated to a third position when such recurrent impulses of current alternately of positive and negative polarity are supplied to said receiving means; and means governed by said receiving means to require at least two reversals of polarity of said current impulses to effect said third position of the decoding means.

2. In combination, receiving means selectively responsive to the polarity of each impulse of different signalling currents of the polarity code type and which currents consist of uniformly recurrent impulses of current; decoding means controlled by said receiving means held energized at a first position when the recurrent impulses of current supplied to said receiving means are of positive polarity, held energized at a second position when the recurrent impulses of current supplied to said receiving means are of negative polarity and held energized at a third position when the recurrent impulses of current supplied to said receiving means are alternately positive and negative in polarity; and means connected

with said decoding means to require two reversals in the polarity of the current impulses before the receiving means can effect a change of the decoding means from said first position or said second position to said third position.

3. In combination, receiving means selectively responsive to the polarity of each impulse of different signalling currents of the polarity code type and which currents consist of uniformly recurrent impulses of current; decoding means controlled by said receiving means held energized at a first position when the recurrent impulses of current supplied to said receiving means are of positive polarity, held energized at a second position when the recurrent impulses of current supplied to said receiving means are of negative polarity and held energized at a third position when the recurrent impulses of current supplied to said receiving means are alternately positive and negative in polarity; and means governed by said receiving means to require at least three consecutive impulses of current the first and third of which are of one polarity and the second of which is of the opposite polarity before said third position of the decoding means can be effected.

4. In combination, receiving means selectively responsive to the polarity of each impulse of different signalling currents of the polarity code type and which currents consist of uniformly recurrent impulses of current; decoding means controlled by said receiving means operated to a first position when such recurrent impulses of current of positive polarity are supplied to said receiving means, operated to a second position when such recurrent impulses of current of negative polarity are supplied to said receiving means and operated to a third position when such recurrent impulses of current alternately of positive and negative polarity are supplied to said receiving means; a first signalling circuit closed at the first position of the decoding means, a second signalling circuit closed at the second position of the decoding means, a third signalling circuit closed at the third position of the decoding means, and means connected with said decoding means to require at least two reversals in the polarity of the current impulses before said third signalling circuit is closed.

5. In combination, receiving means selectively responsive to the polarity of each impulse of different signalling currents of the polarity code type and which currents consist of uniformly recurrent impulses of current; decoding means controlled by said receiving means operated to a first position when such recurrent impulses of current of positive polarity are supplied to said receiving means, operated to a second position when such recurrent impulses of current of negative polarity are supplied to said receiving means and operated to a third position when such recurrent impulses of current alternately of positive and negative polarity are supplied to said receiving means; signalling means selectively controlled by said decoding means and including a circuit closed only at said third position, and reactance means controlled by said receiving means and operative to require at least two reversals of polarity of said current impulses to establish said third position of the decoding means and close said circuit.

6. In combination, code receiving means including a first and a second code following relay, said first relay biased to a first position and operated to a second position in response to a current

impulse of positive polarity supplied to said receiving means, said second relay biased to a first position and operated to a second position in response to a current impulse of negative polarity supplied to said receiving means, a first and a second slow release relay, a third relay, means to energize said first slow release relay including a second position contact of said first code following relay, means to energize said second slow release relay including a second position contact of said second code following relay, a condenser, a charging circuit for said condenser including a front contact of each of said first and second slow release relays and a first position contact of said second code following relay; a pick-up circuit for said third relay including said condenser, a winding of said third relay and a first position contact of said second code following relay, a stick circuit for said third relay including a front contact of each of said first and second slow release relays, and signalling circuits selectively controlled by said first and second slow release relays and said third relay.

7. In combination, code receiving means including a first and a second code following relay, said first relay energized when an impulse of current of one polarity is supplied to said receiving means and said second relay energized when an impulse of current of the opposite polarity is supplied to said receiving means, a first and a second slow acting relay, a third relay, means to energize said first slow acting relay including a front contact of said first code following relay, means to energize said second slow acting relay including a front contact of said second code following relay, a reactance device, a charging circuit for said device including a contact of each of said first and second slow acting relays and a back contact of said second code following relay; a pick-up circuit for said third relay including said device, a winding of said third relay and a front contact of said second code following relay; a stick circuit for said third relay including a current source, a winding of said third relay and a contact of each of said slow acting relays; and a signalling circuit including a front contact of said third relay.

8. In combination, code receiving means including a first and a second code following relay, said first relay energized when an impulse of current of one polarity is supplied to said receiving means and said second relay energized when an impulse of current of the opposite polarity is supplied to said receiving means, a first and a second slow acting relay, a third relay, means to energize said first slow acting relay including a front contact of said first code following relay, means to energize said second slow acting relay including a front contact of said second code following relay, a condenser, a charging circuit for said condenser including a contact of each of said slow acting relays and a back contact of said second code following relay; a pick-up circuit for said third relay including said condenser, a winding of said third relay, a contact of each of said slow acting relays and a front contact of said second code following relay; a stick circuit for said third relay including a current source, a winding of said third relay and a contact of each of said slow acting relays; and signalling circuits selectively controlled by said slow acting relays and said third relay.

9. In combination, a receiving circuit capable of receiving recurrent impulses of current of one polarity or recurrent impulses of current of the

5 opposite polarity or recurrent impulses of current
alternately of said one and said opposite polarities,
a first and a second slow release relay, code responsive means coupled with said receiving circuit and operative to supply an energizing impulse of current to a winding of said first relay in response to each impulse of current of said one polarity flowing in said circuit and to supply an energizing impulse of current to a winding of said second relay in response to each impulse of current of said opposite polarity flowing in said circuit, a third relay, a condenser, a charging circuit for said condenser including a front contact of each of said slow release relays, another circuit for discharging said condenser through a winding of said third relay including a contact closed by said code responsive means when an impulse of current of said opposite polarity flows in said receiving circuit, and a signaling circuit including a front contact of said third relay.

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20 10. In combination, a receiving circuit capable of receiving recurrent impulses of current of one polarity or recurrent impulses of current of the opposite polarity or recurrent impulses of

current alternately of said one and said opposite polarities, a first and a second slow release relay, code responsive means coupled with said circuit and operative to supply an energizing impulse of current to a winding of said first relay in response to each impulse of current of said one polarity flowing in said receiving circuit and to supply an energizing impulse of current to a winding of said second relay in response to each impulse of current of said opposite polarity flowing in said circuit, a third relay, a condenser, a charging circuit for said condenser including a front contact of each of said slow release relays, another circuit for discharging said condenser through a winding of said third relay including a contact closed by said code responsive means when an impulse of current of said opposite polarity flows in said receiving circuit, a stick circuit for said third relay including a front contact of each of said first and second relays as well as a front contact and a winding of said third relay, and signalling circuits selectively controlled by said slow release relays and said third relay.

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