

April 23, 1929.

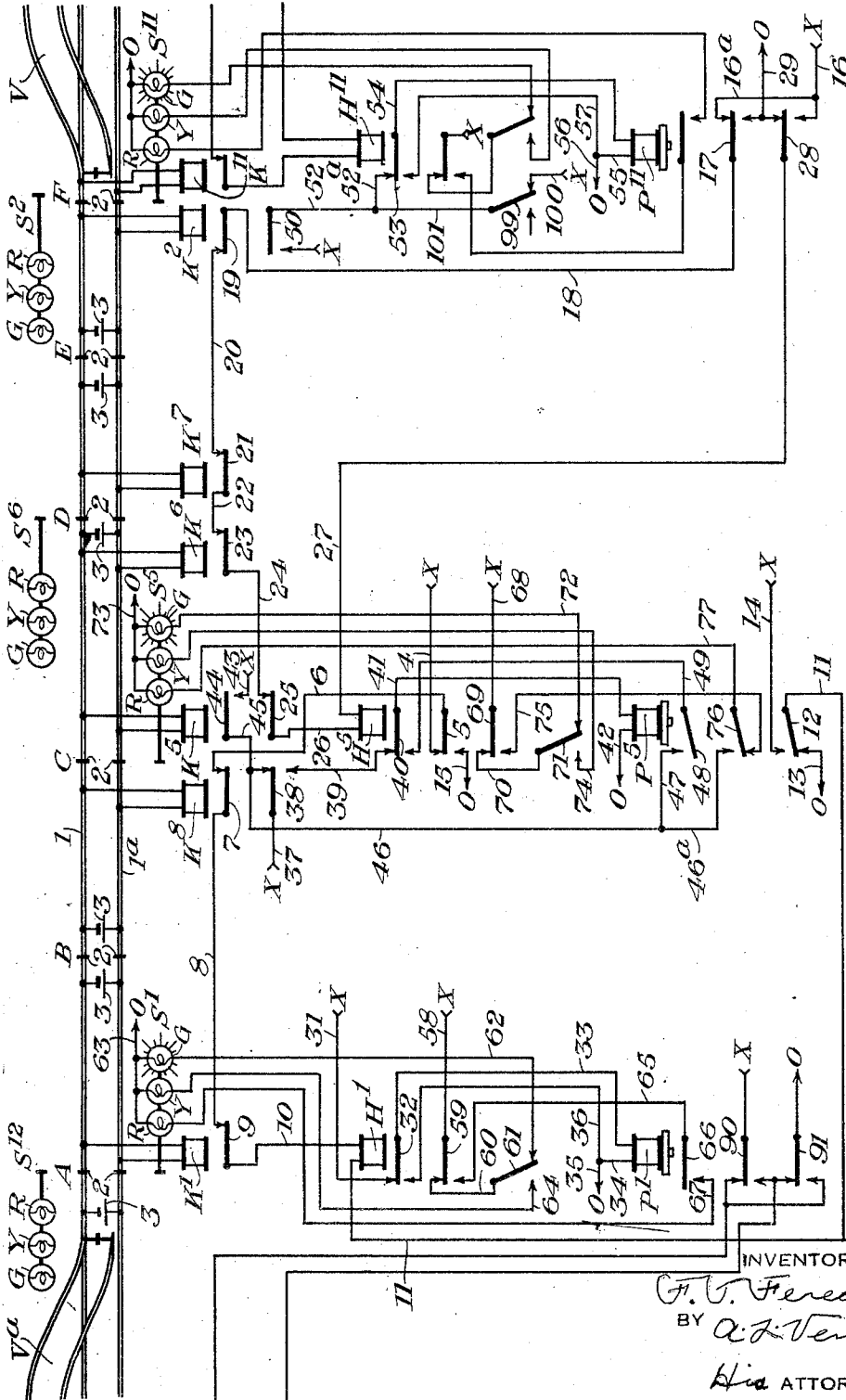
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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 5, 1925

2 Sheets-Sheet 1



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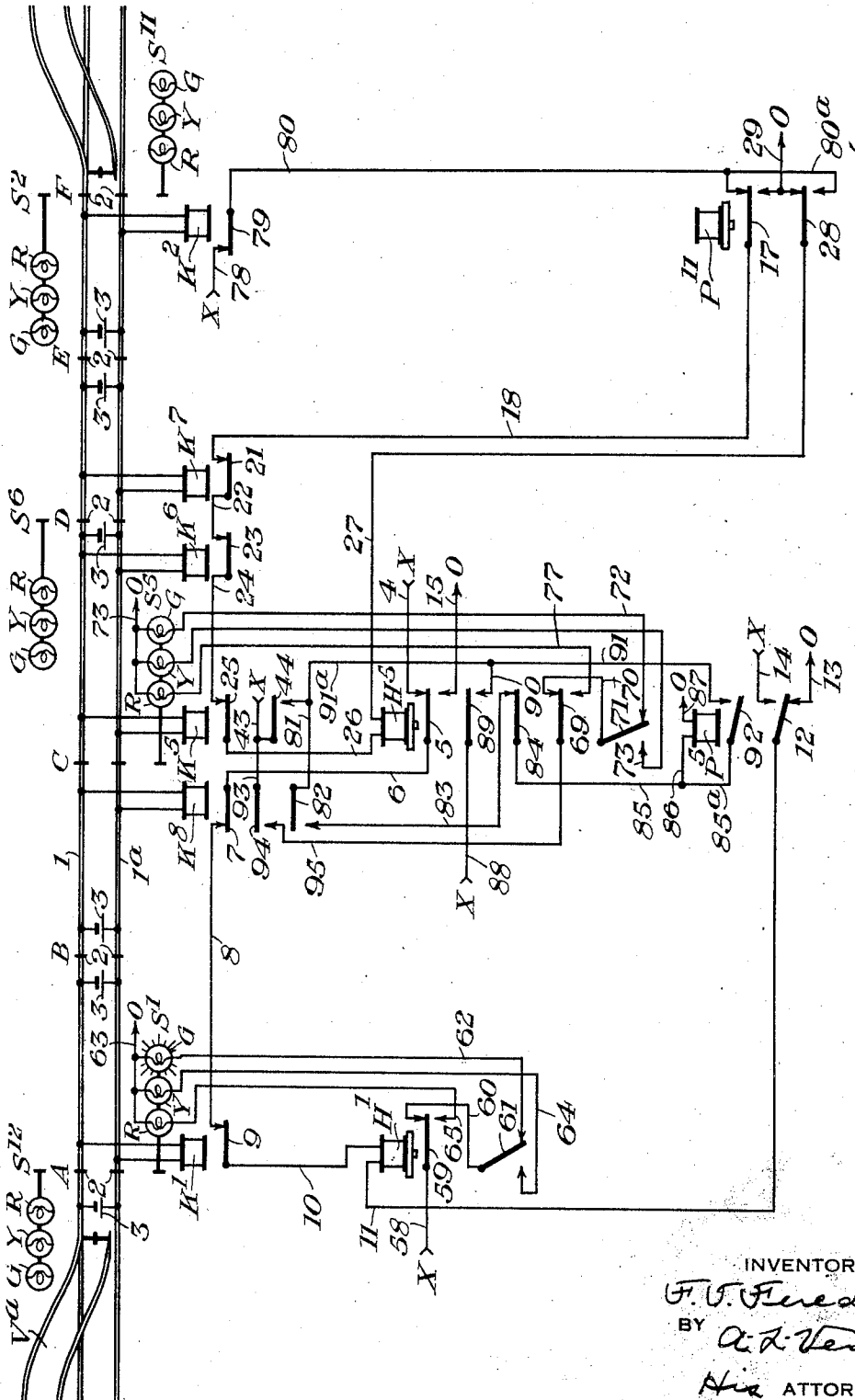
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RAILWAY TRAFFIC CONTROLLING APPARATUS

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE.

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RAILWAY-TRAFFIC-CONTROLLING APPARATUS.

Application filed November 5, 1925. Serial No. 67,020.

My invention relates to railway traffic controlling apparatus, and particularly to apparatus of the type comprising signals located in the trackway and controlled in accordance with traffic conditions.

I will describe two forms of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a diagrammatic view showing one form of railway traffic controlling apparatus embodying my invention. Fig. 2 is a view showing a modified form of the apparatus illustrated in Fig. 1, and also embodying my invention.

Similar reference characters refer to similar parts in both views.

Referring first to Fig. 1, the reference characters 1 and 1^a designate the track rails of a stretch of single track railway over which traffic normally moves in both directions, and which track is provided with two passing sidings V and V^a. The stretch of track between these two sidings is divided, by means of insulated joints 2, into a plurality of successive track sections A—B, B—C, C—D, D—E and E—F. Each such track section is provided with a track circuit comprising a track battery 3 connected across the rails at one end of the section, and a track relay connected across the rails adjacent the other end of the section and designated by the reference character K with an appropriate distinguishing exponent. Section C—D is further provided with a second track relay K^o connected across the rails adjacent the right-hand end of the section, that is, adjacent the track battery 3 for section C—D. Eastbound traffic, that is, traffic from left to right over the stretch of track shown in the drawing, is controlled by trackway signals S', S^o and S¹¹, located at points A, C and F, respectively. These signals, as here shown, each comprise three light units R, Y and G, adapted when energized to indicate stop, caution or proceed, respectively. Each signal S is controlled by a line relay associated therewith and designated by the reference character H with an exponent corresponding to the loca-

tion. Associated with each line relay H is a slow-releasing repeater relay designated by the reference character P with a suitable exponent.

Line relay H' is provided with a circuit which may be traced from one terminal X of a suitable source of current, not shown in the drawing, through wire 4, front contact 5 of relay H^o, wire 6, front contact 7 of track relay K^o, wire 8, front contact 9 of relay K', wire 10, winding of relay H', wire 11, back contact 12 of relay P^o, and wire 13 to terminal O of the same source. Another circuit for relay H' may be traced from terminal X, through wire 14, front contact 12 of repeater relay P^o, wire 11, winding of relay H', wire 10, front contact 9 of relay K', wire 8, front contact 7 of relay K^o, wire 6, back contact 5 of relay H^o and wire 15 to terminal O. It is therefore plain that when relays K' and K^o are both energized relay H' will be supplied with current of one relative polarity, which I will call "normal" relative polarity, when relay H^o is energized and relay P^o is de-energized, but will be supplied with current of the other relative polarity, which I will call "reverse" relative polarity, when relay H^o is de-energized and relay P^o is energized. It should be pointed out with this arrangement if relays H^o and P^o are simultaneously energized, or simultaneously de-energized, relay H' will be de-energized. When relay H' is supplied with current of normal relative polarity contact 61 is swung to the right, when the relay is supplied with current of reverse relative polarity contact 61 is swung to the left, in either of which cases front contacts 32 and 59 will be closed. If, however, relay H' is de-energized back contacts 32 and 59 will be closed.

When relay H' is energized in either direction, current flows from terminal X, through wire 31, front contact 32, wire 33, winding of relay P', and wires 34 and 35 to terminal O. Relay P' is then energized. When relay H' becomes de-energized, however, the energizing circuit just traced for relay P' is interrupted and a shunting circuit of low resistance is completed for relay

P' which may be traced from the right-hand terminal of the relay, through wire 33, back contact 32 of relay H', wires 36 and 34 to the left-hand terminal of relay P'. Due to the slow-acting characteristics of relay P' a considerable interval of time elapses after the de-energization of relay H' before the back contact 66 of relay P' closes, and this time interval is increased by the snubbing effect of the circuit including the back contact 32 of relay H'.

Referring now to line relay H⁵, one circuit for this relay is from terminal X, through wires 16 and 16^a, front contact 17 of relay P¹¹, wire 18, front contact 19 of relay K², wire 20, front contact 21 of relay K⁷, wire 22, front contact 23 of relay K⁶, wire 24, front contact 25 of relay K⁵, wire 26, winding of relay H⁵, wire 27, front contact 28 of relay P¹¹ and wire 29 to terminal O. This circuit is closed only when relays K⁵, K⁶, K⁷, K² and P¹¹ are all energized, under which conditions relay H⁵ is supplied with current of normal relative polarity. If now relay P¹¹ becomes de-energized, the dropping of contacts 17 and 28 reverses the relative polarity of the current supplied to relay H⁵, as will be clear from the drawing, and relay H⁵ becomes energized in the reverse direction.

Relay H¹¹ is controlled by pole changing contacts operated by a repeater relay in advance of passing siding V and corresponding to contacts 90 and 91 on relay P'. The circuit for relay H¹¹ is carried over a front contact on track relay K¹¹. It follows that relay H¹¹ will be de-energized when relay K¹¹ is de-energized, but that when relay K¹¹ is energized, relay H¹¹ will be energized in the normal or the reverse direction according as the relay in advance corresponding to relay P' is energized or de-energized.

When relay H¹¹ is energized in the normal direction current flows from terminal X, through wire 100, normal contact 99 of relay H¹¹, wires 101 and 52^a, front contact 53 of relay H¹¹, wire 54, winding of relay P¹¹, and wires 55 and 56 to terminal O. A branch is provided for this circuit over which current flows from terminal X, through back contact 50 of relay K² and wire 52 to wires 52^a. It follows that relay P¹¹ is energized when relay H¹¹ is energized in the normal direction, and also when relay H¹¹ is energized in the reverse direction provided relay K² is deenergized. When relay H¹¹ is de-energized, a snubbing circuit is completed for relay P¹¹ including back contact 53 of relay H¹¹, which assists in retarding the operation of relay P¹¹ as explained in connection with relay P'.

Relay P⁵ associated with relay H⁵ is provided with a pick-up circuit which may be traced from terminal X, through wire 37, back contact 38 of relay K⁸, wire 39, front contact 40 of relay H⁵, wire 41, winding of relay P⁵, and wire 42 to terminal O. Relay P⁵ is also

provided with a stick circuit which passes from terminal X, through wire 43, back contact 44 of relay K⁵, wires 45, 46 and 47, front contact 48 of relay P⁵, wire 49, back contact 40 of relay H⁵, wire 41, winding of relay P⁵ and wire 42 to terminal O. The stick circuit just traced is provided with a branch over which current flows from terminal X, through wire 37 and front contact 38 of relay K⁸ to wire 45. It follows that relay P⁵, having once been energized, is thereafter maintained in its energized condition as long as relays H⁵ and K⁵ are both de-energized or as long as relay K⁸ is energized and relay H⁵ de-energized.

Considering now the control of signal S', when relay H' is energized in the normal direction a proceed circuit is closed from terminal X, through wire 58, front contact 59 of relay H', wire 60, normal contact 61 of relay H', wire 62, proceed lamp G of signal S', and wire 63 to terminal O, and the signal then indicates "proceed". The signal is provided also with a caution circuit over which current flows from terminal X, through wire 58, front contact 59 of relay H', wire 60, reverse contact 61 of relay H', wire 64, lamp Y of signal S' and wire 63 to terminal O. This circuit is closed only when relay H' is energized in the reverse direction, under which condition signal S' displays a caution indication. A third circuit for signal S' may be traced from terminal X, through wire 58, back contact 59 of relay H', wire 65, back contact 66 of relay P', wire 67, lamp R of signal S', and wire 63 to terminal O. This circuit is closed when relays H' and P' are both de-energized, and signal S' then indicates "stop".

The proceed circuit for signal S⁵ passes from terminal X, through wire 68, front contact 69 of relay H⁵, wire 70, normal contact 71 of relay H⁵, wire 72, lamp G of signal S⁵, and wire 73 to terminal O. The caution circuit for signal S⁵ may be traced from terminal X, through wire 68, front contact 69 of relay H⁵, wire 70, reverse contact 71 of relay H⁵, wire 74, lamp Y of signal S⁵, and wire 73 to terminal O. It will be plain that the proceed and caution circuits for signal S⁵ are similar to those explained in connection with signal S'. Stop lamp R of signal S⁵ is provided with a circuit which may be traced from terminal X, through wire 68, back contact 69 of relay H⁵, wire 75, back contact 76 of relay P⁵, wire 77, lamp R of signal S⁵, and wire 73 to terminal O. A second circuit for lamp R may be traced from terminal X, through wire 37, front contact 38 of relay K⁸, wires 46 and 46^a, front contact 76 of relay P⁵, wire 77, lamp R of signal S⁵, and wire 73 to terminal O. This circuit is closed only when relays K⁸ and P⁵ are both energized under which condition signal S⁵ indicates stop. A third circuit for lamp R may be

traced from terminal X, through wire 43, back contact 44 of relay K⁶, wires 45, 46 and 46^a, front contact 76 of relay P⁵, wire 77, lamp R of signal S⁵, and wire 73 to terminal O.

5 The control of signal S¹¹ by relays H¹¹ and P¹¹ is the same as the control of signal S' by relays H' and P' and will be readily understood from the drawing without tracing the circuits in detail.

10 Westbound traffic through the stretch of track shown in the drawing is controlled by signals S², S⁶ and S¹² located adjacent points F, D and A, respectively and controlled by apparatus which is similar to that described in connection with signals S', S⁵ and S¹¹, but which is omitted from the drawing for the sake of simplicity.

As shown in the drawing the parts of the apparatus are in the positions corresponding to the normal or unoccupied condition of the track. Under this condition, track relays K are all energized and relay H¹¹ is energized in the normal direction. Relays H' and H⁵ are also energized in the normal direction, and relays P' and P¹¹ are energized, but relay P⁵ is de-energized. Signals S', S⁵ and S¹¹ therefore all indicate "proceed".

I will now assume that an eastbound train moves through the stretch of track shown in the drawing. As the train enters section A—B relay K' becomes de-energized, thus de-energizing relay H'. The green lamp G of signal S' is therefore extinguished. The opening of front contact 32 of relay H' opens the circuit for relay P' and closing of back contact 32 closes the snubbing circuit for relay P'. After the time interval required for relay P' to close its back contacts, the circuit is closed for lamp R of signal S', which signal then indicates stop. When the train enters section B—C relay K⁸ becomes de-energized, but this has no effect upon relay H' which is already de-energized. The closing of back contact 38 of relay K⁸ closes the pick-up circuit for relay P⁵, which relay then becomes energized. When the train leaves section A—B, relay K' becomes energized, but relay H' is still de-energized, its circuit being open at front contact 7 of relay K⁸, and signal S' still displays a stop indication. When the train enters section C—D relays K⁵ and K⁶ become de-energized. Relay H⁵ then opens, its circuit being interrupted at front contacts 25 of relay K⁵ and 23 of relay K⁶. The opening of relay P⁵ is delayed due to its slow-acting characteristics and also due to a snubbing circuit which may be traced from terminal O, through wire 42, winding of relay P⁵, wire 41, back contact 40 of relay H⁵, wire 49, front contact 48 of relay P⁵, wires 47 and 46^a, front contact 76 of relay P⁵, wire 77, lamp R of signal S⁵, and wire 73 to terminal O. The stick circuit for relay P⁵ is then closed over its own front contact 48 and back contacts 44 and 40 of relays

K⁵ and H⁵, respectively. Lamp R of signal S⁵ is now energized over a back contact of relay K⁵ and a front contact of relay P⁵. This signal therefore displays a stop indication. When the rear of the train moves out of section B—C, the energization of relay K⁸ completes the circuit for relay H'. Since relay H⁵ is de-energized and relay P⁵ is energized, the current supplied to relay H' is of such polarity that the relay is energized in the reverse direction. Relay P' then becomes energized over front contact 32 of relay H'. Signal S' therefore indicates caution. When the train enters section D—E, relay K⁷ opens, but since the circuit for relay H⁵ is already open, this does not affect the apparatus. When the train moves out of section C—D, relays K⁵ and K⁶ become energized, but relay H⁵ remains de-energized, its circuit being interrupted at front contact 21 of relay K⁷. Relay P⁵ is now held in its energized condition over a stick circuit including front contact 38 of relay K⁸, which relay became energized when the rear of the train moved out of section B—C. Signal S⁵ therefore still displays a stop indication, and signal S' indicates caution. When the train enters section E—F, relay K² becomes de-energized, but this does not affect relay H⁵. The closing of back contact 50 of relay K² closes a branch for the circuit including relay P¹¹, but this relay is already energized, and hence no change results. The energization of relay K⁷, as the train passes out of section D—E, does not change the condition of the apparatus. When the train enters the section to the right of point F, relay H¹¹ becomes de-energized. Relay P¹¹ then opens, its circuit being broken at front contact 53 of relay H¹¹, and signal S¹¹ indicates stop. When the rear of the train moves out of section E—F, relay K² becomes energized, closing at front contact 19 the circuit for relay H⁵. But since relay P¹¹ is de-energized, the polarity of the current now supplied to relay H⁵ is such that the relay is energized in the reverse direction. Signal S⁵ therefore indicates caution. The opening of back contact 40 of relay H⁵ opens the circuit for relay P⁵, which relay becomes de-energized. The picking up of contact 5 of relay H⁵ de-energizes relay H' but when back contact 12 of relay P⁵ becomes closed relay H' is again energized, this time in the normal direction. Signal S' then indicates proceed. It should be noted that as soon as relay H' becomes de-energized, the energizing circuit for relay P' is broken, and the snubbing circuit for this relay is closed. The time interval required for the back contacts of relay P' to close is, however, greater than the time interval elapsing between the opening of the back contact 5 of relay H⁵, and the closing of front contact 5 of relay H⁵ and back contact 12 of relay P⁵, to energize relay H' in the normal direction. When relay H' be-

comes energized in the normal direction, relay P' of course again becomes energized. It is therefore plain that during the change from a caution to a clear indication of signal S', the stop lamp R does not light. When the eastbound train has moved to the right far enough to permit relay H¹¹ to become energized in the reverse direction, signal S¹¹ will indicate caution. When relay H¹¹ becomes energized in the normal direction, signal S¹¹ indicates proceed. The closing of normal contact 99 of relay H¹¹ completes the circuit for relay P¹¹. The energization of relay P¹¹ reverses the relative polarity of the current supplied to relay H⁵, which thereupon becomes energized in the normal direction, and causes signal S⁵ to indicate proceed.

It will be seen from the foregoing that signal S⁵ indicates proceed only when signal S¹¹ also indicates proceed.

I will now assume that relay H¹¹ is energized in the reverse direction so that signal S¹¹ is at caution and relay P¹¹ is de-energized. Relay H⁵ then is energized in the reverse direction so that signal S⁵ also displays a caution indication. I will also assume that a second east-bound train occupies section B—C. Relay K⁸ is therefore de-energized, and relay P⁵ is energized. If, now, relay H¹¹ becomes energized in the normal direction, relay P¹¹ will become energized so that relay H⁵ is reversed, but this reversal may take a time interval so great that the back contacts of relay H⁵ close. Relay P⁵, however, being slow acting, bridges this time interval and prevents the flashing of stop lamp R. Signal S⁵ then changes from a caution to a proceed indication without flashing the stop lamp R.

I will next assume that relay H¹¹ is energized in the reverse direction thereby de-energizing relay P¹¹, and causing S¹¹ to indicate caution, and that an eastbound train enters section E—F. The resulting de-energization of relay K² closes the branch circuit for relay P¹¹ which becomes energized. If, now, relay H¹¹ becomes energized in the normal direction signal S¹¹ will indicate proceed, and the slow acting characteristics of relay P¹¹ will prevent the flashing of the stop lamp R of signal S¹¹ should the reversal of relay H¹¹ require so long a time that its back contacts close during such reversal.

I will now assume that relay H¹¹ is energized in the normal direction so that signal S¹¹ indicates proceed, and that the stretch of track shown in the drawing is unoccupied. Relay P¹¹ is energized, and relay H⁵ is energized in the normal direction so that signal S⁵ indicates proceed. If, now, a westbound train enters the stretch of track between siding V and the next passing siding to the right, the relay for such stretch corresponding to relay P' becomes de-energized, and

thereby reverses the polarity of the current supplied relay H¹¹ which thereupon closes its reverse contacts so that signal S¹¹ indicates caution. It should be noticed however, that when relay H¹¹ is energized in the normal direction relay P¹¹ is also energized but that when relay H¹¹ is reversed, relay P¹¹ becomes de-energized. Due to the slow acting characteristics of relay P¹¹, however, the back contacts require a longer time to close than is required for reversal of relay H¹¹, and therefore lamp R of signal S¹¹ does not flash when the indication of signal S¹¹ changes from proceed to caution.

Should an eastbound train be in section B—C when relay H¹¹ is reversed, relay P⁵ would then be energized. When relay P¹¹ becomes de-energized due to the reversal of relay H¹¹ however, relay H⁵ becomes energized in the reverse direction and signal S⁵ then indicates caution. During the change from proceed to caution in the indication of signal S⁵ relay P⁵ prevents flashing of lamp R in the same manner as described in connection with a change from caution to proceed in the indication of that signal.

Referring now to Fig. 2 the stretch of track shown in the drawing is divided as before into track sections and each track section is provided with a track circuit including a track battery 3 and track relay K, as in Fig. 1. Traffic through this stretch is controlled by trackway signals similar to those described in Fig. 1. Associated with relays K' and K⁵ are line relays H' and H⁵, respectively, each capable of holding its front contacts closed while the polarity of the current supplied to the winding of the relay is reversed. One form of relay adapted to operate in this manner is illustrated in United States Letters Patent #1,421,269, granted to S. M. Lucas on June 27, 1922. Associated with relay H⁵ is a stick relay P⁵ which is not slow acting. When relay H⁵ is energized and relay P⁵ is de-energized, current flows from terminal X, through wire 4, front contact 5 of relay H⁵, wire 6, front contact 7 of relay K⁸, wire 8, front contact 9 of relay K', wire 10, winding of relay H', wire 11, back contact 12 of relay P⁵, and wire 13 to terminal O. When this circuit is closed, relay H' is energized in the normal direction. When relay H⁵ is de-energized and relay P⁵ is energized, relay H' is energized in the reverse direction by current which flows from terminal X, through wire 14, front contact 12 of relay P⁵, wire 11, winding of relay H', wire 10, front contact 9 of relay K', wire 8, front contact 7 of relay K⁸, wire 6, back contact 5 of relay H⁵ and wire 15 to terminal O.

Relay P¹¹ and signal S¹¹ located adjacent point F are controlled in the same manner as the corresponding parts in Fig. 1, and for purposes of simplicity the circuits for accomplishing this control have been omitted from

Fig. 2. When relay P^{11} is energized and relays K^2 , K^7 , K^6 and K^5 are also energized, current flows from terminal X, through wire 78, front contact 79 of relay K^2 , wire 80, front contact 17 of relay P^{11} , wire 18, front contact 21 of relay K^7 , wire 22, front contact 23 of relay K^6 , wire 24, front contact 25 of relay K^5 , wire 26, winding of relay H^5 , wire 27, front contact 28 of relay P^{11} and wire 29 to terminal O. When this circuit is closed relay H^5 is energized in the normal direction. If relay P^{11} is de-energized relay H^5 is energized in the reverse direction by current from terminal X, through wire 78, front contact 79 of relay K^2 , wires 80 and 80^a, back contact 28 of relay P^{11} wire 27, winding of relay H^5 , wire 26, front contact 25 of relay K^5 , wire 24, front contact 23 of relay K^6 , wire 22, front contact 21 of relay K^7 , wire 18, back contact 17 of relay P^{11} , and wire 29 to terminal O.

Relay P^5 is provided with a pick-up circuit which may be traced from terminal X, through wire 43, back contact 44 of relay K^5 , wire 81, back contact 82 of relay K^5 , wire 83, front contact 84 of relay H^5 , wires 85 and 86, winding of relay P^5 , and wire 87 to terminal O. A first stick circuit is provided for relay P^5 over which current flows from terminal X, through wire 88, back contact 89 of relay H^5 , wires 90 and 91, front contact 92 of relay P^5 , wires 85^a and 86, winding of relay P^5 , and wire 87 to terminal O. Relay P^5 is also provided with a second stick circuit which may be traced from terminal X, through wire 43, back contact 44 of relay K^5 , wires 91^a and 91, front contact 92 of relay P^5 , wires 85^a and 86, winding of relay P^5 , and wire 87 to terminal O.

The proceed circuit for signal S' may be traced from terminal X, through wire 58, front contact 59 of relay H' , wire 60, normal contact 61 of relay H' , wire 62, lamp G of signal S' and wire 63 back to terminal O. This circuit is closed only when relay H' is energized in the normal direction, under which condition signal S' indicates proceed. When relay H' is energized in the reverse direction current flows from terminal X, through wire 58, front contact 59 of relay H' , wire 60, reverse contact 61 of relay H' , wire 64, lamp Y of signal S' and wire 63 back to terminal O and the signal displays a caution indication. When relay H' is de-energized current from terminal X flows through wire 58, back contact 59 of relay H' , wire 65, lamp R of signal S' and wire 63 to terminal O, and the signal then indicates stop.

The proceed circuit for signal S^5 may be traced from terminal X, through wires 43 and 93, back contact 94 of relay K^8 , wire 95, front contact 69 of relay H^5 , wire 70, normal contact 71 of relay H^5 , wire 72, lamp G of signal S^5 and wire 73 to terminal O. The caution circuit for signal S^5 may be traced from terminal X, through wires 43 and 93, back

contact 94 of relay K^8 , wire 95, front contact 69 of relay H^5 , wire 70, reverse contact 71 of relay H^5 , wire 73, lamp Y of signal S^5 and wire 73 to terminal O. The stop circuit for signal S^5 is closed when relays K^8 and H^5 are both de-energized, and current then flows from terminal X, through wires 43 and 93, back contact 94 of relay K^8 , wire 95, back contact 69 of relay H^5 , wire 77, lamp R of signal S^5 and wire 73 to terminal O. It will be noted that all three circuits for signal S^5 are open except when track relay K^8 is open, that is, except when a train is approaching the signal.

As shown in the drawing, all parts of the apparatus are illustrated in the positions corresponding to the normal, or unoccupied condition of the trackway. Under this condition track relays K are all energized, line relays H' and H^5 are energized, and stick relay P^5 is de-energized. Relay P^{11} is also energized. Signal S' indicates proceed, but no indication is displayed by signal S^5 because the current supplied to each of the lamps R, Y and G of this signal is carried over back contact 94 of relay K^8 which is now energized.

I will now assume that an eastbound train passes through the stretch of track shown in the drawing. As this train enters section A—B relay K' is de-energized, relay H' is therefore de-energized and signal S' indicates stop. As the train enters section B—C the de-energization of relay K^8 completes the proceed circuit for signal S^5 which signal now displays a proceed indication. The opening of contact 7 of relay K^8 does not affect relay H' because this relay is already de-energized. As the rear of the train moves out of section A—B, signal S' continues to indicate stop, the circuit for relay H' controlling this signal being open at front contact 7 of relay K^8 . As the train enters section C—D relays K^6 and K^5 become de-energized, thus interrupting the circuit for relay H^5 , which relay becomes de-energized. Due, however, to the slow acting characteristics of relay H^5 , a time interval elapses before the front contacts of relay H^5 are opened. During this time interval the closing of back contact 44 of relay K^5 completes the pick-up circuit for relay P^5 which then becomes energized. This pick-up circuit is opened when front contact 84 of relay H^5 opens, but relay P^5 is now retained in its energized condition over its stick circuit which includes back contact 44 of relay K^5 . When the train moves out of section B—C relay K^8 becomes energized, thus disconnecting energy from signal S^5 . The circuit for relay H' is, however, now complete, but relay H^5 is de-energized and relay P^5 is energized, so that the relative polarity of the current supplied to relay H' is such that relay H' is energized in the reverse direction. Signal S' therefore indicates caution. When the train enters section D—E relay K' becomes de-

energized but this has no effect upon the rest of the apparatus. When the train passes out of section C—D relays K⁵ and K⁶ become energized, but stick relay P⁵ is still held in its energized condition over its stick circuit including front contact 92 of relay P⁵ and back contact 89 of relay H⁵. A following train occupying section B—C would, under these conditions, receive a stop indication because relay H⁵ is deenergized. As the train enters section E—F relay K² is energized, but as relay H⁵ is already de-energized, this does not affect the apparatus. When the train moves out of section D—E the relay K⁷ becomes energized but this does not affect the remaining apparatus. When the train enters the section to the right of point F, relay P¹¹ becomes de-energized as explained in connection with Fig. 1. After the rear of the train leaves section E—F, relay K² becomes energized thereby completing the circuit for relay H⁵, and, relay P¹¹ being de-energized, relay H⁵ becomes energized in the reverse direction. Relay P⁵ is then de-energized, its stick circuit being open at back contact 89 of relay H⁵. Relay H⁷ then becomes energized in the normal direction and signal S⁷ indicates proceed.

It should be pointed out that due to the characteristics of relay H⁷ the back contact of this relay does not close during reversal of the relative polarity supplied to the winding of the relay by the energization of relay H⁵ and de-energization of relay P⁵, and that therefore during a change from caution to proceed indication of signal S⁷ due to a reversal in the direction of energization of relay H⁷, the stop lamp R of signal S⁷ does not become lighted. When relay P¹¹ becomes energized, the relative polarity of the current supplied to relay H⁵ is reversed and if section B—C is occupied by a following train so that back contact 94 of relay K⁸ is closed, the indication displayed by signal S⁵ changes from caution to proceed. During this change the stop lamp R will not be energized for the same reason as just explained in connection with signal S⁷.

It should also be pointed out that the front contacts of relays H⁷ and H⁵ will also be held closed when the corresponding relays reverse their polarized contacts from the normal to the reverse positions, and it follows that the relays therefore prevent the flashing of the stop lamp R in the associated signals when the indications displayed by such signals change from proceed to caution.

Signals S² and S⁶ for traffic from east to west are controlled by circuits which are not shown in the drawing but which are the same as the circuits for signals S⁷ and S⁵ governing eastbound traffic.

Although I have herein shown and described only two forms 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, a forward and a rear section of railway track, a first line relay for said forward section, a stick relay controlled in part by said first relay, a second line relay for said rear section responsive to the polarity of the current supplied thereto, a source of energy, means controlled by said first line relay for connecting one terminal of said second line relay with one terminal or the other of said source according as the first line relay is energized or de-energized, and means for connecting the remaining terminal of said second line relay with one terminal or the other of said source according as the stick relay is energized or de-energized.

2. In combination, a forward and a rear section of railway track, a first line relay for said forward section, a stick relay controlled in part by said first relay, a second line relay for said rear section responsive to the polarity of the current supplied to it and provided with a first and a second terminal, a source of energy having a positive terminal and a negative terminal, means for connecting the first terminal of said second line relay with the positive terminal of said source when the first line relay is energized and with the negative terminal of said source when said first line relay is de-energized, and means for connecting the remaining terminal of said second line relay with the positive terminal or the negative terminal of said source according as said stick relay is energized or de-energized.

3. In combination, a section of railway track, a line relay for said section controlled in part by traffic conditions in advance of the section, a slow releasing stick relay, a pick-up circuit for said stick relay closed when a train approaches said section provided said line relay is energized, a first stick circuit for said stick relay arranged to be closed when said section is occupied provided said line relay is de-energized, a second stick circuit for said stick relay arranged to be closed after a train has passed into such section provided said line relay is de-energized, and a trackway signal controlled in part by said stick relay.

4. In combination, a forward and a rear section of railway track, a first line relay for said forward section, a stick relay controlled in part by said first line relay, a second line relay for said rear section, and means for supplying said second line relay with current of one polarity when said first line relay is energized and said stick relay is de-energized, and for supplying the second line relay with current of the opposite polarity when

said first line relay is de-energized and said stick relay is energized, but for discontinuing the supply of energy to said second line relay when said first line relay and said stick relay
5 are both energized or are both de-energized.

5. In combination, a forward and a rear section of railway track, a first track relay for said forward section, a second track relay for said rear section, a line relay controlled
10 by said first track relay and by traffic conditions in advance, a stick relay, a pick-up circuit for said stick relay including a front contact of said line relay and a back contact of said second track relay; a first stick circuit
15 for said stick relay including a front contact of the stick relay, a back contact of the line relay, and a front contact of said second track relay; a second stick circuit for said stick relay including a front contact of said stick relay, a back contact of said line relay, and a
20 back contact of said first track relay, and traffic controlling apparatus controlled by said stick relay.

6. In combination, a section of railway track, a track relay for said section, a line relay controlled by said track relay and by traffic conditions in advance, a slow releasing stick relay controlled by said track relay and
25 by said line relay, a trackway signal, a stop circuit for said signal including a back contact of said stick relay and a back contact of said line relay, and a second stop circuit for said signal including a front contact of said stick relay and a back contact of said track
30 relay.

7. In combination, a forward and a rear section of railway track, a first polarized line relay for said forward section arranged to be energized in one direction or the other or
40 to be de-energized in accordance with traffic conditions in advance, a slow releasing stick relay controlled by said line relay, a second line relay controlled jointly by said first line relay and by said stick relay, a signal for said rear section controlled by said second
45 line relay, a signal for said forward section arranged to indicate proceed or caution according as said first line relay is energized in the normal or the reverse direction, but

to indicate stop when such relay is de-energized, and means controlled by said stick relay for preventing said signal from indicating stop when the first line relay changes from the reverse to the normal condition or vice versa.

8. In combination, a section of railway track, a polarized line relay for said section responsive to traffic conditions, a slow acting relay arranged to be energized when said line relay is energized in one direction but not
60 when said line relay is energized in the opposite direction or is de-energized, and a signal for said section controlled by said slow acting relay.

9. In combination, a section of railway track, a polarized line relay for said section responsive to traffic conditions, a slow acting relay arranged to be energized when said line relay is energized in one direction but
65 not when said line relay is energized in the opposite direction or is de-energized, and governing means for said section controlled by said slow acting relay.

10. In combination, a section of railway track, a track relay connected across the rails
75 adjacent said section, a polarized line relay responsive to traffic conditions, a slow acting relay arranged to be energized when said line relay is energized in either direction provided said track relay is de-energized but to
80 be energized only when the line relay is energized in the normal direction if said track relay is energized, and a signal for said section controlled by said slow acting relay.

11. In combination, a section of railway track, a track relay connected across the rails
85 adjacent said section, a polarized line relay responsive to traffic conditions, a slow acting relay, a first circuit for said slow acting relay including a polarized contact on said line relay, a second circuit for said slow acting relay including a neutral contact on said line
90 relay and a back contact on said track relay, and a signal for said section controlled by said slow acting relay.

In testimony whereof I affix my signature.

FREDERICK T. FEREDAY.