Nov. 9, 1943. J. J. VAN HORN 2,333,963

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Jan. 30, 1943 3 Sheets-Sheet 1

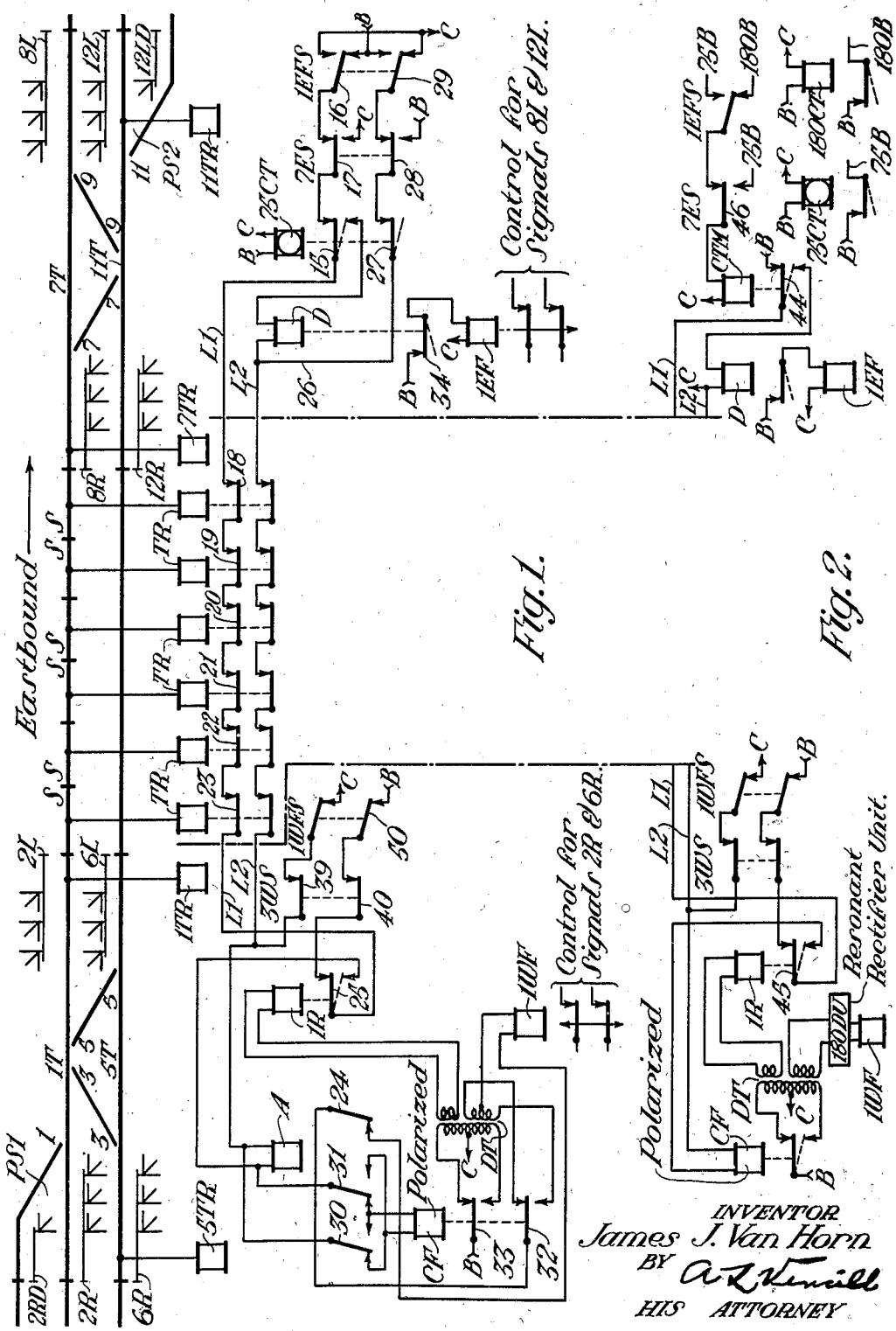


Fig. 1.

Fig. 2.

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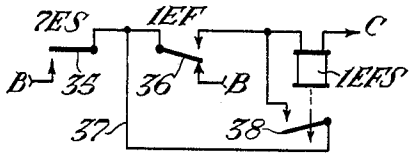


Fig. 1a.

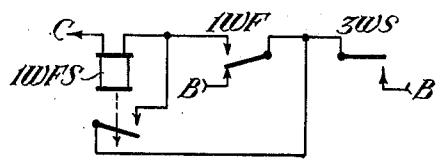


Fig. 1b.

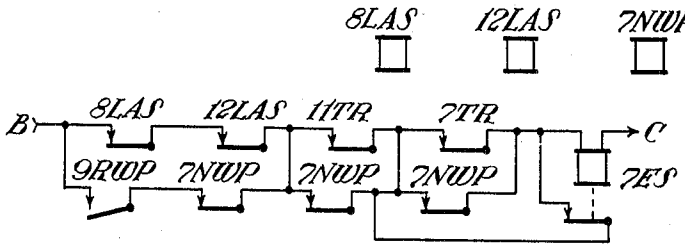


Fig. 1c.

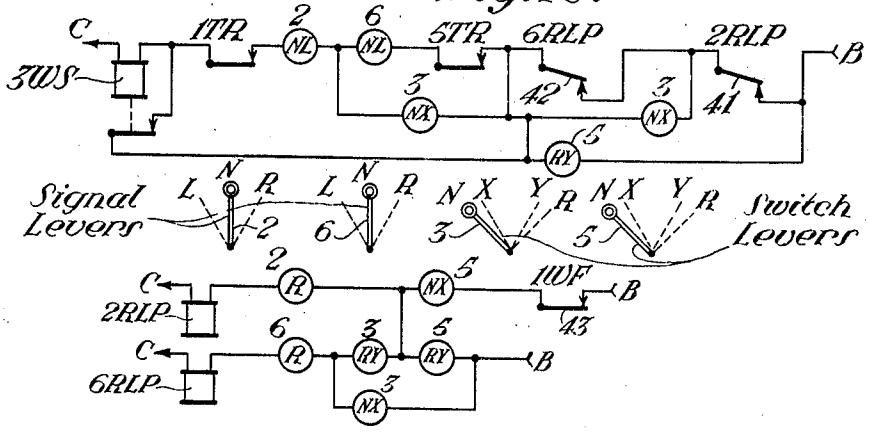


Fig. 1d.

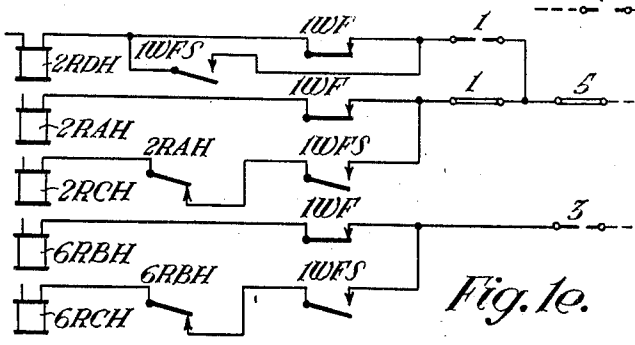
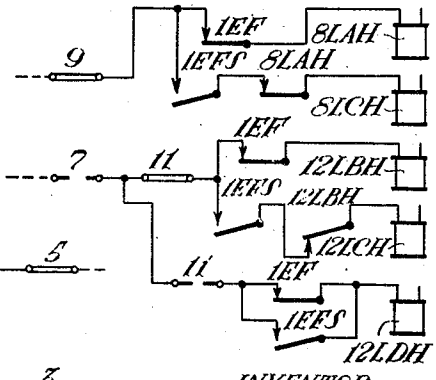


Fig. 1e.



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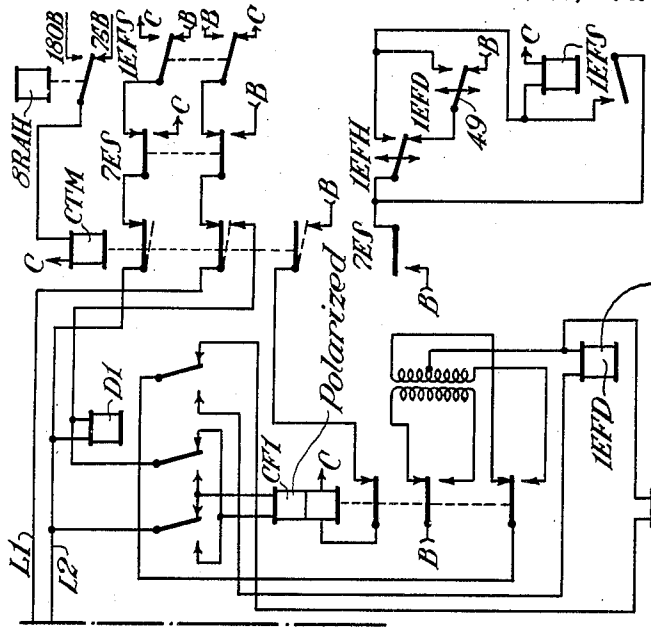


Fig. 3a.

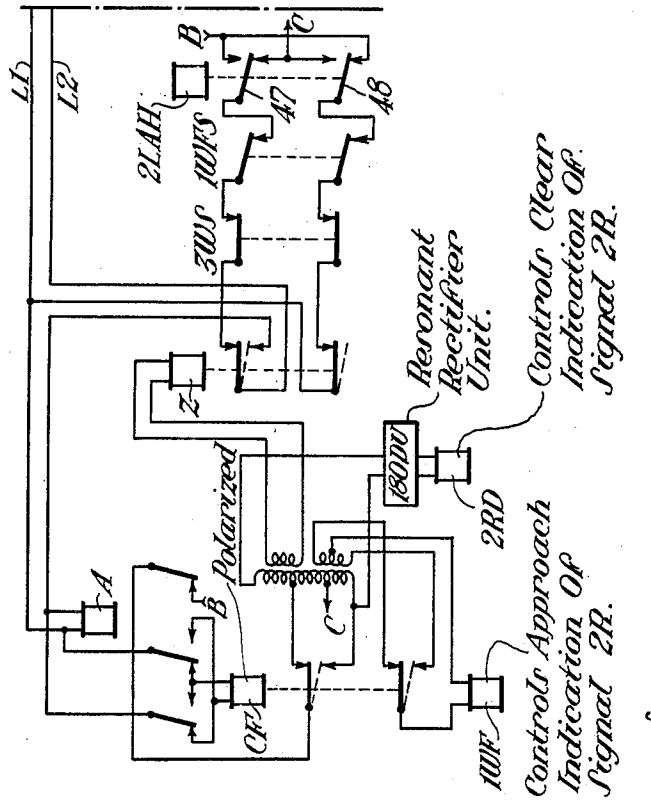


Fig. 3.

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UNITED STATES PATENT OFFICE

2,333,963

RAILWAY TRAFFIC CONTROLLING APPARATUS

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Application January 30, 1943, Serial No. 474,107

5 Claims. (Cl. 246—33)

My invention relates to railway traffic controlling apparatus and is particularly directed to the control of traffic in a single or double track, two-direction system of signaling. More specifically, my invention relates to the control of traffic and of the opposing signals between two interlocked locations in such a system by means of a coded line circuit.

One object of my invention is to provide traffic locking between a mechanically locked machine and a non-mechanically locked machine over a coded line circuit. Another object is to provide for traffic direction selection over the line circuit and for maintaining the established direction until this direction is reversed by the operator. A further object is to provide control for two proceed indications of the opposing headblock signals. A still further object is to simplify the line circuit control and adapt it to a stretch of track having no intermediate signals. Other objects, purposes and characteristic features of the invention will become apparent from the description which follows.

I accomplish the foregoing objects as follows: by employing a series relay at the feed end of the line circuit and a polarized control relay at the receiving end of the line circuit; by transmitting code continuously over the line circuit so as to provide a channel for feed-back code at all times; and by polarizing both the normal control code and the feed-back code.

I shall describe three forms of apparatus embodying my invention and shall then point out the novel features thereof in claims.

Fig. 1 of the accompanying drawings is a diagrammatic view showing one form of apparatus embodying my invention. Figs. 2 and 3 are diagrammatic views showing modified forms of the invention shown in Fig. 1 and also embodying my invention. Figs. 1*a* to 1*e*, inclusive, are circuit diagrams showing control circuits for certain of the apparatus shown in Fig. 1.

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

Referring to Fig. 1 of the drawings, I have shown a stretch of double track having a number of cross-overs and having a passing siding PS1 at one end and a passing siding PS2 at the other end of the stretch. Both tracks of this stretch are arranged for traffic movement in either direction, as indicated by the signals 2R and 8L for the upper track, and signals 6R and 12L for the lower track. Signals 2R, 2RD, 6R, 12L, 12LD and 8L are headblock signals; signals 2L and 6L are westbound leaving signals; and signals 8R and 12R are eastbound leaving signals. Although two tracks are shown in order to illustrate a wider application of the invention, it will be understood that the two passing sidings PS1 and PS2 could be associated with but one track, such as the upper track, for example. Associated with each end of the stretch is an interlocking machine which, at one end, may be a mechanically locked machine and at the other end, a non-mechanically locked machine.

The upper and lower tracks, shown conventionally as single lines in the drawings, are divided into track circuit sections by means of the usual insulated rail joints and there is a source of current S associated with each track circuit at one end thereof and a track relay TR associated with each track circuit at the other end thereof. These current sources and track relays are shown conventionally in order to simplify the drawings. Only the upper track is shown subdivided into a number of track circuit sections but it is apparent that both tracks could be similarly arranged. A contact of each of the track relays is included in the line circuit.

At one end of the line circuit is a source of current having the terminals B—C which supplies current of one polarity or the other according as the traffic direction selecting or traffic stick relay 1EFS is energized or deenergized. The polarized line current is coded by means of the code transmitter 75CT and maintains polar relay A at the other end of the line circuit operated to its one or its other position in accordance with line current polarity. The polar biased code following relay CF follows the line current code impulses and operates on line current of either polarity provided however that the polar contacts of relay A agree in position with this polarity. That is to say, when both the line circuit polarity and the contacts of relay A are reversed, the current polarity supplied to relay CF remains the same so that the relay continues to operate. Current of wrong polarity in the winding of relay CF will cause the armature of this relay to be held more firmly in the deenergized position against the armature backstop.

Code operation of relay CF energizes the decoding transformer DT and causes code operation of the impulse relay IR which under proper conditions delivers impulses of a feed-back code to the line circuit during off intervals in the master code to which relay CF is responding. This manner of operation of relay IR is well known and is shown, for example, in the United States Reissue Patent No. 21,783, granted to Her-

man G. Blosser on April 29, 1941. When the line circuit polarity is normal so that the polar contacts of relay A are in the position shown and relay CF is following code, then and only then the slow pick-up slow release relay 1WF will be maintained energized.

Each time that the coder 75CT closes the back point of its contact 15, it disconnects the current source at that end and connects the code following series line relay D into the line circuit. If feed-back code is now being supplied to the line circuit by relay 1R at the other end, relay D will follow code and will maintain the slow pick-up slow release traffic relay 1EF energized.

As will now be apparent, the line circuit L1—L2 provides a channel for effecting intercontrol of the apparatus at the two ends of the stretch. By constantly operating the coder 75CT, a circuit for the return of feed-back code is always available whenever the stretch is unoccupied. Also, by polarizing the master code, control over two proceed indications is provided for the headblock signals at each end. Relay 1EF and 1WF are traffic locking relays and will normally both be energized when the stretch is unoccupied and all of the signals are at stop, as illustrated in the drawings.

To line up a route from right to left or westbound, traffic direction stick relay 1EFS is first energized so as to reverse the line circuit polarity. This will cause polar relay A to reverse and to open its contact 24 so as to release the westbound traffic locking relay 1WF and thus prevent the clearing of an eastbound route from left to right. Although relay 1WF is released, relay CF continues to follow code and to operate relay 1R so that the feed-back circuit is effective for operating the series relay D which maintains the eastbound traffic locking relay 1EF energized. When a route is set up from left to right, or eastbound, the traffic direction stick relay 1WFS will be energized so that the feed-back circuit for relay D will be opened. The continued release of relay D will cause traffic locking relay 1EF to release which prevents the clearing of a westbound route.

Referring for the moment to Figs. 1*a* and 1*b*, these figures show the control for the traffic direction stick relays 1EFS and 1WFS, respectively. Included in the circuit for relay 1EFS is a contact of relay 7ES which is controlled over the circuit shown in Fig. 1*c*. Similarly, the relay 3WS which enters into the control of relay 1WFS has a control circuit as shown in Fig. 1*d*. The latter figure also shows the signal levers and switch levers for the mechanically locked machine, as well as the control of the repeater relays 2RLP and 6RLP which enter into the control of relay 3WS. Fig. 1*e* shows the control circuits involved in the control of the relays which govern operation of the headblock signals at the two ends of the stretch. The control circuits of Figs. 1*a* to 1*e*, inclusive, are well known and are shown merely to render the disclosure more complete. The nomenclature used and manner of showing of the various elements in these circuits is conventional so that no detailed description of this portion of the apparatus appears necessary.

Returning again to Fig. 1 for a more detailed description of the operation, normally, with the directional stick relay 7ES energized and the traffic stick relay 1EFS deenergized, as shown, current will flow from one terminal B of a suitable source, over the back point of contact 16 of relay 1EFS, front point of contact 17 of relay 7ES, front point of coding contact 15 of coder 75CT, line wire L1, front contacts 18 to 23, inclusive, of the intervening track relays, back point of contact 25 of impulse relay 1R, winding of relay A, front contacts of the various track relays, wire 26, and contacts 27, 28, and 29 of coder 75CT and relays 7ES and 1EFS, respectively, to the other terminal C of the same source. Under this condition, the line circuit will be energized with coded current of what I shall term normal relative polarity so that relay A will maintain its polar contacts closed in the left-hand position, as shown. Relay CF will accordingly be energized with coded current of normal polarity to which it selectively responds, over contacts 30 and 31 of relay A. Since relay CF is following code and contact 24 of relay A is closed, energy is being delivered from the lower output winding of the decoding transformer to maintain the traffic locking relay 1WF energized. This energy is rectified over contact 32 of relay CF in the usual manner. Also, since relay CF is following code, the impulse relay 1R will likewise follow code, being picked up when the back point of contact 33 is closed, and released when the front point of this contact is closed, as fully explained in the above Blosser United States patent.

If at this time, relay 3WS is energized and relay 1WFS is deenergized so that front contact 40 and back contact 50 are both closed, an impulse of feed-back code will be delivered to the line circuit each time that the front point of contact 25 of relay 1R becomes closed. Since the back point of contact 15 of coder 75CT is closed during the time when the feed back impulses are effective, relay D will be energized by feed-back code and will follow this code. The polarity of the feed-back code can be properly selected with respect to the polar bias of relay D so that this relay will operate only when feed-back code of the proper polarity is present in the line circuit.

Code operation of relay D causes relay 1EF to become energized over front contact 34. Accordingly, with the apparatus in its normal condition, relays 1EF and 1WF will both be energized so that signal 8L or 12L may be cleared for a westbound move, or signal 2R or 6R may be cleared for an eastbound move. The conventional circuits for the control of the respective home relays for these signals are shown in Fig. 1*e* and will be clear without detailed description.

Assuming that signal 8L is the one which is cleared, then relay 7ES will be deenergized whereby the polarity of the line circuit will become reversed through the closing of the back points of contacts 17 and 28. Polar relay A will now reverse, opening the circuit for relay 1WF at its contact 24, thus causing this relay to release. Since relay 1WF has its front contacts included in the control circuits for the eastbound signals 2R and 6R, these signals cannot be cleared for an eastbound move opposing that established by the clearing of westbound signal 8L. The line circuit, accordingly, provides traffic locking which comes into play when a headblock signal for a given direction is cleared.

Reversal of polarity of the master code in the line circuit thus causes relay 1WF to release, but the polarized relay CF will continue to operate under this condition. Since relay 1WFS remains deenergized and relay 3WS remains energized, the feed-back circuit over contact 25 of relay 1R will continue effective with a reversal of master code polarity. Accordingly, relays D and 1EF will be energized. The energization of

relay 1EF provides block control for signal 8L when this signal governs a move past signal 8R.

When relay 7ES is deenergized and relay 1EF is energized, relay 1EFS shown in Fig. 1*a* will be energized over an obvious circuit which includes contacts 35 and 36 of these respective relays, and will provide a call-on aspect for a following move past signal 8L, when desired. Relay 1EFS will remain energized over its stick circuit which includes the back point of contact 36 of relay 1EF, wire 37, and the front contact 38 of relay 1EFS. With relay 1EFS picked up, the polarity of the master code supplied to the line circuit is the same as under the previous condition when relay 7ES was assumed deenergized, thus preventing energization of relay 1WF so that this relay cannot permit an opposing move until relay 1EFS becomes deenergized. This will occur only after the train vacates the stretch and relay D again responds to feed-back code and energizes relay 1EF. If traffic had been established in the reverse direction, then relay 3WS would be released so that the feed-back circuit would be open at contacts 39 and 40 whereby locking relay 1EF would be released.

Summarizing the operations described so far, normally when the stretch is unoccupied, master code of normal polarity will be effective in the line circuit to operate locking relay 1WF and feed-back code will be effective to operate locking relay 1EF. When a signal is cleared to establish a given traffic direction, either the polarity of master code is reversed, or the feed-back circuit is rendered ineffective so that in either case, the locking relay for the opposing traffic direction is deenergized so as to lock out all traffic movement in that direction. It will be noted that as shown in Fig. 1*d*, the control circuits for relay 3WS include contacts 41 and 42 of signal lever repeater relays 2RLP and 6RLP which, in turn, are controlled over the front contact 43 of relay 1WF. Accordingly, these repeater relays can be energized only if master code of proper polarity is effective which corresponds with westbound traffic and which means that signals 8L and 12L are at stop.

Referring now to Fig. 2, the apparatus of this figure is similar to that of Fig. 1 with the exception that instead of polarizing the master code, the selection is obtained through the use of two code speeds as, for example, 75 and 180 interruptions per minute. The code transmitting relay CTM repeats the code which it receives and transmits this code as master code to the line circuit over its front contact 44. For eastbound traffic, with relay 7ES energized and relay 1EFS deenergized, the master code is 180 which corresponds to that condition in Fig. 1 in which master code of normal relative polarity was supplied to the line circuit. Relay CF at the other end of the line circuit will follow the 180 code, energizing the decoding transformer DT which causes energization of locking relay 1WF through the resonant rectifier unit 180DU in the usual manner. This unit is so tuned as to cause operation of relay 1WF on 180 code but not on 75 code. Impulse relay 1R will operate at 180 code and will transmit feed-back impulses of this code to the line circuit over its contact 45 for operating relay D at the other end. Operation of relay D will cause the locking relay 1EF to be energized.

If signal 8L is now cleared, relay 7ES will be released so that the master code will be changed from 180 to 75 at the back point of contact 46 of relay 7ES. Relay 1WF will now release to provide the lockout protection but relay 1R will operate at the 75 code rate so as to maintain the feed-back circuit effective for keeping relay 1EF energized. The deenergization of relay 7ES causes the energization of relay 1EFS so that relay CTM will continue to cause 75 master code to be applied to the line circuit after relay 7ES becomes picked up. This occurs when the train vacates the track section 7T and approach locking stick relay 8LAS becomes energized. Relay 1EF is reenergized on feed-back code when the train has vacated the stretch. Relay 1EFS is then deenergized so that 180 master code is reapplied to the line circuit thus restoring the apparatus to its normal condition.

Summarizing the operation of Fig. 2, the line circuit of this figure will normally respond to 180 code at all times except when a signal has been cleared for a westbound move or the directional stick relay for the westbound move is energized. In the latter case, the line circuit will be responding to 75 code. When 75 code is effective, the feed-back circuit will energize the locking relay 1EF provided that relays 3WS and 1WFS are both normal (one energized and the other deenergized) and the stretch of track between the two interlockings is unoccupied. Before an eastbound move can be permitted, 180 code must be received by relay CF at the left-hand end of the line circuit to energize the locking relay 1WF and thus permit signal 2R or 6R to be cleared for a move past the opposing signal 2L.

Referring now to Fig. 3, the apparatus of this figure combines certain features of the apparatus of Figs. 1 and 2 in order to provide two proceed indications for the signals. This is accomplished by not only polarizing the master code in the line circuit but also coding this line circuit at either 75 or 180 code depending upon the traffic conditions in advance of signal 8R. Thus, for traffic from left to right or eastbound, the master code will be of normal relative polarity to permit code following operation of relay CF and energization of locking relay 1WF. If signal 8R is displaying a proceed indication, then the line circuit will be coded at the 180 code rate so that relay 2RD will be energized and will permit the display of a clear proceed indication by signal 2R or 6R. If signal 8R is displaying an indication in which the top arm is at stop, relay 8RAH which is the home relay for signal 8R will be released and the line circuit will be coded at the 75 code rate so that relay 1WF will be energized and relay 2RD will be deenergized to permit the display of an approach proceed indication by signal 2R or 6R.

The feed back circuit in Fig. 3 is polarized over the contacts 47 and 48 of relay 2LAH which is the home relay for signal 2L, and this circuit controls relays D1 and CF1 in a manner similar to that in which relays A and CF at the other end are controlled. The code operation of relay CF1 will cause energization of relay 1EFH provided that relay 2LAH is deenergized so that relay D1 has its contacts closed in the reverse position, as shown. If, on the other hand, relay 2LAH is energized, the contacts of relay D1 will be closed in the normal position whereupon relay 1EFD will respond to the energization of the feed-back circuit. Relay 1EFH provides control of the approach indication of signals 8L and 12L when traffic is lined up in the westbound direction for a move past signal 8R. Similarly, relay 1EFD when energized provides control of the clear indication of signals 8L and 12L.

The control of the traffic relay EFS for the apparatus of Fig. 3 is shown in Fig. 3a and is self-explanatory. This control is similar to that shown in Fig. 1a except for the addition of contact 49 of relay EFD. The control of the traffic relay WFS at the other end is similar to that shown in Fig. 3a and will be clear without added explanation. Thus, in Fig. 3, by combining code and polarity features in the coded feed-back line circuit, selective control of both the approach and the clear indication of the entrance signal is made possible.

From the foregoing description, it will be apparent that I have provided effective and safe control of traffic moving in either direction over a stretch of track by means of a polarized coded feed-back line circuit which remains effective, whenever the stretch is unoccupied, for the reversal of the traffic direction and which prevents such reversal by the provision of traffic locking which is effective whenever the stretch is occupied, or an opposing signal displays a proceed indication.

Although I have herein shown and described only a few 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 with a stretch of track over which traffic may move in either direction, a line circuit extending from one to the other end of said stretch, an eastbound and a westbound headblock signal at the respective ends of said stretch, a normally deenergized eastbound and a westbound traffic direction control relay for the respective ends of said stretch, means effective when said eastbound traffic direction relay is deenergized for supplying impulses of a master code of normal polarity to said line circuit at one end thereof, a first signal control relay at said other end of the stretch energized in response to the receipt of master code of only said normal polarity at said other end for controlling the permissive indication of said eastbound headblock signal, means effective when said westbound traffic direction relay is deenergized and master code is being received at said other end for transmitting impulses of feed-back code from said other end to said one end of the line circuit, a second signal control relay at said one end energized in response to the receipt of said feed-back code at said one end for controlling the permissive indication of said westbound signal, means effective when said eastbound traffic direction relay is energized for reversing the polarity of said master code to cause release of said first signal control relay and prevent the display of said permissive indication by said eastbound signal, means effective when said westbound traffic direction relay is energized for discontinuing said feed-back code to thereby release said second signal control relay and prevent the display of said permissive indication by said westbound signal, and means for energizing said eastbound or said westbound traffic direction relay in accordance withthe traffic direction to be established.

2. In combination with a stretch of track over which traffic may move in either direction, a line circuit extending from one to the other end of said stretch, a normally deenergized eastbound and a westbound traffic direction control relay for the respective ends of said stretch, means effective when said eastbound traffic direction relay is deenergized for supplying impulses of a master code of normal polarity to said line circuit at one end thereof, a first control relay at said other end of the stretch energized in response to the receipt of master code of only said normal polarity at said other end for controlling the entry of eastbound traffic into said stretch, means effective when said westbound traffic direction relay is deenergized and master code is being received at said other end for transmitting impulses of feed-back code of given polarity from said other end to said one end of the line circuit, a second control relay at said one end energized in response to the receipt of feed-back code of only said given polarity for controlling the entry of westbound traffic into said stretch, means effective when said eastbound traffic direction relay is energized for reversing the polarity of said master code to cause a release of said first signal control relay and prevent eastbound traffic from entering said stretch, means effective when said westbound traffic direction relay is energized for discontinuing said feed-back code and releasing said second control relay to prevent westbound traffic from entering said stretch, and means effective for energizing said eastbound or said westbound traffic direction relay in accordance with the traffic direction to be established.

3. In combination with a stretch of track over which traffic may move in either direction, a line circuit extending from one to the other end of said stretch, a normally deenergized eastbound and a westbound traffic direction control relay for the respective ends of said stretch, means effective when said eastbound traffic direction relay is deenergized for supplying impulses of a master code of a first coding rate to said line circuit at one end thereof, a first control relay at said other end of the stretch energized when and only when master code of said first coding rate is received at said other end, said first relay controlling the entry of eastbound traffic into said stretch, means effective when said eastbound traffic direction relay is energized for supplying impulses of a master code of a second coding rate to said line circuit to cause a release of said first control relay and prevent eastbound traffic from entering said stretch, means effective when said westbound traffic direction relay is deenergized and master code of either said first or said second coding rate is being received at said other end for transmitting impulses of feed-back code from said other to said one end of the line circuit, a second control relay at said one end energized in response to the receipt of feed-back code of either said first or said second coding rate for controlling the entry of westbound traffic into said stretch, means effective when said westbound traffic direction relay is energized for discontinuing said feed-back code to release said second control relay and so prevent westbound traffic from entering said stretch, and means effective for energizing said eastbound or said westbound traffic direction relay in accordance with the traffic direction to be established.

4. In combination with a stretch of track over which traffic may move in either direction, a line circuit extending from one to the other end of said stretch, an eastbound entering signal and an eastbound leaving signal for said stretch, a westbound entering signal and a westbound leaving signal for said stretch, a normally deenergized eastbound and a westbound traffic direction

control relay for the respective ends of said stretch, means effective when said eastbound traffic direction relay is deenergized and said eastbound leaving signal is at stop for supplying impulses of a master code of normal relative polarity and a first coding rate to said line circuit at one end thereof, means effective when said eastbound traffic direction relay is deenergized and said eastbound leaving signal is at clear for supplying impulses of a master code of normal relative polarity and a second coding rate to said line circuit at said one end thereof, a first control relay at said other end of the stretch energized when and only when master code of said normal polarity is received at said other end, said first relay controlling the approach indication of said eastbound entering signal, a first auxiliary control relay at said other end of the stretch energized when and only when master code of said normal polarity and said second coding rate is received at said other end, said first auxiliary relay controlling the clear indication of said eastbound entering signal, means effective when said eastbound traffic direction relay is energized for reversing the polarity of said master code to thereby cause a release of said first control relay and of said first auxiliary relay and prevent eastbound traffic from entering said stretch, means effective when said westbound traffic direction relay is deenergized and said westbound leaving signal is at stop for transmitting impulses of a feed-back code of one polarity from said other end to said one end of the line circuit, a second control relay at said one end energized in response to the receipt of feed-back code of only said one polarity for controlling the approach indication of said westbound entering signal, means effective when said westbound traffic direction relay is deenergized and said westbound leaving signal is at approach or clear for transmitting impulses of a feed-back code of the other polarity from said other end to said one end of the line circuit, a second auxiliary control relay at said one end energized in response to the receipt of feed-back code of only said other polarity for controlling the clear indication of said westbound entering signal, and means effective when said westbound traffic direction relay is energized for discontinuing said feed-back code to cause a release of both said second control relay and said second auxiliary relay and so prevent westbound traffic from entering said stretch.

5. In combination with a stretch of track over which traffic may move in either direction, a line circuit extending from one to the other end of said stretch, an eastbound and a westbound traffic direction control relay for the respective ends of said stretch, means effective when said eastbound traffic direction relay is deenergized for supplying impulses of a master code of given character to said line circuit at one end thereof, a first control relay at said other end of the stretch energized in response to the receipt of master code of only said given character at said other end for controlling the entry of eastbound traffic into said stretch, means effective when said eastbound traffic direction relay is energized for altering said given character of the master code in such manner as to cause a release of said first control relay and so prevent eastbound traffic from entering said stretch, means effective when said westbound traffic direction relay is deenergized and master code is being received at said other end for transmitting impulses of feed-back code of given polarity from said other end to said one end of the line circuit, a second control relay at said one end energized in response to the receipt of feed-back code of only said given polarity for controlling the entry of westbound traffic into said stretch, and means effective when said westbound traffic direction relay is energized for discontinuing said feed-back code to cause a release of said second control relay and so prevent westbound traffic from entering said stretch.

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