Dec. 15, 1925. 1,566,150

R. A. McCANN

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 10, 1923 3 Sheets-Sheet 1

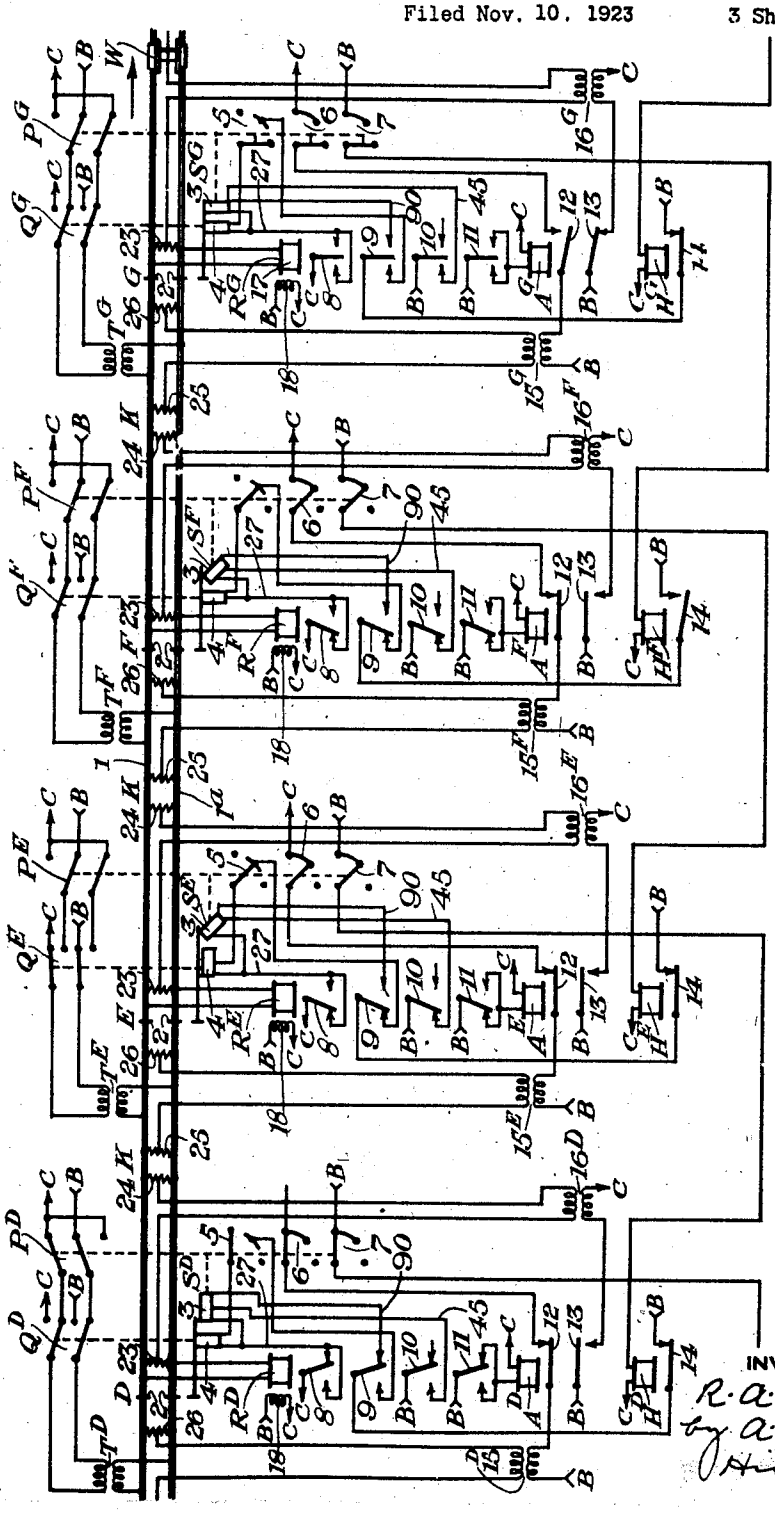

Fig. 1.

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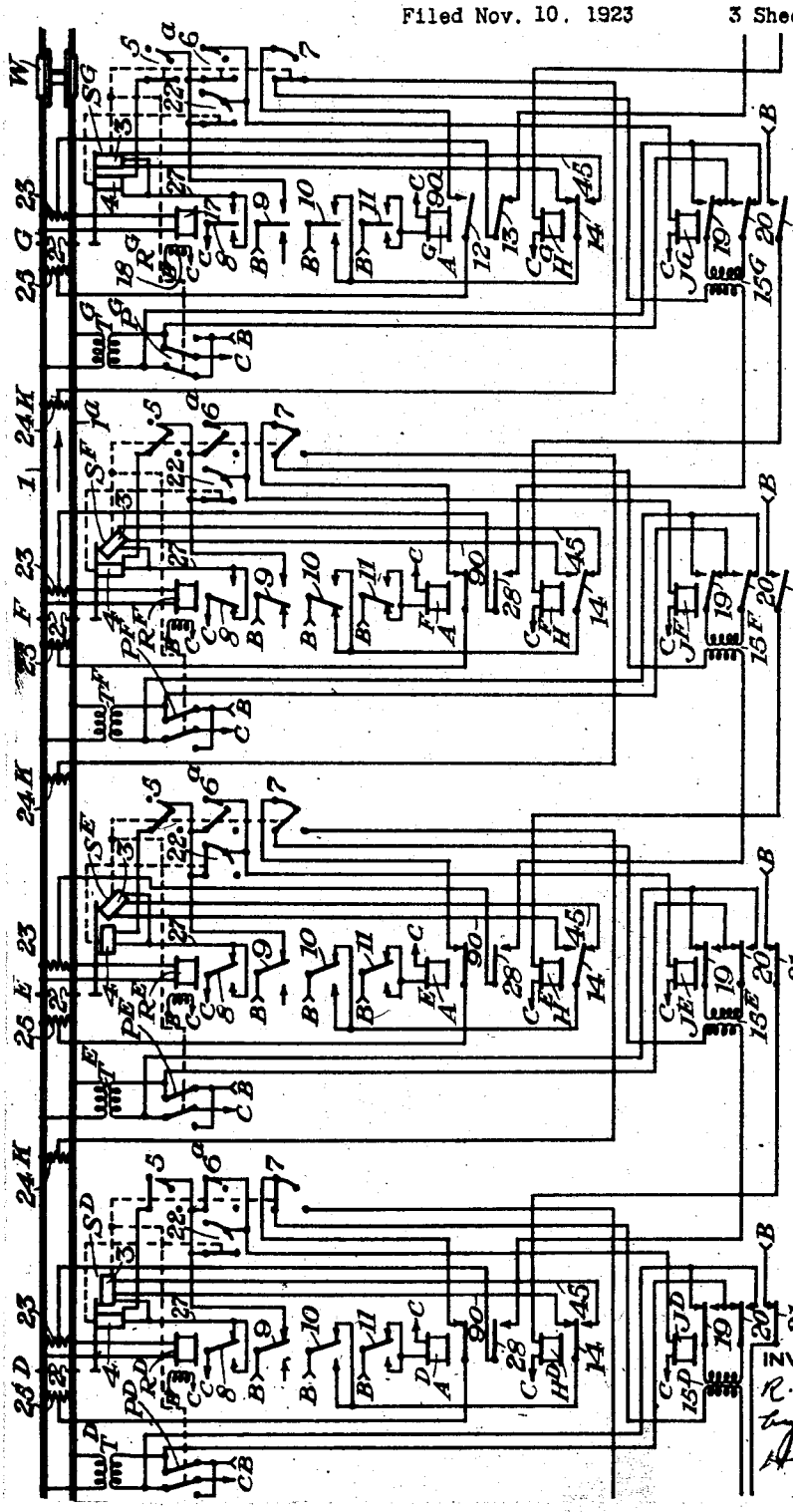

Fig. 2.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed Nov. 10, 1923 3 Sheets-Sheet 3

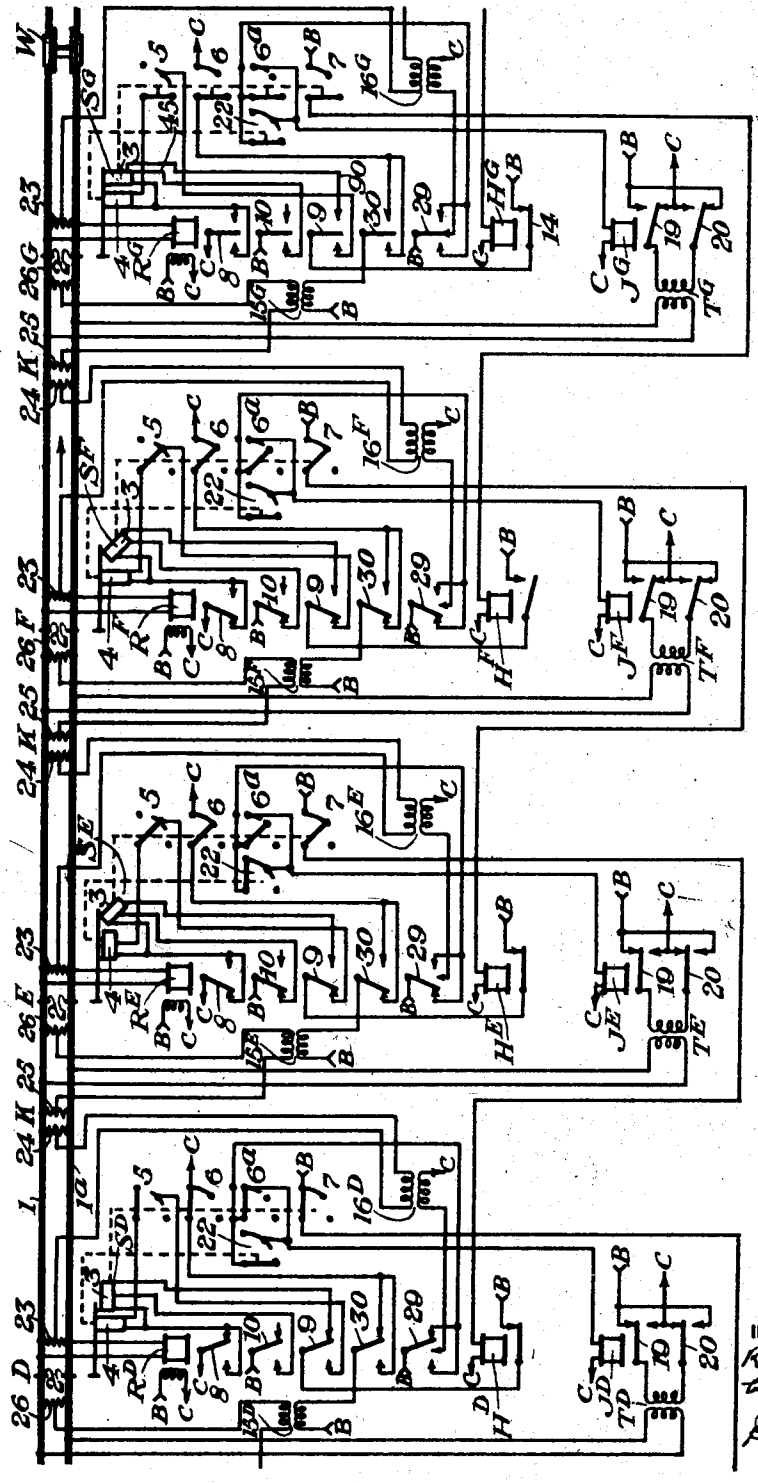

Fig. 3.

INVENTOR:
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Patented Dec. 15, 1925. 1,566,150

UNITED STATES PATENT OFFICE.

RONALD A. McCANN, OF SWISSVALE, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

RAILWAY-TRAFFIC-CONTROLLING APPARATUS.

Application filed November 10, 1923. Serial No. 674,057.

To all whom it may concern:

Be it known that I, RONALD A. McCANN, a citizen of the United States, residing at Swissvale, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Railway-Traffic-Controlling Apparatus, of which the following is a specification.

My invention relates to railway traffic controlling apparatus, and particularly to apparatus of the type wherein cars or trains are governed by energy supplied thereto from the trackway. More specifically, the present invention relates to the trackway portion of such apparatus.

I will describe three 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 apparatus embodying my invention, and Figs. 2 and 3 are views showing modifications of the apparatus shown in Fig. 1 and also embodying my invention.

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

Referring first to Fig. 1, the reference characters 1 and 1^a designate the track rails of a railway along which traffic normally moves in the direction indicated by the arrow. These rails are divided by insulated joints 2 into a plurality of sections, of which only three complete sections, D—E, E—F and F—G, are shown in the drawing.

Located adjacent the entrance end of each section is a roadside signal designated by the reference character S with an exponent corresponding to the location. Each of these signals in the form here shown comprises two semaphore arms 3 and 4, and the indications given by each signal are as follows: When both arms are in the horizontal or zero position, the signal indicates "stop"; when the lower arm 4 is horizontal and the upper arm 3 is in the inclined or 45° position, the signal indicates "proceed prepared to stop at next signal"; when the lower arm 4 is in the vertical or 90° position and the upper arm 3 is inclined, the signal indicates "proceed prepared to slow down at next signal"; and when the lower arm 4 is horizontal and the upper arm 3 is in the vertical or 90° position, the signal indicates "proceed".

Associated with each signal is a track relay designated by the reference character R with the same exponent as that applied to the signal, each track relay comprising a winding 17 connected across the rails of the associated section, and a second winding 18 connected with the two terminals B and C of a suitable source of alternating current which is not shown in the drawing. It will be seen, therefore, that each track relay is responsive to reversals of the relative polarity of the current supplied to its track winding 17.

Also associated with each signal is an auxiliary relay designated by the reference character H with the same exponent as that applied to the signal.

Associated with each track relay R is a track repeating relay A, the circuit for this relay being from terminal B, through contact 11 of the associated track relay R and the winding of relay A to terminal C. It follows that each relay A will be energized whenever the associated track relay is energized, and will be de-energized whenever the associated track relay is de-energized.

The lower arm 4 of each signal is provided with a single controlling circuit, whereas the upper arm 3 of each signal is provided with two circuits which may be termed the "45° circuit" and the "90° circuit," respectively. When the track relay is energized in what I will term "reverse direction," that is, when its contact fingers are swung to the left, and the associated relay H is de-energized, the 45° circuit for the upper arm 3 of the associated signal is closed (see signal S^F), this circuit being from terminal B, through the left-hand point of contact 10, wire 45, the operating mechanism for arm 3, wire 27, and contact 8 to terminal C. When the track relay is energized in the reverse direction and the associated relay H is energized (see signal S^E), the circuit for lower arm 4 is closed, which circuit passes from terminal B, through contact 14 of relay H, left-hand point of contact 9, circuit controller 5 operated by arm 3, operating mechanism of arm 4, wire 27, and contact 8 to terminal C. Circuit controller 5 is closed at such time because arm 3 is in

the 45° position. When relay R is energized in the normal direction, that is, when its contacts are swung to the right, and relay H is energized (see signal S^D), the 90° circuit for arm 3 is closed, which circuit passes from terminal B, through contact 14 of relay H, right-hand point of contact 9, wire 90, operating mechanism of arm 3, wire 27, and contact 8 to terminal C.

Track circuit current is supplied to the rails of each section by a transformer designated T with an exponent corresponding to the location. The secondary of this transformer is connected directly across the track rails, whereas the primary circuit is controlled by a circuit controller Q operated by the lower arm 4 of the adjacent signal and a pole-changer P operated by the upper arm 3 of the adjacent signal. When the signal indicates stop (see signal S^G), the primary circuit for the adjacent transformer T^G is from terminal B, through the upper arm of pole-changer P, upper arm of circuit controller Q, transformer primary, lower arm of circuit controller Q, and lower arm of pole-changer P to terminal C. The current which is thus supplied to the track rails is of what I will term "reverse relative polarity." When the signal indicates "proceed prepared to stop at next signal" there is no change in the positions of circuit controller Q, and pole-changer P (see signal S^F). When the signal indicates "proceed prepared to slow down at next signal" (see signal S^E), the circuit controller Q is reversed due to the movement of arm 4, whereupon the circuit for the primary of transformer T^E is from terminal B, through the lower arm of circuit controller Q, primary of transformer T^E, and upper arm of circuit controller Q to terminal C. The current which is thus supplied to the track rails is of what I will term "normal relative polarity." When the signal indicates "proceed" (see signal S^D), the circuit for the primary of track transformer T^D is the same as when the signal indicates "stop," except that pole-changer P has been reversed due to the movement of the upper arm 3, so that current of normal relative polarity is supplied to the track rails.

It will be seen from the foregoing that track circuit current of reverse relative polarity is supplied to the first and second sections in the rear of an occupied section, and that track circuit current of normal relative polarity is supplied to the rails of all other sections.

Each section is also provided with means for supplying thereto an additional train controlling current which may be termed a "loop" or a "local" current. Referring particularly to section F—G, this loop current is supplied to the rails from the entrance end of the section to an intermediate point K by a transformer 16^F, the secondary terminals of which are connected with two resistances 23 and 24, located respectively at the entrance end of the section and the point K. The primary of transformer 16^F is provided with a circuit which passes from terminal B through back contact 28 of relay A^F and the transformer primary to terminal C. This primary circuit is, therefore, normally de-energized but is energized whenever a train occupies section F—G. Loop current is supplied to the rails between points K and G by a transformer 15^G, the secondary of which is connected with two resistances 25 and 26, located at these two points respectively. The primary circuit for transformer 15^G is from terminal B, through the transformer primary, contact 12 of relay A^G, and circuit controller 6 operated by signal S^G to terminal C. It will be seen, therefore, that the primary circuit for transformer 15^G is opened when the signal indicates stop, but is closed at all other times.

It follows from the foregoing that loop current is supplied to the rails of a section in the rear of an occupied section from the entrance end to an intermediate point, and that loop current is supplied to all other sections from the entrance end of the section to the exit end. This loop current is always of what I will term "normal relative polarity".

Relay H^F is provided with a circuit which passes from terminal B, through circuit controller 7 of signal S^G and winding of relay H^F to terminal C. It follows that this relay will be de-energized when signal S^G indicates stop, and will be energized at all other times. Each of the remaining relays H is controlled in the same manner as relay H^F.

As shown in the drawing, the section immediately to the right of point G is occupied by a train W. Relay R^G is therefore de-energized so that relay A^G is de-energized, but relay H^G is energized. Signal S^G indicates "Stop" because all of its controlling circuits are open at the contacts of track relay R^G. No loop current is supplied to section F^G between points K and G, but loop current will be supplied to this section between points F and K in the event that a train enters the section. Track circuit current of reverse relative polarity is supplied to section F—G so that relay R^F is energized in reverse direction. Relay A^F is consequently energized, but relay H^F is de-energized, because signal S^G indicates stop.

The 45° circuit for arm 3 of signal S^F is closed, but the controlling circuit for arm 4 of this signal is open, so that the signal indicates "proceed prepared to stop at next signal." Loop current is supplied to section E—F between points K and G, and will also be supplied to this section between points E and K in the event that a train enters the section. Track circuit current of re-

verse relative polarity is supplied to section E—F by transformer T^F, so that track relay R^E is energized in reverse direction.

Relay H^E is energized, however, because arm 3 of signal S^F is in the 45° position, so that circuit controller 7 at signal S^F is closed. Signal S^E accordingly indicates "proceed prepared to slow down at next signal". The condition of section D—E in so far as loop current is concerned is the same as the condition of section E—F, but track circuit current of normal relative polarity is supplied to section D—E so that track relay R^D is energized in normal direction. Relay H^D is closed because arm 3 of signal S^E is in the 45° position, and so signal S^D indicates "proceed".

The apparatus shown in Fig. 1 is intended for co-operation with train-carried mechanism adapted to receive energy inductively from the track rails, which mechanism operates in the following manner: When the train receives track circuit current of normal relative polarity and loop current of normal relative polarity, a proceed indication is given aboard the train. When the train receives track circuit current of reverse relative polarity and loop current of normal relative polarity, or track circuit current of normal relative polarity and loop current of reverse relative polarity, a caution indication is given aboard the train. When the supply of either track circuit current or loop current is discontinued, a stop indication is given aboard the train.

When the parts of the apparatus are in the positions shown in the drawing, that is, when the section immediately to the right of point G is occupied by a train W, a following train will receive a proceed indication through section D—E, because both the track circuit current and the loop current supplied to this section are of normal relative polarity. When such following train enters section E—F, however, it will receive a caution indication, because the loop current supplied to this section is of normal relative polarity, whereas the track circuit current is of reverse relative polarity. This caution indication will continue until the trains reaches point K in section F—G, where a stop indication will be given aboard the train because the supply of loop current is discontinued between points K and G. After passing point G the stop indication will continue because the track circuit current supplied to the section to the right of point G is shunted by the train W.

Referring now to Fig. 2, the apparatus shown in this view is similar to that shown in Fig. 1 in that each signal S is controlled by its associated track relay R and line relay H, but the controlling circuits are somewhat different in detail. In Fig. 2 the 45° circuit for arm 3 is from terminal B, through contact 10 of track relay R, back point of contact 14 of relay H, wire 45, operating mechanism of arm 3, wire 27, and contact 8 to terminal C. This circuit is closed whenever track relay R is energized in either direction and line relay H is de-energized. The 90° circuit for arm 3 is from terminal B, through contact 10, front point of contact 14, wire 90, operating mechanism of arm 3, wire 27, and contact 8 to terminal C. This circuit is, of course, closed when relay R is energized in either direction and line relay H is energized. The operating circuit for arm 4 is from terminal B, through right-hand point of contact 9 of relay R, circuit controller 5, operating mechanism of arm 4, wire 27, and contact 8 to terminal C. This circuit is closed only when relay R is energized in normal direction and arm 3 is in the 45° position.

The line relay H associated with each signal is controlled by a pole-changing relay J for the signal next in advance, and, consequently, the control of relay J will first be explained. Referring to location E, relay J^E is provided with a circuit which passes from terminal B, through right-hand point of contact 9 of relay R^E, circuit controllers 6^a and 22 in multiple, and winding of relay J^E to terminal C. Circuit controller 6^a is closed when arm 3 is in the 90° position but not in the horizontal or the 45° position, and circuit controller 22 is closed when arm 4 is in the 90° position but not in the horizontal position. It follows that relay J^E will be energized when signal S^E indicates "proceed" or "proceed prepared to slow down at next signal."

Line relay H^D is controlled by contact 21 of relay J^E in such manner that the line relay is energized or deenergized according as relay J^D is energized or de-energized, the circuit being obvious from the drawing.

Each track transformer T is supplied with track circuit current through a pole-changer P operated by the upper arm 3 of the adjacent signal S. The operation of this pole-changer is such that track circuit current of normal relative polarity is supplied to the rails when arm 3 is in the 45° or 90° position, but that track circuit current of reverse relative polarity is supplied to the rails when arm 3 is in the horizontal position.

As shown in the drawing, a train W occupies the track section immediately to the right of point G, so that signal S^G indicates stop. Track circuit current of reverse relative polarity is therefore supplied to section F—G, so that track relay R^F is energized in the reverse direction. Pole-changing relay J^G is de-energized because its circuit is open at both circuit controllers 6 and 22, and so the line relay H^F is de-energized.

The only circuit which is closed for signal S^F is the 45° circuit for arm 3 and so this signal indicates "proceed prepared to stop at next signal." Arm 3 of signal S^F being in the 45° position, the track circuit current supplied to section E—F is of normal relative polarity, so that track relay R^E is energized in normal direction. Line relay H^E is de-energized, however, because pole-changing relay J^F is de-energized, and so signal S^E indicates "proceed prepared to slow down at next signal." Arm 3 of signal S^E being in the 45° position, the track circuit current supplied to section D—E is of normal relative polarity, so that relay R^D is energized in the normal direction. The pole-changing relay J^E is energized because arm 4 of signal S^E is in the vertical position, and so the line relay H^D is energized. Signal S^D therefore indicates "proceed."

Loop current is supplied to each section by a transformer 15. Referring particularly to section F—G, the circuit for the secondary of transformer 15^G is from the lower terminal of this secondary through back contact 28 of relay A^F, resistance 23, track rails 1 and 1^a, resistance 24 and circuit controller 7 to the upper terminal of the secondary of transformer 15^G. That is to say, signal S^G being in the stop position loop current is supplied to section F—G between points F and K only. When signal S^G gives any other indication, the loop circuit will be as follows: from the lower terminal of the secondary of transformer 15^G, through back contact 28 of relay A^F, resistance 23 at the entrance end of the section, resistance 25 at the exit end, contact 12 of relay A^G, and circuit controller 7 to the upper terminal of the transformer secondary.

The primary of transformer 15^G is supplied with current through pole-changer P^G and also through pole-changing contacts 19 and 20 on relay J^G. The primary circuit for this transformer therefore includes two pole-changers in series, and these pole-changers operate to control the relative polarity of the loop current in the following manner: Signal S^G being at stop, pole-changer P^G is reversed and relay J^G is de-energized, so that the pole-changing contacts 19 and 20 are also reversed. These two reversals result in loop current of normal relative polarity being supplied to the rails of section F—G between points F and K. In section E—F pole-changer P^F is normal and the pole-changing contacts of relay J^F are reversed, so that loop current of reverse relative polarity is supplied to section E—F throughout the entire length of the section. In section D—E pole-changer P^E is normal, and relay J^E is energized, so that loop current of normal relative polarity is supplied to the rails throughout the length of the section.

I will now assume that the section immediately to the right of point G is occupied by a train W, as shown in the drawing, and that a following train equipped with the mechanism hereinbefore described passes through the stretch of track shown in the drawing. In section D—E the following train will receive a proceed indication, because this section is supplied with track circuit current and loop current which are both of normal relative polarity. In section E—F the track circuit current is still of normal relative polarity, but the loop current is of reverse relative polarity, so that a caution indication will be given aboard the train. In section F—G the track circuit current is of reverse relative polarity, but the loop current is of normal relative polarity, so that a caution indication will be given aboard the train from point F to point K. Upon passing point K the train will receive a stop indication because of the absence of loop current.

It will be seen from the foregoing that with the apparatus of Fig. 2 the first section in the rear of an occupied section receives track circuit current of reverse relative polarity and loop current of normal relative polarity; the second section in the rear of an occupied section receives track circuit current of normal relative polarity and loop current of reverse relative polarity, and all other track sections receive track circuit and loop current both of normal relative polarity.

Referring now to Fig. 3, the control of the signals S by the track relays R and the line relays H, is the same as in Fig. 1. The control of the loop current is also the same as in Fig. 1, except that the repeater relays A are omitted and so the primary circuits for transformers 15 and 16 are governed by contacts 30 and 29, respectively, of the track relays R.

Track circuit current is supplied to each section by a transformer T, the secondary of which is connected across the track rails and the primary of which is controlled by pole-changing contacts 19 and 20 of pole-changing relay J. Referring particularly to relay J^G, the circuit for this relay is from terminal B, through contact 29 of relay R^G, circuit controllers 6^a and 22 in multiple, and winding of relay J^G to terminal C. Circuit controller 6^a is closed when arm 3 of signal S^G is in the 90° position but not when this arm is in the 45° or the horizontal position; circuit controller 22 is closed when arm 4 of signal S^G is in the vertical position but not when this arm is in the horizontal position. It follows that relay J^G will be energized only when signal S^G indicates "proceed" or "proceed prepared to slow down at next signal".

With the section immediately to the right

of point G occupied by a train W, as shown in the drawing, track circuit current of reverse relative polarity is supplied to section F—G and also to section E—F, but track circuit current of normal relative polarity is supplied to section D—E. In other words, the first and second sections in the rear of an occupied section are supplied with track circuit current of reverse relative polarity, while all other sections are supplied with track circuit current of normal relative polarity. Inasmuch as the loop current is always of normal relative polarity, the control of the train-carried mechanism will be the same as in Fig. 1. That is, with the train W in the position shown in the drawing, a following train will receive a proceed indication in section D—E; a caution indication in section E—F; a caution indication between points F and K in section F—G; and a stop indication from point K in section F—G up to the train W.

Although I have herein shown and described only three forms of 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 plurality of successive sections of railway track, means for supplying alternating track circuit current of one relative polarity to the rails of the first and second sections in the rear of an occupied section and for supplying track circuit current of the other relative polarity to the rails of all other sections, and means for supplying an additional train controlling current to each section.

2. In combination, a plurality of successive sections of railway track, means for supplying alternating track circuit current of one relative polarity to the rails of the first and second sections in the rear of an occupied section and for supplying track circuit current of the other relative polarity to the rails of all other sections, and means for supplying loop train controlling current of fixed relative polarity from the entrance end to an intermediate point in the first section in the rear of an occupied section and from the entrance end to the exit end of all other sections.

3. In combination, a plurality of successive sections of railway track, means for supplying alternating track circuit current of one relative polarity to the rails of the first and second sections in the rear of an occupied section and for supplying track circuit current of the other relative polarity to the rails of all other sections, and traffic governing means controlled by said current.

4. In combination, a plurality of successive sections of railway track, means for supplying alternating track circuit current of one relative polarity to the rails of the first and second sections in the rear of an occupied section and for supplying track circuit current of the other relative polarity to the rails of all other sections, and signals controlled by said current.

5. In combination, a plurality of successive sections of railway track, a signal for each section arranged to indicate "proceed" or "proceed prepared to stop at next signal" or "proceed prepared to slow down at next signal" or "stop", means controlled by each signal for supplying track circuit current of one relative polarity to the section next in the rear when the signal indicates "stop" or "proceed prepared to stop at next signal", and for supplying track circuit current of the opposite relative polarity to the section next in the rear when the signal indicates "proceed" or "proceed prepared to slow down at next signal", and track relays for said sections for controlling said signals.

6. In combination, a plurality of successive sections of railway track, a signal for each section arranged to indicate "proceed" or "proceed prepared to stop at next signal" or "proceed prepared to slow down at next signal" or "stop", means controlled by each signal for supplying track circuit current of one relative polarity to the section next in the rear when the signal indicates "stop" or "proceed prepared to stop at next signal", and for supplying track circuit current of the opposite relative polarity to the section next in the rear when the signal indicates "proceed" or "proceed prepared to slow down at next signal", and means for supplying an additional train controlling current to each section.

7. In combination, a plurality of successive sections of railway track, a signal for each section arranged to indicate "proceed" or "proceed prepared to stop at next signal" or "proceed prepared to slow down at next signal" or "stop", means controlled by each signal for supplying track circuit current of one relative polarity to the section next in the rear when the signal indicates "stop" or "proceed prepared to stop at next signal", and for supplying track circuit current of the opposite relative polarity to the section next in the rear when the signal indicates "proceed" or "proceed prepared to slow down at next signal", track relays for said sections for controlling said signals, and means controlled by said relays and signals for supplying loop train controlling current of fixed relative polarity from the entrance end to an intermediate point in the first section in the rear of an occupied section and from the entrance end to the exit end of all other sections.

8. In combination, a plurality of succes-

sive sections of railway track, a signal for each section arranged to indicate "proceed" or "proceed prepared to stop at next signal" or "proceed prepared to slow down at next signal" or "stop", a pole-changing relay controlled by each signal and arranged to be energized when the signal indicates "proceed" or "proceed prepared to slow down at next signal" but to be de-energized at all other times, and means controlled by each pole-changing relay for supplying to the section next in the rear-track circuit current of normal or reverse relative polarity according as the relay is energized or de-energized.

In testimony whereof I affix my signature.

RONALD A. McCANN.