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RAILWAY SIGNALING APPARATUS

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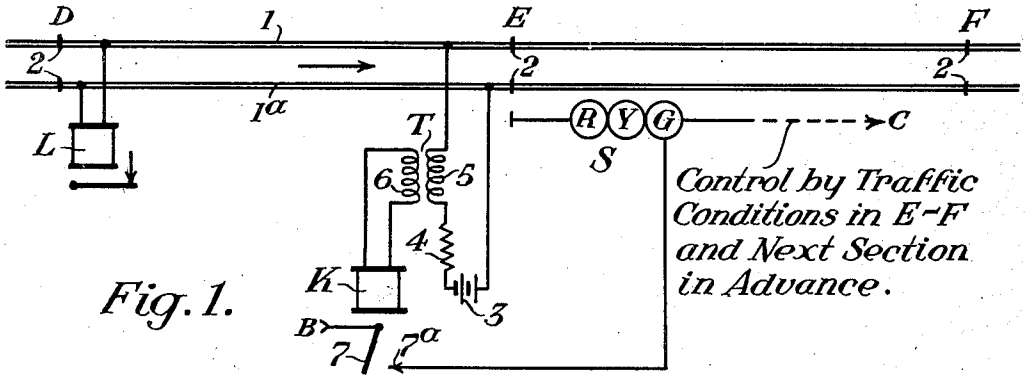

Fig. 1.

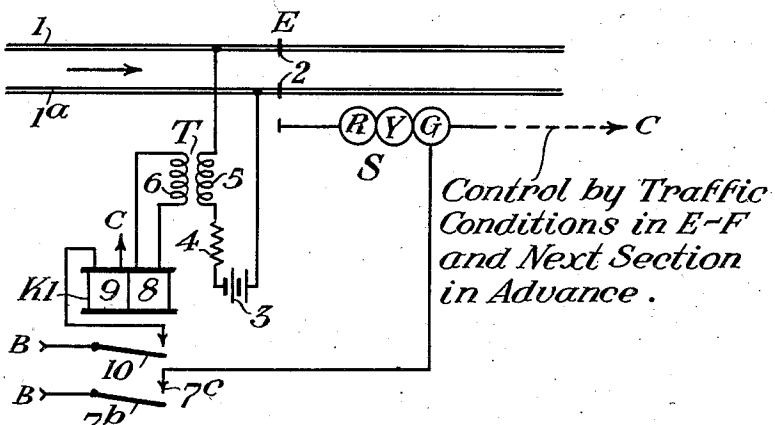

Fig. 2.

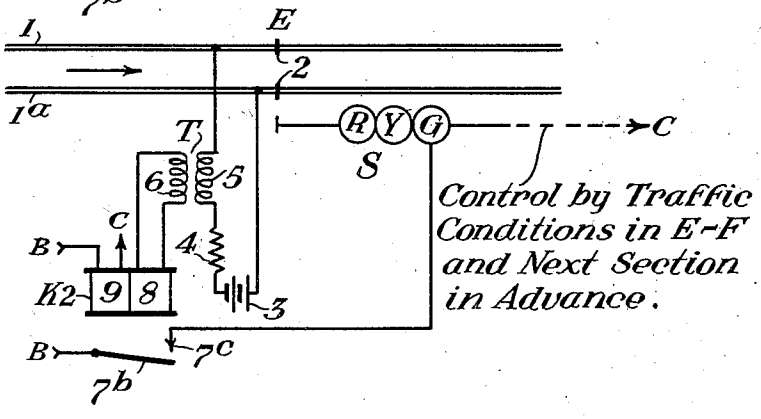

Fig. 3.

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RAILWAY SIGNALING APPARATUS

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10 Claims. (Cl. 246—41)

My invention relates to railway signaling apparatus, and particularly to apparatus of the type involving track circuits. One feature of my invention is the provision of novel and improved means whereby a signaling device may be controlled in part by traffic conditions in the rear of the portion of track with which such device is associated.

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

In the accompanying drawing, Fig. 1 is a diagrammatic view showing one form of signaling apparatus embodying my invention. Figs. 2 and 3 are views showing modifications of a portion 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 1a designate the track rails of a stretch of railway track along which traffic normally moves in the direction indicated by the arrow. These rails are divided by insulated joints 2 to form a plurality of successive sections, of which only two sections, D—E and E—F, are shown in the drawing.

Section D—E is provided with a track circuit comprising a source of current connected across the rails at the exit end of the section and a track relay L connected across the rails at the entrance end of the section. As here shown, the source of current is a battery 3. Interposed between this battery and one of the track rails 1, is the usual current-limiting resistance 4, and the primary 5 of a transformer T. The secondary 6 of this transformer is connected with the operating winding of a relay K. The relay K is what is known as a "last position polar relay", that is, this relay is so constructed that when it has been energized by current of one polarity and then becomes deenergized, its polar armature remains in the position corresponding to the polarity of the current with which the relay was last energized.

The polar armature 7 of the relay K may be used for any desired purpose. As here shown, it is employed for what is known as "approach lighting". That is to say, section E—F is provided with a signal S involving three lamps G, Y and R, which when lighted indicate proceed, caution and stop, respectively. The proceed lamp G may be controlled in the usual manner by traffic conditions in section E—F and in the section next in advance, and this lamp is also controlled by the polar armature 7 of relay K, so that the lamp may be lighted when and only when contact 7—7a is closed. The circuit for lamp G, as shown in the drawing, is from terminal B of a suitable source of current, through contact 7—7a of relay K, lamp G, and the usual means for controlling the lamp in advance of point E, to terminal C of the same source of current.

Contact 7—7a of relay K is normally open, so that lamp G of signal S is normally extinguished. When a train enters section D—E, the shunting action of the forward wheels and axles will cause a sudden increase in the current drawn from the battery 3, and this increase transmitted through the transformer T will result in an impulse of current in the winding of relay K, which impulse is of such polarity as to reverse the position of the polar armature of this relay, thereby closing contact 7—7a. This will cause the lighting of the lamp G of signal S, provided that traffic conditions in advance of point E are such that this lamp should be lighted. The gradual increase in the amount of current drawn from battery 3 as the train proceeds through section D—E will have no effect on relay K. When the rear end of the train leaves this section, however, there will be a sudden decrease in the amount of current drawn from battery 3 and this decrease will produce an impulse of energy in relay K of the polarity opposite to that which was produced by the entrance of the train into section D—E. This impulse of negative polarity will restore the armature of relay K to its normal position, thereby opening contact 7—7a, and this contact will then remain open until another train enters section D—E.

In order to make the disclosure as simple as possible, I have shown only one lamp of signal S controlled by relay K, but it will be understood that in actual practice lamp Y, or both lamps Y and R, may, if desired, be controlled by this relay in the same way that lamp G is controlled.

Referring now to Fig. 2, the approach lighting relay, which is here designated K1, comprises two windings 8 and 9. Winding 8 is connected with the secondary 6 of transformer T, whereas winding 9 is provided with a stick circuit including its own front contact 10. Relay K1 is a neutral relay having a neutral armature controlled jointly by the two windings 8 and 9. The armature of this relay is normally open, but when a train enters section D—E, the impulse which is delivered to winding 8 is sufficient to close the armature, thereby closing the stick circuit for

winding 9, and the current which is then supplied to winding 9 is sufficient to keep the armature closed. Contact 7^b—7^c will then be closed to complete at that point the circuit for lamp G of signal S. When the train leaves section D—E, the impulse of opposite polarity which is then supplied to winding 8 is in such direction as to oppose and neutralize the effect of the current in winding 9, thereby permitting the armature of relay K^1 to release and so opening at contact 7^b—7^c the circuit for signal lamp G.

Referring now to Fig. 3, the approach lighting relay, which is here designated K^2, comprises, as in Fig. 2, two windings 8 and 9, the former of which is connected with the secondary 6 of transformer T. Winding 9, however, is constantly energized by a circuit which passes from terminal B to terminal C of a source of current. The parts are so adjusted that winding 9 alone is not sufficient to close the armature of relay K^2, but is sufficient to hold the armature closed when it has once become closed. When a train enters section D—E, the impulse of current which is delivered to winding 8 is of such polarity as to assist winding 9 in its tractive effort on the armature of the relay, and the co-operative action of the two windings is sufficient to close the armature. This will close the circuit for lamp G at contact 7^b—7^c, and the armature will thereafter remain closed due to the influence of winding 9 as long as the train occupies section D—E. When the train leaves this section, the reverse impulse which is supplied to winding 8 will oppose and neutralize the effect of the current in winding 9, so that the armature of relay K^2 will be released, thereby opening at contact 7^b—7^c the circuit for lamp G.

It will be seen from the foregoing that in all three forms of my invention the operation of the approach lighting relay is accomplished by a change in the value of the track circuit current, and that this operation is independent of the steady value of current drawn from the battery 3 at any given time. That is to say, the approach lighting relay is not affected by steady current or by a gradual change in the current drawn by the track circuit. This relay is a pulse-operated device and it is obvious that regardless of track circuit conditions, if the track circuit is an operable one, there will be a very definite change in current upon the entrance of a train into the track section, and another very definite change in current upon the exit of a train from the track section, which changes are of sufficient abruptness and value to operate the approach lighting relay in the manner described.

Apparatus embodying my invention is independent of current surge, because a surge will produce a complete wave of alternating current in the winding of the approach lighting relay, and if the relay is operated by the first half of such wave, it will immediately be restored to its previous position by the second half of the wave.

Although I have herein shown and described only a few 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 section of railway track, a track circuit for said section including a source of direct current connected across the rails of said section, a transformer having its primary included in the connection between said source and one of the rails, a relay having two windings one of which is adapted to receive energy from the secondary of said transformer, a circuit for the other winding of said relay including a second source of current and a front contact of the relay, said parts being so designed and proportioned that when a train enters said section the impulse of current which is supplied to the first winding of said relay will energize the relay to close its armature, that the current which is thereupon supplied to the second winding will keep the armature closed, and that the reverse impulse of current which is supplied to said first winding when a train leaves said section will neutralize the effect of the current in the second winding and so will cause the relay to release its armature.

2. In combination, a section of railway track, a track circuit for said section including a source of direct current connected across the rails of said section, a transformer having its primary included in the connection between said source and one of the rails, a relay having two windings one of which is adapted to receive current from the secondary of said transformer, a constantly closed circuit for the second winding of said relay including a source of current, said parts being so designed and proportioned that the current supplied to the second winding is not sufficient to close the armature of the relay but is sufficient to hold the armature closed after it has been closed, that the impulse of current which is supplied to the first winding when a train enters said section coacts with the current in the second winding to close the armature, and that the reverse impulse of current which is supplied to said first winding when a train leaves said section will oppose the current in the second winding and so cause said armature to release.

3. In combination, two successive sections of railway track, a track circuit for the rear section including a source of current connected across the rails thereof, means interposed between said source and one of the rails and selectively responsive to the increase and decrease of the current drawn from said source when a train enters and leaves said rear section respectively but not to a steady value of such current or to a gradual change in its value, a signal for the forward section including an electric lamp, and means for lighting said lamp if and only if said first means has responded to an increase of the current drawn from its associated source.

4. In combination, two successive sections of railway track, a track circuit for the rear section including a source of current connected across the rails thereof, means interposed between said source and one of the rails and selectively responsive to a sudden increase or decrease in the current drawn from said source but not to a steady value of such current or to a gradual change in its value, a signal for the forward section including an electric lamp, and means for lighting said lamp if and only if said first means has responded to an increase of the current drawn from its associated source.

5. In combination, two successive sections of railway track, a track circuit for the rear section including a source of direct current connected across the rails thereof, a transformer having its primary included in the connection between said source and one of the rails, a last position polar relay adapted to receive energy from the secondary of said transformer, a signal for the forward section including an electric lamp, and means

for lighting said lamp if and only if said polar relay has responded to the entrance of a train into said rear section.

6. In combination, two successive sections of railway track, a track circuit for the rear section including a source of current connected across the rails thereof, a transformer having its primary included in the connection between said source and one of the rails, a relay having two windings one of which is adapted to receive energy from the secondary of said transformer, a circuit for the other winding of said relay including a second source of current and a neutral front contact of the relay, said parts being so designed and proportioned that when a train enters the rear section the impulse of current which is supplied to the first winding of said relay will energize the relay to close its neutral armature, that the current which is thereupon supplied to the second winding will keep the neutral armature closed, and that the reverse impulse of current which is supplied to said first winding when a train leaves the first section will neutralize the effect of the current in the second winding and so will cause said relay to release its armature, a signal for the forward section including an electric lamp, and means for lighting said lamp if and only if the neutral armature of said relay is closed.

7. In combination, two successive sections of railway track, a track circuit for the rear section including a source of current connected across the rails thereof, a transformer having its primary included in the connection between said source and one of the rails, a relay having two windings one of which is adapted to receive current from the secondary of said transformer and the other of which is constantly energized, said parts being so designed and proportioned that the current supplied to the second winding is not sufficient to close the neutral armature of the relay but is sufficient to hold such armature closed after it has become closed, that the impulse of current which is supplied to the first winding when a train enters the first section coacts with the current in the second winding to close the neutral armature, and that the reverse impulse of current which is supplied to said first winding when a train leaves the first section will oppose the current in the second winding and so cause the neutral armature to release, a signal for the forward section including an electric lamp, and means for lighting said lamp if and only if the neutral armature of said relay is closed.

8. In combination, a section of railway track, a track circuit for said section including a source of current connected across the rails of said section, a transformer having its primary included in the connection between said source and one of the rails, an impulse relay having a winding which is adapted to receive energy from the secondary of said transformer, and means associated with said relay for maintaining said relay energized provided said winding has first received an impulse of energy resulting from the entry of a train into said section, said means being ineffective to prevent release of said relay when said winding receives a reverse impulse of energy resulting from the exit of the train from said section.

9. In combination, a section of railway track, a track circuit for said section including a source of current connected across the rails of said section, a transformer adapted to receive energy from the connection between said source and one of the rails, an impulse relay having a winding energized inductively from said transformer, and means associated with said relay for maintaining the relay in its operated condition provided said winding has first received an impulse of energy resulting from the entry of a train into said section, said means being ineffective to prevent release of said relay when said winding receives a reverse impulse of energy resulting from the exit of the train from said section.

10. In combination, two successive sections of railway track, a track circuit for the rear section including a source of current connected across the rails thereof, a transformer adapted to receive energy from the connection between said source and one of the rails, an impulse relay having a winding energized inductively from said transformer, means associated with said relay for maintaining the relay in its operated condition provided said winding has first received an impulse of energy resulting from the entry of a train into the rear section, said means being ineffective to prevent release of said relay when said winding receives a reverse impulse of energy resulting from the exit of the train from the rear section, a signal for the forward section including an electric lamp, and means for lighting said lamp if and only if said impulse relay is in its operated condition.

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