Nov. 26, 1935. A. L. VENCILL 2,021,951

RAILWAY SIGNALING APPARATUS

Filed Dec. 19, 1933

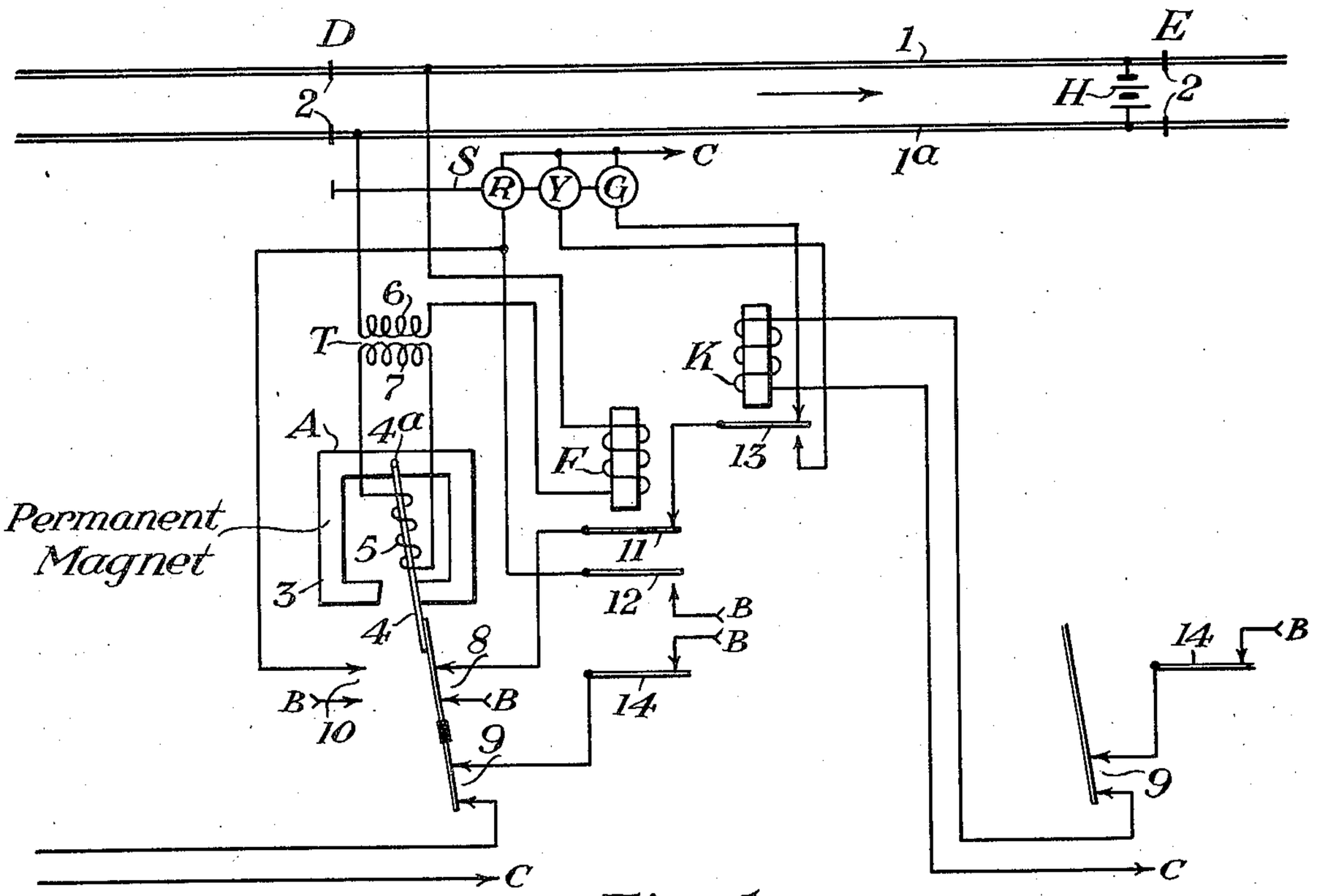

Fig. 1.

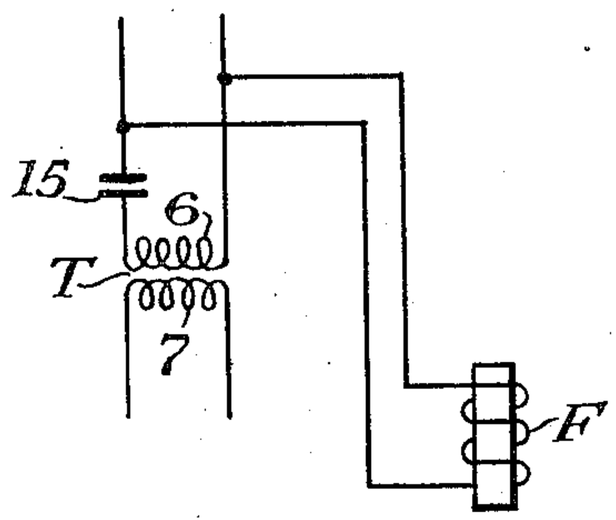

Fig. 2.

INVENTOR

Albert R. Vencill

Patented Nov. 26, 1935 2,021,951

UNITED STATES PATENT OFFICE

2,021,951

RAILWAY SIGNALING APPARATUS

Albert L. Vencill, Pittsburgh, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Application December 19, 1933, Serial No. 703,075

9 Claims. (Cl. 246—41)

My invention relates to railway signaling apparatus of the type involving track circuits, and has for an object the provision, in apparatus of this type, of a track circuit including a relay which will respond in one way to the decrease in current supplied to it when a train enters the associated section and in another way to the increase in current supplied to it when the train leaves the section, but which will not be affected by steady value of the track circuit current or to gradual changes in the current supplied to the relay due for example to changes in ballast 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 drawing, Fig. 1 is a diagrammatic view showing one form of apparatus embodying my invention. Fig. 2 is a view showing a modification 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 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 track sections, of which only one complete section, D—E, is shown in the drawing. Traffic moving through section D—E from left to right is governed by a signal S, which, as here shown, is a light signal comprising a proceed lamp G, a caution lamp Y, and a stop lamp R.

Section D—E is provided with a track circuit comprising a battery H connected across the rails at the exit end of the section, as well as the primary 6 of a transformer T and the winding of a relay F connected in series across the rails at the entering end of the section. The secondary 7 of the transformer T is connected with the operating winding of a relay A.

Relay A is a polarized relay comprising a U-shaped core 3, which is either a permanent magnet or is permanently magnetized by means exterior to the core. Pivotally mounted at 4a in the back strap of the core 3 is an armature 4, which is arranged to oscillate between the two pole faces of the core, and which carries a winding 5 which receives energy from the secondary 7 of the transformer T. The armature 4 cooperates with pairs of contacts 8, 9 and 10 in such manner that contacts 8 and 9 are closed when the armature 4 is swung to the right, which I will term its "normal" position, and contact 10 is closed when this armature is swung to the left or "reverse" position.

The relay F may be a neutral relay.

Associated with the relays A and F is a third relay K, which is a distant relay controlled by the following circuit: From terminal B of a suitable source of current at location E, through front contact 14 of relay F at location E, normal contact 9 of relay A at location E, and winding of relay K, to terminal C of the same source of current.

The proceed lamp G is provided with a circuit which passes from terminal B, through normal contact 8 of relay A, front contact 11 of relay F, front point of contact 13 of relay K, and lamp G to terminal C of the same source of current. The caution lamp Y is provided with a circuit which passes from terminal B, through normal contact 8 of relay A, front contact 11 of relay F, back point of contact 13 of relay K, and lamp Y to terminal C. The stop lamp R is provided with two circuits. One of them is from terminal B, through the reverse contact 10 of relay A, and lamp R to terminal C. The other is from terminal B, through back contact 12 of relay F and lamp R to terminal C.

The operation of the system is as follows: When section D—E is unoccupied, armature 4 of relay A is in the normal position, as shown in the drawing, and relay F is energized by current from battery H. If the section next in advance is also unoccupied, relay K is energized. Lamp G will then be lighted, so that signal S will indicate proceed. If, however, the section in advance of point E is occupied by a train, relay K will be deenergized, so that lamp Y will be lighted and signal S will indicate caution.

I will now assume that a train enters section D—E. When this occurs, the shunt afforded by the wheels and axles of such train will suddenly reduce the amount of current flowing in primary 6 of transformer T, and this sudden change in the primary current will induce an impulse of current in secondary 7 of such polarity as to reverse the position of armature 4. This armature will then remain in its reverse position, because relay A is characterized by the fact that when it becomes deenergized, the armature remains in the position corresponding to the polarity of the current with which the relay was last energized. In other words, relay A is what is known as a "last position" relay. If the shunt afforded by the wheels and axles of the

train is sufficiently effective, the current supplied to relay F will be reduced to less than the release value of this relay, and this relay will accordingly operate to open its front contacts and close its back contacts but if the current supplied to primary winding 6 and the winding of relay F is not reduced to the release point of relay F, the latter relay will remain energized. In either event the circuits for the proceed lamp G and caution lamp Y will be opened at contact 8 of relay A, and if relay F releases they will also be opened at contact 11 of this relay; the first circuit for stop lamp R will be closed at contact 10 of relay A and if relay F releases the second circuit for lamp R will be closed at back contact 12 of this relay. Signal S will then indicate stop.

When the train leaves section D—E, there will be a sudden increase in the amount of current supplied to primary 6 of transformer T and this sudden change in the primary current will cause an impulse to be induced in secondary 7 of such polarity as to return the armature 4 to its normal or right-hand position. This armature will thereafter remain in its normal position until the relay again becomes energized by an impulse of reverse polarity. If relay F was deenergized while the train was in the section, this relay will again become energized. Relay K will have become deenergized due to the train entering the section in advance of section D—E, and so signal S will indicate caution until the train passes out of such section in advance, when it will again indicate proceed.

The operation of relay A is independent of the energy level at the left-hand end of the section D—E, and is dependent only on the change in the amount of current supplied to transformer T when a train enters or leaves the section. It follows that changes in the characteristics of the track circuit due to variations in weather or other conditions will not affect the operation of this relay. During dry weather conditions when very good shunting action is necessary to cause relay F to release in response to a train entering the section, relay A will be reversed by a relatively poor shunt because of the relatively large change in the amount of current supplied to this relay as the train enters the section; whereas during wet weather conditions when relay A may not be so sensitive, relay F will be released by a relatively poor shunt. The combination of the two relays A and F provides, therefore, for reliable shunting under all possible conditions of the track.

If desired, relay F may be connected in multiple with the primary 6 of transformer T, as shown in Fig. 2, and a condenser 15 may then be included in series with primary 6 to prevent saturation of the core of transformer T by direct current from the battery H.

Although I have herein shown and described only two 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 source of current connected across the rails at one point in said section, means receiving energy from said rails at another point in said section and selectively responsive to the changes in the value of the current received thereby due to the entrance of a train into the section and the exit of a train from the section, a relay also receiving energy from the rails of said section and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, and a signal associated with said section and controlled jointly by said means and said relay in such manner as to provide a proceed indication when and only when said means has responded to the exit of a train from the section and said relay is effectively energized.

2. In combination, a section of railway track, a source of direct current connected across the rails of said section, a transformer the primary of which receives energy from said rails, a relay receiving energy from the secondary of said transformer and selectively responsive to momentary impulses of one polarity or the other due to decrease or increase of the current supplied to the primary of said transformer, a second relay receiving energy from the rails of said section and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, and a signal associated with said section and controlled jointly by said two relays in such manner as to provide a proceed indication when and only when the first relay has responded to an impulse of said other polarity and said second relay is effectively energized.

3. In combination, a section of railway track, a source of direct current connected across the rails of said section, a transformer the primary of which receives energy from said rails, a relay receiving energy from the secondary of said transformer and having a polar armature which moves to a normal or a reverse position in response to momentary impulses of normal or reverse polarity due to increase or decrease of the current supplied to the primary of the transformer and which remains in the position to which it was last moved until influenced by an impulse of the other polarity, a second relay receiving energy from the rails of said section and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, a signal for said section, and means for causing said signal to indicate proceed when and only when said polar armature is in its normal position and said second relay is energized.

4. In combination, a section of railway track, a source of direct current connected across the rails of said section, a transformer the primary of which receives energy from said rails, a relay receiving energy from the secondary of said transformer and having a polar armature which moves to a normal or a reverse position in response to momentary impulses of normal or reverse polarity due to increase or decrease of the current supplied to the primary of the transformer and which remains in the position to which it was last moved until influenced by an impulse of the other polarity, a second relay receiving energy from the rails of said section and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, a signal for said section, a proceed circuit for said signal closed only when said polar armature is in its normal position and said second relay is energized, and two stop circuits for said signal one of which is closed when said polar armature is in its reverse position and the other of which is closed when said second relay is deenergized.

5. In combination, a section of railway track, a

source of direct current connected across the rails of said section, a transformer the primary of which receives energy from said rails, a relay receiving energy from the secondary of said transformer and selectively responsive to momentary impulses of one polarity or the other due to decrease or increase of the current supplied to the the primary of said transformer, a second relay having its operating winding interposed between said transformer primary and one of the track rails and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, and a signal associated with said section and controlled jointly by said two relays in such manner as to provide a proceed indication when and only when the first relay has responded to an impulse of said other polarity and said second relay is effectively energized.

6. In combination, a section of railway track, a source of direct current connected across the rails of said section, a transformer the primary of which receives energy from said rails, a relay receiving energy from the secondary of said transformer and selectively responsive to momentary impulses of one polarity or the other due to decrease or increase of the current supplied to the primary of said transformer, a condenser interposed between the primary of said transformer and one of the track rails to prevent the flow of steady direct current in the transformer primary, a second relay having its operating winding connected across the rails of said section and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, and signaling apparatus associated with said section and controlled jointly by said two relays.

7. In combination, two successive sections of railway track, a source of direct current connected across the rails of each section, a transformer for each section the primary of which receives energy from the rails of the section, a relay for each section receiving energy from the secondary of the associated section and each having a polar armature which moves to a normal or a reverse position in response to momentary impulses of normal or reverse polarity due to increase or decrease of the current supplied to the primary of the transformer and which remains in the position to which it was last moved until influenced by an impulse of the other polarity, a second relay for each section receiving energy from the rails of the section and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, a third relay for the rear section, means for energizing said third relay if and only if the armature of the first relay for the forward section is in its normal position and the second relay for the forward section is energized, a signal for the rear section, and means for causing said signal to indicate proceed if and only if the armature of the first relay for the rear section is in its normal position and the second relay for the rear section is energized and said third relay is energized.

8. In combination, a section of railway track, a source of current connected across the rails of said section, means including a contact controlled by energy received from said rails in such manner as to open upon a rapid decrease in the energy received by said means occurring when a train enters said section and to remain closed if the energy received by said means changes gradually, a relay receiving energy from said rails and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a give value, a signal for said section, and means for causing said signal to indicate proceed when and only when said contact is closed and said relay is energized.

9. In combination, a section of railway track, a source of current connected across the rails of said section, means including a contact controlled by energy received from said rails in such manner as to open upon a rapid decrease in the energy received by said means occurring when a train enters said section and to remain closed if the energy received by said means changes gradually, a relay receiving energy from said rails and arranged to be effectively energized or not according as the amount of energy which it receives is above or below a given value, a signal for said section, a proceed circuit for said signal effective only when said contact is closed and said relay is energized, and a stop circuit for said signal effective when said relay is deenergized.

ALBERT L. VENCILL.