

Oct. 9, 1928.

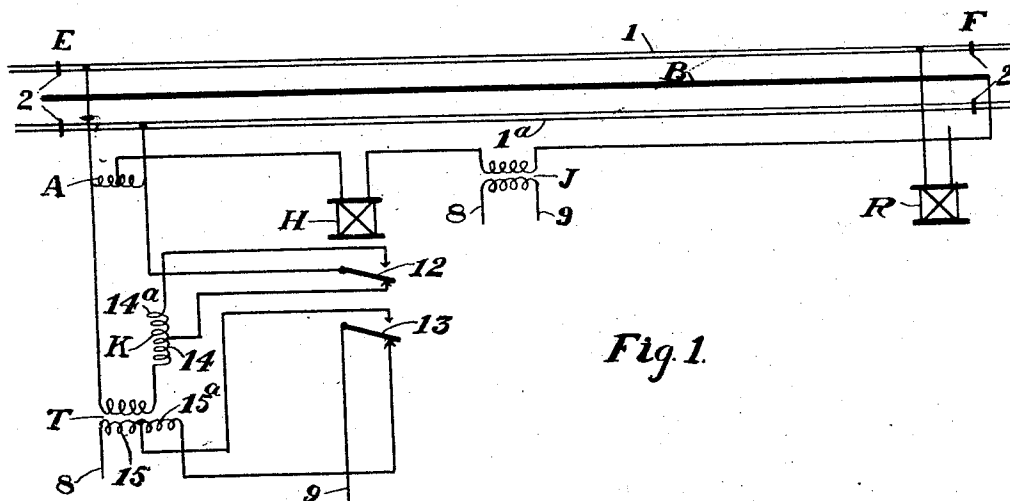
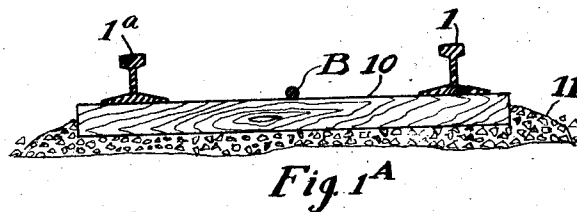
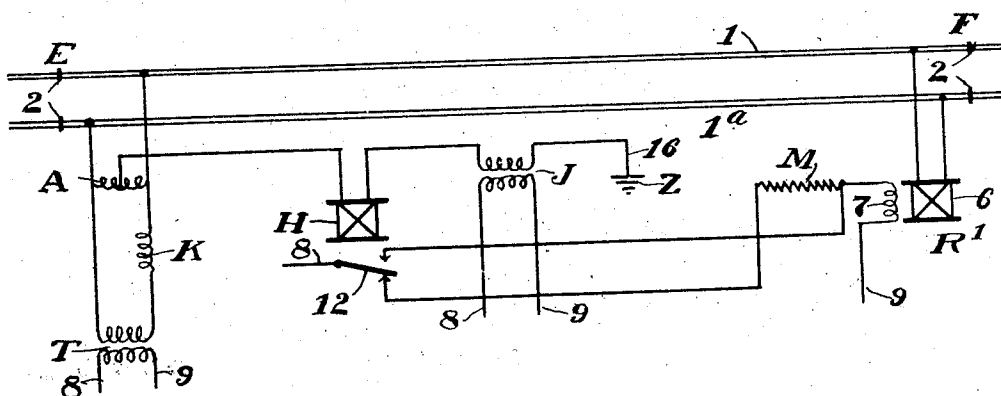
1,687,111

A. A. SKENE

RAILWAY SIGNALING APPARATUS

• Filed Aug. 4, 1926

2 Sheets-Sheet 1



INVENTOR:

a. a. Thorne,
by a. z. Vencill
his attorney

Oct. 9, 1928.

1,687,111

A. A. SKENE

RAILWAY SIGNALING APPARATUS

Filed Aug. 4, 1926

2 Sheets-Sheet 2

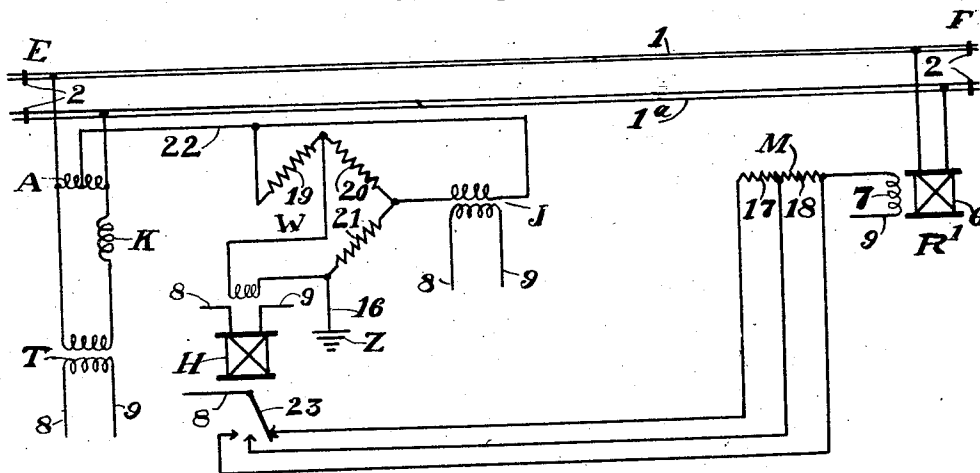


Fig. 3.

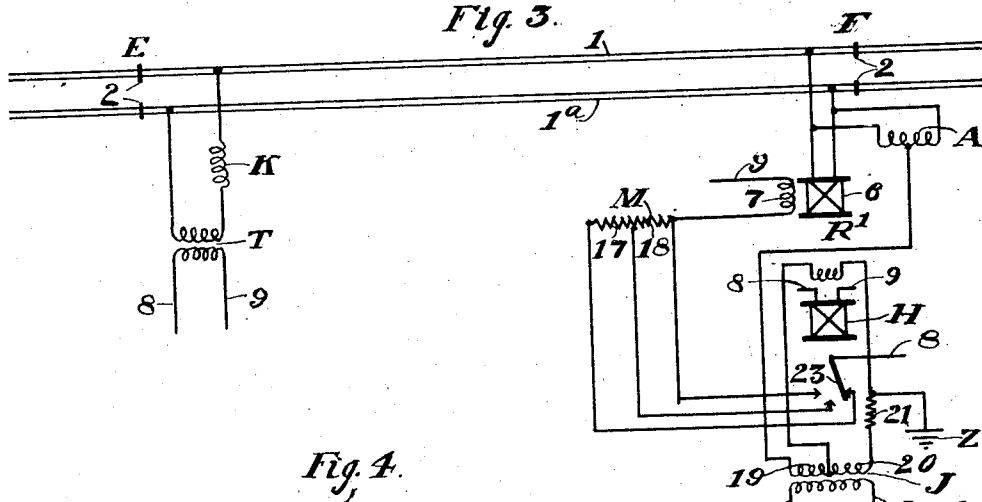


Fig. 4.

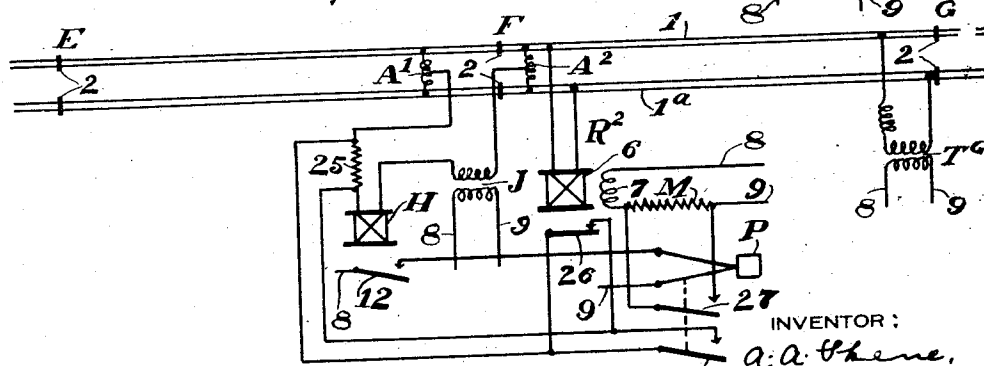


Fig. 5.

INVENTOR:

A. A. Skene,
by A. R. Venable
His Attorney

UNITED STATES PATENT OFFICE.

ANDREW A. SKENE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

RAILWAY SIGNALING APPARATUS.

Application filed August 4, 1926. Serial No. 126,985.

My invention relates to railway signaling apparatus and particularly to apparatus of the type involving track circuits.

I will describe several 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. Fig. 1^A is a sectional view across the track rails shown in Fig. 1 and illustrating one location of, and one means for mounting, the auxiliary conductor B. Fig. 2 is a diagrammatic view showing a modification of the apparatus shown in Fig. 1 for varying the voltage supplied to the second winding of a two-winding relay, such modification also embodying my invention. Fig. 3 is a view showing a modification of the apparatus shown in Fig. 2, but involving a Wheatstone bridge arrangement and also embodying my invention. Fig. 4 is a modification of the apparatus shown in Fig. 3 and embodying my invention. Fig. 5 is a diagrammatic view showing a still further modification of my invention and including slow-acting means for varying the voltage applied to a relay winding.

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 rails of a railway track, which rails are divided by insulated joints to form a section E—F. This section is provided with a track circuit comprising a transformer T having its secondary connected across the rails adjacent the point E, and a track relay R connected across the rails adjacent the point F. The primary of transformer T is connected with two terminals 8 and 9 which are in turn constantly connected with a source of alternating track circuit voltage which is not shown in the drawing.

Connected across the rails 1 and 1^a of the section E—F is a reactance A, and an auxiliary conductor B is in contact with the track ballast for this section. As here shown, this conductor B extends the entire length of the section, and as illustrated in Fig. 1^A, it is preferably mounted on the ties 10 midway between the two rails 1 and 1^a, so that it is in constant contact with the ties 10 and the ballast 11. This particular means for mounting the conductor is not essential to my in-

vention, however, and it is also not essential that the conductor extend the entire length of the section. The reference character J designates an auxiliary source of voltage, and, as here shown, is a transformer having its primary constantly connected with the alternating current terminals 8 and 9. The secondary of transformer J is connected with the auxiliary conductor B and with the mid point of reactance A, and an auxiliary relay H is included in the secondary circuit of this transformer.

As is well understood in the railway signaling art, the resistance of track ballast varies through wide limits, depending on weather conditions. When the ballast is wet its resistance is comparatively low, but when the ballast is dry its resistance is comparatively high. The circuit for the secondary of transformer J is so adjusted that when the ballast between auxiliary conductor B and the track rails is dry so that the current flowing in this circuit is relatively small, relay H is open, whereas when the ballast is wet so that the current flowing in this circuit is relatively high, relay H is closed.

The primary of transformer T includes two portions 15 and 15^a. When relay H is open, contact 13 of this relay includes both portions in the circuit between terminals 8 and 9, whereas when relay H is closed this contact connects only the portion 15 of the primary winding with terminals 8 and 9. Interposed between the secondary of transformer T and the track rail 1^a is a limiting reactance K having two portions 14 and 14^a. When relay H is open contact 12 of this relay connects only the portion 14 in the secondary circuit of transformer T, whereas when relay H is closed this contact connects both portions 14 and 14^a in the signal circuit. It follows that in dry weather both of the portions 15 and 15^a of the primary of transformer T will be supplied with voltage, and only the portion 14 of the reactance K will be interposed in the secondary circuit, so that relatively low voltage will be applied to the track rails 1 and 1^a. In wet weather, however, only the portion 15 of the primary of transformer T will be supplied with voltage and both portions 14 and 14^a of reactance K will be included in the circuit for the secondary of this transformer, so that relatively high voltage will be applied to the rails 1

and 1^a. The reason for varying the amount of the reactance K according to weather conditions is to limit the short-circuit current drawn from the transformer T to substantially the same value regardless of the voltage delivered by this transformer. By the short-circuit current I mean the current drawn from transformer T when a train is in the section E—F at or near the point E.

Referring now to Fig. 2, the apparatus shown in this view is the same as that shown in Fig. 1, except that the track relay, which is here designated R¹, has two windings 6 and 7, the former of which is connected with the track rails and the latter of which is supplied with voltage from the alternating current terminals 8 and 9. In this form of the invention I vary the voltage applied to winding 7 instead of varying the voltage applied to the track rails by transformer T, and as here shown this is accomplished by a limiting resistance M which is included in the circuit of this winding in dry weather but not in wet weather. That is to say, when relay H is de-energized, the circuit for winding 7 includes the back point of contact 12 and the resistance M, but when relay H is energized, the circuit for winding 7 includes the front point of contact 12 and not the resistance M. It will be seen, therefore, that during dry weather, that is, when the voltage applied to winding 6 of relay R¹ is relatively high, the voltage applied to winding 7 is relatively low, because of resistance M, whereas, during wet weather, when the voltage applied to winding 6 is relatively low, the voltage applied to winding 7 is relatively high, because resistance M is then not in circuit with winding 7. It follows that the total energy applied to relay R¹ may be made substantially constant regardless of variation in weather conditions.

As shown in Fig. 2, the auxiliary conductor B is eliminated and a conductor 16 is substituted therefor, this conductor 16 being connected with the ground at point Z.

Referring now to Fig. 3, I have here shown a Wheatstone bridge W for the control of relay H. Three of the arms of this bridge 19, 20 and 21 are fixed resistances, whereas the fourth arm is the ballast resistance between the mid-point of reactance A and the ground at point Z. The secondary of transformer J is connected across two opposite points of the bridge W, whereas the relay H is connected across the other two opposite points of the bridge. Relay H is a polarized relay, that is, it is responsive to reversals of the polarity of the current supplied to its winding, so that its contact 23 is swung to the right when the relay is supplied with current of one polarity and to the left when the relay is supplied with current of the other polarity. These contacts, of course, hang vertically when the relay is substantially de-energized.

As here shown, the contacts of relay H control a limiting resistance M, which is included in the circuit for winding 7 of relay R¹. The parts are so adjusted that in dry weather the contacts of relay H swing to the right, so that both sections 17 and 18 of resistance M are included in the circuit for winding 7. As the ballast becomes wet, the current supplied to winding H decreases until this relay becomes substantially de-energized, whereupon contact 23 assumes its intermediate position and thereby cuts section 17 of resistance M out of the circuit for winding 7. Upon further saturation of the ballast, relay H becomes energized in the other direction, so that contact 23 swings to the left and thereby cuts the entire resistance M out of the circuit for winding 7. It follows that as the current supplied to the track winding 6 of relay R¹ decreases in response to increased wetness of the ballast the current supplied to winding 7 of this relay increases and thereby tends to maintain substantially constant energization of the relay as a whole.

Referring now to Fig. 4, the apparatus shown herein is substantially the same as that shown in Fig. 3, except that the separate resistances 19 and 20 of the Wheatstone bridge have been replaced by the two halves of the secondary of transformer J. The operation of the apparatus shown in Fig. 4 is the same as that of the apparatus shown in Fig. 3, and will be understood without further explanation.

Referring now to Fig. 5, the circuit for winding 7 of track relay R² is provided with a resistance M, which resistance is shunted by a contact 27 when a thermal relay P is energized. This relay P is in turn controlled by contact 12 of auxiliary relay H, and in this view the circuit for relay H and the secondary of transformer J is connected with two reactances A¹ and A². These reactances are connected across the rails of sections E—F and F—G, respectively. In dry weather relay H is de-energized, so that relay P is de-energized and the resistance M is included in the circuit for relay winding 7. In wet weather, however, relay H is energized, relay P is energized, and the resistance M is shunted, thereby increasing the supply of current to winding 7 to offset the decreased supply of current to winding 6. If, however, no means were provided to prevent it, relay H would become energized each time a train bridges the insulated joints 2 at point F, and so I include in the circuit of this relay a resistance 25, which is normally shunted by a front contact 26 of track relay R², and is also shunted by contact 28 of relay P when the latter relay is energized.

The operation of the apparatus shown in Fig. 5, is as follows: Assuming that relay H is de-energized, when a train moving toward the right enters section F—G, it de-energizes

relay R², thereby opening the shunt around resistance 25 at contact 26 and so preventing relay H from becoming energized. If, however, relay H is energized when the train enters section F—G, relay P will be energized, so that contact 28 will be closed, but since relay H is already energized, no change occurs in the condition of the apparatus other than to open contact 26 of relay R².

The thermal relay P introduces a time element between the closing of relay H and the closing of contacts 27 and 28. If relay H should close before relay R² opens when a train enters section F—G, this time interval will prevent contact 27 from shunting resistance M, and so increasing the current in winding 7, until relay R² opens. Of course, any other type of slow-acting relay may be substituted for the thermal relay P.

Although I have herein shown and described only five 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 with a section of railway track provided with a source of track circuit voltage and a track relay, an auxiliary conductor in contact with the track ballast, and means for varying the voltage applied to a winding of said track relay in response to variations in the resistance of the ballast between said auxiliary conductor and the track rails.

2. In a railway signal system comprising a section of track, a source of track circuit voltage connected across the rails of said section, and a track relay having a first winding receiving energy from the rails of said section and a second winding supplied with voltage, the combination with the aforesaid instrumentalities of an auxiliary conductor in contact with the track ballast, and means responsive to variations in the resistance of the ballast between said conductor and the track rails for varying the voltage applied to the second winding of said track relay.

3. In combination with a section of railway track provided with a source of track circuit voltage and a track relay, an auxiliary conductor in contact with the track ballast, an auxiliary source of voltage connected with said conductor, and a track rail, an auxiliary relay included in circuit with said auxiliary

source and arranged to be closed or open according as the ballast resistance is relatively low or relatively high, and means controlled by said auxiliary relay for varying the voltage applied to a winding of said track relay.

4. In a railway signal system comprising a section of track, a source of track circuit voltage connected across the rails of said section, and a track relay having a first winding receiving energy from the rails of said section and a second winding supplied with voltage, the combination with the aforesaid instrumentalities of an auxiliary conductor in contact with the track ballast, an auxiliary source of voltage connected with said conductor and a track rail, an auxiliary relay included in circuit with said auxiliary source and arranged to be closed or open according as the ballast resistance is relatively low or relatively high, and means controlled by said auxiliary relay for varying the voltage applied to the track rails by said first source.

5. In combination with a section of railway track provided with a source of track circuit voltage and a track relay, an auxiliary relay responsive to variations in the resistance of the track ballast, and means controlled by a contact of said auxiliary relay for varying the voltage applied to a winding of said track relay.

6. In a railway signal system comprising a section of track, a source of track circuit voltage connected across the rails of said section, and a track relay having a first winding receiving energy from the rails of said section and a second winding supplied with voltage, the combination with the aforesaid instrumentalities of an auxiliary relay responsive to variations in the resistance of the track ballast, and means controlled by a contact of said auxiliary relay for varying the voltage applied to the second winding of said track relay.

7. In combination with a section of railway track provided with a source of track circuit voltage and a track relay, an auxiliary conductor in contact with the track ballast, an impedance connected across the rails of said section, an auxiliary source of voltage connected with said conductor and an intermediate point in said impedance, an auxiliary relay included in circuit with said auxiliary source, and means controlled by said auxiliary relay for varying the voltage applied to a winding of said track relay.

In testimony whereof I affix my signature.

ANDREW A. SKENE.