

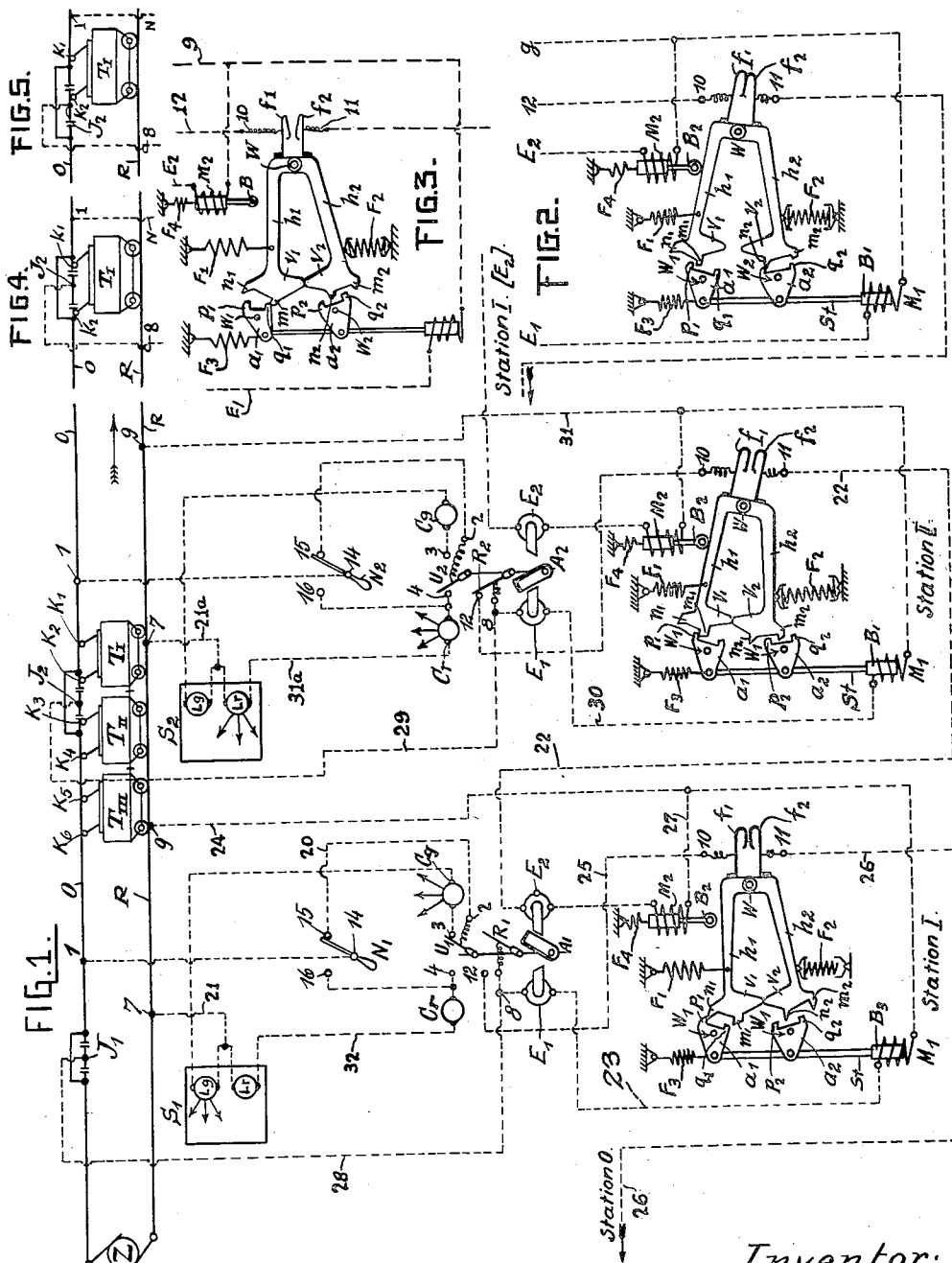
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BLOCK SIGNALING SYSTEM FOR RAILWAYS

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## UNITED STATES PATENT OFFICE

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BLOCK SIGNALING SYSTEM FOR  
RAILWAYSCarl König, Vohwinkel-Hammerstein,  
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1 Claim. (Cl. 246—81)

This invention relates to automatic block signaling systems for railways in which the train when leaving a block is caused to send two or more current impulses into the block signaling system, the first of said current impulses being used to close a contact in the circuit leading to the rearwardly positioned block signaling apparatus.

My invention consists essentially therein, that the second of said current impulses is caused to operate by way of these contacts, at the beginning of the rearwardly positioned block, signaling apparatus to indicate that the respective block is "free" and that the retarding and current limiting apparatus have been moved back into its initial position, thereby simultaneously again interrupting the circuit which had been closed by said first current impulse to the rearwardly positioned signaling apparatus by opening said contact. In this manner further current impulses will no more be able to affect the block signaling apparatus.

An example of a block signaling system according to my invention is shown in the accompanying drawing of which

Fig. 1 is a diagram showing the connection of two railway block stations which are in signaling connection with each other, the mechanism shown in the lower half of the figure being the retarding and current-limiting apparatus,

Figure 2 shows also the retarding and current-limiting apparatus, the movable members being, however, in another position,

Fig. 3 is a view similar to Fig. 2, showing the same parts in another position, and

Figs. 4 and 5 are views similar to the uppermost portion of Fig. 1 and show a railway car in two other positions relatively to the places where the current is drawn from the overhead line.

On the drawing, R denotes the track of an electric railway and O the overhead line which receives the current from the electric central station Z. The track is subdivided in the usual manner into individual blocking stations (I and II), each of which is provided with a block signaling apparatus S<sub>1</sub> or S<sub>2</sub>, respectively. Each thereof is provided with a green lamp L<sub>g</sub> for indicating that the line is clear, and with a red lamp L<sub>r</sub> co-operating with the stopping signals. These optical signaling means may be combined with mechanical ones. I have abstained from showing in the drawing also mechanical signaling means (in connection with said optical ones) in that they do not constitute essential

parts of this invention. The said block signaling apparatus receives the current from the overhead line of the track, from which the current is tapped at the point J<sub>1</sub> or J<sub>2</sub>, respectively, the current being then conducted according to the position of a switch N<sub>1</sub> or N<sub>2</sub> respectively, either across the pivot 14 of the switch arm, the contact, the switch arm U<sub>1</sub> or U<sub>2</sub>, respectively, the contact piece 3 and the green control lamp C<sub>g</sub> to the green signal lamp L<sub>g</sub>, or across the pivot 14, the contact 16, and the control lamp C<sub>r</sub> to the red signal lamp L<sub>r</sub>. From both lamps the current flows back to the track through the wire 21 which is connected with the track R at the point 7, as shown.

When the switch N<sub>1</sub> or N<sub>2</sub>, respectively, is in the first-mentioned position, as in the drawing, so as to supply the green lamp with current, the current can nevertheless be conducted also to the red lamp. That is effected by turning the switch lever U<sub>1</sub>, or U<sub>2</sub>, respectively, onto the contact piece 4, in which case the current passes from this contact piece across the control lamp C<sub>r</sub>.

There appertains to each block signaling apparatus, besides the just described circuit a second circuit, with the aid of which the switch U<sub>1</sub> or U<sub>2</sub>, respectively, is actuated. These second circuits of the individual block signaling apparatus are connected with one another by a wire 22, and also they receive the requisite current from the overhead wire O of the track. The current is drawn therefrom at the point J<sub>1</sub> or J<sub>2</sub>, respectively, provided, that a railway car has established a connection between the overhead line and said point J<sub>1</sub> or J<sub>2</sub>, respectively. In this case, the current passes across the contact piece 8 the electromagnet E<sub>1</sub> the wire 23, the solenoid coil M<sub>1</sub> and the wire 24 to the point 9 at the track. Near the contact piece 8 is provided a branch switch R<sub>1</sub> which is so designed that it branches off from the circuit located between the point J<sub>1</sub> or J<sub>2</sub>, respectively, and the contact piece 8, a current, if the switch arm R<sub>1</sub> contacts with said contact piece 8. This part of the current then flows across the contacts 12, 10, f<sub>1</sub>, f<sub>2</sub> and 11 to the rearwardly located blocking station, and in the same across the appertaining electromagnet E<sub>2</sub>, the solenoid coil M<sub>2</sub>, and the wire 27 to the point 9 at the track. In order to render it possible that a current flows through that branched-off circuit, it is necessary that the contact f<sub>1</sub>, f<sub>2</sub> is closed. The construction and operation of this contact will be fully described hereinafter.

Drawing current from the overhead line O at the point J<sub>1</sub>, or J<sub>2</sub>, respectively, is possible, however, only if a car just running through the respective portion of the track establishes a connection between the line O and said point J<sub>1</sub>, or J<sub>2</sub>. In the example shown in Fig. 1 it is assumed that the cars T<sub>I</sub>, T<sub>II</sub> and T<sub>III</sub> are provided with trolleys K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub> and K<sub>6</sub>. Each car has two trolleys which are conductively connected with one another, whereby it is rendered possible that when one of the two trolleys pertaining to a car contacts with the current-carrying line O and the other trolley contacts with the line section in which the point J<sub>1</sub> or J<sub>2</sub> respectively, is located, the current can pass from the current carrying line O across the two trolleys to said point J<sub>1</sub> or J<sub>2</sub>, respectively, as is the case in Fig. 5.

When, thus, a car runs past a block signaling station and its two trolleys contact successively with the line section containing the point J<sub>1</sub>, or J<sub>2</sub>, respectively, there will in that moment in which the first trolley, say K<sub>1</sub>, contacts with said line section a current flow through the above described circuit, and this action will last as long as said trolley contacts with the said line section. Thereafter the flow of the current is interrupted, but is established anew when the other trolley arrives upon the section in which the point J<sub>1</sub>, or J<sub>2</sub>, respectively, is located. In order to bring about that interruption at the proper points of time it is necessary that the two trolleys of every car are more remote from one another than would correspond to the length of the line section containing the point J<sub>1</sub> or J<sub>2</sub>, respectively. When a car has moved past the line portion with the point J<sub>1</sub> it gets into the range of the line section with the point J<sub>2</sub>, and so on, as may be seen from Fig. 5. It is a matter of course that the number of line interrupting places may be chosen as best suited for the conditions of the individual tracks.

When a car runs through a block signaling station a plurality of current impulses, at least, however, two such ones, are sent into the circuit of the block signaling apparatus across the point J<sub>1</sub>, or J<sub>2</sub>, respectively, each of the two impulses, if provision for only two has been made, as in the constructional form illustrated in the drawing by way of example, taking its way across the wire 28, the contact piece 8, the electromagnet E<sub>1</sub>, wire 23, the solenoid coil M<sub>1</sub>, the wire 24, and the connecting point 9 of the track. Each rush of current excites the electromagnet, as well as the solenoid coil. The electromagnet attracts the armature A<sub>1</sub>, or A<sub>2</sub>, respectively, which is so connected with the switches R<sub>1</sub> and U<sub>1</sub>, or R<sub>2</sub> and U<sub>2</sub>, respectively, that when the armature A<sub>1</sub> or A<sub>2</sub>, respectively, is being attracted by the appertaining electromagnet, the switch U<sub>1</sub>, or U<sub>2</sub>, respectively, contacts with the contact piece 4, whereby the red lamp is switched on, whereas the switch R<sub>1</sub>, or R<sub>2</sub>, respectively, contacts with the contact piece 12, whereby the sub-circuit containing the contact members 10, f<sub>1</sub>, f<sub>2</sub>, and 11 is closed, provided, that the position of the contact members f<sub>1</sub>, f<sub>2</sub> is such that the current can pass through it.

Simultaneously with the electromagnet E<sub>1</sub> also the solenoid coil M<sub>1</sub> is excited whereby the core B<sub>3</sub> is drawn therinto. The core is connected with the contact springs f<sub>1</sub>, f<sub>2</sub> by mechanical means which are described in detail hereinafter, and the arrangement and combination of the parts concerned is such that, while

the contact f<sub>1</sub>, f<sub>2</sub> is closed when the first current impulse ceases, it is again opened when the second current impulse ceases, but it is not actuated in any manner by current impulses which may follow those two.

The contact springs f<sub>1</sub>, f<sub>2</sub> project forth from lever arms h<sub>1</sub> and h<sub>2</sub> and are insulated from the same, said arms being movably connected with one another and having the common fulcrum W. At the free end of each of said arms is a projection V<sub>1</sub>, or V<sub>2</sub>, respectively, which are directed towards one another and their length in this direction is such that when they contact with one another the contact between the springs f<sub>1</sub> and f<sub>2</sub> is interrupted, as in Fig. 1. The lever arm h<sub>1</sub> is provided with two noses n<sub>1</sub> and m<sub>1</sub> and the lever arm h<sub>2</sub> is provided with two noses n<sub>2</sub> and m<sub>2</sub>. Opposite the first-mentioned two noses is a pawl a<sub>1</sub> having two noses p<sub>1</sub> and q<sub>1</sub> and being supported upon a pivot W<sub>1</sub>, and opposite the other two noses is a pawl a<sub>2</sub> having two noses p<sub>2</sub> and q<sub>2</sub> and being also supported upon a pivot W<sub>1</sub>. The noses n<sub>1</sub> and m<sub>1</sub> co-operate with the noses p<sub>1</sub> and q<sub>1</sub>, and the noses n<sub>2</sub> and m<sub>2</sub> co-operate with the noses p<sub>2</sub> and q<sub>2</sub>. The pawls a<sub>1</sub> and a<sub>2</sub> are hinged to a rod St which is firmly connected with the solenoid B<sub>1</sub> and is suspended from a helical tensile spring F<sub>3</sub>, the strength of which is such that it can hold the solenoid core in its upper position when it is not subjected to the action of current passing through the appertaining coil.

Another helical tensile spring F<sub>1</sub> tends continually to hold the lever arm h<sub>1</sub> in its upper position (Fig. 1, station II, and Fig. 2). A third helical spring F<sub>2</sub> which is a compressive spring is arranged below the lever arm h<sub>2</sub> and tends continually to move it upwardly so as to keep the projection V<sub>2</sub> of this lever arm in contact with the projection V<sub>1</sub> of the lever arm h<sub>1</sub>, as in the station II of Fig. 1. Finally, laterally from the spring F<sub>1</sub> is a helical tensile spring F<sub>4</sub> which is connected with the core B<sub>2</sub> of a solenoid M<sub>2</sub> that draws this core against, and presses it onto, the lever arm h<sub>1</sub> when the coil M is traversed by a current. Otherwise the spring F<sub>4</sub> holds the core B<sub>2</sub> remote from the arm h<sub>1</sub>.

When the car T<sub>I</sub> is running on the track between two block signaling stations (I and II), the track portion concerned must be blocked in rearward direction. On the station I, therefore, the switch arm U<sub>1</sub> contacts with the contact piece 4, the switch arm R<sub>1</sub> with the contact piece 12, and the armature A<sub>1</sub> is attracted by the electromagnet E<sub>1</sub>. On the station II the arm h<sub>2</sub> is in that position in which the projections V<sub>1</sub> and V<sub>2</sub> contact with one another as do also the noses m<sub>1</sub> and p<sub>1</sub>. In this position of the parts the contact f<sub>1</sub>, f<sub>2</sub> is open. While the car is running from the station I to the station II, the switch arm of this station contacts with the contact piece U<sub>2</sub> 3 so that the green lamp is switched on and the track portion concerned is announced as being clear. The switch arm R<sub>2</sub> is at this time out of contact with the contact piece 12 and the armature A<sub>2</sub> is kept attracted by the electromagnet E<sub>2</sub>.

When the car reaches with its first brush K<sub>1</sub> the track portion in which the connecting point J<sub>2</sub> (that pertains to the station II) is located the solenoid M<sub>1</sub> of the station II is excited and the core B<sub>1</sub> is drawn therinto whereby the rod St is moved downwardly and the pawls a<sub>1</sub> and a<sub>2</sub> are turned in such a direction that, as regards first the pawl a<sub>1</sub>, the nose n<sub>1</sub> of the

lever  $h_1$  can move past the nose  $p_1$  of said pawl when said lever is turned upwardly under the pull of the spring  $F_1$ , whereas the nose  $m_1$  of the lever  $h_1$  contacts with the nose  $q_1$  of the said pawl, and is stopped thereby. The lever  $h_2$  follows the lever  $h_1$  under the pressure of the spring  $F_2$ . The parts are then in the position shown in Fig. 3.

When then, thereafter, the brush  $K_1$  of the car  $T_1$  leaves the track portion in which the point  $J_2$  is located, the solenoid becomes currentless and the spring  $F_3$  draws the rod  $St$  and the core  $B_1$  upwardly into their former position, and at the same time the pawls  $a_1$  and  $a_2$  are correspondingly turned, and as now the nose  $m_1$  of the lever  $h_1$  can move past the nose  $q_1$  of the pawl  $a_1$  the spring  $F_1$  will lift the lever  $h_1$  still further, but the lever  $h_2$  cannot follow the lever  $h_1$  because its nose  $m_2$  is retained by the nose  $p_2$  of the pawl  $a_2$ . Owing to that moment of the levers  $h_1$  and  $h_2$  relatively to one another the contact  $f_1, f_2$  will be closed, as shown at the right-hand end of Fig. 2.

While the car is running through the block signaling station II the brush  $K_2$  of the car  $T_1$  passes through the line portion containing the connecting point  $J_2$  and a second current impulse flows from the overhead line  $O$  across the brushes  $K_1$  and  $K_2$ , the wire 29, the contact piece 8, the electromagnet  $E_1$ , the wire 30, the solenoid  $M_1$  and the wire 31 to the connecting point 9, at the track. As now said solenoid is again excited, it attracts the core  $B_1$ , draws the rod  $St$  downwardly and turns the pawls  $a_1$  and  $a_2$  whereby it is rendered possible that the nose  $m_2$  of the lever  $h_2$  can move past the nose  $p_2$  of the pawl  $a_2$  so that this lever can now follow the lever  $h_1$  until its nose  $m_2$  contacts with the nose  $q_2$  of the pawl  $a_2$  and is stopped and retained by the same. In this position of the parts in question the contact springs  $f_1, f_2$  are still open.

At the same time, however, a current branched off from said second rush of current flows across the contact piece 8, the switch arm  $R_2$ , the wire 32, the contact piece 10, the contact springs  $f_1, f_2$ , the contact piece 11, and the wire 22 rearwardly to the preceding station (I), in consequence whereof the electromagnet  $E_2$  attracts the armature  $A_1$  (on the station I) whereby the switch arm  $R_1$  is drawn away from the contact piece 12 so that the sub-circuit of the station I is interrupted. Simultaneously therewith the armature  $A_1$  turns the switch lever  $U_1$  from the contact piece 4 to the contact piece 3 whereby the green lamp indicating that the track at the station I is free is switched on. Owing to the solenoid  $M_2$  being excited simultaneously with the electromagnet  $E_2$  the core  $B_2$  of said solenoid is drawn therinto and its free end is thereby pressed onto the lever  $h_1$  whereby also the lever  $h_2$  is moved downwardly by the intermediary of the projections  $V_1$  and  $V_2$  of these levers, this movement being continued until the nose  $m_1$  of the projection  $V_1$  has arrived behind, i. e. below, the nose  $p_1$  of the pawl  $a_1$ .

When the second rush of current ceases, that is to say, when the brush  $K_2$  of the car leaves the line portion in which the connecting point  $J_2$  is located the solenoid  $M_1$  becomes currentless,

so that the core  $B_1$  of the same is pulled upwardly by the spring  $F_3$  by the intermediary of the rod  $St$ , and the pawls  $a_1$  and  $a_2$  are also, therefore, turned back into their former position, or position of rest respectively. The nose  $m_2$  of the lever  $h_2$  can now move past the nose  $p_2$  of the pawl  $a_2$  so that the projection  $V_2$  of the lever  $h_2$  can contact with the projection  $V_1$  of the lever  $h_1$ , in consequence whereof the contact springs  $f_1, f_2$  are opened.

The levers  $h_1$  and  $h_2$  have now reached that position in which they are nearest the solenoid  $M_2$  and further impulses of current caused by further brushes passing away over the point  $J_2$  cannot bring about any change in the position of said levers. Turning these latter back into their initial position can take place only when the car has reached the next blocking signaling station (III, not shown), the several movements of the parts concerned in this station (III) and in the preceding one (II) then taking place in exactly the same manner as has been described with respect to the stations I and II.

If the track is to be blocked without a car running through any part of it, that may be effected by shifting the switch arm  $N_1$  (or  $N_2$ ) from the contact piece 15 onto the contact piece 16 whereby the red lamps will be switched on independently of the other switching means that are automatically actuated in the described manner. The current flows then from one or the other of the connecting points 1 of the overhead line across the respective switch arm 14, the contact piece 16, the instrument  $C$ , the wire 32 or 31a, respectively, the lamp  $L_r$  and the wire 21, or 21a respectively, to the appertaining connecting point 7 of the track.

I claim:

An automatic block signaling system for electric railways, comprising, in combination with the conducting track, an overhead line divided into main sections and intermediate sections, each of which latter is located between two consecutive main sections and is insulated from them, back-signaling wires between the consecutive block stations, trolley cars having means adapted to produce two consecutive current impulses in the back-signaling wire concerned when running over the intermediate overhead line section concerned, electromagnetically actuated contact devices in the block stations, and conducting connections between said devices on the one hand and the main sections and the intermediate sections, as well as the track, on the other hand, said conducting connections forming circuits connected with one another by the back-signaling wires; said electromagnetically actuated contact devices comprising switching levers and contacts closed by means of the appertaining electromagnet by the first of said two consecutive current impulses and closing thereby the circuit for the electromagnet pertaining to the switching lever of the rearwardly located block station which in turn causes opening of the block station following it, and signaling means adapted to be electrically operated by the said switching levers in dependency of the said contacts, substantially as set forth.

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