

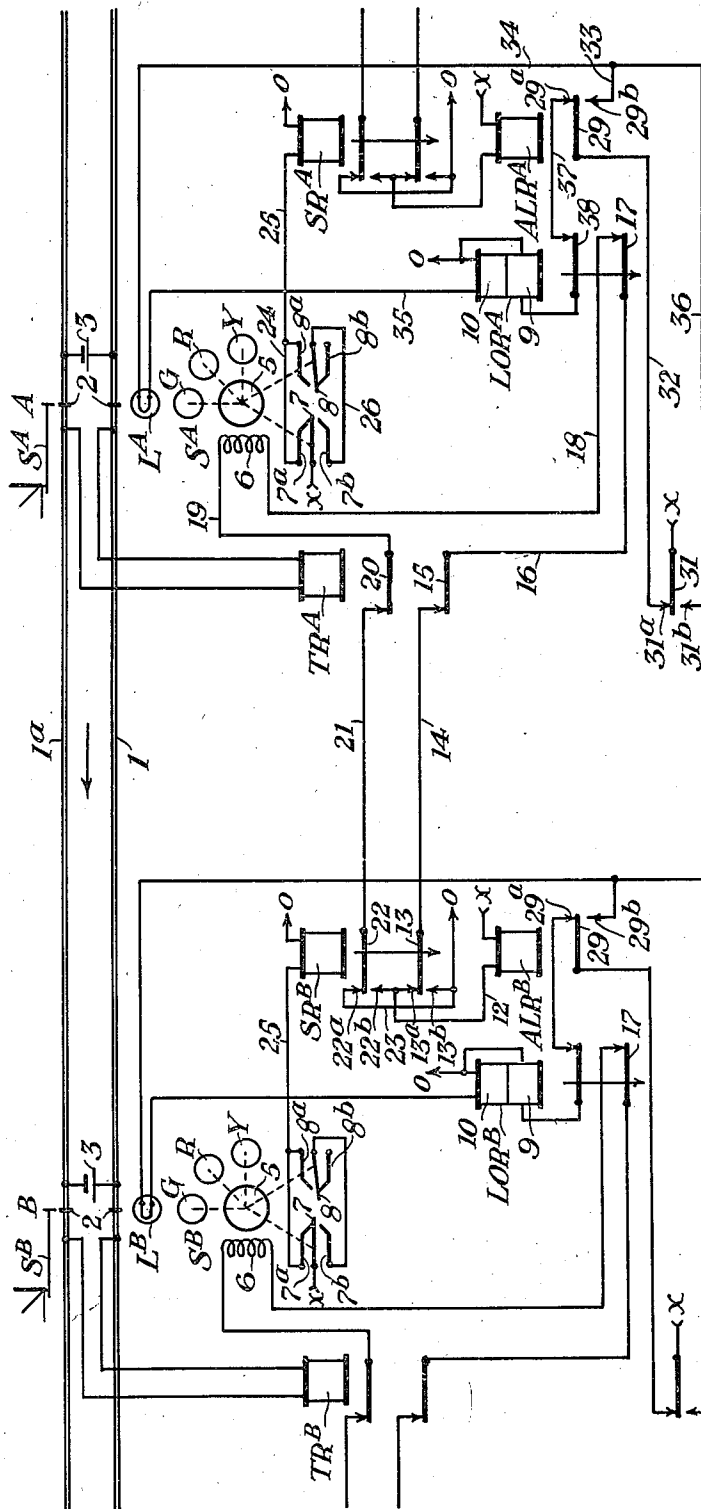
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RAILWAY SIGNALING SYSTEM

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RAILWAY SIGNALING SYSTEM

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My invention relates to railway signaling systems of the type involving light signals which are approach lighted.

One object of my invention is to provide novel and improved means for causing an approach lighted signal to display a restrictive indication when a train approaches the signal if the filament of the lamp for the signal next in advance is burned out.

The subject matter of the present application is closely related to that set forth in the copending application for Letters Patent of the United States, Serial No. 742,095, filed by H. S. Young, on August 30, 1934, for Railway signaling systems, and also to that set forth in the copending application for Letters Patent of the United States, Serial No. 84,498, filed by P. H. Crago, on June 10, 1936, for Railway signaling systems, and both said copending applications contain claims which cover broadly certain features of the invention described in the present application.

I will describe one form of railway signaling system embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view showing one form of signaling system embodying my invention.

Referring to the drawing, the reference characters 1 and 1^a designate the track rails of a stretch of railway track along which traffic normally moves in the direction indicated by the arrow. These track rails are divided, by means of insulated joints 2, to form blocks, only one of which A—B is shown complete in the drawing. Each block is provided with a track circuit comprising a track relay, designated by the reference character TR with a suitable distinguishing exponent, and a track battery 3, the track relay and the track battery being connected directly with the rails of the associated block adjacent the entrance and exit ends, respectively, of the block.

Located adjacent the entrance end of each block is a signal designated by the reference character S with an exponent corresponding to the location. Each signal, as here shown, is of the type commonly known as a searchlight signal, and comprises an armature 5 mounted to rotate between an intermediate position to which it is biased, and two extreme positions. Each armature 5 is controlled by an armature winding 6, and is polarized by the field from a permanent magnet or an electromagnet (not shown) in such manner that when the winding

6 is energized, the armature will rotate to its right-hand or left-hand extreme position according as winding 6 is then supplied with current of normal or reverse polarity, respectively. Attached to each armature 5 to rotate therewith are three colored roundels G, R, and Y, which are arranged to be disposed in the path of a beam of light projected from an associated lamp L according as the armature 5 occupies its right-hand extreme position, its intermediate position, or its left-hand extreme position, respectively. For convenience in illustration, each lamp L in the drawing is shown disposed above the associated roundels, but it will be readily understood that in actual practice each lamp will be located directly back of the associated roundel and will have associated therewith a suitable optical system, not shown, for projecting a beam of light from the lamp. The signals S each indicate "proceed", "stop", or "caution" according as the roundel G, R, or Y is in front of the associated lamp L when this lamp is lighted. Operatively connected with each armature 5 is a circuit controller comprising two movable contact fingers 7 and 8. The movable contact finger 7 cooperates with a fixed contact 7^a to close a contact 7—7^a when the armature 5 occupies its right-hand extreme position, and with a fixed contact 7^b to close a contact 7—7^b when the armature occupies its intermediate position or its left-hand extreme position; while the movable contact finger 8 cooperates with a fixed contact 8^a to close a contact 8—8^a when the armature occupies its left-hand extreme position, and with a fixed contact 8^b to close a contact 8—8^b when the armature occupies its intermediate or its right-hand extreme position. A signal of the type described is disclosed and claimed in Letters Patent of the United States No. 1,864,224, granted to Wesley B. Wells, on June 21, 1932, for Light signals.

Associated with each signal is a slow-releasing signal repeater relay designated by the reference character SR with a suitable distinguishing exponent, an approach lighting relay designated by the reference character ALR with a suitable distinguishing exponent, and a slow-releasing lightout relay designated by the reference character LOR with a suitable distinguishing exponent. Each lightout relay LOR is provided with two windings, one of which, 9, has a relatively high resistance, and the other of which, 10, has a relatively low resistance.

Each signal repeater relay is provided with two energizing circuits which are controlled by the

circuit controller of the associated signal. Referring to relay SR^A , for example, the one energizing circuit for this relay is closed when and only when the mechanism of signal S^A occupies its proceed position, and passes from terminal X of a suitable source of current not shown in the drawing through contact 7—7^a of signal S^A , wires 24 and 25, and the winding of relay SR^A to terminal O. The other energizing circuit for relay SR^A is closed when and only when the mechanism of signal S^A occupies its caution position, and passes from terminal X through contact 7—7^b of signal S^A , wire 26, contact 8—8^a of signal S^A , wire 25, and the winding of relay SR^A to terminal O. It will be apparent, therefore, that relay SR^A will be energized when the mechanism of signal S^A occupies either its proceed or its caution position, but will be deenergized when the mechanism of signal S^A occupies its stop position. Relay SR^A is made sufficiently slow releasing so that it will not open its front contacts while signal S^A is moving from its proceed to its caution position or vice versa.

The winding 6 of each signal is controlled by the associated track and lightout relays, and by the signal repeater relay for the signal next in advance, through the medium of a polarized line circuit which includes the winding of the approach lighting relay for the signal next in advance. Referring to signal S^A , for example, when track relay TRA and lightout relay LOR^A are both energized, and signal repeater relay SR^B is also energized, the polarized line circuit for winding 6 of signal S^A is closed, and under these conditions, winding 6 is supplied with current of normal polarity, the path of the current being from terminal X through the winding of relay ALR^B , wire 12, front contact 13—13^a of relay SR^B , line wire 14, front contact 15 of track relay TRA , wire 16, front contact 17 of lightout relay LOR^A , wire 18, winding 6 of signal S^A , wire 19, front contact 20 of track relay TRA , line wire 21, front contact 22—22^a of signal repeater relay SR^B , and wire 23 to terminal O. When track relay TRA and lightout relay LOR^A are both energized and signal repeater relay SR^B is deenergized, the polarized line circuit for winding 6 of signal S^A is again closed, but under these conditions, due to the fact that back contacts 13—13^b and 22—22^b of relay SR^B are now closed instead of front contacts 13—13^a and 22—22^a, winding 6 of signal S^A is supplied with current of reverse polarity over this line circuit. When either track relay TRA or lightout relay LOR^A is deenergized, the polarized line circuit for winding 6 of signal S^A will, of course, be open.

It will be apparent, therefore, that when track relay TRA and lightout relay LOR^A are both energized, the mechanism of signal S^A will occupy its proceed or its caution position according as signal repeater relay SR^B is then energized or deenergized, but that, when either track relay TRA or lightout relay LOR^A is deenergized, the mechanism of signal S^A will occupy its stop position. It will also be apparent that approach lighting relay ALR^B will be energized whenever winding 6 of signal S^A is energized by current of either normal or reverse polarity, but that, when winding 6 of signal S^A is deenergized, approach lighting relay ALR^B will also be deenergized.

Each signal lamp L is provided with two energizing circuits which are controlled by the associated track and approach lighting relays, and each of which includes the low resistance winding 10 of the associated lightout relay. Referring to lamp L^A , for example, the one energizing circuit

for this lamp is closed when and only when track relay TRA is energized and approach lighting relay ALR^A is deenergized, and passes from terminal X through front contact 31—31^a of track relay TRA , wire 32, back contact 29—29^b of relay ALR^A , wires 33 and 34, the filament of lamp L^A , wire 35, and low resistance winding 10 of lightout relay LOR^A to terminal O. The other energizing circuit for lamp L^A is closed whenever track relay TRA is deenergized and passes from terminal X through back contact 31—31^b of track relay TRA , wires 36 and 34, the filament of lamp L^A , wire 35, and the winding 10 of relay LOR^A to terminal O. When either of these energizing circuits is closed, lamp L^A will be lighted and lightout relay LOR^A will be picked up.

Relay LOR^A , as here shown, is provided with a stick circuit which includes its own front contact, and front contacts of the associated track and approach lighting relays, the function of this circuit being to maintain the lightout relay energized when the two energizing circuits for the associated lamp are both open provided the associated lamp is not burned out when these energizing circuits become opened. Referring to the lightout relay LOR^A , for example, the stick circuit for this relay passes from terminal X through front contact 31—31^a of track relay TRA , wire 32, front contact 29—29^a of approach lighting relay ALR^A , wire 37, front contact 38 of lightout relay LOR^A , and the high resistance winding 9 of relay LOR^A to terminal O. The reason for making the winding 9 a high resistance winding is to save energy, since this winding is energized at all times when the signal lamp is extinguished.

As shown in the drawing, all parts are in their normal positions, that is to say, all relays are picked up, the winding 6 of each signal is supplied with current of normal polarity so that its armature 5 occupies its right-hand or proceed position, and the lamps L^A and L^B of signals S^A and S^B are both extinguished.

In explaining the operation of the apparatus as a whole, I will first assume that a train moving in the direction of the arrow traverses the stretch of track shown in the drawing. When the train enters the block in rear of block A—B, the shunting of the track relay associated with this block will cause approach lighting relay ALR^A to become deenergized, and close its back contact 29—29^b. The closing of this contact will complete the one energizing circuit for lamp L^A , and this lamp will, therefore, become lighted and cause signal S^A to display a proceed indication.

When the train enters block A—B, track relay TRA will become deenergized, and will interrupt the circuit for winding 6 of signal S^A , thus causing the mechanism of this signal to move to its stop position, and approach lighting relay ALR^B to become deenergized. When signal S^A moves to its stop position, it will interrupt the circuit which was previously closed for signal repeater relay SR^A , and since both circuits for this relay will then be open, this relay will become deenergized. The deenergization of relay SR^A will cause the polarity of the current supplied to the circuit for the winding 6 of the signal for the block to the right of block A—B to become reversed, and as a result, as soon as the train moves out of this block, this signal will move to its caution position. When this signal moves to its caution position, approach lighting relay ALR^A will become energized and will interrupt the energizing circuit which was previously closed for lamp L^A at back contact 29—29^b of relay ALR^A , but due to the fact

that track relay TR^A is then deenergized, the other energizing circuit for lamp L^A will be closed, and lamp L^A will therefore remain lighted, thus causing signal S^A to continue to display a stop indication. The deenergization of approach lighting relay ALR^B will cause the one energizing circuit for lamp L^B of signal S^B to become closed, and this lamp will therefore become lighted, thus causing signal S^B to display a proceed indication, while the train is traversing the block A—B. Lightout relay LOR^A is sufficiently slow releasing so that it will not open its front contacts during the interval of time which elapses between the opening of the front contacts of relay ALR^A and the closing of its back contacts or vice versa, thus preventing signal S^A from blinking when relay ALR^A becomes released.

When the train enters the block next in advance of block A—B, track relay TR^B will become deenergized, and will cause winding 6 of signal S^B to become deenergized. The deenergization of winding 6 of signal S^B will cause the mechanism of this signal to move to its stop position, which movement, in turn, due to the resultant operation of the associated circuit controller, will deenergize signal repeater relay SR^B . When relay SR^B becomes deenergized, it will reverse the polarity of the current supplied to the circuit for winding 6 of signal S^B , but as long as any part of the train remains in block A—B, the circuit for winding 6 will remain open at the front contacts of track relay TR^A , and signal S^A will continue to display a stop indication. As soon, however, as the train passes completely out of block A—B, the resultant energization of track relay TR^A will complete the circuit for winding 6 of signal S^A , and this signal will then move to its caution position. The resultant energization of track relay TR^A will also interrupt the circuit which was previously closed for lamp L^A at back contact 31—31^b of relay TR^A and will complete the stick circuit for lightout relay LOR^A . Lamp L^A will therefore become extinguished, but relay LOR^A will remain energized. The movement of signal S^A to its caution position will complete the previously traced circuit for signal repeater relay SR^A including contacts 7—7^b and 8—8^a of the circuit controller of signal S^A , and relay SR^A will then pick up. When this relay picks up, it will cause the winding 6 of the signal for the block to the right of block A—B to be supplied with current of normal polarity, whereupon the mechanism of this signal will move to its proceed position.

When the train leaves the block to the left of block A—B, track relay TR^B will pick up and will cause signal S^B to move to its caution position and lamp L^B to become extinguished in the same manner that the picking up of track relay TR^A caused signal S^A to move to its caution position and lamp L^A to become extinguished. As soon as signal S^B reaches its caution position, signal repeater relay SR^B will pick up, whereupon the mechanism for signal S^A will move to its proceed position. When the train passes out of the second block in advance of block A—B, signal S^B will move to its proceed position, and all parts will then be restored to the positions in which they are shown in the drawing.

I will now assume that with the parts in the positions in which they are shown in the drawing, the filament of lamp L^B becomes broken, and that a train subsequently enters block A—B. When the filament of lamp L^B becomes broken under these conditions, approach lighting relay ALR^B

will, of course, be energized and lightout relay LOR^B will also be energized by virtue of its stick circuit, so that no immediate change in the condition of the apparatus will take place. As soon, however, as the train enters block A—B, the resultant deenergization of track relay TR^A will cause approach lighting relay ALR^B to become deenergized, and when this relay becomes deenergized, it will interrupt the stick circuit for lightout relay LOR^B , thus causing lightout relay LOR^B to become deenergized. The deenergization of relay LOR^B , in turn, will interrupt at its front contact 17 the circuit for the winding 6 of signal S^B , and the mechanism of signal S^B will therefore immediately move to its stop position, whereupon relay SR^B will become deenergized. It will be seen, therefore, that while the train is approaching signal S^B , the mechanism of this signal will occupy its stop position instead of its proceed position. This is desirable because the operating rules of railroads usually require that a dark signal be obeyed as a stop signal, and since the signal mechanism occupies its stop position when the signal is dark, if any light from an extraneous source, such for example, as a locomotive headlight or the sun's rays when the sun is close to the horizon, should enter the signal and be reflected back by the optical assembly of the signal, the resultant indication would be a stop indication.

When the train has passed signal S^B , lightout relay LOR^B will remain deenergized until the burned out signal lamp L^B has been replaced by a new lamp and another train has entered block A—B, and as long as relay LOR^B remains deenergized and no train occupies block A—B, signal S^A will occupy its caution position. As a result, if a train enters the block to the right of point A after the first train has passed signal S^B , signal S^A will display a caution indication instead of a proceed indication, thus insuring that the engineer of the following train will not be required to pass a signal which indicates proceed only to find the signal next in advance dark, and hence eliminating the necessity for, and hazard of, an unexpected brake application in so far as the second or following train is concerned.

If the lamp of a signal burns out after it has become lighted due to the presence of a train immediately in rear of a signal, the operating mechanism of the associated signal will immediately move to its stop position for reasons which will be readily seen from the foregoing and from an inspection of the drawing, and the subsequent operation of the apparatus will be similar to that described above after the signal mechanism had moved to its stop position. With the apparatus constructed in the manner described, it is assumed that if a lamp continues to burn during the entire time a train is approaching a signal, the lamp filament will be intact when the next train reaches a position at which the signal lamp normally becomes illuminated.

Although I have herein shown and described only one form of railway signalling systems 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 stretch of railway track divided into blocks, a two-winding relay associated with each block, a signal for each block

controlled by traffic conditions in advance and by the associated relay and including a lamp which at times becomes lighted to cause the signal to display an indication, an energizing circuit for each lamp controlled by traffic conditions in rear of the associated signal and including one winding of the associated relay, and a stick circuit for each relay including its own front contact and the other winding of the relay and arranged to be closed when and only when the block in rear of the associated signal is unoccupied.

2. In combination, a stretch of railway track divided into blocks, a two-winding relay for each block, a signal for each block controlled by traffic conditions in advance and also by the associated relay in such manner that said signal is prevented from moving to its caution or proceed position unless the associated relay is energized, each said signal being provided with a lamp which at times becomes lighted to cause the signal to display an indication, an energizing circuit for each lamp controlled by traffic conditions in rear of the associated signal and including one winding of the relay, and a stick circuit for each relay controlled by traffic conditions in rear of the associated signal and including the other winding of the relay.

3. In combination, a stretch of railway track divided into blocks, a two-winding relay for each block, a signal for each block controlled by traffic conditions in advance and also by the associated relay in such manner that said signal is prevented from moving to its caution or proceed position unless the associated relay is energized, each said signal being provided with a lamp which at times becomes lighted to cause the signal to display an indication, an energizing circuit for each lamp controlled by traffic conditions in rear of the associated signal and including one winding of the relay, and a stick circuit for each relay including its own front contact and the other winding of the relay and arranged to be closed when and only when the block in rear of the associated signal is unoccupied.

4. In combination, a stretch of railway track divided into blocks, a relay associated with each block, each said relay being provided with a relatively high resistance winding and a relatively low resistance winding, a signal for each block controlled by traffic conditions in advance and by the associated relay and including a lamp which at times becomes lighted to cause the signal to display an indication, an energizing circuit for each lamp controlled by traffic conditions in rear of the associated signal and including the low resistance winding of the associated relay, and a stick circuit for each relay including its own front contact and the high resistance winding of the relay and arranged to be closed when and only when the block in rear of the associated signal is unoccupied.

5. In combination, a stretch of railway track divided into blocks, a two-winding relay associated with each block, a signal for each block controlled by traffic conditions in advance and by the associated relay and including a lamp which at times becomes lighted to cause the signal to display an indication, an energizing circuit for each lamp arranged to be closed when the block in rear of the associated signal is occupied and including one winding of the associated relay, and a stick circuit for each relay including its own front contact and the other winding of the re-

lay and arranged to be closed when and only when the block in rear of the associated signal is unoccupied.

6. In combination, a stretch of railway track divided into blocks, a two-winding relay associated with each block, a signal for each block controlled by traffic conditions in advance and by the associated relay in such manner that when the associated block is occupied or the associated relay is deenergized the mechanism of the signal will occupy its stop position but that when the associated relay is energized the mechanism of the signal will occupy a caution or a proceed position according as the associated block is unoccupied and the block next in advance is occupied or as the associated block and the block next in advance are both unoccupied, means for energizing each lamp when the block next in rear of the associated signal is occupied, means for supplying the one winding of each relay with current when the associated lamp is energized, and means for supplying the other winding of each relay with current over a stick circuit which is controlled by the associated block and the block next in rear when the associated lamp is deenergized but its filament is intact, the parts of each relay being so proportioned that the relay will hold its front contacts closed when either winding is energized.

7. In combination, a stretch of railway track divided into blocks, a two-winding relay associated with each block, a signal for each block controlled by traffic conditions in advance and by the associated relay in such manner that when the associated block is occupied or the associated relay is deenergized the mechanism of the signal will occupy its stop position but that when the associated relay is energized the mechanism of the signal will occupy a caution or a proceed position according as the associated block is unoccupied and the block next in advance is occupied or as the associated block and the block next in advance are both unoccupied, means for energizing each lamp when the block next in rear of or the block immediately in advance of the associated signal is occupied, means for supplying the one winding of each relay with current when the associated lamp is energized, and means for supplying the other winding of each relay with current over a stick circuit which is controlled by the associated block and the block next in rear when the associated lamp is deenergized but its filament is intact, the parts of each relay being so proportioned that the relay will hold its front contacts closed when either winding is energized.

8. In combination, a stretch of railway track divided into blocks, a signal for governing the entrance of traffic into each block responsive to reversals in polarity of the current supplied thereto and including an electric lamp, a signal repeater relay controlled by each signal in such manner that each signal repeater relay will be deenergized when the associated signal is deenergized but will be energized when the associated signal is energized by current of either polarity, a two-winding lightout relay associated with each signal, means for supplying each signal with current of one polarity or the other when the associated block is unoccupied and the associated lightout relay is energized according as the signal repeater relay for the signal next in advance is then energized or deenergized, an approach lighting relay for each signal arranged to be energized whenever the signal next in rear

is supplied with current of either polarity, an energizing circuit for each lamp including one winding of the associated lightout relay and a back contact of the associated approach lighting relay, and a stick circuit for each lightout relay including the other winding of the relay, its own front contact, and a front contact of the associated approach lighting relay.

9. In combination, a stretch of railway track divided into blocks, a signal for governing the entrance of traffic into each block responsive to reversals in polarity of the current supplied thereto and including an electric lamp, a signal repeater relay controlled by each signal in such manner that each signal repeater relay will be deenergized when the associated signal is deenergized but will be energized when the associated signal is energized by current of either polarity, a two-winding lightout relay associated with each signal, means for supplying each signal with current of one polarity or the other when the associated block is unoccupied and the associated lightout relay is energized according as the signal repeater relay for the signal next in advance is then energized or deenergized, an approach lighting relay for each signal arranged to be energized whenever the signal next in rear is supplied with current of either polarity, an energizing circuit for each lamp controlled by the associated approach lighting relay and including one winding of the associated lightout relay, and a stick circuit for each lightout relay controlled by the associated approach lighting relay and including a front contact of the lightout relay.

10. In combination, a stretch of railway track divided into blocks, a track circuit for each block including a track relay, a signal for governing the entrance of traffic into each block including an electric lamp and a winding responsive to reversals in the polarity of the current supplied thereto, a signal repeater relay controlled by each signal in such manner that each signal repeater relay will be deenergized when the associated signal is deenergized but will be energized when the associated signal is energized by current of either polarity, a two-winding lightout relay associated with each signal, an approach lighting relay associated with each signal, a polarized line circuit for the winding of each signal including the winding of the approach lighting relay for the signal next in advance, pole-changing contacts on the signal repeater relay for the signal next in advance, front contacts of the track relay for the associated block, and a front contact of the associated lightout relay; a first energizing circuit for each lamp including a front contact of the track relay for the associated block, and a back contact of the associated approach lighting relay and one winding of the associated lightout relay; a second energizing circuit for the associated lamp including a back contact of the track relay for the associated block and said one winding of the associated lightout relay, and a stick circuit for each lightout relay including the other winding of the relay, its own front contact, a front contact of the associated approach lighting relay and a front contact of the track relay for the associated block.

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