

June 8, 1937.

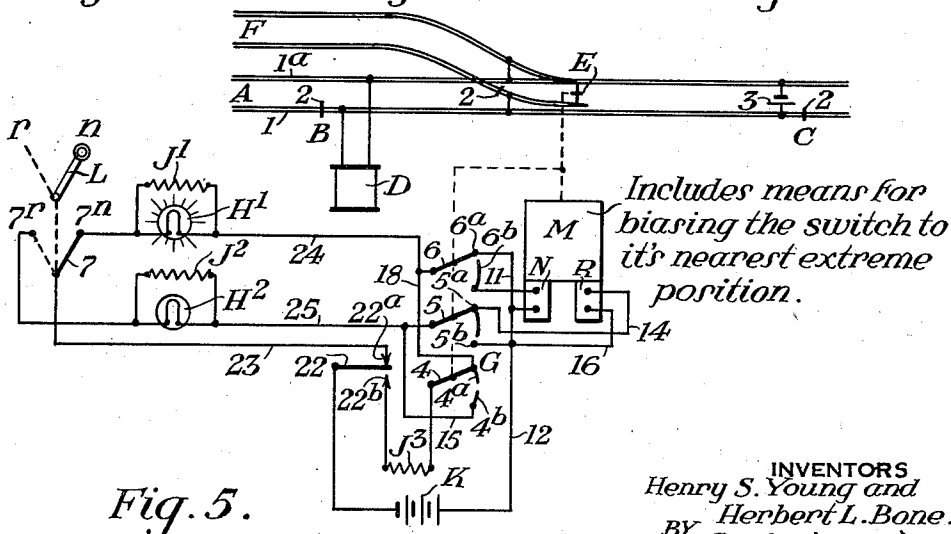
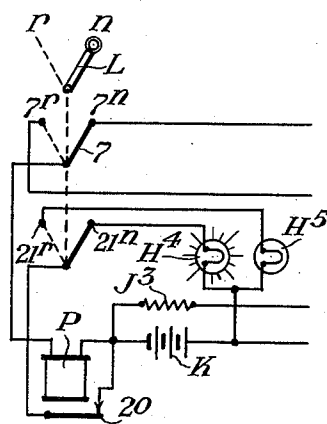
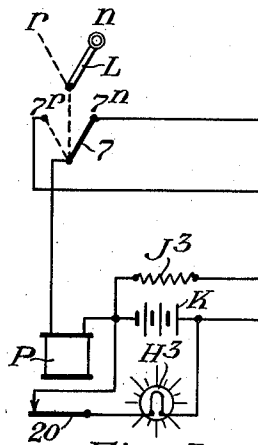
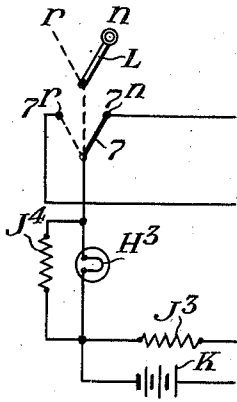
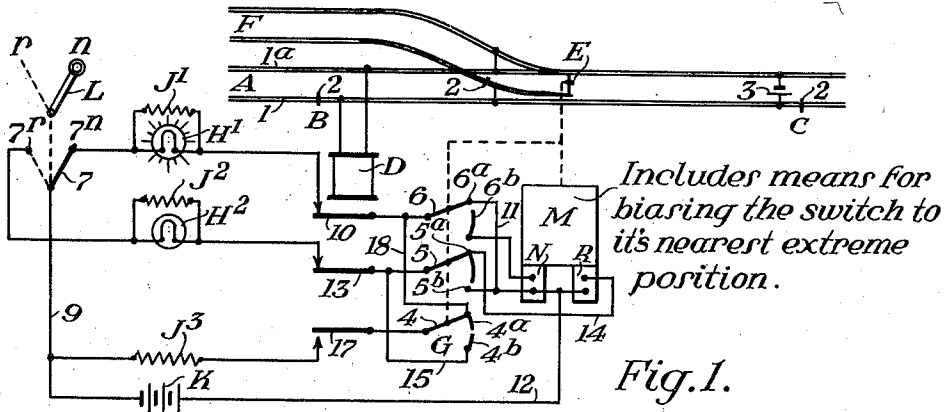
H. S. YOUNG ET AL

2,082,930

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

Filed Dec. 10, 1935

4 Sheets-Sheet 1



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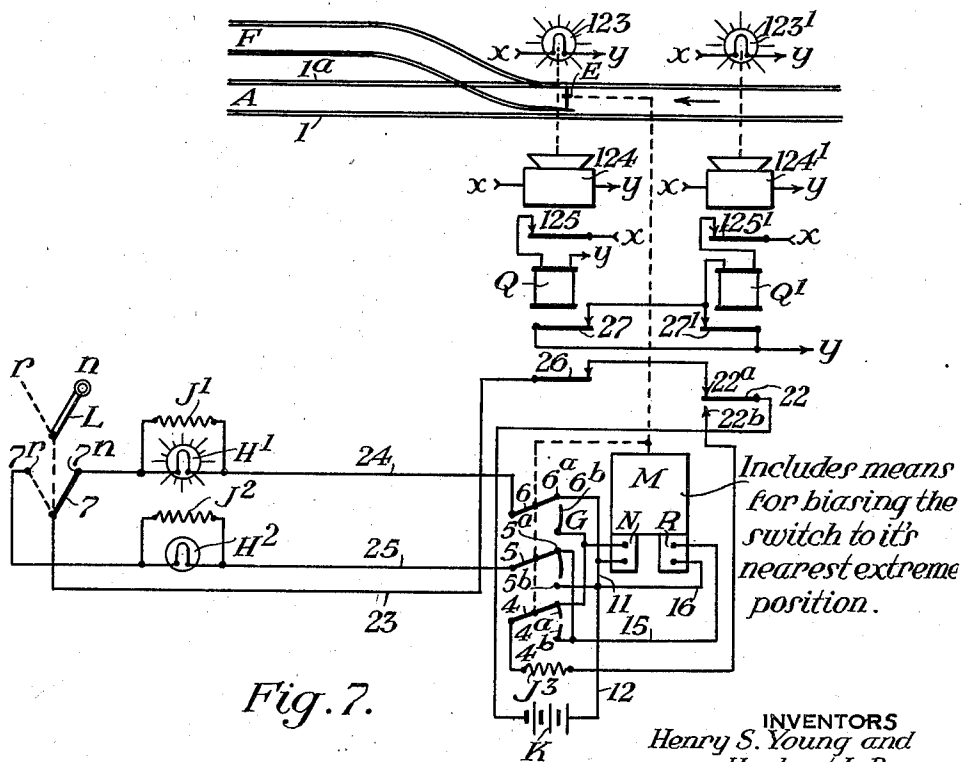
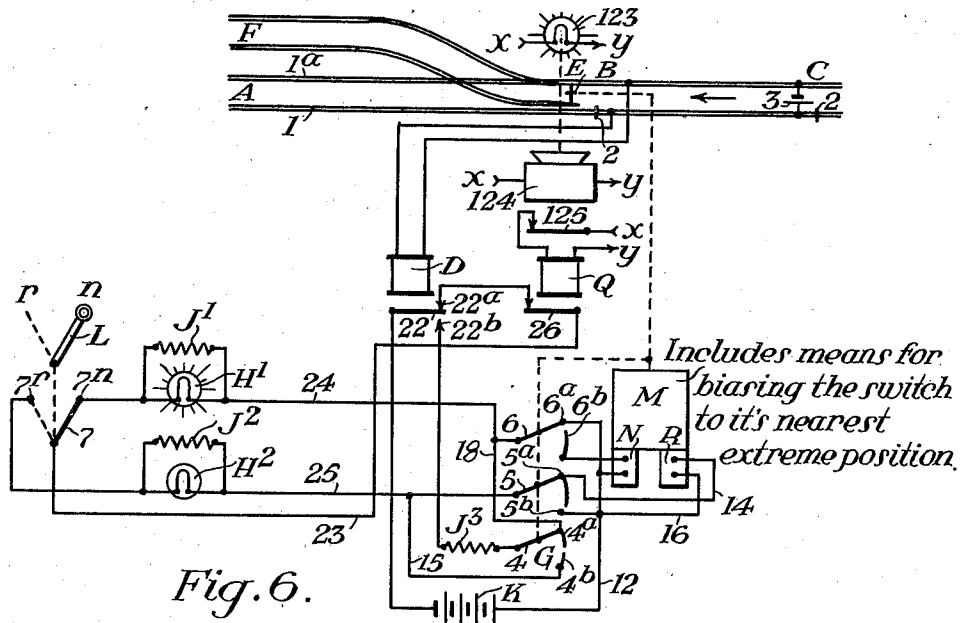
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APPARATUS FOR CONTROLLING RAILWAY SWITCHES

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4 Sheets-Sheet 2



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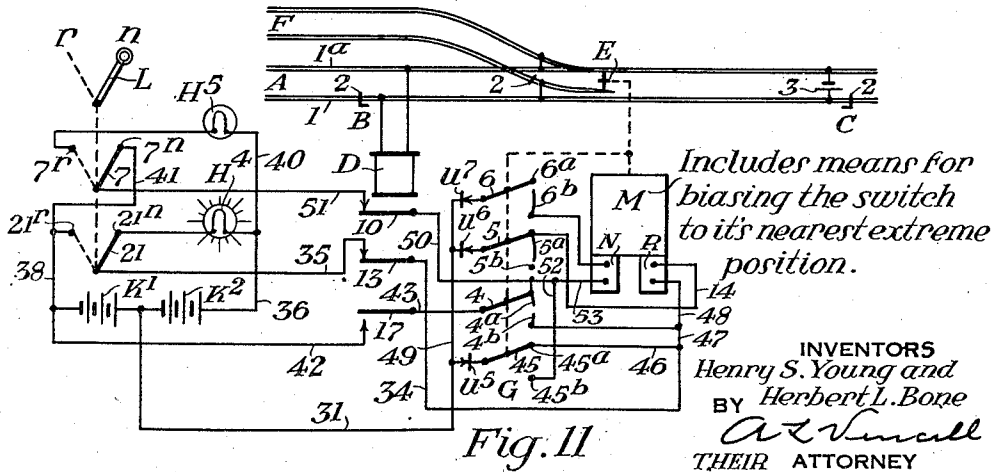
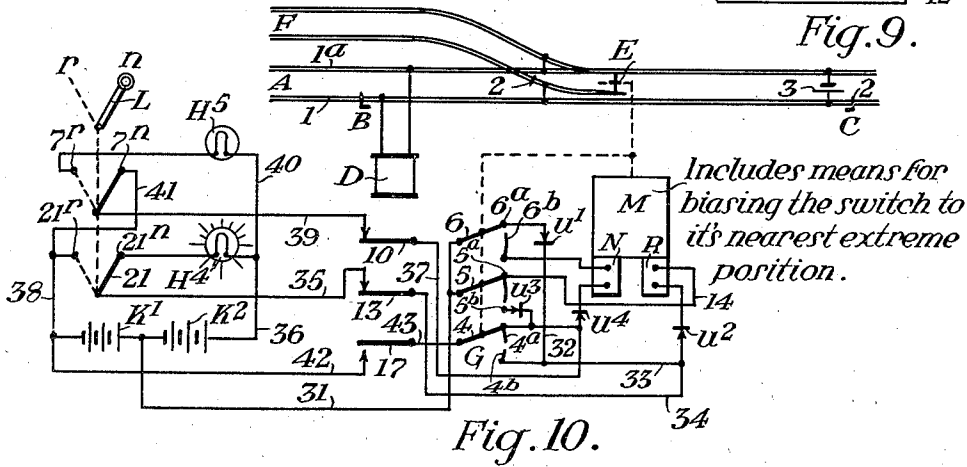
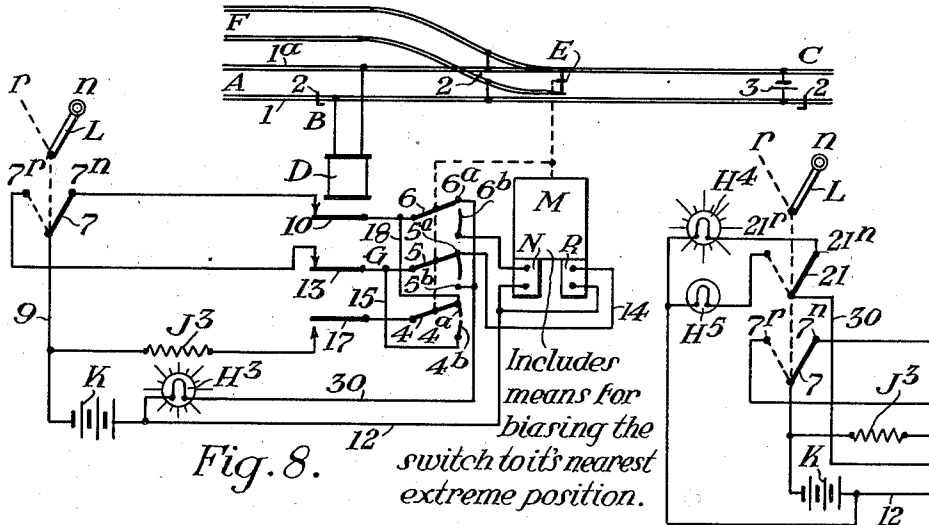
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APPARATUS FOR CONTROLLING RAILWAY SWITCHES

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4 Sheets-Sheet 3



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2,082,930

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

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4 Sheets-Sheet 4

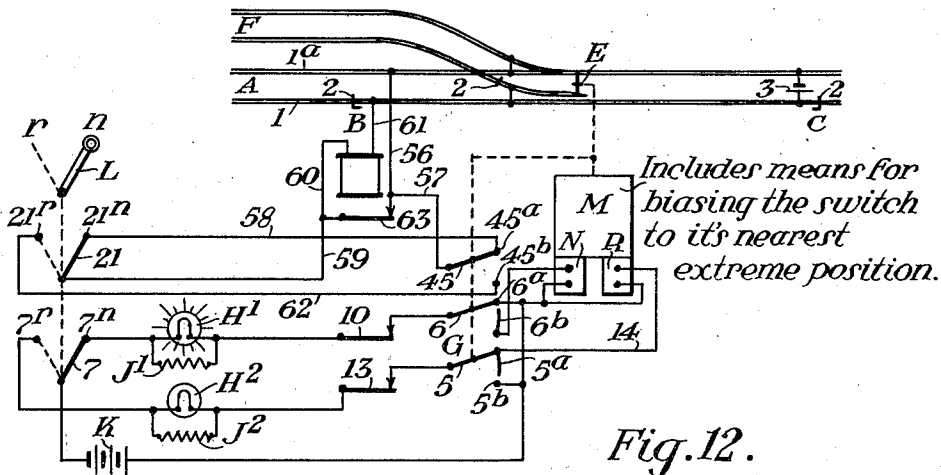


Fig. 12.

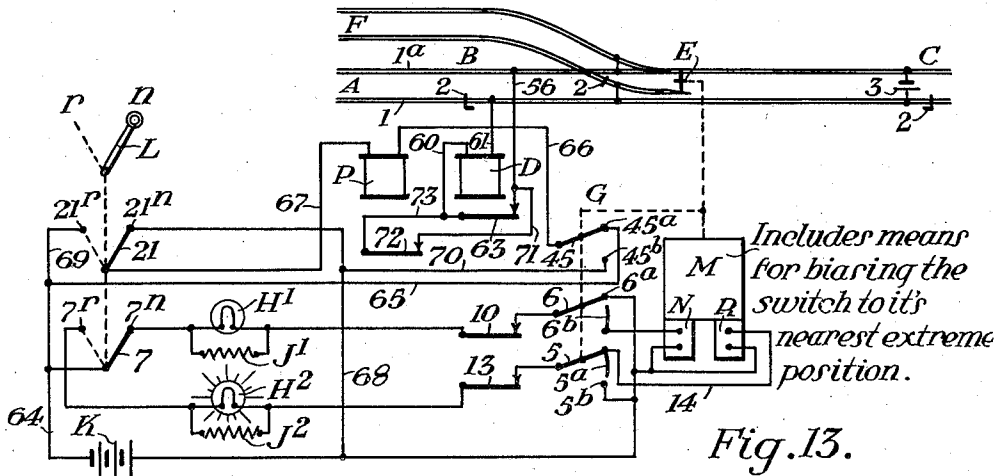


Fig. 13.

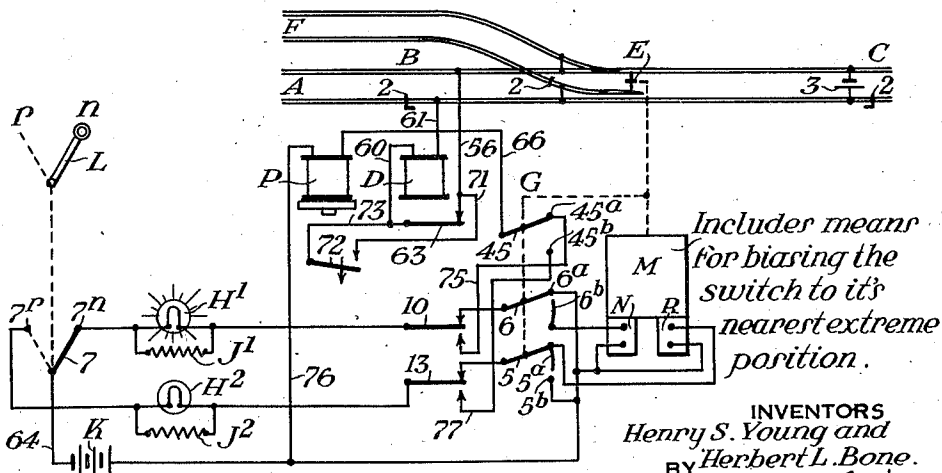


Fig. 14.

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UNITED STATES PATENT OFFICE

2,082,930

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

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Application December 10, 1935, Serial No. 53,774

18 Claims. (Cl. 246—219)

Our invention relates to apparatus for controlling railway switches, and particularly to apparatus for normally controlling a switch from a remote point, but for at times modifying such control in accordance with traffic conditions adjacent the switch.

Apparatus embodying our invention is particularly suitable for, although in no way limited to, the control of railway switches which are arranged to be operated by means of the switch operating mechanism described and claimed in an application for Letters Patent of the United States, Serial No. 40,606, filed by Herbert L. Bone, on September 14, 1935, for Railway switch operating apparatus.

We will describe a number of forms of apparatus embodying our 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 our invention. Figs. 2, 3, and 4 are views showing modifications of portions of the apparatus illustrated in Fig. 1. Figs. 5 to 8, inclusive, and 10 to 14, inclusive, are diagrammatic views showing other forms of apparatus embodying our invention. Fig. 9 is a view showing a modification of a portion of the apparatus illustrated in Fig. 8.

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 track rails of a stretch A of railway track, the one rail 1 of which is divided by means of insulated joints 2 to form a track section B—C. This track section is provided with a track circuit comprising a track relay D connected across the rails adjacent one end of the section, and a suitable source of track circuit current, here shown as a battery 3, connected across the rails adjacent the other end of the section.

Located in section B—C is a switch E which connects the stretch A with a stretch of track F. The switch E is operated by a suitable switch mechanism M, which mechanism, as here shown, is of the electropneumatic type having included therein suitable biasing means for biasing the switch to its nearest extreme position, whereby when the switch is moved to either extreme position, it will be yieldingly held in such extreme position even though the supply of fluid to the operating motor of the mechanism is then cut off. The mechanism M is provided with the usual normal magnet N and reverse magnet R, it being understood that the switch may be moved from

its normal position to its reverse position by energizing the reverse magnet R, and from its reverse position to its normal position by energizing the normal magnet N. One form of mechanism which will operate in the manner just described is shown and described in an application for Letters Patent of the United States, Serial No. 40,606, filed by Herbert L. Bone, on September 14, 1935, for Railway switch operating apparatus.

Operatively connected with the switch E is a circuit controller G comprising three movable contact fingers 4, 5 and 6 which cooperate respectively with fixed contact fingers 4^a 4^b, 5^a 5^b, and 6^a 6^b, to form contacts 4—4^a, 4—4^b, 5—5^a, 5—5^b, 6—6^a, and 6—6^b. Contact 4—4^a is closed when switch E occupies its normal position or any position between its normal position and its mid stroke position; contact 4—4^b is closed when switch E occupies its reverse position, or any position between its reverse position and its mid stroke position; contact 5—5^a is closed when switch E occupies any position but its full reverse position; contact 5—5^b is closed only when switch E occupies its full reverse position; contact 6—6^a is closed only when switch E occupies its full normal position; and contact 6—6^b is closed when switch E occupies any position but its full normal position.

The magnets of the switch mechanism M are controlled by the circuit controller G, by the track relay D and by a manually operable lever L.

The lever L will usually be located at a point remote from the switch, and as here shown is capable of assuming a normal position *n* and a reverse position *r*. Operatively connected with the lever L is a contact arm 7 which cooperates with two fixed contacts 7ⁿ and 7^r to close a normal contact 7—7ⁿ or a reverse contact 7—7^r according as lever L occupies its *n* or its *r* position.

The apparatus also includes two indication lamps H¹ and H², three resistors J¹, J², and J³, and a battery K. The function of the lamps H¹ and H² and resistors J¹, J², and J³ will become apparent as the description proceeds.

As shown in the drawings, all parts are in their normal positions. That is to say, lever L and switch E both occupy their normal positions, and section B—C is unoccupied by a train. Under these conditions, magnets N and R are both de-energized and lamp H² is also deenergized. Lamp H¹, however, is lighted over a normal indication circuit which passes from battery K through wire 9, contact 7—7ⁿ of lever L, the filament of lamp H¹ connected in parallel with resistor J¹, front

contact 10 of relay D, contact 6-6^a of circuit controller G, and wires 11 and 12 back to battery K.

We will now assume that the parts are in the positions in which they are shown in the drawings, and that it is desired to reverse switch E. To do this, lever L is moved from its normal position *n* to its reverse position *r*, thus opening contact 7-7ⁿ and closing contact 7-7^r. The opening of contact 7-7ⁿ interrupts the circuit which was previously closed for indication lamp H¹ so that this lamp now becomes extinguished, while the closing of contact 7-7^r completes a normal control circuit for the reverse magnet R, which circuit passes from battery K through wire 9, contact 7-7^r of lever L, lamp H² connected in parallel with resistor J², front contact 13 of relay D, contact 5-5^a of circuit controller G, wire 14, the winding of magnet R, and wire 12 back to battery K. The reverse magnet R therefore becomes energized and causes the switch E to move to its reverse position. When the switch reaches its reverse position, contact 5-5^a of circuit controller G becomes opened and contact 5-5^b becomes closed. The opening of contact 5-5^a interrupts the circuit which was previously closed for reverse magnet R, whereupon this magnet becomes deenergized and cuts off the supply of fluid pressure to the switch operating mechanism M. The closing of contact 5-5^b of circuit controller G completes a reverse indication circuit including lamp H², which circuit may be traced from battery K through wire 9, contact 7-7^r of lever L, the filament of lamp H² connected in multiple with resistor J², front contact 13 of track relay D, contact 5-5^b of circuit controller G, and wire 12 back to battery K. The indication lamp H² therefore becomes lighted to indicate that the switch occupies its full reverse position.

It should be pointed out that while the circuit over which the reverse magnet R becomes energized during movement of the switch to its reverse position under the conditions just described includes lamp H² connected in multiple with resistor J², the lamp H² will not become lighted under these conditions because the resistance of the reverse magnet R is too high to permit enough current to flow in the lamp. The function of the resistor J² is to prevent the operator from losing control of the switch in the event that the lamp H² burns out.

It should also be pointed out that if, when the switch occupies its reverse position, it should creep away from this position for any reason due, for example, to misadjustment of the biasing means of the mechanism M, contact 5-5^a will become closed and will reestablish the circuit previously traced for the reverse magnet R, thus causing the switch to be immediately restored to its reverse position.

When the switch has been moved to its reverse position in the manner just described and it is desired to restore it to its normal position, lever L is restored to its normal position. Under these conditions, as soon as the lever is moved away from its reverse position, the reverse indication circuit becomes interrupted at contact 7-7^r of lever L, thus causing lamp H² to become extinguished; and when the lever reaches its normal position, the resultant closing of contact 7-7ⁿ of lever L completes a normal control circuit for the normal magnet N passing from battery K through wire 9, contact 7-7ⁿ of lever L, the filament of lamp H¹ connected in multiple with

resistor J¹, front contact 10 of track relay D, contact 6-6^b of circuit controller G, the winding of normal magnet N, and wire 12 to battery K. The normal magnet N therefore becomes energized and causes the switch to move to its normal position. When the switch reaches its full normal position, contact 6-6^b of circuit controller G opens and deenergizes magnet N, and contact 6-6^a of circuit controller G closes and completes the previously described indication circuit for lamp H¹. Lamp H¹ then becomes lighted to indicate that the switch occupies its full normal position.

It should be pointed out that while the circuit over which the normal magnet N becomes energized during the movement of the switch to its normal position under the conditions just described includes lamp H¹ and resistor J¹ connected in multiple, lamp H¹ will not become lighted because the resistance of the normal magnet is too high to permit sufficient current to flow in the lamp H¹. It should also be pointed out that the function of the resistor J¹ is to prevent the operator from losing control of the switch in the event that the lamp H¹ burns out.

It should further be pointed out that if, when the switch occupies its normal position, the switch should creep away from this position for any reason, the resultant closing of contact 6-6^b of circuit controller G will reestablish the energizing circuit described above for the normal magnet, and will thus cause the switch to be immediately restored to its normal position.

We will now assume that the switch occupies its normal position and that a train enters the track section B-C. The presence of a train in this track section will deenergize track relay D, and this relay will therefore open its front contacts 10 and 13 and close its back contact 17. The opening of front contacts 10 and 13 of relay D will interrupt all control circuits which were previously traced for the magnets N and R, thus preventing operation of the switch by means of the lever L as long as the train remains in the section B-C. The opening of the front contact 10 of relay D will also interrupt the normal indication circuit including lamp H¹, thus causing this lamp to become extinguished. The closing of contact 17 will complete a circuit passing from battery K through resistor J³, back contact 17 of track relay D, contact 4-4^a of circuit controller G, wire 18, contact 6-6^a of circuit controller G, and wires 11 and 12 back to battery K. The circuit just traced is inactive, and has no effect on the operation of the apparatus as a whole, it being noted that a relatively small current will flow in this circuit due to the presence of the resistor J³ in the circuit.

If while the train is within section B-C, the switch moves away from its normal position far enough to close contact 6-6^b for any reason, the normal magnet N will become energized over an auxiliary control circuit which may be traced from battery K through wire 9, resistor J³, back contact 17 of track relay D, contact 4-4^a of circuit controller G, wire 18, contact 6-6^b of circuit controller G, the winding of the normal magnet N and wire 12 back to battery K. The energization of the normal magnet will, of course, cause the mechanism to immediately restore the switch to its normal position.

If a train enters the section B-C when the switch occupies its reverse position, the operation of the apparatus will be similar to that just described when the switch occupied its normal po-

sition with the exception that under these latter conditions the opening of front contact 13 of track relay D will interrupt the reverse indication circuit, thus causing lamp H² to become extinguished, while the closing of back contact 17 of relay D will complete another inactive circuit passing from battery K through resistor J³, back contact 17 of track relay D, contact 4—4^b of circuit controller G, wire 15, contact 5—5^b of circuit controller G and wire 12 back to battery K. The closing of this latter circuit will have no effect on the remainder of the apparatus.

If while the train is within section B—C, the switch moves away from its reverse position far enough to close contact 5—5^a of circuit controller G, an auxiliary control circuit for the reverse magnet will become closed, thus causing the mechanism M to immediately restore the switch to its reverse position. This auxiliary control circuit for the reverse magnet R under these conditions passes from battery K through resistor J³, back contact 17 of track relay D, contact 4—4^b of circuit controller G, wire 15, contact 5—5^a of circuit controller G, wire 14, the winding of reverse magnet R, and wire 12 to battery K.

We will now assume that the switch occupies its normal position and that a train trails the switch. Under these conditions, as soon as the train passes the insulated joint 2 which is disposed adjacent the one switch point, track relay D will become deenergized and will complete the previously described inactive circuit including back contact 17 of relay D and resistor J³. This circuit will only remain closed for a brief interval, however, because as soon as the train starts to displace the switch points from their normal positions, contact 6—6^a of circuit controller G will open and will interrupt this circuit. Furthermore, the displacement of the switch points by the train will cause contact 6—6^b to close and complete the previously traced auxiliary control circuit for magnet N. Magnet N will therefore become energized, and will cause the mechanism M to tend to return the switch to its normal position. The extreme forces which are exerted on the switch by the wheels of a train, however, will cause the switch to move toward its reverse position in spite of the fact that magnet N is then energized, and as soon as the switch passes its mid stroke position, the resultant opening of contact 4—4^a of circuit controller G will deenergize magnet N. Furthermore, the resultant closing of contact 4—4^b of circuit controller G will complete the previously described auxiliary control circuit for the reverse magnet R including this contact and the back contact 17 of track relay D, and this magnet will therefore become energized and will assist the train in completing the movement of the switch points to their reverse positions. When the switch points reach their full reverse positions, contact 5—5^a of circuit controller G will open and contact 5—5^b will become closed. The opening of contact 5—5^a will interrupt the auxiliary control circuit for the reverse magnet R, while the closing of contact 5—5^b will complete the inactive circuit including back contact 17 of relay D and resistor J³. When the train which has just trailed the switch departs from the track section B—C, track relay D will pick up and will complete the normal control circuit for the normal magnet N. Normal magnet N will therefore become energized, and will cause the mechanism M to restore the switch to its normal position. When the switch reaches its normal position, the resultant opening of contact 6—6^b of

circuit controller G will deenergize magnet N. Furthermore, the resultant closing of contact 6—6^a of circuit controller G will complete the normal indication circuit. Lamp H¹ will therefore become lighted to indicate that the switch is restored to its normal position. When this happens, all parts will be restored to the positions in which they are shown in the drawings.

When the switch occupies its reverse position and a train trails the switch, the operation of the apparatus will be similar to that just described when the switch occupies its normal position and a train trails the switch. It is believed, therefore, that this latter operation will be apparent from an inspection of the drawings without further description.

It should be noted that resistor J³ has approximately the same resistance as the resistance of either the resistor J¹ or the resistor J² so that when the auxiliary control circuits for the magnets N and R including the resistor J³ are completed, these magnets will be supplied with current of substantially the same magnitude as these magnets are supplied with if one of the lamps H¹ or H² burns out.

If desired, the two indication lamps H¹ and H² may be replaced by a single indication lamp H³ which is connected in series with the control and indication circuits shown in Fig. 1 in the manner illustrated in Fig. 2. The operation of the apparatus as a whole when provided with only one indication lamp is similar to that previously described with the exception that the indication lamp will become lighted whenever either the normal or reverse indication circuit which is the equivalent of that described in connection with Fig. 1 becomes completed, but not when any of the control circuits becomes completed. A resistor J⁴ is preferably connected in multiple with the filament of the lamp H³ for the same reasons that the resistors J¹ and J² are connected in multiple with the lamps H¹ and H² in Fig. 1.

Referring now to Fig. 3, in the modification here illustrated a relay P is connected in series with the control and indication circuits previously described in connection with Fig. 1 in the same manner that the lamp H³ is connected in series with these circuits in Fig. 2. The resistance of relay P is such that this relay will close its front contact 20 when either the normal or reverse indication circuits are closed, but that, this relay will not close its front contact when any of the control circuits are closed. Relay P controls a lamp H³ over a circuit which is obvious from an inspection of the drawings. The operation of the apparatus as a whole when modified as shown in Fig. 3 is similar to that previously described with the exception that relay P will close its front contact 20 whenever either the normal or reverse indication circuit corresponding to that described in connection with Fig. 1 becomes closed, and that when front contact 20 of relay P is closed, lamp H³ will become lighted to give an indication that the switch occupies one or the other of its extreme positions.

One advantage of the apparatus shown in Fig. 3 is that since the control circuits do not have the indication lamps connected in the circuits, these circuits will be unaffected by the burning out of the indication lamp.

In the modification shown in Fig. 4 the apparatus is similar to that shown in Fig. 3 with the exception that lever L is provided with two additional contacts 21—21ⁿ and 21—21^r which contacts are arranged to be closed according as lever

L occupies its *n* or its *r* position, and which contacts control two indication lamps H^4 and H^5 , jointly with the relay P. The circuit for lamp H^4 is closed when and only when lever L occupies its normal position and relay P is energized and includes front contact 20 of relay P, normal contact 21—21ⁿ of lever L, and the filament of lamp H^4 . The circuit for lamp H^5 is closed when and only when lever L occupies its reverse position and relay P is energized and passes from battery K through front contact 20 of relay P, reverse contact 21—21^r of lever L and the filament of lamp H^5 back to battery K. The operation of the apparatus as a whole when modified as shown in Fig. 4 will be understood from the foregoing and from an inspection of the drawings without further description.

Referring now to Fig. 5, the apparatus here shown is similar to that shown in Fig. 1, but the control and indication circuits have been modified in the manner which will now be described to decrease the number of line wires extending from the lever to the operating mechanism.

As shown in Fig. 5, lever L and switch E both occupy their normal positions and section B—C is unoccupied by a train. Under these conditions, the normal and reverse magnets are both deenergized and the indication lamp H^2 is also deenergized. The indication lamp H^1 , however, is energized by virtue of a normal indication circuit which passes from battery K through front contact 22—22^a of relay D, line wire 23, contact 7—7ⁿ of lever L, the filament of lamp H^1 connected in multiple with resistor J^1 , line wire 24, contact 6—6^a of circuit controller G, and wires 11 and 12 back to battery K.

We will now assume that with the parts in the positions just described the operator, wishing to reverse switch E, moves lever L from its normal to its reverse position. Under these conditions, the resultant opening of contact 7—7ⁿ of lever L will interrupt the normal indication circuit just described, while the resultant closing of contact 7—7^r of lever L will complete a normal control circuit for the reverse magnet R passing from battery K through front contact 22—22^a of relay D, line wire 23, contact 7—7^r of lever L, the filament of lamp H^2 connected in multiple with resistor J^2 , line wire 25, contact 5—5^a of circuit controller G, wire 14, the winding of magnet R, and wires 16 and 12 back to battery K. The reverse magnet R will therefore become energized and will move the switch to its reverse position. When the switch reaches its reverse position, contact 5—5^a of circuit controller G will become opened and will deenergize magnet R, and contact 5—5^b of circuit controller G will become closed and will complete a reverse indication circuit. This reverse indication circuit may be traced from battery K through front contact 22—22^a of relay D, line wire 23, contact 7—7^r of lever L, the filament of lamp H^2 connected in multiple with resistor J^2 , line wire 25, contact 5—5^b of circuit controller G and wire 12 back to battery K. Lamp H^2 will therefore become lighted to indicate that the switch and lever both occupy their reverse positions.

If after the switch has been moved to its reverse position in the manner just described it is desired to restore it to its normal position, the operator will restore lever L to its normal position. This movement of the lever will interrupt the reverse indication circuit including lamp H^2 and will complete a normal control circuit for the normal magnet N. This latter circuit may

be traced from battery K through front contact 22—22^a of relay D, line wire 23, contact 7—7ⁿ of lever L, the filament of lamp H^1 connected in multiple with resistor J^1 , line wire 24, contact 6—6^b of circuit controller G, the winding of magnet N, and wire 12 back to battery K. The energization of the normal magnet N will, of course, cause the switch to move to its normal position. When the switch reaches its normal position, contact 6—6^b of circuit controller G will open and will deenergize the normal magnet N, and contact 6—6^a will become closed and will complete the previously described normal indication circuit including the indication lamp H^1 . When the normal indication circuit becomes closed, lamp H^1 will, of course, become lighted to indicate that the switch and lever both occupy their normal positions.

We will now assume that the parts are in the positions in which they are shown in the drawings and that a train enters the section B—C. Under these conditions, relay D will, of course, become deenergized and will open its front contact 22—22^a and will close its back contact 22—22^b. The opening of front contact 22—22^a will interrupt the normal indication circuit that was previously closed at this contact, thus causing the normal indication lamp H^1 to become extinguished, while the closing of contact 22—22^b of relay D will complete an inactive circuit passing from battery K through back contact 22—22^b of relay D, resistor J^3 , contact 4—4^a of circuit controller G, wire 18, contact 6—6^a of circuit controller G, and wires 11 and 12 back to battery K.

If while the train occupies section B—C, the switch points become displaced from their normal positions for any reason, contact 6—6^a of circuit controller G will open and will interrupt the inactive circuit just traced, and contact 6—6^b of circuit controller G will become closed and will complete an auxiliary control circuit for the normal magnet N passing from battery K through back contact 22—22^b of relay D, resistor J^3 , contact 4—4^a of circuit controller G, wire 18, contact 6—6^b of circuit controller G, the winding of the normal magnet N, and wire 12 back to battery K. The normal magnet N will therefore become energized and will admit fluid pressure to the operating motor of the mechanism M, thus causing the mechanism M to immediately restore the switch to its normal position. When the train leaves section B—C, relay D will, of course, again become energized which will cause the apparatus to become restored to the condition which it occupied before the train entered the section.

When the switch occupies its reverse position and a train enters section B—C, the operation of the apparatus will be similar to that just described when the switch occupies its normal position and a train enters section B—C with the exception that, under these latter conditions, the deenergization of relay D will interrupt the reverse indication circuit and will complete another inactive unit. This latter inactive circuit passes from battery K through back contact 22—22^b of relay D, resistor J^3 , contact 4—4^b of circuit controller G, wire 15, contact 5—5^b of circuit controller G and wire 12 back to battery K.

If the switch is displaced from its reverse position for any reason when a train occupies section B—C, contact 5—5^b of circuit controller G will become opened and will interrupt the inactive circuit just traced, and contact 5—5^a will

become closed and will complete an auxiliary control circuit for the reverse magnet R. This auxiliary control circuit for the reverse magnet R passes from battery K through back contact 22—22^b of relay D, resistor J³, contact 4—4^b of circuit controller G, wire 15, contact 5—5^a of circuit controller G, wire 14, the winding of reverse magnet R, and wires 16 and 12 back to battery K. When this auxiliary circuit for the reverse magnet R becomes closed, the reverse magnet will, of course, become energized, and will cause the mechanism M to immediately restore the switch to its reverse position.

We will now assume that the parts occupy the positions in which they are shown in the drawings and that a train trails the switch. Under these conditions, the track relay D will become deenergized as soon as the train starts to trail the switch and will cause the normal magnet N to become energized over the auxiliary control circuit previously traced for the magnet. The excessive forces which are exerted on the switch by the trailing train, however, will force the switch toward its reverse position and as soon as the switch is forced past its mid stroke position, contact 4—4^a of circuit controller G will become opened and will interrupt the auxiliary control circuit which was previously closed for the normal magnet at this contact and the contact 4—4^b will become closed and will complete the auxiliary control circuit previously traced for the reverse magnet R. The normal magnet will therefore become deenergized and the reverse magnet R will become energized, thus causing the mechanism M to assist the train in completing the movement of the switch to its reverse position. As soon as the switch reaches its reverse position, contact 5—5^a of circuit controller G will open and will deenergize the reverse magnet, and contact 5—5^b will become closed and will complete the previously described inactive circuit. When the train leaves section B—C, relay D will pick up and will interrupt the inactive circuit and will complete the normal control circuit for the normal magnet N. This will cause the mechanism to restore the switch to its normal position. When the switch reaches its normal position, lamp H¹ will become lighted in the manner previously described.

When the switch occupies its reverse position and a train trails the switch, the operation of the apparatus will be similar to that just described when the switch occupies its normal position and a train trails the switch, and it is believed, therefore, that this latter operation will be apparent from the foregoing and from an inspection of the drawings without further detailed description.

Referring now to Fig. 6, in the modified form of the apparatus here shown, the switch E, instead of being located in section B—C, is located immediately to the left of this section, and disposed on opposite sides of the switch a short distance back from the points are a source of light 123 and a light sensitive device 124. The source of light 123 and light sensitive device 124 are so arranged that light from the source 123 will normally strike the device but will be interrupted by the body of a car which is moving over the switch. The light 123 is constantly connected with the terminals X and Y of a suitable source of current, and the device 124 is similarly constantly connected with the terminals X and Y of the source. The device 124 is provided with a front contact 125 which is closed or opened

according as the device does or does not receive light from the source 123, and this contact is connected in series with the winding of a relay Q. It will be apparent, therefore, that relay Q will be picked up or released according as the device 124 does or does not receive light from the source 123. The remainder of the apparatus shown in Fig. 6 is similar to that shown in Fig. 5 and the circuits for controlling the magnet valves N and R are likewise similar to those shown in Fig. 5 with the exception that the normal indication circuit and the normal control circuit over which the normal magnet becomes energized when the lever L is moved to its normal position to move the switch from its reverse position to its normal position have both been modified to include a front contact 26 of relay Q, and that, the reverse indication circuit and the normal control circuit over which the reverse magnet becomes energized when the lever is moved to its reverse position to move the switch from its normal position to its reverse position have likewise both been modified to include the front contact 26 of relay Q.

The operation of the apparatus shown in Fig. 6 in so far as the movement of the switch to its normal and reverse positions in response to the movement of the lever to its normal and reverse positions is concerned is identical with that previously described in connection with Fig. 5 and will be understood from the foregoing without further description.

When a train moving in the direction of the arrow enters track section B—C, the resultant deenergization of relay D will open the normal control and indication circuits and will complete one or the other of the inactive circuits depending upon which position the switch then occupies in the same manner as was previously described in connection with Fig. 5 when a train entered the section B—C. When the train reaches the position where it is directly opposite the switch, it will intercept the beam of light from the source 123 and will thus cause relay Q to become deenergized. The deenergization of this relay under these conditions, however, will have no effect on the remainder of the apparatus until after the train clears the track section B—C in which event the normal indication circuit will be retained open at front contact 26 until the car clears the light beam. When a train moving in the direction opposite to that indicated by the arrow passes the switch, it will cause relay Q to become deenergized before track relay D becomes deenergized. The deenergization of relay Q will open all control and indication circuits, thus preventing operation of the switch by the lever while a train is passing the switch. The deenergization of relay D under these conditions will have no effect on the apparatus unless the switch points should be displaced from this original position, for any reason, in which event one or the other of the auxiliary control circuits will become closed at back contact 22—22^b of relay D, and cause the mechanism M to immediately restore the switch points to their original positions.

When a train trails the switch, the operation will be similar to that just described with the exception that the trailing train will force the points to their trailed position before relay D becomes deenergized, thus permitting the switch to be trailed without applying fluid to the operating motor of the switch mechanism M during the movement of the points to their trailed positions.

If the points become displaced from their trailed positions before the train clears section B—C, one or the other of the auxiliary control circuits depending upon the position the switch occupies, will become completed in an obvious manner and will immediately restore the parts to their trailed positions. When the trailing train clears section B—C, the resultant picking up of relay D will complete the proper control circuit to cause the switch to be restored to its original position.

Referring now to Fig. 7, as here shown, the track relay D shown in Fig. 6 has been replaced by a relay Q¹ which is controlled by a light sensitive device 124¹. The light sensitive device 124¹ is disposed on the opposite side of the track A from a source of light 123¹ in such manner that a car approaching the switch E in a facing point direction will intercept the supply of light to the device 124¹ when the car reaches a point which is slightly less than a car length away from the switch, and will continue to intercept the light to the device 124¹ until after the car intercepts the supply of light to the device 124. The relay Q¹, as here shown, is provided with a pickup circuit which passes from terminal X of the source through front contact 125¹ of light sensitive device 124¹, the winding of relay Q¹, and a front contact 27 of relay Q to terminal Y. Relay Q¹ is also provided with a stick circuit which passes from terminal X through front contact 125¹ of device 124¹, the winding of relay Q¹ and front contact 27¹ of relay Q¹ to terminal Y. The remainder of the apparatus shown in Fig. 7 is similar to that shown in Fig. 6, but the control and indication circuits have been modified somewhat in a manner which will become apparent from the following description of the operation of the apparatus as a whole.

As shown in the drawings, lever L and switch E both occupy their normal positions, and stretch A is unoccupied so that both light sensitive devices 124 and 124¹ are receiving light from the associated sources 123 and 123¹. Under these conditions, relays Q and Q¹ are both picked up, and the normal and reverse magnets N and R are both deenergized. Furthermore, under these conditions, the normal indication lamp H¹ is energized by virtue of a circuit which passes from battery K through front contact 22—22^a of relay Q¹, front contact 26 of relay Q, line wire 23, the contact 7—7^a of lever L, the filament of lamp H¹ connected in multiple with resistor J¹, line wire 24, contact 6—6^a of circuit controller G, and wires 11 and 12 back to battery K.

We will now assume that with the parts in the positions just described the operator, wishing to reverse the switch E, moves lever L to its reverse position. This movement of lever L will interrupt the indication circuit for lamp H¹ at contact 7—7^a, and will complete a normal control circuit for the reverse magnet R passing from battery K through front contact 22—22^a of relay Q¹, front contact 26 of relay Q, line wire 23, contact 7—7^a of lever L, the filament of lamp H² connected in multiple with resistor J², line wire 25, contact 5—5^a of circuit controller G, wire 15, the winding of reverse magnet R, and wires 16 and 12 back to battery K. The interruption of the indication circuit for the lamp H¹ will cause this lamp to become extinguished, while the closing of the normal control circuit for the magnet R will cause this magnet to become energized, thus causing the switch to move to its reverse position. When the switch reaches its reverse posi-

tion, contact 5—5^a of circuit controller G will open and will interrupt the circuit which was previously closed for reverse magnet R, and contact 5—5^b of circuit controller G will become closed and will complete a reverse indication circuit passing from battery K through front contact 22—22^a of relay Q¹, front contact 26 of relay Q, line wire 23, contact 7—7^a of lever L, the filament of lamp H² connected in multiple with resistor J², line wire 25, contact 5—5^b of circuit controller G, and wire 12 back to battery K. Lamp H² will therefore become energized to indicate that the switch and lever both occupy their reverse positions.

When the switch has been moved to its reverse position in the manner just described and it is desired to restore it to its normal position, the operator will restore lever L to its normal position. This movement of the lever will interrupt the reverse indication circuit including lamp H² and will complete a normal control circuit for the normal magnet N passing from battery K through front contact 22—22^a of relay Q¹, front contact 26 of relay Q, line wire 23, normal contact 7—7^a of lever L, the filament of lamp H¹ connected in multiple with resistor J¹, line wire 24, contact 6—6^b of circuit controller G, the winding of normal magnet N, and wires 11 and 12 back to battery K. The reverse indication lamp will therefore become extinguished and the normal magnet N will become energized. The energization of the normal magnet N will, of course, cause the switch to move to its normal position, and when the switch reaches its normal position, the resultant opening of contact 6—6^b of circuit controller G will deenergize the normal magnet. Furthermore, when the switch reaches its normal position the resultant closing of contact 6—6^a of circuit controller G will reestablish the previously traced normal indication circuit including lamp H¹.

If when the parts are in their normal positions in which they are shown in the drawings the switch becomes displaced for any reason, contact 6—6^a of circuit controller G will become opened and contact 6—6^b will become closed. The closing of contact 6—6^b will complete the previously described circuit for the normal magnet N which magnet will therefore become energized and cause the switch to be immediately restored to its normal position. In a similar manner, if when the switch is moved to its reverse position by movement of the lever L to its reverse position, the switch is moved away from its reverse position for any reason the resultant closing of contact 5—5^a of circuit controller G will reestablish the previously described normal control circuit for the reverse magnet R and will thus cause the switch to be immediately restored to its reverse position.

When a train moving in the direction of the arrow traverses the stretch of track shown in the drawings, it will intercept the beam of light from the source 123¹ and will thus cause relay Q¹ to become deenergized, before the train reaches the switch. If, when relay Q¹ becomes deenergized, the switch occupies its normal position, the deenergization of this relay will complete an auxiliary control circuit for the normal magnet N passing from battery K through back contact 22—22^b of relay Q¹, resistor J³, contact 4—4^a of circuit controller G, the winding of magnet N and wires 11 and 12 to battery K. The completion of this auxiliary control circuit for the normal magnet N will, of course, cause this mag-

net to become energized and will thus insure that when the train reaches the switch, the switch will be held in its full normal position. If, however, when relay Q^1 becomes deenergized the switch occupies its reverse position, an auxiliary control circuit for the reverse magnet R will become energized which latter circuit passes from battery K through back contact 22—22^b of relay Q^1 , resistor J³, contact 4—4^b of circuit controller G, wire 15, the winding of reverse magnet R, and wires 16 and 12 back to battery K. Under these latter conditions, therefore, the reverse magnet R will become energized and will cause the switch to be held in its reverse position. As the train passes over the switch, it will intercept the beam of light to the device 124 and will cause relay Q to become deenergized. The deenergization of this relay will interrupt at its front contact 27 the pickup circuit for relay Q^1 , and since the stick circuit for relay Q^1 is then open at its own front contact 27¹, relay Q^1 will be prevented from picking up until after the train has completely passed the switch. When this happens, relay Q will pick up, and as soon as this relay picks up, relay Q^1 will become picked up. The picking up of relay Q^1 will deenergize the normal or reverse magnet which was previously energized and will complete the normal control circuit for the indication lamp H¹ or H² thus restoring the parts to the conditions which they occupied before the train started to traverse the stretch.

We will now assume that the parts are in the positions in which they are shown in the drawings and that a train trails the switch. Under these conditions, relay Q will become deenergized before the train reaches a position in which it exerts a force on the points of the switch, and the deenergization of this relay will interrupt the normal indication circuit which was previously closed at this contact. Furthermore, the deenergization of relay Q will prevent the normal control circuit for the normal magnet N from becoming energized when the switch points are displaced by the trailing train and it will be apparent, therefore, that under these conditions the movement of the switch to its reverse position will be opposed only by the biasing means which are included in the mechanism M, and that as soon as the switch has been moved to its mid stroke position these biasing means will become effective to complete the movement of the switch. When the train reaches the position where it intercepts the beam of light to the device 124¹, relay Q^1 will become deenergized and will complete the previously described auxiliary control circuit for the reverse magnet R, thus causing the switch to be securely held in its reverse position until after the train clears the light sensitive device 124¹. When this happens, the resultant picking up of relay Q^1 will reestablish the normal control circuit for the normal magnet N and fluid pressure will then be admitted to the mechanism M to cause the switch to be restored to its normal position. When the switch reaches its normal position, the normal magnet will become deenergized and the normal indication lamp H¹ will become energized in a manner which will be apparent from the foregoing without further description.

When the switch occupies its reverse position and a train trails it, the operation of the apparatus will be similar to that just described with the exception that when the train has moved the switch points to their normal position, the auxiliary control circuit for the normal magnet N will then become completed and will thus cause

the normal magnet to become energized. This magnet will subsequently remain energized until the rear end of the train passes the device 124¹ and it follows, therefore, that under these conditions the switch will be positively held in its normal position until the train has cleared the device 124¹. When this happens, relay Q^1 will pick up and will cause the parts to be automatically restored to the positions which they occupied before the train started to trail the switch in a manner which will be readily understood from the foregoing without further description.

Referring now to Fig. 8, the apparatus here shown is similar to that shown in Fig. 1 with the exception that only one indication lamp H³ is provided, and that the circuits have been rearranged in such manner that this indication lamp is not included in any of the control circuits and is capable of giving three distinctive indications, as will now be made clear.

The operation of the apparatus shown in Fig. 8 as a whole is as follow: As shown in the drawings, lever L occupies its normal position, section B—C is unoccupied, and switch E occupies its normal position. Under these conditions, the normal and reverse magnets are both deenergized but the indication lamp H³ is energized over a normal indication circuit which passes from battery K through wire 9, contact 7—7ⁿ of lever L, front contact 10 of relay D, contact 6—6^a of circuit controller G, wire 30, and the filament of lamp H³ to battery K. When the lamp is energized over this circuit, it burns with full brilliancy, thus indicating that the switch and lever occupy corresponding extreme positions and section B—C is unoccupied.

If the operator in charge of lever L wishes to reverse the switch, he reverses lever L, thereby opening contact 7—7ⁿ and closing contact 7—7^r. The opening of contact 7—7ⁿ interrupts the indication circuit which was previously closed for lamp H³ at this contact, thus causing this lamp to become extinguished, while the closing of the contact 7—7^r completes a normal control circuit for the reverse magnet R which is identical with the corresponding circuit for this magnet which becomes closed when lever L is moved to its reverse position in Fig. 1 with the exception that this circuit does not include an indication lamp. Mechanism M is therefore actuated to move switch E to its reverse position. When the switch reaches its reverse position, contact 5—5^a of circuit controller G opens and deenergizes the reverse magnet, and contact 5—5^b closes and completes a reverse indication circuit for lamp H³. This latter indication circuit may be traced from battery K through wire 9, contact 7—7^r of lever L, front contact 13 of relay D, contact 5—5^b of circuit controller G, wire 30, and the filament of lamp H³ to battery K. Lamp H³ therefore becomes lighted at full brilliancy to again indicate that the switch and lever occupy corresponding extreme positions and section B—C is unoccupied.

If the operator wishes to restore switch E to its normal position, he returns lever L to its normal position, whereupon the normal magnet becomes energized by virtue of a normal control circuit which is similar to that previously described in connection with Fig. 1 with the exception that this circuit does not include an indication lamp. Mechanism M then restores the switch to its normal position. When the switch reaches its normal position, contact 6—6^b of circuit controller G opens and deenergizes magnet N, and contact

6—6^a closes and completes the normal indication circuit for lamp H³. Lamp H³ therefore becomes energized at full brilliancy to indicate that the switch and lever occupy corresponding extreme positions and section B—C is unoccupied.

When the parts occupy their normal positions in which they are shown in the drawings and a train enters section B—C, the resultant deenergization of relay D will open all control circuits controlled by lever L, thus preventing operation of the switch by the lever as long as the section B—C remains occupied. The deenergization of relay D will also interrupt the normal indication circuit including normal contact 7—7^a of lever L and will complete an auxiliary indication circuit passing from battery K through resistor J³, back contact 17 of relay D, contact 4—4^a of circuit controller G, wire 18, contact 6—6^a of circuit controller G, wire 30, and the filament of lamp H³ back to battery K. The resistance of the resistor J³ is such that when this circuit is closed, lamp H³ will become lighted at reduced brilliancy, thus giving an indication that the switch is in one of its extreme positions and section B—C is occupied. If the switch does not occupy its normal position at any time while section B—C is occupied by the train, contact 6—6^a of circuit controller G will be open and contact 6—6^b will be closed, and under these conditions current will flow from battery K through resistor J³, back contact 17 of relay D, contact 4—4^a of circuit controller G, wire 18, contact 6—6^b of circuit controller G, the winding of normal magnet N, and wire 12 back to battery K. The magnet N will therefore become energized and will immediately restore the switch to its normal position.

If a train enters section B—C when the switch occupies its reverse position, the operation of the apparatus will be similar to that just described with the exception that under these conditions the indication lamp H³ will become lighted at reduced brilliancy over another auxiliary indication circuit which passes from battery K through resistor J³, back contact 17 of relay D, contact 4—4^b of circuit controller G, wire 15, contact 5—5^b of circuit controller G, wire 30, and the filament of lamp H³ to battery K. If the switch moves away from its reverse position for any reason while the train is in section B—C, contact 5—5^a of circuit controller G will become closed and will complete an auxiliary control circuit for the reverse magnet R passing from battery K through resistor J³, back contact 17 of relay D, contact 4—4^b of circuit controller G, wire 15, contact 5—5^a of circuit controller G, wire 14, the winding of reverse magnet R, and wire 12 back to battery K. The reverse magnet R will therefore become energized and will immediately restore the switch to its reverse position.

We will now assume that the parts are in their normal positions and that a train trails the switch. Under these conditions, as soon as the train has moved the switch away from its normal position far enough to close contact 6—6^b of circuit controller G, the normal magnet N will become energized over the previously traced auxiliary control circuit including contact 6—6^b of circuit controller G, contact 4—4^a of circuit controller G, and back contact 17 of relay D and will thus cause the mechanism M to tend to retain the switch in its normal position. The train, however, will exert sufficient force on the switch to move it toward its reverse position in opposition to the force exerted on it by the mechanism M, and as soon as the switch passes its midstroke

position, the circuit which was previously closed for the normal magnet N will become interrupted at contact 4—4^a of circuit controller G, and a circuit for the reverse magnet R will become closed at contact 4—4^b of circuit controller G. This latter circuit may be traced from battery K through resistor J³, back contact 17 of relay D, contact 4—4^b of circuit controller G, wire 15, contact 5—5^a of circuit controller G, wire 14, the winding of magnet R, and wire 12 back to battery K. The energization of magnet R will cause the mechanism M to assist the train in moving the switch to its reverse position. When the switch reaches its reverse position, contact 5—5^a of circuit controller G will open and will deenergize magnet R. Furthermore, contact 5—5^b will become closed and will complete the previously described auxiliary indication circuit for lamp H³ including this contact and back contact 17 of relay D. Lamp H³ will therefore become lighted at reduced brilliancy, thus indicating that the switch has reached its reverse position. When the train which trailed the switch departs from section B—C, relay D will, of course, pick up and will thus interrupt the auxiliary indication circuit which was previously closed at back contact 17. Furthermore, the picking up of this relay will complete the previously described circuit for the normal magnet N including front contact 10 of relay D and contact 6—6^b of circuit controller G. This magnet will therefore become energized and will cause the mechanism M to restore the switch to its normal position. As soon as the switch reaches its normal position, contact 6—6^b of circuit controller G will open and will deenergize the magnet N, and contact 6—6^a of circuit controller G will become closed and will complete the previously described indication circuit for lamp H³ including this contact. It will be apparent, therefore, that with the apparatus constructed as shown in Fig. 8 if a train trails the switch when the switch occupies its normal position, the switch will be restored to its normal position as soon as the train departs from the section B—C.

If a train trails the switch when the switch occupies its reverse position as soon as the switch points have been forced away from their reverse position far enough to close contact 5—5^a of circuit controller G, a circuit for the reverse magnet R will become completed which may be traced from battery K through resistor J³, back contact 17 of relay D, contact 4—4^b of circuit controller G, wire 15, contact 5—5^a of circuit controller G, wire 14, the winding of the reverse magnet R, and wire 12 back to battery K. The reverse magnet R will therefore become energized and will cause the mechanism M to oppose the movement of the switch. The train, however, will continue to force the points toward their normal positions, and as soon as the switch passes its mid stroke position, the circuit which was previously closed for the reverse magnet R will become opened at contact 4—4^b of circuit controller G and a circuit for the normal magnet N will become closed at contact 4—4^a of circuit controller G. This latter circuit passes from battery K through resistor J³, back contact 17 of track relay D, contact 4—4^a of circuit controller G, wire 18, contact 6—6^b of circuit controller G, the winding of normal magnet N, and wire 12 to battery K. The reverse magnet R will therefore become deenergized and the normal magnet N will become energized, thus caus-

ing the mechanism M to assist the train in moving the switch to its normal position. When the switch reaches its full normal position, the resultant opening of contact 6—6^b of circuit controller G will deenergize the normal magnet N and the resultant closing of contact 6—6^a of circuit controller G will complete the previously described auxiliary indication circuit for lamp H³ including the contact 6—6^a and the back contact 17 of relay D. When the train departs from the section B—C, relay D will, of course, pick up thereby opening its back contact 17 and closing its front contacts 10 and 13. The opening of back contact 17 will interrupt the auxiliary indication circuit for lamp H³ including this contact, while the closing of front contact 13 of the relay will complete the previously described circuit for the reverse magnet R including this contact and contact 5—5^a of circuit controller G. The reverse magnet R will therefore become energized and will cause the mechanism M to restore the switch to its reverse position. When the switch reaches its reverse position, contact 5—5^a of circuit controller G will open and will deenergize the magnet R, and contact 5—5^b of circuit controller G will close and will complete the previously described indication circuit for the lamp H³.

It follows from the foregoing that with the apparatus constructed as shown in Fig. 8, when the switch occupies either extreme position, lamp H³ will be lighted at full brilliancy or at reduced brilliancy according as section B—C is unoccupied or occupied and that, when the switch is in transit, the lamp will be extinguished, thus giving three distinctive indications by means of a single indication lamp.

Referring now to Fig. 9, we have here shown a modification of a portion of the apparatus shown in Fig. 8. As here illustrated, two indication lamps H⁴ and H⁵ are provided. The lamp H⁴ is connected between the wire 30 and the negative terminal of battery K in series with a normal contact 21—21ⁿ of lever L, while the lamp H⁵ is similarly connected in series with a contact 21—21^r of lever L between the wire 30 and the negative terminal of the battery K. It will be seen, therefore, that with the apparatus modified as shown in Fig. 9, the lamp H⁴ will become energized at full brilliancy when the switch and lever both occupy their normal positions and section B—C is unoccupied, and at reduced brilliancy when the switch occupies its normal position and section B—C is occupied, or when the switch is forced to its reverse position by a trailing train. It will also be seen that lamp H⁵ will become energized at full brilliancy when the switch and lever both occupy reverse positions, and section B—C is unoccupied, and at reduced brilliancy when the switch occupies its reverse position and section B—C is occupied, or when the switch is forced to its normal position by a trailing train. It will further be seen that when switch E is in transit, both lamps H⁴ and H⁵ will be extinguished, thus giving the operator an indication at all times of the position of the switch and whether or not section B—C is occupied or unoccupied.

Referring now to Fig. 10, we have here shown another form of apparatus for controlling the switch E. The apparatus here shown is similar to that previously described in connection with Fig. 1 with the exception that the control and indication circuits have been separated, two bat-

a single battery K, and a number of rectifiers have been provided to permit the use of a minimum number of line wires between the control lever and the switch.

The operation of the apparatus shown in Fig. 10 is as follows: As illustrated in the drawings, all parts are in their normal positions. All parts of the apparatus are therefore deenergized with the exception of the track relay D and the normal indication lamp H⁴. The circuit over which the normal indication lamp H⁴ is energized passes from battery K² through line wire 31, contact 6—6^a of circuit controller G, asymmetric unit U¹ in its low resistance direction, wires 32, 33 and 34, front contact 13 of track relay D, line wire 35, contact 21—21ⁿ of lever L, the filament of lamp H⁴ and wire 36 back to battery K².

Assuming now that it is desired to reverse switch E, lever L is moved from its normal position to its reverse position. This movement of the lever interrupts the normal indication circuit which was previously closed for lamp H⁴, thus causing this lamp to become extinguished. This movement of the lever also completes a normal control circuit for the reverse magnet R passing from battery K¹ through wire 38, contact 21—21^r of lever L, line wire 35, front contact 13 of track relay D, wire 34, an asymmetric unit U² in its low resistance direction, the winding of magnet R, wire 14, contact 5—5^a of circuit controller G, and line wire 31 back to battery K¹. The reverse magnet R therefore becomes energized and causes the mechanism M to move the switch E from its normal position to its reverse position. When the switch reaches its reverse position, contact 5—5^a of circuit controller G becomes opened and interrupts the circuit over which the reverse magnet R was previously energized, thus causing this magnet to become deenergized. Furthermore, contact 5—5^b of circuit controller G becomes closed and completes a reverse indication circuit passing from battery K² through line wire 31, contact 5—5^b of circuit controller G, an asymmetric unit U³ in its low resistance direction, wire 37, front contact 10 of relay D, line wire 39, contact 7—7^r of lever L, the filament of lamp H⁵, and wires 40 and 36 to battery K². Lamp H⁵ therefore becomes energized to indicate that the switch now occupies its reverse position.

When the switch occupies its reverse position and it is desired to restore the switch to its normal position, lever L is restored to its normal position. This movement of the lever interrupts the reverse indication circuit and completes a normal control circuit passing from battery K¹ through wires 38 and 41, contact 7—7ⁿ of lever L, line wire 39, front contact 10 of track relay D, wire 37, an asymmetric unit U⁴ in its low resistance direction, the winding of the normal magnet N, contact 6—6^b of circuit controller G, and wire 31 back to battery K¹. The interrupting of the reverse indication circuit, of course, causes the reverse indication light H⁵ to become extinguished, while the closing of the normal control circuit causes the normal magnet N to become energized. The energization of the normal magnet N, in turn, causes the switch mechanism M to restore the switch E to its normal position. When the switch reaches its normal position, the resultant opening of contact 6—6^b of circuit controller G interrupts the circuit which was previously closed for the normal magnet, thus causing this magnet to become deenergized; while the resultant closing of the contact 6—6^a of circuit

controller G completes the previously described normal indication circuit, thus causing lamp H⁴ to become energized.

When a train enters section B—C, track relay D will become deenergized and will open its front contacts 10 and 13 and will close its back contact 17. The opening of the contacts 10 and 13 will prevent operation of the switch by the lever L as long as the train remains in section B—C in a manner which will be readily apparent from the foregoing description and from an inspection of the drawings. The closing of back contact 17 of track relay D will have no effect on the remainder of the apparatus unless the switch points become displaced from the positions which they occupied when the train entered the section in which event the closing of this contact will complete an auxiliary control circuit for the normal or the reverse magnet depending upon whether the switch occupies its normal or its reverse position. The auxiliary control circuit for the normal magnet passes from battery K¹ through line wire 42, back contact 17 of track relay D, wire 43, contact 4—4^a of circuit controller G, asymmetric unit U⁴ in its low resistance direction, the winding of the normal magnet N, contact 6—6^b of circuit controller G, and line wire 31 back to battery K¹. The auxiliary control circuit for the reverse magnet R passes from battery K¹ through line wire 42, back contact 17 of track relay D, wire 43, contact 4—4^b of circuit controller G, wire 33, asymmetric unit U² in its low resistance direction, wire 14, contact 5—5^a of circuit controller G, and wire 31 back to battery K¹. It will be apparent that when the auxiliary control circuit for the normal magnet N becomes completed, the normal magnet will become energized and will immediately restore the switch to its normal position, whereupon this magnet will again become deenergized. In a similar manner, when the auxiliary control circuit for the reverse magnet R becomes completed, the reverse magnet will become energized and will immediately restore the switch to its reverse position whereupon this magnet will again become deenergized. When the train which entered section B—C departs from this section, track relay D will, of course, pick up and will restore the apparatus to the condition which it occupied before the train entered section B—C.

When the switch occupies its normal position and a train trails the switch, the track relay D will become deenergized before any displacement of the switch takes place and, as a result, as soon as the train starts to displace the switch points from their normal positions, the auxiliary control circuit previously described for the normal magnet N will become completed. The normal magnet N will therefore become energized and will cause the mechanism M to oppose the movement of the switch points to their reverse positions. The extreme forces which are exerted on the points by the trailing train, however, will force the points to their reverse positions in spite of the opposition to the movement of the points exerted by the mechanism M and as soon as the switch points pass their mid stroke positions, the resultant opening of contact 4—4^a of circuit controller G will interrupt the auxiliary control circuit for the normal magnet N, while the closing of contact 4—4^b of circuit controller G will complete the auxiliary control circuit previously traced for the reverse magnet R. The normal magnet N will therefore become deenergized and the reverse magnet R will become energized, thus

causing the mechanism M to assist the train in completing the movement of the switch points to their reverse positions. When the switch points reach their reverse positions, the resultant opening of front contact 5—5^b of circuit controller G will deenergize the reverse magnet R. The switch, however, will remain in its reverse position due to the biasing means included in the mechanism M until the train departs from section B—C. When this happens, track relay D will pick up, and the picking up of this relay will complete the normal control circuit for the normal magnet N, thus causing the mechanism M to restore the switch to its normal position. When the switch is restored to its full normal position, the normal magnet N will become deenergized and the normal indication lamp H⁴ will become energized in a manner which will be apparent without further description.

When the switch occupies its reverse position and a train trails the switch, the operation of the apparatus is similar to that just described and will be apparent from the foregoing description and from an inspection of the drawings without further detailed description.

Referring now to Fig. 11, the apparatus here shown is similar to that shown in Fig. 10 with the exception that the circuit controller G has been provided with two additional contacts 45—45^a and 45—45^b thus making possible the use of one less rectifier than is required with the apparatus shown in Fig. 10. The contact 45—45^a of circuit controller G is closed when and only when the switch E occupies its full normal position, and the contact 45—45^b is closed when and only when the switch occupies its full reverse position.

As shown in Fig. 11, lever L occupies its normal position, section B—C is unoccupied and switch E occupies its normal position. Under these conditions, the normal and reverse magnets are both deenergized and the indication lamp H⁵ is also deenergized. The indication lamp H⁴, however, is energized over a normal indication circuit which passes from battery K² through line wire 31, an asymmetric unit U⁵ in its low resistance direction, contact 45—45^a of circuit controller G, wires 46 and 34, front contact 13 of relay D, line wire 35, contact 21—21ⁿ of lever L, the filament of lamp H⁴ and wire 36 back to battery K². Lamp H⁴ is therefore energized to indicate that the switch and lever both occupy their normal positions.

We will now assume that the operator wishing to reverse the switch reverses lever L. This movement of the lever will interrupt the previously described indication circuit at its contact 21—21ⁿ, thus causing the lamp H⁴ to become deenergized. This movement of the lever will also complete a normal control circuit for the reverse magnet R passing from battery K¹ through wire 33, contact 21—21^r of lever L, line wire 35, front contact 13 of relay D, wires 34, 47 and 48, the winding of reverse magnet R, wire 14, contact 5—5^a of circuit controller G, an asymmetric unit U⁵ in its low resistance direction, wire 49, and line wire 31 back to battery K¹. Magnet N will therefore become energized and will cause the mechanism M to move the switch E to its reverse position. When the switch E reaches its reverse position, the opening of contact 5—5^a of circuit controller G will de-energize the magnet R, while the closing of contact 45—45^b of circuit controller G will complete a reverse indication circuit passing from battery K² through line wire 31, 75

asymmetric unit U^5 in its low resistance direction, contact 45—45^b of circuit controller G, wires 52 and 50, front contact 10 of track relay D, line wire 51, contact 7—7^r of lever L, reverse indication lamp H^5 , and wires 40 and 36 to battery K^2 . The lamp H^5 will therefore become energized to indicate that the switch and lever both occupy their normal positions.

We will now assume that the switch and lever both occupy their reverse positions and that the operator wishing to restore the switch to its normal position restores the lever L to its normal position. This movement of the lever will interrupt the reverse indication circuit and will complete a normal control circuit for the normal magnet N, thus causing the reverse indication lamp H^5 to become de-energized and the normal magnet to become energized. The normal control circuit for the normal magnet N may be traced from battery K^1 through wires 38 and 41, contact 7—7ⁿ of lever L, wire 51, front contact 10 of track relay D, wires 50 and 53, the winding of normal magnet N, contact 6—6^b of circuit controller G, an asymmetric unit U^7 in its low resistance direction, and wires 49 and 31 back to battery K^1 . The energization of the normal magnet N will, of course, cause the mechanism M to move the switch to its normal position and when the switch reaches its normal position, contact 6—6^b of circuit controller G will open and will deenergize normal magnet N. Furthermore, when the switch reaches its normal position, the normal indication circuit previously described will become closed at contact 45—45^a of circuit controller G, and the normal indication lamp H^4 will therefore become lighted, thus indicating that the switch and lever both occupy their normal positions.

If, when the switch occupies its normal position, the points should creep away from this position for any reason, contact 6—6^b of circuit controller G will become closed and will complete the normal control circuit for the normal magnet N, thus causing the mechanism M to immediately restore the switch points to their normal positions. In a similar manner, if the switch points creep away from their reverse positions when the lever L occupies its reverse position, the normal control circuit for the reverse magnet R will become energized and will thus cause the mechanism M to restore the switch to its reverse position.

If the switch points creep away from their normal positions when a train occupies section B—C, relay D will then be deenergized and, under these conditions, the normal magnet N will become energized over an auxiliary control circuit for this magnet passing from battery K^1 through line wire 42, back contact 17 of track relay D, wire 43, contact 4—4^a of circuit controller G, wire 53, winding of magnet N, contact 6—6^b of circuit controller G, asymmetric unit U^7 in its low resistance direction, and wires 49 and 31 back to battery K^1 . The energization of the normal magnet N will, of course, cause the mechanism M to immediately restore the switch to its normal position. In a similar manner, if the switch E creeps away from its reverse position when section B—C is occupied, relay D will then be deenergized and the reverse magnet R will become energized over an auxiliary control circuit for this magnet which passes from battery K^1 through line wire 42, back contact 17 of relay D, wire 43, contact 4—4^b of circuit controller G, wire 48, the winding of the reverse magnet R,

wire 14, contact 5—5^a of circuit controller G, asymmetric unit U^6 in its low resistance direction, and wires 49 and 31 back to battery K^1 . The reverse magnet R will therefore become energized and will immediately restore the switch to its reverse position.

We will now assume that the switch occupies its normal position and that a train trails the switch. Under these conditions, when the train starts to displace the switch points, track relay D will be deenergized and the auxiliary control circuit for the normal magnet N will therefore become completed, thus causing the mechanism M to oppose the movement of the points. The wheels of a train will force the points toward their reverse positions in spite of the opposition by the mechanism M, however, and as soon as the points pass their midstroke positions, the resultant opening of contact 4—4^a of circuit controller G will deenergize the normal magnet N, while the resultant closing of contact 4—4^b of circuit controller G will complete the auxiliary control circuit for the reverse magnet R. As a result, the mechanism M will then exert a force on the points which assists the train in completing their movement. When the switch reaches its full reverse position, the resultant opening of contact 5—5^a of circuit controller G will deenergize the reverse magnet R. The switch will then remain in its reverse position due to the bias of the mechanism M, however, until the train departs from the section B—C whereupon the resultant picking up of the track relay D will complete the normal control circuit for the normal magnet N. This will cause the mechanism M to restore the switch to its normal position and, when the switch reaches its normal position, the normal magnet N will become deenergized and the normal indication lamp H^4 will become energized in a manner which will be apparent without further description.

When the switch occupies its reverse position and a train trails the switch, the operation of the apparatus will be similar to that just described and will be apparent from the foregoing and from an inspection of the drawings without further description.

Referring now to Fig. 12, we have here shown means for controlling the switch mechanism M in such manner that, if the switch is trailed, it will remain in its trailed position until the control lever is moved to a position corresponding with the new position of the switch after which the switch may be restored to its original position by restoring the control lever to its original position. The desired control of the mechanism M is accomplished by controlling relay D jointly by the lever L and the circuit controller G in such manner that one pick-up circuit will be closed for relay D when and only when the switch and lever both occupy their normal positions and that another pick-up circuit for relay D will be closed when and only when the switch and lever both occupy their reverse positions. The pick-up circuit for relay D which is closed when and only when the switch and lever both occupy their normal positions passes from track battery 3 through rail 1^a, wires 56 and 57, contact 45—45^a of circuit controller G, line wire 58, contact 21—21ⁿ of lever L, wires 59 and 60, the winding of relay D, wire 61, and rail 1 back to battery 3. The other pick-up circuit for relay D passes from battery 3 through rail 1^a, wires 56 and 57, contact 45—45^b of circuit controller G, line wire 62, contact 21—21^r of lever L, wires 59 and 60,

the winding of relay D, wire 61, and rail 1 back to battery 3. Relay D is further provided with a stick circuit which passes from battery 3 through rail 1^a, wire 56, front contact 63 of relay D, wire 60, the winding of relay D, wire 61, and rail 1 to battery 3.

It will be seen, therefore, that, when relay D is once picked up, it will remain picked up by virtue of its stick circuit until a train enters section B—C whereupon this relay will then become deenergized. It will also be seen that, when relay D does become deenergized due to a train entering section B—C, this relay will subsequently remain deenergized until the train leaves the section and lever L is moved to the position corresponding to the position which the switch then occupies.

The lever L and relay D jointly control the magnet valves N and R in the same manner as in Fig. 1 and it is believed, therefore, that this control will be understood from an inspection of the drawings without further description. It should be noted, however, that the auxiliary control circuits which are provided in Fig. 1 for energizing the normal and reverse magnets, if the switch points are displaced from their extreme position when the train occupies section B—C, have been omitted from the drawings because they are deemed unnecessary.

Referring now to Fig. 13, we have here shown another form of apparatus for accomplishing the same results as are accomplished by means of the apparatus shown in Fig. 12, but which introduces less resistance in the pick-up circuit for the track relay. As here shown, the track relay D is controlled by a relay P which latter relay, in turn, is controlled jointly by the lever L and the circuit controller G. Relay P is provided with one pick-up circuit which is closed when and only when lever L and switch E both occupy their normal positions and which passes from battery K through wires 64 and 65, contact 45—45^a of circuit controller G, wire 66, the winding of relay P, wire 67, contact 21—21ⁿ of lever L, and wire 68 back to battery K. Relay P is also provided with another pick-up circuit which is closed when and only when lever L and switch E both occupy their reverse positions and which passes from battery K through wires 64 and 69, contact 21—21^r of lever L, wire 67, the winding of relay P, wire 66, contact 45—45^b of circuit controller G, and wires 70 and 68 back to battery K. It will be apparent, therefore, that with the apparatus constructed as shown in Fig. 13, relay P will be energized when and only when the switch and lever both occupy corresponding extreme positions.

Relay D is provided with a pick-up circuit which is closed when and only when relay P is energized, and which passes from battery 3 through rail 1^a, wires 56 and 71, front contact 72 of relay P, wires 73 and 60, the winding of relay D, wire 61, and rail 1 to battery 3. Relay D is also provided with a stick circuit which is identical with the stick circuit previously traced in connection with Fig. 12.

It will be apparent, therefore, that with the apparatus constructed as shown in Fig. 13 whenever relay D has once been energized, it will subsequently remain energized until a train enters section B—C whereupon this relay will then become deenergized. It will also become apparent that, when this relay once becomes deenergized, it will subsequently remain deenergized until the train departs from section B—C whereupon this

relay will then become energized if relay P is energized, which latter relay P, as pointed out hereinbefore, will be energized if and only if the switch and lever occupy corresponding extreme positions.

The remainder of the apparatus shown in Fig. 13 is similar to that shown in Fig. 12 and need not therefore be described further.

Referring now to Fig. 14, as here shown, relay D is controlled by relay P in the same manner as in Fig. 13 but relay P, as here shown, is made slow releasing and is controlled by the lever L, by relay D and by the circuit controller G in such manner that relay P will be energized when and only when the switch and lever occupy corresponding positions and the track relay D is deenergized. Relay P, as here shown, is provided with one pick-up circuit which passes from battery K through wire 64, contact 7—7ⁿ of lever L, the filament of lamp H¹ connected in multiple with resistor J¹, back point of contact 10 of relay D, wire 75, contact 45—45^a of circuit controller G, wire 66, the winding of relay P, and wire 76 back to battery K. Relay P is also provided with another pick-up circuit which passes from battery K through wire 64, contact 7—7^r of lever L, the filament of lamp H² connected in multiple with resistor J², the back point of contact 13 of relay D, wire 77, reverse contact 45—45^b of circuit controller G, wire 66, the winding of relay P, and wire 76 back to battery K. Relay P is made sufficiently slow releasing so that it will bridge the time interval which elapses between the opening of the back contacts and the closing of the front contacts of the track relay.

With the apparatus arranged as shown in Fig. 14 it will be apparent that, when relay D once becomes energized, it will remain energized until a train enters section B—C whereupon this relay will then become deenergized. It will also be apparent that, when this relay once becomes deenergized, it will subsequently remain deenergized until the train departs from section B—C whereupon, if the switch and lever then occupy corresponding positions, one or the other of the pick-up circuits for relay P will become closed and will cause this relay to pick up. The picking up of relay P, in turn, will complete the pick-up circuit for relay D including front contact 72 of relay P which will cause relay D to pick up. When relay D picks up, it will open the circuit which was previously closed for relay P at back point 10 of this relay or back point 13 depending upon which position the switch then occupies but, due to the slow releasing characteristics of relay P, this relay will not open its front contact 72 until relay D has picked up and closed its stick circuit. When relay D does pick up and completes its stick circuit, all parts will then be restored to their normal positions.

The apparatus shown in Fig. 14 which has not been specifically described is similar to that shown and described in the preceding views and will be understood from an inspection of the drawings without further description.

Although we have herein shown and described only a few forms of apparatus embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. In combination, a railway switch having normal and reverse positions, a switch operating

mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving said switch to its normal position or its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions, a circuit controller controlled by said switch, two indication lamps, two resistors; a control circuit for said normal magnet controlled by said lever, said relay, and said circuit controller and including one of said indication lamps connected in multiple with one of said resistors and closed when and only when said lever occupies its normal position, said relay is picked up and said switch occupies any position but its normal position, a control circuit for said reverse magnet controlled by said lever, said relay and said circuit controller and including the other indication lamp connected in multiple with the other resistor and closed when and only when said lever occupies its reverse position, said relay is picked up, and said switch occupies any position but its reverse position; an indication circuit for the one lamp controlled by said lever, said relay, and said circuit controller in such manner that said indication circuit will be closed when and only when the switch and lever both occupy their normal positions and said relay is energized, and an indication circuit for the other lamp controlled by said lever, said relay and said circuit controller in such manner that said last mentioned indication circuit will be closed when and only when the switch and lever both occupy their reverse positions and said relay is energized.

2. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving said switch to its normal position or its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions, a circuit controller controlled by said switch, two indication lamps, two resistors; a control circuit for said normal magnet controlled by said lever, said relay, and said circuit controller and including one of said indication lamps connected in multiple with one of said resistors and closed when and only when said lever occupies its normal position, said relay is picked up, and said switch occupies any position but its normal position; a control circuit for said reverse magnet controlled by said lever, said track relay, and said circuit controller and including the other indication lamp connected in multiple with the other resistor and closed when and only when said lever occupies its reverse position, said relay is picked up, and said switch occupies any position but its reverse position, an auxiliary control circuit for said normal magnet controlled by said relay and said circuit controller in such manner that said auxiliary control circuit will be closed when and only when said relay is released and said switch occupies any position between its mid stroke position and its normal position, an auxiliary control circuit for said reverse magnet controlled

by said relay and said circuit controller in such manner that said last mentioned auxiliary control circuit will be closed when and only when said relay is released and said switch occupies any position between its mid stroke position and its reverse position, an indication circuit for the one lamp controlled by said lever, said relay, and said circuit controller in such manner that said indication circuit will be closed when and only when the switch and lever both occupy their normal positions and said relay is energized, and an indication circuit for the other lamp controlled by said lever, said relay, and said circuit controller in such manner that said last mentioned indication circuit will be closed when and only when the switch and lever both occupy their reverse positions and said relay is energized.

3. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, and with a fourth contact which is closed when and only when said switch occupies its reverse position, a circuit for said normal magnet including a normal contact of said lever, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, a second front contact of said relay, and said second contact, two indication lamps, a normal indication circuit including the one lamp, said normal contact of said lever, said first front contact of said relay and said third contact, and a reverse indication circuit including the other lamp, said reverse contact of said lever, said second front contact of said relay and said fourth contact.

4. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and

only when the switch occupies its normal position, and with a fourth contact which is closed when and only when said switch occupies its reverse position, a circuit for said normal magnet including a normal contact of said lever, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, a second front contact of said relay, and said second contact, two indication lamps, a normal indication circuit including the one lamp, said normal contact of said lever, said first front contact of said relay and said third contact, a reverse indication circuit including the other lamp, said reverse contact of said lever, said second contact of said relay and said fourth contact, and two resistors one connected in multiple with each of said lamps in said indication circuits.

5. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, with a fourth contact which is closed when and only when said switch occupies its reverse position, with a fifth contact which is closed when the switch occupies any position between its mid stroke position and its normal position, and with a sixth contact which is closed when the switch occupies any position between its mid stroke position and its reverse position, a circuit for said normal magnet including a normal contact of said lever, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, a second front contact of said relay, and said second contact, two indication lamps, a normal indication circuit including the one lamp, said normal contact of said lever, said first front contact of said relay and said third contact; a reverse indication circuit including the other lamp, said reverse contact of said lever, said second contact of said relay and said fourth contact; two resistors one connected in multiple with each lamp, a third resistor, an auxiliary circuit for said normal magnet including said third resistor, a back contact of said relay, said fifth contact, and said first contact, and an auxiliary circuit for said reverse magnet including said third resistor, said back contact of said relay, said sixth contact, and said second contact.

6. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch

to its normal position or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, and with a fourth contact which is closed when and only when said switch occupies its reverse position, two indication lamps, a circuit for said normal magnet including a normal contact of said lever, one of said indication lamps, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, the other of said indication lamps, a second front contact of said relay, and said second contact; a normal indication circuit including the one lamp, said normal contact of said lever, said first front contact of said relay and said third contact; a reverse indication circuit including the other lamp, said reverse contact of said lever, said second contact of said relay and said fourth contact; and two resistors one connected in multiple with each of said lamps.

7. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, and with a fourth contact which is closed when and only when said switch occupies its reverse position, two indication lamps, a circuit for said normal magnet including a normal contact of said lever, one of said indication lamps, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, the other of said indication lamps, a second front contact of said relay, and said second contact; a normal indication circuit including the one lamp, said normal contact of said lever, said first front contact of said relay and said third contact; a reverse indication circuit including the other lamp, said reverse contact of said lever, said second contact of said relay and said fourth contact; and two resistors one connected in multiple with each of said lamps, the parts being so proportioned that said lamps will become lighted when and only when the associated indication circuits are closed.

8. In combination, a railway switch having

normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, and with a fourth contact which is closed when and only when said switch occupies its reverse position; a circuit for said normal magnet including a normal contact of said lever, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, a second front contact of said relay, and said second contact; two indication lamps, a circuit for the one lamp including a normal contact of said lever, said first front contact of said relay, and said third contact; and a circuit for the other lamp including a reverse contact of said lever, said second front contact of said relay, and said fourth contact.

9. In combination, a stretch of railway track provided with a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said switch operating mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or its reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, with a fourth contact which is closed when and only when the switch occupies its reverse position, a track section formed in said stretch and extending in opposite directions from said switch, a track relay, a second relay, a pick-up circuit for said track relay including the rails of said section and a front contact of said second relay, a stick circuit for said track relay including its own front contact and the rails of said section, a first pick-up circuit for said second relay including a normal contact of said lever and said third contact of said circuit controller; a second pick-up circuit for said second relay including a reverse contact of said lever and said fourth contact of said circuit controller; a circuit for the normal magnet including a normal contact of said lever, a first front contact of said track relay, and said first contact of said circuit controller, and a circuit for the reverse magnet including a reverse

contact of said lever, a second front contact of said track relay, and said second contact of said circuit controller.

10. In combination, a stretch of railway track provided with a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said switch operating mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or its reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, with a fourth contact which is closed when and only when the switch occupies its reverse position, with a fifth contact which is closed when and only when the switch occupies its normal position, and with a sixth contact which is closed when and only when the switch occupies its reverse position, a track section formed in said stretch and extending in opposite directions from said switch, a track relay, a second relay, a pick-up circuit for said track relay including the rails of said section and a front contact of said second relay, a stick circuit for said track relay including its own front contact and the rails of said section, a first pick-up circuit for said second relay including a normal contact of said lever and said third contact of said circuit controller, a second pick-up circuit for said second relay including a reverse contact of said lever and said fourth contact of said circuit controller, two indication lamps, a circuit for the normal magnet including a normal contact of said lever, one of said indication lamps, a first front contact of said track relay, and said first contact of said circuit controller, a circuit for the reverse magnet including a reverse contact of said lever, the other indication lamp, a second front contact of said relay, and said second contact of said circuit controller; a normal indication circuit including a normal contact of said lever, said one indication lamp, said first front contact of said track relay, and said fifth contact of said circuit controller; and a reverse indication circuit including a reverse contact of said lever, said other indication lamp, said second front contact of said relay, and said sixth contact of said circuit controller.

11. In combination, a stretch of railway track provided with a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said switch operating mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or its reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any po-

sition but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, with a fourth contact which is closed when and only when the switch occupies its reverse position, a track section formed in said stretch and extending in opposite directions from said switch, a track relay, a slow releasing relay, a pick-up circuit for said track relay including the rails of said section and a front contact of said slow releasing relay, a stick circuit for said track relay including its own front contact and the rails of said section, a first pick-up circuit for said slow releasing relay including a normal contact of said lever, a first back contact of said track relay, and said third contact of said circuit controller; a second pick-up circuit for said slow releasing relay including a reverse contact of said lever, a second back contact of said track relay, and said fourth contact of said circuit controller; a circuit for the normal magnet including a normal contact of said lever, a first front contact of said track relay, and said first contact of said circuit controller; and a circuit for the reverse magnet including a reverse contact of said lever, a second front contact of said track relay, and said second contact of said circuit controller.

12. In combination, a stretch of railway track provided with a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said switch operating mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal position or its reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch; said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, with a fourth contact which is closed when and only when the switch occupies its reverse position, with a fifth contact which is closed when and only when the switch occupies its normal position, and with a sixth contact which is closed when and only when the switch occupies its reverse position, a track section formed in said stretch and extending in opposite directions from said switch, a track relay, a slow releasing relay, a pick-up circuit for said track relay including the rails of said section and a front contact of said slow releasing relay, a stick circuit for said track relay including its own front contact and the rails of said section; a first pick-up circuit for said slow releasing relay including a normal contact of said lever, a first back contact of said track relay, and said third contact of said circuit controller; a second pick-up circuit for said second relay including a reverse contact of said lever, a second back contact of said track relay, and said fourth contact of said circuit controller; two indication lamps, a circuit for the normal magnet including a normal contact of said lever, one of said indication lamps, a first front contact of said track relay, and said first contact of said circuit con-

troller; a circuit for the reverse magnet including a reverse contact of said lever, the other indication lamp, a second front contact of said relay, and said second contact of said circuit controller; a normal indication circuit including a normal contact of said lever, said one indication lamp, said first front contact of said track relay, and said fifth contact of said circuit controller; and a reverse indication circuit including a reverse contact of said lever, said other indication lamp, said second front contact of said relay, and said sixth contact of said circuit controller.

13. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with means for biasing the switch to its nearest extreme position and with a normal and a reverse magnet and being effective for moving the switch to its normal or to its reverse position according as said normal or said reverse magnet is energized, a relay controlled by traffic conditions adjacent said switch, a manually operable lever having normal and reverse positions and provided with normal and reverse contacts, a circuit controller operatively connected with said switch, said circuit controller being provided with a first contact which is closed when the switch occupies any position but its normal position, with a second contact which is closed when the switch occupies any position but its reverse position, with a third contact which is closed when and only when the switch occupies its normal position, and with a fourth contact which is closed when and only when said switch occupies its reverse position; a circuit for said normal magnet including a normal contact of said lever, a first front contact of said relay, and said first contact; a circuit for said reverse magnet including a reverse contact of said lever, a second front contact of said relay, and said second contact; a first indication circuit including a normal contact of said lever, said first front contact of said relay, and said third contact; and a second indication circuit including a reverse contact of said lever, said second front contact of said relay, and said fourth contact.

14. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch and provided with a normal and a reverse magnet and effective for moving the switch to its normal or its reverse position according as said normal or said reverse magnet is energized, two indication lamps, two resistors, a control circuit for said normal magnet including one of said lamps connected in multiple with one of said resistors, a control circuit for said reverse magnet including the other lamp connected in multiple with the other resistor, an indication circuit controlled in accordance with the position of said switch and including said one lamp connected in multiple with said one resistor, and another indication circuit controlled in accordance with the position of said switch and including said other lamp connected in multiple with said other resistor, the parts being so proportioned that said indication lamps will only become lighted when the associated indication circuit is closed.

15. In combination, a railway switch having normal and reverse positions, a switch operating mechanism operatively connected with said switch, said mechanism being provided with a normal and a reverse magnet and being effective for moving said switch to its normal position or

its reverse position according as said normal or said reverse magnet is energized, two indication lamps, two resistors, a relay controlled by traffic conditions adjacent said switch, a manually operable lever, a circuit controller controlled by said switch; a circuit for said normal magnet controlled by said relay, said lever, and said circuit controller and including one of said indication lamps connected in multiple with one of said resistors; a circuit for said reverse magnet controlled by said relay, said lever and said circuit controller and including the other indication lamp connected in multiple with the other resistor; an indication circuit controlled by said relay, said lever, and said circuit controller and including said one indication lamp connected in multiple with said one resistor; and another indication circuit controlled by said relay, said lever, and said circuit controller and including said other lamp connected in multiple with said other resistor.

16. In combination, a section of railway track the track rails of which are divided to form a track section, a railway switch located in said track section, a switch operating mechanism operatively connected with said switch and including a normal and a reverse magnet and effective to move said switch to a normal or a reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions, a slow releasing relay, a track relay, a pick-up circuit for said track relay including the rails of said section and closed only when said slow releasing relay is picked up, a stick circuit for said track relay including its own front contact and the rails of said section, means for energizing said slow releasing relay when said switch and said lever occupy corresponding positions and said track relay is deenergized, and means controlled by said lever and said track relay for controlling said normal and reverse magnets.

17. In combination, a section of railway track the track rails of which are divided to form a track section, a railway switch located in said track section, a switch operating mechanism operatively connected with said switch and includ-

ing a normal and a reverse magnet and effective to move said switch to a normal or a reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions, a slow releasing relay, a track relay, means for energizing said track relay whenever said track section is unoccupied and said slow releasing relay is picked up, means for maintaining said track relay energized after it once becomes energized as long as said track section remains unoccupied, means for energizing said slow releasing relay when said switch and said lever occupy corresponding positions and said track relay is deenergized, and means controlled by said lever and said track relay for controlling said normal and reverse magnets.

18. In combination, a section of railway track the track rails of which are divided to form a track section, a railway switch located in said track section, a switch operating mechanism operatively connected with said switch and including a normal and a reverse magnet and effective to move said switch to a normal or a reverse position according as said normal or said reverse magnet is energized, a manually operable lever having normal and reverse positions, a slow releasing relay, a track relay, a pick-up circuit for said track relay including the rails of said section and closed only when said slow releasing relay is picked up, a stick circuit for said track relay including its own front contact and the rails of said section, means for energizing said slow releasing relay when said switch and said lever occupy corresponding positions and said track relay is deenergized, a circuit for said normal magnet closed when said lever occupies its normal position, said track relay is picked up and said switch occupies any position but its normal position, and a circuit for said reverse magnet closed when said lever occupies its reverse position, said track relay is picked up and said switch occupies any position but its reverse position.

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