June 8, 1937. H. S. YOUNG ET AL 2,082,933

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

Original Filed Dec. 10, 1935 2 Sheets-Sheet 1

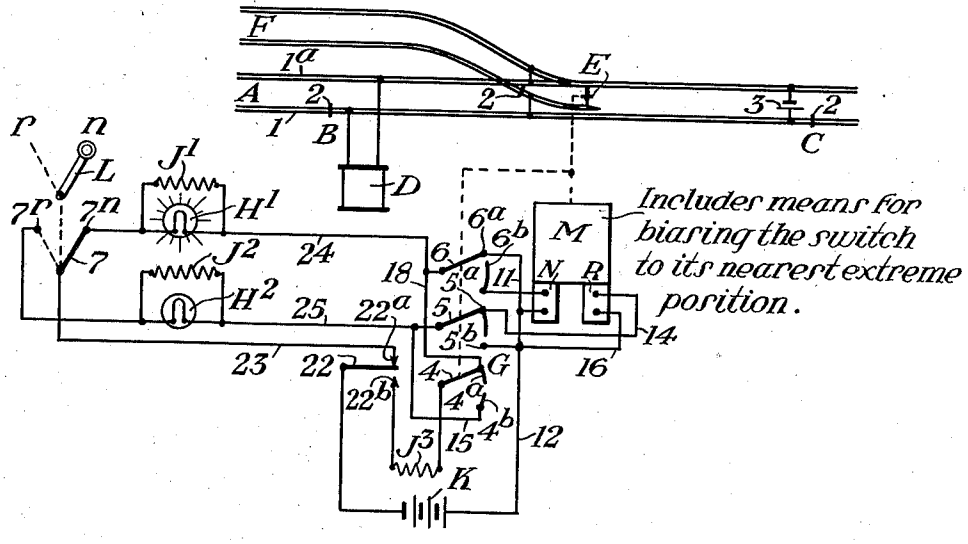


Fig. 1.

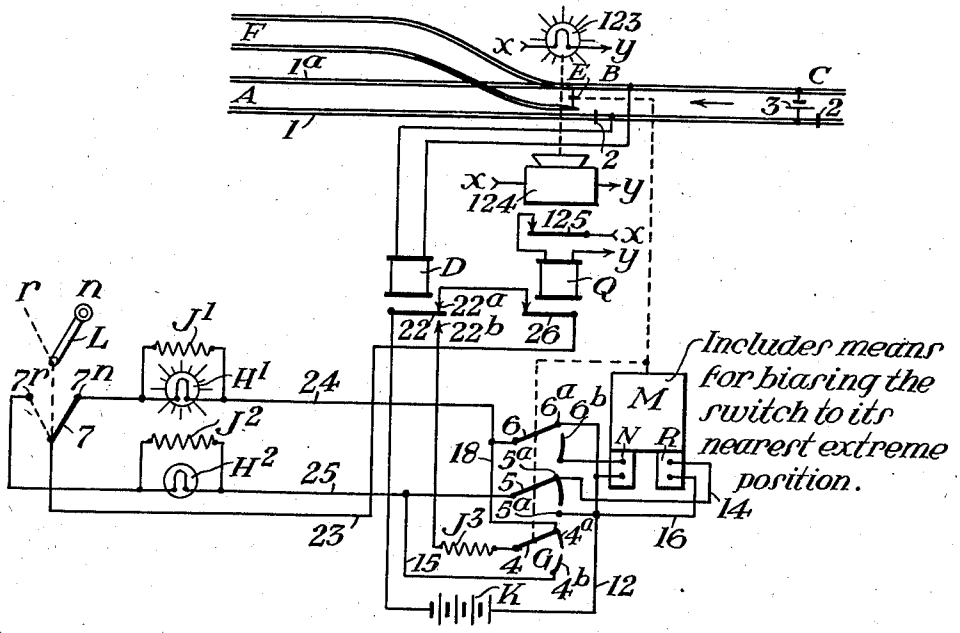


Fig. 2.

INVENTORS
Henry S. Young and
BY Herbert L. Bone.
THEIR ATTORNEY

June 8, 1937. H. S. YOUNG ET AL 2,082,933

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

Original Filed Dec. 10, 1935 2 Sheets-Sheet 2

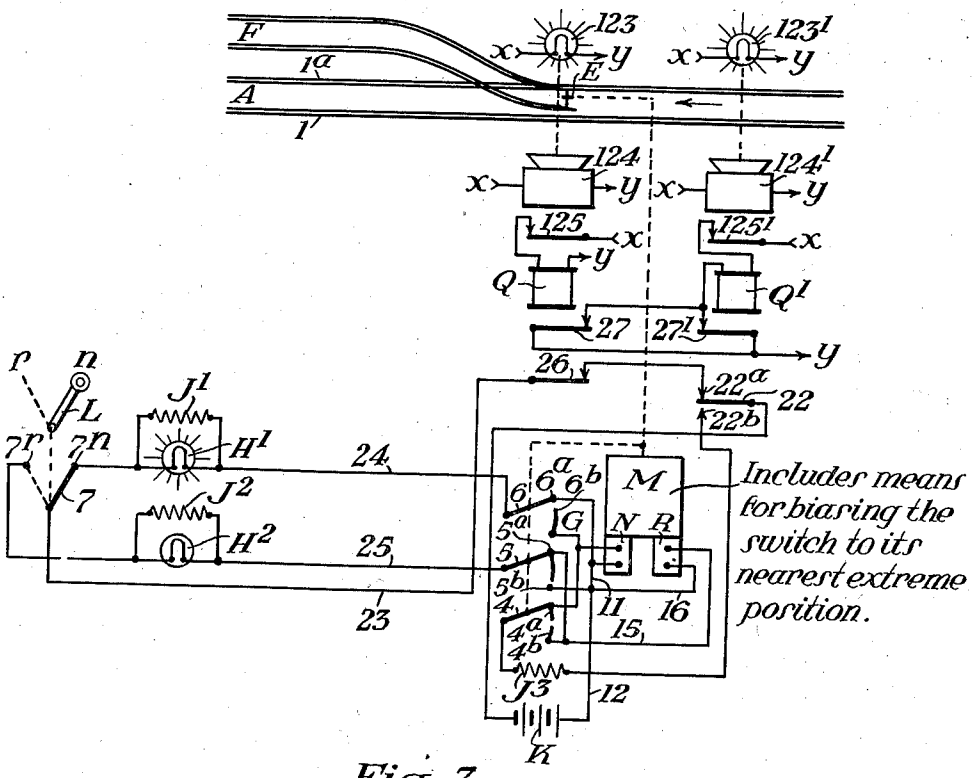


Fig. 3.

INVENTORS
Henry S. Young and
BY Herbert L. Bone.
THEIR ATTORNEY

Patented June 8, 1937 2,082,933

UNITED STATES PATENT OFFICE

2,082,933

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

Henry S. Young, Wilkinsburg, and Herbert L. Bone, Forest Hills, Pa., assignors to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Original application December 10, 1935, Serial No. 53,774. Divided and this application November 25, 1936, Serial No. 112,718

7 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.

The present application is a division of our copending application, Serial No. 53,774 filed on December 10, 1935, for Apparatus for controlling railway switches.

We will describe three 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 and 3 are diagrammatic views showing other forms of apparatus embodying our invention.

Similar reference characters refer to similar parts in all three 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 midstroke position; contact 4—4^b is closed when switch E occupies its reverse position, or any position between its reverse position and its midstroke 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 7^n and 7^r to close a normal contact 7—7^n 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 H^1 and H^2, three resistors J^1, J^2 and J^3, and a battery K. The function of the lamps H^1 and H^2 and resistors J^1, J^2 and J^3 will become apparent as the description proceeds.

As shown in the drawings, all parts are in 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 denergized. 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—7^n 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—7r of lever L will complete a normal control circuit for the reverse magnet R passing from battery K through front contact 22—22a of relay D, line wire 23, contact 7—7r of lever L, the filament of lamp H2 connected in multiple with resistor J2, line wire 25, contact 5—5a 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—5a of circuit controller G will become opened and will deenergize magnet R, and contact 5—5b 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—22a of relay D, line wire 23, contact 7—7r of lever L, the filament of lamp H2 connected in multiple with resistor J2, line wire 25, contact 5—5b of circuit controller G and wire 12 back to battery K. Lamp H2 will therefore become lighted to indicate that the switch and lever both occupy their reverse positions.

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—5a 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.

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 H2 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—22a of relay D, line wire 23, contact 7—7n of lever L, the filament of lamp H1 connected in multiple with resistor J1 line wire 24, contact 6—6b 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—6b of circuit controller G will open and will deenergize the normal magnet N, and contact 6—6a will become closed and will complete the previously described normal indication circuit including the indication lamp H1. When the normal indication circuit becomes closed, lamp H1 will, of course, become lighted to indicate that the switch and lever both occupy their normal positions.

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—6b 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 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—22a and will close its back contact 22—22b. The opening of front contact 22—22a will interrupt the normal indication circuit that was previously closed at this contact, thus causing the normal indication lamp H1 to become extinguished, while the closing of contact 22—22b of relay D will complete an inactive circuit passing from battery K through back contact 22—22b of relay D, resistor J3, contact 4—4a of circuit controller G, wire 18, contact 6—6a 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—6a of circuit controller G will open and will interrupt the inactive circuit just traced, and contact 6—6b 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—22b of relay D, resistor J3, contact 4—4a of circuit controller G, wire 18, contact 6—6b 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—22b of relay D, resistor J3, contact 4—4b of circuit controller G, wire 15, contact 5—5b 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 J^3, 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 midstroke 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 H^1 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.

It should be noted that resistor J^3 has approximately the same resistance as the resistance of either the resistor J^1 or the resistor J^2 so that when the auxiliary control circuits for the magnets N and R including the resistor J^3 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 H^1 or H^2 burns out.

Referring now to Fig. 2, 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. 2 is similar to that shown in Fig. 1 and the circuits for controlling the magnet valves N and R are likewise similar to those shown in Fig. 1 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. 2 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. 1 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. 1 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 appa-

ratus 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—22b 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. 3, as here shown, the track relay D shown in Fig. 2 has been replaced by a relay Q^1 which is controlled by a light sensitive device 124^1. The light sensitive device 124^1 is disposed on the opposite side of the track A from a source of light 123^1 in such manner that a car approaching the switch E in a facing point direction will intercept the supply of light to the device 124^1 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 124^1 until after the car intercepts the supply of light to the device 124. The relay Q^1, as here shown, is provided with a pickup circuit which passes from terminal X of the source through front contact 125^1 of light sensitive device 124^1, the winding of relay Q^1, and a front contact 27 of relay Q to terminal Y. Relay Q^1 is also provided with a stick circuit which passes from terminal X through front contact 125^1 of device 124^1, the winding of relay Q^1 and front contact 27^1 of relay Q^1 to terminal Y. The reminder of the apparatus shown in Fig. 3 is similar to that shown in Fig. 2, 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 124^1 are receiving light from the associated sources 123 and 123^1. Under these conditions, relays Q and Q^1 are both picked up, and the normal and reverse magnets N and R are both deenergized. Furthermore, under these conditions, the normal indication lamp H^1 is energized by virtue of a circuit which passes from battery K through front contact 22—22a of relay Q^1, front contact 26 of relay Q, line wire 23, the contact 7—7n of lever L, the filament of lamp H^1 connected in multiple with resistor J^1, line wire 24, contact 6—6a 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 H^1 at contact 7—7n, and will complete a normal control circuit for the reverse magnet R passing from battery K through front contact 22—22a of relay Q^1, front contact 26 of relay Q, line wire 23, contact 7—7r of lever L, the filament of lamp H^2 connected in multiple with resistor J^2, line wire 25, contact 5—5a 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 H^1 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 position, contact 5—5a of circuit controller G will open and will interrupt the circuit which was previously closed for reverse magnet R, and contact 5—5b of circuit controller G will become closed and will complete a reverse indication circuit passing from battery K through front contact 22—22a of relay Q^1, front contact 26 of relay Q, line wire 23, contact 7—7r of lever L, the filament of lamp H^2 connected in multiple with resistor J^2, line wire 25, contact 5—5b of circuit controller G, and wire 12 back to battery K. Lamp H^2 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 H^2 and will complete a normal control circuit for the normal magnet N passing from battery K through front contact 22—22a of relay Q^1, front contact 26 of relay Q, line wire 23, normal contact 7—7n of lever L, the filament of lamp H^1 connected in multiple with resistor J^1, line wire 24, contact 6—6b 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—6b of circuit controller G will deenergize the normal magnet. Furthermore, when the switch reaches its normal position the resultant closing of contact 6—6a of circuit controler G will reestablish the previously traced normal indication circuit including lamp H^1.

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—6a of circuit controller G will become opened and contact 6—6b will become closed. The closing of contact 6—6b 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—5a of circuit controller G will reestablish the previous 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 123[1] and will thus cause relay Q^1 to become deenergized, before the train reaches the switch. If, when relay Q^1 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 Q^1, resistor J^3, 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 magnet 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 J^3, 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 27[1], 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 H^1 or H^2 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 124[1], 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 124[1]. 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 H^1 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 124[1] 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 124[1]. 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.

Although we have herein shown and described only three 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 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, two resistors, a circuit for said normal magnet including a front contact of said relay, a normal contact of said lever, one of said indication lamps connected in multiple with one of said resistors, and said first contact, a circuit for said reverse magnet including said front contact of said relay, a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor and said second contact; a normal indication circuit including said front contact of said relay, said normal contact of said lever, and said third contact; and a reverse indication circuit includ-

ing said front contact of said relay, said reverse contact of said lever, and said fourth contact, the parts being so proportioned that said indication lamps will become lighted when and only when the associated indication circuit is closed.

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 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 midstroke position and its normal position, and with a sixth contact which is closed when the switch occupies any position between its midstroke position and its reverse position; two indication lamps, two resistors; a circuit for said normal magnet including a front contact of said relay, a normal contact of said lever, one of said indication lamps connected in multiple with one of said resistors, and said first contact; a circuit for said reverse magnet including said front contact of said relay, a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor, and said second contact; a normal indication circuit including said front contact of said relay, said normal contact of said lever, said one lamp connected in multiple with said one resistor, and said third contact; a reverse indication circuit including said front contact of said relay, said reverse contact of said lever, said other lamp connected in multiple with said other resistor, and said fourth contact, the parts being so proportioned that said indication lamps will become lighted when and only when the associated indication circuit is closed; a third resistor, an auxiliary circuit for said normal magnet including a back contact of said relay, said third resistor, said fifth contact, and said first contact; and an auxiliary circuit for said reverse magnet including said back contact of said track relay, said third resistor, said sixth contact, and said second contact.

3. In combination, 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 first relay controlled by traffic conditions in advance of said switch, a light sensitive device and a source of light disposed on opposite sides of said switch in such manner that said device will normally receive light from said source but that the supply of light to said device will be cut off when a car or train is passing over said switch, a second relay controlled by said light sensitive device, 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 the switch occupies its reverse position, a manually operable lever having a normal and a reverse position and provided with normal and reverse contacts, two indication lights, two resistors, a circuit for said normal magnet including a normal contact of said lever, one of said indication lights connected in multiple with one of said resistors, said first contact, a front contact of said first relay and a front contact of said second relay; a circuit for said reverse magnet including a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor, said second contact, said front contact of said first relay, and said front contact of said second relay; a normal indication circuit including a normal contact of said lever, said one indication light connected in multiple with said one resistor, said third contact, said front contact of said first relay, and said front contact of said second relay; and a reverse indication circuit including a reverse contact of said lever, said other indication light connected in multiple with said other resistor, said fourth contact, said front contact of said first relay, and said front contact of said second relay.

4. In combination, 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 first relay controlled by traffic conditions in advance of said switch, a light sensitive device and a source of light disposed on opposite sides of said switch in such manner that said device will normally receive light from said source but that the supply of light to said device will be cut off when a car or train is passing over said switch, a second relay controlled by said light sensitive device, 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 the switch occupies any position between its midstroke position and its normal position, and with a sixth contact which is closed when the switch occupies any position between its midstroke position and its reverse position, a manually operable lever having a normal and

a reverse position and provided with normal and reverse contacts, two indication lights, two resistors, a circuit for said normal magnet including a normal contact of said lever, one of said indication lights connected in multiple with one of said resistors, said first contact, a front contact of said first relay and a front contact of said second relay; a circuit for said reverse magnet including a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor, said second contact, said front contact of said first relay, and said front contact of said second relay; a normal indication circuit including a normal contact of said lever, said one indication light connected in multiple with said one resistor, said third contact, said front contact of said first relay, and said front contact of said second relay; a reverse indication circuit including a reverse contact of said lever, said other indication light connected in multiple with said other resistor, said fourth contact, said front contact of said first relay, and said front contact of said second relay; a third resistor, an auxiliary circuit for said normal magnet including a back contact of said first relay, said third resistor, said fifth contact, and said first contact; and an auxiliary circuit for said reverse magnet including said back contact of said first relay, said third resistor, said sixth contact, and said second contact.

5. In combination, a stretch of 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 first light sensitive device and a first source of light disposed on opposite sides of said stretch a short distance in advance of said switch in such manner that said first device normally receives light from said first source but that the supply of light to said first device from said first source will be cut off by a car or train approaching said switch, a first relay controlled by said first light sensitive device, a second light sensitive device and a second source of light disposed on opposite sides of said switch in such manner that said second device will normally receive light from said second source but that the supply of light to said second device from said second source will be cut off when a car or train is passing over said switch, a second relay controlled by said second light sensitive device, 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 the switch occupies its reverse position, a manually operable lever having a normal and a reverse position and provided with normal and reverse contacts, two indication lights, two resistors, a circuit for said normal magnet including a normal contact of said lever, one of said indication lights connected in multiple with one of said resistors, said first contact, a front contact of said first relay and a front contact of said second relay, a circuit for said reverse magnet including a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor, said second contact, said front contact of said first relay and said front contact of said second relay; a normal indication circuit including a normal contact of said lever, said one indication light connected in multiple with said one resistor, said third contact, said front contact of said first relay, and said second relay; a reverse indication circuit including a reverse contact of said lever, said other indication light connected in multiple with said first resistor, said fourth contact, said first contact of said first relay, and said front contact of said second relay.

6. In combination, a stretch of 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 first light sensitive device and a first source of light disposed on opposite sides of said stretch a short distance in advance of said switch in such manner that said first device normally receives light from said first source but that the supply of light to said first device from said first source will be cut off by a car or train approaching said switch, a first relay controlled by said first light sensitive device, a second light sensitive device and a second source of light disposed on opposite sides of said switch in such manner that said second device will normally receive light from said second source but that the supply of light to said second device from said second source will be cut off when a car or train is passing over said switch, a second relay controlled by said second light sensitive device, 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 the switch occupies any position between its midstroke position and its normal position, and with a sixth contact which is closed when the switch occupies any position between its midstroke position and its reverse position, a manually operable lever having a normal and a reverse position and provided with normal and reverse contacts, two indication lights, two resistors, a circuit for said normal magnet including a normal contact of said lever, one of said indication lights connected in multiple with one of said resistors, said first contact, a front contact of said first relay and a front contact of said second relay, a circuit for said reverse magnet including a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor, said second contact, said front contact of said first relay, and said front contact of said second relay; a normal indication circuit including a normal contact of said lever, said one indication light connected in multiple with said one resistor, said third contact, said front contact of said first relay, and

said front contact of said second relay; and a reverse indication circuit including a reverse contact of said lever, said other indication light connected in multiple with said other resistor, said fourth contact, said first contact of said first relay, and said front contact of said second relay.

7. In combination, a stretch of 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 first light sensitive device and a first source of light disposed on opposite sides of said switch in such manner that said first device will normally receive light from said first source but that the supply of light to said first device from said first source will be cut off when a car or train is passing over said switch, said first light sensitive device being provided with a contact which is closed when and only when said first device is receiving light from said first source; a second light sensitive device and a second source of light disposed on opposite sides of said stretch a short distance in advance of said switch in such manner that said second device normally receives light from said second source but that the supply of light to said second device from said second source will be cut off by a car or train passing said second device, said second device being provided with a contact which is closed when and only when said second device is receiving light from said second source, a first relay provided with a pickup circuit including the contact of said first device, a second relay provided with a pickup circuit including the contact of said second device and a front contact of said first relay and with a stick circuit including the contact of said second device and its own front contact, 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 the switch occupies any position between its midstroke position and its normal position, and with a sixth contact which is closed when the switch occupies any position between its midstroke position and its reverse position, a manually operable lever having a normal and a reverse position and provided with normal and reverse contacts, two indication lights, two resistors; a circuit for said normal magnet including a normal contact of said lever, one of said indication lights connected in multiple with one of said resistors, said first contact, a front contact of said first relay and a front contact of said second relay; a circuit for said reverse magnet including a reverse contact of said lever, the other indication lamp connected in multiple with the other resistor, said second contact, said front contact of said first relay, and said front contact of said second relay; a normal indication circuit including a normal contact of said lever, said one indication light connected in multiple with said one resistor, said third contact, said front contact of said first relay, and said front contact of said second relay; and a reverse indication circuit including a reverse contact of said lever, said other indication light connected in multiple with said other resistor, said fourth contact, said first contact of said first relay, and said front contact of said second relay.

HENRY S. YOUNG.
HERBERT L. BONE.