

Oct. 26, 1937.

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2,096,941

RAILWAY TRAFFIC CONTROLLING SYSTEM

Filed June 15, 1935

2 Sheets--Sheet 2

Fig. 2.

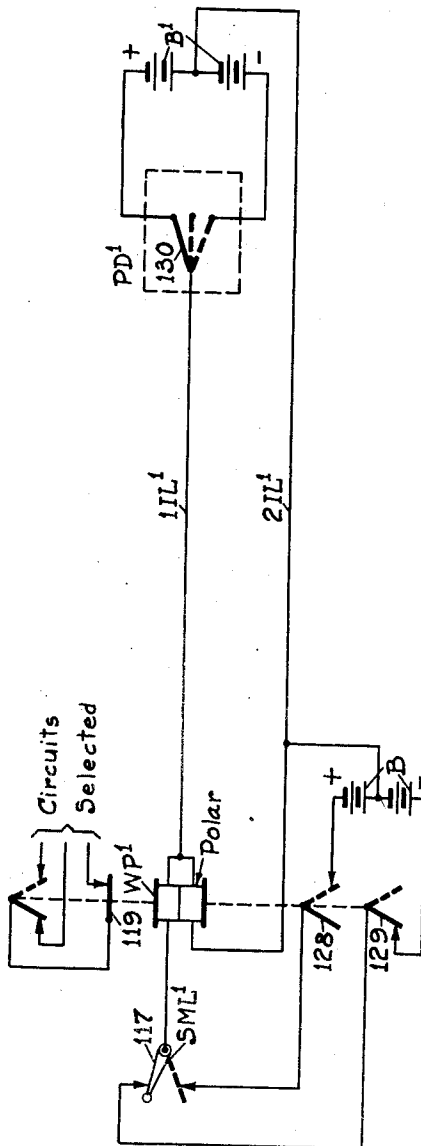
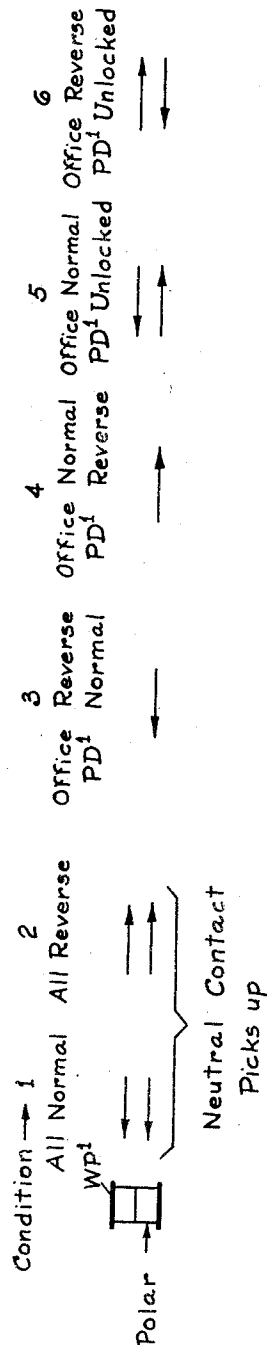


Fig. 2.A.



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2,096,941

RAILWAY TRAFFIC CONTROLLING SYSTEM

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Application June 15, 1935, Serial No. 26,787

10 Claims. (Cl. 246—3)

This invention relates to centralized traffic controlling systems for railroads and it more particularly pertains to a system for transmitting controls from a control office to an outlying field station and for transmitting indications from the station to the control office by means of a direct or unit line wire arrangement.

In the type of centralized traffic controlling systems contemplated by the present invention the switches, signals or other traffic controlling devices are operated from a remote point such as a tower, a control office or the like.

Similarly, information regarding the positions and conditions of the various traffic governing devices is transmitted from the remote point where these devices are located to the tower or control office in the form of indications for giving the operator the required information in a readily discernible form. In accordance with the present invention it is proposed to control a switch machine at a field station to its normal and reverse positions by transmitting current of normal and reverse polarity over a line circuit connecting the switch machine lever in the office to the switch machine controlling relay at the station.

The present invention provides a separate indication line circuit over which indications of the position and locked or unlocked conditions of the track switch are transmitted. An important feature of the present invention is the arrangement of the indication circuit in such a manner that the point detector contacts at the remote station, the indication relay contacts in the office and the switch machine lever contacts in the office are all checked. In other words, the indication circuits controlled by the indication relay in the control office are not effective until the point detector contacts at the station, the polar contacts of the indication repeating relay which respond to the position of the track switch at the station and the switch machine control lever contacts are all in correspondence. This feature will be more clearly brought out in the description which follows.

Various other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawings and in part pointed out as the description progresses, reference being made to the accompanying drawings in which:—

Fig. 1 illustrates one form of circuit arrangement embodying the present invention.

Fig. 2 illustrates another form of circuit arrangement embodying the present invention.

Fig. 2A is a chart which illustrates various conditions of energization of relay WP¹ of Fig. 2.

These two forms of circuit arrangement employing the present invention will be described and the novel features will be pointed out in the claims.

The accompanying drawings are diagrammatic views illustrating the two forms selected as typical examples for practicing the present invention.

Apparatus.—Fig. 1 illustrates one form of the present invention in which currents of opposite polarities are used for controlling the switch machine control relay over a control line circuit, with a pair of battery bus wires extending from the control office to the remote station. It will be understood that additional stations may be controlled over separate control line circuits from the control office, in which case the battery bus wires 10 and 12 lead to all of the stations in common.

A separate indication line circuit comprising conductors 11L and 21L connect the indication repeating relay WP in the control office to the point detector contacts at the field station. Relay WP is of the polar neutral type such for example as disclosed in Field Patent No. 1,749,331. This relay WP has two windings. The energization of one of these windings (the lower winding as shown), which may be conveniently termed the polar winding, is sufficient to operate the polar armature to the normal or reverse position, but not to operate the neutral armature. If the other winding of this relay WP (the upper winding as shown), which may be conveniently termed the neutral winding, is also energized at the same time, the energization of both windings is sufficient to pick up the neutral contacts. The operation of relay WP¹ of Fig. 2 is the same, that is, the polar contacts are actuated in response to the polar winding alone but it requires the energization of both windings to pick up the neutral contacts.

Switch machine control relay WZ is of the polar type with the contact actuating arrangement being so arranged that the energization of the relay winding in a direction to change the position of the polar contacts will effect this change in position even though the polar contacts interrupt the circuit of the winding of the relay. It is well understood by those skilled in the art that a relay of the toggle type, for example, operates to accomplish this result.

Reference character TS designates a railway track switch which is operated by a switch machine SM. This machine may be, for example,

of the type shown in the patent to W. K. Howe, No. 1,466,903 dated September 4, 1923.

The switch machine is controlled by a manually operated switch machine lever SML which may, for example, be one of a group of similar levers in an interlocking machine. As illustrated, lever SML is in its normal position for controlling the operation of the track switch to its normal position through the medium of switch machine control relay WZ. Lever SML obviously can be operated to its reverse position for controlling the track switch to its reverse position by means of relay WZ.

The switch machine through its point detector contact PD controls the operation of switch repeating relay WP. Relay WP with its neutral contacts dropped away repeats the unlocked condition of the switch machine. The polar contacts of relay WP in their left hand positions indicate that the switch machine is in its normal locked position. These polar contacts in their right hand dotted positions indicate that the switch machine is in its reverse locked position.

East bound traffic over track switch TS is controlled by signal ES and west bound traffic over this track switch is controlled by signals WS and WSA, but since this portion of the system forms no part of the present invention the details of the signal control have been omitted.

In the Fig. 2 modification the indication circuits and apparatus alone have been illustrated, it being assumed that the same control circuit for controlling the track switch illustrated in Fig. 1 may be used. Since the control circuit is entirely independent of the indication circuit it will be obvious that a two wire line circuit extending from the control office to the switch control relay at the station may be provided in place of the control line conductor and the two battery bus line conductors illustrated in Fig. 1, but since the circuit for controlling the operation of the switch machine forms no part of the present invention it need not be considered.

The embodiment illustrated in Fig. 2 checks the point detector contacts, the WP relay contacts and the switch machine lever contacts but accomplishes this result over a single line circuit without the need of the direct current bus line circuit such as 10 and 12 of Fig. 1. As will be pointed out in detail this result is accomplished by the use of a midtap battery B in the control office and a similar midtap battery B' at the field station.

Operation

Referring to Fig. 1 and assuming the switch machine lever SML to be in its normal position as illustrated, relay WZ will have its polar contacts actuated to their right hand positions for controlling the operation of the track switch to its normal locked position over a circuit not shown in detail but illustrated by dotted line 29.

The lower winding of relay WP, which controls the operation of the polar contacts of this relay, is energized over a circuit extending from (+) on bus 10, point detector contact 30 in its normal position, indication line conductor 11L, lower winding of relay WP, indication line conductor 21L, point detector contact 31 in its normal position and bus 12 to the (-) terminal of battery LB. The upper winding of relay WP is energized, for producing a magnetic flux in addition to that produced by the energization of its lower winding, over a circuit extending from (+) on bus 10, point detector contact 30 in its normal position, indication line conductor 11L, upper winding of relay

WP, contact 18 of lever SML in its normal position and contact 29 of relay WP in its normal position to the (-) terminal of battery LB. The energization of the two windings of relay WP effects the picking up of its neutral contact 19.

It will be noted that the winding of relay WZ is not energized since the connection to both terminals of this winding lead to (+) bus 10 with the apparatus in the positions illustrated in the drawings.

It will now be assumed that it is desired to operate track switch TS to its reverse position. To accomplish this, lever SML is actuated from its normal to its reverse position thereby energizing relay WZ over a circuit extending from (+) on bus 10, contact 21 of relay WZ in its normal position, winding of relay WZ, control line conductor CL and contact 17 of lever SML in its reverse position to the (-) terminal of battery LB. Relay WZ actuates its polar contacts to their left hand dotted positions in which position contact 22 controls the operation of the switch machine for actuating the track switch to its reverse locked position. When contact 21 of relay WZ shifts from its normal to its reverse position the energizing circuit of relay WZ, above traced, is interrupted and the terminals of the winding of relay WZ are connected to the same terminal of battery LB which maintains relay WZ de-energized.

Before the point detector contacts leave their normal positions the upper winding of relay WP is de-energized by the shifting of contact 18 of lever SML. This opens front contact 19 of relay WP so that the circuits selected by this relay are de-energized. It will be noted, however, that the lower winding of relay WP is maintained energized in a normal direction as long as the point detector contacts are in their normal positions. Furthermore, when the point detector contacts reach their mid positions for indicating the unlocked condition of the track switch the lower winding of relay WP is de-energized but of course the polar contacts remain in their normal positions because relay WP is of the magnetic stick type.

When the switch reaches its reverse locked position, as repeated by point detector contacts 30 and 31 in their reverse positions, a circuit is closed for energizing the lower winding of relay WP in the opposite direction from that indicated in the drawings, which circuit extends from (+) on bus 10, contact 31 in its reverse position, line conductor 21L, lower winding of relay WP, line conductor 11L and contact 30 in its reverse position to (-) on bus 12. This actuates the polar contacts of relay WP to their reverse positions but until these contacts reach their reverse positions the upper winding of relay WP can not be energized to close neutral contact 19 because of open contact 23 of relay WP.

When the polar contacts of relay WP reach their reverse positions a circuit is closed for energizing the upper winding of relay WP which extends from (+) on bus 10, contact 28 of relay WP in its reverse position, contact 18 of lever SML in its reverse position, upper winding of relay WP, conductor 11L and point detector contact 30 in its reverse position to (-) on bus 12. Therefore neutral contact 19 will be picked up to indicate by means of the circuits leading to the bracket indicated "circuits selected" that the switch machine at the remote station, the WP relay polar contacts and the switch machine lever contacts are all in correspondence. It will be understood that the "circuits selected" may be

used for any purpose desired such as a visual indication or the control of the signal clearing circuits, not shown but obvious to those skilled in the art.

When it is desired to actuate switch TS to its normal position lever SML is restored to its full line position as shown in the drawings. With contact 21 of relay WZ in its reverse position and contact 17 of lever SML in its normal position a circuit is completed for energizing relay WZ in a normal direction which extends from (+), contact 17 of lever SML in its normal position, line conductor CL, winding of relay WZ and contact 21 of relay WZ in its reverse position to (-) on bus 12. Relay WZ therefore actuates its polar contact 22 back to its normal position for controlling the actuation of the track switch to its normal condition and the shifting of contact 21 from its reverse to its normal position de-energizes the winding of relay WZ because both terminals of the relay are connected to the same terminal of the battery.

With contact 18 of lever SML in its normal position and the point detector contacts in their reverse positions and with the polar contacts of relay WP in their reverse positions the lower winding of relay WP is maintained energized in its reverse direction but the upper winding is de-energized because of the open circuit at contact 29 of relay WP.

With the point detector contacts in their mid positions the lower winding of relay WP is de-energized but the polar contacts of this relay remain in their reverse positions until point detector contacts 30 and 31 reach their normal positions when the lower winding of relay WP is energized in its normal direction for restoring the polar contacts to the positions indicated in the drawings. The upper winding of relay WP is then energized over the previously described circuit for effecting the closure of neutral contact 19 to control the selected circuits.

Description of modification.—As above mentioned the control of the track switch by the switch machine lever is not illustrated in Fig. 2 but it will be assumed that this control is effected in the same manner pointed out in connection with Fig. 1.

With the apparatus in the positions illustrated in Fig. 2, the lower winding of relay WP¹ is energized over a circuit extending from the (+) terminal of the upper portion of battery B¹, point detector contact 130 in its normal position, line conductor 11L¹, lower winding of relay WP¹ and line conductor 21L¹ to the (-) terminal of the upper portion of battery B¹. The energization of the lower winding of relay WP¹ in this direction maintains its polar contacts in their normal positions.

Neutral contact 119 of relay WP¹ is picked up because the upper winding of relay WP¹ is also energized over a circuit extending from the (+) terminal of the upper portion of battery B¹, point detector contact 130 in its normal position, line conductor 11L¹, upper winding of relay WP¹, contact 117 of lever SML¹ in its normal position, contact 129 of relay WP¹ in its normal position, through the lower portion of battery B and line conductor 21L¹ to the (-) terminal of the upper portion of battery B¹.

It will now be assumed that lever SML¹ is actuated to its reverse position, in which position the control of the track switch is effected over a control circuit not shown in Fig. 2. With contact 117 of lever SML¹ in its reverse position the up-

per winding of relay WP¹ is de-energized because of open polar contact 128 of this relay and front contact 119 is opened. As long as the point detector contact remains in its normal position the lower winding of relay WP¹ is energized over the above described circuit.

When the point detector contact reaches its mid position as an indication that the track switch is unlocked, then the lower winding of relay WP¹ is de-energized but since this relay is of the magnetic stick type the polar contacts remain in their illustrated positions.

When point detector contact 130 reaches its reverse position the lower winding of relay WP is energized in the opposite sense over a circuit extending from the (+) terminal of the lower portion of battery B¹, line conductor 21L¹, lower winding of relay WP¹, line conductor 11L¹ and contact 130 in its reverse position to the (-) terminal of the lower portion of battery B¹. This effects the actuation of the polar contacts of relay WP¹ to their reverse positions.

It will be obvious that the upper winding of relay WP¹ will not be energized for picking up neutral contact 119 until polar contact 128 reaches its reverse position, at which time this winding is energized over a circuit extending from the (+) terminal of the upper portion of battery B, contact 128 of relay WP¹ in its reverse position, contact 117 of lever SML¹ in its reverse position, upper winding of relay WP¹, line conductor 11L¹, point detector contact 130 in its reverse position, through the lower portion of battery B¹ and line conductor 21L¹ to the (-) terminal of the upper portion of battery B.

From the chart of Fig. 2A, which illustrates various conditions of energization of the WP¹ relay, it will be observed that both windings of this relay are energized by current flowing from right to left as indicated by the arrows opposite these windings under the No. 1 "all normal" condition. This condition of course refers to the circuits in the condition illustrated in Fig. 2.

The No. 2 "all reverse" condition refers to the switch machine lever in its reverse position, the polar contacts of relay WP¹ in their reverse positions and the point detector contact in its reverse position. Under this condition both windings of relay WP¹ will be energized by current flowing from left to right as illustrated by the two arrows and which was previously explained. These two conditions effect the picking up of neutral contact 119 as indicated by the legend "neutral contact picks up" associated with the bracket indicating these two conditions.

Condition No. 3 will now be assumed, that is, the actuation of lever SML to its reverse position with the point detector contact in its normal position. This condition will be brought about in the event that the switch machine or track switch fails to operate to its reverse position in response to lever SML¹ in its reverse position. The lower winding of relay WP¹ is energized by current flowing through this winding from right to left as indicated by the arrow which is effective to maintain the polar contacts of this relay in their normal positions. As above mentioned the upper winding of relay WP¹ is de-energized as long as contact 128 of this relay is away from its reverse position.

When contact 128 is closed in its reverse position the upper winding of relay WP¹ is still de-energized until the point detector contact is closed in its reverse position. This is because, with the point detector contact 130 in its normal position

and contact 128 in its reverse position a circuit may be traced from the (+) terminal of the upper portion of battery B¹, point detector 130 in its normal position, line conductor 11L¹, upper winding of relay WP¹, contact 117 of lever SML¹ in its reverse position and contact 128 of relay WP¹ in its reverse position to the (+) terminal of the upper portion of battery B. Since both terminals of the upper winding of relay WP¹ are connected to points of the same potential this winding will not be energized to close neutral contact 119. If point detector contact 130 reaches its mid position then of course both windings of relay WP¹ are open and contact 119 does not close.

Condition No. 4 is the opposite of the No. 3 condition and it is believed unnecessary to explain the circuit connections of this condition in detail. This condition results from failure of the switch machine or track switch to shift from its reverse to its normal position in response to an operation of lever SML¹ from its reverse to its normal position. It will merely be pointed out that the lower winding of relay WP¹ is energized by current flowing from right to left as indicated by the arrow because of a circuit from the lower portion of battery B¹ through point detector contact 130 in its reverse position. With lever SML¹ in its normal position the upper winding of relay WP¹ cannot be energized as long as contact 129 of this relay is in its reverse position and when this contact reaches its normal position both terminals of the upper winding of relay WP¹ are connected to the (-) terminals of both batteries, which is ineffective to energize this winding.

If the point detector contact reaches its mid-position the circuit of the WP¹ relay windings connected to line conductor 11L¹ is open but there are certain local circuits closed which must be ineffective to energize the upper winding of this relay. Condition No. 5, for example, is the condition where lever SML¹ is in its normal position, polar contacts of relay WP¹ are in their normal positions and the point detector contact is in its midposition. It will be assumed that the switch machine sticks or fails leaving contact 130 in its mid-position. A circuit may now be traced from the (+) terminal of the lower portion of battery B, lower winding of relay WP¹ from left to right (as indicated by the lower arrow under condition 5), upper winding of relay WP¹ from right to left (as indicated by the upper arrow under condition 5), contact 117 of lever SML¹ in its normal position and contact 129 of relay WP¹ in its normal position to the (-) terminal of the lower portion of battery B. It will be observed that current flows through these two windings in opposition so that the effect of one is neutralized by the other to prevent the actuation of any of the relay contacts. In other words, the polar contacts remain in their previous positions and neutral contact 119 is not picked up.

The No. 6 condition, which is the reverse of the above, is effective when the contacts of lever SML¹ are in their reverse positions, the polar contacts of relay WP¹ are in their reverse positions and the point detector contact stays in its mid-position because of a failure of the switch machine or track switch. Under this condition a circuit may be traced from the (+) terminal of the upper portion of battery B, contact 128 of relay WP¹ in its reverse position, contact 117 of lever SML¹ in its reverse position, upper winding of relay WP¹ from left to right (as indicated by the upper arrow under condition No. 6), lower

winding of relay WP¹ from right to left (as indicated by the lower arrow under condition No. 6) to the (-) terminal of the upper portion of battery B. Under this condition the windings of relay WP¹ are energized in opposition so that the polar contacts cannot be shifted from their previous positions and neutral contact 119 cannot be picked up.

From the above explanation it will be observed that two very simple circuit arrangements are provided to check the proper positions of the point detector contacts, the indication relay contacts and the switch machine lever contacts, before the circuits selected by the indication relay contacts are permitted to be completed.

Furthermore, the breaking of line wire 21L of Fig. 1 prevents the picking up of neutral contact 19, since it requires the energization of both windings to pick up this contact. If line wire 11L is broken, neutral contact 19 can not be picked up because both windings of the relay are either deenergized (contacts 18, 23, 29, and 31 all in correspondence), or they are energized in opposition in the manner previously described under conditions 5 and 6.

If line wire 11L¹ or 21L¹ of Fig. 2 breaks, the windings of relay WP¹ cannot be energized in aiding relation for picking up contact 119 under any condition of the lever and relay contacts. The open condition of either line prevents any return path including battery B¹ and under this condition one winding of relay WP¹ cannot be energized without the opposite energization of the other.

Although I have herein shown and described only two forms of an indicating arrangement embodying my invention it is to be understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit or scope of my invention.

Having thus described my invention, what I claim is:—

1. In combination; a railway switch; a contactor controlled by said switch; a lever for the control of said switch; a relay controlled by said contactor, said relay having a polar winding, a neutral winding, the energization of the polar winding alone causing operation of the polar contacts to the normal or reverse position but not operation of the neutral contacts, the energization of both of said windings at the same time being required to operate the neutral contacts; a normal circuit for the polar winding of said relay including a normal contact of said contactor; a reverse circuit for the polar winding of said relay including a reverse contact of said contactor; and a checking circuit for said relay including its neutral winding energized over a circuit including the normal and reverse contacts of said contactor, the normal and reverse contacts of said lever and the normal and reverse polar contacts of said relay in corresponding positions, whereby said neutral contacts are controlled.

2. In combination; a railway switch; a contactor controlled by said switch; a lever for the control of said switch; a relay controlled by said contactor, said relay having a polar winding, a neutral winding, polar contacts controllable by the energization of its polar winding alone, and neutral contacts being controllable only by the contemporaneous energization of both windings; a normal circuit for the polar winding of said relay including a normal contact of said con-

factor; a reverse circuit for the polar winding of said relay including a reverse contact of said contactor; a checking circuit for said relay including its neutral winding energized over a circuit including the normal and reverse contacts of said contactor, the normal and reverse contacts of said lever and the normal and reverse polar contacts of said relay in corresponding positions, whereby said neutral contacts are controlled and whereby the energization of said checking circuit is prevented when any of said contacts are out of correspondence.

3. In combination; a railway switch; a lever for controlling said switch; a contactor controlled by said switch; a relay having contacts; a first energizing circuit for said relay including a source of current and said contactor; a second energizing circuit for said relay including said source of current, said contactor, said lever and said contacts; and a second source of current included in series with said second energizing circuit.

4. In combination; a central office and a distant station; a track switch at said station; a switch machine for operating said track switch; a lever in said office for controlling said switch machine; a double wound polar indication relay in said office; a split battery at said office and at said station having mid-taps connected together; a contactor controlled by said switch machine; circuit means including said contactor and the station battery for reversibly energizing one winding of said relay; lever contacts on said lever; relay contacts on said relay; and additional circuit means including said lever contacts, said relay contacts and the office battery for energizing the other winding of said relay.

5. In combination; a central office and a distant station; a track switch at said station; a switch machine for operating said track switch; a lever in said office for controlling said switch machine; a double wound polar indication relay in said office; a split battery at said office and at said station having mid-taps connected together; a contactor controlled by said switch machine; circuit means including said contactor and the station battery for reversibly energizing one winding of said relay; lever contacts on said lever; relay contacts on said relay; and additional circuit means including said lever contacts, said relay contacts and the office battery for energizing the other winding of said relay only when said lever and said relay contacts are in correspondence.

6. In combination; a central office and a distant station; a track switch at said station; a switch machine for operating said track switch; a lever in said office for controlling said switch machine; a double wound polar indication relay in said office; a split battery at said office and at said station having mid-taps connected together; a contactor controlled by said switch machine; circuit means including said contactor and the station battery for reversibly energizing one winding of said relay; lever contacts on said lever; relay contacts on said relay; and additional circuit means including said lever contacts, said relay contacts and the office battery for energizing the other winding of said relay only when said lever and said relay contacts are in correspondence and in a direction determined by the positions of said lever and said relay contacts.

7. In combination; a railway switch; a lever having contacts for controlling said switch; a contactor operated by said switch; a neutral-polar relay having a first winding, a second wind-

ing and neutral and polar contacts; an energizing circuit for the first winding of said relay including a source of current and said contactor, the energization of said first winding operating said polar contacts of said relay but not the neutral contacts; and a second energizing circuit for the second winding of said relay including said source of current, said contactor, said lever contacts and polar contacts of said relay and closed only if said polar contacts are in a position corresponding with the contacts of said lever; the energization of said second winding cooperating with the energization of said first winding to operate the neutral contacts of said relay.

8. In combination; a power operated railway switch; a lever having contacts for controlling the operation of said switch to its normal and reverse position; a contactor operated by said switch; a neutral-polar indication relay; an energizing circuit for said relay including said contactor for causing a partial energization of said relay sufficient to operate its polar contacts but not its neutral contacts; other energizing circuits for said relay including the said contactor and said lever contacts in corresponding positions for causing a further energization of said relay sufficient to operate the neutral contacts if the first circuit is energized at the same time; and indication circuits including in series neutral and polar contacts of said relay.

9. In combination; a power operated railway switch; a control lever having contacts for governing the operation of said switch to a normal or reverse position; a polar-neutral indication relay having two windings, said windings being so proportioned that the energization of one of said windings alone is sufficient to operate the polar contacts but not the neutral contacts, the combined energization of both of said windings at the same time being required to operate the neutral contacts; a pole-changer operated by said track switch; an energizing circuit including one of said windings of said relay, said pole changer, and a source of current for operating the polar contacts of said relay; and means including said lever contacts and the polar contacts of said relay in corresponding positions for energizing the other winding of said relay to cooperate with said one winding and operate the neutral contacts.

10. A switch indicating system of the character described comprising, in combination with a power operated track switch and pole-changing contacts operated thereby, a neutral-polar indication relay having two separate windings, said windings being so proportioned that the energization of one is sufficient to operate the polar contacts but not the neutral contacts and the energization of both of said windings at the same time and in the same direction causes operation of the neutral contacts; a circuit including a source of current and said pole-changing contacts for energizing said one winding of said relay with current of one polarity or the other in accordance with the operated position of said track switch; a control lever having normal and reverse contacts governing the operation of said track switch; and circuit means including said source of current, the polar contacts of said relay, and said lever contacts for energizing the other winding of said relay with the same polarity only if said polar contacts and said lever are in positions corresponding with the position of said track switch pole changing contacts.

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