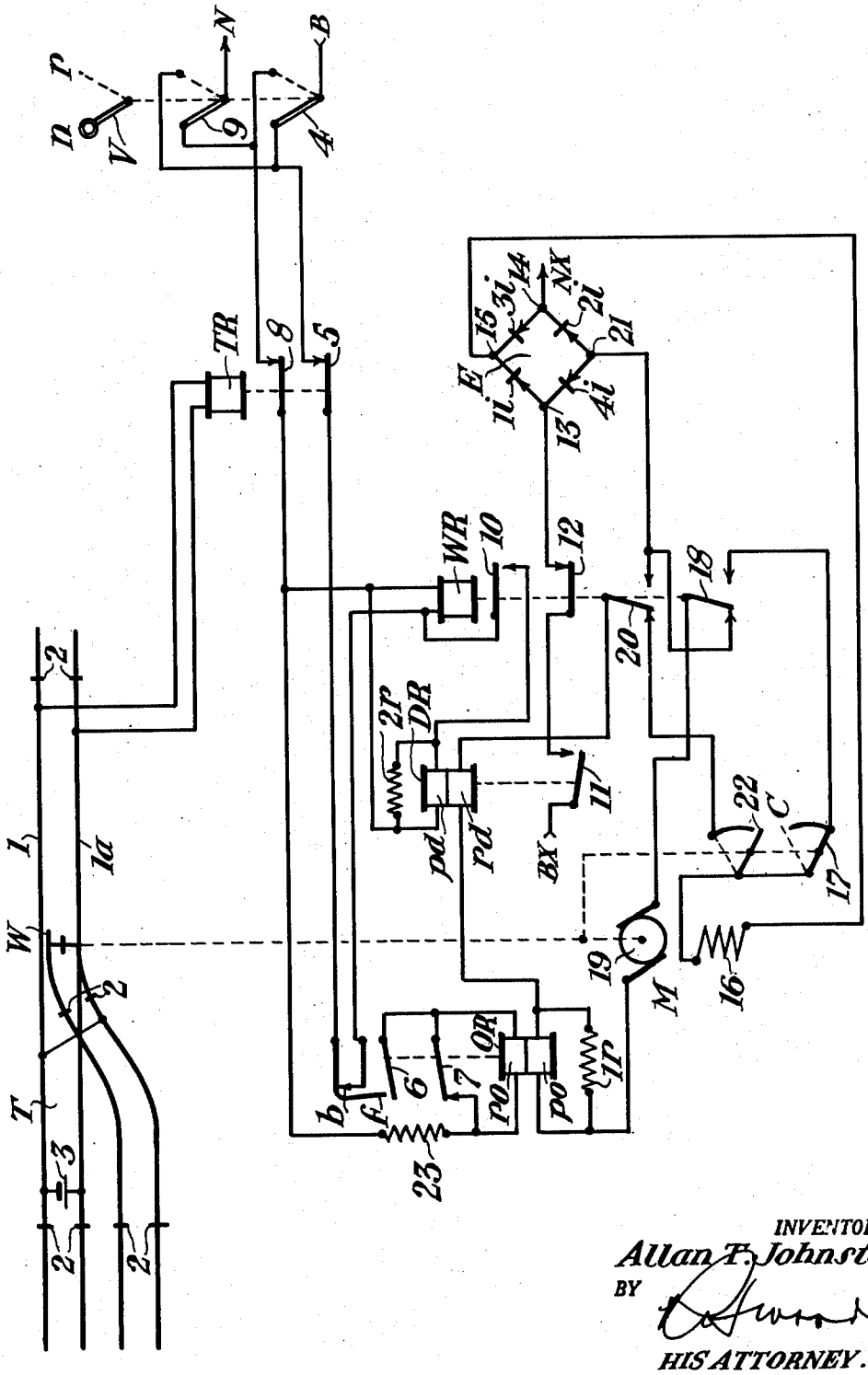
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RAILWAY SWITCH CONTROLLING APPARATUS

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RAILWAY SWITCH CONTROLLING APPARATUS

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My invention relates to railway switch controlling apparatus, and particularly to apparatus of the type in which alternating current is supplied to a rectifier which is in turn supplies direct current to an operating mechanism for moving a railway track switch between its extreme positions.

One feature of my invention is the provision of a power control relay having a pick-up winding and a retaining winding controlled to disconnect the source of alternating current from the rectifier upon completion of each operation of a railway track switch to either of its extreme positions.

A further feature of my invention is the provision of means for energizing the pick-up winding of the power control relay for only a brief period of time, and for then energizing the retaining winding of this relay only as long as operating current is being supplied to the switch operating mechanism.

I shall describe one form of apparatus embodying my invention, and shall then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view showing one form of apparatus embodying my invention, in which the pick-up winding of a power control relay is controlled by a back contact of a switch control relay in multiple with the control winding of the switch control relay, and the retaining winding of the power control relay is connected in series with the switch operating mechanism in the switch operating circuits.

In the drawing, a stretch of railway is shown having rails 1 and 1*a* divided by insulated joints 2 to form a section T in which a switch W is located. Section T is provided with a track circuit including a suitable source of current, such as a battery 3, connected across the rails adjacent one end of the section, and a track relay, designated by the reference character TR, connected across the rails adjacent the opposite end of the section.

A switch operating mechanism, shown as an electric motor M having an armature 19 and a field winding 16, is provided for at times moving switch W between its extreme positions. A switch circuit controller C, having contacts 17 and 22, is operated in conjunction with switch W. Contact 17 is closed while switch W is in its normal position and also while switch W is moving between its normal and reverse positions but becomes opened when switch W reaches the reverse position. Contact 22 is open while switch W is in its normal position but becomes closed as soon as switch W leaves the normal position and

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remains closed while switch W is moving to the reverse position, and while it occupies the reverse position.

A polarized switch control relay WR is manually controllable by a lever V which may be located in an interlocking tower or at a remote point, such, for example, as a dispatcher's office. Relay WR is also controlled by contacts of relay TR and by contacts of an overload relay OR.

Lever V has a normal position *n*, in which it is shown in the drawing, and is manually movable to a reverse position *r*. Contacts 4 and 9 of lever V are closed in both the normal and reverse positions of lever V.

Overload relay OR has a pick-up winding *po* and a retaining winding *ro*. A resistor 1*r* having positive temperature coefficient of resistance is connected in multiple with winding *po*, so that overload current flowing in resistor 1*r* heats this resistor and thus increases its resistance, causing winding *po* to become energized to the pick-up value of relay OR. Relay OR has a continuity contact 6 which has a front point *f* and a back point *b*. When winding *po* of relay OR becomes energized to the pick-up value, contact 6 first becomes closed at its front point *f*, and then becomes opened at its back point *b*. When relay OR becomes deenergized, contact 6 first closes at its back point *b*, and then opens at its front point *f*.

A power control relay DR has a pick-up winding *pd* and a retaining winding *rd*. A resistor 2*r* is connected in multiple with winding *pd* in order to make this relay slow enough in releasing that its front contact will be retained closed by switch operating current flowing through winding *rd* when relay WR picks up.

A power rectifier E has alternating current input terminals 13 and 14, and has direct current output terminals 15 and 21. A suitable source of power, such, for example, as an alternating current source having terminals BX and NX is connected across terminals 13 and 14 of rectifier E through front contacts of relays DR and WR. Rectifier E may be of the full-wave design which comprises half-wave units 1*i*, 2*i*, 3*i* and 4*i* of the well-known copper oxide type.

Direct current is supplied from terminals 15 and 21 of rectifier E through switch operating circuits which include the pick-up winding *po* of relay OR, the retaining winding *rd* of relay DR, armature 19 of motor M, and field winding 16 of motor M, all in series, and which are controlled by polar contacts of relay WR and by the contacts of switch circuit controller C.

Having described, in general, the arrangement

of the various parts of apparatus embodying my invention, I shall now describe the circuits and operation in detail.

As shown in the drawing, all parts of the apparatus are in the normal condition, that is, lever V is in its *n* position; switch W is in its normal position; track section T is unoccupied, and therefore relay TR is energized; relay WR is energized by current of normal polarity; and rectifier E, relays OR and DR, and motor M are deenergized.

The circuit by which relay WR is energized by current of normal polarity passes from terminal B of a suitable source of current, through contact 4 of lever V in the *n* position, contact 5 of relay TR, back point *b* of contact 6 of relay OR, winding of relay WR, contact 8 of relay TR, and contact 9 of lever V in the *n* position to terminal N of the same source of current.

With relay OR deenergized, a shunt path is connected through contact 7 of relay OR across retaining winding *ro* of this relay. This serves to prevent pick-up of the relay on the starting surge current of motor M.

I shall assume that, with apparatus arranged as shown in the drawing, it is desired to move switch W to its reverse position. A leverman or dispatcher will therefore move lever V to its *r* position, thereby completing a circuit for energizing relay WR in the reverse direction, this circuit passing from terminal B, through contact 4 of lever V closed in the *r* position, contact 8 of relay TR, winding of relay WR, back point *b* of contact 6 of relay OR, contact 5 of relay TR, and contact 9 of lever V closed in the *r* position to terminal N.

When the energization of relay WR is changed from the normal to the reverse direction, back contact 10 of this relay is closed for a brief period of time during which a circuit is completed for energizing the pick-up winding *pd* of relay DR, which is the same as the circuit traced for relay WR except that, instead of including the winding of relay WR, it includes winding *pd* of relay DR in multiple with resistor 2*r*, and the back point of contact 10 of relay WR.

As shown in the drawing, relay DR is of a neutral type, having only one front contact 11, whereas relay WR is of a polarized type, having a back contact 10, a front contact 12, and polar contacts 18 and 20. In order to insure that relay DR will operate satisfactorily to close its front contact 11, the windings of relays DR and WR can, according to well-known engineering practice in the design of relays and their control circuits, be so proportioned that winding *pd* will always close contact 11 during the brief period of time that its control circuit will be closed before contact 10 opens.

When winding *pd* of relay DR becomes energized, contact 11 of this relay completes a circuit for supplying alternating current to rectifier E, this circuit passing from terminal BX, through contact 11 of relay DR, contact 12 of relay WR, terminals 13 and 14 of rectifier E, and terminal NX of the source of current.

When relay WR becomes energized by current of reverse polarity, the reverse operating circuit for motor M becomes completed through contacts 18 and 20 of relay WR in the reverse position, and, when relay DR closes its front contact 11, direct current is supplied to this circuit by rectifier E, passing from terminal 15 of rectifier E, through field winding 16 of motor M, contact 17 of switch circuit controller C, contact 18 of relay WR closed in the reverse position, armature 19 of motor M, winding *po* of relay OR in multiple with resistor 1*r*, winding *rd* of relay DR, and contact 20 of relay WR closed in the reverse position, to terminal 21 of rectifier E.

By means of resistor 2*r* connected in multiple with winding *pd* of relay DR, this relay is made slow enough releasing that current starts flowing in the reverse operating circuit for motor M before contact 11 of relay DR opens after contact 10 of relay WR opens. As soon as current starts flowing in the reverse operating circuit for motor M, winding *rd* is energized and retains contact 11 of relay DR in the closed position as long as current is flowing in the reverse operating circuit for motor M.

Operating current for motor M is not sufficient in magnitude or does not flow for a sufficient length of time to cause relay OR to open its contact 7 and close its contact 8 at its front point *f*.

When switch W leaves its normal position, circuit controller C closes its contact 22, and when switch W reaches the reverse position, circuit controller C opens its contact 17. When contact 17 opens, the reverse operating circuit through armature 19 of motor M is interrupted, and therefore not only motor M is deenergized but also the retaining winding *rd* of relay DR is deenergized. With relay DR deenergized, contact 11 disconnects the source of alternating current from terminal 13 of rectifier E.

Because of this method of control of relay DR for opening the alternating current supply circuit for rectifier E upon the completion of an operation of the switch, fewer polar contacts are required in relay WR than with a previous such switch control system in which a railway track switch is operated by direct current supplied from a rectifier. In the previous such switch control system, a polar contact of the WR relay is required in the alternating curent supply circuit for the rectifier, in addition to the polar contacts which are used in the switch operating circuits energized by direct current from the rectifier. Still another polar contact of the WR relay is also required in such other switch control system in the retaining circuits for the overload relay OR.

Furthermore, in my present invention, the retaining winding *rd* of relay DR, on account of being energized by the switch operating circuits, checks the integrity of those circuits. In the event of an open connection in the switch operating circuits, winding *rd* will not become energized, and therefore contact 11 of relay DR will open the alternating current supply circuit to the rectifier E as soon as contact 11 is released after winding *pd* of relay DR becomes deenergized by the opening of contact 10 of relay WR. With my present invention, the rectifier is therefore less likely to be damaged than if the opening of the alternating current supply circuit had to wait for the operation of an overload device.

I shall next assume that after a train moves over switch W in its reverse position, the leverman or dispatcher returns lever V to its *n* position. With lever V in its *n* position, the normal control circuit for relay WR will again be closed as previously traced, and pick-up winding *pd* of relay DR will become energized through contact 10 of relay WR as previously described. With winding *pd* of relay DR again energized, the source of alternating current will again be connected across terminals 13 and 14 of rectifier E. Current will now flow in the normal operating circuit for motor M, passing from terminal 15 of

rectifier E, through field winding 16 of motor M, contact 22 of circuit controller C, contact 20 of relay WR closed in the normal position, retaining winding *rd* of relay DR, pick-up winding *po* of relay OR connected in multiple with resistor *1r*, armature 19 of motor M, and contact 18 of relay WR closed in the normal position, to terminal 21 of rectifier E.

I shall assume further that there is now some obstruction, such, for example, as a lump of coal or a stone which prevents switch W from being operated to the normal position. The abnormal amount of power now being taken by motor M will cause pick-up winding *po* of relay OR to open contact 7 of relay OR and close contact 6 at its front point *f*, thereby completing a retaining circuit for winding *ro* of relay OR, this circuit passing from terminal B, through contact 4 of lever V closed in the *n* position, contact 5 of relay TR, front point *f* of contact 6 of relay OR, winding *ro* of relay OR, resistor 23, contact 8 of relay TR, and contact 9 of lever V to terminal N. Relay OR, upon opening its contact 6 at its back point *b*, deenergizes relay WR. Relay WR, upon becoming deenergized, opens its contact 12, thereby interrupting the supply of alternating current to rectifier E. With the supply of alternating current disconnected from rectifier E, there will now be no current flowing from rectifier E through the normal operating circuit for motor M, and hence winding *po* of relay OR, winding *rd* of relay DR, and motor M will all be deenergized.

In order to remove the obstruction from switch W, the leverman or dispatcher will again move lever V to its reverse position. The source of current which has terminals B and N will be disconnected from winding *ro* of relay OR during the time that lever V is being moved from the *n* to the *r* position, and when lever V reaches the *r* position, winding *ro* of relay OR will be energized in the reverse direction which will force its contact 6 to open at front point *f* if it has not released during the open-circuit period of lever V. With the retaining circuit for relay OR thus opened, this relay will remain deenergized until it again becomes energized by an excessive amount of power flowing through its winding *po*.

With contact 6 of relay OR again closed at its back point *b*, the reverse control circuit for relay WR will again be closed, and the circuit for energizing pick-up winding *pd* of relay DR will also be closed. The alternating current source will therefore again be connected across terminals 13 and 14 of rectifier E through contact 11 of relay DR and contact 12 of relay WR, and current will again flow in the reverse operating circuit for motor M.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In railway switch controlling apparatus including a switch operating motor and a polarized switch control relay and also an overload relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, the combination comprising, a power control relay having a pick-up winding and a retaining winding, manually controllable circuits including the back point of said continuity contact for energizing the winding of said switch control relay by current of normal and reverse polarity and for energizing the pick-up winding of said power control relay connected through a back contact of said switch control relay in multiple with the winding of said switch control relay, a rectifier having a pair of alternating current input terminals and a pair of direct current output terminals, an alternating current source connected through a front contact of said power control relay in series with a front contact of said switch control relay across said input terminals, switch operating circuits including the retaining winding of said power control relay and the pick-up winding of said overload relay and said switch motor all connected in series across said output terminals, and manually controllable means including said front point of said continuity contact for energizing said retaining winding of said overload relay by current of normal and reverse polarity.

2. In railway switch controlling apparatus including a switch control relay and also an overload relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, the combination comprising, a power control relay having a pick-up winding and a retaining winding, manually controllable circuit means including the back point of said continuity contact for energizing the winding of said switch control relay and for energizing in multiple with the winding of said switch control relay the pick-up winding of said power control relay connected through a back contact of said switch control relay, a rectifier having a pair of alternating current input terminals and a pair of direct current output terminals, an alternating current source connected across said input terminals through contacts controlled by said switch control relay and said power control relay, switch operating circuit means including the retaining winding of said power control relay and the pick-up winding of said overload relay controlled by said switch control relay and energized from said output terminals, and manually controllable circuit means including said front point of said continuity contact for energizing said retaining winding of said overload relay.

3. In railway switch controlling apparatus including a switch control relay and also an overload relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, including manually controllable circuit means for energizing said switch control relay through said back point of said continuity contact and for energizing said retaining winding of said overload relay through said front point of said continuity contact, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay having a pick-up winding energized in multiple with the winding of said switch control relay through a back contact of said switch control relay and said power control relay also having a retaining winding, and means controlled by said power control relay and by said switch control relay for energizing said switch operating means in series with said retaining winding of said power control relay and said pick-up winding of said overload relay.

4. In railway switch controlling apparatus including a switch control relay and also an over-

load relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, including manually controllable circuit means for energizing said switch control relay through said back point of said continuity contact and for energizing said retaining winding of said overload relay through said front point of said continuity contact, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay having a pick-up winding energized in multiple with the winding of said switch control relay through a back contact of said switch control relay and said power control relay also having a retaining winding, a source of current, a second source of current, and a circuit including said first source of current controlled by said switch control relay and by said power control relay for controlling energization of said switch operating means by said second source of current through said retaining winding of said power control relay and said pick-up winding of said overload relay.

5. In railway switch controlling apparatus including a switch control relay and also an overload relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, including manually controllable circuit means for energizing said switch control relay through said back point of said continuity contact and for energizing said retaining winding of said overload relay through said front point of said continuity contact, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay having a pick-up winding energized in multiple with the winding of said switch control relay through a back contact of said switch control relay and said power control relay also having a retaining winding, a source of alternating current, a rectifier, a circuit controlled by front contacts of said switch control relay and of said power control relay for energizing said rectifier from said source of alternating current, and switch operating circuits controlled by said switch control relay for energizing said switch operating means in series with said retaining winding of said power control relay and said pick-up winding of said overload relay by direct current from said rectifier.

6. In railway switch controlling apparatus including a switch control relay and also an overload relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, including manually controllable circuit means for energizing said switch control relay through said back point of said continuity contact and for energizing said retaining winding of said overload relay through said front point of said continuity contact, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay having a pick-up winding energized in multiple with the winding of said switch control relay through a back contact of said switch control relay and said power control relay also having a retaining winding, a source of current, a rectifier, a circuit including a front contact of said power control relay in series with a front contact of said switch control relay for energizing said rectifier from said source of current, and circuits controlled by said switch control relay for energizing said switch operating means in series with said retaining winding of said power control relay and said pick-up winding of said overload relay by rectified current from said rectifier.

7. In railway switch controlling apparatus including a switch control relay and also an overload relay which has a pick-up control winding and a retaining winding and which has a continuity contact comprising a front point and a back point, including manually controllable circuit means for energizing said switch control relay through said back point of said continuity contact and for energizing said retaining winding of said overload relay through said front point of said continuity contact, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay energized in multiple with said switch control relay through a back contact of said switch control relay, and means controlled by said power control relay and by said switch control relay for retaining said power control relay energized in series with said switch operating means and said pick-up winding of said overload relay.

8. In railway track switch controlling apparatus including a switch control relay, including manually controllable circuit means for energizing said switch control relay, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay energized in multiple with said switch control relay, and means controlled by said power control relay and by said switch control relay for retaining said power control relay energized in series with said switch operating means.

9. In railway track switch controlling apparatus including a switch control relay, including manually controllable circuit means for energizing said switch control relay, and also including switch operating means for moving a railway track switch between its extreme positions, the combination comprising, a power control relay having a pick-up winding and a retaining winding, circuit means for energizing said pick-up winding for only a brief period of time in multiple with the winding of said switch control relay, a rectifier, means controlled by front contacts of said power control relay and of said switch control relay for energizing said rectifier, switch contacts operated in conjunction with said switch operating means, and operating circuits controlled by said switch control relay and by said switch contacts for energizing said switch operating means by current from said rectifier in series with said retaining winding of said power control relay only until completion of an operation of said switch between its extreme positions.

10. In railway track switch controlling apparatus including a switch control relay and manually controllable circuit means for energizing said switch control relay and also including switch operating means for moving a railway track switch between its extreme positions, and including switch contacts operated in conjunction with a railway track switch, the combination comprising, a power control relay having a slow release pick-up winding and a retaining winding, circuit means controlled by a back contact of said switch control relay for energizing said pick-up winding

in multiple with the winding of said switch control relay for only a brief period of time, a rectifier, means controlled by said switch control relay and by said power control relay upon becoming energized for energizing said rectifier, and operating circuits controlled by said switch control relay and by said switch contacts for energizing said switch operating means from said rectifier in series with said retaining winding of said power control relay and arranged to be opened by said switch contacts when each switch operation is completed.

11. In railway switch controlling apparatus including a switch control relay and manually controllable circuit means for energizing said switch control relay, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay having a slow release pick-up winding energized in multiple with the winding of said switch control relay through a back contact of said switch control relay and said power control relay also having a retaining winding, and means controlled by said power control relay and by said switch control relay for energizing said switch operating means in series with said retaining winding of said power control relay.

12. In railway switch controlling apparatus including a switch control relay and manually controllable circuit means for energizing said switch control relay, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay having a slow release pick-up winding energized

in multiple with the winding of said switch control relay through a back contact of said switch control relay and said power control relay also having a retaining winding, a source of current, a second source of current, and a circuit including said first source of current controlled by said switch control relay and by said power control relay for controlling energization of said switch operating means by said second source of current through said retaining winding of said power control relay.

13. In railway switch controlling apparatus including a switch control relay and manually controllable circuit means for energizing said switch control relay, and also including switch operating means for moving a railway track switch between normal and reverse positions, the combination comprising, a power control relay energized in multiple with said switch control relay through a back contact of said switch control relay, and means controlled by said power control relay and by said switch control relay for retaining said power control relay energized in series with said switch operating means.

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