

June 1, 1937.

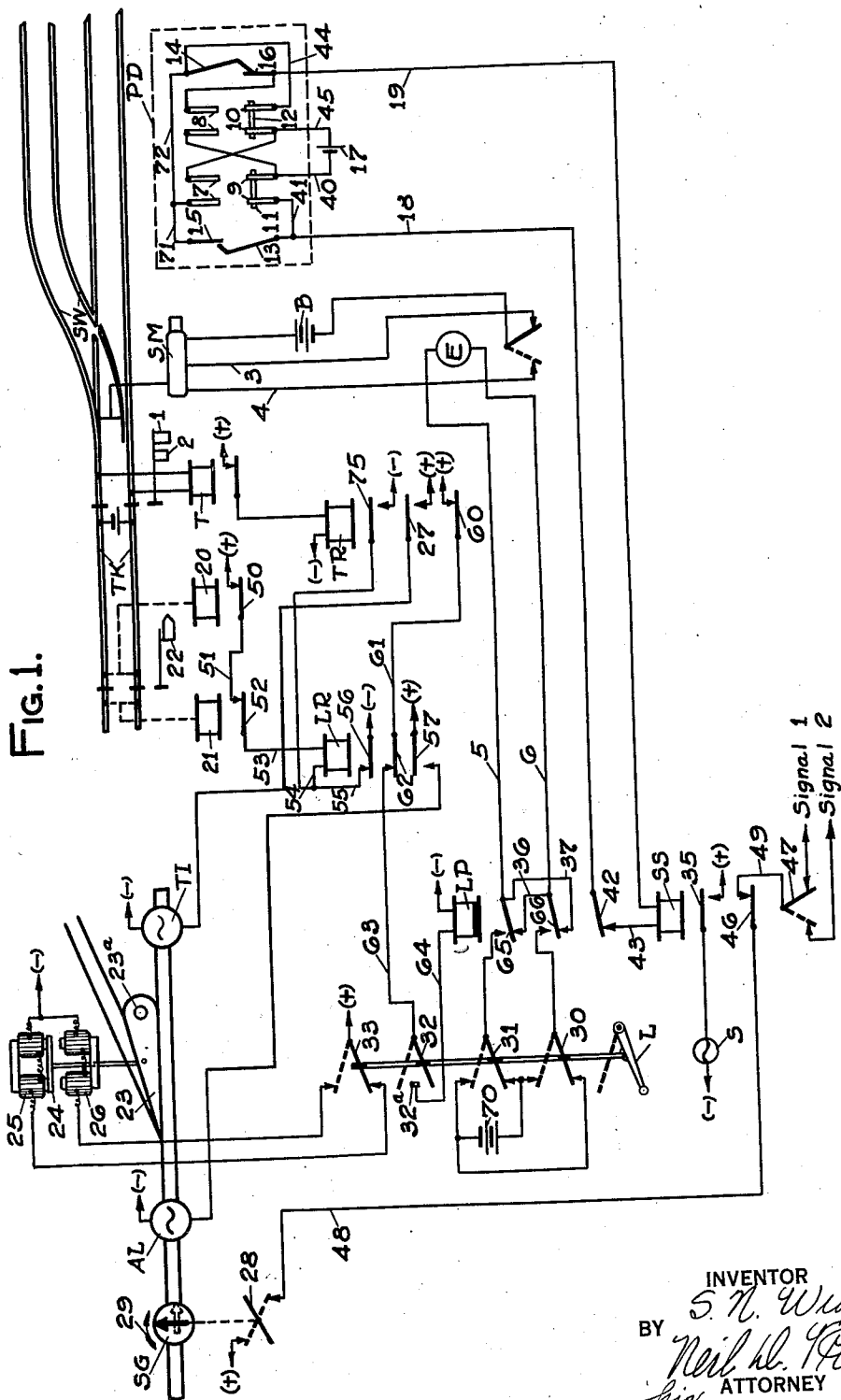
S. N. WIGHT

2,082,437

INTERLOCKING SYSTEM FOR RAILROADS

Filed Feb. 27, 1930

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 2.

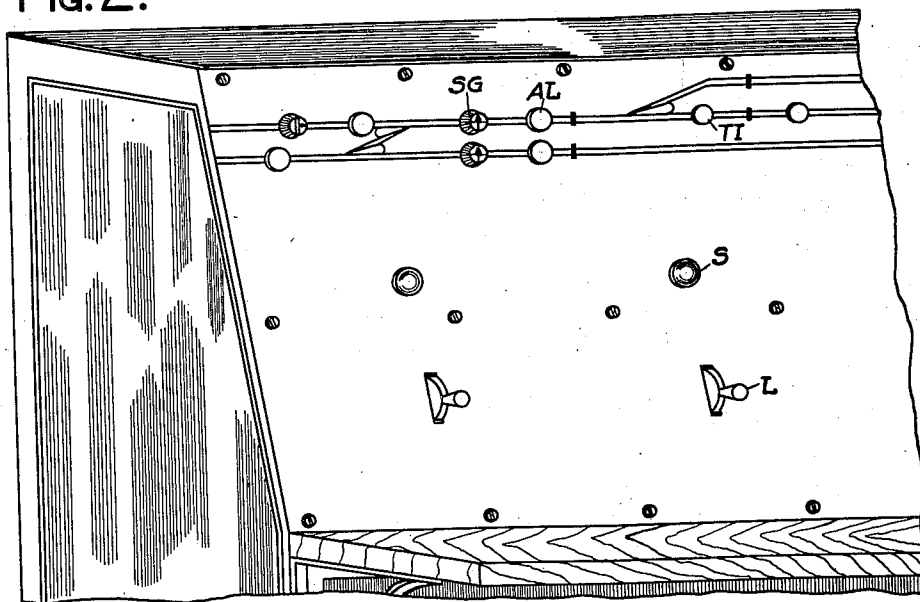
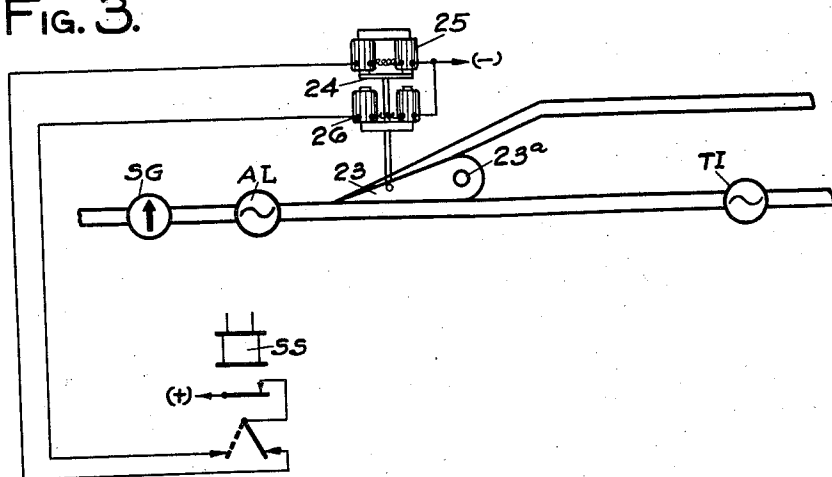


FIG. 3.



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2,082,437

INTERLOCKING SYSTEM FOR RAILROADS

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Application February 27, 1930, Serial No. 431,748

35 Claims. (Cl. 246—135)

This invention relates to manually controlled power operated interlocking systems for railroads, and more particularly to a system of remote control for a power-operated switch machine.

This application is a continuation in part of my prior application Ser. No. 257,643 which matured into Patent No. 1,759,383 dated May 20, 1930.

One object of the present invention is to provide a simple and novel organization of parts and circuits to obtain the necessary or desirable controls and indications for a power-operated switch and its associated signals.

Another object of the invention is to provide simple electrical means for approach and detector locking control, which requires movement of the control lever while the approach and detector locking devices are energized, without mechanically restraining the movement of the control lever.

Another object of the invention is to simplify and facilitate the manipulations of the operator by providing such correlation between the track diagram, the control levers, and indicators, as will enable the operator to manipulate the levers effectively with the minimum amount of effort.

Other objects, characteristic features and advantages of the invention will be in part apparent to those skilled in the art, and in part pointed out hereinafter, as the description progresses.

In the accompanying drawings, Fig. 1 shows in a diagrammatic and simplified way one specific embodiment of the invention applied to the control of a single track switch and signals for diverging routes governing traffic over this switch;

Fig. 2 shows the form of track diagram contemplated in accordance with this invention, with the disposition of the switch and signal control levers, as applied to a simple track layout; and

Fig. 3 shows a modification or adaptation of the embodiment of the invention illustrated in Fig. 1.

Referring to Fig. 1 of the accompanying drawings, the principles and functions of the invention are exemplified by one specific embodiment applied to a single switch, the various devices and circuits being illustrated conventionally and in a diagrammatic manner, more with the object of making it easy to understand the nature and mode of operation of the invention, rather than with the purpose of showing specifically the detail construction and arrangement of parts preferably employed in practice. The stretch of track TK, the switch SW, and the signals 1 and 2, governing traffic over this switch, are typical

or representative of a simple facing point switch, frequently encountered in track layouts for interlocking plants; and an explanation of the invention, applied to such a switch, will readily demonstrate to those skilled in the art how the invention may be applied to double slip switches, movable point frogs, cross-overs, and other track combinations encountered in practice.

The switch machine SW is operated by a suitable power switch machine SM; and it is assumed that this switch machine is of the electrically operated type, such as disclosed, for example, in the patent to W. K. Howe, No. 1,466,903, dated Sept. 4, 1923. The operating current for this switch machine is derived from a local battery B, or other suitable source of direct or alternating current, in accordance with the characteristics of the switch machine. The application of operating current from the battery B to the switch machine SM, over normal and reverse operating wires 3 and 4, is controlled by a suitable polarized three-position remote control relay E. If direct current is employed for the control of the switch machine, as in the particular embodiment shown, this remote control relay E may be of the three-position D. C. motor type, such as disclosed, for example, in the patent to W. K. Howe et al., No. 1,180,719, dated April 25, 1916. If alternating current is available and employed for the control of the switch machine, this remote control relay E may be of the three-position two-element alternating current induction type, such as disclosed, for example, in the patent to S. M. Day No. 1,624,478, dated April 12, 1927. The detail construction of this remote relay forms no part of this invention, and may take various forms, so long as provision is made for the closing of its normal contacts, when this relay is energized over the control wires 5 and 6 with one polarity, close its reverse contacts when energized with the opposite polarity, and for maintaining closed either its normal or reverse contacts when deenergized, until energized with current of the opposite polarity. In other words, this remote control relay E, is of the stick type, and its contacts are held in some suitable manner, by friction, spring, permanent magnet, toggle levers, or the like, in an operated position until operated to the other position.

In accordance with this invention, the switch machine SM is equipped with suitable point detector contacts, operated in accordance with the position and locked condition of the switch points. A point detector, suitable for this purpose, is shown and described, for example, in the

patent to C. S. Bushnell, No. 1,517,236, dated Nov. 25, 1924. In Fig. 1, the contacts of this point detector PD are shown diagrammatically and comprise four pairs of contact fingers 7-10, and two movable contact blocks 11 and 12. When the switch points are over and locked in the normal position, as shown, the contact blocks 11 and 12 engage the pairs of fingers 9 and 10; and when the switch points are over and locked in the other extreme reverse position, these contact blocks engage the other pairs of contact fingers 7 and 8. When the points are unlocked or in mid-stroke, the contact blocks 11 and 12 are operated to an intermediate position out of engagement with all of the contact fingers. These point detector contacts PD also preferably include shunting contacts, comprising movable arms 13 and 14 and cooperating stationary contacts 15 and 16. With the points in the normal locked position, the shunting contacts 13-15 are open, and the shunting contacts 14-16 are closed. In the reverse position, just the opposite is true, that is, contacts 13-15 are closed and contacts 14-16 are open. While the switch points are unlocked or in mid-stroke, both the shunting contacts 13-15 and 14-16 are closed.

A suitable source of current, as a battery 17, and a pair of control wires 18 and 19, are connected to these point detector contacts PD, providing for the energization, with one polarity or another, or the deenergization and shunting, of a switch repeating or signal selecting relay SS located in the tower.

The track rails of the stretch of main track TK and the turn-out track, together with the switch points, are provided with insulated joints and cross bonding to provide a detector track circuit having a track relay T, in accordance with well known practice. This track relay T controls a track repeater relay TR, located in the tower, over a circuit readily traced on the drawings from one terminal of a suitable source of current, indicated by (+), to the other terminal of that source, indicated by (-).

The stretch of main track TK, in the rear of the switch and signals 1 and 2, is also provided with suitable track circuits, two of which with track relays 20 and 21 having been shown. A distant signal 22 is also illustrated, the track circuit for the track relay 21 being associated with the track section next in the rear of the distant signal 22.

The tower equipment, shown in the left hand part of Fig. 1, comprises a suitable track diagram, such as shown more fully in Fig. 2. This track diagram includes the usual wide lines indicating the tracks of the track layout for the plant, but the track switches are pivoted members, movable by an electro-magnetic device to positions corresponding to the normal and reverse positions of the switch. More specifically, referring to Fig. 1, the member or miniature switch 23, representing the switch SW on the track diagram, is pivoted at 23^a, and is operatively connected in some suitable manner, indicated by a dotted line, to the armature 24 of two electro-magnets 25 and 26, so that when the electro-magnet 25 is energized, the miniature switch point 23 is moved to the normal position as shown, and if the other magnet 26 is energized, it is moved to the reverse position. On the track diagram, at the point corresponding to the location of the several track circuits, is an indicator lamp TI, which is lighted when the corresponding track circuit is occupied. For example, re-

ferring to Fig. 1, the lamp TI is energized by a circuit including the back contact 27 of the track repeater relay TR, so that whenever the detector track circuit for the switch SW is occupied, the lamp TI is lighted.

Also preferably located on the track diagram, at the proper corresponding point, are knobs or handles for operating the contacts controlling the signals. For example, referring to Fig. 1, a knob SG is employed for controlling the signals 1 and 2. This knob is suitably connected, as indicated by dotted lines, to a contact 28, closed when this knob is turned to the right, as indicated by the arrow 29, preferably marked on the track diagram. This knob SG also preferably carries an arrow, or other suitable symbol, to show its position. As shown, when the arrow on this knob SG points cross-wise of the line indicating the track, the contact 28 is open, and the signals 1 and 2 indicate stop; and when the knob is turned to the right, so that this arrow points lengthwise of the line indicating the track and toward the miniature switch 23, the contact 28 is closed, controlling the signals 1 and 2 to cause one or the other to clear, depending upon the position of the points of the switch SW, and the presence or absence of trains. If desired, this switch SG may have two contacts associated therewith one of which is closed when the arrow points up which may be included in the circuit for the signal 1 and the other of which is closed when the arrow points down included in the signal 2, so that the arrow may indicate whether a high or low signal is conditioned for clearing. Similarly, the arrow may indicate the contemplated direction of traffic movement on single track railroads where trains move in both directions.

The control levers L for the several switches are preferably located, as nearly as possible, directly below the corresponding switch on the track diagram. For example, referring to Fig. 1, the lever L controlling the switch SW is located directly below the miniature switch point 23. This lever L is shown diagrammatically and is movable from the normal position shown, to a reverse position, indicated by dotted lines; and this lever is connected in a suitable manner, indicated by dotted lines, to a plurality of contact fingers 30-33, likewise movable from one extreme position to the other into and out of engagement with contacts indicated conventionally as arrows, with the exception of the contact finger 32, which engages a stationary contact 32^a during a portion of the movement of the lever at its intermediate position, for the purposes hereinafter explained.

Associated with each switch control lever L is a lamp AL to indicate the presence or absence of trains, or other conditions, permitting or preventing operation of the switch. A lamp S, energized through a back contact 35 of the switch repeating relay SS, indicates when the switch machine is operating.

Also associated with the lever L in the tower is a slow release relay LP, and a relay LR for approach locking. This relay LP although slow release has preferably a quick pick-up characteristic, so that it will pick up even though the lever L is moved quickly from one extreme to the other extreme position. This may be accomplished by providing suitable retarding means delaying the opening of the contact such as a dash-pot or a coil on the relay short circuited only when the relay is in its attracted condition.

Operation.—Considering now the operation of

the embodiment of the invention shown in Fig. 1, the parts and circuits are shown in the normal condition, corresponding to the switch SW in the normal position and the signals 1 and 2 indicating stop. Under these conditions, the switch repeating relay SS is energized with one polarity over a circuit from the battery 17 through the point detector contacts PD which may be traced in detail as follows: from the (+) terminal of the battery 17, wire 40, contacts 9—11, wire 41, control wire 18, back contact 42 of the relay LP, wire 43 of the relay SS, control wire 19, shunt contacts 14—16, wire 44, contacts 10—12, and wire 45 back to the other terminal of the battery 17.

With the switch repeating relay SS energized with this polarity of current, its armature is attracted closing its front contact 46, and causing its polar contact 47 to assume the normal position shown and ready to establish the control circuit for the signal 1, this control circuit being connected in a manner not shown to a suitable relay governing the indications of the signal 1, subject to the automatic block signal circuits governing the indication of that signal, in accordance with the presence of trains in advance of it.

Under the normal conditions assumed, the operator may clear the high speed signal 1 by turning the knob SG to close the contact 28, whereupon current may flow from (+) through contact 28, wire 48, front contact 46 of the relay SS, wire 49, polar contact 47 of relay SS normal, and thence over the control circuit for signal 1, clearing this signal if there are no trains ahead, and no conflicting route is established. It should be understood, in this connection, that the control circuit for the signal 1 includes contacts of the switch repeating relay SS associated with each and all of the switches in the routes governed by this signal 1, and in any conflicting routes, in accordance with the recognized practice.

Assuming that the operator desires to set up a new route through the plant, and in tracing this new route on the track diagram, finds that the particular switch SW, shown in Fig. 1, should be put in the reverse position. If no train has entered the approach locking limits since the last train movement over the switch SW, the track relays 20 and 21 are energized, and the approach locking relay LR is energized by its stick circuit which may be traced from (+), through the front contact 50 of the track relay 20, wire 51, front contact 52 of track relay 21, wire 53 to the tower, relay LR, wires 54 and 55, front contact 56 of relay LR, to (—).

The relay LR, being thus energized, opens its back contact 57 and an indicator lamp AL is extinguished, indicating to the operator that the approach locking permits operation of the switch SW in question. Obviously, the lamp AL may be lighted through a front contact of the relay LR, so that this lamp indicates, when lighted, that the switch may be operated, rather than when extinguished.

If there is no train present on the detector track circuit for the switch SW, the track relay repeater TR is energized and the track indicator lamp TI is extinguished. The control of this indicator lamp TI may of course be reversed, without departing from the invention, so that it is lighted, when the detector track circuit is unoccupied, rather than extinguished.

After noting from these indicator lamps TI and AL that the switch SW may be properly operated to the reverse position, the operator moves his

lever L from the normal position shown to the reverse position. In passing through the intermediate position, the lever contacts 32—32^a are closed for a short interval of time; and since the relays TR and LR are assumed to be energized, an energizing circuit for the relay LP is established as follows: from (+), front contact 60 of relay TR, wire 61, front contact 62 of relay LR, wire 63, contacts 32—32^a, wire 64, relay LP, to (—).

The lever contacts 32—32^a are so designed as to maintain contact, during normal manual movement of the lever L, for sufficient length of time to cause the relay LP to attract its armature and move its contact fingers 65 and 66 from the lower position, as shown, to the upper position; and on account of the slow releasing characteristic of this relay LP, its front contacts are maintained closed for a short interval of time, during which the remote control relay E is energized from the tower battery 70, through the lever contact fingers 30—31, as can be readily traced on the drawings. The time of dropping the relay LP is of course such that the relay E has time to respond. This energization of the remote control relay E, with reverse polarity, causes the switch machine to operate the switch points to the reverse position.

As soon as the relay LP is energized, by movement of the lever L in the manner just explained, the opening of its back contact 42 deenergizes the switch repeating relay SS, opening its front contact 46, so as to prevent the clearing of the signals 1 and 2, and closing its back contact 35, so as to light the indicator lamp S. As soon as the switch points are unlocked, the contact blocks 11 and 12 of the point detector contacts PD assume an intermediate position, cutting off the battery 17 from the control wires 18—19, so as to maintain the relay SS deenergized. Also, while the switch points are unlocked or in mid-stroke, both of the shunting contacts 13—15 and 14—16 are closed, thereby providing a short circuit for the two control wires 18 and 19, comprising wires 71 and 72, so as to deenergize the relay SS, even though stray potential may be applied to these control wires.

After the switch machine has completed its cycle of operation, and the point detector contacts PD have shifted to the reverse position, the relay SS is again energized, but with the opposite polarity, the relay LP in the meantime having closed its back contact 42. This energization of the relay SS opens its back contact 35 and extinguishes the indicator lamp S, thereby informing the operator that the switch has operated properly as intended.

It will be observed that the indicator lamp S is lighted while the switch machine is operating; and if it should remain lighted, the operator knows that the switch points have encountered some obstruction, or something else has happened to prevent its regular operation.

With the switch SW operated to the reverse position in this manner, the operator may then clear the low speed signal 2 by operating the knob SG to close its contacts 28, the control circuit for the signal 2 being established in this case, because the polar contact 47 of the relay SS has been reversed.

It should be noted that current can not be applied to the remote control relay unless the relay LP is energized, the connection between the control wires 5 and 6 through the lever contacts 30 and 31 to the battery 70 being broken at the

front contacts 65—66 of the relay LP. The wires 36 and 37, connecting the back points of the relay LP of the opposite control wire 5 or 6 are preferably employed to provide two shunts or short circuits for these control wires, so as to prevent energization of the remote control relay by stray currents applied to the control wires through crosses or grounds, while the relay LP is de-energized. Moreover, the relay LP is energized temporarily, during movement of the lever from one position to the other, providing the detector and approach locking permits such energization. In other words, there must be a movement of the control lever L for the switch, each time before current can be supplied to the remote control E to change the position of the switch.

Thus, the relay LP provides the desirable characteristics of a lever lock, mechanically restraining movement of the control lever, because no operation of the switch machine occurs unless the lever is moved while or as the detector and approach locking relays are energized. This prevents abnormal or unexpected operation of the switch, which might occur if the operator should carelessly or accidentally leave his control lever in the wrong position, while the approach or detector locking is effective. In such a case, if it were not for the relay LP, as soon as the detector and approach locking relays became energized, the switch would operate into position corresponding with the position of the lever, and such operation might be unintentional and unexpected.

The electro-magnets 25 and 26, operating the miniature switch point 23 on the track diagram, are shown in Fig. 1 as energized through the lever contact 33 in the normal and reverse position. With this arrangement, the miniature switch point 23 follows the movements of the control lever L, irrespective of the position of the corresponding track switches. This is considered desirable, because the operator can readily tell from his track diagram what route has been set up by the movement of the control levers; and if the indicator lamps S on the track diagram are all extinguished, he knows that the track switches are in positions corresponding with the position of the middle switches, and that the desired route has actually been set up, making it possible to clear the signals.

The miniature switch point 23, however, may be operated so as to indicate the position actually assumed by the corresponding track switch. This is done by controlling the circuits for the electro-magnets 25 and 26 through polar contacts on the switch repeating relay SS, as shown in Fig. 3. With this arrangement, the operator knows that, when the indicator lamp S is extinguished (or lighted if the reverse arrangement is employed) the switch points are over and locked in the same position indicated by the miniature switch 23.

The control of the approach locking relay LR may take various forms, such as described, for example, in my prior application, Ser. No. 48,553, filed August 6, 1925. In the simple arrangement shown, this relay LR is deenergized upon the entrance of a train into a track section next in the rear of a distant signal, and so long as this train is in the rear of the home signal. Thus, if a train is approaching the switch SW, the relay LR is deenergized, the relay LP cannot be energized and the switch cannot be operated, even though the operator should cause the signals 1 and 2 to indicate stop by operation of the signal

control knob SG. As shown, the relay LR, once deenergized, is again picked up through the back contact 75 of the track relay repeater TR, providing the track relays 20 and 21 of the approach locking zone are energized.

Having thus shown and described one specific embodiment of the invention, it is desired to be understood that the particular embodiment selected has been selected for the purpose of exemplifying the invention and is not intended to show the scope of the invention or the exact construction preferably employed in practicing the invention, and it is also to be understood that various additions, changes and modifications may be made to adapt the invention to the particular problem encountered in practicing the same, all without departing from the spirit or scope of the invention, except as demanded by the scope of the following claims.

What I claim as new is:—

1. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, and means associated with said lever permitting closure of said circuit for a limited time only upon movement of said lever.

2. In an interlocking system for railways, the combination with a switch machine for operating a track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, a locking relay, and means associated with said lever permitting closure of said circuit only if said lever is moved at a time when said locking relay is energized.

3. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, a locking relay, and means associated with said lever permitting closure of said circuit for a limited time only after each movement of the lever from one extreme to the other extreme position and only if said locking relay is energized at the time of such lever movement.

4. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, a slow-dropping relay having a front contact included in said circuit, and a lever which in one position energizes said slow dropping relay and in another position closes said circuit.

5. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, means associated with said lever permitting closure of said circuit only if said lever assumes two specific positions in less than a predetermined time, a miniature track switch associated with said lever, and electro-responsive means for operating said miniature track switch in accordance with the position assumed by said lever.

6. In an interlocking system for railways, the combination with a track switch and a switch machine for operating the track switch, a relay

of the stick type for controlling said switch machine, a circuit for said relay, a lever, and means associated with said lever permitting closure of said circuit only if said lever assumes two specific positions in less than a predetermined time, a miniature track switch associated with said lever, electro-responsive means for operating said miniature track switch, means for controlling said electro-responsive means in accordance with the position assumed by said lever, and means for indicating if said switch is over and locked in one position or the other.

7. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, a slow-dropping relay having a front contact included in said circuit, a back contact on said slow dropping relay for shunting said first mentioned relay, and a lever which in one position energizes said slow dropping relay and in another position closes said circuit.

8. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, approach locking means in said circuit for preventing operation of said switch machine during the approach of a train, a lever, and means controlled by said approach locking means and responsive to the movement of said lever for connecting said relay circuit to said lever for a limited time only after movement of the lever.

9. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, approach locking means in said circuit for preventing operation of said switch machine during the approach of a train, a lever, and means rendered effective by movement of said lever only if said locking means is then ineffective for operatively connecting said circuit to said lever for a limited time.

10. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, approach locking means in said circuit for preventing operation of said switch machine during the approach of a train, a lever, and a slow-releasing relay energized temporarily upon movement of said lever only if said locking means is then ineffective for connecting said circuit to said lever for a limited time.

11. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, a lever, a slow-dropping relay, a front contact of said slow-dropping relay included in said circuit, a back contact on said slow-dropping relay for shunting said first mentioned relay, and a lever which in one position energizes said slow dropping relay and in another position closes said circuit.

12. In an interlocking system for railways, the combination with a switch and signal layout in-

cluding a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, approach locking means in said circuit for preventing operation of said switch machine during the approach of a train, a lever, and means associated with said lever permitting closure of said circuit only if said lever is operated at a time when said approach locking means is not effective, a miniature track switch associated with said lever, and electro-responsive means for operating said miniature track switch in accordance with the position assumed by said lever.

13. In an interlocking system for railways, the combination with a switch and signal layout including a track switch and a switch machine for operating the track switch, a relay of the stick type for controlling said switch machine, a circuit for said relay, approach locking means in said circuit for preventing operation of said switch machine during the approach of a train, a lever, means associated with said lever permitting closure of said circuit only if said lever is operated at a time when said locking means is not effective, a miniature track switch associated with said lever, electro-responsive means for operating said miniature track switch, and means for controlling said electro-responsive means in accordance with the position assumed by said track switch.

14. In combination, a railway track layout, a miniature track layout corresponding to said railway track layout, a rotatable control button located in the track of said miniature track layout, contacts associated with said button for controlling said signal, and an indicia on said button for indicating the direction of traffic permitted by said signal when said button assumes the signal clear position.

15. In a system for governing power-operated switches the combination with a switch machine, a control lever, a track diagram positioned adjacent said lever and including a movable miniature switch point, electro-responsive means governed in accordance with the position of said lever for actuating said switch points, and indicating means automatically governed by the switch machine for indicating when the points of said track switch are over and locked in one position or the other.

16. A controlling system for power-operated switches comprising, a control lever, a switch position indicator governed by said lever, a polarized indication circuit controlled by the switch machine, and a transit lamp controlled by said circuit.

17. In a traffic controlling system for railroads, a switch machine, a control circuit for said switch machine, a free and non-lockable control lever for governing the energization of said circuit, a locking relay responsive to the presence of trains adjacent said switch, and means for rendering said lever effective to govern the energization of said circuit at any time thereafter only if said lever is shifted to a different position at a time when said locking relay is energized.

18. In a traffic controlling system for railroads, the combination with a power-operated switch machine, a polarized control circuit, a remote control relay governed by said circuit and remaining in its last energized position until energized with current of opposite polarity, a track circuit controlled locking relay, and means including a manually operable control lever for momentarily energizing said control circuit when

said lever is shifted to a different position at a time when said locking relay is energized.

19. A control system for power operated switch machines for railroads comprising, a switch machine, a control circuit for said switch machine, a lock relay having a front contact included in said control circuit, a control lever having contacts included in said control circuit and in the circuit of said lock relay respectively of which only one contact can be closed at one time, and a traffic controlled contact included in said circuit of said lock relay, whereby said control circuit can be energized only if said traffic controlled contact is closed just prior to movement of said lever to a position to close said control circuit at the lever contact.

20. A control system for power operated switch machines for railroads comprising, a control circuit for such switch machine, a lock relay having a front contact included in said control circuit, a control lever having contacts included in said control circuit and in the circuit of said lock relay respectively of which only one contact can be closed at one time, and a traffic controlled contact in series with one of the said contacts of said lever.

21. In a railway control system, a track layout, a miniature diagram of said track layout, manually operable contact means so associated with said miniature layout to simulate various conditions of traffic controlling devices thereof and control means effective to condition said traffic controlling devices in accordance with the manually selected contact means.

22. In a control system for power operated switch machines, in combination with a switch machine and a track switch operable thereby, a distant central control office, a miniature track switch at the control office, a line circuit connecting the control office with the switch location, electromagnetic means at the control office which if energized in one manner will cause the miniature switch to be actuated to one extreme position and if energized in another manner will cause said miniature switch to be actuated to a different extreme position, and a relay distinctively controlled over the line circuit in accordance with the position assumed by the track switch and controlling distinctive energization of the electro-magnetic means.

23. In a system for the remote control of power-operated switches, the combination with a track diagram having a movable miniature switch point to indicate the position of a distant switch, a polarized indication circuit having its continuity and polarity governed in accordance with the locked condition and position of the track switch, a polar relay in said indication circuit, electro-responsive means distinctively energized in accordance with the polarity of energization of said polar relay for automatically magnetically actuating said miniature switch to a position corresponding with the position of the distant track switch, and an indicating lamp controlled over said indication circuit for indicating when said switch is in mid-stroke.

24. In combination, a distant traffic controlling device; a two position relay constructed to respond to a momentary flow of current and to remain in its last operated position until operated to another position for controlling said device; a lever for controlling said relay but normally ineffective to directly control said relay; and means for permitting control of said two position relay by said lever including, a slow act-

ing relay having front contacts included in the circuit of said two position relay, and means for energizing said slow acting relay for a time in response to the act of changing the position of said lever.

25. In combination, a railway traffic controlling device having a normal and an abnormal condition, a free lever operable to two extreme positions and tending when in one position to cause said traffic controlling device to be operated to the normal condition and when in the other position tending to cause said traffic controlling device to be operated to the abnormal condition, traffic controlled means for preventing said lever from controlling said traffic controlling device so long as traffic conditions are unfavorable, and other means for preventing said lever from controlling said traffic controlling device in response to clearing up of said unfavorable traffic conditions unless said lever is operated after such clearing up of traffic conditions.

26. In combination, a railway traffic controlling device having a normal and an abnormal condition, a free lever operable to two extreme positions and tending when in one position to cause said traffic controlling device to be operated to the normal condition and when in the other position tending to cause said traffic controlling device to be operated to the abnormal condition, and other means for preventing control of said traffic controlling device by said lever under certain traffic conditions and thereafter irrespective of traffic conditions unless said lever is operated after traffic conditions have again changed.

27. In combination, a track layout including a track switch for establishing any one of a plurality of routes, a switch machine for operating said track switch, a polar control circuit for controlling said switch machine to a normal position and to the reverse position respectively when energized by current of one polarity or the other, a lock relay having front contacts included in said polar control circuit, whereby said switch machine cannot be operated to either position unless said lock relay is energized, a signal for governing traffic over one of said routes, and a circuit which must be closed to permit clearing of said signal and including back contacts of said lock relay closed only if said lock relay is de-energized.

28. In combination, a railway track switch, a switch machine for operating said track switch, a lock relay which must assume its energized position for each cycle of operation of said switch machine to permit such switch machine to operate said track switch and which does not select the direction of operation of said switch machine, a signal for governing traffic over said switch, and a circuit which must be closed to permit clearing of said signal including in series a contact reflecting the position of said track switch and a back contact of said lock relay.

29. In a remote control system, an office and a station, a railway track switch and signals for governing the movement of traffic over the switch; a switch control circuit comprising a switch control relay at the station, line wires and contacts of a switch lever at the office and adapted to be closed to energize the relay to operate the switch; a signal control circuit comprising line wires and contacts of a signal lever at the office and adapted to be closed in certain positions of the signal lever to selectively clear said signals; a contact at the office included in said

signal control circuit; a switch indication relay at the office; adapted to indicate the condition of the switch; and means controlled by the switch when fully operated to energize the switch indication relay, said contact being controlled by said switch indication relay and when closed to thereby render the signal circuit responsive to the condition of said signal lever contacts.

30. In a system for the remote control of power-operated track switches and signals on railroads, a control panel having thereon lines constituting the track rails of a diagram of the track layout where the track switches and signals are located, manually movable knobs rotatably supported on said panel on the lines of said track diagram at points corresponding approximately with the location of the signals on the trackway in the field, means associated with each knob for visually indicating the position thereof, and actuated by movement of said knob, and means governed by said circuit controller means controlling the clearing of the corresponding signal.

31. In a system for the remote control of power-operated track switches and signals on a track layout on a railroad providing various routes for train movement, a control panel having thereon lines constituting the track rails of a miniature track diagram of said track layout, manually rotatable knobs supported by said panel on the lines of said diagram at points corresponding approximately with the location of the signals in the field, means associated with each knob for visually indicating the position thereof, contacts for each knob each supported by the panel and closed by movement of said knob to a position in line with the line representing the track, said contacts being opened by movement of the knob to a position crosswise of such line representing the track, said contacts being adapted to control circuits for causing clearing of the corresponding signals.

32. In a system for the remote control of power-operated track switches of a track layout on railroads providing different routes for train movement, a control panel having lines thereon constituting the track rails of a miniature track diagram of the track layout, miniature switch points pivotally supported on said panel at points corresponding with the location of the track switches in the field, and having pointed ends cooperating with the lines of the track diagram to show graphically the different positions of the switch points, electro-magnets for operating each miniature track switch to its two different positions, a manually operable control lever on the panel having a contact included in the control circuit for governing the operation of each track switch, and means for selectively energizing said electro-magnets of each miniature track switch in accordance with the position of the corresponding control lever.

33. A control panel for systems having a com-

bined manual and automatic control of power-operated track switches of a track layout providing various routes for train movement comprising, means on the face of the panel constituting a miniature track diagram of the track layout, manually operable signal controlling knobs supported on said panel on the lines of said diagram signifying track rails at points corresponding with the location of the signals in the field, means associated with each signal knob for visually indicating the position thereof, miniature switch points pivotally supported on said panel at points corresponding with the location of track switches in the field and having pointed ends cooperating with the lines of said track diagram to show visually the different positions of the switch points, and electro-magnets for operating each miniature track switch to its two different positions.

34. In a system for the remote control of power-operated track switches and signals on railroads, the combination with power-operated switch machines and their associated signals of a track layout for establishing different routes for train movements, a control panel having thereon a diagram of the track layout, miniature track switches movably supported on said panel at points corresponding with the location of the track switches in the field, manually rotatable knobs supported by said panel on the lines of said track diagram signifying track rails at points corresponding approximately with the location of the signals in the field, means associated with each knob for visually indicating the position thereof, means for automatically operating said miniature track switches to positions to conform with the controlled position of the corresponding track switches in the field, and means governed by movement of said knobs for governing the clearing of the corresponding signals.

35. In a system for the remote control of power-operated switches of a track layout providing various routes for train movement, the combination with switch machines operating said track switches, of a control panel having lines thereon constituting a miniature track diagram of the track layout, miniature track switches pivotally supported on said panel at points corresponding with the location of the track switches in the field and having pointed ends cooperating with the lines of said track diagram to indicate visually the different positions of the switch points, manually operable means on said panel included in control circuits for governing the operation of the switch machines for the several switches of the track layout, and means for automatically positioning said miniature track switches on the track diagram in accordance with the position to which the corresponding switch machine in the field is controlled by said manually operable control means.

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