Dec. 19, 1939. F. X. REES 2,183,694

TRAFFIC CONTROL SYSTEM FOR RAILROADS

Filed Feb. 4, 1937 2 Sheets-Sheet 1

FIG. 1.

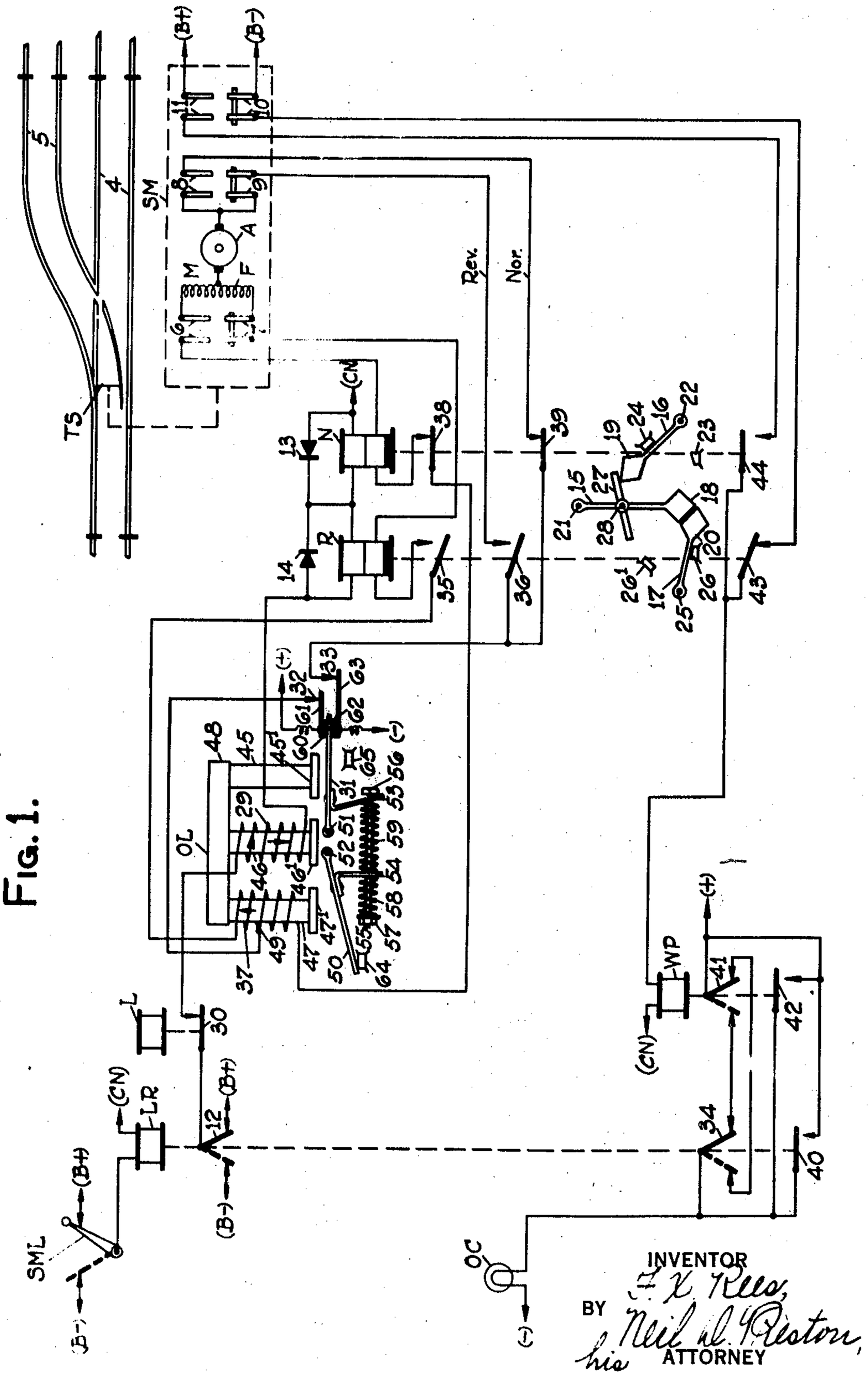

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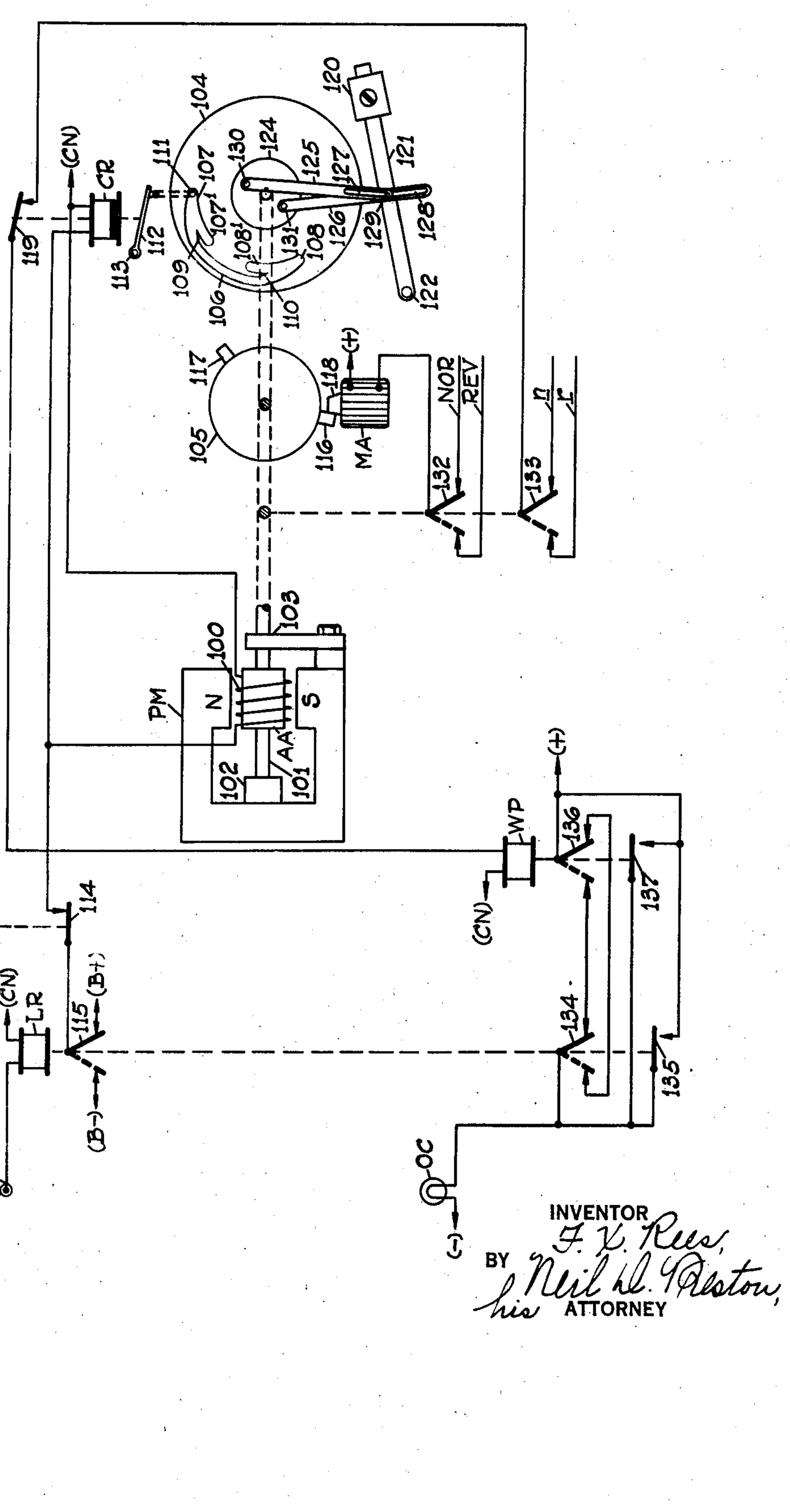
FIG. 2.



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2,183,694

TRAFFIC CONTROL SYSTEM FOR RAILROADS

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Application February 4, 1937, Serial No. 124,060

15 Claims. (Cl. 246—3)

This invention relates to traffic control systems for railroads and has particular reference to a system for the remote control of power operated switch machines.

In interlocking systems of the mechanically interlocked lever type and in types of systems in which the levers are locked by suitable approach locking or detector locking means, the operator is, of course, not able under unsafe conditions to move the lever, and for that reason cannot tentatively set up an operating condition that may later become effective due to the clearing up of the conditions which formerly locked the lever.

In accordance with the present invention, it is proposed to leave the levers free and unlocked at all times and provide an electric lock equivalent arrangement whereby in the event that the operator shifts the switch machine control lever while the circuits have the switch machine locked against operation, it is necessary for the operator to restore the switch machine control lever into correspondence with the position of the associated switch machine control relay before control of the switch machine is obtained. Stated another way, in order to operate the switch machine the switch machine control lever must be operated at the time the locking is not effective and, in the event that the switch machine control lever is moved while the locking circuit is in effect, the switch machine will not operate after a train movement over the switch until after the operator moves the control lever to its last effective position.

Another object of the present invention is to provide over load protection for the switch machine motor, so arranged that when the overload protective device operates it is necessary only for the operator to restore the switch machine control lever to its original position in order to obtain control of the switch machine.

Another object of the present invention is to provide means for indicating the electrically unlocked position of the lever and the out-of-correspondence condition of the lever with respect to the switch points.

Other objects, purposes and characteristic features of the invention will be in part apparent and in part brought out as the description of the invention progresses, reference being made to the accompanying drawings, showing by way of examples and in manner in a limiting sense, two forms which the invention may assume.

Fig. 1 illustrates in a diagrammatic and conventional manner one form of the present invention.

Fig. 2 illustrates a second form of the present invention also in a diagrammatic and conventional manner.

Referring to Fig. 1 although the present invention may be applied to various track layouts, it has been specifically illustrated as applied to a track switch TS which connects the rails **4** of a main track to the rails **5** of a diverging or turnout track. Track switch TS is operated by a power driven switch machine SM which may be of any suitable type such, for example, as disclosed in the patent to W. K. Howe, No. 1,466,903, dated September 4, 1923.

The switch machine SM comprises a motor M having an armature A and a field winding F, operating contacts **6**, **7**, **8** and **9** and point detector contacts **10** and **11**. The operating contacts **6**, **7**, **8** and **9** are controlled by motor M, contacts **7** and **9** being closed in a reverse operating circuit at all times except when the switch machine completes the movement of switch TS to its reverse position and contacts **6** and **8** are closed at all times except when the switch machine completes the movement of switch TS to its normal position. The point detector contacts **10** and **11** are employed to energize a switch position repeating relay WP of the usual polar neutral type in accordance with the extreme position and the locked condition of the track switch. These point detector contacts may be of any suitable type such, for example, as disclosed in the patent to C. S. Bushnell, No. 1,517,236, dated November 25, 1924.

Two slow release neutral relays N and R each having an upper operating winding and a lower stick winding are provided for controlling the operation of switch machine SM. The upper operating windings are connected in series and selectively energized over a polarized line circuit in accordance with the position of a polar contact **12** of a lever repeater relay LR. Asymmetric units **13** and **14**, which may be of the well known copper oxide valve type, are connected in multiple with the upper windings of relay N and R respectively, to permit the current to flow through the windings in the directions indicated by the arrow head portions of the symbols.

The energizing circuit for the switch control relays R and N includes a winding **29** on the center core of an overload relay OL, the front contact **30** of a lock relay L and the polar contact **12** of a lever repeater relay LR. The operation of overload relay OL will be explained in detail

later in the description, it being sufficient at this time to point out that regardless of the direction of current flowing in coil 29 armature 31 will pick up and close its front contacts 32 and 33.

The normal energized lock relay L is provided to lock the circuit for the switch control relays N and R against operation whenever the switch track section is occupied or whenever a signal governing traffic over the switch is clear. The circuits controlling relay L have been omitted for the sake of simplicity as they are well known to those skilled in the art and form no part of this invention.

Relays N and R are mechanically interlocked by means of three movable members or arms 15, 16 and 17 having at their free ends detents 18, 19 and 20 respectively. Arm 15 is suspended from a fixed pivot 21 and normally occupies the position in which it is illustrated in the drawings, but it is arranged to at times move to the right or left in accordance with conditions to be described hereinafter. Member 16 is free to turn on a fixed pivot 22 between a lower stop 23 and an upper stop 24 and member 17 is free to turn on a fixed pivot 25 between lower stop 26 and upper stop 26^1. Members 16 and 17 are mechanically connected (not shown) to the armature of relays N and R respectively; relay N being shown energized with its associated arm 16 in its upper position against the stop 24 and relay R being shown deenergized and its associated member 17 resting on the lower stop 26. An arm 27 is loosely secured at its midpoint to arm 15 by a pivot 28 and is arranged to move in a clockwise or counter-clockwise direction in accordance with conditions that also will be described hereinafter.

In explaining the operation and function of the interlocking apparatus just described and with the interlocking apparatus in the positions shown in the drawings, it will now be assumed, merely for purposes of explaining the operation of the interlock, that relay N is denergized and relay R is energized as would result from an operation of lever SML. The relay N being slow release, as pointed out above, arm 16 will remain for a short time in its upper position thereby allowing clearance for arm 17 to move arm 15 and position it to the right as arm 17 moves towards its upper position. As arm 17 completes its upward movement it contacts the left side of arm 27, moving it in a clockwise direction thereby forcing arm 16 downward, arm 16 being able to move arm 15 to the left, since at this time, arm 17 has positioned its detent 20, above and out of locking position in relation to detent 18, with the result that arms 16 and 17 will assume positions that are the reverse of those illustrated in the drawing. The operation involved when the relay R becomes deenergized and relay N becomes energized is merely the inverse of that just described and need not be specifically pointed out.

It will now be assumed that with the interlocking apparatus in the positions shown in the drawing, relay N is deenergized and relay R is not immediately energized as would occur upon release of lock relay L. Under these conditions arm 16 will release and move downwardly until its detent 19 rests on detent 18 of arm 15 thereby holding arm 17 securely in its released position against stop 26, due to the added weight, and also positively, since in this position of arm 16, any force exerted by arm 17 in attempting to raise, is transmitted through 18 to the detent 19 in a direction in line with, or even actually below, fixed point 22. It is therefore evident that in order to energize relay R to pick up its front contacts, relay N must be energized first to unlock arm 17 of relay R. Also, under the reverse conditions, that is with relay R picked up and relay N released, if relay R is deenergized for a time sufficient for its associated arm 17 to release, then it is necessary for relay R to be picked up again before relay N can be operated to pick up its front contacts. In other words, this interlocking arrangement insures that after both relays have been in deenergized condition at the same time the last previously energized relay must be picked up first before the other relay can be operated.

In accordance with this invention, it is contemplated that the track adjacent to switch TS will in practice be provided with track circuits, wayside signals, line circuits and the like, constituting suitable approach locking for the switch. The specific details for such approach locking circuits and other cooperating circuit arrangements are immaterial to the present invention and have therefore been omitted.

In the control office a two-position switch machine control lever SML is provided for controlling the lever repeater relay LR. The contacts of the lever SML are preferably of the snap action type so that there never will be more than a momentary interruption of the current flowing in the circuit for energizing relay LR due to the switching of these contacts from one position to the other.

Symbols (+) and (—) are employed to indicate the positive and negative terminals respectively of suitable battery or other sources of electric energy; and those terminals with which these symbols are used are presumed to have current flowing from the positive terminal designated (+) to the negative terminal designated (—). The symbols (B+) and (B—) are employed to indicate the positive and negative terminals respectively of suitable batteries or other source of direct current having an intermediate tap (CN) and the circuits with which these symbols are used may have current flowing in one direction or the other depending upon whether the terminal (B+) or (B—) is used in combination with tap (CN).

It is believed that further description of the present invention will best set forth the characteristic features and functions of the system by considering the operation under certain characteristic or typical conditions.

Operation

With the switch track section unoccupied and with the switch lever SML in the position illustrated the various devices, relays and circuits assume positions and conditions of energization as illustrated in Fig. 1 of the drawings. Since it is assumed that the switch track section is unoccupied and all signals (not shown) governing traffic over the switch are at stop the locking relay L will be energized.

It will now be assumed that the operator moves lever SML to its reverse dotted line position. The actuation of lever SML to its reverse position closes an obvious circuit for energizing lever repeating relay LR to operate its polar contacts 12 and 34 to their reverse positions as indicated by the dotted lines. The closure of contact 12 to its reverse position completes a circuit for energizing relay R that may be traced as follows, from (CN) through asymmetric unit 13, upper coil of

relay R, coil 29 of overload relay OL, front contact 30 of lock relay L, contact 12 of relay LR in its reverse position to (B—) battery. The energy flowing in this circuit energizes relay R to close its front contacts 35 and 36 and also energizes the overload relay OL to pick up its armature 31, as explained below, thereby closing its front contacts 32 and 33.

A circuit has now been set up for operating switch machine SM to its reverse position that may be traced as follows, from (+) battery front contact 32 of relay OL, through the upper portion of coil 37 of relay OL, front contact 35 of relay R, lower winding of relay R, operating contacts 7 of switch machine SM, field F of switch machine SM, armature A of switch machine SM, operating contacts 9 of switch machine SM in its normal position, reverse wire REV, front contact 36 of relay R, front contact 33 of relay OL, to (—) battery.

The operations involved in actuating the track switch from its reverse locked position to its normal locked position is merely the inverse of that just described and need not be specifically pointed out. It need only be mentioned that the return of lever SML to its normal position operates the polar contact 12 of relay LR to its right hand position to energize the control relay N and deenergize the control relay R. With the switch machine SM in its reverse position controller contacts 6 and 8 are closed and the switch machine is operated to its normal position through a circuit that includes the controller contacts 6 and 8 and the front contacts 38 and 39 of control relay N.

It may be pointed out here that, while the switch machine SM is being operated to either its normal or reverse position, the switch machine operating current flows through the lower or stick winding of the corresponding control relay R or N, thus guaranteeing that the operating circuit will remain closed until the switch completes its movement.

Electric lock equivalent.—In the event that the operator actuates lever SML to a new position while the switch control circuit is locked, as is effected by relay L being deenergized, this actuation is ineffective to condition the control circuits. With the circuits in the conditions indicated in Fig. 1 it will be assumed that relay L is dropped and that the operator actuates lever SML to its reverse position before relay L is picked up. It will be understood that relay L may be dropped by the clearing of a signal or by the occupancy of the track section as above described. Since the energizing circuits to relays N and R are open at front contact 30 of relay L, the actuation of lever SML is ineffective to control the operation of the switch machine SM.

In the event that the switch control circuit becomes unlocked (relay L picking up) while lever SML is in its reverse position, relay R will become energized, but its armature cannot operate to its picked up position to close its front contacts 35 and 36 due to the fact that during the time relay L was deenergized, relay N became deenergized and its arm 16 dropped and locked arm 17 of relay R in its released position, all in a manner previously described. It is therefore necessary for the operator to restore lever SML to its normal position before control of the switch control relay R can be reestablished. This energizes relay N, and its associated arm 16 moves to its upper position to unlock arm 17 so that the actuation now of lever SML to reverse position will effect the desired operation of relay R.

Assuming the reverse condition, it is obvious that with the switch lever SML in the reverse position, if the lever SML is moved to the normal position with lock contact 30 open, the control of relay N is not effected and after lock relay L has picked up, it is necessary first to move the lever SML back to its reverse position, to energize relay R and pick up lock arm 17 before the relay N will again operate in accordance with the position of the switch lever.

An out-of-correspondence lamp OC is provided in the control office for indicating by becoming lighted, when the switch machine SM is unlocked or in a position that does not correspond with the position of the lever SML. Energy for lighting this lamp OC is controlled by circuits that include, in various combinations, the polar contact 34 and a neutral contact 40 of relay LR and a polar contact 41 and a neutral contact 42 of relay WP.

As previously mentioned, the WP relay indicates the position and the locked condition of switch machine SM. When switch machine SM is in its normal locked position, the WP relay is energized through a circuit that includes point detector contacts 10 of switch machine SM and back contact 43 of relay R, and under these conditions the contacts of relay WP will assume the positions shown in the drawings. When switch machine SM is in its reversed lock position relay WP will be energized to position its polar contact 41 to its left hand position through a circuit that includes the point detectors contacts 11 of switch machine SM and back contact 44 of relay N.

When the lever SML is moved from its normal to its reverse position, back contact 40 of relay LR will be momentarily closed and the OC lamp will be energized through an obvious circuit and after the polar contact 34 of relay LR moves to its left hand position, the lamp OC will remain lighted through a circuit that includes polar contact 41 of relay WP in its right hand position and polar contact 34 of relay LR in its left hand position. The lamp OC will remain lighted until the WP relay operates its polar contact 41 to the left hand position at the completion of the movement of switch machine SM. It is evident that in a similar manner the OC lamp will be energized when the lever SML is operated from the reverse to the normal position. If the switch machine SM for any reason remains in an unlocked position or condition, as due to hand cranking operation, the switch position repeater relay WP will become deenergized and close its back contact 42, thereby energizing the lamp OC.

The overload relay OL as previously pointed out, operates to close its front contacts 32 and 33, thereby closing a circuit for operating the switch machine SM to either its normal or reverse position in accordance with the position of the switch machine lever SML and is also designed to operate in such a manner that contacts 32 and 33 will open and break the switch machine control circuit in the event the switch machine operating current through either the upper or lower portions of winding 37 becomes excessive.

The relay OL comprises three parallel cores 45, 46 and 47, connected together at their upper ends by a back strap 48 and provided at their lower ends with enlarged pole pieces 45^1, 46^1

and 47[1] respectively. The center core 46 carries the operating winding 29 which is connected in series with the control circuit for relays N and R, and core 47 carries a winding 37 having a mid-tap 49, the upper portion of the winding forming a part of the circuit for operating the switch machine SM to its reverse position, and the lower portion of the winding forming a part of the circuit for operating the switch machine SM to its normal position.

The relay OL also comprises an armature 31 which underlies the pole pieces 45[1] and 46[1] and an armature 50 which underlies the pole pieces 46[1] and 47[1]. Armature 31 is pivotally supported by a fixed pin 51 located under the pole piece 46[1] and armature 50 is supported in a similar manner by a pin 52 also located under the pole piece 46[1]. Secured to armature 31 and 50 and extending downwardly are two brackets 53 and 54 respectively which slidingly carry a spring supporting member 55 having two heads 56 and 57. Member 55 carries two slightly compressed springs 58 and 59, spring 58 being located between head 57 and bracket 54, and spring 59 between brackets 53 and 54.

Attached to the upper side of armature 31 by means of an insulated support 60 is a fixed contact finger 61 and attached to the under side of armature 31 by means of an insulated support 62, is a fixed contact finger 63, which fingers engage fixed front contacts 32 and 33 respectively when armature 31 is in its attracted upward position as shown in the drawings.

Armature 50 is shown in its retracted position with its free end resting on a stop 64 and the armatures are so arranged that when they are both in their retracted positions, that is with armature 31 resting on stop 65 and armature 50 resting on stop 64, the air gap between armature 50 and pole piece 47[1] is considerably longer than the air gap between pole piece 45[1] and armature 31.

It is evident that from the foregoing that, due to the magnetically favorable position of armature 31 with respect to armature 50, when coil 29 is energized with current of one polarity or the other, armature 31 will be attracted to the position shown in the drawings to cam pins, spring 58 and the force exerted by cam pins and spring 58 against bracket 54 of armature 50 will act to hold armature 50 firmly in its retracted position against stop 64.

As previously pointed out, when armature 31 picks up, and closes contacts 32 and 33 a circuit is completed through either the upper or lower portion of winding 37 for operating switch machine SM to either its normal or reverse position in accordance with the position of control lever SML and the flux set up in cores 46 and 47 by the normal switch machine operating current is not sufficient to attract armature 50 and move it from its present biased downward position, and therefore armatures 31 and 50 remain in the positions as shown during normal switch machine operation.

However, if the current taken by the switch machine SM becomes excessive for any reason, for example, when the switch is being operated to its normal position, the greater portion of the flux produced by the current flowing through the upper portion of winding 37 threads the cores 46 and 47 in the directions indicated by the arrows and exerts a relatively large torque on armature 50 causing the armature to move from its position as shown to an extreme upward position until its free end engages pole piece 47[1]. The upward movement of armature 50 causes a further compression of spring 58, thereby producing a force against bracket 53 to move armature 31 to its retracted position against stop 65. The release of armature 31 opens the switch machine operating circuit at contacts 32 and 33, thus removing the overload from the switch machine SM. Furthermore, with armature 50 in its attracted position, and 31 retracted, the circuit through coil 37 on core 47 is broken, and so remains, due to the fact that armature 50 is now in the more favorable position. Thus the switch machine operating circuit will remain open until the operator moves the switch lever SML to the reverse position which will momentarily remove energy from winding 29, thereby releasing armature 50, and due to the fact that both armatures are momentarily in their retracted position, the next energization of coil 29 will pick up armature 31.

When an overload condition takes place during a reverse operation of the switch machine SM the overload relay OL will operate in a similar manner to that just described except that in this case the lower portion of the coil 37 is energized and the flux threads cores 46 and 47 in a direction opposite to that indicated by the arrows.

Referring now to Fig. 2, in the modified form of the electric lock equivalent arrangement here shown, switch control lever SML and its associated polar neutral repeater relay LR are similar to the corresponding lever and relay of Fig. 1 and they are arranged for the purpose of controlling a switch machine (not shown). Lock relay L at the control office operates in the same manner as lock relay L of Fig. 1. The switch machine and its controller and point detector contacts have been omitted to simplify the illustration, just the control wires NOR and REV and and the switch indication wires *n* and *r* being shown; it should be understood, however, that the switch is controlled in the same manner as in Fig. 1 to operate the track switch (not shown). The switch position repeater relay WP and the out-of-correspondence indicator OC are similar to the corresponding WP relay and indicator OC of Fig. 1 and are controlled in a similar manner.

The modified form of the present invention further comprises a polar relay including a permanent magnet PM having oppositely disposed north and south magnetic poles designated N and S, respectively. An armature AA having a winding 100 is fixed to a shaft 101 and is arranged to rotate between the poles N and S, the shaft 101 being journaled at its ends in suitable fixed non-magnetic bearings 102 and 103.

Rigidly mounted on shaft 101 at the end of the shaft adjacent bearing 103 is a disc 104 and a cam disc 105. Disc 104 is provided with an arcuate slot 106 concentric with shaft 101, the extremities of the slot 106 taper inwardly to form two cam slots 107 and 108 which are eccentric to the shaft 101 and have similar faces 107[1] and 108[1] which are concentric with shaft 101 and extend towards the center of slot 106 in an undercut fashion, thereby forming two detents 109 and 110 respectively below the extremities of slot 106. The slotted portion of cam 104 is adapted to at all times receive a member 111, which member is attached to the free end of an armature 112 of a slow release magnet CR, the other end of armature 112 being pivotally supported by a fixed pin 113.

Disc 105 is provided with two outwardly projecting lugs 116 and 117, which may be of any suitable magnetic material, such as soft iron or steel, and are secured and positioned on the circumference of 105 in such a manner that when it is rotated to its extreme clockwise or counter-clockwise position, lugs 116 and 117 respectively will contact a pole piece 118 of a holding magnet MA.

The winding of control magnet CR and the armature winding 100 are connected in parallel and energized through a circuit that includes a front contact 114 of lock relay L and a polar contact 115 of the lever repeater relay LR closed in either its right-hand or left-hand position. When contact 115 is positioned to the right, current of positive polarity is applied to winding 100 which causes armature AA and its associated members 104 and 105 to rotate in a counter-clockwise direction and when contact 115 is positioned to the left, current of negative polarity is applied to armature AA which causes a clockwise rotation of armature AA and its associated members 104 and 105.

Due to the fact that armature AA and relay CR are simultaneously energized, armature 112 of relay CR tends to move upward thereby holding member 111 against the outer wall of the slotted portion of cam 104, thus permitting the cam 104 to rotate between an extreme counter-clockwise position, as shown, to a corresponding extreme clockwise position in which latter position member 111 will occupy the extreme left hand portion of slot 108.

It may be pointed out here that when energy is removed from armature winding 100, shaft 101 will tend to assume a biased center position in which position the slot 106 in cam 104 will be directly below the relay CR. However, cam 104 will be unable to rotate to this biased center position due to the fact that, if the armature is deenergized when, for example, the cam 104 is in the position shown in Fig. 2, armature 112 of relay CR will release and member 111 will drop to occupy a position in the left hand portion of slot 107, beneath the detent 109. In a similar manner, if armature winding AA is deenergized when cam 104 is in its extreme clockwise position, armature 112 will release and member 111 will drop to occupy the portion of slot 108 beneath detent 110 thereby preventing cam 104 from rotating to its biased center position.

The biasing means provided for operating cam 104 comprises a weight 120 secured to the free end of a movable lever arm 121, the arm being free to turn on a fixed pivot 122 thereby allowing weight 120 to be raised and lowered. Lever arm 121 is connected to a hub 124 of cam 104 by means of two connecting arms 125 and 126 having at their lower ends slots 127 and 128 respectively which receive a fixed pin 129 located at the mid point of arm 121 and the upper ends of the arms are attached to the hub 124 by means of pivots 130 and 131 respectively. Thus when cam 104 is rotated to its extreme counter-clockwise direction, as shown in the drawings, arm 125 moves upward and the bottom portion of slot 127 engages pin 129 to raise arm 121 and during this movement slot 128 in arm 126 allows arm 126 to move downward. When cam 104 is rotated in a clockwise direction the reverse operation takes place and arm 121 is raised by arm 126.

Two contacts 132 and 133 are arranged to be operated by the shaft 101, these contacts being closed to the right when the shaft completes its counter-clockwise movement and closed to the left when the shaft completes its clockwise movement. Contact 132 is provided for controlling the operation of the switch machine and for energizing magnet MA and contact 133 forms a part of the circuit for controlling the operation of the switch position repeating relay WP.

Operation

In the modified form of the invention, with the switch track section unoccupied and the signals at stop, the switch lever SML and the various devices, relays and circuits assume positions and conditions of energizations as illustrated in Fig. 2 of the drawings. Since it is assumed that the switch track section is unoccupied and all signals governing traffic over the switch are at stop, the locking relay L will be energized.

It will now be assumed that the operator moves lever SML to its reverse dotted line position. The actuation of lever SML to its reverse position closes an obvious circuit for energizing lever repeater relay LR to position its polar contact 115 to the left. This completes a circuit that includes contact 114 of lock relay L for simultaneously applying current of negative polarity to armature winding 100 and magnet CR. This energizes magnet CR and causes armature AA to rotate in a clockwise direction which rotation will continue until member 111 is positioned in the extreme left hand portion of slot 108 all as previously described.

When the rotary movement of shaft 101 is completed, contact 132 is closed to the left and energy is supplied to wire REV to operate the switch machine to its reverse position. The current supplied to the switch machine energizes the winding of magnet MA and as previously pointed out, disc 105 has moved until lug 117 is in contact with pole piece 118 of magnet MA, therefore, until the switch machine has operated to open its operating circuit the shaft 101 will be locked against its center bias, in its clockwise position by the magnetic force of pole piece 118 acting on lug 117.

The operations involved in operating the switch machine from the reverse position to the normal position are the reverse of those just described and need not be specifically pointed out except to state that when shaft 101 has rotated to its extreme clockwise position contacts 132 and 133 are positioned to the right. With contact 132 positioned to the right energy is supplied through the coil of magnet MA to wire NOR to operate the switch machine to its reverse position and to also energize magnet MA to hold disc 105 in its clockwise position during the time the switch machine is being operated.

Electric lock equivalent.—Assuming conditions as shown in Fig. 2, in the event that the operator moves the switch lever SML to the reverse position while the switch control circuit is locked, as is effected by relay L being deenergized, this lever movement is ineffective to control the operation of the switch as the energizing circuit for armature winding 100 and relay CR is open at contact 114 of relay L.

It will now be assumed that the switch control circuit becomes unlocked (relay L picking up) while lever SML is in the reverse position. Under these conditions the armature winding 100 and the relay CR will become energized and armature AA will tend to rotate in a clockwise direction. However, due to the fact that armature winding AA and relay CR were deenergized while

the lever SML was in the normal position, member 111 is now occupying the extreme left portion of slot 107 under detent 109, in which position the shaft of the cam 104 is locked against a clockwise movement. It is therefore necessary for the operator to restore lever SML to the normal position before control of armature AA can be reestablished. This will unlock cam 104 by moving 111 out from under 109 and to the position shown in Fig. 2, and a subsequent actuation of lever SML to its reverse position will effect the desired operation of armature AA and its associated contacts 132 and 133.

Assuming the reverse condition, it is obvious that when lever SML is moved to its normal position with lock contact 115 open, the control of armature AA is not effected and after the lock relay L has picked up, it is necessary first to move the lever back to the reverse position before the armature AA will operate in accordance with the position of the switch lever.

The out-of-correspondence lamp OC is controlled in the same manner as is shown in Fig. 1 to indicate the locked condition of the switch machine or indicate when the switch machine is in a position that does not correspond with the position of the switch lever SML. The switch position repeating relay WP is also controlled in a similar manner except that its control circuit includes a contact 119 that is cammed to its closed position when the cam 104 is operated to either its extreme clockwise or counter-clockwise position.

If it were not for the latch means employed, (Figs. 1 and 2) after a route, as normal, is set up, and a train has accepted it to thus drop L, the lever SML could be moved to (B—) and if there were a temporary loss of shunt and L picked up, when the train is in the switch section, relay R would pick up and TS would operate to reverse, and thus change the route after it had been accepted; and possibly throw the switch under the train. As it is, such operation is ineffective, for, due to L having been down and the switch machine having completed its stroke, N is down to lock R against picking up.

The applicant has thus shown and described two forms of the present invention in which the switch machine can not be operated unless the switch machine control lever SML is operated at a time in which the switch machine is unlocked, namely, when the lock relay L is energized, and in the event the switch lever SML is operated to a new position when the lock relay is deenergized, the switch machine will not move to a position corresponding to the position of the lever after the lock relay L picks up.

It is to be understood that although only two specific embodiments of the present invention have been disclosed, the principles of the invention may be applied to various other types of systems and that various types of track layouts may be controlled in a similar manner without departing from the spirit of the present invention. The above rather specific descriptions of two forms of the present invention are given solely by way of example and are not intended in any manner whatsoever in a limiting sense. It is also to be understood that various modifications, adaptations, and alterations may be employed to meet the demands of practice without in any way departing from the scope of the present invention except as limited by the appended claims.

What I claim is:

1. In a centralized traffic controlling system for railroads; a track switch; power operated means for the switch; slow acting normal and reverse relays for controlling the power operated means; a control lever; a line circuit including a lock contact through which the lever can selectively energize the control relays; and mechanical lock means for the relays which, if both relays are released, locks down the relay that released first, and including; a pendant pivoted lock arm, a swinging pivoted arm for each relay and operable by its relay from a lower to an upper position upon the relay picking up its armature and through a path including the pendant arm and requiring movement of the pendant arm to one side, each swinging arm when in released condition above the pendant arm operating to lock the pendant arm against swinging to its side, whereby to prevent the other relay from picking up its armature.

2. In a centralized traffic controlling system for railroads; a track switch; power operated means for the switch; slow acting normal and reverse relays for controlling the power operated means; a control lever; a line circuit including a lock contact through which the lever can selectively energize the control relays; and mechanical lock means for the relays which, if both relays are released locks down the relay that released first and including; a pendant pivoted lock arm, a cross arm pivoted to the pendant arm near its upper end, a swinging pivoted arm for each relay and operable by its relay from a lower to an upper position upon its relay picking up its armature and through a path including the pendant arm and requiring movement of the pendant arm to one side, each swinging arm upon moving to its upper position operating the cross arm thereby knocking down the other swinging arm and each swinging arm when in released condition above the pendant arm operating to lock the pendant arm against swinging to its side, whereby to prevent the other relay from picking up.

3. In a centralized traffic controlling system for railroads; a power operated track switch; a motor relay having an armature and an armature shaft, said shaft operating a cam and a switch control contact for controlling the operation of said switch; a magnet having an armature interconnected with said cam to control the rotary movement of said armature shaft; a switch control lever; a polar switch control repeater relay; a source of energy associated with a polar contact of said repeater relay; a lock relay for at times locking said switch; a line circuit including said polar contact, said armature and said magnet; said line circuit having one polarity or the other applied thereto from said source depending on the position of said lever, and said circuit including a contact on said lock relay, whereby operation of said lever causes energization of said magnet and said armature and rotation of said armature in accordance with the position of said lever and only while the contact of said lock relay is closed; and mechanical locking means between said armature of said magnet and said cam whereby energization of said line circuit following an opening of said line circuit by said lock relay is ineffective to operate said switch control contact unless the lever occupies the same position it occupied when said line circuit was opened.

4. In a centralized traffic controlling system for railroads; a power operated track switch; a

motor relay having an armature and an armature shaft, said shaft operating a cam and a switch control contact for controlling the operation of said switch; a magnet having an armature interconnected with said cam to control the rotary movement of said armature shaft; a switch control lever; a polar switch control repeater relay; a source of energy associated with a polar contact of said repeater relay; a lock relay for at times locking said switch; a line circuit connecting said polar contact, said armature and said magnet; said circuit have one polarity or the other applied thereto from said source depending on the position of said lever, and said circuit including a contact on said lock relay, whereby operation of said lever causes energization of said magnet and said armature and rotation of said armature in accordance with the position of said lever and only while the contact of said lock relay is closed; and mechanical locking means between said magnet armature and said cam whereby a movement of said lever to a new position after an opening of said line circuit by said lock contact is ineffective to control said switch and remains ineffective after a closure of said lock contact.

5. In a centralized traffic controlling system for railroads; a track switch; power operated means for the switch; a motor relay having an armature and an armature shaft, said shaft operating a slotted cam and a switch control contact for controlling said power operated means; a magnet having an armature with a projecting portion operating in said cam slot; a control lever; a line circuit including a lock contact through which the lever can selectively energize said armature and said magnet; and mechanical lock means for said armature shaft whereby said projecting portion of said armature holds said cam in the last operated position when said lock contact is open and holds said cam in said operated position after closure of said lock contact if the control lever is then in a new position to which it was moved while the lock contact was open.

6. In a centralized traffic controlling system for railroads; a track switch; power operated means for the switch; a motor relay having an armature and an armature shaft, said shaft operating a slotted cam and a switch control contact for controlling said power operated means; a magnet having an armature with a projecting portion operating in said cam slot; a control lever; a line circuit including a lock contact through which the lever can selectively energize said armature and said magnet; and mechanical lock means for holding said control contact in its last operated position when said lock contact is open and including, a locking section at the extremities of said slot whereby opening of said lock contact releases said magnet armature and said projecting portion enters a corresponding locking section and prevents a rotation of said cam so long as the lock contact remains open and after said lock contact recloses if said lever is then in a new position to which it was moved while said lock contact was open.

7. In a centralized traffic controlling system; a track section; a power operated track switch associated with said section; a normal and a reverse neutral relay for controlling the operation of said power operated switch; a lock relay for at times locking said track switch; a switch control lever; a polar switch control repeater relay; an overload relay having an operating winding and a split winding; a source of energy associated with a polar contact of said lever repeater relay; a line circuit connecting said polar contact and said switch control relays, said circuit including a contact of said lock relay and the operating coil of the overload relay in series, whereby operation of said lever causes energization of one or the other of said control relays in accordance with the position of said lever and only when the lock relay is closed; a switch operating circuit including, a contact of the overload relay which is closed when the operating winding is energized, one or the other portions of the split winding in accordance with the selected control relay and a contact of the control relay selected, whereby excessive operating current causes the switch operating circuit to be broken at said contact of said overload relay.

8. In a centralized traffic controlling system; a track section; a power operated track switch associated with said section; a normal and a reverse neutral relay for controlling the operation of said power operated switch; a lock relay for at times locking said track switch; a switch control lever; a polar switch control repeater relay; an overload relay having an operating winding and a split winding; a source of energy associated with a polar contact of said lever repeater relay; a line circuit connecting said polar contact and said switch control relays, said circuit including a contact of said lock relay and the operating coil of the overload relay in series, whereby operation of said lever causes energization of one or the other of said control relays in accordance with the position of said lever and only when the lock relay is closed; a switch operating circuit including, a contact of the overload relay which is closed when the operating winding is energized, one or the other portions of the split winding dependent upon the control relay selected and a contact of the control relay selected, whereby excessive operating current causes the switch operating circuit to be broken at said contact of said overload relay and remains broken until the line circuit is deenergized.

9. In a traffic controlling system, in combination, a track section including a track switch, power operated means for moving the switch to either of two operated positions, relay means movable to either of two effective positions for correspondingly governing the power operated means, a control circuit for the relay means, a lever free to move at all times to either of two extreme positions to distinctively energize the control circuit and the relay means to thereby operate the track switch to its operated position, a lock contact in the control circuit, and mechanical latch mechanism for the relay means, and including movable detent means movable to block and prevent movement of the relay means to a new effective position in response to energization over the control circuit if, between a movement of the lever from a former extreme position to the other extreme position, there has occurred an opening, and a subsequent closing, of the control circuit by the lock contact.

10. In a centralized traffic controlling system; a track section having a power operated track switch; a normal and a reverse neutral relay for controlling the operation of said power operated switch; a lock relay for at times locking said track switch against operation; a switch control lever; an overload relay having an operating winding and a split winding and a front con-

tact; a source of energy associated with said lever repeater relay; a line circuit connecting said lever and said switch control relays, said circuit including a contact of said lock relay and the operating coil of the overload relay in series, whereby operation of said lever causes energization of the overload relay and one or the other of said control relays in accordance with the position of said lever and only when the lock relay is closed; a switch operating circuit including, the contact of the overload relay, one or the other portions of the split winding in accordance with the selected control relay, and a contact of the control relay selected, the portions of the split winding, when energized, being arranged to tend to open the front contact of the overload relay, whereby excessive operating current causes the switch operating circuit to be broken at said contact of said overload relay.

11. In a centralized traffic controlling system for railroads; a power operated track switch; a normal and a reverse slow acting neutral relay for controlling the operation of said power operated switch; a lock relay for at times locking said track switch; a switch control lever; a source of energy associated with the lever; a line circuit connecting said lever and said neutral switch control relays; said circuit having one polarity or the other applied thereto from said source depending on the position of said lever, and said circuit including a contact on said lock relay, whereby operation of said lever causes energization of one or the other of said switch control relays in accordance with the position of said lever and only while the contact of said lock relay is closed; and mechanical interlocking means associated with said neutral control relays and including a latch freely movable unless blocked, a blocking means associated with, and operable by, each neutral relay, and each movable, upon release of its relay prior to the picking up of the other relay, to block movement of the latch and thereby prevent the picking up of the other relay, whereby control of the operation of said switch to a new position by said lever first requires correspondence between the last previously energized control relay and said control lever following each opening of said line circuit and subsequent closing thereof by said lock relay.

12. In a centralized traffic controlling system for railroads; a power operated track switch; a normal and a reverse neutral relay for controlling the operation of said power operated switch; a lock relay which, if deenergized, deenergizes both said neutral relays; a switch control lever for selectively energizing said neutral relays through a line circuit whereby operation of said lever causes energization of one or the other of said switch control relays in accordance with the position of said lever and only while said lock relay is energized; and mechanical interlocking means associated with said neutral control relays and including a normally freely movable latch, a blocking means controlled, respectively, by each neutral relay and each positionable, by its relay operation, at times, to block movement of the latch so as to prevent movement of the other blocking means and thereby the picking up of the other neutral relay despite the energization of such neutral relay.

13. In a traffic controlling system, in combination, a track section including a track switch, power operated means for moving the switch to either of two operated positions, translating means movable to either of two effective positions for correspondingly governing the power operated means, a control circuit for the translating means, a lever free to move at all times to either of two extreme positions to distinctively energize the control circuit and the translating means to thereby operate the track switch to its operated position, a lock contact in the control circuit, and mechanical latch mechanism for the translating means, and including movable detent means movable to block and prevent movement of the translating means to a new effective position in response to energization over the control circuit if, between a movement of the lever from a former extreme position to the other extreme position, there has occurred an opening, and a subsequent closing, of the control circuit by the lock contact.

14. In a centralized traffic controlling system; a track section including a power operated track switch; a control lever for the switch; a polar lever repeater relay having a polar contact and a source of energy associated therewith; a lock relay for at times locking said switch against operation; a control circuit for controlling said switch, said circuit including a contact of said lock relay and energizable with one polarity of current or the other in accordance with the position of said lever repeater relay; relay means distinctively responsive to the polarity of current in said control circuit to normally move so as to cause distinctive operation of said switch, and mechanical locking means for at times locking said relay means against response to current in said control circuit, and including, latch means positionable to prevent said relay means response and normally freely movable to permit the response of the relay means to current in the control circuit, and a plurality of blocking means associated with the relay means and effective to prevent movement of the latch and thereby of the relay means upon movement of the lever to a new operative position after said control circuit is opened by the lock relay contact and remains so effective until the lock relay contact closes the control circuit and the lever is returned to its old position.

15. In a centralized traffic controlling system, in combination, a track section including a track switch, power operated means for operating the switch, a control circuit for the power operated means, a lock contact in the control circuit, a two position lever for selectively energizing the control circuit, translating means movably responsive to the energization of the control circuit to make the control circuit effective to energize the power operated means, and mechanical lock means for locking the translating means against response to energization, and including, latch means normally freely movable, blocking means controlled by the translating means to a position to retain the latch means in a position to prevent the response of the translating means to the energization of the control circuit, unless the lever is moved from a position where it is in correspondence with the track switch.

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