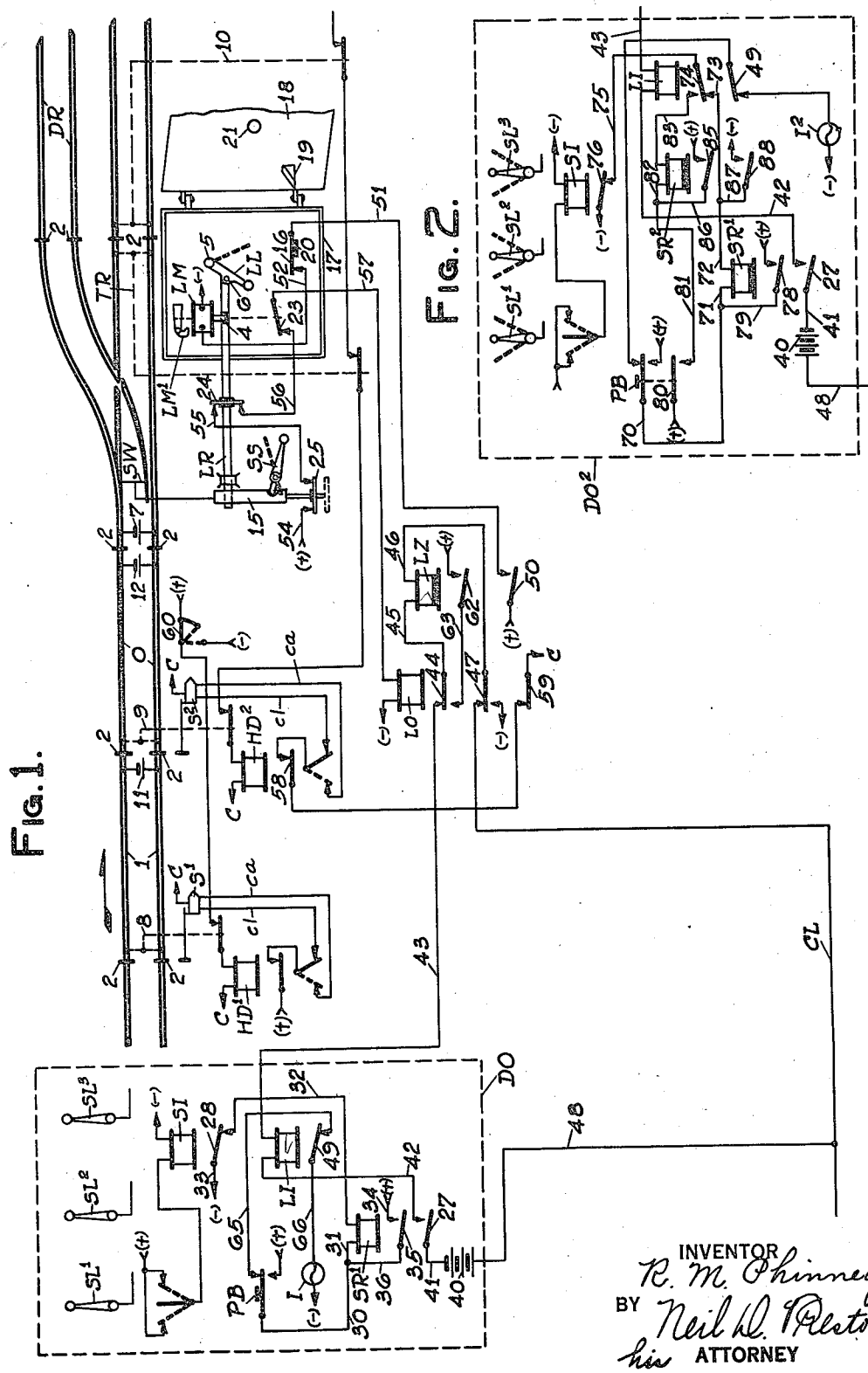
Oct. 29, 1935. R. M. PHINNEY 2,019,462

SIGNALING SYSTEM FOR RAILROADS

Filed Jan. 15, 1931 2 Sheets-Sheet 1



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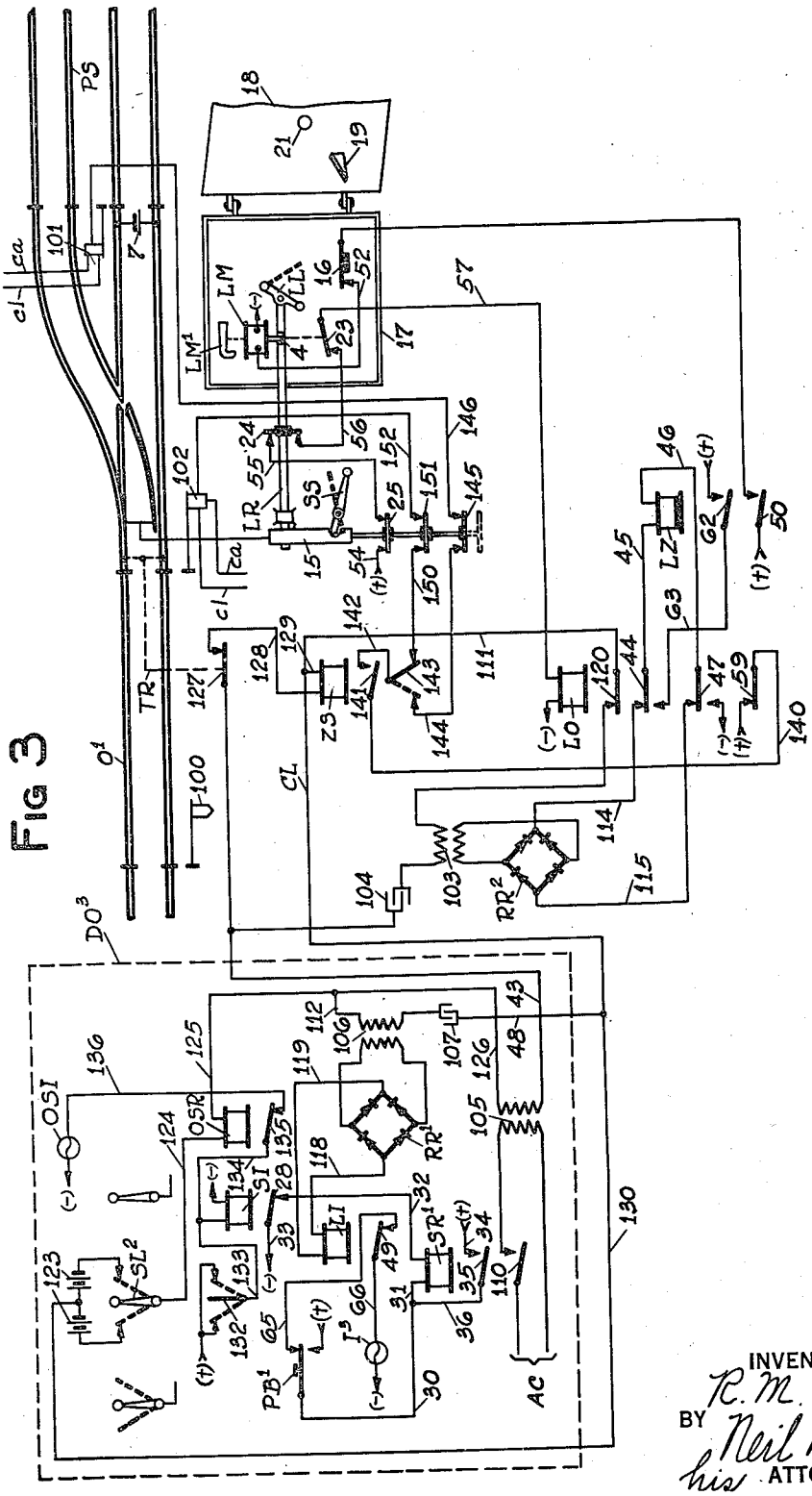


FIG 3

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SIGNALING SYSTEM FOR RAILROADS

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22 Claims. (Cl. 246—3)

This invention relates to railway signaling, and more particularly to an out-lying switch lock circuit which prevents the train crew from operating a track switch in the absence of the consent of the train dispatcher.

In railway signaling practice it is customary to place the signals which are within braking distance of a diverging route at stop when the track switch leading to such diverging route is in either its reverse position or in an intermediate position. This protection affords the necessary safety in case the approaching train is beyond the approach section over which traffic is governed by these signals. If, on the other hand, the approaching train has already accepted a signal at proceed the operation of the track switch, even though it would place such signal at stop, does not inform the engineer of such change in the position of the track switch. In accordance with the present invention it is proposed to provide a switch lock circuit which extends from the point of the diverging route, passing siding or other track switch location, to a central office, and to provide means whereby the track switch cannot be operated unless the dispatcher or operator places the circuit in its unlocking condition.

Another object of the present invention resides in the provision of means whereby the track switch cannot be operated through the medium of its associated switch stand unless the train crew has performed a particular act, such as opening the door of the locking cabinet, in combination with a particular act of the dispatcher, such as the depression of a push-button, and to indicate to the dispatcher over the same circuit the condition of the lock for locking such switch stand, the occupancy of track circuits, and the like.

Other objects, purposes and characteristic features of the present invention will in part be apparent from the accompanying drawings and will in part be more specifically pointed out hereinafter.

In describing the invention in detail reference will be made to the accompanying drawings, in which:—

Fig. 1 shows one embodiment of the invention, in which the switch stand locking and the condition of the locking means for such switch stand is transmitted over one line circuit;

Fig. 2 shows a modified form of central office equipment, in which the condition of unlocking the switch stand is automatically cancelled; and

Fig. 3 shows a system similar to that shown in Fig. 1 with additional means for controlling over the line circuit of the signals associated with the track switch and the condition of occupancy of a track circuit.

Structure Fig. 1

Although the present invention may be applied to a system of railway signaling in which the movement of trains is dispatched entirely through the medium of wayside signals controlled by direct circuits, as shown, for instance, in the prior application of S. N. Wight, Ser. No. 120,423 filed July 3, 1926, may be applied to a system in which the wayside signals are principally automatically controlled, may be applied to a system in which the signals are controlled through the medium of a selector apparatus, such, for instance, as shown in the prior application of Preston and Hitchcock, Ser. No. 455,304 filed May 24, 1930, or may be applied to an unsignaled railroad, the invention has for convenience been shown applied to a single track section O, which is signaled for one direction of traffic only and in which the wayside signals are principally automatically controlled.

As shown the diverging route DR is connected to the single track section O through the medium of a track switch SW, which track switch may be operated through the medium of a switch stand SS. This switch stand SS may be locked against movement from its normal position through the medium of the lock rod LR, which lock rod is normally locked through the medium of deenergized lock magnet LM. This lock magnet LM includes a lock plunger 4 connected to a miniature semaphore signal or lock indicator LMI. The lock rod LR may be operated through the medium of a lock lever LL, pivoted at 5 and pivotally connected to the lock lever by the pin 6.

The track rails 1 of the railway track are divided by insulating joints 2 into blocks in the usual way, of which blocks the detector section is provided with a track relay TR and a track battery 7, and of which the remaining blocks include track relays 8, 9 and 10, and track batteries 11 and 12. Directly in the rear of the track switch SW, the normal direction of traffic being from left to right, as indicated by the arrow, are located a home signal S^2 and a distant signal S^1, which signals although they have been shown controlled principally automatically, may also be controlled manually from the central office DO, if desired. These signals S^1 and S^2 are controlled respectively, through the medium of polar

neutral home-and-distant relays HD^1 and HD^2, respectively.

It will be noted that the operating bar 15 of the switch stand SS is provided with a lock opening into which the lock rod LR is adapted to move, and that the switch stand SS cannot be operated until the lock lever LL has been moved to its dotted position, and that this lock lever LL cannot be moved to its dotted position until the lock plunger 4 has been raised by energization of the lock magnet LM. Furthermore, it will be noted that the lock magnet LM cannot be energized unless the contact 16 contained in the lock cabinet 17 is closed, and that this contact 16 cannot be closed until the door 18 has been opened, this by reason of the fact that with the door 18 closed the wedge 19 engages the insulating block 20 of the contact 16 and holds this contact 16 in open position. Furthermore, it will be noted that the door 18 of the lock cabinet 17 cannot be closed unless the lock lever LL is in its normal full line position, this by reason of the hole 21 in the door 18 through which the handle of the lock lever LL extends with the door 18 in its closed position. The lock plunger 4 also has associated therewith a contact 23 which is open only when the lock plunger 4 is in its raised position. Similarly, the lock rod LR has associated therewith a contact 24 which is closed only when the lock rod LR is in its locked position, and the lock bar 15 has associated with it a contact 25 which is closed only when the switch stand SS is in its normal main track position. The lock magnet LM may be controlled through the medium of a manual controllable stick lock relay LZ, controlled from the central office DO, all in a manner more readily explained in the operation of the system hereinafter.

Referring to the central office DO, attention is directed to the fact that the lock relay LZ is controlled through the medium of the front contact 27 of the stick relay SR^1, and that the line circuit has included in series therewith an indicating relay LI. The stick relay SR^1, on the other hand, is controlled through the medium of the push-button PB providing of course that the signal repeating relay SI is in its deenergized condition. This relay SI is energized if the signal lever SL^1 is in either of its extreme positions. This lever SL^1 is presumably used for controlling the signals S^1 and S^2, although the control means for the signals S^1 and S^2 by the lever SL^1 has been omitted. In this connection it may be stated that if the signals S^1 and S^2 are not manually controlled, the relay SI together with its back contact 28 will be omitted, and a suitable push button contact will be substituted therefor.

Operation of Fig. 1

Let us first assume that there is a train occupying the diverging route DR, and that this train wishes to enter the main track O. The train under consideration will of course remain off of the detector track circuit containing the track relay TR, this by reason of rules governing the conduct of train crews. A member of the train crew will now get into communication with the central office DO, as through the medium of a telephone, and will inform the operator or dispatcher that he is ready to operate the switch SW to allow his train to enter the main track O. The operator will then, assuming that there is no conflicting train movement on the main track O, of which the operator of course has information, depress the push-button PB and thereby close the following pick-up circuit for the relay SR^1:—beginning at the terminal (+) of a suitable battery, contact of the push-button PB, wires 30 and 31, winding of the relay SR^1, wire 32, back contact 28 of the lever repeating relay SI, wire 33 to the other terminal (—) of said battery. The completion of this circuit will energize the relay SR^1, which relay will then be stuck up through the completion of the following stick circuit:—beginning at the terminal (+), wire 34, front stick contact 35 of the relay SR^1, wires 36 and 31, winding of the relay SR^1, wire 32, back contact 28 of the relay SI, wire 33 to the other terminal (—).

With the stick relay SR^1 now picked up the closure of its contact 27 will complete the following energizing circuit for the indicating relay LI and the lock control relay LZ:—beginning at the battery 40, wire 41, front contact 27 of the relay SR^1, wire 42, winding of the relay LI, line wire 43, front contact 44 of the lock indicating relay LO, wire 45, winding of the control relay LZ, wire 46, front contact 47 of the relay LO, wires CL and 48 back to the battery 40. The completion of this energizing circuit will pick up the relays LI and LZ, so that even though the push-button PB has been returned to its normal position the indicating lamp I will not be illuminated by reason of the fact that the back contact 49 of the indicating relay LI is open. The member of the train crew, will, of course, in the meantime have opened the door 18 of the lock cabinet 17 and will thereby have closed the contact 16.

With the lock control relay LZ now energized and its front contact 50 closed, the following energizing circuit for the lock magnet LM is closed:—beginning at the terminal (+), front contact 50 of the relay LZ, wire 51, front contact 16, wire 52, winding of the lock magnet LM to the other terminal (—). The completion of this circuit will lift the lock plunger 4 and open the contact 23 associated therewith. Opening of the contact 23 will break the following energizing circuit for the relay LO:—beginning at the terminal (+), wire 54, switch stand contact 25, wire 55, lock rod contact 24, wire 56, contact 23, wire 57, winding of the relay LO to the other terminal (—).

With the relay LO deenergized energy is cut off the front contact 58 of the relay HD^2 by the front contact 59 of the relay LO, so that current cannot be applied to the clearing circuit *cl* or the caution circuit *ca* of the signal S^2, so that this signal will assume its stop position, and with this signal S^2 assuming the stop position the signal blade contact 60 will be connected to the terminal (—) of a suitable battery, so that the relay HD^1 is energized to its left hand dotted position, thereby operating the signal S^1 to its caution position, through the medium of the caution circuit *ca*. Also, dropping of the relay LO will cause the control relay LZ to be energized through the following stick circuit:—beginning at the terminal (+) of a suitable battery, front stick contact 62 of the relay LZ, wire 63, back contact 44 of the relay LO, wire 45, winding of the relay LZ, wire 46, back contact 47 of the relay LO, to the other terminal (—) of said battery.

Although the control relay LZ remanis energized through the stick circuit just traced, dropping of the relay LO will effect deenergization of the indicating relay LI at the central office DO, thereby completing the following energizing circuit for the lamp I:—beginning at the terminal (+) of a suitable battery, wire 34, front contact

35 of the relay SR^1, wires 36 and 30, push-button contact PB assuming its normal position, wire 65, back contact 49 of the relay LI, wire 66, indicating lamp I to the other terminal (—) of said battery. The operator is thus informed that the member of the train crew has opened the lock cabinet 17 and that this energization of the control relay LZ has actually affected lifting of the lock plunger 4 so that the train crew may unlock the switch stand SS by operating the lever LL to its right hand dotted position.

Let us assume that the train crew has moved the lever LL to its dotted position and has moved the switch stand SS to its dotted position which allows the train to move out of the diverging route DR. As soon as the train has moved out of the diverging route DR the train crew may return the switch stand SS to its normal position, may return the lock rod LR and lock lever LL to its normal position, and if the train crew then recloses the door 18 the wedge 19 will open the contact 16, thereby deenergizing the lock magnet LM and reclosing the contact 23. As soon as the contact 23 is reclosed the lock repeating relay LO is again energized through its circuit heretofore traced. Picking up of the relay LO will return the contact 44 of this relay to its normal raised position, thereby reenergizing the indicating magnet LI in the dispatcher's office, thus extinguishing the indicator lamp I and informing the dispatcher that the train crew has returned the track switch to the normal position and has reclosed the lock cabinet 17. The dispatcher may then operate the signal lever SL^1 and thereby effect opening of the contact 28 of the relay SI, which in turn will break the stick circuit for the stick relay SR^1 and return the apparatus to its normal condition, as shown in the drawings. In the event no such signal lever LS^1 is employed the contact 28 may comprise a normally closed push-button contact, which the operator may momentarily open after the indicating light I has been extinguished informing the dispatcher that the train crew no longer requires the lock magnet LM energized.

In Fig. 1 of the drawings there has thus been shown a lock circuit through the medium of which a switch stand may be unlocked by the cooperation of the train crew with the train dispatcher or other authorized person, and over the same circuit through which such cooperation is carried on an indication is transmitted to the dispatcher as to when the train crew begins its unlocking of the switch stand and also when the train crew has returned the switch stand and its associated apparatus to its normal locked condition.

Structure Fig. 2

In Fig. 2 of the drawings has been shown a modified form of apparatus for the central office DO for operating apparatus in the field identical to the field apparatus shown in Fig. 1 of the drawings. In addition to the apparatus shown in the central office DO of Fig. 1, the apparatus shown in Fig. 2 includes a second stick relay SR^2. It is believed that the automatic cancelling features of the apparatus shown in Fig. 2 can best be explained by considering the operation of the central office apparatus in connection with the field apparatus shown in Fig. 1.

Operation of Fig. 2

It will be noted that the energizing circuit for the indicating relay LI in Fig. 2 of the drawings is identical to the corresponding circuit shown in Fig. 1. Let us assume that the dispatcher wishes to unlock the distant switch stand associated with the dispatcher's office DO^2 (see Fig. 2), and in order to do so depresses the push button PB. This depression of the push button PB closes the following energizing circuit for the stick relay SR^1:—beginning at the terminal (+) of a suitable battery, contact of push button PB in its depressed position, wires 70 and 71, winding of the relay SR^1, wires 72 and 73, back contact 74 of the relay LI, wire 75, back contact 76 of the relay SI, to the other terminal (—). The completion of the circuit just traced will energize the relay SR^1 thereby closing the following stick circuit:—beginning at the terminal (+) of the same battery, front contact 78 of the relay SR^1, wires 79 and 71, winding of the relay SR^1, wires 72 and 73, back contact 74, wire 75, back contact 76 to the other terminal (—).

Picking up of the relay SR^1 will close the energizing circuit for the relays LI and LZ traced in connection with Fig. 1 of the drawings, and including the front contact 27 of the relay SR^1. With the relay LI energized, the push button PB being still depressed, the stick relay SR^2 is energized through the following circuit:—beginning at the terminal (+) of a suitable battery, back contact 80 of the push button PB, wires 81 and 82, winding of the relay SR^2, wire 83, front contact 74 of the relay LI, wire 75, back contact 76 of the relay SI to the other terminal (—) of said battery. With the stick relay SR^2 once picked up it is stuck up through the following circuit:—beginning at the terminal (+), front stick contact 85 of the relay SR^2, wires 86 and 82, winding of the relay SR^2, wire 83, contact 74, wire 75, contact 76 to the other terminal (—).

Picking up of the relay SR^2 will close an auxiliary circuit for the stick relay SR^1 which may be traced as follows:—beginning at the terminal (+) of a suitable battery, stick contact 78 of the relay SR^1, wires 79 and 71, winding of the relay SR^1, wires 72 and 87, front contact 88 of the relay SR^2, to the other terminal (—) of said battery. It will be noted that the stick relay SR^1 had its energy cut off between the time of lifting of the contact 74 of the relay LI and the closing of the contact 88 of the relay SR^2, but this relay SR^1 is sufficiently slow acting to prevent its dropping during this interval. The dispatcher will in the meantime have allowed his push button PB to return to its normal position, so that the indicating lamp I would be illuminated were it not for the fact that the contact 49 in the meantime had been operated to its raised open position.

Let us now assume that the train crew by reason of verbal instructions from the dispatcher has opened the door 18 of the cabinet 17 (see Fig. 1) and has allowed the lock magnet LM to become energized, so that the contact 23 associated with this lock magnet LM is open and the relay LO is deenergized. Dropping of the relay LO (see Fig. 1) will of course effect deenergization of the lock indicating relay LI (see Fig. 2) and the dropping of the contact 74 of this relay LI will effect deenergization of the stick relay SR^2 and also through the medium of its back contact 49 will effect illumination of the indicating lamp I, so that the dispatcher is informed of the fact that the train crew has taken advantage of the cooperation given through his depression of the push button PB. Dropping of the stick relay SR^2, although it has opened the auxiliary

circuit for the stick relay SR[1] at the contact 88, will not allow this relay SR[1] to drop, because the original circuit including a back contact 74 of the relay LI is again completed. The indicating lamp I will thus remain lighted so long as the contact 44 of relay LO (see Fig. 1) remains in its retracted position.

As soon as the train crew has completed its manipulation of the switch stand SS and has reclosed the door 18 of the lock cabinet 17 the relay LO will be reenergized, thereby effecting the reenergization of the relay LI (see Fig. 2) in the dispatcher's office DO. Energization of the relay LI, at this time results, through the lifting of its contact 74, in the deenergization of the relay SR[1], and since this relay SR[1] is a stick relay it will remain deenergized. The opening of the contact 27 of the relay SR[1] will of course remove energy from the relays LI and LZ, thereby automatically returning the apparatus in the central office DO to its original normal condition. The apparatus in Fig. 2, therefore, not only informs the dispatcher when the train crew is through using the releasing feature of the lock magnet LM, but it also automatically removes the release given by the dispatcher, so that if the train crew has once returned the field apparatus to its normal position it cannot again operate the switch stand SS until a second release has been given by the dispatcher.

Structure Fig. 3

Referring to Fig. 3 of the drawings the apparatus in the field for unlocking the switch stand SS is exactly the same as that shown in Fig. 1, except that the control relay LZ receives its energy from the rectifier RR[2], which rectifier in turn is energized by alternating current superimposed on the single line circuit including the line wire 43. In Fig. 3 of the drawings the single track section O[1] is preferably a section of single track connected with the passing siding PS of a railway signaling system of the absolute-permissive-block type, of which system the starting signal 101, the entering signal 102 and the distant signal 100 only have been shown.

In the particular arrangement shown the direction of traffic over the track switch SW[1] is governed through the medium of the signal control relay ZS, which relay is controlled by direct current through the medium of the line wire 43. The apparatus in the central office DO of Fig. 3 is exactly the same as that shown in Fig. 1 of the drawings, except that instead of applying direct current to the line circuit including the line wire 43 for the purpose of unlocking the switch stand SS, alternating current is applied to this circuit through the medium of the transformer 105, and the indicating relay LI instead of being included in series with this circuit, is energized by current derived from a rectifier RR[1] receiving its energy from the transformer 106 connected between the line wire 43 and the common return wire through the medium of the condenser 107. The line circuit including the line wire 43 is of course also at times energized by direct current through the medium of a lever for controlling the signal relay ZS, and also includes an indicating relay OSI in series therewith for manifesting the passage of a train over a track switch SW[1]. The direct current is applied to the line circuit through the medium of the signal lever SL[2], all in a manner more clearly pointed out in the description of the operation of the system hereinafter.

Operation

Referring to Fig. 3, it will be noted that under normal conditions, that is with the signals 101 and 102 held at stop, because the lever SL[2] is in its neutral signal-stop position, and with the relay ZS deenergized, the lock relay LO is energized through the same circuit as illustrated in Fig. 1, namely a circuit beginning at the positive terminal of the way station battery, wire 54, switch stand contact 25, wire 55, lock rod contact 24, wire 56, lock magnet contact 23, wire 57, winding of the relay LO to the other terminal (—) of said battery.

Let us now assume that there is a train moving from left to right in the single track section O[1] and that the dispatcher in the central office DO[3] wishes this train to take the side track of the passing siding PS. Since the train is to take the side track the dispatcher will not operate his signal lever SL[2], but will bring the train to a stop at the signal 102. It may be pointed out here that if desired a special signal may be displayed through a front contact of relay LZ, this to call the train crew to the telephone for instructions from the dispatcher. A member of the train crew will then get into touch with the dispatcher, as over a telephone, giving his location and stating that the entering signal 102 is at stop. The dispatcher will then inform the train crew that this train is to take the side track and that he will unlock the switch stand SS permitting operation thereof. The dispatcher will then or has already depressed the push button PB, thereby closing the following pickup circuit for the stick relay SR[1]:—beginning at the terminal (+), push button contact PB in its depressed position, wires 30 and 31, winding of the stick relay SR[1], wire 32, back contact 28 of the relay SI, wire 33 to the other terminal (—) of said battery. With the relay SR[1] once picked up it will be stuck up through the stick circuit heretofore traced and including the stick contact 35.

With the stick relay SR[1] up, alternating current will be applied to the primary winding of the transformer 105 through the medium of front contact 110 of the relay SR[1]. With the transformer 105 energized alternating current will flow in the following circuit:—beginning at the secondary winding of transformer 105, line wire 43, condenser 104, primary winding of the transformer 103, the condenser 104 resonating the transformer 103 to the frequency of the alternating current source AC, front contact 120 of the relay LO, wires 111, CL and 48, condenser 107, primary winding of the transformer 106, wires 112 and 126, back to the secondary winding of the transformer 105. The condenser 107 is of a capacity to resonate with the inductance of the transformer 106 at the frequency of the source AC. The flow of alternating current in the circuit just traced will impress an alternating current potential on the rectifier RR[2] thereby causing direct current to flow in the following circuit:—beginning at the rectifier RR[2], wire 114, front contact 44 of the relay LO, wire 45, winding of the relay LZ, wire 46, contact 47 of the relay LO, wire 115, back to the rectifier RR[2].

The flow of current in the circuit just traced will energize the lock relay LZ, thereby closing its contact 50 and energizing the lock magnet LM through the circuit heretofore traced in connection with Fig. 1 of the drawings and including the door operated contact 16, this on the assumption that the train crew has already opened

the door 18 of the lock cabinet 17. As soon as the lock magnet LM picks up its locking plunger 4 the contact 23 included in the circuit for the relay LO is opened, thereby causing the relay LO to assume its deenergized position and dropping its contacts 44, 47, 59 and 120. The relay LZ will of course be stuck up through a stick circuit heretofore traced in connection with Fig. 1 and including its stick contact 62.

Attention is now directed to the fact that the alternating current flowing in the primary winding of the transformer 106 has picked up the lock indicating relay LI through the medium of direct current through the following circuit:—beginning at the positive terminal of the rectifier RR^1, wire 118, winding of the relay LI, wire 119, back to the rectifier RR^1.

With the contact 120 of the relay LO now assuming its retracted position, the alternating current circuit heretofore traced and including the line wire 43 is broken at this contact 120, so that the transformer 106 in the central office DO is deenergized and the lock indicating relay LI assumes its deenergized position and closes the following energizing circuit for the indicating lamp I^3:—beginning at the terminal (+) of the central office battery, wire 34, front contact 35 of the relay SR^1, wires 36 and 30, push-button contact PB, wire 65, back contact 49 of the relay LI, wire 66, indicating lamp I^3, to the other terminal (—) of said battery. The operator now being informed that the train crew has actually opened the lock cabinet 17 and effected deenergization of the lock indicating relay LO, and knowing that the signals 101 and 102 cannot be cleared, will move a signal lever SL^2 to the right, signifying east bound traffic, thereby energizing the signal relay ZS to its right hand position through the following energizing circuit:—beginning at the positive terminal of the battery 123, lever contact SL^2, wire 124, winding of the relay OSR, wires 125 and 126, secondary winding of the transformer 105, line wire 43, front contact 127 of the detector track relay TR, wire 128, winding of the relay ZS, wires 129, CL and 130, back to the mid-point of the battery 123. The flow of current in the circuit just traced will pick up the signal relay ZS, but with the relay LO deenergized the signals 101 and 102 will remain in their stop position. The train may now proceed into the side track of the passing siding PS in accordance with the verbal instructions given by the dispatcher, it being of course assumed that the train crew has in the meantime operated the track switch S^1 to the take-siding position.

The entrance of the train into the side track of the passing siding will, of course, deenergize the detector track relay TR, thereby opening the contact 127 and effecting deenergization of the relay OSR in the central office DO^3. With the relay OSR deenergized the following energizing circuit is completed for the OS-ing lamp OSI:—beginning at the terminal (+) of the central office battery, lever contact 132 assuming its right hand position, wires 133 and 134, back contact 135 of the relay OSR, wire 136, indicating lamp OSI, to the other terminal (—) of said battery. The dispatcher is thus informed of the passage of the train in question over the switch SW^1, and as soon as the indicating lamp OSI is extinguished, because the detector track relay TR has again picked up, the dispatcher is informed of the movement of the train into the side track of the passing siding PS. Also, as soon as the train crew returns the switch stand SS to its normal position, and returns the lock rod LR and recloses the locking cabinet 17, the contacts 25, 24 and 23 of the energizing circuit for relay LO are closed the relay LO is again energized, thereby re-establishing the alternating current circuit heretofore traced and including the line wire 43, thereby returning the lock indicating relay LI to its abnormal energized position and again extinguishing the indicating lamp I^3, informing the dispatcher that the train crew has returned the apparatus at the location of the track switch SW^1 to its normal position. The operator may then effect deenergization of the stick relay SR^1, as by the operation of the lever SL^2.

Let us now assume that there is a west bound train standing on the main track of the passing siding PS, and that the dispatcher, or operator, wishes the train to proceed into the single track section O^1. The operator under this condition will operate his lever SL^2 to its left hand position, thereby energizing the signal relay ZS to its left hand position, thereby clearing the signal 101, assuming traffic conditions in advance thereof to be clear, through the following circuit:—beginning at the terminal (+) of the way station battery, front contact 59 of the relay LO, wire 140, neutral contact 141 of the relay ZS, wire 142, polar contact 143 of the relay ZS assuming its left hand position, wire 144, switch box contact 145 closed only when the track switch SW^1 only assumes its main track position, wire 146 through the mechanism of the signal 101 to the clear wire *cl* or the caution wire *ca*, depending on traffic conditions in advance to the other terminal (—) of said way station battery, the wires *cl* and *ca* being selected in accordance with the energized position of a home-and-distant relay (not shown) and substantially as shown in Fig. 1 of the drawings.

The train in question may now proceed in response to the clearing of the signal 101, and as soon as it enters upon the detector track circuit containing the track relay TR, this condition of traffic will be manifested in the central office DO^3 by the illumination of the OS-ing light OSI, all for reasons heretofore explained. Similarly, for east bound traffic on the main track the operator would operate his lever SL^2 to the right, thereby energizing the signal relay ZS to the right and completing the following energizing circuit for the mechanism of the signal 102:—beginning at the terminal (+) of the way station battery, front contact 59 of the relay LO, wire 140, neutral contact 141 of the relay ZS, wire 142, polar contact 143 of the relay ZS assuming its right hand position, wire 150, switch box contact 151 closed only if the track switch SW^1 assumes the main track position, wire 152, mechanism of the signal 102 through the clear wire *cl* or the caution wire *ca*, depending on traffic conditions in advance.

Applicant has thus shown several rather specific embodiments of his invention, and it is desired to be understood that the particular embodiments of the invention illustrated have not been selected to show the exact circuit arrangements preferably employed in practicing the invention nor have they been selected for showing the scope of the invention, but they have been selected for the purpose of facilitating disclosure of the nature of the invention, its underlying principles and the manner in which it may be applied to certain railway signaling problems, and it is further desired to be understood that

various changes, modifications and additions may be made to adapt the invention to the other and particular problems encountered in practicing the same, all without departing from the spirit or scope of the invention or the idea of means underlying the same, except as demanded by the scope of the following claims.

What I claim as new is:—

1. In combination, a local central office, a distant track switch, a signal associated with said track switch, a switch stand for operating said track switch, locking means for locking said switch stand against movement, a single line circuit connecting said office and track switch location, means for manually controlling said signal and releasing said locking means from said office over said line circuit, and means for indicating at said office over said line circuit the passage of a train over said track switch.

2. In combination, a local central office, a distant track switch, a signal associated with said track switch, a switch stand for operating said track switch, locking means for locking said switch stand against movement, a single line circuit connecting said office and track switch location, means for manually controlling said signal and releasing said locking means from said office over said line circuit including means requiring cooperation of a member of a train crew at said track switch to render said lock releasing means effective, and means for indicating at said office over said line circuit the passage of a train over said track switch.

3. In combination, a local central office, a distant track switch, a signal associated with said track switch, a switch stand for operating said track switch, locking means for locking said switch stand against movement, a single line circuit connecting said office and track switch location, means for manually controlling said signal and releasing said locking means from said office over said line circuit including means requiring cooperation of a member of a train crew at said track switch to render said lock releasing means effective, means for indicating at said office over said line circuit the passage of a train over said track switch, and means for indicating at said office and over said line circuit when said locking means has been unlocked.

4. In combination, a distant track switch, a local office, a switch stand for manually operating said track switch, manually operable locking means for locking said track switch and housed in a casing, a cover for said casing which when in place insures that said locking means shall be in its locked position, an electric lock for locking said manually operable locking means controlled over a circuit extending to said local office, an indicator in said office, and means for controlling said indicator over said circuit in accordance with whether or not said cover is in place.

5. In combination, a distant track switch, a local office, a switch stand for manually operating said track switch, manually operable locking means for locking said track switch and housed in a casing, a cover for said casing the closing of which insures that said locking means is in its locked position, an electric lock for locking said manually operable locking means controlled over a circuit extending to said local office, an indicator in said office, and means effective only when said cover is in place for controlling said indicator over said circuit in accordance with whether or not said track switch assumes its normal position.

6. In combination, a distant track switch, a local office, a switch stand for manually operating said track switch, manually operable locking means for locking said track switch and housed in a casing, a cover for said casing which can be in place only if said locking means is in its locked position, an electric lock for locking said manually operable locking means controlled over a circuit extending to said local office, an indicator in said office, and means effective only if said cover is in place for controlling said indicator over said circuit in accordance with whether or not said manually operable locking means assumes a position to lock said track switch.

7. In combination, a distant track switch, a local office, a switch stand for manually operating said track switch, manually operable locking means for locking said track switch and housed in a casing, a cover for said casing which can be in place only if said locking means is in its locked position, an electric lock for locking said manually operable locking means controlled over a circuit extending to said local office and energizable to unlock said manually operable locking means only if said cover is removed from said casing, an indicator in said office, and means for controlling said indicator over said circuit in accordance with whether or not said electric lock is energized, whereby said indicator may also reflect whether or not said cover is in place.

8. In combination, a distant track switch, a signal for governing traffic over said track switch, a switch stand for operating said track switch, a normally deenergized electric lock for locking said track switch, a stick relay, a line circuit for controlling said electric lock including a front contact of said stick relay, a lever for controlling said signal, and a contact in a stick circuit for said stick relay closed only when said signal is at stop.

9. In combination, a distant track switch, a signal for governing traffic over said track switch, a switch stand for operating said track switch, a normally deenergized electric lock for locking said track switch, a stick relay, a circuit for controlling said electric lock including a front contact of said stick relay, a lever for controlling said signal, a contact in a stick circuit for said stick relay closed only when said signal is at stop, and means for controlling said signal over said line circuit.

10. In combination, a distant track switch, a signal for governing traffic over said track switch, a switch stand for operating said track switch, a normally deenergized electric lock for locking said track switch, a stick relay, a line circuit for controlling said electric lock including a front contact of said stick relay, a lever for controlling said signal, a contact in a stick circuit for said stick relay closed only when said signal is at stop, and means for indicating the condition of energization of said electric lock over said line circuit.

11. In combination, a distant track switch, a signal for governing traffic over said track switch, a switch stand for operating said track switch, a normally deenergized electric lock for locking said track switch, a stick relay, a circuit for controlling said electric lock including a front contact of said stick relay, a lever for controlling said signal, a contact in a stick circuit for said stick relay closed only when said signal is at stop, means for controlling said signal over said line circuit, and means for indicating the condition of energization of said electric lock over said line circuit.

12. In combination, a distant track switch, a

signal for governing traffic over said switch, an electric lock which if deenergized locks said switch, a local control lever, a control relay at said track switch controlled by said lever which if energized may energize said electric lock, and a lock indicating relay energized only if said electric lock is deenergized and controlling said signal.

13. In combination, a distant track switch, a signal for governing traffic over said switch, an electric lock which if deenergzied locks said switch, a local control lever, a control relay at said track switch controlled by said lever and which if energized may energize said electric lock, a lock indicating relay energized only if said electric lock is deenergized and controlling said signal, means local to said lever for indicating the continuity of the circuit for said control relay, and a front contact of said lock indicating relay included in the circuit for said control relay.

14. In combination, a distant track switch, a signal for governing traffic over said switch, an electric lock which if deenergized locks said switch, a local control lever, a control relay at said track switch controlled by said lever and which if energized may energize said electric lock, a lock indicating relay energized only if said electric lock is deenergized and controlling said signal, means local to said lever for indicating the continuity of the circuit for said control relay, a front contact of said lock indicating relay included in the circuit for said control relay, and a stick circuit for said control relay including a back contact of said lock indicating relay.

15. In combination, a distant track switch, a switch stand for operating said track switch, a manually movable device housed in a casing for locking said track switch, an electrically operable lock which if deenergized locks said manually movable device, a cover for said casing which may be closed only if said manually movable device is in its locked position, a signal governing the movement of traffic over said switch, a control relay at said switch, a lever at a local point for controlling said electrically operable lock through the medium of said control relay, a lock repeating relay for controlling said signal energized only if said manually movable device and said electrically operable lock are in their locked condition, a circuit for said electrically operable lock closed only if said control relay is energized and said cover is open, an indicator at said local point and actuated in response to the opening of the control circuit for said control relay, and means for opening the control circuit for said control relay when said lock repeating relay assumes its deenergized condition.

16. In combination, a distant track switch, a switch stand for operating said track switch, a manually movable device housed in a casing for locking said track switch, an electrically operable lock which if deenergized locks said manually movable device, a cover for said casing which may be closed only if said manually movable device is in its locked position, a signal governing the movement of traffic over said switch, a control relay at said switch, a lever at a local point for controlling said electrically operable lock through the medium of said control relay, a lock repeating relay for controlling said signal energized only if said manually movable device and said electrically operable lock are in their locked condition, and a circuit for said electrically operable lock closed only if said control relay is energized and said cover is open.

17. In combination, a track switch at a distant point, an electric lock for when deenergized locking said track switch, manually controllable means at a local point for energizing said electric lock through the medium of a line circuit connecting said local and said distant point, said manually controllable means including a stick relay, means at said track switch for opening said line circuit so long as said track switch assumes an abnormal position to deenergize said stick relay and leave it deenergized after return of said switch to its normal position, whereby said electric lock is deenergized and left deenergized in response to operation of said track switch to an abnormal position.

18. In combination, a track switch at a distant point, an electric lock for when deenergized locking said track switch, manually controllable means at a local point for energizing said electric lock through the medium of a line circuit connecting said local and said distant point, said manually controllable means including a stick relay, means at said track switch for opening said line circuit so long as said track switch assumes an abnormal position to deenergize said stick relay and leave it deenergized after return of said switch to its normal position, whereby said electric lock is deenergized and left deenergized in response to operation of said track switch to an abnormal position, and means for indicating the condition of energization of said stick relay.

19. In combination, a normally locked track switch at a distant point, a stick relay at a local point, means included in the stick circuit for said stick relay for holding the stick relay energized for unlocking said track switch when said stick circuit is energized, and means responsive to operation of said track switch for breaking said stick circuit.

20. In combination, a normally locked track switch at a distant point, a stick relay at a local point, means included in the stick circuit for said stick relay for unlocking said track switch when said stick circuit is energized, means responsive to operation of said track switch for breaking said stick circuit, and means at said local point for indicating when said stick relay is energized and in turn indicating when said track switch has been operated in response to such unlocking.

21. In combination, a distant track switch, a signal for governing traffic over said switch, a switch stand for manually operating said switch, an electric lock for when deenergized locking said switch stand, a single line circuit connecting a local office with said track switch location, electro-responsive means included in said line circuit at said track switch location, and means at said office for selectively energizing said line circuit and electro-responsive means to either allow clearing of said signal or energize said electric lock.

22. In combination, a distant track switch, a signal for governing traffic over said switch, a switch stand for manually operating said switch, an electric lock for when deenergized locking said switch stand, a single line circuit connecting a local office with said track switch location, electro-responsive means included in said line circuit at said track switch location, and means at said office for selectively energizing said line circuit with either direct current or alternating current to cause said electro-responsive means to either allow clearing of said signal or energize said electric lock.

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