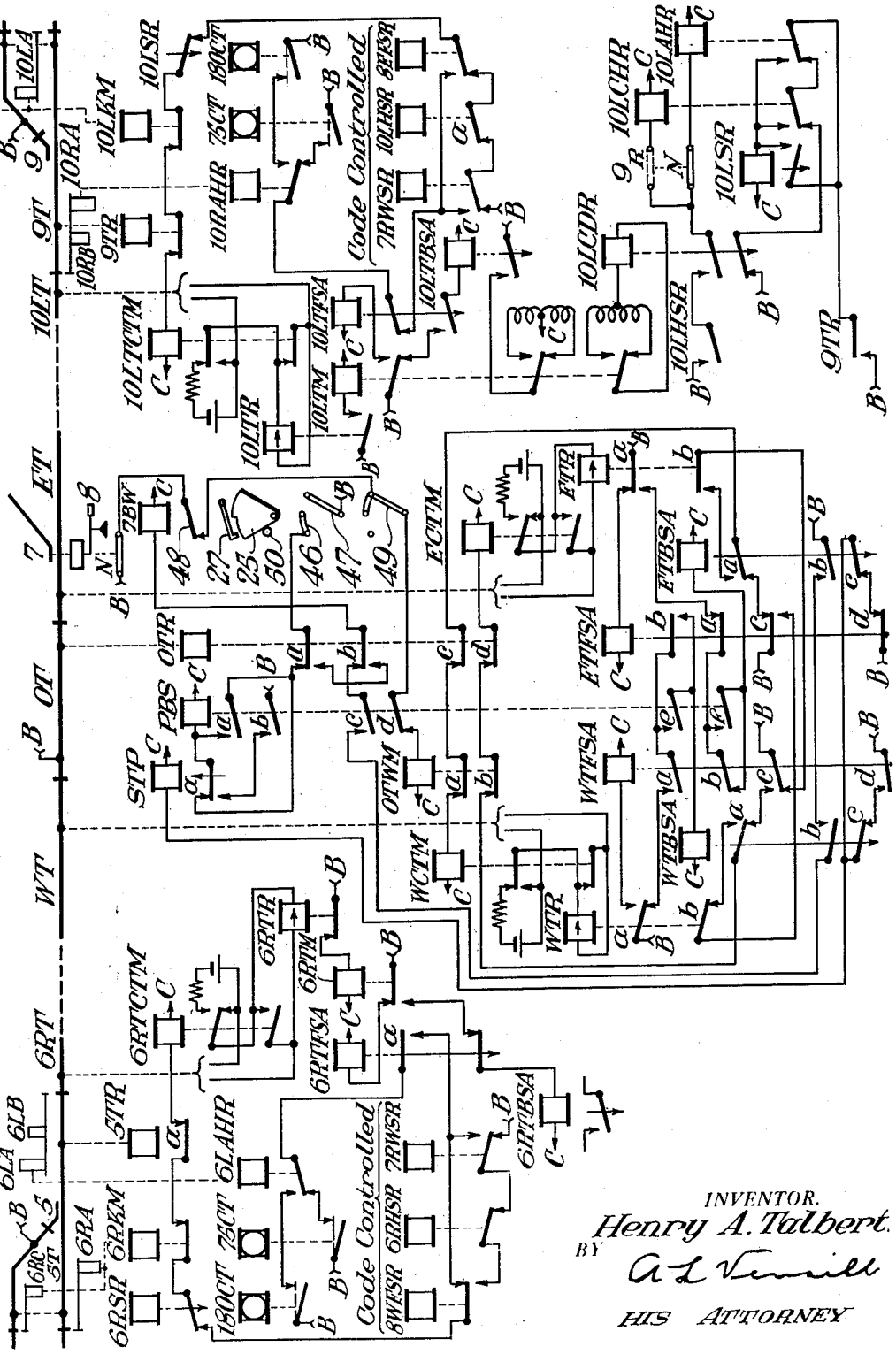
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OUTLYING TRACK SWITCH CONTROL FOR CENTRALIZED TRAFFIC CONTROL SYSTEMS OF THE CODED TRACK CIRCUIT TYPE

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OUTLYING TRACK SWITCH CONTROL FOR CENTRALIZED TRAFFIC CONTROL SYSTEMS OF THE CODED TRACK CIRCUIT TYPE

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My invention relates to railway traffic controlling apparatus, and more particularly to single track, absolute-permissive block signaling systems of the centralized traffic control type in which the signals are controlled in accordance with traffic conditions by a system of coded reversible track circuits.

In signaling systems of this character, the passing tracks which provide meeting and passing points for through trains are usually equipped with power operated track switches at each end. Continuous track circuits are provided for all main track, having track relays which control entering and leaving signals at the ends of the passing tracks and also control intermediate signals at spaced locations in the intervening single track stretches and these switches as well as the signals at the switch locations are manually controllable from a central office by means of a code type communication system, which also governs indication lamps on the operator's control panel at the office which indicate the condition of the switches and signals and the movement of trains through the controlled territory.

In general, the territory covered by such systems includes numerous other track switches for giving access to the main track from industrial sidings or the like, at points having no definite relation to the location of the block signals. Such switches are termed "outlying" track switches and as their use is relatively infrequent, it is the practice to operate them by hand throw mechanisms which are normally locked mechanically in the normal position for main line movements and in addition, to electrically interlock the outlying switches with the signals in such a manner as to prevent the authorization of a through train movement over the switch except when it is locked in its normal position and by providing an electric lock, controlled by the signaling system, for preventing switch operation except under proper traffic conditions, and then only with the authorization of the train controller or dispatcher.

In its earlier forms, the absolute permissive block system employs line wires extending the length of each block section to provide circuits controlled by the track relays for governing the signals which circuits were available at the outlying track switch locations for the interlocking purposes mentioned.

In the more recently developed centralized traffic control systems to which my invention relates, the conventional continuous track circuits have been replaced, except for special situations, by an improved system of coded reversible track

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circuits which serves not only for train detection but also provides different codes for controlling the caution and proceed aspects of the signals by periodically interrupting the track current at different rates, such as 75 or 180 times per minute.

The line circuits referred to are thereby eliminated and they are no longer available for outlying switch control purposes.

The object of my invention is to provide an improved arrangement for the control of electric switch locks for protecting train movements over outlying hand throw track switches in systems of this character.

The apparatus of my invention provides means whereby the crew of a train may unlock the hand throw switch to permit their train to enter the main track only after the operator at the control office has conditioned the trackway system so that coded current is transmitted over the track rails toward the switch location from both directions and the train crew have cooperated by interrupting the continuity of the trackway system and thereby placed it in condition to receive coded currents, by which the release of the electric switch lock is effected, from both directions.

This arrangement insures that a train cannot enter the main track except when the sections of the block adjacent the switch are unoccupied, but may enter when a remote section of the block is occupied by a train only if its direction of movement is away from the switch.

A feature of my invention is the provision of improved means for preventing the interruption of the continuity of the track circuit system by the train crew under improper traffic conditions, as for example, when the portion of the system which includes the switch location is energized by coded currents to effect the clearing of a signal for an approaching train, or when the track circuit system is deenergized by a train which has just passed the switch location. This is desirable for the reason that in absolute-permissive block systems of the type described, a directional stick relay is provided at each signal location which is energized by the control relay for the signal prior to, or when the signal is put to stop by a train and is released when current is again received over the track rails at the signal location, indicating that the train has vacated the block section in advance of the signal. At each intermediate signal location the directional stick relay controls the energization of the next section in the rear, and at a head block location it provides means for controlling a "call on" signal or

the like. Under the second of the two traffic conditions above referred to it might happen that the release of the directional stick relay at some location would be prevented if the train crew were permitted to interrupt the continuity of that portion of the track circuit system which is deenergized by a passing main line train, and this would prevent the subsequent energization of a portion of the track circuit system in the opposite direction, as required for the release of the electric switch lock.

One object of my invention is the provision of means whereby the train crew is enabled to interrupt the continuity of the track circuit system only when this is energized by current of a distinctive character, as by steady current, for example, the presence of which in the track rails at the outlying switch location indicates that the operations by which the release of the electric switch is effected may properly be initiated.

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

In the accompanying drawing, in order to illustrate my invention in a simple manner, I have shown it applied to a specific system of the type referred to, namely, that disclosed in Letters Patent of the United States No. 2,344,333, issued March 14, 1944, to James J. Van Horn, for Railway traffic controlling apparatus, which patent was reissued as No. 22,780 on Aug. 13, 1946. It will be understood, however, that my invention is not limited to use with this system but can readily be applied to other systems of the same general nature. To facilitate an understanding of my invention, I have employed reference characters similar to those of this patent, that is to say, each relay shown herein which corresponds to one shown in the patent is identified by the same reference character.

The apparatus embodying my invention is that comprising the central portion of the drawing, which as shown, is applied to the control of an electric lock for an outlying hand throw switch 7. This portion is a substitute for Fig. 3*b* of the patent and may replace that view in the Van Horn system, or it may replace the corresponding parts of Fig. 3*a* of the patent, in the event the switch is at an intermediate signal location. The outlying track switch 7 is assumed to be located at some point in a single track block, as indicated by the track diagram at the top of the drawing, which block extends from the head block signal 6RA or 6RC, shown in Fig. 1*b*, of the patent, through one or more intermediate signal locations, not shown herein, but corresponding to Fig. 1*c* of the patent, to the opposing signal 10LA or 10LC shown in Fig. 1*d* of the patent.

Before describing my invention, I shall briefly describe the operation of the related portions of the system of the Van Horn patent, with reference to through train movements.

The central office control of train movements is effected by the operation of the relays designated "code controlled" on the accompanying drawing, the circuits for which are shown in Figs. 1*b* and 1*d* of the patent. These include two traffic relays 8WFSR and 8EFSR for governing the traffic direction which are controlled by the traffic lever 8 and its repeating relay 8LPR shown in Fig. 1*a* of the patent. Relay 8WFSR is energized for westbound movements, from right to left, and is released, with relay 8EFSR energized, for eastbound movements, from left to right. Relays

6RHSR and 10LHSR are signal control relays governed by signal levers at the office which may be energized to clear one of the associated head block signals when the corresponding direction is established. A switch lock control relay 7RWSR, at each head block location, is governed by a switch lock lever 7 shown in Fig. 1*a* of the patent. These relays are provided for the control of the electric switch lock, that is, when relay 8WFSR or 8EFSR is energized at one end of the block, the energization of relay 7RWSR at the other end conditions the system for the transmission of coded current from both directions toward switch 7.

These code controlled relays are manually governed from the control office by means of a code type communication system such, for example, as is disclosed in Letters Patent of the United States No. 2,229,249, issued January 21, 1941, to Lloyd V. Lewis, for Remote control systems. Portions of this remote control system are shown in the Van Horn patent, comprising two coding units having the code calls 234 and 235 in Fig. 1*b*, at the left-hand end of the single track block, and two others having the code call 236 and 237, in Fig. 1*d*, at the right-hand end of the block. For an understanding of how the Van Horn system is remotely controlled it will suffice to note that in the Lewis patent, a signal control relay RHS may be picked up or released by a control code having the code call 234, initiated by the operation of a starting button SK, in accordance with the position of a signal lever HK, and that relay RHS is released automatically by the track relay when a train passes the signal which it controls. The mode of operation of Van Horn's signal control relays is similar to this, except that a different code call 235 or 237 is used. The control of the switch lock and traffic relays differs only in that a separate starting button SK is not used, the levers 7 and 8 being provided with push contacts which close to initiate code transmission whenever the lever is rotated. Each operation of lever 7 or 8 energizes two starting relays of the remote control system and two control codes are transmitted having the code calls 234 and 236, so that the switch lock and traffic relays at both ends of the block are operated in accordance with the positions of their respective levers, in response to the operation of either lever 7 or 8. It is also to be understood that the track switches 5 and 9 are governed in the manner described for switch W in the Lewis patent, and that a miniature representation of the track plan is provided at the office, containing "OS" indication lamps lighted in response to indication codes transmitted automatically by the communication system to indicate occupancy of the switch sections, such as sections 5T and 9T. The remote control system also controls a "block light" at the office, shown in Fig. 1*a* of the Van Horn patent to indicate block occupancy, and also controls other lamps to indicate the condition of the track switches and of the head block signals as shown in the Lewis patent.

The trackway portion of the Van Horn system as shown herein includes track circuits of the conventional normally energized type, for the switch sections 5T and 9T at the ends of the block and for a short releasing section OT in advance of the outlying hand throw switch 7. Each remaining track section of the system is equipped with a coded reversible track circuit, arranged to be supplied with current at either end over front contacts of a transmitter relay CTM to operate

a code following track relay TR at the opposite end. Each relay TR or a repeating relay TM which follows its periodic operation energizes two slow acting relays FSA and BSA over its front and back contacts, respectively. Each relay FSA or BSA has a release period sufficient to maintain the relay in its energized position as long as the controlling track relay is being operated periodically at the rate of 75 or 180 times per minute. When the track relay is steadily energized, relay FSA is held energized and relay BSA releases and since each relay BSA is also controlled over a front contact of the associated relay FSA it is released by relay FSA when the track relay is steadily deenergized and therefore is a code detector relay which is maintained energized only in response to the periodic operation of the controlling track relay.

The Van Horn coded track circuit system is of the normally inactive type, in which coded current is supplied to the rails of the single track stretch by manual control, only when it is desired to permit a train to enter the stretch. The operation by remote control of the signal control relay at the entrance end of the stretch, for the traffic direction designated by the position of the traffic lever 8, causes coded current to be supplied to the track circuit system at the opposite end of the stretch, the successive sections becoming energized in cascade to clear the intermediate and head block signals for the corresponding direction. The operation of the switch lock relays 7RWSR causes coded current to be supplied to the track circuit system at both ends of the stretch, the detection of which at the location of any outlying track switch in the stretch permits the energization of the corresponding electric lock.

Normally, the trackway system is in an inactive condition in which the circuits constitute a traffic locking or direction controlling system governed by the traffic lever 8. Under this condition the track circuits are energized in cascade by steady current supplied at the entrance end. As shown the system is set up for westbound traffic with relay 8WFSR energized. The code transmitter relay 10LTCTM, which in its energized position connects a track battery to the rails of section 10LT and in its released position connects the track relay 10LTR thereto, is steadily energized over back contacts of the code controlled relays 7RWSR, 10LHSR and 8EFSR, a back contact of a directional stick relay 10LSR, and front contacts of the track relay 9TR and of a locking relay 10LKM, and in this position relay 10LCTM supplies track circuit current steadily to the track rails of section 10LT at the right-hand end of the block to energize in cascade the track relays at the left-hand ends of the coded track sections. The control by relay 9TR has the obvious effect of extending the block governed by relay 10LTCTM to include section 9T. Relay 10LKM is a locking relay which is picked up only when the signals 10LA and 10LC are properly at stop, as they should be if a reversal of traffic in the single track stretch is to be permitted, and may be controlled like the analogous relay LMR shown in Fig. 9 of the Lewis patent above referred to. Relay 10LSR is a directional stick relay which picks up only when a train governed by signal 10LA or 10LC enters the block, and its operation therefore does not need to be considered at this time. At the location of switch 7, relays ETR and ETFSA are therefore steadily energized and relay WCTM is energized over front contacts c of relays ETFSA and OTR and contact *a* of relay OTWM as well as back contact *a* of relay ETBSA. The energization of relay WCTM thus checks the energization of relay OTR and the unoccupied condition of the short track section OT, and also of relay OTWM, the latter being an indication relay for switch 7 which is energized only when the switch is properly locked in the normal position for through traffic movements. The energization of relay WCTM supplies steady current to the rails of section WT, and at the left-hand end of the block, relays 6RTR, 6RTM and 6RTFSA are steadily energized.

One purpose of the steady energization of the track circuit system is to control a block indication lamp on the operator's track diagram at the control office, which when lighted indicates block occupancy. By reference to Figs. 1*a*, 2*a* and 2*b* of Patent No. 2,344,333, it will be seen that the block indication lamp is extinguished under the inactive condition described above, for the reason that the block indication relay 8WTK of Fig. 2*a* is picked up by an indication code transmitted from station 234 at the exit end of the block when relays 8WFSR and 6RTFSA are both energized. It is also to be noted that when the track circuit system is supplied with coded current and a code detector relay at the entrance end such as the relay 10LCDR is energized to indicate that the entire block, exclusive of the entrance end switch section 9T, is unoccupied, the block indication lamp is extinguished due to the energization of the block indication relay 8ETK of Fig. 2*b* of the patent, which relay is picked up by an indication code transmitted from station 236 at the entrance end of the block. Relay 8WTK is released prior to the energization of relay 8ETK, due to the release of relay 6RTFSA as hereinafter described. It is also to be noted that as explained in the Van Horn patent, the traffic direction may be changed, by the operation of lever 8, from westbound to eastbound only when relay 8WTK is energized, and from eastbound to westbound only when relay 8ETK is energized.

With the system set up for west bound traffic and in the inactive condition shown, the entering signal 10LA may be cleared by the central office operator by energizing the signal control relay 10LHSR, the energization of this relay being effective to also clear any intermediate signals in the block governing westbound traffic. The opening of back contact *a* of relay 10LHSR releases relay 10LTCTM and the cascade-connected relays of the track circuit system controlled thereby, including relay 6RTFSA at the exit end, and the latter relay by closing its back contact *a* completes a circuit for energizing relay 6RTCTM over a periodically operating contact of a code transmitter 75CT or 180CT to supply coded or periodically interrupted current to the track circuit system at the exit end, as required to control westbound traffic.

At the location of switch 7, relay WTR responds to the coded current received over the track rails of section WT, first energizing relay WTFSA and then energizing relay WTBSA over the back contact *b* of relay ETFSA. Relay ECTM is then energized periodically by relay WTR to supply coded current to the rails of section ET. To simplify the drawings, the local sources of current for energizing the various relays are indicated herein by reference to their terminals, the reference character B designating the positive or supply terminal and the reference character C the common return terminal, in each case,

The circuit for the relay ECTM referred to, as shown, extends from terminal B at the back contact *c* of relay ETFSA, back contact *b* of relay WTR, front contact *a* of relay WTBSA, contact *b* of relay OTWM, contact *d* of relay OTR, through relay ECTM to terminal C.

It will be seen that the energization of relay ECTM, like that of relay WCTM above described, checks the energized condition of relays OTR and OTWM.

At the entrance end of the block, relay 10LTR is operated by the coded current received from the track rails, and operates its repeating relay 10LTM to energize relays 10LTFSA and 10LTBSA, and also the code detector relay 10LCDR and the signal relay 10LAHR, to effect the clearing of signal 10LA.

When a westbound train passes signal 10LA, the release of the track relay 9TR releases the signal control relay 10LHSR by the opening of contacts in its stick circuit as shown in Fig. 1*d* of the Van Horn patent, and also picks up a directional stick relay 10LSR, having a back contact in the circuit for relay 10LTCTM. When the train enters section 10LT, the code operation of relay 10LTR ceases, releasing the relays it controls, whereupon relay 10LSR is held energized over a stick circuit including a back contact of relay 10LCDR until that relay is again energized, that is to say, until the train has passed the next signal in advance of signal 10LA. Assuming that the block is so short that no intermediate signals are provided, as shown herein, the code operation of relay 6RTCTM will be resumed when the train vacates section 5T, and this relay will then supply coded current to the rails of the section in the rear, energizing relay 10LCDR and thereby releasing relay 10LSR. By reenergizing relay 10LHSR the operator may clear signal 10LA again, for a following train, but if there are no further train movements to be provided for relay 10LHSR will remain released and the release of relay 10LSR will cause relay 10LTCTM to pick up to supply steady current to the rails of section 10LT. Relay ECTM, which is repeating the code operation of contact *b* of relay WTR, releases periodically, and so permits relay ETR to respond to the current received from the track rails of section ET, to energize relay ETFSA. The opening of contact *b* of relay ETFSA releases relay WTBSA and the shift of contact *c* of relay ETFSA to its upper position holds relay ECTM released and energizes relay WCTM to supply steady current to the rails of section WT. Similarly, relay 6RTR becomes energized, energizing relay 6RTFSA which by opening its contact *a* stops the code operation of relay 6RTCTM and restores the apparatus to its normal inactive condition as shown in the drawings.

Assuming now that the block includes one or more intermediate signal locations, such as are shown in Fig. 1*c* of the Van Horn patent, it will be seen from the following that such locations may be interposed between sections 6RT and WT or between sections ET and 10LT of the present application without change in the mode of operation.

Normally the signals 7W and 7E shown in Van Horn's Fig. 1*c* are deenergized and when the operator sets the system into operation for westbound traffic, the relays 7ETR, 7ETFSA and 7WCTM release and cooperate in causing coded current to be supplied to the rails at the exit end of the block as above described. The track relay 7WTR then responds to the coded current in the section in advance of signal 7W, and energizes relay 7WTFSA, which causes relay 7TM to repeat the code and to energize relay 7HR, causing signal 7W to indicate caution, in response to 75 code, relay 7DR being also energized to cause signal 7W to indicate proceed, in response to 180 code. Relay 7HR also energizes the directional stick relay 7WS and causes 180 code to be supplied by relay 7ECTM to the rails of the section in the rear of signal 7W.

When a westbound train occupies the section in advance of signal 7W, all of these relays with the exception of relays 7WS and 7ECTM are released, restoring signal 7W to stop. Relays 7WS is held energized over a stick circuit completed by the release of relay 7WTFSA, and the release of relay 7HR then causes relay 7ECTM to supply 75 code to the rails of the section in the rear of signal 7W.

When the entrance end signal control relay 10LHSR is released to restore the system to its inactive condition as hereinbefore described, the steady current supplied to the rails energizes relay 7ETR during the interval between two code impulses supplied by relay 7ECTM, so that relay 7ETFSA picks up and holds relay 7ECTM released.

When the westbound train vacates the section in advance of signal 7W, the code operation of relay 7WTR is resumed and relay 7WTFSA becomes energized. If relay 7ETFSA is released, the system resumes operation, but if relay 7ETFSA has been energized, relay 7HR remains released, and relay 7WS is released by relay 7WTFSA and upon releasing energizes the associated relay 7WCTM to supply steady current to the entrance end of the advance section. The track circuit system thus assumes its normal inactive condition, section by section, in response to the release of the signal control relay 10LHSR.

From the symmetry of the circuits, it will be readily apparent that the operation of the system when set up for estbound traffic, with relay 8EFSR energized and relay 8WFSR released, is similar to that described for the westbound direction.

The electric lock for the hand throw switch as shown herein is to be understood to be of the type shown in Letters Patent of the United States No. 1,126,834, issued February 2, 1915, to Walter P. Neubert and William E. Smith, and is applied to the hand throw lever 8 for switch 7 in such a manner as to maintain the switch locked in its normal position as shown. The lever latch by which lever 8 is locked normal is attached to a segment 25 held in its locking position by the bail 50 of a padlock. To unlock the switch, the padlock must first be removed by the train crew, which permits the segment to be moved a short distance, limited by engagement of the segment with the locking dog 27, to close the contacts 46—47. For a movement from the main track to the side track, the train must occupy the short releasing section OT to obtain an unlock, which section usually is not more than 150 feet long, with one end adjoining the switch rails. It follows that when the train arrives at the switch location the track relay OTR is released and when the switch lock lever is operated by the train crew, the closing of contacts 46—47 completes a circuit from terminal B, over the back contacts *a* and *b* of relay OTR, through the lock magnet 7BW to terminal C, magnet 7BW becoming energized to open contact 48 and to lift the locking dog 27. This permits segment 25 to

be moved to its full reverse position in which lever 8 of the switch stand is free to be operated by hand to move the switch. Segment 25 is locked reverse mechanically as explained in the Neubert et al patent, until lever 8 is again restored to normal. The switch stand is equipped with the usual switch circuit controller having a contact N included in a circuit for a normally energized indication relay OTWM. This circuit extends from terminal B at contact N over contacts 48 and 49, contact *d* of relay PBS through relay OTWM to terminal C. Relay OTWM is therefore released by unlocking the switch, and by opening its contacts *a* and *b* in the circuits for the code transmitter relays ECTM and WCTM, interrupts the continuity of the track circuit system at the switch location. The circuit for relay OTWM is opened at contact N whenever the switch is displaced from its normal position.

This electric lock differs in detail from the one shown in Patent No. 2,344,333, which may also be used, in which case the contacts of the auxiliary bolt lock 7A would replace the contacts 46—47 shown herein.

For movements out of the side track, an unlock can be obtained only by cooperation with the central office operator, as already pointed out, and this operation can be initiated by the train crew only under proper traffic conditions as manifested by the presence of steady current in the track rails at the switch location.

To detect this steady current, I provide a slow pick-up relay STP, which is energized when the system is in its inactive condition, over front contact *d* of relay ETFSA and the back contact *c* of relay ETBSA, assuming the system to have been set up for westbound traffic movements as shown, or if the eastbound traffic direction is set up, relay STP is energized over the corresponding contacts of relays WTFSA and WTFSB.

To obtain an unlock with the track relay OT energized, so as to enable a train to enter the block via switch 7 for a movement in the established direction, relay STP must also be energized, and if the bail 50 of the padlock is removed by the train crew under this condition, after obtaining authorization by telephone from the central office operator, the closing of contacts 46—47 completes a circuit from terminal B over front contacts *a* of relays OTR and STP through the winding of a stick relay PBS to terminal C. Relay PBS picks up and the opening of its back contact *d* releases relay OTWM, which as already explained, interrupts the continuity of the track circuit system. It follows that when the westbound direction is set up and the system is in its inactive condition the portion of the track circuit system at the left of section OT becomes deenergized so that relay 6RTFSA is released, and since relay 8WFSR is energized, this allows relay 6RTCTM to supply coded current to that portion of the track circuit system as required for westbound traffic, and relay WTR responds, energizing relays WTFSA and WTBSA. Relay WTBSA is energized over contact *e* of relay PBS in this instance, since relays ETR and ETFSA are steadily energized and contact *b* of relay ETFSA is open.

The release of relay 6RTFSA as above described is not followed by the energization of relay 10LCDR as when the system is set up for through traffic, and therefore a block occupied indication will be displayed at the office, due to the release of relay 6RTFSA, which will be understood by the operator to be due to the energization of relay PBS by the train crew. When this indication is received, the operator will reverse the switch lock lever 7 as explained in connection with Fig. 1*a* of the Van Horn patent, and thereby cause the transmission of control codes which will energize the code controlled switch control relays 7RWSR at both ends of the block, and the energization of relay 7RWSR at the right-hand end of the block will cause relay 10LTCTM to supply coded current to section 10LT in place of steady current. This conditions the portion of the track circuit system at the right of section OT as required for eastbound traffic movements, and relay ETR operates periodically and energizes relay ETBSA over front contact *a* of relay ETFSA and front contact *f* of relay PBS. Back contacts *c* of relays ETBSA and WTBSA are both open, consequently relay STP releases, completing a stick circuit at its back contact *a* and the front contact *b* of relay PBS by which relay PBS is held energized.

The energization of the relays BSA by coded currents received from both directions indicates that conditions are proper for releasing switch 7, and completes a circuit for the lock magnet 7BW from terminal B over contacts *b* of relays ETBSA and WTBSA, contact *c* of relay PBS, contact *b* of relay OTR through magnet 7BW to terminal C, so that magnet 7BW lifts latch 27, permitting segment 25 to be moved to its reverse position in which lever 8 is free to be operated. Switch 7 is then reversed by the train crew and the train enters sections OT and WT, releasing relays OTR, WTR, WTFSA and WTBSA and magnet 7BW, after which switch 7 is restored to normal and lever 8 is locked in its normal position by restoring segment 25 to normal, the train crew advising the operator by telephone when these operations are completed.

The operator then restores his lever 7 to normal and thereby causes the transmission of control codes which will release the relays 7RWSR, and the release of the relay 7RWSR at the right-hand end of the block will restore the portion of the track circuit system at the right of section OT to its normal inactive condition with relays 10LCTM, ETR and ETFSA steadily energized. Relay ETBSA releases, and the closing of its back contact *c* causes relay STP to become energized, releasing relay PBS, thereby reenergizing relays OTWM and WCTM and preparing a circuit for relay ECTM. Steady current is now supplied to the right-hand ends of the sections in the rear of the train, the shunting effect of which prevents this current from operating relay 6RTR to restore the portion of the system in advance of the train to its normal condition until the train has passed signal 6LA, assuming that its movement is in the established westbound direction.

When the block includes an intermediate signal such as the signal 7W shown in Van Horn's Fig. 1*c* which is beyond the switch in the established westbound direction, the energization of relay STP when steady current is received at the switch location as above described will cause relay WCTM to cut off the supply of steady current from the rails of the section in the rear of the intermediate signal 7W enabling the associated relay 7ECTR to supply coded current to the rails to energize relay WTBSA at the switch location, even though signal 7W is held at stop by a westbound train in the section in advance of that signal. It follows that switch 7 may be unlocked to permit a train to enter the block via switch 7

behind a receding train which has passed the first intermediate signal beyond the switch.

It may be that the operator wishes to clear signal 10LA or 10LC to permit a through train to enter the block behind a train which enters the block via switch 7. In this case he will first release relay 7RWSR in order to energize relay 10LTCTM and thereby release relay PBS and re-energize relay OWTM as above described, and will then energize relay 10LHSR, thereby releasing relay 10LTCTM to discontinue the supply of steady current at the entrance end. Then when the train which entered the block via switch 7 vacates section 5T or passes the first intermediate signal, as the case may be, the section or sections in the rear will be supplied with coded current, energizing relay 10LCDR as required.

The train which entered via switch 7 may also move against the established westbound direction of traffic so as to leave the block via section 9T. If the portion of the block at the right of section OT includes an intermediate signal location, the eastbound signal at that location will be cleared, due to the operation of relay 7RWSR at the right-hand end of the block and to insure that this signal will remain at clear until the train passes it, the operator will hold the relay 7RWSR energized until he has ascertained by the lighting of the "OS" lamp for the section 9T, on his diagram, that the train has arrived at the end of the block.

It may be that a block will include a plurality of electrically locked hand throw switches in different sections, each of which is equipped with an electric lock controlled like the one shown, in which case it will be readily apparent that only one switch lock lever 7 is required for the block and that only one of these switches can be unlocked at a time for a movement into the main track and that no interference occurs.

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

Having thus described my invention, what I claim is:

1. Railway traffic controlling apparatus comprising a stretch of railway track including two block sections extending in opposite directions from the location of a track switch, an electric lock which when deenergized locks the switch in its normal position, an indication relay which is energized only when the switch occupies its normal position and is locked by said electric lock, means for transmitting track circuit current steadily over the rails of one of said block sections toward the switch, means for transmitting coded track circuit current at times over the rails of one or both block sections toward said switch, detecting means for indicating whether the currents received at the switch location are steady or coded, circuits rendered effective when said indication relay is energized and said detecting means indicates that coded current is being received over the rails of either block section for supplying track circuit current to the rails of the other block section at the switch location to control the movement of traffic toward said switch, circuit means including a manually operable contact associated with the switch lock which is effective only when said detecting means indicates that coded current is being received at the switch location to release said indication relay, and a circuit closed by said detecting means upon the reception of coded currents from the rails of both block sections following the release of said indication relay for energizing said electric lock.

2. Railway traffic controlling apparatus comprising a stretch of railway track including a short releasing section adjacent a track switch and two block sections extending in opposite directions from said releasing section, an electric lock which when deenergized locks the switch in its normal position, a normally energized track relay for said releasing section, an indication relay which is energized only when the switch occupies its normal position and is locked by said electric lock, means for transmitting track circuit current steadily over the rails of one block section toward the switch, means for transmitting coded track circuit current at times over the rails of one or both block sections toward said switch, detecting means for indicating whether the currents received at the switch location are steady or coded, circuits rendered effective if said detecting means indicates that coded current is being received over the rails of either block section when said track relay and said indication relay are both energized for supplying current to the rails of the other section to control the movement of traffic toward said switch, a manually operable contact associated with said electric lock, a first circuit for energizing said electric lock closed in response to the operation of said manually operable contact when said track relay is released, means for releasing said indication relay if the manually operable contact is operated when the track relay is energized but only if said detecting means indicates that steady current is being received from the rails of one of said block sections, and a second circuit for energizing said electric lock closed only when said detecting means indicates that coded currents are being received from the rails of both sections following the release of said indication relay.

3. In a coded track circuit signaling system, a stretch of railway track including a track switch, two block sections in said stretch extending in opposite directions from the location of the switch, an electric lock which when deenergized locks the switch in its normal position, an indication relay which is energized only when the switch occupies its normal position and is locked by said electric lock, means for transmitting steady current over the rails of one block section toward the switch for detecting when such section is unoccupied, means for transmitting coded currents over the rails of one or both block sections toward said switch, the coded current received from either section being effective when said indication relay is energized to supply current to the rails of the other block section to control the movement of traffic toward the switch, circuit means including a manually operable contact and requiring the reception of steady current from the rails of one of said block sections for releasing said indication relay, and a circuit for energizing said electric lock in response to the reception of coded current from the rails of both block sections following the release of said indication relay.

4. In a coded track circuit signaling system, a stretch of railway track including a track switch, two block sections in said stretch extending in opposite directions from the location of the

switch, an electric lock which when deenergized locks the switch in its normal position, a short releasing section in said stretch between said block sections having a normally energized track relay, a stick relay, means responsive to coded current received over the rails of one block section effective only if said track relay is energized and said stick relay is released to supply coded current to the rails of the other block section for governing traffic movements toward the switch, a pick-up circuit for said stick relay including a manually operable contact, a front contact of said track relay and a contact closed only when steady current is received over the rails of one of said block sections, a stick circuit which holds said stick relay energized when coded current is being received and also when no current is being received from the rails of said block sections, and two circuits for energizing said electric lock, one of which includes said manually operable contact and a back contact of said track relay, the other including front contacts of said track relay and of said stick relay.

5. In a coded track circuit signaling system, a stretch of railway track including a track switch, two block sections in said stretch extending in opposite directions from the location of the switch, an electric lock which when deenergized locks the switch in its normal position, a short releasing section in said stretch between said block sections having a normally energized track relay, a stick relay, an indication relay, a normally closed circuit for said indication relay including a back contact of said stick relay and contacts which are closed only when the switch occupies its normal position and is locked by said electric lock, means responsive to coded current received over the rails of one block section effective only if said track relay and indication relay are both energized to supply coded current to the rails of the other block section for governing traffic movements toward the switch, a pick-up circuit for said stick relay including a manually operable contact, a front contact of said track relay and a contact closed only when steady current is received over the rails of one of said block sections, a stick circuit which holds said stick relay energized when coded current is being received and also when no current is being received from the rails of said block sections, and a circuit for energizing said electric lock in response to the reception of coded current from the rails of both block sections which includes front contacts of said track relay and of said stick relay.

6. In a coded track circuit signaling system having a track section extending from the location of a hand throw switch to the location of a signal governing the movement of traffic toward the switch, a transmitter relay at each location, each effective when actuated to supply track circuit current to the rails of said section at the corresponding end, an indication relay which is energized only when the switch is locked in its normal position, a directional stick relay at said signal location, manually controllable means at the signal location normally effective when said directional relay is released to maintain the transmitter relay at that location in its actuated position so as to supply steady current to the rails of said section, detecting means for indicating the reception of said steady current at the switch location, means controlled by said detecting means and rendered effective when said steady current is cut off, but only if said indication relay is energized to cause the transmitter relay at the switch location to supply coded current to the rails of said section, means at the signal location responsive to said coded current for controlling said signal, a pick-up circuit for the directional relay which is closed when a train governed by the signal enters the section, and thereby terminates the reception of coded current at said signal location, a stick circuit arranged to hold the directional relay energized until coded current is again received at the signal location, a manually operable contact for governing the operation of the switch, and means controlled by said contact but effective only when said detecting means indicates that steady current is being received at the switch location for releasing said indication relay.

7. In a coded track circuit signaling system having a track section extending from the location of a hand throw switch to the location of a signal governing the movement of traffic toward the switch, a transmitter relay at each location, each effective when actuated to supply track circuit current to the rails of said section at the corresponding end, an indication relay which is energized only when the switch is locked in its normal position, a directional stick relay at said signal location, manually controllable means for maintaining the transmitter relay at the signal location normally in its actuated position to supply steady current to the rails of said section, detecting means for indicating the reception of said steady current at the switch location, means effective when said indication relay is energized and said detecting means indicates that said steady current has been cut off, to cause the transmitter relay at the switch location to supply coded current to the rails of said section for controlling said signal, a pick-up circuit for the directional relay which is closed when a train governed by the signal enters the section, a stick circuit arranged to hold the directional relay energized when said section is occupied and until coded current is again received at the signal location, a manually operable contact for governing the operation of said switch and for releasing said indication relay, means controlled by said detecting means for preventing the release of said indication relay in response to the operation of the manually operable contact except when steady current is being received at the switch location, and means comprising a back contact of said directional relay for preventing the actuation of the transmitter relay at the signal location while the directional relay is energized.

8. In combination with a stretch of railway track over which traffic may move in either direction, said stretch including a track switch equipped with an electric switch lock, a first block section and a second block section in said stretch extending from the switch location toward the opposite ends of the stretch, means for normally transmitting steady current over the rails of said block sections in the direction established for traffic movements in said stretch, manually controllable means at the switch location effective only when steady current is being received from the rails of said first block section to prepare a circuit for releasing said electric lock and to also discontinue the supply of steady current to the other section, means manually controllable from a central office, but located at the end of said second block section remote from said switch, for supplying coded current to the

rails of said second block section when the steady current is cut off, by the operation of the manually controllable means at the switch location, means manually controllable from a central office, but located at the end of said first block section remote from the switch, for supplying coded current in lieu of steady current to the rails of said first block section, and means responsive to coded current received over the rails of both block sections at the switch location for completing said prepared circuit.

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The following references are of record in the file of this patent:

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