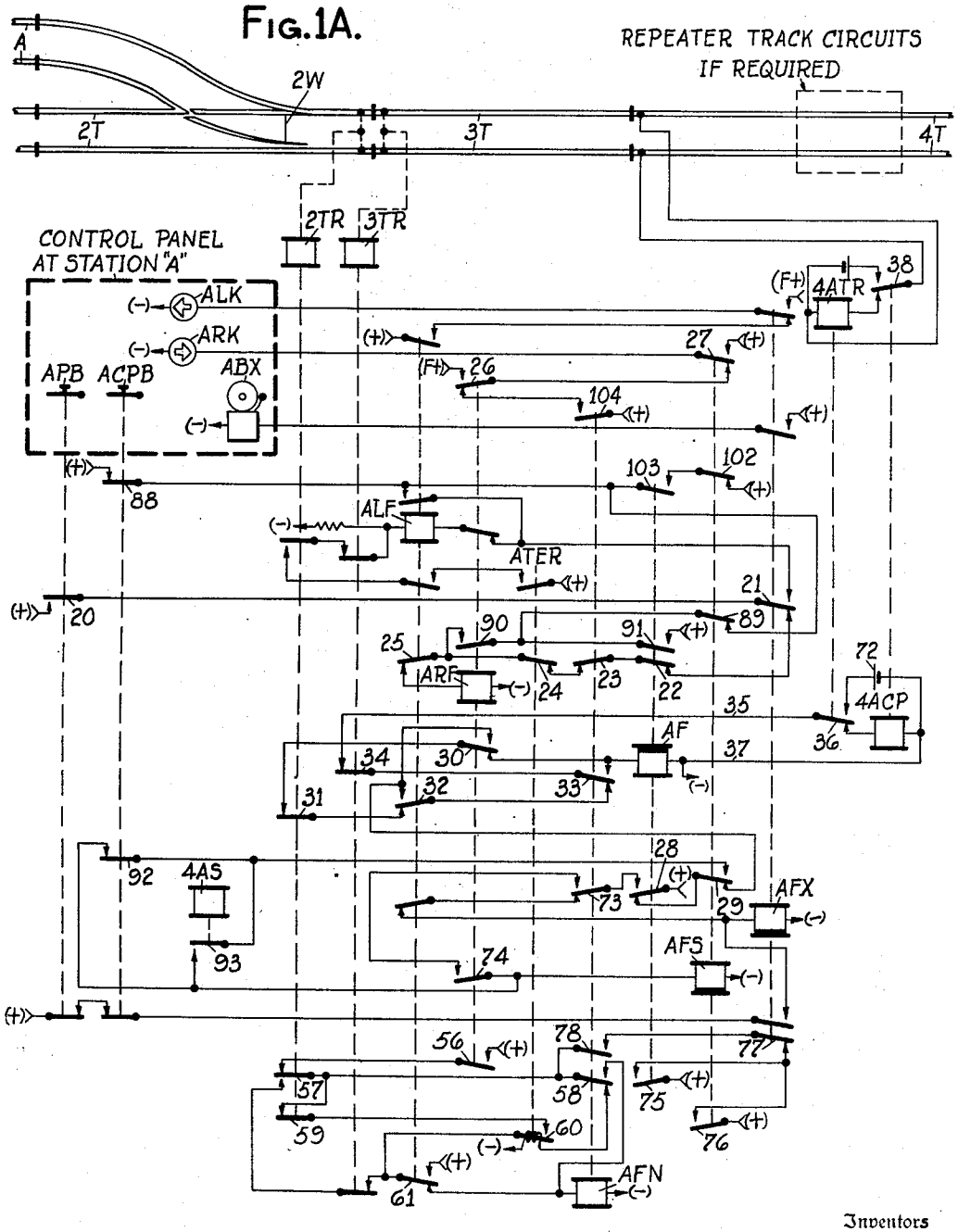
Jan. 25, 1955 T. J. JUDGE ET AL 2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Filed Nov. 14, 1950 6 Sheets-Sheet 1

FIG. 1A.



Inventors

T. J. Judge and R. M. Phinney

By Neil W. Preston

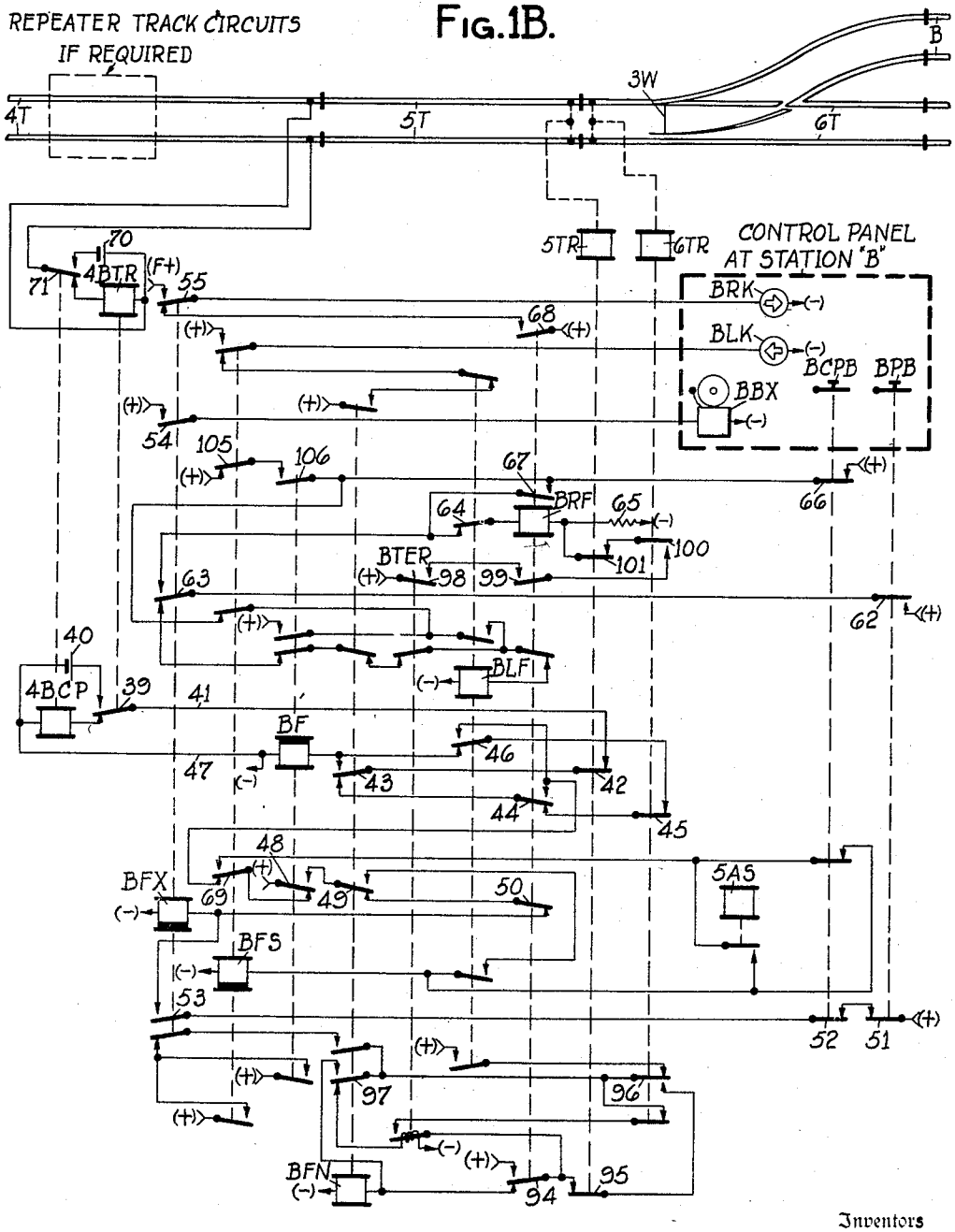
Their Attorney

Jan. 25 1955 T. J. JUDGE ET AL 2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Filed Nov. 14, 1950 6 Sheets-Sheet 2

FIG. 1B.



Inventors

T. J. Judge and R. M. Phinney

By

Neil W. Prestore,

Their Attorney

Jan. 25, 1955 T. J. JUDGE ET AL 2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Filed Nov. 14, 1950 6 Sheets-Sheet 3

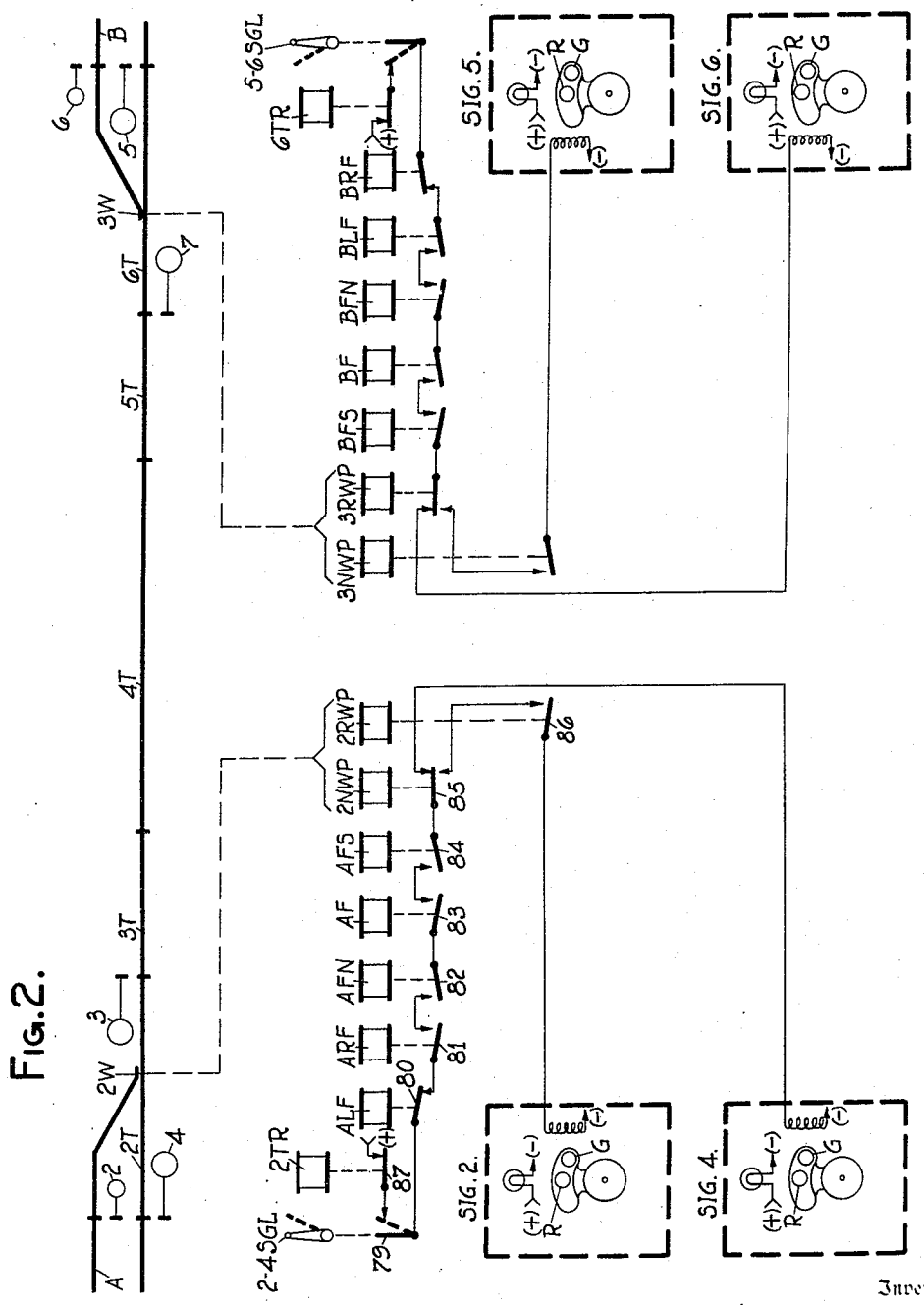


FIG. 2.

Inventors
T. J. Judge and R. M. Phinney
By
Neil W. Preston,
Their Attorney

Jan. 25, 1955 T. J. JUDGE ET AL 2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Filed Nov. 14, 1950 6 Sheets-Sheet 4

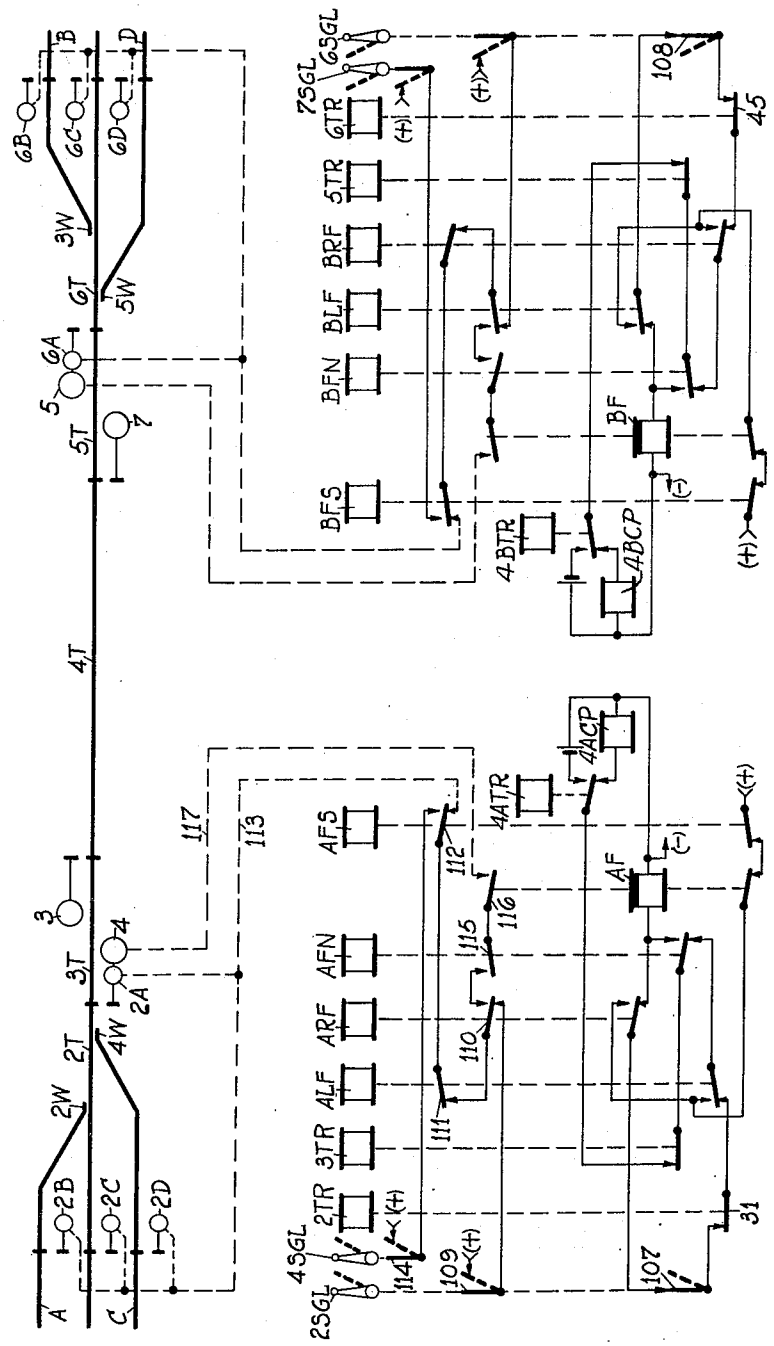


FIG. 3.

Inventors
T. J. Judge and R. M. Phinney
By
Neil W. Reston,
Their Attorney

Jan. 25, 1955 T. J. JUDGE ET AL 2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Filed Nov. 14, 1950 6 Sheets-Sheet 5

FIG. 4A.

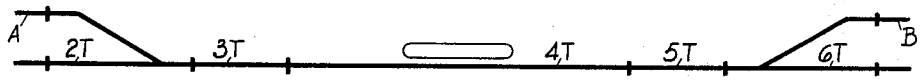
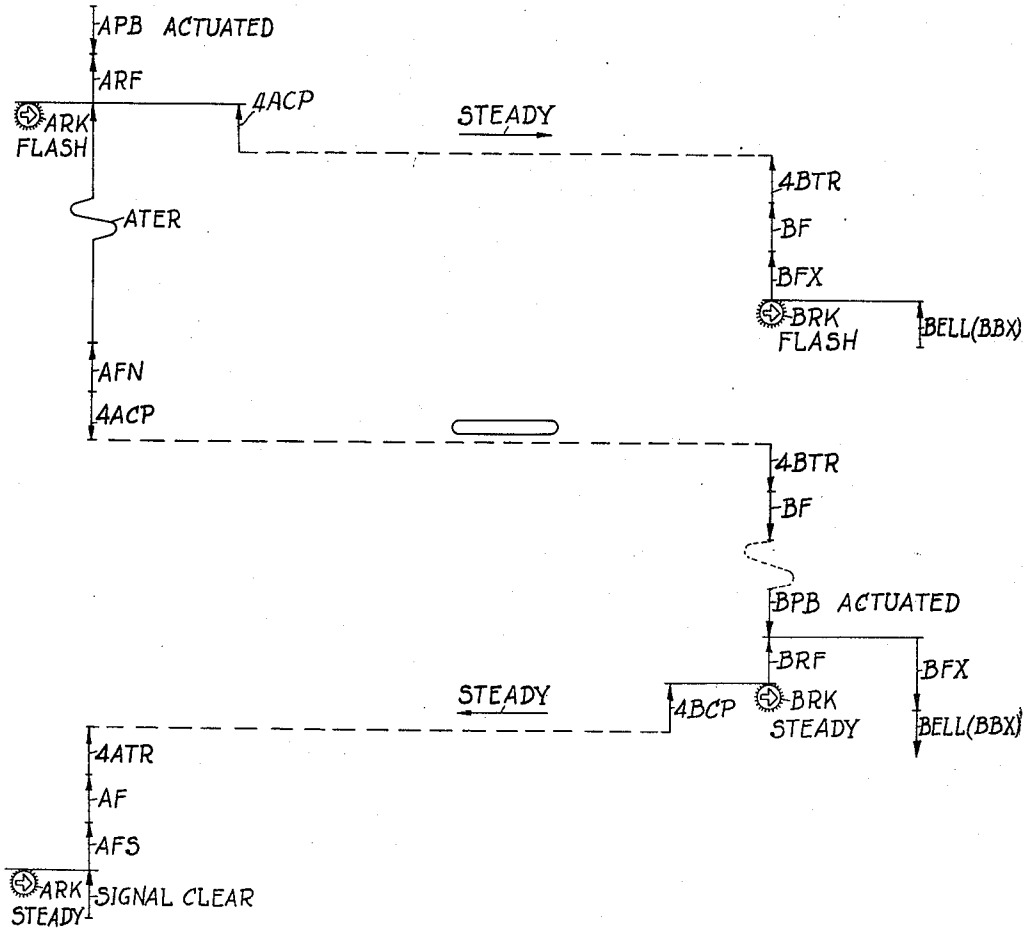


FIG. 5A.



Inventors
T.J. Judge and R.M. Phinney
By
Neil W. Preston,
Their Attorney

Jan. 25, 1955 T. J. JUDGE ET AL 2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Filed Nov. 14, 1950 6 Sheets-Sheet 6

FIG. 4B.

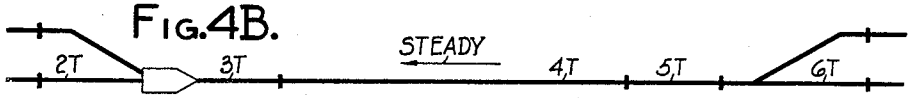


FIG. 5B.



FIG. 4C.

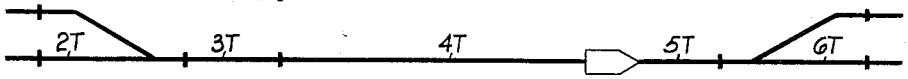


FIG. 5C.

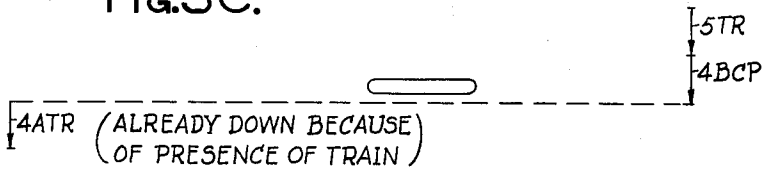


FIG. 4D.

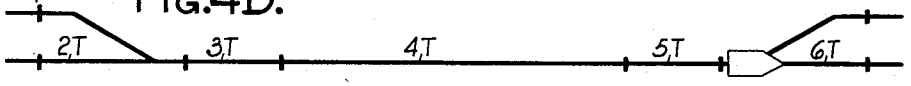
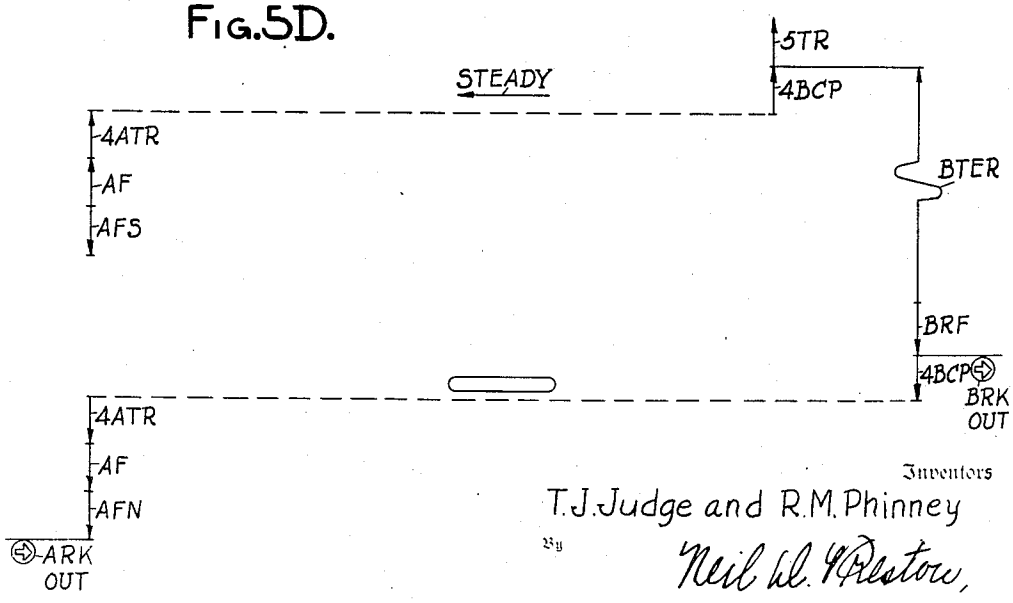


FIG. 5D.



Inventors
T. J. Judge and R. M. Phinney
By
Neil W. Preston,
Their Attorney

United States Patent Office 2,700,727
Patented Jan. 25, 1955

2,700,727

BLOCK SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS

Thomas J. Judge and Robert M. Phinney, Rochester, N. Y., assignors to General Railway Signal Company, Rochester, N. Y.

Application November 14, 1950, Serial No. 195,561

7 Claims. (Cl. 246—26)

This invention relates to signalling systems for railroads, and it more particularly pertains to manual block signal systems for single track railroads wherein the direction of the traffic is governed by supervisory control.

In manual block signalling systems of the character to which the present invention relates, a block is considered as the stretch of single track between successive passing sidings, and signals governing entrance to the respective blocks for both directions of traffic are manually governed, subject to traffic locking, by respective operators. In systems of this character, cooperation in manual designation is required between the operators at the respective ends of a block before the direction of traffic through the block can be changed. This is often accomplished by the positioning in correspondence of two position traffic direction levers or switches at the stations at the respective ends of the blocks.

Generally speaking, and without attempting to define the scope of the present invention, the present invention contemplates use of self-restoring push buttons at the ends of the blocks for designation of traffic direction. Only a single traffic direction push button being required at each station, because it is provided circuit-wise that the order of actuation of the buttons at the stations at the respective ends of a block serves to determine the direction of traffic. That is, the first button actuated defines that end of the block as the entrance point. Upon the initial actuation of a traffic direction button to so establish an entrance point, energy is fed through the track rails of the block, repeated from track section to track section, for a period of time sufficient to energize a track relay at the opposite end of the block. An indication is thus set up at the opposite end of the block, and an alarm sounded, calling for acknowledgment of the traffic direction designated by the actuation of the traffic direction push button at the exit end of the block. Such acknowledgement, in turn, applies energy to the track rails at the exit end of the block which is repeated from track section to track section until it is effective at the entering end of the block to energize a relay permitting the clearing of the signal governing entrance at that end.

When traffic direction is set up as has been described, block indicator lamps are energized at both stations, the lamps being intermittently energized until acknowledgment has become effective, and then being steadily energized to indicate that the acknowledgment has been made.

The indicator lamps are maintained steadily energized until the train for which the route has been established has moved out of the route. At this time, energy is fed through the track rails of the block from the exit end for the direction of traffic that has been established until it reaches the other end of the block and extinguishes the block indicator lamp at the entrance end, thus indicating to the operator at that station that the block is clear and can be used for the passage of another train.

An object of the present invention is to establish traffic locking through the track rails, without the use of line wires connecting the stations at the ends of a block.

Another object of the present invention is to distinctively indicate, without the use of line wires connecting the stations at the ends of a block, the direction of traffic designated, the requirement for acknowledgment, the completion of the establishment of traffic locking between the two stations, and the block becoming unoccupied in the rear of a train.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the

accompanying drawings and in part pointed out as the description progresses.

In describing the invention in detail reference is made to the accompanying drawings in which similar letter reference characters are used for designation of relays having similar functions, such relays being made distinctive by preceding letters or numerals indicative of particular locations or devices with which these relays are more directly associated; and in which:

Figs. 1A and 1B when placed side by side illustrate one embodiment of the present invention comprising a system organization for establishing traffic locking through a block connecting two passing sidings.

Fig. 2 illustrates a signalling system for the control of entering signals for a block in accordance with traffic locking as provided according to Figs. 1A and 1B;

Fig. 3 illustrates a modified form of signal control for governing entrance to a block, such system of signal control being adapted to provide for switching movements, and being used in accordance with the establishment of traffic locking by means of the organization illustrated in Figs. 1A and 1B;

Figs. 4A, 4B, 4C, and 4D are track diagrams illustrating typical conditions of energy transmission through a block under certain typical conditions of operation of the systems; and,

Figs. 5A, 5B, 5C, and 5D are sequence charts illustrating the sequence of operation of certain of the relays for the establishment of traffic locking under certain typical conditions of operation of the system.

The drawings have been prepared in the conventional schematic manner, more particularly to illustrate the mode of operation, than to illustrate the specific organization and arrangement of parts that may be required in practice. The symbols (+) and (−) have been used to indicate connections to the respective positive and negative terminals of suitable batteries or other sources of direct current, and the symbol (F+) has been used to designate a connection to the positive terminal of a suitable source of direct current energy through an interrupter contact to provide flashing energy.

The track layout for the embodiment of the present invention illustrated in Figs. 1A and 1B comprises a block connecting passing sidings A and B. The block is divided into track sections of suitable length in accordance with the length of the block, the minimum number of track circuits being illustrated in Figs. 1A and 1B as comprising the track sections 3T, 4T, and 5T. It is indicated that the track section 4T can be broken up into any desired number of track sections by providing repeater track sections according to practice familiar to those skilled in the art.

The right-hand end of the passing siding A is illustrated as being connected to a main stretch of single track by the track switch 2W, and a detector track section 2T is provided for the track switch 2W according to the usual practice. Similarly, the left-hand end of the passing siding B is connected to the main track by the track switch 3W, and the detector track section 6T is provided for that track switch.

The same track layout is illustrated in Fig. 2 by single line diagram as is shown in Figs. 1A and 1B, and the track layout for the signalling system illustrated in Fig. 3 is modified from that which has been described by the addition of the passing sidings C and D which are connected to the main track at the respective ends of the block by the track switches 4W and 5W respectively.

It will be readily apparent as the description progresses that any of the conventional types of railway signals may be employed for governing entrance to the block under consideration, such, for example, as searchlight signals, semaphore signals, position light signals, or signals having individual color light units.

With reference to Fig. 2, signals 4 and 5 have been illustrated as governing entrance to the block between the passing sidings A and B for main line traffic, and the dwarf signals 2 and 6 have been illustrated as being provided for governing entrance to the block from the respective passing sidings A and B. These signals have been illustrated as being of the searchlight type such as is disclosed in the patent to O. S. Field, No. 2,239,316, dated April

22, 1941, although other types of signals could as well be employed. Leaving signals 3 and 7 have been illustrated for the block under consideration, but no circuits have been shown for the control of these signals, as it is to be understood that the control of these signals can be provided in accordance with usual practice.

With reference to Fig. 3, a somewhat different arrangement of signalling is provided to facilitate the use of the ends of the passing sidings for switching purposes. Thus the signals 4 and 5 are provided in Fig. 3 for governing entrance to the block comparable to the provision of similar signals in the layout according to Fig. 2, except that these signals are located beyond the track switches at the ends of the sidings so that they can have associated therewith, on the same signal mast, switching signals 2A and 6A respectively. These switching signals when energized indicate that clearance is given the train for switching operations only, and no clearance through the block has been given. Similarly, switching dwarf signals 2B, 2C, and 2D are illustrated as being located to the left of the track switches as shown in Fig. 3 for governing passage of trains for switching operations only. A comparable arrangement of switching signals 6B, 6C, and 6D is provided for governing switching operations at the right-hand end of the block according to the track layout illustrated in Fig. 3 through the track switches 3W and 5W.

Of the track sections illustrated for this embodiment of the present invention, the track sections 2T, 3T, 5T, and 6T are to be understood as having conventional steadily energized track circuits, while the track section 4T is normally deenergized and has energy applied thereto for predetermined lengths of time as will be more apparent as the description progresses. The energization of the track section 4T at its left-hand end is provided at times by a transmit relay 4ACP (see Fig. 1A) and similarly energization of the track section 4T is at times provided by a transmit relay 4BCP (see Fig. 1B). When the transmit relays 4ACP and 4BCP are respectively in their deenergized positions, track relays 4ATR and 4BTR at the associated ends of the block are respectively connected across the track rails so as to be responsive to energy fed from the opposite end of the track section 4T. Conventional track circuits for the track sections 2T, 3T, 5T, and 6T include track relays 2TR, 3TR, 5TR, and 6TR respectively.

Right and left traffic direction relays ARF and ALF at the left-hand end of the block, and BRF and BLF at the right-hand end of the block are provided as traffic direction relays responsive to push button actuation for the designation of the direction of traffic to be established.

A slow pickup relay AF is provided at the left-hand end of the block, and a corresponding slow pickup relay BF is provided at the right-hand end of the block. Each of these relays is controlled in response to energy transmitted through the track rails of the track section 4T from the opposite end, and is also subject to local control. These relays AF and BF are made slow in picking up particularly so as to be nonresponsive to a momentary loss of shunt in the track section 4T.

A relay AFX is provided at the station at the left-hand end of the block, and a relay BFX is provided at the station at the right-hand end of the block, for the purpose of registering that end of the block as an exit end, and for the purpose of controlling the energization of an associated bell BX, or other suitable type of annunciator, and for the control of the energization of a block indicator lamp ALK or BRK at the associated station for a particular direction of traffic.

Entrance relays AFN and BFN are provided at the respective left-hand and right-hand ends of the block for the purpose of designation of the associated station as an entrance point for the setting up of traffic direction through the block.

Relays AFS and BFS are provided at the respective left-hand and right-hand ends of the block for the purpose of the control of the signal and the control of the steady energization of one of the block indicator lamps ARK or BLK at the associated station.

Each station has a timer TER which is illustrated as being of the thermal type, but any suitable timer relay, such as a timer of the motor driven type could as well be employed. The purpose of the timers TER is to govern the duration of energization of the track section 4T under various conditions of operation to be more readily apparent upon consideration of the mode of operation of the system under typical operating conditions to be encountered in practice.

The signals are provided with suitable approach and/or time locking in the conventional manner, and relays providing such locking are shown as the relays AS in Figs. 1A and 1B, such relays being associated with the respective signals governing entrance to the block.

Suitable self-restoring push buttons PB and CPB are provided at each of the stations for manual actuation in designating respectively the setting up and cancellation of traffic direction through the block extending between the passing sidings A and B. The manual control of the signals at the ends of the passing sidings for governing entrance to the block is accomplished by suitable two-position signal control levers SGL (see Figs. 2 and 3).

Having thus considered the general organization of the apparatus, consideration will now be given as to the specific circuit organization which accomplishes the desired mode of operation under certain typical operating conditions.

Operation

The nature of the system is such that it automatically restores itself subsequent to the passage of each train to a condition of rest wherein traffic is set up for neither direction, and the relays of the system are all deenergized, except for the track relays TR which are associated with the conventional steadily energized track circuits at the ends of the block, and except for the approach and/or time locking relays AS which are normally energized in the usual manner for providing this type of locking. Thus, the conditions to which the system is restored after passage of a train may be conveniently called the normal conditions of the system, and it is illustrated in the track diagram of Fig. 4A that under these conditions there is no energy transmitted through the track circuit for the track section 4T. Because of there being no traffic direction established by the system under normal conditions, the traffic direction block lamps ALK, ARK, BLK, and BRK which are provided at the stations at the respective ends of the block are normally dark.

To consider a typical condition of operation for the setting up of a route, it will be assumed that an operator at the station at the right-hand end of siding A desires to set up a route for an eastbound train through the block. To initiate the setting up of such a route, he actuates his push button APB, and in accordance therewith, steady energy is fed through the track section 4T to the station at the other end of the block. The reception of this energy at the station at the left-hand end of siding B is effective to initiate the flashing of the traffic direction indicator lamp BRK for indicating that entrance has been designated for the establishment of a route for eastbound traffic. If the operator at the station at the right-hand end of the block is agreeable to the establishment of traffic for an eastbound train at this time, he actuates his push button BPB by way of acknowledgment of the traffic direction that has been initially designated at the other end of the block.

The initial steady energization of the track section 4T is provided for only a limited length of time so as to set up an indication calling for acknowledgment at the station at the exit end of the block, and thus the energization of track section 4T is terminated afer a time determined by the thermal relay ATER and the designation of the exit end of the route by the actuation of the push button BPB is effective to apply steady energy to the track section 4T feeding toward the entrance end of the route being established. The reception of this energy at the station at the entrance end of the route being set up, provides for the clearing of the signal governing entrance to the block, and also provides for the steady energization of the traffic direction indicator lamp ARK to indicate to the operator at the station at the entrance end of the route that the traffic direction has been established, this lamp ARK having been flashed initially in response to entrance designation.

When a route has been thus established through the block, steady energy is maintained in the track section 4T feeding toward the entrance end of the route, and the reception of this steady energy at the entrance end is required to maintain the signal governing entrance to the route clear. When a train accepts the entering signal which has been cleared, the signal is immediately

restored to stop, and as the train progresses through the block for an eastbound train movement to the point of occupancy to the track section 5T as illustrated in Fig. 4C, energy is removed from the track section 4T, and it is again applied as a means for extinguishing the indicator lamp at the entrance end of the route when the train has progressed so as to leave the track section 5T unoccupied in the rear of the train as is illustrated in Fig. 4D. Thus, when the track section 5T becomes unoccupied in the rear of the train, a restoration pulse is applied to the track section 4T for a time interval determined by the thermal relay BTER at the exit end of the route under consideration. The picking up of the track relay 5TR, when track section 5T becomes unoccupied in the rear of the train, is effective to extinguish the block indicator lamps at both stations and cause the restoration to normal of the traffic direction relays so as to condition the system so that another route can be set up, for either direction of traffic, by the same mode of operation that has been in general considered in setting up traffic for the typical route under consideration.

To consider more specifically the mode of operation heretofore described, it will be assumed that at a time when the system is at rest, and the track layout is unoccupied, that an operator at the station at the right-hand end of passing siding A desires to set up a route for the passage of an eastbound train. He designates the entrance end of the route by the actuation of the push button APB, and the actuation of this button is effective to energize the right directional traffic relay ARF. This relay is energized by a circuit extending from (+) including contact 20 of push button APB in its depressed position, back contact 21 of relay AFX, back contact 22 of relay AF, back contact 23 of relay AFN, back contact 24 of the thermal relay ATER, back contact 25 of relay ALF, and winding of relay ARF, to (—). The picking up of traffic direction relay ARF completes its stick circuit from (+), and including front contact 88 of cancel button ACPB, back contact 89 of relay AFS, front contact 90 of relay ARF, back contact 25 of relay ALF, windings of relay ARF, to (—).

Relay ARF when picked up provides for the flashing energization of the eastbound direction indicator lamp ARK. The circuit for the energization of this lamp extends from (F+) including front contact 26 of relay ARF, back contact 27 of relay AFS and lamp ARK, to (—).

The picking up of the eastbound traffic direction relay ARF also causes the application of energy to the track rails of the track section 4T by the energization of the relay 4ACP. This relay is energized by a circuit extending from (+) including back contact 28 of relay AF, back contact 29 of relay AFS, front contact 30 of relay ARF, front contact 31 of relay 2TR, back contact 32 of relay ALF, back contact 33 of relay AFN, front contact 34 of relay 3TR, wire 35, back contact 36 of relay 4ATR, winding of relay 4ACP, and wire 37 to (—). The wires 35 and 37 can be considered as being line wires, if the track section 3T is of sufficient length as to require the location of the relays 4ACP and 4ATR at some distance from the station at the right-hand end of passing siding A.

The picking up of relay 4ACP is effective by the closure of its front contact 38 to apply energy across the track rails of the track section 4T so as to cause energy to feed through that track section to the exit end for the direction of traffic being established, which upon reception at the exit end is effective to energize the track relay 4BTR which is connected across the track rails at the right-hand end of the track section 4T as is shown in Fig. 1B.

Thus the relay 4BTR is picked up, and the closure of its front contact 39 causes the picking up of the relay BF at the station at the exit end of the route being established. Relay BF is energized under these conditions by a circuit extending from the positive terminal of battery 40, including front contact 39 of relay 4BTR, wire 41, front contact 42 of relay 5TR, back contact 43 of relay BFN, back contact 44 of relay BRF, front contact 45 of relay 6TR, back contact 46 of relay BLF, winding of relay BF, and wire 47, to the negative terminal of the battery 40. It will be noted from the circuit just described that the relay BF can be picked up only provided that there has been no designation for a route made at the station at the exit end of the route being established and only provided that the entire block, including the detector track sections 2T and 6T for the track switch 2W and 3W, is unoccupied by a train.

The picking up of relay BF is effective by the energization of the relay BFX to initiate the sounding of the bell BBX. Relay BFX is picked up by the energization of a circuit extending from (+), including front contact 48 of relay BF, back contact 49 of relay BFN, back contact 50 of relay BRF and winding of relay BFX to (—). This relay when picked up is maintained energized by a stick circuit extending from (+), including normally closed contact 51 of the push button BPB, normally closed contact 52 of the cancellation push button BCPB, front contact 53 of relay BFX and winding of relay BFX to (—). The sounding of the bell BBX is initiated by the closure of front contact 54 of relay BFX, and the flashing of the eastbound direction indicator lamp BRK is rendered effective by the application of flashing energy (F+) at front contact 55 of relay BFX.

Upon observing the flashing indicator lamp BRK, and in accordance with the ringing of the bell BBX, the attention of an operator at the station at the exit end of the route being established is called to the fact that acknowledgment is now required.

At the station at the entrance end of the route being established, the steady energization of the track section 4T is maintained only for a time sufficient for the energy to be repeated through the block and to cause the picking up of relays as has been described at the opposite end. The timing of the duration of the application of energy to the track section 4T is accomplished by the thermal relay ATER (see Fig. 1A) which becomes energized upon the picking up of the relay ARF. Energy for the heater coil of the thermal relay is provided through a circuit extending from (+), including front contact 56 of relay ARF, front contact 57 of relay 2TR, back contact 58 of relay AFN and winding of thermal relay ATER, to (—). The actuation of the thermal relay ATER after a time is effective to close a circuit for the relay AFN, such circuit extending from (+), including front contact 56 of relay ARF, front contact 57 of relay 2TR, front contact 59 of relay 2TR, contact 60 of the thermal relay ATER, back contact 61 of relay ALF and winding of relay AFN, to (—).

Relay AFN when picked up causes the termination of energy feeding the track section 4T by the opening of the circuit for relay 4ACP at back contact 33. The closure of front contact 33 of relay AFN conditions the circuit for the relay AF so that it can be energized in response to the transmission of acknowledgment energy through the track sections 4T from the exit end of the route being established. The dropping away of relay 4ACP removes energy from the track section 4T by the opening of front contact 38, and the shifting of this contact 38 connects the track relay 4ATR across the track rails at the left-hand end of the track section 4T so as to be conditioned for the reception of acknowledgment energy transmitted through the track rails from the exit end of the block. The removal of energy from the track rails of the track section 4T causes the dropping away of the relay 4BTR (see Fig. 1B), which, in turn, by the opening of front contact 39 provides for the deenergization of the relay BF.

Consideration will now be given to the acknowledgment by an operator at the station at the exit end of the route being established, and this is accomplished by actuation of the push button BPB. It will be noted that this push button BPB corresponds to the push button APB at the other station, but its actuation for acknowledgment is made at a time when the relay BFX is picked up, so that the traffic direction relay BRF is picked up at the station at the exit end of the route. This relay BRF is picked up upon acknowledgment by a circuit extending from (+), including contact 62 of push button BPB in its actuated position, front contact 63 of relay BFX, back contact 64 of relay BLF, winding of relay BRF, and resistor 65, to (—). This relay when picked up is maintained energized by a stick circuit including normally closed contact 66 of the cancelled push button BCPB and front contact 67 of relay BRF.

The cessation of the sounding of the bell BBX is rendered effective by the dropping away of the relay BFX to open its front contact 54 upon the actuation of the push

button BPB. That is, the opening of normally closed contact 51 of the push button BPB when it is actuated for acknowledgment, opens the stick circuit which has been described for the relay BFX so as to cause that relay to be dropped away. The pickup circuit for the relay BFX is open at this time at back contact 50 of relay BRF. Upon the opening of front contact 55 of relay BFX, flashing energy is removed from the lamp BRK, and such lamp becomes steadily energized through front contact 68 of relay BRF and through back contact 55 of relay BFX.

Upon the closure of front contact 44 of relay BRF, the relay 4BCP becomes energized to apply energy to the track rails of the track section 4T at the exit end of that track section for the route being established. The circuit for the energization of relay 4BCP under these conditions extends from (+), including back contact 48 of relay BF, back contact 69 of relay BFS, front contact 44 of relay BRF, back contact 43 of relay BFN, front contact 42 of relay 5TR, wire 41, back contact 39 of relay 4BTR, winding of relay 4BCP and, wire 47 to (−). The picking up of relay 4BCP connects the track battery 70 across the track rails at the right-hand end of the track section 4T through front contact 71.

The reception of energy through the track rails of the track section 4T at the entrance end of the route being established causes the picking up of the track relay 4ATR, and the picking up of this relay closes a circuit at front contact 36 to cause the picking up of the relay AF. The circuit by which the relay AF is energized under these conditions extends from the positive terminal of battery 72, through front contact 36 of relay 4ATR, wire 35, front contact 34 of relay 3TR, front contact 33 of relay AFN, winding of relay AF, and wire 37, to the negative terminal of battery 72.

In accordance with the picking up of relay AF, a pickup circuit is closed for the relay AFS extending from (+) including front contact 28 of relay AF, front contact 73 of relay AFN, front contact 74 of relay ARF, and winding of relay AFS, to (−). Relay AFS when picked up changes the energization of the direction indicator lamp ARK from flashing to steady by the shifting of contact 27. The picking up of relays AFS and AF respectively closes auxiliary stick circuits for the relay AFN so as to maintain this relay picked up subsequent to the entrance of the block by a train. Thus the relay AFN is energized by stick circuit energy through front contacts 75 and 76 of relays AF and AFS connected in multiple, back contact 77 of relay AFX, front contact 78 of relay AFN and front contact 58 of relay AFN.

With the traffic direction thus established, the signal governing entrance to the block can be cleared in accordance with the actuation of the associated signal control lever. Thus, if signals are provided as is shown in Fig. 2, the actuation of the signal control lever 2–4SGL to its right-hand position is effective to energize the mechanism of either signal 2 or signal 4 in accordance with the position of the track switch 2W. If it is assumed that the track switch 2W is in its normal position, the signal 4 can be energized at this time. The circuit for the energization of the winding of signal 4 extends from (+), including front contact 87 of relay 2TR, contact 79 of the signal control lever 2–4SGL, back contact 80 of relay ALF, front contact 81 of relay ARF, front contact 82 of relay AFN, front contact 83 of relay AF, front contact 84 of relay AFS, front contact 85 of relay 2NWP, and winding of signal 4, to (−).

In a case where it is desirable to clear signal 2 rather than signal 4 for the passage of an eastbound train through the block extending between the passing sidings A and B, this can be accomplished by the actuation of the track switch 2W to its reverse position, which is effective to cause the deenergization of the relay 2NWP and the energization of the relay 2RWP. Under these conditions, the energization of signal 2 becomes effective rather than the energization of signal 4 upon the actuation of the lever 2–4SGL to its right-hand position. The circuit by which the signal 2 can be energized under these conditions extends from (+), front contact 87 of relay 2TR, including contact 79 of lever 2–4SGL in its right-hand position, back contact 80 of relay ALF, front contact 81 of relay ARF, front contact 82 of relay AFN, front contact 83 of relay AF, front contact 84 of relay AFS, back contact 85 of relay 2NWP, front contact 86 of relay 2RWP, and winding of signal 2, to (−).

If it is assumed that a train accepts a clear signal 2 or 4, in accordance with whichever of the two signals has been cleared, that signal is restored to stop by the dropping away of the track relay 2TR which is provided for the detector track section associated with the track switch 2W. Thus, with reference to Fig. 2, the opening of front contact 87 of relay 2TR is effective to deenergize the signal that has been cleared. As the train progresses further so as to enter the track section 3T, the track relay 3TR, in dropping away, is effective to cause the dropping away of the relay AF by opening its circuit at front contact 34.

Relay ARF which has had its pickup circuit opened at back contact 24 by the actuation of the thermal relay ATER, and subsequently opened by the picking up of the relay AFN at back contact 23, has been maintained picked up, first by a stick circuit including normally closed contact 88 of the cancel button ACPB, back contact 89 of relay AFS, and front contact 90 of relay ARF. Prior to the opening of this stick circuit by the picking up of the relay AFS as has been described, the relay AF has been picked up, and thus the relay ARF has been last maintained energized through a stick circuit including front contact 91 of relay AF and front contact 90 of relay ARF. Therefore, when the relay AF is dropped away by the presence of the train in the track section 3TR, the relay ARF is in turn dropped away because of the opening of its stick circuit at front contact 91, its pickup circuit being maintained open at back contact 23 of relay AFN.

When the train progresses further through the block so as to occupy the track section 5T as is illustrated in Fig. 4C, the dropping away of the relay 5TR causes the deenergization of the relay 4BCP by the opening of its circuit at front contact 42. Thus the relay 4BCP is dropped away and opens the circuit feeding the track rails of the track section 4T at front contact 71. The track relay 4ATR at the opposite end of the track section 4T is already dropped away, however, because of the shunting of the track rails by the train, and the removal of energy from the track rails of the track section 4T by the presence of the train in track section 5T merely is effective in preventing the reenergization of the track relay 4ATR until the train has progressed out of the track section 5T.

As the train progresses so as to leave the track section 5T as is illustrated in Fig. 4D, the sequence of relay operations is initiated as is shown by the sequence chart of Fig. 5D wherein energy is fed through track rails of the block to the entrance end for a predetermined time sufficient to cause the extinguishing of the block indicator lamp ARK at the entrance end of the block.

To consider specifically the mode of operation involved under these conditions, the picking up of the relay 5TR closes a circuit that has been described for the energization of the relay 4BCP. Relay 4BCP when picked up, closes front contact 71 and thus applies energy to the track rails of the track section 4T. The reception of this energy at the opposite end of the track section 4T causes the picking up of relay 4ATR (see Fig. 1A), which in turn provides for the energization of the relay AF through a circuit which has been described. Relay AF in picking up causes the dropping away of the relay AFS, which has been held by a stick circuit extending from (+), including back contact 28 of relay AF, front contact 29 of relay AFS, and normally closed contact 92 of cancel button ACPB. Connected in multiple with the contact 92 of the cancel button ACPB is a back contact 93 of the approach locking relay 4AS for the purpose of preventing restoration of the relay AFS by manual cancellation at a time when the approach locking is effective in a manner to be hereinafter considered.

The energy applied to the track section 4T is timed by the thermal relay BTER (see Fig. 1B) which has its winding energized upon the picking up of the track relay 5TR through a circuit dependent upon the presence of the train in the detector track section 6T. This circuit extends from (+), including front contact 94 of relay BRF, front contact 95 of relay 5TR, back contact 96 of relay 6TR, back contact 97 of relay BFN and winding of relay BTER, to (−). Upon actuation of the thermal relay BTER, its front contact 98 becomes closed after a time, and the closure of that contact causes the dropping away of the relay BRF by applying a shunt across the winding of that relay extending from (+),

including front contact 98 of relay BTER, front contact 99 of relay BRF, back contact 100 of relay 6TR, front contact 101 of relay 5TR, and limiting resistor 65, to (—). Thus the relay BRF is dropped away and the dropping away of that relay is effective by the opening of front contact 99 to open the shunt circuit that has just been described as being applied.

The dropping away of relay BRF extinguishes the traffic direction lamp BRK at the associated station by the opening of its circuit at front contact 68. The dropping away of the relay BRF is also effective to cause the dropping away of the relay 4BCP, and thus cause the opening of front contact 71 to remove energy from the track section 4T. The circuit for the relay 4BCP is opened at front contact 44.

In accordance with the removal of energy from the track rails of the track section 4T, the relay 4ATR (see Fig. 1A) is dropped away at the entrance end of the route for the traffic direction that has last been established, and the dropping away of this relay causes the dropping away of the relay AF by the opening of its circuit at front contact 36. Relay AF when dropped away, in turn, provides for the dropping away of the relay AFN by the opening of its stick circuit at front contact 75, the front contact 76 of relay AFS having already been opened. Thus the restoration of the directional control apparatus to its normal conditions has been automatically effected upon a train leaving the block. The opening of front contact 104 of relay AFN extinguishes the traffic direction lamp ARK.

Provision is made by the cancel buttons CPB at the respective stations for manual cancellation in case it is desirable to change the direction of traffic that has been established. Thus, it is provided that by actuation of the cancellation buttons at the respective stations, the traffic direction control relays can be restored to their normally deenergized positions, provided there is no train present in the block, and provided that the approach locking for the signal involved is released.

Assuming traffic direction to have been set up for an eastbound train as has been described, and assuming the track layout to be unoccupied by a train, cancellation can be rendered effective, subsequent to the restoration of the signal control lever to stop, by the actuation of the cancel buttons ACPB and BCPB at the stations at the respective entrance and exit ends of the block.

At the exit end of the block, the actuation of the cancel button BCPB is effective to cause the dropping away of the relay BRF by the opening of normally closed contact 66 of the cancellation button. Relay BRF is dropped away because its pickup circuit is open at front contact 63 of relay BFX at this time, and because there can be no energy fed through the stick circuit including back contact 105 of relay BFS and front contact 106 of relay BF on account of the relay BF being deenergized at this time.

The dropping away of relay BRF extinguishes the traffic direction indicator lamp BRK by the opening of its circuit at front contact 68, and the dropping away of this relay also deenergizes the relay 4BCP by the opening of its circuit at front contact 44. Relay 4BCP in dropping away removes energy from the track rails of the track section 4T by the opening of front contact 71, and thus completes the restoration to normal of the apparatus at the exit end of the block.

In accordance with the removal of energy from the track rails of the track section 4T, at the entrance end of the block, for the traffic direction that has been established, the relay 4ATR (see Fig. 1A) is dropped away, and the dropping away of this relay, by the opening of front contact 36, deenergizes the relay AF at the station at the right-hand end of passing siding A.

Upon the dropping away of the relay AF, the circuit for the control of the entering signal 4 (see Fig. 2) is opened at front contact 83 so as to cause the restoration of that signal to stop. Upon the restoration of signal 4 to stop, the approach locking relay 4AS (see Fig. 1A) is picked up according to the usual practice in the control of approach locking relays, and the picking up of this relay is effective by the opening of its back contact 93 to remove a shunt that is applied across the cancel button contact 92 of button ACPB so as to condition the relay AFS so that it can be deenergized upon the actuation of this cancel button.

As an operator actuates the cancel button 9CPB at this time, the opening of normally closed contact 92 of that button causes the release of the relay AFS because its pickup circuit is open at front contact 28 of relay AF. The dropping away of relay AFS causes the dropping away of the relay AFN by the opening of the stick circuit for that relay at front contact 76, front contact 75 of relay AF having been already opened. The winding of the thermal relay ATER has been deenergized by reason of the relay AFN having been picked up so as to open back contact 58, and therefore, there is no pickup circuit closed for the relay AFN at this time.

Also, in accordance with the actuation of the cancel button ACPB, energy is removed from the traffic direction relay ARF by reason of the opening of normally closed contact 88 of this cancel button. Energy has already been removed at front contact 91 of relay AF due to the dropping away of that relay, and there is no energy applied to the pickup circuit for relay ARF at this time because of the circuit being normally open at contact 20 of the push button APB. Because of the relay AFN being the last relay to be dropped away upon restoration according to the mode of operation that has been described, this relay is effective to hold energy on the traffic direction lamp ARK by the closure of its front contact 104 until completion of the restoration of all relays at the associated station has been made.

After having considered manual restoration of the traffic directional control apparatus for a particular route as has been described, it will be readily apparent that restoration must be initiated at the exit end of the route, because it is required that the relay AF or BF at the entrance end of the route be dropped away for restoration of the signal to stop in order to restore the approach locking so as to permit manual cancellation at the entrance end of the route. In other words, the relay AF must be dropped away in order to put the signal 4 to stop so that the relay 4AS can be restored to its normally energized position as has been described so as to open back contact 93 and permit the dropping away of the relays AFS and AFN as has been described. If the cancel button at the entrance end of the route should be actuated first, rather than the cancel button at the exit end of the route, there will be no restoration, because the relay AF or BF at the associated station will be picked up so as to provide stick energy directly for the traffic direction relay at that station. For example, the application of energy by front contact 91 of relay AF through front contact 90 of relay ARF to the winding of relay ARF prevents the dropping away of relay ARF in case the cancelled button ACPB should be actuated prior to cancellation having been made at the exit end of the route.

It is to be understood that the system of traffic control as illustrated in Figs. 1A and 1B can be used in connection with different arrangements of signalling, and thus the signal arrangement provided according to the track layout illustrated in Fig. 3 can as well be used. This signalling arrangement is slightly different in that it provides for the setting up of distinctive switching signals at the respective ends of the block, which are provided particularly for the purpose of local switching moves at that station and do not require the setting up of traffic through the block. However, an interlock is provided so as to check that there is no switching signal designated by an associated signal control lever at either end of the block before traffic can be set up so as to clear a signal governing entrance to the block. This is acomplished by the inclusion of contact 107, for example, of the switching signal control lever 2SGL in series with front contact 31 of relay 2T in the circuit for the enrgization of the relays AF and ACP, the remainder of the circuits for these relays being the same as has been described specifically with reference to the circuit organization illustrated in Fig. 1A. The circuit for the control of the relay BF is similarly modified according to Fig. 3 by the inclusion of contact 108 of the switching signal lever 6SGL in its normal position in series with the front contact 45 of relay 6TR.

Inasmuch as the switching signals do not require the setting up of traffic control, but do require a check that no route is set up through the block, the clearing of a switching signal is accomplished through back contacts of the traffic direction relays in a manner to insure that there is no traffic set up through the block. Thus, the control of a switching signal is arranged according to Fig. 3 to include contact 109 of signal lever 2SGL in its right-hand position, back contact 110 of relay ARF, back contact 111 of relay ALF and back contact 112 of relay AFS.

The signal control from the back contact 112 of relay AFS is indicated by the dotted line 113 as extending to the signals 2A, 2B, 2C, and 2D, and it is to be understood that additional circuit control contacts as required are included in this dotted portion of the circuit. Such additional contacts can include switch selection contacts of the track switches 2W and 4W so as to select signal 2B, 2C, or 2D to be cleared in accordance with whichever one of the tracks is positioned for the train movement. The signal 2A is energized for all switching movements, and thus it displays an aspect beyond the passing sidings A and C distinctively indicative of a switching operation so as to definitely inform a trainman that he must not proceed through the block.

The mode of operation for the clearing of the signal 4, or the signal 5, governing entrance to the block, is assumed to be accomplished for the signalling arrangement shown in Fig. 3 by a mode of operation comparable to that which has been heretofore specifically described. Thus, when the traffic direction relays are properly conditioned for a route through the block governed by the signal 4, for example, this signal is energized in accordance with the actuation of the signal control lever 4SGL to its right-hand position by a circuit including contact 114 of signal control lever 4SGL in its right-hand position, front contact 112 of relay AFS, back contact 111 of relay ALF, front contact 110 of relay ARF, front contact 115 of relay AFN, front contact 116 of relay AF, and additional signal controls as required according to practice included in the dotted connection 117 extending from the front contact 116 of relay AF to the signal 4.

Having thus described specifically a typical circuit organization and the mode of operation involved in setting up a route for a particular direction of traffic, it is to be understood that this description is typical of the mode of operation for the establishment of a route for the opposite direction of traffic, as the apparatus provided for both traffic directions is similar and has a similar mode of operation.

It is also to be understood that various modifications, adaptations, and alterations may be made to the specific form of the invention shown and described in accordance with the requirements of practice without departing from the spirit or scope of the present invention except as limited by the appending claims.

What we claim is:

1. A manual block signalling system for a stretch of single track constituting a block having an entering signal at each end and connecting passing sidings at respective stations comprising in combination, a self restoring manually operable contacting means at each station, traffic direction relays at each station for both directions of traffic, a track relay and a source of energy associated with the track rails of the block at each station, circuit means at each station responsive to the actuation of said manually operable contacting means for selectively energizing one or the other of said traffic direction relays at the associated station, dependent upon whether or not said track relay at the associated end of the block has been temporarily energized in accordance with the actuation of said manually operable contacting means at the other station, said circuit means being effective until cancelled, track circuit control means for disconnecting said track relay from the track rails and connecting said source of energy in response to the energization of either of said traffic direction relays at the associated station, a timer at each station set into operation upon the energization of that traffic relay at the corresponding station governing traffic to the other station and effective to allow said source of energy to be connected to the track rails by said track circuit control means for only a predetermined interval at such station, and signal control means for each of said entering signals permitting that signal to be cleared only subsequent to the energization of that one of said traffic direction relays governing traffic to the other station and said track relay at the associated end of the block.

2. A manual block signalling system for a stretch of single track constituting a block having an entering signal at each end and connecting passing sidings at respective stations at the block ends comprising in combination, self restoring manually operable contacting means at each station, traffic direction relays for both directions of traffic at each station, a track relay and a source of energy associated with the track rails of the block at each end, each of said track relays being normally connected to the track rails, circuit means at each station responsive to the actuation of said contacting means for selectively energizing one or the other of said traffic direction relays at the associated station, dependent upon whether or not said track relay at the associated end of the block has been temporarily energized, track circuit control means at each station for disconnecting said track relay from the track rails and connecting said source of energy in response to the energization of either of said traffic direction relays at the associated end of the block, and a timer at each station controlled by said traffic direction relay at such station governing traffic to the other station for acting on said track circuit control means to permit said source of energy to be connected to the track rails for only a predetermined interval at the station first to have its manually operable contacting means actuated.

3. In a manual block signalling system for governing entering signals at respective stations at the ends of a single track block connecting two passing sidings, manually operable means at each station for designation of respective entrance and exit ends of a route extending through the block from station to station for either direction of traffic, a source of energy and a track relay at each station, the track relay being normally connected across the track rails but being disconnected upon the connection of said source of energy to the track rails at the associated end, circuit means including a timing device at each station effective in response to the actuation of said manually operable means for designation of an entrance point for connecting said source of energy to the track rails for only a predetermined length of time so as to actuate said relay at the other station, circuit means at each station effective upon the actuation of said manually operable means for designation of an exit point, subsequent to said track relay at the associated station having been actuated by energy feeding through the block, for connecting said source of energy to the track rails to feed through the block toward the entrance end of the route being established, an indicator at each station distinctively actuated in response to the respective entrance and exit designations, and means including said timing device effective upon the block becoming unoccupied in the rear of a train for connecting said source of energy to the track rails at the exit end of the block for the direction of traffic that has been last established for only a predetermined time interval, and circuit means including energy feeding through the track rails during said time interval after passage of a train for restoring said indicator at the entrance end of the block for the direction of traffic that has last been established.

4. In a manual block signalling system for a stretch of single track constituting a block extending between two stations and connecting passing sidings at the respective stations, manually operable self-restoring contact means at the respective stations, traffic direction indicators at both stations for indicating the respective directions of traffic established, a source of energy and a track relay selectively connected to the track rails of the block at both stations, said track relay at each station being normally connected to the track rails and said source of energy at each station being normally disconnected from the track rails, circuit means including a timer responsive to the initial actuation of said manually operable means at a given station for connecting said source of energy to the track rails for only a predetermined time interval sufficient to cause the actuation of an indicator at the other station, and circuit means at the other station effective in response to the actuation of said manually operable means subsequent to the actuation of said indicator at the associated station for steadily connecting said source of energy to the track rails to distinctively actuate an indicator at the station at which said manually operable means has first been actuated.

5. In a manual block signalling system for a stretch of single track between two block stations, a signal at each end of the block for governing the entrance of traffic into such block, manually operable means at each block station for governing circuit elements at that station to establish entrance and exit controls respectively, a source of energy and a track relay at each end of the block, each track relay being normally connected across the rails at its end of the block, circuit means at each block station effective in response to a manual operation of a circuit element to designate an entrance control for disconnecting said track relay at that end and connecting said source of energy across the track rails at that end for a short interval of

time, circuit means at each station effective in response to the manual actuation of a circuit element to designate an exit control for disconnecting said track relay at that end and steadily connecting said source of energy across the track rails at that end, and circuit control means for each entering signal effective to clear the associated signal only when an entrance control is established by the associated circuit elements and said track relay for the corresponding end is steadily energized through the track rails of the block from the opposite end.

6. A manual block signalling system for a stretch of single track constituting a block extending between two stations and connecting successive passing sidings at the respective stations comprising in combination, an entering signal for said block at each station, manually operable means at each station for designating the entrance and exit ends of a route, a source of energy and a track relay at each end of the block, said track relay at each end being normally connected across the track end, circuit means effective at either station in response to the actuation of said manually operable means for designation of an entrance route end for temporarily disconnecting said track relay and temporarily connecting said source of energy to the track rails for only a relatively short time interval, circuit means effective at either station in response to the actuation of said manually operable means for designation of an exit route end following the temporary actuation of said track relay for the corresponding end over the track rails of the block from the entrance end for disconnecting said track relay and steadily connecting said associated source of energy to the track rails, signal control means for each of said entering signals permitting the clearing of the associated signal subsequent to the entrance designation by the actuation of said manually operable means at the associated station and only so long as said associated track relay is actuated by energy fed through the track rails of the block from the exit end for the direction of traffic being established.

7. In a manual block signalling system for a stretch of single track between two block stations, a signal at each end of the block for governing the entrance of traffic into such block, manually operable means at each station for governing circuit elements at that station to establish entrance and exit controls respectively, a source of energy and a track relay at each end of the block, each track relay being normally connected across the rails at its end of the block but being capable of being disconnected and having said source of energy connected across the rails in response to an entrance or exit control at its station, entrance control circuit means at each station effective in response to a manual operation of a circuit element to designate an entrance control for disconnecting said track relay at that end and connecting said source of energy across the track rails for a short interval of time, exit control circuit means at each station effective in response to the manual designation of an exit control following the energization of the associated track relay for a short interval of time for disconnecting said track relay at that end and steadily connecting said source of energy across the track rails at such end, signal circuit control means for each entering signal permitting it to be cleared only when an entrance control has been designated at the associated station and the associated track relay is steadily energized by energy received through the track rails from the opposite end of the block, and circuit means at each station rendered active by the passage of a train out of said block at that station for automatically acting on said exit control circuit means to restore it to a normal condition.

References Cited in the file of this patent

UNITED STATES PATENTS

2,315,677	Wallace	Apr. 6, 1943
2,611,074	Pascoe et al.	Sept. 16, 1952