R. P. TUTTLE.

RAILWAY SIGNALING SYSTEM.

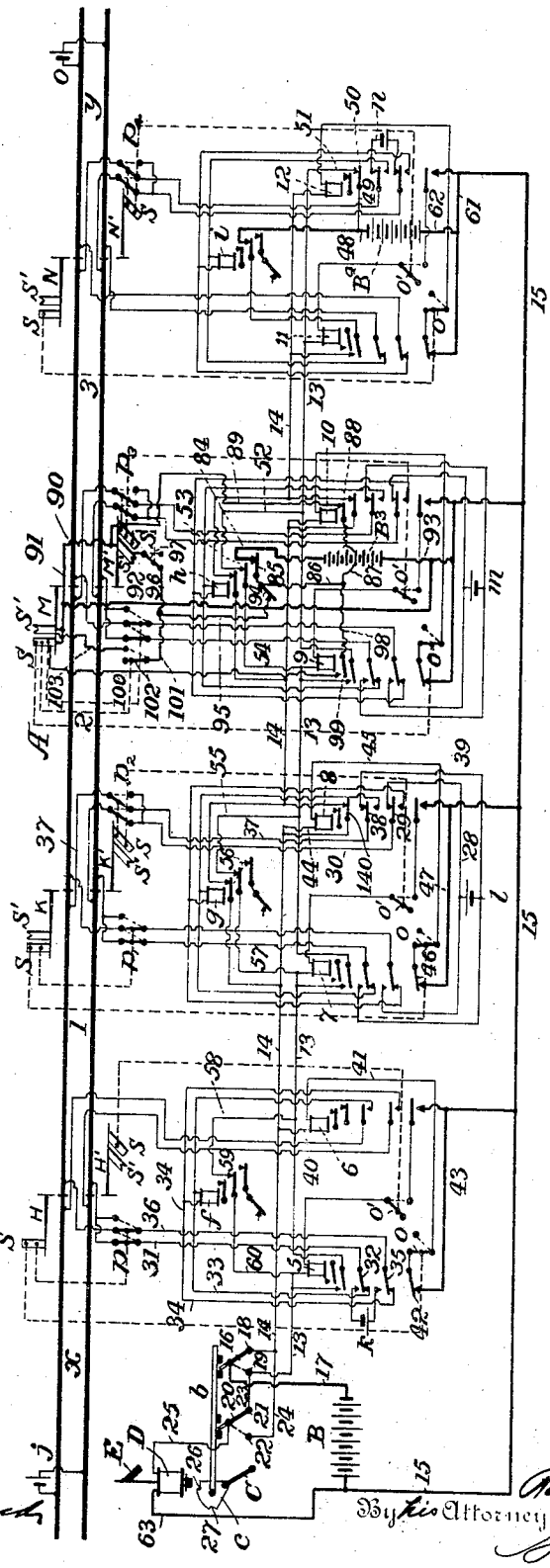
APPLICATION FILED JULY 29, 1909.

980,709.

Patented Jan. 3, 1911.

3 SHEETS—SHEET 1.

Fig. 1



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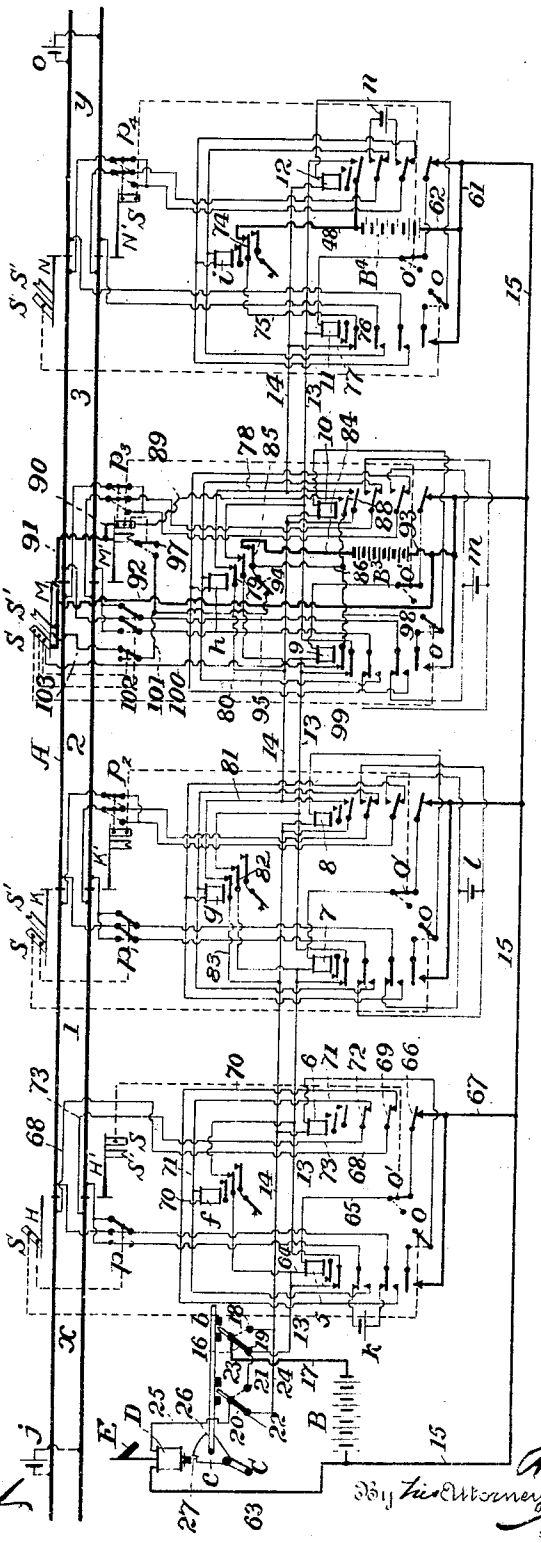
3 SHEETS—SHEET 2.

Fig. 2



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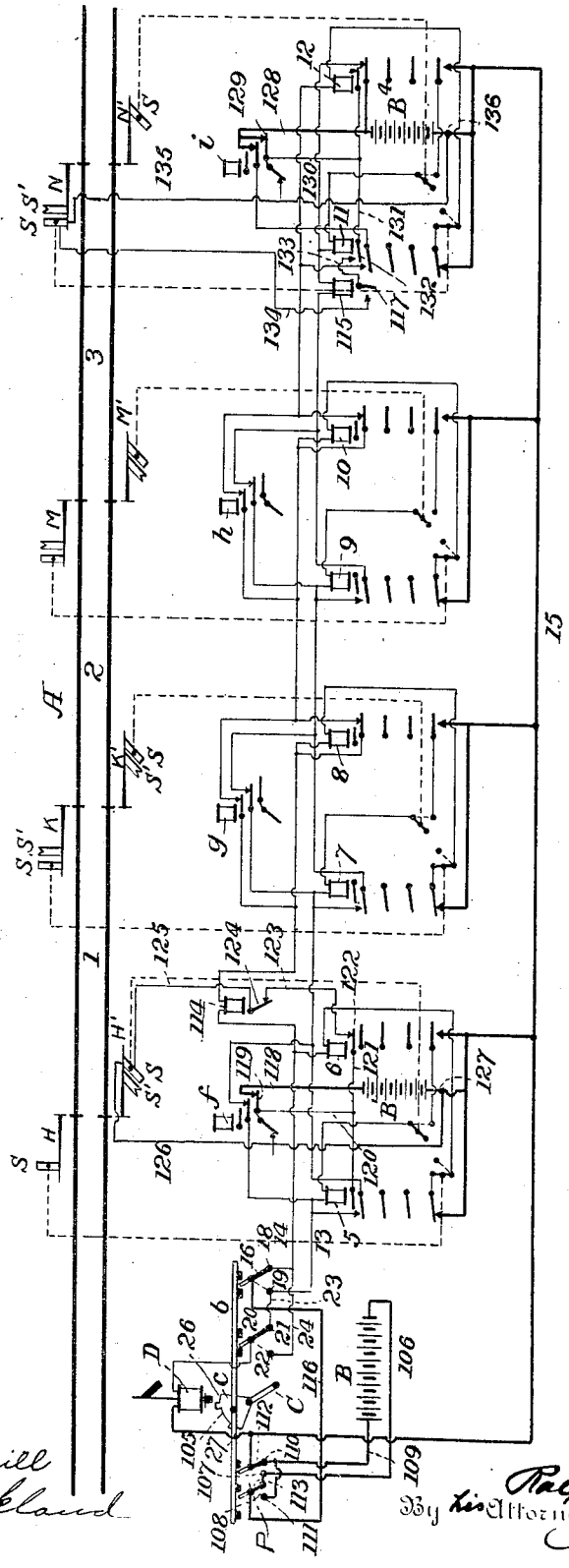
3 SHEETS—SHEET 3.

Fig. 3



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UNITED STATES PATENT OFFICE.

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RAILWAY SIGNALING SYSTEM.

980,709. Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed July 29, 1909. Serial No. 510,274.

To all whom it may concern:

Be it known that I, RALPH P. TUTTLE, a citizen of the United States, residing at New York city, in the county and State of New York, have invented certain new and useful Improvements in Railway Signaling Systems, of which the following is a specification.

My invention relates to signaling systems adapted for use on single track railways.

In the application of my invention the railway will be divided into sections of any desired length and each section may be divided into any desired number of blocks each of which will be protected by signals designed to govern the movement of traffic in either direction. At one end of each section means are provided by which an operator may govern all signals in the section and thereby establish the direction of traffic desired.

I will describe a signaling system embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatical view of a section of a single track railway, divided into a series of blocks, equipped with signals to control traffic in either direction and embodying my invention. In this view the signals are set to permit traffic from left to right. Fig. 2 is a view similar to Fig. 1 in which the parts are set to permit traffic from right to left. Fig. 3 is a view, with the track circuits omitted but otherwise similar to Figs. 1 and 2, showing a modified form of direction controller.

Similar reference characters designate corresponding parts in all of the figures.

A designates a section of a single track railway, divided into blocks 1, 2 and 3. Each block is provided at its entrance end with a signal having a home arm S and a distant arm S′, these being shown as mounted on the same post, but they may, if preferred, be mounted on separate posts. At the exit end of block 3 when traffic is moving from left to right there is provided a signal N′ having a home arm only. The same is true of the exit end H of block 1 when traffic is moving from right to left. There is thus provided a pair of opposing signals at the junction of adjacent blocks.

B designates a battery from which current is supplied to a series of relays, which for the sake of distinction will be termed traffic relays, 5, 6, 7, 8, 9, 10, 11 and 12. To supply the current to these relays two main wires 13 and 14 are employed and a return wire 15 is common to all of the traffic relays. The traffic relays 5, 7, 9 and 11 receive their current from wire 13, and those numbered 6, 8, 10 and 12 from wire 14, and those latter relays are connected to the battery B in Fig. 1, while the former are connected to said battery in Fig. 2. Traffic relays 6, 8, 10 and 12 control the traffic from left to right and the other relays from right to left. In order to determine which set of traffic relays shall be operative, I provide a direction controller at one end of the section, which comprises a movable switch 16 connected by a wire 17 to the battery B. This switch is adapted to engage either of two contacts 18 or 19, to which the wires 14 and 13 are respectively connected. The switch is preferably operated by means of a pivoted lever C, and a bar *b* connected to the lever and engaging the switch 16 in any desired manner to positively move the latter in either direction. When either of the wires 13 or 14 is not in use to supply current to its traffic relays, it is utilized as part of a locking or indicating circuit, for governing the direction controller. In this connection, I employ another switch 20 also operated by the lever C and bar *b*, to engage either of two contacts 21—22. The contact 22 is connected to wire 14 by a wire 24, and the contact 21 is connected to the wire 13 by a wire 23. A wire 25 leads from switch 20 through a solenoid D to wires 63 and 15 and a battery B^4. With the circuits as shown in either Fig. 1 or Fig. 2, the solenoid will be energized and its core be drawn inwardly to clear a locking plate *c* connected to the lever C and provided with two recesses 26 and 27, and while in this position the operator can operate the lever C to set the signals to change the direction of traffic. Should, however, the solenoid become deënergized, its core will drop into one of the recesses 26 or 27 and so lock the lever C against movement. This would occur when a train is in any part of the section, as will be hereinafter explained. In addition to the lock, I may provide an indicator or signal E adapted to be moved into two positions by the solenoid and so indicate to the operator whether or not he should operate the lever

C to change the direction of traffic. As shown, the indicator E is in the form of a semaphore in position to indicate safety and it will move to indicate danger when the core of the solenoid drops. Any other indicating device may, however, be employed, and any other form of electric motor may be employed to control the locking and indicating.

There are four track relays indicated by *f*, *g*, *h* and *i*, and six track circuit batteries indicated by *j*, *k*, *l*, *m*, *n* and *o*. The same track battery does not always supply current to the same relay. When the parts are in position shown in Fig. 1 the batteries *l*, *m*, *n* and *o* supply current to the track relays *f*, *g*, *h* and *i* respectively. The circuit from battery *l* to relay *f* may be traced as follows: from battery *l* to wire 28, armature 29 of traffic relay 8, wire 30, lower rail of section 1, wire 31, armature 32 of traffic relay 5, wire 33, through relay *f* to wire 34, armature 35 of traffic relay 5, wire 36, upper rail of section 1, wire 37, armature 38 of traffic relay 8, wire 39 to battery *l*. As the wiring is the same in each case, it is not necessary to trace out the other circuits. The traffic relays 6, 8, 10 and 12 are connected in multiple to the wire 14 and return wire 15, as follows: wire 14, wire 40, through traffic relay 6, wire 41, switch O, armature 42 of traffic relay 5 wire 43 to common return wire 15; wire 14, wire, 44 through traffic relay 8, wire 45, switch O, armature 46 of traffic relay 7, wire 47 to common return wire 15. To reach traffic relay 10, however, the course of the current is from battery B through switch 16, wire 14, armature 82 of track relay *g* or armature 140 of traffic relay 8, wire 14, relay 10, switch O, armature of traffic relay 9, common return wire 15 to battery B. It will thus be observed that the wire 14 is broken at relay 8, but is closed around this break in two ways—first through armature 82 of track relay *g*, and second through armature 140 of traffic relay 8. The reason for breaking wire 14 and closing it through armature 82 of track relay *g* is that, when this wire is used for locking purposes, it must include the armature of the track relay, as will be explained hereinafter in connection with the detailed description of the locking circuits. The purpose of the additional path through armature 140 of traffic relay 8 is to maintain a closed circuit to traffic relays 10 and 12 from battery B when track relay *g* is subsequently opened due to the presence of a train in its block. Wire 14 is similarly broken again at relay 10 and is closed around this break through armatures of track relay *h* and traffic relay 10. The reasons for not breaking wire 14 at relays 6 and 12 and introducing similar paths through the track and traffic relays at these points will be hereinafter explained in connection with the locking circuits.

It will be observed that there is a switch O in each of the circuits of the traffic relays 6, 8, 10 and 12, which switches are operated by the movement of the home arms of the signals which govern traffic from right to left, in such manner that said switches will be closed only when said home signals indicate danger. Similarly there is a switch O′ in each of the circuits of the traffic relays 5, 7, 9 and 11, which are controlled by the movement of the home arms of the signals which govern the traffic from left to right and are closed only when said home signals are in position to indicate danger. The mechanical connections between the home arms of the signals and the switches O and O′ are indicated on the drawings by dash lines, these connections being similar to the mechanical connections shown in Letters Patent No. 894,471 granted to Jacob B. Struble on July 28, 1908.

As before stated, each of the wires 13 and 14 when not in use to control traffic forms part of a locking or indicating circuit. Thus in Fig. 1 the locking circuit can be traced as follows: from battery B^4 wires 48, 49, armature 50 of traffic relay 12, wire 51, wire 13, wire 52, armature 53 of track relay *h*, wire 54, wire 13, wire 55, armature 56 of track relay *g*, wire 57, wire 13, wire 58, armature 59 of track relay *f*, wire 60, wire 13, to contact 19, wire 23 to contact 21, switch 20, wire 25, through motor D, wire 63, wire 15, wires 61 and 62 to battery B^4. As the parts are shown in Fig. 1, the section A is supposed to be entirely free of cars and consequently the locking circuit is closed, the motor D energized and its core clear of the locking plate *c*. Should, however, a train or car be on either of the blocks 1, 2 or 3, the track relay *f*, *g* or *h*, respectively, will be deënergized and the locking circuit broken at such point whereupon the core of the solenoid will engage the locking plate *c* and so prevent any operation of the lever C. The locking circuit just described does not include an armature of track relay *i* for the reason that when wire 13 is in use for locking or indication purposes, this track relay is connected with block *y*, and in the particular arrangement of circuits which I have shown herein, the locking circuit is not controlled by cars or trains beyond the limits of signals H and N′.

Referring now to Fig. 2, the parts are arranged to permit traffic from right to left, and it will be seen that the lever C has been operated to connect the wire 13, with battery B, which results in energizing traffic relays 5, 7, 9 and 11. In this case the track relays *f*, *g*, *h* and *i*, are energized by the batteries *j*, *k*, *l* and *m*, respectively. The wire 14 forms part of the locking circuit, and

traffic relays 6, 8, 10 and 12 are deënergized. Also the switches O have been opened by the movement of the home arms S of the signals which control traffic from right to left, to safety position, and the switches O′ have been closed by the movement of the opposing home arms to danger.

The circuit for traffic relay 5 is as follows: from battery B, to wire 17, switch 16, contact 19, wire 13, wire 64, through traffic relay 5, wire 65, switch O′, armature 66 of traffic relay 6, wire 67 to return wire 15. It will be observed that wire 13 is broken at traffic relays 5, 7 and 9, and that it is closed around these breaks in manners similar to those described in connection with wire 14 of Fig. 1.

It is unnecessary to specifically trace the circuits of traffic relays 7, 9 and 11, as they are similar to that of relay 5, and each includes a switch O′ and an armature of the next succeeding relay, as 8, 10 or 12. Neither is it necessary to trace specifically the circuits of all the track relays, *f*, *g*, *h* and *i*, when the signals are set for traffic from right to left, but I will trace that of track relay *f* as follows: from battery *j* to upper rail of block section *a* to wire 68, armature 69 of traffic relay 6, wire 70, through track relay *f* to wire 71, armature 72 of traffic relay 6, wire 73 to lower rail of block section X to battery *j*.

The locking circuit in Fig. 2 may be traced as follows: from battery B^4 to wire 48, armature 74 of track relay *i*, wire 75, armature 76 of traffic relay 11, wire 77, wire 14, wire 78, armature 79 of track relay *h*, wire 80, wire 14, wire 81, armature 82 of track relay *g*, wire 83 wire 14, wire 24, switch 20, wire 25 through motor D, wires 63, 15, 61 and 62 to battery B^4. This locking circuit does not include an armature of track relay *f* for the reason hereinbefore stated in connection with the locking circuit for Fig. 1; viz. that relay *f* is at this time connected with block X, and the locking circuits as I have herein shown them are not controlled by the presence of cars or trains beyond the limits of signals H and N′.

To avoid unnecessary complication in the drawings, I have omitted the signal circuits, except those for the signals at the junction of blocks 2 and 3, but it is to be understood that each signal is operated by a circuit similar to those illustrated. The circuits may be traced as follows: Referring to Fig. 1, the circuit for the home arm S of signal M′ at the entrance to block 3 is from battery B^3, to wire 84, armature 85 of track relay *h*, wires 86, 87, armature 88 of traffic relay 10, wire 89 through home signal S, wires 90, 91, 92 and 93 to battery. For the distant signal S′ at the entrance to the same block, the circuit may be traced as follows: from battery B^3 to wire 84, armatures 85 and 94 of track relay *h*, wires 95 and 96, switch 97 through distant signal S′ to wires 90, 91, 92 and 93 to battery B^3.

Referring now to Fig. 2 the circuit for the home arm S of the signal M at the entrance to block 2 may be traced as follows: from battery B^3, to wire 84, armature 85 of track relay *h*, wire 86, wire 98, armature 99 of traffic relay 9, wire 100, to home signal S to wires 91, 92 and 93 to battery. The circuit for the distant signal S′ at the entrance to the same block is as follows: from battery B^3, to wire 84, armatures 85 and 94 of track relay *h*, wire 95, wire 101, switch 102, wire 103, through distant signal S′ to wires 91, 92 and 93 to battery B^3. The switches 97 and 102 in the circuits of the distant signals of M and M′ are operated by the movement of the corresponding home signals respectively. Thus switch 102 is operated by the home arm of signal M which protects block 2, and switch 97 is operated by the home arm of signal M′ which protects block 3.

Pole-changing switches, designated as *p*, p^1, p^2, etc. are included in the circuit of track batteries *k*, *l*, *m*, and *n*, and are operated respectively by the home arms of signals H, K, K′, etc. These pole-changing switches control the distant signals S′ in the well known manner by governing the direction of current through the polarized track relays *f*, *g*, *h* and *i*. Although there are two pole-changers included in each track circuit, one at the battery end of the block and one at the track relay end of the same block, only one of these, viz. the one at the battery end, is active. The other one, located at the relay end, being operated by the home signal governing traffic in the opposite direction, remains inactive owing to the fact that its operating signal is inactive. Thus, in block 1 of Fig. 1, the pole-changer p^2, being operated by the home blade S of signal K′, moves to reverse the polarity of the current in the rails of block 1 when a train enters block 2. Pole-changer *p*, however, remains inactive owing to its being operated by the blade S of signal H, which is inactive with the apparatus set for traffic in the direction shown.

Referring now to Fig. 3, there is shown a modified locking or indicating mechanism, which in addition to performing the functions of the locking and indicating mechanism of Figs. 1 and 2, will also indicate that the traffic and track relays are working properly before the home arm of the signal at the entrance end of the section, depending upon the direction of traffic, sought to be established, can be moved to safety position. As shown in this figure, the parts are set for traffic from left to right. The locking plate *c* is provided with another recess 105 between the recesses 26 and 27. From one end of the battery B a wire 106 leads to two

contacts 107 and 108, and from the other end of said battery a wire 109 leads to two contacts 110 and 111. Two switches 112 and 113 are provided, the first to engage either of the contacts 110 or 107, and the second to engage either of the contacts 108 or 111. These switches 112 and 113, with their corresponding contacts, comprise a pole-changer P, the function of which is to control the polarity of battery B through the traffic relay circuits. There is a polarized relay 114 inserted in the line wire 14 adjacent the signal H′ at the entrance of block 1. There is also a polarized relay 115 inserted in the line wire 13 adjacent the signal N at the entrance of block 3. The switch 113 is connected by a wire 116 to the switch 16, which wire takes the place of wire 17 in Figs. 1 and 2. The switches 112 and 113 are operated by the bar *b* but only after the bar has moved sufficiently to move the switch 16 from contact 18 to contact 19, or vice versa. The operation of this part of the invention is as follows: Assuming it is desired to reverse the direction of traffic as set up in Fig. 3, the operator will move the lever C and thereby operate switches 16 and 20. As soon as these switches disengage contacts 18 and 21 respectively, the traffic relay circuit will be broken, and also the locking or indicating circuit, and they will remain broken until the switches 16 and 20 engage contacts 19 and 22 respectively. During the movement of the switches from one contact to the other, the core of the solenoid D will have dropped into the recess 105 in the locking plate *c*. The parts are to be so proportioned and arranged that the core will engage the end of the recess when the switches engage the contacts 19 and 22. If now all the traffic relays and the track relays are operating properly the locking circuit will be closed and the solenoid D will be energized thereby withdrawing its core from recess 105 to permit the operator to complete the stroke of the direction controller. If the solenoid D does not so operate, the operator will know that the circuit is somewhere out of order. In this case the polarized relay 115, although receiving current from the wire 13, will not respond thereto because the polarity of the current from battery B, as controlled by the pole-changer P is wrong. The polarized armature 117 of the relay 115 is included in the circuit of the home arm S of signal N, which is at the entrance of block 3; and consequently, such signal circuit will be broken at said armature, until the operator completes the stroke of the controller C and moves the switches 112 and 113 into engagement with contacts 107 and 111, and thereby changes the polarity of the current flowing through wire 13.

The relay 114 will respond to current of opposite polarity to that to which relay 115 responds. As shown in Fig. 3 the polarity of the current is such that relay 114 responds thereto. The circuit for the home arm S of signal H′ at entrance of block 1 as shown in Fig. 3 may be traced as follows: from battery B′ to wire 118, armature 119 of track relay *f* wires 120 and 121, armature 122 of traffic relay 6, wire 123, armature 124 of polarized relay 114, wire 125, through signal to wires 126 and 127 to battery B′. The circuit of the home arm S of signal N at the entrance of block 3 is traced as follows: from battery B⁴ to wire 128, armature 129 of track relay *i*, wires 130 and 131, armature 132 of traffic relay 11, wire 133, armature 117 of polarized relay 115, wire 134, through signal S, and wires 135 and 136 to battery B⁴. As shown in this circuit the armature 132 is disengaged from its contact, as is also the armature 117. When the direction controller is moved, however, a complete stroke as before described, these breaks in the circuit will be closed. By the use of this system, it is evident that unless all the track relays and traffic relays have been properly operated, in response to a shifting of the battery B from wire 14 to wire 13 or vice versa, the movement of the controlling switch C cannot be completed, and therefore the signal governing traffic into the section cannot be cleared. The advantage of this system over that disclosed in Figs. 1 and 2 lies in the fact that in the preceding systems it was only essential that the armature contacts of all track relays and of the traffic relay farthest from the controlling switch should be closed to permit of a complete reversal of the controlling switch and a consequent clearing of the signals governing traffic in the opposite direction; while in the system of Fig. 3 it is also essential that all signals should move to the danger position, all traffic relays which are by the movement of the controlling lever disconnected from battery B should open their armature contacts, and all traffic relays which are connected with battery B by the movement of the controlling switch should close their armature contacts, before the signal governing traffic into the section can be cleared. For example, referring to Fig. 2, assuming that the direction controlling lever should be reversed and that signal N should fail to move to danger position, signal H′ could be cleared and the section would be open to traffic from both directions. With the additional devices of Fig. 3, however, the failure of signal N to move to danger would hold open the circuit for traffic relay 12 at switch O, resulting in track relays *h* and *i* being both connected with block 3 and consequently holding open their armature contacts whereby the indication circuit would be open and signal H′ could not be cleared. A

failure of traffic relay 11 to open its contacts would result in the same conditions as above described, the circuit for traffic relay 12 being then held open at the back contact of the armature of relay 11. Again, if traffic relay 12 should fail to close its armature contacts when connected with battery B, the same conditions would obviously exist. The failure of a track relay to close its contacts after a reversal of the controlling switch, would of course, hold open the indication circuit directly. A similar explanation holds true regarding the failure of any signal, track relay, or traffic relay in Figs. 1 or 2.

From the foregoing it will be seen that there are opposing signals at the junction of adjacent blocks, and that the operation of these signals is controlled by two sets of traffic relays, one set being connected to one wire and the other set to another wire, and that by means of a direction controller either of said sets of relays may be connected to a common battery and a common return wire, and thus determine which of the opposing signals shall be operated. Also that the track relays are common to both sets of opposing signals, and that the traffic relays determine which of the two block sections on either side of opposing signals shall receive current from a certain battery. Thus in Fig. 1 the track rails of block 1 receive current from battery *l*, while in Fig. 2 the track rails of block 2 receive the current from battery *l*, and in each case the current is supplied to the track relay in the rear (that is against traffic) and this allows the use of the well-known polarized system of track circuits for the control of distant signals as previously referred to. This particular system of distant signal control, however, forms no part of my present invention. It will also be seen that one set of signals cannot be moved to indicate safety unless all of the opposing set of signals have moved to indicate danger and that there can be no change made in the direction of traffic unless the entire section is clear of cars, and all the relays and circuits are in proper working order.

The wiring for each pair of opposing signals is the same in all cases except at the ends of the section (signals H—H′ and N—N′). The difference in these is the elimination of parts which would be necessary if there were distant signals in the rear of signals H′ and N, and if the control of the lock D were desired beyond signals H and N′. I have shown the locking circuits as controlled only by cars within the limits of track mentioned, but this control may be extended in either direction if desired.

Having described my inention, what I claim is:

1. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a pair of opposing signals at each junction of adjacent blocks, two sets of traffic relays, one for controlling the operation of one set of signals and the other for controlling the operation of the opposing set of signals, a source of current for energizing both sets of traffic relays, and means for connecting either set with the source of current.

2. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a plurality of pairs of opposing signals, one pair at each junction of adjacent blocks, a track relay for each pair of opposing signals and controlling said signals, two sets of traffic relays, one for controlling the operation of one set of signals and the other for controlling the operation of the opposing set of signals, and each set of traffic relays controlling the circuits of the track relays, a source of current for energizing both sets of traffic relays and means for connecting either set with the source of current.

3. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a plurality of pairs of opposing signals, one pair at each junction of adjacent blocks, a track relay for each pair of signals, two track circuits for each block, a track battery for each track relay, two sets of traffic relays for controlling respectively the two sets of track circuits, a source of current supply for both sets of traffic relays and means for connecting either set with the source of current.

4. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a plurality of pairs of opposing signals, one pair at each junction of adjacent blocks, a signaling circuit for each signal, two sets of traffic relays, one set for controlling the circuits of one set of signals and the other set for controlling the circuits of the opposing set of signals, a source of current supply for both sets of traffic relays, and means for connecting either set of traffic relays with said source.

5. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a plurality of pairs of opposing signals one pair at each junction of adjacent blocks, a signaling circuit for each signal, a track relay for each pair of signals, an armature in each signal circuit operated by the corresponding track relay, a track battery for each track relay, two track circuits for each block, and two traffic relays for each block, each of which traffic relays connects the rails of its block with either a track battery or a track relay.

6. In a signaling system for single track railways, a plurality of pairs of opposing signals arranged at intervals along a track

section, a circuit for each signal, two sets of traffic relays for controlling the circuits of the respective sets of opposing signals, two feed wires to which the sets of traffic relays are respectively connected, a return wire common to both sets of relays, a source of current supply, and means for connecting either of said feed wires with the source of current.

7. In a signaling system for single track railways, a plurality of pairs of opposing signals arranged at intervals along a track section, a circuit for each signal, two sets of traffic relays for controlling the circuits of the respective sets of opposing signals, two feed wires to which the sets of traffic relays are respectively connected, a source of current supply, a return wire common to all of said relays, a switch for connecting either of said feed wires with the source of current supply, and means for locking said switch against movement under predetermined conditions.

8. In a signaling system for single track railways, a plurality of pairs of opposing signals arranged at intervals along a track section, a circuit for each signal, two sets of traffic relays for controlling the circuits of the respective sets of opposing signals, two feed wires to which the sets of traffic relays are respectively connected, a return wire common to all of said relays, a source of current supply, a switch for connecting either of said feed wires with the source of current, an electrically controlled locking device for said switch, and a circuit for said locking device including the feed wire not connected to the said source of current.

9. In a signaling system for single track railways, a plurality of pairs of opposing signals, a circuit for each signal, two sets of traffic relays for controlling the circuits of the respective sets of opposing signals, a source of current supply, two circuits in which the respective sets of traffic relays are included, a polarized relay in each of said traffic relay circuits, a pole-changer in said circuits, a switch for connecting either of said circuits with the source of current, and means for first operating said switch and subsequently the pole-changer.

10. In a signaling system for single track railways, a plurality of pairs of opposing signals arranged at intervals along a track section, a circuit for each signal, two sets of traffic relays for controlling the circuits of the respective sets of opposing signals, two feed wires to which the sets of traffic relays are respectively connected, a source of current supply, a switch for connecting either of said feed wires with the source of current supply, and means for locking said switch against movement under predetermined conditions; a return wire common to all of said relays, and a switch in the circuit of each of said relays, operated by the movement of the signals controlled by the other set of relays.

11. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a pair of opposing signals at each junction of adjacent blocks, a track relay for each pair of opposing signals, a track battery for each pair of opposing signals, and two traffic relays for each block, each of which is adapted to connect the rails of the block with a track battery while the other connects the rails of the block with a track relay.

12. In a signaling system for single track railways, a section of track divided into a plurality of blocks, a pair of opposing signals at each junction of adjacent blocks, a track relay for each pair of signals, a plurality of track batteries for the section of track, and two traffic relays for each block, each of which is adapted to connect the rails of the block with a track battery while the other connects the rails of the block with a track relay.

13. In a railway signaling system, a block section of a railway track, two track batteries and two track relays for said block, and two traffic relays for said block, each of which is adapted to connect the rails of the block with one of the track batteries while the other connects the rails of the block with one of the track relays.

14. In a railway signaling system, a block-section of a railway track, a track battery and a track relay at each end of said block, and a traffic relay at each end of said block each of which is adapted to connect the rails with a track battery at one end of the block while the other connects the rails with a track relay at the other end of the block.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RALPH P. TUTTLE.

Witnesses:
M. S. KIRKLAND,
A. L. VENCHL.