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A. J. WILSON.

BLOCK SIGNALING SYSTEM FOR RAILWAYS.

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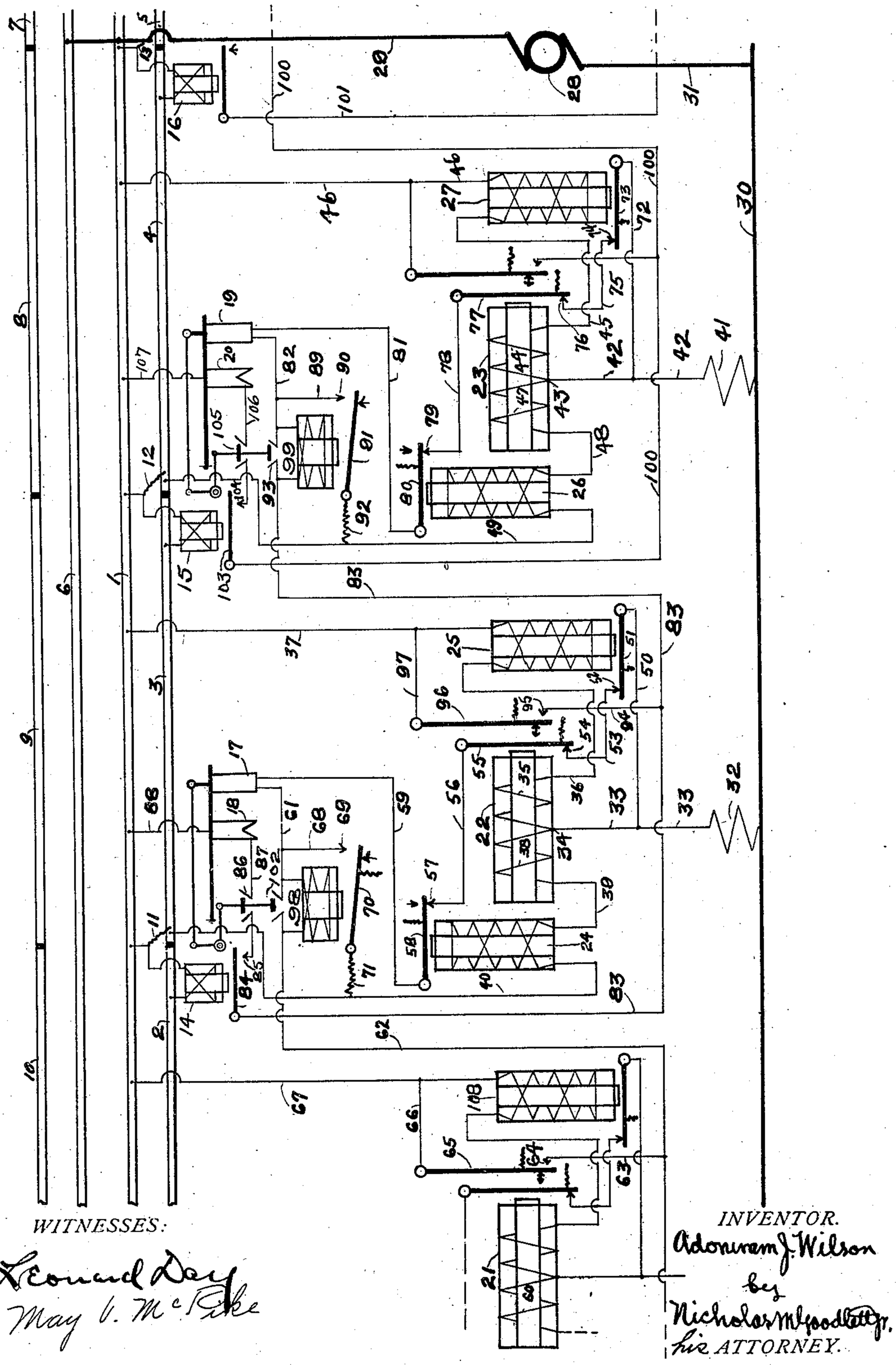

WITNESSES:

Leonard Day

May V. McIlke

INVENTOR.

Adoniram J. Wilson

by

Nicholas M. Goodell Jr.

his ATTORNEY.

UNITED STATES PATENT OFFICE.

ADONIRAM J. WILSON, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO THE HALL SIGNAL COMPANY, A CORPORATION OF MAINE.

BLOCK-SIGNALING SYSTEM FOR RAILWAYS.

No. 842,285. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed August 21, 1906. Serial No. 331,426.

To all whom it may concern:

Be it known that I, ADONIRAM J. WILSON, a citizen of the United States, and a resident of Westfield, in the county of Union, State of New Jersey, have invented certain new and useful Improvements in Block-Signaling Systems for Railways, of which the following is a specification.

This invention relates generally to block-signaling systems, but more particularly to block-signaling systems for electric railways.

The invention seeks to provide a system which is reliable under all conditions, highly efficient in operation, and which reduces the maintenance factor to a minimum.

A feature of the present invention is its capability of employing the same source of electric energy as that employed for the propulsion of trains, also for the energization of its various signal and track circuits, in which case a continuous return-rail extending throughout all the blocks and the trolley-wire or "third rail" are jointly employed as power-mains for the signal-circuits as well as for the trains.

In carrying out the invention one or more track-controlled electromagnetic devices are employed at each protected block, and it is preferred that one of these devices be differentially wound and be controlled jointly by the opposite rails of the block. The system contemplates the protection of a plurality of blocks by means of a home and a distant signal near the entrance to a block and by various interdependent and local signal-circuits. The signals are shown as of the "normal-danger" type, and a peculiar feature of the system is their dependence upon an approaching train before giving a "safety" indication and then only in case of a "clear" block ahead. The control of the signal-circuits from one block to another, together with the means employed to effect this control, is a feature of the invention.

Another object is to provide suitable local means which will effect a considerable economy in line-wire between blocks.

A system is illustrated in which both home and distant signals are properly controlled through the medium of a single through-wire between blocks.

An embodiment of the invention is shown in the following drawing, forming part of the specification, and in which the figure shows the signaling system applied to an east-bound track.

Referring now more particularly to the drawing, the figure illustrates a portion each of a west and an east bound track, the system being shown in its application to the east-bound track. The track is divided into various blocks, as shown. A continuous return-rail 1 extends throughout all the blocks of the east-bound track. The various blocks are determined by the insulated rail-sections 2 3 4 5, &c. Thus each block comprises a portion of a continuous return-rail and an insulated rail-section. The first block will be designated by 2 1, the second or next succeeding block by 3 1, the third by 4 1, and the fourth by 5 1. Corresponding blocks for the west-bound track are designated by 7 6, 8 6, 9 6, and 10 6. The west-bound track might be provided with the system, if desired, the arrangement being similar to that illustrated in connection with the east-bound track. The rail-sections 2 3 4 5 7 8 9 10, &c., are insulated, as indicated, one from another and from the continuous return-rails 1 and 6. However, each insulated rail-section or the east-bound track is shown as bridged across at one end to the opposite return-rail by track resistances 11, 12, and 13, respectively. The adjacent end of the neighboring rail-section is also bridged across to the continuous return-rail 1, as shown, by a track-relay—14 for section 2, 15 for section 3, and 16 for section 4.

17 and 18, respectively, designate home and distant signals for the block 3 1, and 19 and 20 designate home and distant signals, respectively, for the block 4 1.

All the signals, circuits, and apparatus are shown in their normal positions and normal conditions, and at least one complete circuit of each variety embodied in the system is illustrated and will be described.

21, 22, and 23 each designates an electromagnetic device, and particularly a differential magnetic device or relay associated, respectively, with the blocks 2 1, 3 1, and 4 1. These devices are included, as will be described, in the track-circuits.

24 and 25 each designates an electromagnetic device associated with differential relay 22, while 26 and 27 each designates a similar electromagnetic device associated with differential relay 23. A similar installation is

of course provided in connection with differential relay 21, although this is not illustrated in detail to obviate unnecessary repetition.

28 is a source of electric energy, preferably that for supplying motive power to the trains. It is connected to the return-rails 1 and 6 by wire 29 and to the "third rail" or trolley-wire 30 by wire 31.

Each protected block has associated therewith a normally energized track-circuit comprising two branches, each extending through one of the two oppositely-wound coils of the differential relays 21, 22, and 23, respectively.

The branched track-circuit for block 3 1 is as follows: third rail 30, potential reducing resistance 32, wire 33 to point 34, then branching, first through coil 35, wire 36, electromagnetic device 25, wire 37, to return-rail 1; second through opposing-coil 38, wire 39, electromagnetic device 24, wire 40, insulated rail-section 3, thence through track resistance 11 and track-relay 15 in parallel to return-rail 1. A similar track-circuit for block 4 1 may be traced as follows: third rail 30, resistance 41, wire 42 to point 43, then branching, first through coil 44, wire 45, electromagnetic device 27, wire 46, to return-rail 1; second through opposing coil 47, wire 48, electromagnetic device 26, wire 49, insulated rail-section 4, then through track resistance 12 and track-relay 16 in parallel to return-rail 1. When tracing all circuits, third rail 30 and return-rail 1 are regarded as the opposite terminals of the source of electric energy, since for all practical purposes they are such. Each of these branched track-circuits is normally energized, and each of the coils of the electromagnetic devices included therein normally have a magnetizing effect. The branch through coil 38 has included therein the resistance of track resistance 11 and track-relay 15, which is not included in the branch through coil 35. Therefore the normal current through this branch is less than that through coil 35. The magnetizing effect of coil 35 therefore overbalances that of the coil 38 in normal condition, and the combined coils of the differential device have a normal joint magnetizing effect or normal operative effect. However, if a train bridges insulated rail-section 3 to return-rail 1, track resistance 11 and track-magnet 15 are shunted out, and the current through coil 38 is made equal to that through coil 35, the joint magnetizing effect of the two coils being destroyed and the differential device having an inoperative effect. The branched track-circuit through differential relay 23, as illustrated, has functions similar to those described in connection with differential relay 22. Obviously the branched track-circuit through differential relay 21 must also be similar.

98 is a shunting-relay for block 3 1, and 99 is a shunting-relay for block 4 1. These relays are normally deënergized, and each operates a local circuit upon actuation from a preceding block, as will be described.

The first holding-circuit of the system and, namely, that for home signal 17 may be traced as follows: third rail 30, resistance 32, wire 33, wire 50, armature 51, contact 52, wire 53, contact 54, armature 55, wire 56, contact 57, armature 58, wire 59, signal 17, wire 61, circuit-closer 102, through-wire 62, wire 63, contact 64, armature 65, wires 66 and 67, to return-rail 1. This circuit is normally open, as shown at 102 and 64.

The signal-circuit for home signal 17 may be traced as follows: third rail 30, resistance 32, wires 33 and 50, armature 51, contact 52, wire 53, contact 54, armature 55, wire 56, contact 57, armature 58, wire 59, signal 17, wires 61 and 68, contact 69, armature 70, compensating resistance 71, wire 40, insulated rail-section 3, track resistance 11, and track-relay 15 in parallel to return-rail 1. This circuit is normally open, as shown at 69.

The next succeeding holding-circuit and, namely, the circuit for home signal 19 may be traced as follows: third rail 30, resistance 41, wire 42, wire 72, armature 73, contact 74, wire 75, contact 76, armature 77, wire 78, contact 79, armature 80, wire 81, signal 19, wire 82, circuit-closer 93, through-wire 83, wire 94, contact 95, armature 96, wires 97 and 37, to return-rail 1. This circuit is normally open, as shown at 93 and 95.

The next succeeding signal-circuit and, namely, that for the home signal 19 may be traced as follows: third rail 30, resistance 41, wires 42 and 72, armature 73, contact 74, wire 75, contact 76, armature 77, wire 78, contact 79, armature 80, wire 81, signal 19, wires 82 and 89, contact 90, armature 91, compensating resistance 92, wire 49, insulated rail-section 4, track resistance 12, and track-relay 16 in parallel to return-rail 1. This circuit is normally open, as shown at 90.

The first clearing-circuit completely shown in the drawing and for home signal 19 of block 4 1 may be traced as follows: third rail 30, resistance 41, wires 42 and 72, armature 73, contact 74, wire 75, contact 76, armature 77, wire 78, contact 79, armature 80, wire 81, signal 19, wire 82, shunting-relay 99, through-wire 83, armature 84, contact 85, circuit-closer 86, wire 87, distant signal 18, wire 88 to return-rail 1. This circuit is normally open, as shown at 85 and 86. A similar clearing-circuit for home signal 17 is shown complete, so far as block 3 1 is concerned, and may be traced as follows: third rail 30, resistance 32, wires 33 and 50, armature 51, contact 52, wire 53, contact 54, armature 55, wire 56, contact 57, armature 58, wire 59, home signal 17, wire 61, shunting-relay 98, through-wire 62 to mechanism in the preceding block similar to that described

in connection with through-wire 83. A portion of a third similar clearing-circuit enters block 4 1 on through-wire 100, as shown, and a portion of a fourth clearing-circuit is designated by wire 101.

The signal-circuit for distant signal 18 may be traced as follows: third rail 30, resistance 41, wires 42 and 72, armature 73, contact 74, wire 75, contact 76, armature 77, wire 78, contact 79, armature 80, wire 81, home signal 19, wire 82, circuit-closer 93, through-wire 83, armature 84, contact 85, circuit-closer 86, wire 87, distant signal 18, wire 88 to return-rail 1. This circuit is normally open, as shown at circuit-closer 93, contact 85, and circuit-closer 86.

A portion of the signal-circuit for distant signal 20 may be traced as follows: from block 5 1, over through-wire 100, armature 103, contact 104, circuit-closer 105, wire 106, distant signal 20, wire 107 to return-rail 1. This circuit is similar to the signal-circuit for distant signal 18, previously described and shown complete in the drawings.

Circuit-closers 86 and 102 are normally open, as shown, when the home signal 17 is at "danger." They are both mechanically operated by home signal 17 and are closed when said signal goes to "safety." Similarly circuit-closers 105 and 93 are normally open, as shown, when home signal 19 is at "danger." They are mechanically operated by said signal 19 and are both closed when signal 19 goes to "safety."

Although various signal-circuits are illustrated as leading to the signal-blades, it is to be understood that this is merely a diagrammatic indication and that the circuits do not necessarily lead directly through the motor for operating a signal, but may include any signal device, such as a clutch-magnet, releasing-magnet, or many other similar devices, all well known in the art.

The operation of the system in response to a train advancing in an easterly direction along the east-bound track is as follows: Home signal 17 has been cleared by the advancing train in a manner similar to the subsequent clearing of home signal 19, which will presently be described. Signal 17 now at "safety" has closed circuit-closers 86 and 102. As the train advances into block 2 1, the differential relay 21 loses its normal operative effect in the same manner in which differential relay 22 loses its normal operative effect, as will presently be described. Circuit-controlling armature or circuit-breaker 65 will be released, closing holding-circuit for home signal 17 at 64 to hold said signal at "safety." The train also shunts out the track-relay 14 in a manner similar to the subsequent shunting out of track-relay 15, presently to be described. Armature 84 is released to make contact with 85 and close the clearing-circuit for home signal 19 of the second block succeeding block 2 1. Current now traverses shunting-relay 99, which is provided with a comparatively large winding and possesses a considerable resistance, so as to require a comparatively small actuating-current. This relay is now energized and attracts its controlling-armature 91, closing the signal-circuit for home signal 19, previously traced at 90. The closing or this armature 91 provides a short return for the circuit of home signal 19 to return-rail 1 and increases the current for this signal sufficiently to throw home signal 19 to "safety." Signal 19 on going to "safety" closes circuit-closers 105 and 93. The closing of circuit-closer 93 shunts out shunting-relay 99, thereby deënergizing the same and sending back a strong current over through-wire 83 to distant signal 18, which then goes to "safety" in advance of the train. As the train advances into block 3 1 its wheels and axles bridge insulated rail-section 3 across to return-rail 1. Track resistance 11 and track-relay 15 are therefore shunted out. Both branches of the branched track-circuit for block 3 1 are now caused to have each the same resistance and the current through them is equalized. The two opposing coils 35 and 38 of differential relay 22 being equal and opposite now lose their joint magnetizing or operative effect and release both the controlling-armatures 55 and 96. These armatures may be termed respectively, a "circuit-closer" and a "circuit-breaker." 55 opens the holding-circuit for home signal 17 at 54. Signal 17 thereupon goes to "danger," opening circuit-closer 86, which opens the previously-closed circuit for distant signal 18 and causes said distant signal 18 to go to "danger." Both signals 17 and 18 are now at "danger" as the train enters block 3 1 and will protect the rear of the train. The released armature 96 makes contact with 95 to close the holding-circuit for home signal 19, so that before the signal-circuit for home signal 19, extending over through-wire 83 through circuit-closer 86, is broken at 86 this holding-circuit will be closed, so that the home signal will still be held at "safety" in advance of the train. As the train leaves block 2 1 differential relay 21 and track-relay 14 regain their normal condition, and the circuit over through-wire 83 is opened at a second point 85. The shunting out of track-relay 15, previously referred to, deënergizes the same to release the armature 103, making contact with 104 and closing a clearing-circuit for the succeeding home signal and afterward clearing distant signal 20 in the same manner that distant signal 18 was cleared. As the train enters block 4 1 it bridges insulated rail-section 4 to return-rail 1 to destroy the normal operative effect of differential relay 23 in the same way as was described in connection with differential relay 22. The signal-circuit for

home signal 19 is thereupon broken at 76 upon the retraction of armature 77, and home signal 19 goes to "danger," as did home signal 17. As the train leaves block 3 1 differential relay 22 regains its normal operative effect and attracts its armatures 55 and 96 and track-relay 15 is energized to attract its armature 103, so that all the apparatus associated with block 3 1 is in normal condition ready for a second actuation.

A complete operation both for clearing and going to "danger" of home signal 19 and distant signal 18 has now been described, and it is to be understood that this operation may indefinitely be repeated for other similar signals. The description has been for clear blocks ahead of the advancing train.

If the block 4 1 is occupied by a train as an east-bound train advances into block 2 1, distant signal 18 cannot be cleared. Home signal 17 has been cleared as described above. Circuit-closer 86 has been closed, and armature 84 is in contact with 85, but the clearing-circuit for home signal 19 is open at 76, since the train in block 4 1 has destroyed the normal operative effect of differential relay 23, so that this relay has released its armature 77. Home signal 19 must, therefore, remain at "danger," since the shunting-relay 99 cannot be actuated, and also no current can be sent back over through-wire 83 to clear distant signal 18. Thus signal 17 is at "safety" and distant signal 18 is at "danger," the two signals giving a combined indication of "caution." As the train advances into block 3 1 home signal 17 is thrown to "danger" to protect its rear, the same as previously described. This train can advance no farther, since the train ahead in block 4 1 is holding home signal 19 at "danger" and also distant signal 20 at "danger," since the circuit for distant signal 20 is held open at 105. In a similar manner if the block 3 1 is occupied by a train an advancing train will fail to clear home signal 17, since the train in block 3 1 has destroyed the normal operative effect of differential relay 22, breaking the clearing-circuit for home signal 17 at 54.

A train held in block 3 1 by the danger indication of signals 19 and 20 due to a train occupying block 4 1 will be allowed to pass on into the next block as soon as the train in that block departs. The operation in that instance is as follows: The train leaving block 4 1 restores the normal operative effect of differential relay 23, attracting armature 77 against contact 76. The train waiting in block 3 1 has released armature 96, which has previously been described as completing the holding-circuit. In this instance the holding-circuit acts as a clearing-circuit for home signal 19, since there is no train back in block 2 1 to deënergize track-relay 14 and drop armature 84. The shunting-relay 99 is energized to attract its armature 91 and clear home signal 19, as previously described, Circuit-closer 105 is closed, track-relay 15 is deënergized, so that armature 103 is in contact with 104, with the result that distant signal 20 is ready to be thrown to "safety" as soon as the blocking-train ahead has left block 5 1. In any event the train in block 3 1 may advance into block 4 1.

Each branch of the branched track-circuits described may be provided, as shown, with an electromagnetic device, such as 24, 25, 26, 27, and 108. Each of these devices is normally energized and holds attracted an armature included in the signal-circuits. All the armatures associated with all of the electromagnetic devices are arranged to be retracted upon the deënergization of their associated electromagnetic devices. The purpose of the additional devices 24, 25, 26, 27, and 108 is to break the signal-circuits at a block if a branch of the track-circuit extending through one of these devices should accidentally become broken. The signals all have a "bias to danger," so that any break in the various signal-circuits will cause a danger indication of the signal or signals affected.

From the above description it is obvious that home signal 19 is controlled by all the electromagnetic devices of the associated block—namely, 23, 26, 27, and 99—also by the electromagnetic devices 22, 24, and 25 of the preceding block and also by the electromagnetic device or track-relay 14 of a second preceding block. The distant signal 18 is controlled by the electromagnetic devices 23, 26, 27, and 99 and by the home signal 19 through the medium of circuit-closer 93 of the succeeding block, also by the electromagnetic devices 22, 24, and 25 and by the home signal 17 through the medium of circuit-closer 86 of the associated block and also by the electromagnetic device or track-relay 14 of the preceding block. The other signals are similarly controlled. Furthermore, the control of distant signal 18 extends to a portion of the track in advance of distant signal 20, and therefore overlaps signal 20 in its control.

It should be noted that the provision of the relays 98 and 99 makes it possible for a single through-wire between blocks to clear the signal of one block and also of a preceding block, while each of these signals is subject to a control dependent upon the condition of the associated block.

What has been shown and described is considered to be illustrative of a preferred embodiment of the invention, although various changes in details are well within the scope thereof.

The particular novel features of the inven-

tion will be pointed out in the following claims, which are desired to be secured by Letters Patent:

1. In a block-signaling system, the combination of a circuit having two multiple branches; a magnetic device with two opposing windings, one associated with each branch; each branch including the rails of a separate track side; said branches having a normal operative effect upon said magnetic device which is changed by train bridging said rails; a signal normally indicating danger; and local means operable by an approaching car in a second preceding block to throw said signal to safety when said branches have their normal operative effect.

2. In a block-signaling system for railways, the combination with the block of a circuit having two multiple branches; a magnetic device with two opposing windings, one winding in each branch; each branch including the rails of a separate track side; said branches having a normal operative effect upon said magnetic device; a train in the block being capable of changing said normal operative effect of said branches; a signal associated with said block; and means associated with a preceding block and operable by a car in that block to control said signal when said branches have their normal operative effect, and a track-relay in a second preceding block also for controlling the signal.

3. In an electric block-signaling system; a plurality of blocks; a train-controlled electromagnetic device for each block normally holding a circuit-closer closed and a circuit-breaker open; a home and a distant signal for each block; a track-relay for each block; a home-signal circuit; a distant-signal circuit; a shunting-relay for said circuits; said home-signal circuit being controlled by the electromagnetic device of the block associated with the home signal, and by that of the preceding block and also by the track-relay of the second preceding block; said distant-signal circuit being controlled by the electromagnetic device and by the shunting-relay of the succeeding block and by the home signal of the associated block.

4. In an electric block-signaling system; a plurality of blocks; a train-controlled electromagnetic device for each block; a home and a distant signal for each block; a track-relay for each block; a home-signal circuit; a distant-signal circuit; a shunting-relay for said circuits; said home-signal circuit being controlled by the electromagnetic device of the block associated with the home signal, and by that of the preceding block and also by the track-relay of the second preceding block; said distant-signal circuit being controlled by the electromagnetic device and by the shunting-relay of the succeeding block and by the home signal and by the electromagnetic device both of the associated block.

5. In an electric block-signaling system; a plurality of blocks; a train-controlled electromagnetic device for each block; a home and a distant signal for each block; a track-relay for each block; a home-signal circuit; a distant-signal circuit; a shunting-relay for said circuits; said home-signal circuit being controlled by the electromagnetic device of the block associated with the home signal and by that of the preceding block and also by the track-relay of the second preceding block; said distant-signal circuit being controlled by the electromagnetic device and by the shunting-relay of the succeeding block and by the home signal and by the electromagnetic device of the associated block; a portion of the distant-signal circuit of one block operating as clearing-circuit for the home signal circuit of the succeeding block through the medium of the shunting-relay of said succeeding block so as to necessitate the use of only one through-wire between blocks.

6. In an electric block-signaling system; a plurality of blocks; a train-controlled electromagnetic device for each block; a home and a distant signal for each block; a track-relay for each block; a home-signal circuit; a distant-signal circuit; a shunting-relay for said circuits; said home-signal circuit being controlled by the electromagnetic device of the block associated with the home signal, by that of the preceding block and also by the track-relay of the second preceding block; said distant-signal circuit being controlled by the electromagnetic device and by the shunting-relay both of the block in advance, and by the home signal and by the electromagnetic device of the associated block; a portion of the distant-signal circuit of one block operating as a clearing-circuit for the home-signal circuit of the succeeding block through the medium of the shunting-relay of said succeeding block so as to necessitate the use of only one through-wire between blocks.

7. In a block-signaling system, a plurality of blocks; a distant signal for one block; a home signal for a distant or succeeding block; a track-controlled device for said succeeding block; an actuating device preceding said distant signal; a shunting-relay for said succeeding block; a clearing-circuit for said home signal, including said shunting-relay; a signal-circuit for said distant signal; both of said circuits employing but a single through-wire between said block and said succeeding block; both of said circuits being controlled by said actuating device and said track-controlled device for the said succeeding block; and a signal-circuit for said home signal controlled by said shunting-relay.

8. In a block-signaling system; a plurality

of blocks, each comprising a portion of a continuous return-rail and an insulated rail-section; a source of electric energy; a differential relay with each of its two opposing windings connected between said source of energy and a separate rail of the block so that said windings have a combined inductive effect when the block is clear and no combined inductive effect when the block is occupied by a train; a track-relay and a shunting-relay for each block; a single through-wire-controlling circuit for the home signal of one block and for the distant signal of the preceding block; said controlling-circuit being controlled by said relays.

9. In a block-signaling system; three blocks, each block comprising a portion of a continuous return-rail and an insulated rail-section; a source of electric energy; a branched track-circuit, each branch connecting an opposite rail of each of said blocks with the source of electric energy; one coil of a differential relay included in each of said branches; a track-relay at the first block; a shunting-relay at the third block; a home and a distant signal at the second block; a home signal at the third block; a circuit for the home signal of the second block and controlled by the differential relay of the first block and by the differential relay of the second block including the shunting-relay of the third block and controlled by the track-relay at the first block.

10. In a block-signaling system; three blocks, each block comprising a portion of a continuous return-rail and an insulated rail-section; a source of electric energy; a branched track-circuit, each branch connecting an opposite rail of one of said blocks with the source of electric energy; a separate coil of a differential relay included in each of said branches; a track-relay at the first block; a shunting-relay at the third block; a home and a distant signal at the second block; a home signal at the third block; a circuit for the home signal of the second block and controlled by the differential relay of the first block and by the differential relay of the second block; a clearing-circuit for the home signal of the third block and the distant signal of the block, the second block including the shunting-relay of the third and controlled by the track-relay at the first block; a local circuit for the home signal at the third block; said shunting-relay operating to increase the current strength first through said local circuit for the home signal at the third block and then, after said home signal is thrown, through a circuit for the distant signal of the second block.

11. In a block-signaling system; a plurality of blocks; a signal at each of two separate blocks; a shunting-relay associated with one of said signals; a clearing-circuit for both of said signals including said shunting-relay and a source of electric energy; means for closing said circuit; said shunting-relay operating to increase the current strength first for one signal and then, after said signal has been thrown, for the other signal.

12. In a block-signaling system, a block comprising a portion of a continuous return-rail and an insulated rail-section; a branched track-circuit, each branch included a separate track side of said block; a separate coil of a differential relay including in each of said branches; a signal for said block; a local circuit for said signal controlled by said differential relay; a clearing-circuit controlled by a track device preceding said block and in parallel with a portion of said local signal-circuit; and a shunting-relay for said local circuit and included in said clearing-circuit to increase the current in said local circuit when said clearing-circuit is energized.

13. In a block-signaling system, a block comprising a portion of a continuous return-rail and an insulated rail-section; a track resistance connected between said insulated rail-section and said return-rail; a branched track-circuit normally energized; each branch including a separate track side of said block; a separate coil of a differential relay included in each of said branches; a signal for said block; a local circuit for said signal controlled by said differential relay; a clearing-circuit controlled by a track device preceding said block and in parallel with a portion of said local signal-circuit; and a shunting-relay for said local circuit and included in said clearing-circuit to increase the current in said local circuit when said clearing-circuit is energized.

14. In a block-signaling system, a block comprising a portion of a continuous return-rail and an insulated rail-section; a track resistance connected between said insulated rail-section and said return-rail; a branched track-circuit normally energized, each branch including a separate track side of said block; a separate coil of a differential relay and a separate relay included in each of said branches; a signal for said block; a local circuit for said signal controlled by said differential relay and each of said separate relays; a clearing-circuit controlled by a track device preceding said block and in parallel with a portion of said local signal-circuit; and a shunting-relay for said local circuit and included in said clearing-circuit to increase the current in said local circuit when said clearing-circuit is energized.

15. In a block-signaling system, a plurality of blocks, each comprising a portion of a continuous return-rail and an insulated rail-section; a branched track-circuit, each branch including a separate track side of a block; a separate coil of a differential relay included in each of said branches; a signal for a block; a circuit for said signal con-

trolled by the differential relay of the associated block; a signal for a preceding block; a circuit for said latter signal controlled by the differential relay of said preceding block and by a portion of the track succeeding said first-mentioned signal so as to overlap the same.

16. In a block-signaling system, a plurality of blocks, each comprising a portion of a continuous return-rail and an insulated rail-section; a branched track-circuit, each branch including a separate track side of a block; a separate coil of a differential relay included in each of said branches; a signal for a block; a circuit for said signal controlled by the differential relay of the associated block and by a portion of the preceding track; a signal for a preceding block; a circuit for said latter signal controlled by the differential relay of said preceding block, by a portion of the preceding track, and by a portion of the track succeeding said first-mentioned signal so as to overlap the same.

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

ADONIRAM J. WILSON.

Witnesses:

MAY V. MCPIKE,

LEONARD DAY.