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A. J. WILSON.

ELECTRIC BLOCK SIGNALING SYSTEM.

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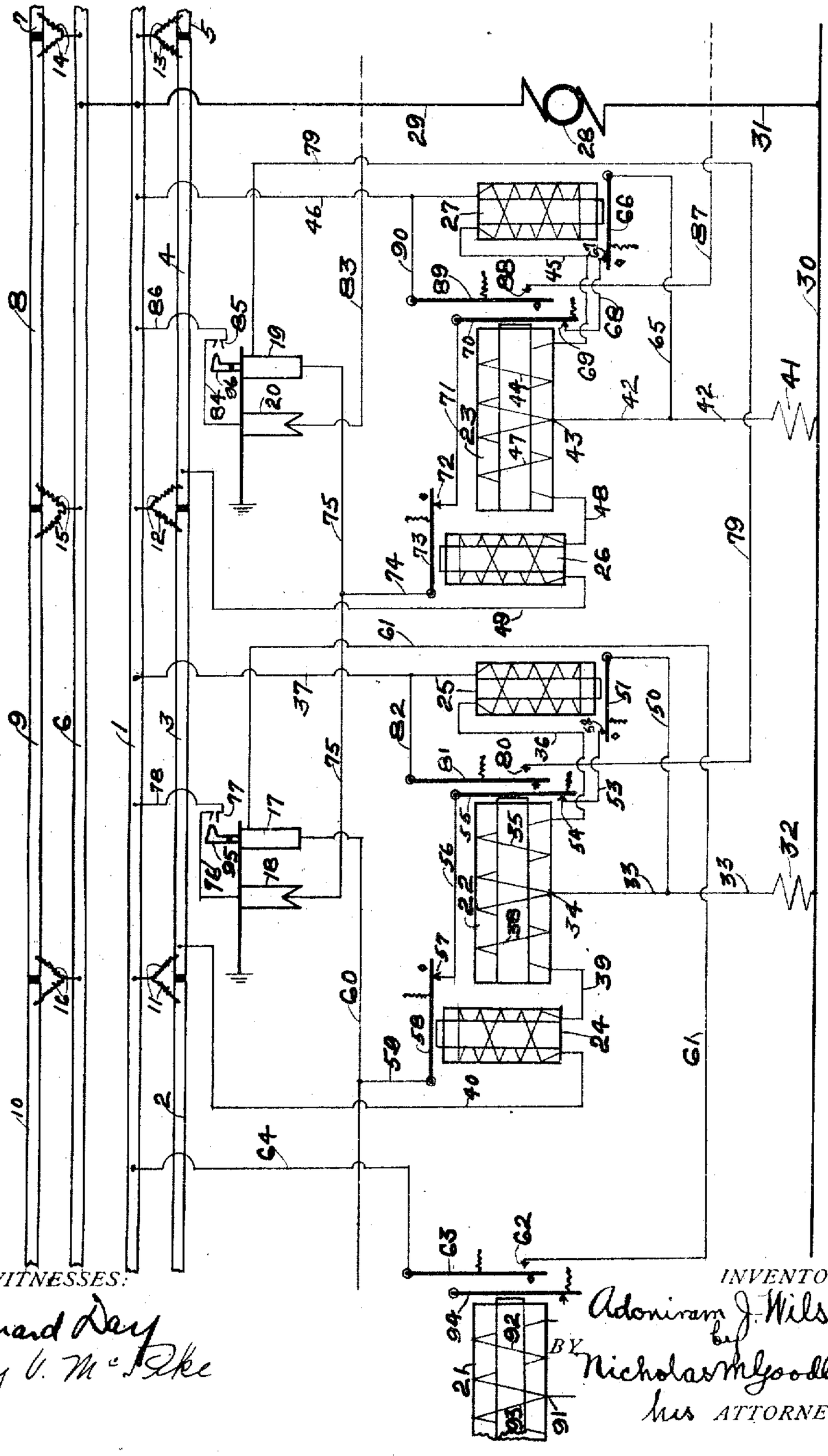

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ELECTRIC BLOCK-SIGNALING SYSTEM.

No. 842,366. Specification of Letters Patent. Patented Jan. 29, 1907.

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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 Electric Block-Signaling Systems, 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 system 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 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 is made dependent upon various circuit-changing devices, which are such as to require few through-wires 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 employing two through-wires between the blocks.

Referring now more particularly to the drawing, the figure shows the system applied to an east-bound track. This track is divided into various blocks, of which four are indicated.

1 indicates a continuous return-rail extending throughout all the blocks. Rails 1 and 2 constitute the first block, rails 1 and 3 the second block, rails 1 and 4 the third block, and rails 1 and 5 the fourth block. The second and third blocks are shown complete, together with their associated circuits and apparatus.

Numerals 6, 7, 8, 9, and 10 indicate corresponding rails of a west-bound track, which might be provided with the same system as that indicated in connection with the east-bound track, if desired.

2, 3, 4, 5, 7, 8, 9, and 10 are termed "insulated rail-sections," and, as indicated, are insulated one from another and from the continuous return-rails 1 and 6. However, each insulated rail-section is shown electrically bridged to the adjoining rail-section and to the adjacent return-rail by properly-proportioned resistances 11, 12, 13, 14, 15, and 16, respectively.

17 and 18 and 19 and 20 are respectively the home and the distant signals for the respective blocks 3 1 and 4 1.

The circuits and the various apparatus are shown all in their normal positions, and one complete circuit of each variety embodied in the system is illustrated.

21, 22, and 23 each designates an electromagnetic device, and particularly a differential electromagnetic device or relay associated, respectively, with the blocks 3 1, 2 1, and 4 1.

24 and 25 each designates a similar device associated with the differential relay 23.

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

At each of the blocks 3 1 and 4 1 there is shown a normally energized branched track-circuit, which for block 3 1 is as follows: third rail 30, resistance 32, wire 33, branching at 34 through coil 35, wire 36, relay 25, wire 37, to return-rail 1, and also branching at 34 through coil 38, wire 39, relay 24, wire 40, insulated rail-section 3, resistances 11 and 12, to rail 1. For the purposes of this description the continuous return-rail 1 and the third rail 30 are viewed, when connected, as completing a circuit, since at any locality along the track these two elements supply the operating-current from the source 28. A similar branched track-circuit through differen-

tial relay 23 may be traced as follows: third rail 30, resistance 41, wire 42, to point 43, there branching through coil 44, wire 45, relay 27, wire 46, to rail 1, and also branching at 43 through coil 47, wire 48, relay 26, wire 49, rail-section 4, resistances 12 and 13, to rail 1. A similar branched track-circuit is of course provided for the device 21 from trolley 30 through coils 92 and 93, respectively, to the opposite rails 1 and 2. In fact, the installation for block 2 1 is the same as that for blocks 3 1 and 4 1, but is not illustrated in full, so as to avoid unnecessary repetition of detail.

The signal-circuit for the 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, wires 59 60, home signal 17, through-wire 61, contact 62, armature 63, wire 64, return-rail 1. This circuit, asshown, is normally open between 62 63.

The distant-signal circuit of the distant signal 18 may be traced as follows: third rail 30, resistance 41, wire 42, wire 65, armature 66, contact 67, wire 68, contact 69, armature 70, wire 71, contact 72, armature 73, wires 74 and 75, distant signal 18, wire 76, circuit-closer 77, wire 78, to return-rail 1. This circuit, as shown, is normally open at 77.

The signal-circuit for the home signal 19 is similar to the corresponding circuit for the home signal 17 and may be traced as follows: third rail 30, resistance 41, wires 42 65, armature 66, contact 67, wire 68, contact 69, armature 70, wire 71, contact 72, armature 73, wires 74 75, home signal 19, through-wire 79, contact 80, armature 81, wires 82 37, return-rail 1. This circuit is normally open between contact 80 and armature 81, as shown.

The signal-circuit for the distant signal 20 is not shown complete, but would be similar to the corresponding circuit described in connection with distant signal 18. It enters the block 4 1 on through-wire 83, distant signal 20, wire 84, circuit-closer 85, wire 86, to return-rail 1. Wire 87 is the second through-wire returning from block 5 1 to contact 88, armature 89, wires 90 and 46, to return-rail 1, and is a part of the home-signal circuit for the block 5 1.

The differential relay 21 operates two armatures 94 and 63, which are precisely similar to the corresponding armatures 55 81 and 70 89 of the relays 22 and 23 and respectively operated thereby. These armatures, together with their contact-points, respectively constitute circuit-closers and circuit-breakers. Circuit-closers 94, 55, and 70 are normally held closed by the differential relays, while circuit-breakers 63, 81, and 89 are normally held open by the differential relays. 58, 51, 73, and 66 also constitute circuit-closers and are normally held closed by the magnets 24, 25, 26, and 27, respectively. Each of the armatures constituting circuit-closers and circuit-breakers is provided with a retracting-spring or equivalent device which is overcome by the magnetic force when the electromagnetic device is energized.

The circuit-closers 77 and 85 are closed by the bridges 95 and 96, respectively, when the corresponding home signal goes to "safety." The bridges 95 and 96 are mechanically connected to the home signals 17 and 19, respectively.

The operation of the system is as follows: If the blocks 3 1 and 4 1 are clear and a train moving in an easterly direction enters block 2 1, circuit-breaker 63 is released to close the signal-circuit for the home signal 17, as traced above. This signal will then be thrown to "safety," closing the distant-signal circuit for signal 18 at 77, whereupon signal 18 likewise goes to "safety," indicating the clear condition of the two blocks succeeding block 2 1. As the train progresses into block 3 1 its wheels and axles bridge rails 3 and 1, electrically connecting them and shunting out resistance 11 and 12, if these resistances are provided. (In some instances it may be preferred to omit these resistances, in which case if the opposite rails were well insulated there would be no current in the branches of the track-circuits connected to insulated rail-sections 2 3 4, &c., until these rail-sections were bridged to the return-rail. With this arrangement the relays 24 26, &c., would have to be omitted; otherwise no change in the installation would be required except the proper adjustment of the resistance in the branches of the track-circuits.) When the rails 3 1 are thus bridged, the branch circuit through coil 38 of differential relay 22 is caused to have the same resistance as the branched circuit through coil 35, so that the current's strength through each of these coils becomes equal, and since the coils are in opposition they have no joint magnetizing effect, whereas normally they did have a joint magnetizing effect or operative effect, due to the stronger current through coil 35. Both the armatures 55 and 81 are therefore retracted by their springs, and the signal-circuit from home signal 17 is broken at 55, the home signal 17 then going to "danger" by gravity or by other suitable means, the signal having a "bias to danger." As the home signal 17 goes to "danger" it simultaneously breaks the signal-circuit through distant signal 18 at 77, which permits 18 to go to "danger" in the same way that signal 17 went to "danger." It is thus evident that both signals go to "danger" immediately on the entrance of the train. The retracting of the armature 81 closes the signal-circuit for home signal 19 at 80 81, so as to put signal 19 to "safety" in advance of the train. Signal 19 then closes

the distant-signal circuit for signal 20 at 85 to place signal 20 at "safety" if block 5 1 is clear. As the train enters block 4 1 signals 19 and 20 are put to "danger" in a manner similar to that described in connection with signals 17 and 18. However, if block 4 1 is occupied by a train when the advancing train enters block 2 1 the operation is as follows: Home signal 17 is set at "safety," as has been described. It closes the signal-circuit for distant signal 18 at 77, as previously; but this signal-circuit is now broken at 69 70, since the train in block 4 1 has destroyed the normal operative effect or the joint magnetizing effect of the differential relay 23 by bridging rail-section 4 to return-rail 1 to equalize the current through coils 44 and 47. Distant signal 18 therefore remains at "danger," and the combined indication of signals 17 and 18 is one of "caution."

If the block 3 1 is occupied by a train, as the advancing train enters block 2 1 the home signal 17 must remain at "danger," since its circuit will then be broken at 54 55, as the normal operative effect of the differential relay 22 has been destroyed by the train bridging rail-section 3 to return-rail 1. Obviously the distant signal 18 must also remain at "danger," since its circuit is maintained open at 77. In these later instances the signals are put to "danger" by an advancing train the same as was described when the blocks ahead were "clear."

The relays 24, 25, 26, and 27 operate as additional safety devices, and each relay controls the same circuits as do the corresponding differential relays 22 and 23. If any of the track-leads 40, 37, 49, and 46 should be broken, the corresponding relay would be deënergized to release its armature and open the signal-circuit, which otherwise would falsely be held closed by the electromagnetic force of the coil in the corresponding differential relay which still remained energized.

From the above description it is obvious that home signal 17 is controlled by the two blocks 2 1 and 3 1 and specifically by each of the four electromagnetic devices 21, 22, 24, and 25; that distant signal 18 is controlled by the three blocks 2 1, 3 1, and 4 1 and specifically by each of the seven electromagnetic devices 21, 22, 23, 24, 25, 26, and 27 and also by the home signal 117. It is also obvious that the respective distant signals are controlled by their associated home signals. It is also obvious that distant signal 18 is controlled by the differential device 22 through the medium of home signal 17 and circuit-closer 77; also, that the circuit for distant signal 18 extends ahead and is controlled by differential device 23, which in turn is controlled by a portion of the track-rails ahead of or succeeding distant signal 20. Thus the signal-circuit for distant signal 18 overlaps distant signal 20. This overlap-circuit and its signal might be variously arranged and not necessarily as shown.

What has been shown and described is considered to be illustrative of a preferred embodiment of the invention, the particular novel features of which 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 coils, 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; means operable by a car for changing said normal operative effect of said branches; a signal normally indicating danger; and means operable by an approaching car 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 a block of a circuit having two multiple branches; a magnetic device with two opposing coils, one in each branch; each branch including the rails of a separate track side; said branches having a normal operative effect upon said magnetic device; means operable by a car in the block for 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.

3. In an electric block-signaling system for electric railroads, a plurality of protected blocks each provided with a signal; a differential relay at each protected block; means at each of said blocks for utilizing the same source of electric power as is used for the propulsion of trains for the operation of said differential relays; a signal; a signal-circuit therefor controlled by the differential relay of the associated block and also by the differential relay of a preceding block.

4. In an electric block-signaling system for electric railroads, a plurality of protected blocks each provided with a signal; a differential relay at each protected block; means at each of said blocks for utilizing the same source of electric power as is used for the propulsion of trains for the operation of said differential relays; a signal for each block; each of said differential relays controlling the signal of the associated block and the signal of a block in advance of the associated block.

5. 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 power; a differential branched track-circuit, each branch including the source of electric power and one rail of the block; said branched circuit having a normal operative effect when the block is not

occupied by a train; a signal for each block; a signal-circuit operable to actuate the signal when the branched circuit of the associated block has its normal operative effect and the branched circuit of a preceding block has its inoperative effect.

6. In a block-signaling system; a source of electric power; a track divided into blocks, each block comprising a portion of a continuous return-rail and an insulated rail-section; a differential electromagnetic device for each block comprising two opposing coils, one connected between the source of electric power and the return-rail and the other connected between said source of power and the insulated rail-section; said differential device having a normal operative effect when the associated block is clear and an inoperative effect when the associated block is occupied by a train; a home and a distant signal for each block; signaling-circuits controlled by said differential devices and operable to actuate said signals only when the differential electromagnetic device of the associated block has its normal operative effect.

7. In an electric block-signaling system; a plurality of blocks each comprising a portion of a continuous return-rail and an insulated rail-section; an electromagnetic device with opposing windings for each block, one of said windings connected to the continuous return-rail and the other connected to the insulated rail-section; a home and a distant signal for each block; a home-signal circuit controlled by the electromagnetic device of a preceding block; a distant-signal circuit controlled by the electromagnetic device of a succeeding block and by said home signal.

8. In a signaling system; a source of electric power; a track comprising a continuous return-rail and a plurality of insulated rail-sections forming blocks; a signal for each block; a magnetic device with opposing windings for each block, one winding connected between the source of electric power and the continuous return-rail and the other winding connected between said source of electric power and an insulated rail-section of the block, said windings having a normal operative effect upon said device when the block is clear; a circuit-closer normally held closed by said magnetic device when the block is clear; a circuit-breaker normally held open by said magnetic device; a signal-circuit including said circuit-closer one block and said circuit-breaker of a preceding block whereby the signal is controlled jointly by said magnetic devices.

9. In a signaling system; a source of electric power; a track comprising a continuous return-rail and a plurality of insulated rail-sections forming blocks; a home and a distant signal for each block; a magnetic device with opposing windings for each block, one winding connected between the source of electric power and the continuous return-rail and the other winding connected between said source of electric power and the insulated rail-section of the block, said winding having a normal operative effect upon said device when the block is clear; a circuit-closer normally held closed by said magnetic device when the block is clear; a circuit-breaker normally held open by said magnetic device; a home-signal circuit including said circuit-closer of one block and said circuit-breaker of a preceding block whereby said home signal and said circuit-breaker of a preceding block whereby said home signal is controlled jointly by said magnetic devices; and a second signal-circuit for said distant signal and including the circuit-closer of a succeeding block and controlled by said home signal.

10. A normal-danger electric block-signaling system, in which a differential relay controls the signal-circuits, and arranged for utilizing the same source of power as for the propulsion of trains to cause a signal to move from "danger" to "safety" on the approach of a train to a "clear" block.

11. An electric block-signaling system, in which a differential relay controls the signal-circuits, and arranged for utilizing the same source of power as for the propulsion of trains to operate home and distant signals and a plurality of electromagnetic devices controlling signal-circuits for said signals.

12. In a block-signaling system for railways, a block comprising a portion of a continuous return-rail and an insulated rail-section; a source of electric energy; a differential electromagnetic device comprising two opposing coils; a branched track-circuit comprising two branches each connected to the source of electric energy, one extending to the return-rail through one of said opposing coils and the other extending to the insulated rail-section through the other of said opposing coils, so that said differential device has a normal operative effect when said block is clear and an inoperative effect when said block is occupied by a train; a signal for said block and a second signal for an extent of track succeeding said block; means controlled by track-rails succeeding said second signal; and a signal-circuit for said first-mentioned signal controlled by said differential device and by said means controlled by track-rails succeeding said second signal so that said signal-circuit overlaps said second signal.

13. In a block-signaling system for railways, a block comprising a portion of a continuous return-rail and an insulated rail-section; a source of electric energy; a differential electromagnetic device comprising two opposing coils; a branched track-circuit comprising two branches each connected to

the source of electric energy, one extending to the return-rail through one of said opposing coils and the other extending to the insulated rail-section through the other of said opposing coils, so that said differential device has a normal operative effect when said block is clear and an inoperative effect when said block is occupied by a train; a signal for said block and a second signal for an extent of track succeeding said block; means for controlling said second signal controlled by track-rails succeeding said second signal; and a signal-circuit for said first-mentioned signal controlled by said differential device and by said means controlled by track-rails succeeding said second signal so that said signal-circuit overlaps said second signal.

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

ADONIRAM J. WILSON.

Witnesses:

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LEONARD DAY.