

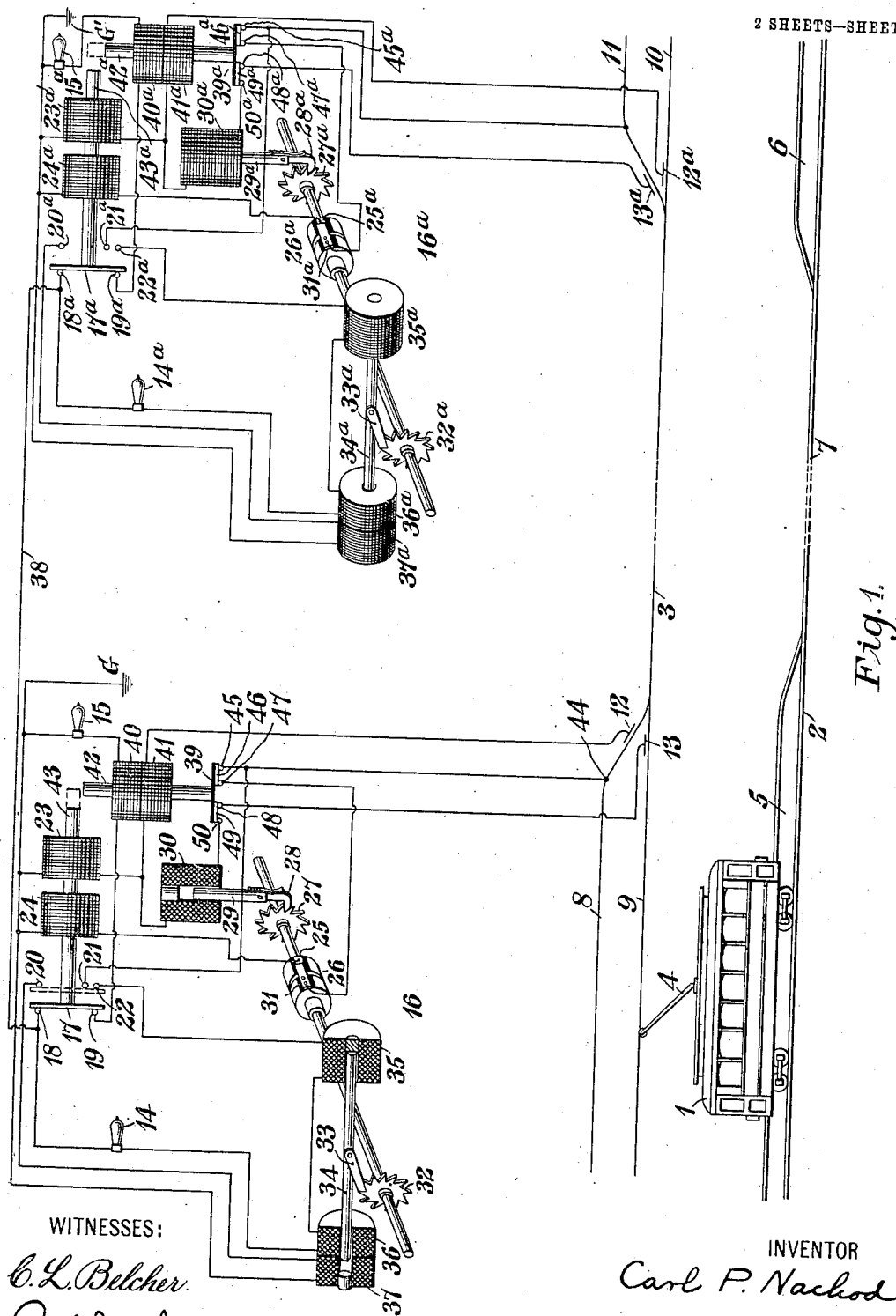
No. 825,927.

PATENTED JULY 17, 1906.

C. P. NACHOD.
ELECTRICAL SIGNAL SYSTEM.

APPLICATION FILED AUG. 2, 1905.

2 SHEETS—SHEET 1.



WITNESSES:

C. L. Belcher.
R. J. Harbom.

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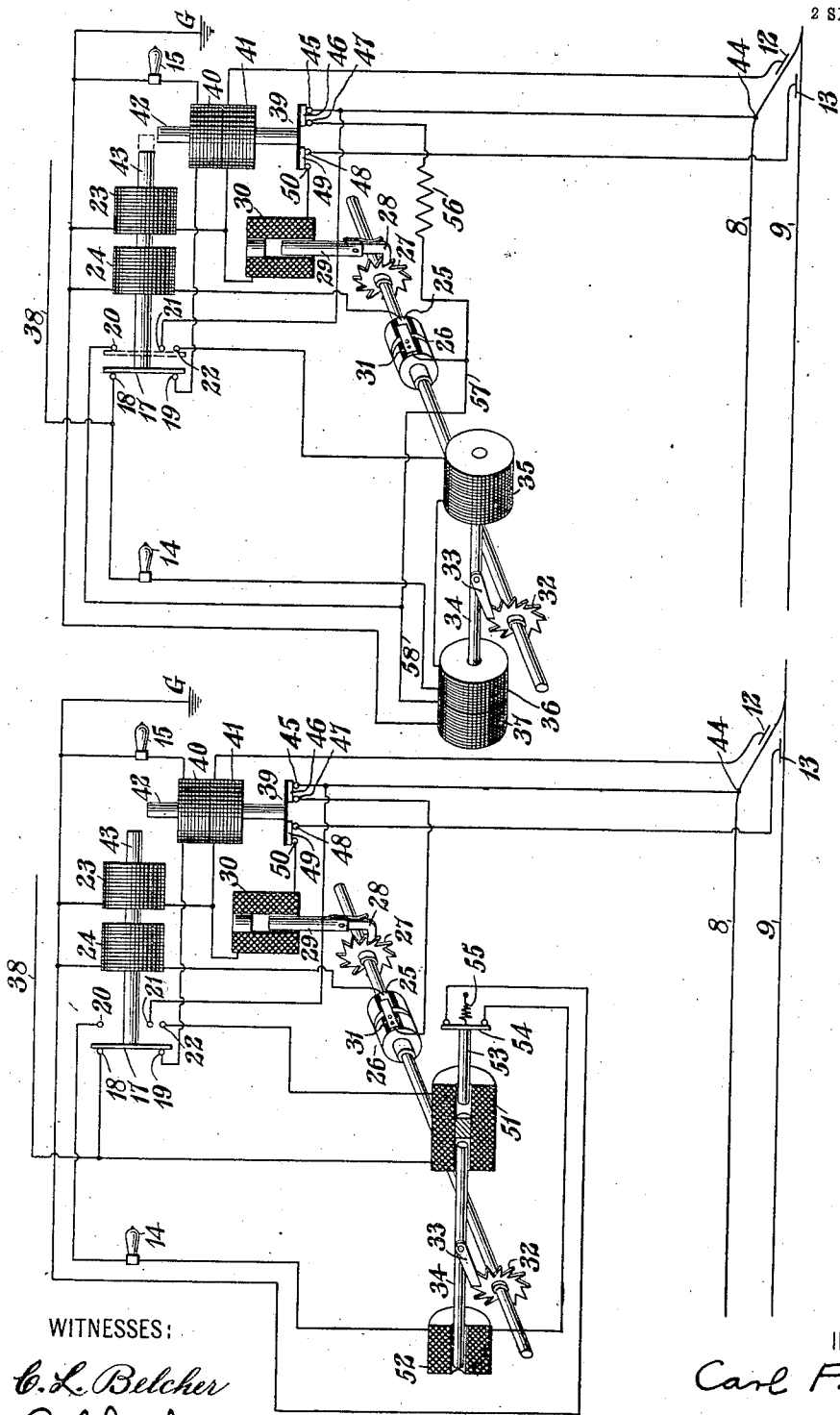


Fig. 3.

Fig. 2.

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ELECTRICAL SIGNAL SYSTEM.

No. 825,927.

Specification of Letters Patent.

Patented July 17, 1906.

Application filed August 2, 1905. Serial No. 272,368.

To all whom it may concern:

Be it known that I, CARL P. NACHOD, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrical Signal Systems, of which the following is a specification.

My invention relates to systems for operating signals in connection with railways, and particularly to such signal systems as are employed in connection with single-track electric railways having turnouts at convenient intervals to allow passage of cars.

The several objects of my invention are as follows: The provision of a symmetrical system of signaling, in which the signals may be operated by a car going in either direction; the provision of means for indicating at the turnouts whether or not the block of single track between is occupied by a car; the provision of means for setting a cautionary signal at the turnout in the rear and a danger-signal at the turnout in advance of a car entering the block of single track, whereby the direction of motion of a car in the block may be indicated at the turnouts; the provision of means for returning the signals to conditions of no indication when the block of single track is vacant or clear; the provision of means for recording the numbers of cars which enter and leave the block of single track in succession and for preventing the signals from indicating vacancy of the single track until the same number of cars have left the block going in the same direction as had entered it previously—i. e., until or unless the block is vacant; the provision of means for preventing a change in the indications of the signals while the single track is occupied, and the provision of means for automatically restoring the signals to the previous conditions of indication upon temporary cessation of the supply of current and its subsequent restoration.

Figure 1 of the accompanying drawings illustrates diagrammatically a system embodying my invention; and Figs. 2 and 3 illustrate, similarly, systems embodying modifications thereof.

The propelling-motors (not shown) of a car 1 are supplied with energy from a track-rail 2 and a trolley-conductor 3 through a trolley or current-collector 4, the track-rail being provided with turnouts at 5 and 6 and an intervening block of single track 7. The

trolley-conductor 3 is provided with branches 8 and 9 and 10 and 11, corresponding, respectively, to branches of the turnouts 5 and 6.

Located in proximity to the branches 8, 9, 10, and 11 of the trolley-conductor are terminal plates 12, 13, 12^a, and 13^a, respectively, that are adapted to be electrically connected therewith by means of the trolley-collector 4 during its passage beneath them. The indications of cautionary and danger signals 14 and 15, respectively, at a station 16, that is situated near the turnout 5, and of corresponding signals 14^a and 15^a at a station 16^a, that is situated near the turnout 6, are governed thereby. The signals may be, and preferably are, incandescent lamps of different colors, such as green for the cautionary signals and red for the danger-signals, though they may be of any other desired character, such as semaphores, which may be operated in any suitable manner.

Since the means for operating the signals are substantially alike at both stations, they will be described mainly with reference to station 16, subscripts being applied to the numerals which refer to like parts in station 16^a. These means comprise a switch 17, which during the absence of cars from the block of single track normally occupies the position shown in full lines, and thereby electrically connects terminal pieces 18 and 19. Operation of the switch to a position (shown in broken lines) to electrically connect contact-pieces 20, 21, and 22 is effected by means of a magnet-winding 23, that is energized when the car 1 leaves the turnout at 5 to enter the block 7 of single track, due to the connecting of the terminal plate 13 with the branch 9 of the trolley-conductor by means of the current-collector 4. A magnet-winding 24 is provided for restoring the switch 17 to the position shown in full lines, one terminal of the winding being connected to a movable terminal piece 25 of a switch 26, that is closed to establish the circuit of the winding 24 only when the block 7 is vacant.

The terminal piece 25 is rigidly connected with a ratchet-wheel 27, that is operated by means of a pawl 28, the pawl being attached to magnetizable core 29 of a winding 30, which is energized simultaneously with the winding 23 whenever the trolley-collector electrically connects the terminal plate 13 with the branch 9 of the trolley-conductor. Each time the winding 30 is energized the

ratchet-wheel is moved, by means of the pawl, a distance equal to the pitch of the teeth of the ratchet and the terminal piece 25 of the switch 26 is moved a corresponding distance.

5 Another movable terminal piece 31 of the switch is rigidly connected with a second ratchet-wheel 32, with which a pawl 33 is adapted to engage, the pawl being actuated by means of a magnetizable core 34 of three

10 windings 35, 36, and 37. The magnetizing effects of the windings 36 and 37 are approximately equal and opposed, so that when both windings are energized operation of the core 34 may be effected only by the winding 35.

15 The circuits of the windings 35, 36, and 37 are governed by the positions of switches 17 and 17^a in the two signal-stations, the contact-terminals 18 and 18^a of which are electrically connected by means of a conductor 38, all

20 three of the windings 35, 36, and 37 being energized when the switch 17 occupies the position shown in broken lines and switch 17^a occupies the position shown in full lines. When the switch 17^a is caused in a manner which

25 will be more fully explained hereinafter to occupy a mid-position—i. e., such a position that none of the contact-terminals 18^a to 22^a, inclusive, are electrically connected—the circuit of the windings 35 and 36 is interrupted,

30 and the magnetizing effect of the winding 37 prevails and causes actuation of the core 34 and of the pawl 33. Rotation of the ratchet 32 is thereby effected through a distance equal to the pitch of the teeth of the ratchet, and

35 the terminal 31 of the switch 26 is moved toward the terminal 25 a corresponding amount. The pawl 33 is restored to the position shown for the purpose of setting the apparatus for the next operation, owing to the prevalence

40 of the magnetizing effect of the winding 35, when the switch 17 occupies the position shown in broken lines and the switch 17^a again occupies the position shown in full lines. It will of course be understood that the operation of switch 26^a at the station 16^a will be

45 alike in all respects to that of switch 26 if the corresponding governing conditions are established conversely at the stations.

As additional means to those already described for governing the circuits of the windings 23, 24, and 30 a switch 39, having operating magnet-windings 40 and 41, is provided, the circuit of the winding 40 being governed by the switches 17 and 17^a and connection

55 of the terminal piece 12 with the branch 8 of the trolley-conductor serving to establish the circuit of the winding 41. Switches 17 and 39 are so arranged with reference to each other that when the switch 39 is open switch

60 17 may be moved only to a mid-position and will be prevented from connecting contact-terminals 20, 21, and 22. In the present case one end of a magnetizable core 42 of the switch 39 is raised into the path of movement

65 of magnetizable core 43 of the switch 17, and

thereby shortens its travel, though evidently any other suitable means may be employed for preventing the switch 17 from occupying the position shown in broken lines when the core 42 is raised.

70 While the car 1 occupies a turnout, the signal-operating devices are in the conditions indicated by full lines, except core 34, which is in the left-hand position, and a circuit is established from any suitable point of connection

75 44 with the trolley-conductor 3 through contact-terminal 45, conducting-segment 46, contact-terminal 47 of switch 39, terminal pieces 31 and 25 of switch 26, and restoring magnet-winding 24 of the switch 17 to the ground

80 at G, the switch 17 being thereby maintained in position to connect contact-terminals 18 and 19. When the car 1 leaves the turnout at 5 to enter the block 7 of single track and the trolley-collector connects terminal plate 13

85 with branch 9 of the trolley-conductor, a circuit is established from the terminal plate 13 through contact-terminal 48, conducting-segment 49, contact-terminal 50 of switch 39, operating magnet-winding 30, and operating

90 magnet-winding 23 of the switch 17 to the ground at G. Energizing of the winding 30 causes operation of the pawl 28 and rotation of the ratchet 27 through a distance equal to the pitch of the teeth of the ratchet.

95 The terminal pieces 25 and 31 of the switch 26 are thereby separated a corresponding amount, and the circuit of the restoring magnet-winding 24 of the switch 17 is interrupted. This operation occurs each time the terminal

100 piece 13 is connected to the trolley-conductor. The magnet-winding 23 then causes the switch 17 to move to the position shown in broken lines, and a circuit is established from point 44 through switch 17

105 by way of contact-terminals 21 and 20 and magnet-winding 37 to the ground at G. Another circuit is established simultaneously from the point 44 through the switch 17 by way of contact-terminals 21 and 22, magnet-

110 windings 35 and 36, green-light or cautionary signal 14, conductor 38, contact-terminals 18^a and 19^a of switch 17^a, magnet-winding 40^a of the switch 39^a, red-light or danger signal 15^a, to the ground at G'. The magnetiz-

115 ing effects of the windings 36 and 37 oppose and neutralize each other, and the winding 35 causes the core 34 to operate to the right and to set the pawl 33 in engagement with one of the teeth of the ratchet 32 in readiness for

120 operation thereof. Energizing of the magnet-winding 40^a causes the switch 39^a to open, and thereby prevents the establishment of the circuits through windings 30^a and 23^a and also through winding 24^a, while

125 the block of single track is occupied by a car. Thus when the switch 39^a is open the signals are locked against changes in their indications, which might otherwise be caused by the connection of terminal piece 13^a with

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the branch 11 of the trolley-conductor by means of a trolley-collector carried by a car moving from the turnout at 6 to the block 7 of single track. When the devices occupy the positions just described, the green light 14 at the station 16 indicates that the block 7 of single track is occupied and that the car is moving away from the turnout at 5, and the red light 15^a at the station 16^a indicates that the car is proceeding toward this station. No further operation of the devices occurs until the car 1 enters the turnout at 6 and the trolley-collector 4 connects terminal plate 12^a with the branch 10 of the trolley-conductor, whereby a circuit is established from the terminal plate 12^a through magnet-winding 41^a of the switch 39^a and magnet-winding 23^a of the switch 17^a to the ground at G'. Switch 39^a being open, its magnetizable core 42^a is raised, thereby preventing the core 43^a of the switch 17^a from being operated beyond a mid-position, as before described, on account of the energizing of the winding 23^a. The movement of the switch 17^a to a mid-position interrupts the circuit of the red lamp 15^a, of the winding 40^a, of the green lamp 14, and the windings 35 and 36. Extinguishment of the lamps 14 and 15^a indicates at both turnouts that the block of single track between is vacant. Deenergizing of the windings 35 and 36 permits the winding 37 to move the core 34 to the left, thereby causing the ratchet 32 to operate through a distance equal to the pitch of its teeth and also causing the terminal 31 of the switch 26 to be moved a corresponding distance, which, if only a single car had previously entered the block 7 of single track, would be sufficient to bring the terminals 25 and 31 into engagement again and effect closure of the switch. Closing of the switch 26 completes the circuit of the restoring magnet-winding 24 of the switch 17 and causes the switch to be returned to the position shown in full lines. Interruption of the circuit of the winding 40^a has no effect upon the position of the switch 39^a, because the winding 41^a is energized simultaneously with the winding 23^a and retains the switch in its uppermost position, while the terminal piece 12 is electrically connected with the trolley-conductor, the length of the terminal piece being such as to insure such connection for a period sufficient to permit operation of the switch 26. It will be observed then that the function of the winding 41^a is to prevent closure of the switch 39^a during this period and until the trolley-collector disengages the terminal plate 12^a. Upon deenergizing of the winding 41^a the switch 39^a is permitted to fall to its lowermost position, whereupon a circuit is established from the trolley-conductor 3 to the ground at G' by way of devices 45^a, 46^a, 47^a, 26^a, and 24^a. Energizing of the winding 24^a causes restoration of the switch 17^a to the

position shown in full lines. If a second car enters the block 7 of single track from the turnout 5 while the first car still occupies the block, the circuit of the magnet-winding 30 will be established, due to the connecting of the terminal plate 13 with the branch 9 of the trolley-conductor, and the pawl 28 will actuate the ratchet 27 and cause separation of the contacts 25 and 31 of the switch 26 a distance equal to twice that by which they were separated when only one car occupied the block. The magnet-winding 30 will be energized each time a car leaves the turnout at 5 to enter the block of single track, and the contacts 25 and 31 of the switch 26 will be separated a predetermined amount for each car so entering. The windings 41^a and 23^a at the signal-station 16^a will be energized and the circuits of the windings 35 and 36 at the signal-station 16 will be interrupted each time a car leaves the block of single track to enter the turnout at 6. The winding 37 then actuates its armature 34 and the pawl 33 to cause rotation of ratchet 32 and movement of the contact-terminal 31 of the switch 26 a corresponding distance toward the contact-terminal 25. By means of this arrangement the indications of the signals 14 and 15^a remain unchanged while the block of single track is occupied by a car, and any number of cars, not to exceed one less than the number of teeth on the ratchet, may occupy the block of single track simultaneously, but all must leave the block before the signal-lights 14 and 15^a become extinguished.

It will be observed that the arrangement of the circuits and of the operating devices at the two signal-stations are symmetrical, and consequently cars may operate in both directions and effect similar indications of the signals—i. e., a car may leave the turnout at 6, moving to the left, and in so doing cause indication by the cautionary signal 14^a at the station 16^a in the rear and indication by the danger-signal 15 at the station 16 in advance thereof. It is also to be noted that the means for restoring the signals to conditions of no indication are independent of gravity and the action of springs and that they depend for operation only upon the conditions of the controlling-switches 17 and 17^a, which switches are also actuated only by energizing of their corresponding operating magnet-windings. As a consequence the indication of the signals will be the same after a temporary cessation of current in the track and trolley circuit and the subsequent restoration thereof.

If a car enters the block 7 from the turnout 5 at the same time that another car leaves the block and enters the turnout at 6, the respective operations of the two parts of the switch 26 in directions to effect opening and closing thereof, resulting from connections of the terminal plates 13 and 12^a with

the trolley-conductor, do not interfere, as the operating devices and their circuits are independent of one another.

The system is susceptible of many modifications, and one which I have found useful is indicated in Fig. 2, in which the core 34 is provided with only two operating magnet-windings 51 and 52, respectively, the winding 51 being for the purpose of setting the pawl 33 in position to actuate the ratchet 32 and the winding 52 for the purpose of moving the pawl and causing actuation of the ratchet 32. The winding 51 is provided with a second movable portion 53 of its magnetizable core, which is adapted to effect opening of a switch 54, that is located in the circuit of the winding 52 and that is normally maintained closed by a spring 55. In this manner energizing of the winding 52 is prevented except when the winding 51 is de-energized.

Since the restoring magnet-winding 24 for the switch 17 is continuously energized when the block of single track is vacant, it may be desirable to introduce resistance into its circuit in order to reduce to a very small amount the current supplied thereto under these conditions. If this is done, provision should also be made for supplying more current to the winding to effect movement of the switch than is supplied to it when the switch occupies its normal position. In the modification of Fig. 3 a resistance 56 is connected between terminal pieces 47 and 31, respectively, of switches 39 and 26, which are closed when the block 7 is unoccupied, so as to establish a circuit between the point 44 of connection with the trolley-conductor and the ground at G through the winding 24 and the resistance 56. A connection 57 is also made between the terminal 31 of the switch 26 and terminal 58 of the magnet-winding 37, so that if the switch 26 is closed while the switch 17 occupies the position shown in broken lines a circuit will be established momentarily from the trolley-conductor at 44, through the switch 17, switch 26, and winding 24 to the ground at G, the circuit being interrupted by the movement of the switch 17. It will be noted that this circuit does not include the resistance 56, and consequently a greater force will be exerted by the winding 24 to effect movement of the switch than would be the case if the resistance were connected in circuit permanently.

If desired, the lamp 15 may be connected in shunt to the magnet-winding 40 instead of in series therewith, and the lamp 14 may be likewise connected in shunt to either one or both of the magnet-windings 35 and 36.

While the invention has been shown and described as applied to an electric-railway system, it will be understood that it may be applied as well to other systems and that

when a trolley-conductor is not employed the signals and the controlling devices therefor may be supplied from any other suitable source.

Other modifications of the system than those herein shown and described may obviously be made without changing the functions of the devices or altering in a substantial degree their modes of operation, and I therefore desire my invention to be construed, broadly, to cover such modifications.

I claim as my invention—

1. In a railway-signal system, the combination with turnouts, a block of single track, and cars that operate thereon, of means for automatically indicating at the turnouts the passage of cars therefrom to the single track, means for terminating such indications only after vacation of the single track by the corresponding number of cars, means for preventing changes in the indications while the block of single track is occupied by a car and a single auxiliary conductor that connects the means located at the respective turnouts.

2. In a railway-signal system, the combination with turnouts, a block of single track, and cars that operate thereon, of means located at the turnouts for indicating whether or not the single track is occupied, means for recording the numbers of cars which enter and leave the block of single track respectively and whereby termination of the indications is caused to occur only when the records of the numbers of cars entering and leaving the block agree, means for preventing changes in the indications while the single track is occupied by a car and a single auxiliary conductor that connects the means located at the respective turnouts.

3. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of a cautionary signal, a danger-signal, and controlling means therefor that are located at each turnout, a single auxiliary conductor that connects the controlling means, means for causing setting of the signals upon passage of cars from the turnouts to the block of single track, and means for causing restoration of the signals only upon passage therefrom of all of the one or more cars that may have previously entered the block.

4. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, means that are actuated upon the passage of cars from the turnouts to the block of single track for causing setting of a danger-signal at the station in advance of a car and of a cautionary signal at the station in the rear of a car, and

means for causing release of the signals only upon passage of all cars from the block of single track that had previously entered it.

5. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, means that are actuated upon the passage of cars from the turnouts to the block of single track for causing setting of the signals, and means that are similarly actuated for recording the number of cars that enter the block.

6. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, means that are actuated upon the passage of cars from the turnouts to the block of single track for causing setting of the signals, means that are similarly actuated for recording the number of cars that enter the block, and means that are actuated upon the passage of cars from the block of single track to the turnouts for recording the number of cars that leave the block and for causing release of the signals.

7. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, means that are actuated upon the passage of cars from the turnouts to the block of single track for causing setting of the signals, means that are similarly actuated for recording the number of cars that enter the block, and means that are actuated upon the passage of cars from the block of single track to the turnouts for recording the number of cars that leave the block, whereby release of the signals is prevented unless the respective records of the numbers of cars entering and leaving the block become equal.

8. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling setting of the signals, and magnet-windings for causing operation thereof respectively in opposite directions, one of which is energized upon the passage of cars from the corresponding turnout to the block of single track, and the other of which is energized upon the passage therefrom to another turnout of all the cars that had previously entered the block.

9. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-sta-

tions and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling setting of the signals, controlling magnet-windings therefor one of which is energized upon passage of cars from the corresponding turnout to the block of single track, and a switch for controlling the circuit of the other winding which is closed only during vacancy of the block of single track.

10. In a railway-signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling setting of the signals, controlling magnet-windings therefor one of which is energized upon passage of cars from the corresponding turnout to the block of single track, and a switch for controlling the circuit of the other winding which is caused to open upon passage of cars from the corresponding turnout to the block of single track and which is caused to close only upon passage therefrom to another turnout of the same number of cars as had previously entered the block.

11. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, and a controlling magnet-winding therefor that is energized and that causes opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track.

12. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, a controlling magnet-winding therefor that is energized and that causes opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track, and another controlling magnet-winding that causes closing thereof a predetermined amount each time a

car passes from the block of single track to the non-corresponding turnout.

13. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, a controlling magnet-winding therefor that is energized and that causes opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track, and means for preventing energizing thereof when the non-corresponding signal-controlling switch occupies a position to cause setting of the signals.

14. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, a controlling magnet-winding therefor that is energized and that causes opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track, and means for preventing energizing thereof when a car is proceeding in the block of single track toward the corresponding turnout.

15. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, that comprises independently-movable terminal members one of which is actuated upon passage of cars from the corresponding turnout to the block of single track, and the other of which is actuated upon passage of cars from the block of single track to the non-corresponding turnout.

16. In a railway signal system, the combination with turnouts, a block of single track

and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, and a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members one of which is actuated upon passage of cars from the corresponding turnout to the block of single track.

17. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, and a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members one of which is actuated upon passage of cars from the corresponding turnout to the block of single track and the other of which is actuated upon passage of cars from the block of single track to the non-corresponding turnout, the terminal members being brought into engagement with each other only when the same number of cars have vacated the block of single track as had previously entered it.

18. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members, and a controlling magnet-winding for one of the members which causes actuation thereof upon the passage of cars from the corresponding turnout to the block of single track.

19. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, that comprises independently-movable terminal members, and a controlling magnet-winding for one of the members which causes actuation thereof upon the passage of cars from the corresponding turnout to the block of single track.

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20. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions; the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members, a controlling magnet-winding for one of the members which causes actuation thereof upon the passage of cars from the corresponding turnout to the block of single track, and a controlling magnet-winding for the other member that causes actuation thereof upon the passage of cars from the block of single track to the non-corresponding turnout.

21. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members, a controlling magnet-winding for one of the members which causes actuation thereof upon the passage of cars from the corresponding turnout to the block of single track, means for causing actuation of the other member, and a magnet-winding for causing operation of the actuating means upon the passage of cars from the block of single track to the non-corresponding turnout.

22. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members, a controlling magnet-winding for one of the members which causes actuation thereof upon the passage of cars from the corresponding turnout to the block of single track, means for causing actuation of the other member, a magnet-winding for causing operation of the actuating means upon the passage of cars from the block of single track to the non-corresponding turnout, and another magnet-winding for causing restoration of the actuating means.

23. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, operating and restoring magnet-windings therefor, and a switch that prevents energizing thereof when the signal-controlling switch at the non-corresponding station occupies a non-corresponding position to that in the same station except upon passage of cars from the block of single track to the corresponding turnout and that also prevents full operation of the signal-controlling switch under like conditions.

24. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, operating and restoring magnet-windings therefor, and a switch located in the circuits thereof having an operating magnet-winding that is energized when the signal-controlling switch at the non-corresponding station occupies a position for causing display of the signals and a retaining-magnet winding therefor that is energized only upon the passage of cars from the block of single track to the corresponding turnout.

25. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for

controlling display of the signals, operating and restoring magnet-windings therefor; a switch for controlling the circuit of the restoring magnet-winding and a switch located in the circuits of the signal-controlling switch-windings that prevents full operation of the corresponding signal-controlling switch until after the operation of the restoring magnet-winding-controlling switch.

26. The combination with a branched supply-conductor and movable current-collectors to engage therewith, of signal-stations and a single auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, means for causing display of the signals upon the passage of current collectors from a branched to an unbranched portion of the supply-conductor, and means for preventing resetting of the signals except when all of the one or more current-collectors that had previously passed from a branched to an unbranched portion of the supply-conductor have passed from the unbranched portion to the next branched portion.

27. The combination with moving vehicles, signal-stations at intervals along the path of movement thereof, and a single signal-conductor that connects the stations, of means for causing display of signals at the stations when one or more vehicles are located between the same, and means for terminating display of the signals only when all of the one or more vehicles have vacated the interval between the stations.

28. The combination with moving vehicles, signal-stations at intervals along the path of movement thereof, and a single signal-conductor that connects the stations, of means for causing display of signals at successive stations when a car passes one of them toward the other, means for recording the passing of a given station by one or more vehicles and the arrival thereof at the next station and for causing termination of the display of the signals only when the records of the numbers of departing and arriving vehicles agree.

29. The combination with moving vehicles, signal-stations at intervals along the path of movement thereof, and a single signal-conductor that connects the stations, of means for causing display of signals at the stations when one or more vehicles are located between the same, means for terminating display of the signals only when all of the one or more vehicles have vacated the interval between the stations, and means for preventing the departure of a vehicle from a station that is being approached in the opposite direction by another vehicle from effecting a change in the indications of the signals.

30. The combination with moving vehicles, signal-stations at intervals along the path of movement thereof, and a single sig-

nal-conductor that connects the stations, switches at the stations for controlling display of the signals, and operating and restoring magnet-windings therefor the former of which are energized when vehicles depart from the corresponding stations, and the latter of which are energized only when the same number of vehicles have arrived at a given station as had previously departed from a preceding station.

31. The combination with moving vehicles, signal-stations at intervals along the path of movement thereof, and a single signal-conductor that connects the stations, switches at the stations for controlling display of the signals, operating and restoring magnet-windings therefor the former of which are energized when vehicles depart from the corresponding stations, and the latter of which are energized only when the same number of vehicles have arrived at a given station as had previously departed from a preceding station, and means for preventing energizing of said windings in a station that is being approached by vehicle.

32. The combination with moving vehicles, signal-stations at intervals along the path of movement thereof, and a single signal-conductor that connects the stations, switches at the stations for controlling display of the signals, and operating and restoring magnet-windings therefor the former of which are energized when vehicles depart from the corresponding stations, and the latter of which are energized when vehicles arrive at the non-corresponding stations.

33. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a signal-controlling switch, operating and restoring magnet-windings therefor, a switch in the circuits thereof and a magnet-winding therefor whereby the switch is maintained in open position when the block of single track is occupied by a car traveling toward the corresponding turnout.

34. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of means for automatically indicating at the turnouts the passage of cars therefrom to the single track, means for terminating such indications only after vacation of the single track by the corresponding number of cars, means for preventing the entering of the block by a car going in the opposite direction to one which already occupies the block from causing a change in the indications and a single auxiliary conductor that connects the means located at the respective turnouts.

35. In a railway signal system, the combination with turnouts, a block of single track, and cars that operate thereon, of means lo-

cated at the turnouts for indicating whether or not the single track is occupied, means for recording the numbers of cars which enter and leave the block of single track respectively and whereby termination of the indications is caused to occur only when the records of the numbers of cars entering and leaving the block agree, means for preventing the entering of the block by a car going in the opposite direction to one which already occupies the block from causing a change in the indications and a single auxiliary conductor that connects the means located at the respective turnouts.

36. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, and means for causing opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track.

37. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, and means for causing opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track, and means for preventing operation thereof when a car is proceeding in the block of single track toward the corresponding turnout.

38. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations and an auxiliary conductor that connects the stations, each station comprising a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, means for causing opening thereof a pre-

determined amount each time a car passes from the corresponding turnout to the block of single track, and means for causing closing thereof a predetermined amount each time a car passes from the block of single track to the non-corresponding turnout.

39. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, a controlling magnet-winding therefor that is energized and that causes opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track, and means for preventing energizing thereof when the non-corresponding signal-controlling switch occupies a position to cause setting of the signals.

40. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, a controlling magnet-winding therefor that is energized and that causes opening thereof a predetermined amount each time a car passes from the corresponding turnout to the block of single track, and means for preventing energizing thereof when a car is proceeding in the block of single track toward the corresponding turnout.

41. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding, that comprises independently-movable terminal members one of which is actuated upon passage of cars from the corresponding turnout to the block of single track, and the other of which is actuated upon passage of cars from the block of single track to the non-corresponding turnout.

42. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, and a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members one of which is actuated upon passage of cars from the corresponding turnout to the block of single track.

43. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signal, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, and a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members one of which is actuated upon passage of cars from the corresponding turnout to the block of single track and the other of which is actuated upon passage of cars from the block of single track to the non-corresponding turnout, the terminal members being brought into engagement with each other only when the same number of cars have vacated the block of single track as had previously entered it.

44. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-

winding that comprises independently-movable terminal members, and means whereby one of the members is actuated upon the passage of cars from the corresponding turnout to the block of single track.

45. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary signal and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members, a controlling-magnet winding for one of the members which causes actuation thereof upon the passage of cars from the corresponding turnout to the block of single track, and means for preventing energizing thereof when a car is proceeding in the block of single track toward the corresponding turnout.

46. In a railway signal system, the combination with turnouts, a block of single track and cars that operate thereon, of signal-stations at the turnouts each of which comprises a cautionary and a danger signal, a switch for controlling display of the signals, magnet-windings for controlling operation of the switch respectively in opposite directions, the circuit of one of which is established upon the passage of cars from the turnouts to the block of single track and vice versa, a switch located in the circuit of the other magnet-winding that comprises independently-movable terminal members, means whereby one of the members is actuated upon the passage of cars from the corresponding turnout to the block of single track, and means whereby the other member is actuated upon the passage of cars from the block of single track to the non-corresponding turnout.

In testimony whereof I have hereunto subscribed my name this 31st day of July, 1905.

CARL P. NACHOD.

Witnesses:

OTTO S. SCHAIERER,
BIRNEY HINES.