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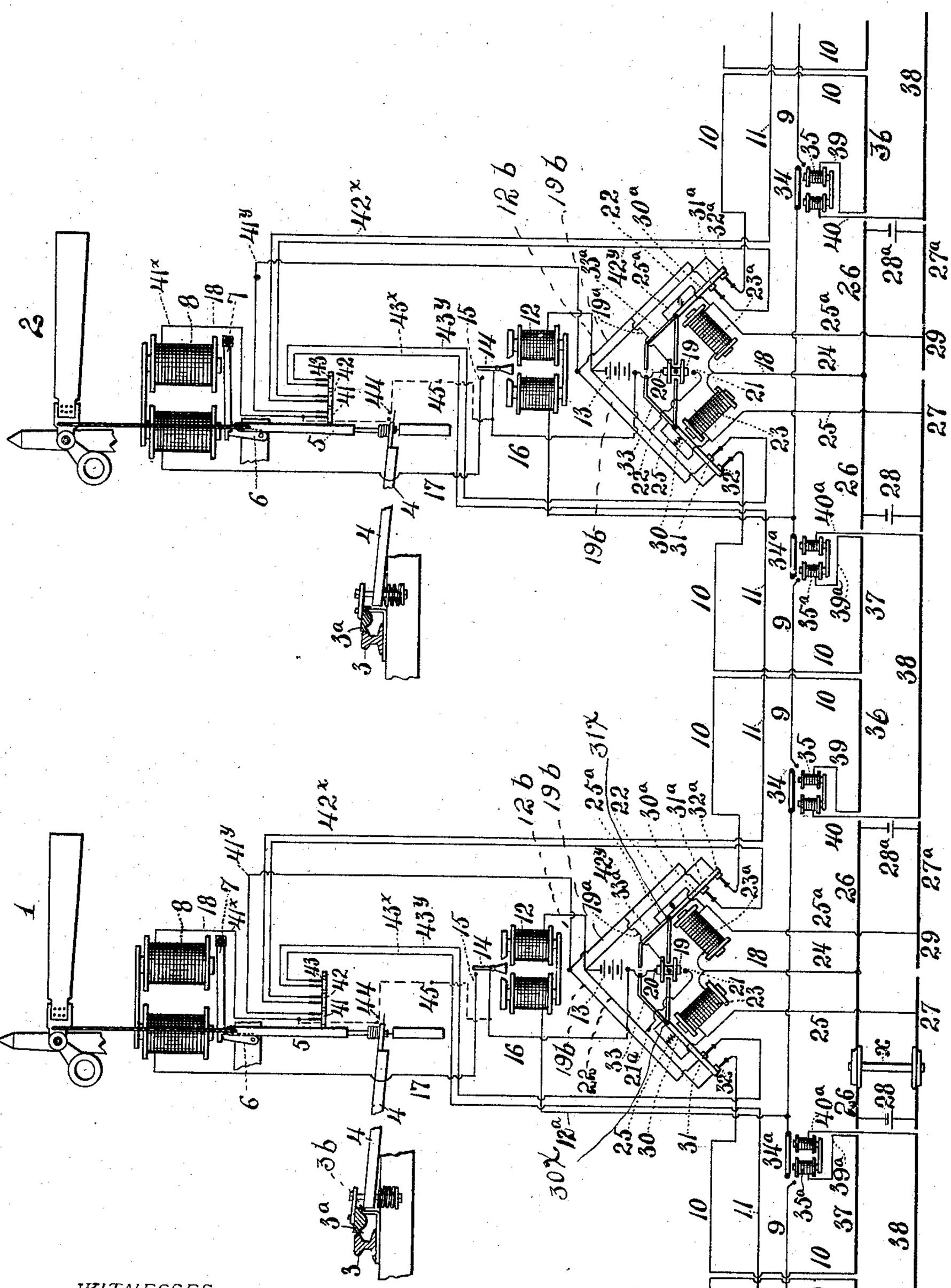
S. W. HUFF.

RAILWAY ELECTRIC SIGNAL.

(Application filed Dec. 6, 1898.)

(No Model.)



WITNESSES

W. E. Allen.

A. Paul Sickey.

INVENTOR

Slaughter W. Huff.

By Harvey B. Knight & Co.

Attorney.

UNITED STATES PATENT OFFICE.

SLAUGHTER W. HUFF, OF BALTIMORE, MARYLAND.

RAILWAY ELECTRIC SIGNAL.

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To all whom it may concern:

Be it known that I, SLAUGHTER W. HUFF, a citizen of the United States, and a resident of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Railway Electric Signals, of which the following is a specification.

My invention relates to automatic block-signal systems, and has for its object to improve the plan of operation as well as the details in the arrangement of the circuits, whereby the system will be rendered less subject to disturbance from leakage, more effective and economical in use, and less costly in installment.

My present invention employs a series of signals located at selected points along the road, each signal being preferably provided with an automatic device for setting it to the position which it is to normally assume and with an electrical tripping mechanism which is set in operation by the presence of the train at a given point, provided certain conditions exist in the track to be guarded.

My present invention relates to the controlling electrical connections whereby the battery-power at a given station is cut off from the main line and the equilibrium in the latter is destroyed by the approach of the train for the purpose of rendering a distant battery effective as to the signal approached; also, means whereby in a single-track system responsive to trains in either direction the controlling connections, after having been energized by an approaching train to trip the signal, will not after the signal has been set by the train again trip it when in departing from the signal the train reaches the tripping-point for trains coming in the opposite direction; also, to an arrangement whereby the intervening track, the condition of which is a controlling factor in the operation of the system, may be successfully introduced as a portion of the main circuit without the undue leakage that has generally heretofore made such arrangements impracticable.

My invention will be fully understood upon reference to the accompanying drawing, which is a schematic view of a section of a railroad and the signals, the operating connections, and the automatic setting devices arranged in connection therewith.

1 2 represent adjacent signals of a system, which are preferably of conventional type, mounted upon posts, and will be described as being arranged to stand normally at "danger." I prefer to use in connection with these signals automatic setting mechanism, which consists of suitable track devices 3^a, fulcrumed at 3^b, adjacent to a rail 3, so as to receive motion from the treads of passing wheels, and by a suitable lever connection 4 set the signal 1 or 2 at "danger," or, if the signal is counterbalanced, permit it to assume the danger position as the train passes the station. Automatic setting devices are well known, and no particular form need be specifically referred to here.

6 represents a detent for holding the setting connections 5 in elevated position, and this detent is under control of the armature 7 of the tripping-magnet 8.

The primary object of the system is to release the detent 6 by producing some effect upon the electromagnet 8 as a train approaches the signal, provided the track ahead of the train is in proper condition. This is accomplished, preferably, by having the armature rest normally in engagement with detent 6, so that by energizing the magnet 8 the armature 7 will be raised out of such engagement and the signal will drop to "safety;" but so long as said magnet is deënergized the signal stands at danger position.

The system employs three main wires 9, 10, and 11, coextensive with the system, and at each signal a signal-relay 12, connected by wire 12^a with main wire 9 and by wires 12^b and 22 with main wire 10, and a main battery 13, connected by wires 22 and switches 32 32^a with the wire 10, and by wire 19^a, wires 19^b, and switches 31 31^a with wire 11. The signal-relays 12 are preferably polarized, so that they are responsive only to a current in a given direction, and the batteries 13 are so connected that each signal-relay 12 will be affected only by the flow of current from battery 13 at a distant signal. When the relay 12 is acted upon, it throws its armature 14 upon a contact 15, and thus closes a circuit from battery 13 through wire 16, armature 14, contact 15, wire 17, tripping-magnet 8, and wire 18, circuit-break 41, wire 41^y, wires 19^b, wire 19^a, and switch 19, back to battery

13. In order to disturb the equilibrium or balanced effect of having the batteries 13 connected by like poles to the wires 10 and 11, I employ the switch 19, which rests normally against contact 20, but which is moved through armatures 30 or 30ª on their pivots 30× or 31× against a contact 21 in a wire 22 by the deenergizing of magnet 23 or 23ª upon the approach of a train to the signal. By thus breaking at contact 33 battery 13 at the signal being operated is cut out from the return-wire 11; but the track-wire 10, over which current comes from the distant battery, and the relay 12 to be energized by said distant battery-current are connected with the return-wire 11 through said wire 22, contact 21, and switch 19. At the same time the switch 19 by breaking at contact 20 deënergizes magnet 12, allowing its permanently-polarized armature 14 to touch at 15, and thus serve the further purpose of throwing the main battery 13 at the switch being operated upon into a tripping-circuit and closing said circuit, which is as follows: from battery 13 over 16, 14, 15, 17, 8, 18, 41, 41ʸ, 19ᵇ, 19ª, 19, 21, 21ª, and 22 back to battery—that is to say, by connecting the wire 18 with the opposite pole of the battery 13 to that which is connected to the wire 16. By this means I am enabled to use the main battery 13 for operating the signal instead of having a special battery for that purpose.

The switch 19 is controlled by the presence of rolling-stock through the medium of the following instrumentality:

23 23ª represent a pair of relays, interposed by means of wires 24, 25, and 25ª between the rail-sections 26, 27, and 27ª, which make up the lead-sections on opposite sides of the signal. Between the distant ends of the rails of the lead-sections are located batteries 28 and 28ª, while between meeting ends of the sections 27 27ª, and therefore between the wires 25 25ª, is an insulated joint 29. The armatures 30 30ª of the relays 23 23ª both control the switch 19. Hence if a train reaches the position indicated by the wheels *x* the battery 28 is short-circuited, the armature 30 is released, and the switch 19 is thrown to the position opposite to that shown at the signal 1. This establishes the connections which operate the signal-magnet and closes the battery 13 into the tripping-circuit, as just described. In order to prevent energizing the magnet 12 by a current from the rear of the train, the armature of the initiating-relay at the signal being operated likewise opens a switch 31 in the return-wire 11. As a further safeguard against possible leakage from the battery at the signal in rear of the train, which might serve to trip the signal, and thus give a false impression of the condition of the track ahead of the train, the armature 30 of the initiating-relay 23 is further provided with a switch 32, which opens up the track-wire 10, running to the rear. It has been seen that the switch 19 is thrown from the position indicated at the signal 1 by the operation of either the armature 30 or the armature 30ª of the initiating-relays. The switches 31 and 32, however, are operated only by the armature 30, and additional switches 31ª and 32ª are employed in the corresponding parts of the return-wire and track-wire, extending in the opposite direction from the signal 1, so that the operation will be precisely similar in whichever direction a train approaches the signal.

It has been stated that the system is preferably operated in connection with an automatic setting device. In order that the signal may not be tripped by the train leaving the signal in either direction by operating the mechanism which trips on the approach of a train from that direction, the relays 23 and 23ª are rendered interlocking by means of contacts 33 33ª, carried by their respective armatures 30 30ª. Hence when the wheels approach the signal—say from the left—cut out the battery 28, deënergize relay 23, and then pass over the insulating-joint 29 and cut out the battery 28ª and deënergize the relay 23ª before the train has passed off the lead-section on the side of approach, the contacts 33 and 33ª touch and close a circuit around the insulating-joint 29, through wire 25, contact 33, contact 33ª, and wire 25ª, so that thereafter the presence of the wheels on lead-section 27ª will not only short-circuit battery 28ª but continue the short circuit of battery 28 and leave both the relays 23 and 23ª deënergized. Under this condition we have not only the switches 31 and 32 opened to prevent current coming from the signal in rear end of the train, but likewise the switch 31ª opened, which robs the signal-relay 12 of its current and causes the armature 14 to open the tripping-circuit, and hence the signal cannot be released.

I will next describe the circuits employed for rendering the operation of the parts already described subject to the condition of track ahead of the train which is approaching the signal to be operated. For convenience in describing these connections I will call the wires 9, 10, and 11 the "tripping-wire," the "track-wire," and the "return-wire."

It has been seen that the energizing of the polarized relay 12 in the proper direction must be effected by a distant battery 13, (I will refer for purposes of illustration to the battery as "signal 2,") operating over the wire 12ᵇ in reverse or ineffective direction through distant relay 12, distant wire 12ª, tripping-wire 9, and local wire 12ª, to local relay 12 in effective direction, then back over local wire 12ᵇ, local wire 22, local wire 21ª, local switch 19, local wire 19ª, local wire 19ᵇ, contact 31ª, return-wire 11, distant wires 43ˣ 43ʸ, distant contact 31, distant wires 19ᵇ 19ª, switch 19, and contact 20. But the tripping-wire 9 has located in it a number of breaks 34, which must be closed before any current can affect the relay 12. To render the closing of these breaks 34 dependent upon the condition of the track

between the signals, they are brought under control of relays 35, and these relays are in turn so interposed in the track-wire 10 that the presence of wheels upon any part of the track between the signals outside of the lead-sections will short-circuit one or more of the relays and prevent their being energized. This is accomplished by dividing the respective rails of track between the lead-sections of adjacent signals into a number of insulated sections and connecting said sections up in series with the track-wire and the relays. For instance, the portion of the track outside the lead-sections between the signals 1 and 2 is divided up into insulated sections 36, 37, and 38, of which adjacent ends of the sections 36 and 37 are connected to terminals in the track-wire 10, while distant ends of the sections 36 and 37 are connected through wires 39 or 39^a, relays 35 or 35^a, and wires 40 or 40^a with the opposite ends of the section 38. The ends of the section 38 which are respectively connected to the sections 36 and 37 through the wires 39 40 and 39^a 40^a are substantially opposite to the distant ends of the sections 36 and 37, so that as soon as rolling-stock enters upon either the section 36 or 37 one of the relays 35 will immediately be short-circuited and one of the breaks 34 left open, the circuit of signal-relay 12 opened, and the signal being approached will remain at "danger."

From the foregoing description it will be seen that the track-wire, with its interposed parts, is connected by the initiating-relay with the return-wire, so as to make a complete circuit, as follows: from battery 13 at signal 2, through wire 22, contact 32, wire 10, section 37, wire 39^a, relay 35^a, wire 40^a, section 38, wire 40, relay 35, wire 39, section 36, wire 10, contact 32^a, wire 22, contact 21, switch 19, wire 19^a, contact 31^a, and return-wire 11, through switch 42 back to battery 13. It will also be seen that if the track between the signals is clear and the insulated sections of said track remain intact, so that the track-relays 35 and 35^a are energized, a signal-actuating circuit over the tripping-wire 9 is closed. The track-wire 10 and the return-wire 11, with intervening parts, thus become what may be termed an "exploring-circuit."

41 42 43 represent breaks which are opened by the tripping of the signal and closed by the setting of the signal. The break 41 is connected by wires 41^x 41^y with the wire 18 of the tripping-circuit, break 42 is connected by wires 42^x 42^y with the return-wire 11 on the right-hand side of the signal, and break 43 is connected by wires 43^x and 43^y with the return-wire 11 on the left-hand side of the signal. The effect of making these breaks by the tripping of the signal is to open both the circuits over which the battery-power is being expended after the tripping of the signal is accomplished, so that however long the train may be that is passing the signal or for whatever length of time the train may stand upon the lead-section adjacent to a signal battery-power is expended only for the time necessary to trip the signal. These switches also serve to render the signals interlocking, since by the openings they make in the return-wire 11 it becomes impossible for current to flow from a signal that is in a safety position.

44 represents a break likewise closed by the raising of the signal and which closes a torpedo-circuit 41^x, switch 44, torpedo 45, connecting with wire 16, thus shunting the tripping-circuit. The closing of the break 44, however, is only momentary as the setting device moves upward and is not effective as to said break when the setting device moves downward. The result is that if the circuit closed by the said break is already closed at the break 41 the raising of the setting devices will explode the torpedo 45 through the following circuit: from battery 13 through wire 16, torpedo 45, torpedo-break 44, wire 41^x, switch 41, wire 41^y, wire 19^a, switch 19, contact 21, and wire 22 back to battery 13. Hence in the event that the signal stands at "danger" and the engineer attempts to pass the signal the track device will be raised and the torpedo 45 explodes, and an audible signal will thus be given in addition to the visual signal; but inasmuch as the completion of the audible-signal circuit depends on switch 19 being in contact with point 21, which can only result from relay 23 or 23^a being deënergized by the presence of a train or other short-circuiting means on one of the lead-sections, it follows that the torpedo cannot be fired by the mere lifting of the arm 4 or closing of the torpedo-switch 44.

Having thus fully described my invention, what I claim as new therein, and desire to secure by Letters Patent of the United States, is—

1. In a railway electric signal, the combination of a plurality of signals, relays for controlling said signals, continuous main-circuit conductors between which said relays are introduced, batteries for the respective signals arranged in multiple between the main conductors, and an initiating-relay for each signal having contacts arranged to open the main circuit as the rolling-stock approaches each signal and to cut out the battery at said signal; substantially as herein explained.

2. In combination with a series of signals, a series of relays for controlling said signals, continuous main conductors between which said relays are introduced, and a series of batteries arranged in multiple between said main conductors and with like poles connected to the same conductors; of an initiating-relay for each signal, and switches controlled by said initiating-relays, whereby, upon the approach of the rolling-stock to a given signal, the main conductors are broken toward the rear of the train, and the local battery is cut out of the main circuit and thrown into the local signal-circuit, substantially as herein explained.

3. In a railway electric signal system, the

combination of a plurality of signals each having a tripping-magnet and a signal-relay controlling the circuit of said magnet, a battery for each signal, continuous main conductors including all of the batteries and signal-relays, and in which said batteries are introduced in multiple, whereby each signal-relay is energized by the battery from a distant point, and means whereby the flow of current from the distant battery is subject to the condition of the intervening track, the same consisting of a circuit formed in part by the rails of the track to be guarded, and a relay or relays in said track-circuit controlling breaks in the main circuit; substantially as and for the purposes set forth.

4. In combination with a plurality of signals, controlling relays and batteries for the respective signals, common main conductors between which all of said relays and batteries are introduced, the batteries being introduced in multiple, and means for controlling the flow of current over the main conductors by the condition of the track intervening between the signals and for preventing loss of current by leakage in the track, consisting of a number of insulated sections dividing the track into short sections of conductor and a relay for each track-section electrically connected therewith and with all the relays and series, substantially as herein explained.

5. In combination with a series of signals, a series of controlling-relays, a series of batteries and common continuous conductors between which the relays are introduced and between which the batteries are connected in multiple; of a series of track-relays introduced in one conductor of the main circuit, a track divided into a number of insulated sections, wires connecting the insulated sections of the track and the track-relays in series, and a third wire forming a return for the track-relay circuit; substantially as herein explained.

6. In combination with a series of signals, a series of controlling-relays, a series of batteries and common continuous conductors between which the relays are introduced and between which the batteries are connected in multiple; of a series of track-relays introduced in one conductor of the main circuit, a track divided into a number of insulated sections, wires connecting the insulated sections of the track and the track-relays in series, a third wire forming a return for the track-relay circuit, and an initiating-relay at each signal controlled by a local battery and the presence of rolling-stock, and which operates a switch for closing the track-circuit around the battery at the signal being operated; substantially as herein explained.

7. In an electric railway signal system, the combination of signals, a tripping-circuit including relays actuating said signals, an exploring-circuit controlling breaks in the tripping-circuit and itself controlled by the condition of track between signals, and suitable means for initiating the operation of said parts upon the approach of a train to a signal; substantially as herein explained.

8. In a railway electric signal system, the combination of a tripping-circuit, having means whereby it controls the signals, an exploring-circuit having means whereby it controls the tripping-circuit and is itself controlled by the condition of track to be guarded against, and an initiating-circuit having means whereby it is controlled by the presence of a train and including relays whereby it controls the other circuits; substantially as herein explained.

9. In a railway electric signal system, the combination of a series of signals, continuous main conductors coextensive with the system, a polarized relay and a battery introduced in series at each signal, the batteries being arranged with like poles connected to the same main conductors, means whereby said main conductors are controlled by the condition of the track between signals, and initiating means at each signal which is actuated by the presence of rolling-stock and which in turn closes a main circuit around the local battery and subjects the polarized relay to the influence of the battery at a distant signal, substantially as herein explained.

10. In combination with a signal and its automatic setting and tripping mechanism; of means for operating the tripping mechanism upon the approach of rolling-stock to the signal and preventing the operation of said tripping mechanism by the departure of the rolling-stock the same consisting in interlocking relays controlled by the presence of rolling-stock on the respective sides of the signal, and an electrical connection between the sections of the track on opposite sides of the signal, which is normally broken, but which is closed by the simultaneous action or interlocking of the relays, substantially as explained.

11. In a railway electric signal system, the combination with signals and main circuits, relays and batteries controlling said signals; of means consisting of a relay, a circuit composed in part of the respective rails of the lead-section on the side of approach to the signal, a battery electrically inserted between the respective rails and holding said relay normally energized, but short-circuited by the presence of rolling-stock to deënergize said relay, and switches moved by the deenergizing of said relay to close the controlling-circuit of the signal, substantially as explained.

12. In combination with an electric signal system, a track instrument controlling the signal at each station, the same comprising interlocking relays connected between the relays of the lead-sections of the track, an insulated joint dividing one rail electrically, batteries connected in multiple between the

rails of said lead-sections and normally energizing the respective relays, but short-circuited by the presence of rolling-stock for deenergizing said relays, and a normally broken electric conductor between the insulated rails of the two lead-sections, which conductor is closed by the simultaneous deënergizing of both relays, substantially as explained.

13. In a railway electric signal, the combination of a section of track to be protected, a signal located at one end of said section of track, an actuating-battery located at the other end of said section distant from said signal, a divided circuit leading from said distant actuating-battery to the signal for the transmission of the actuating-current, and consisting of three conductors, to wit, two conductors arranged respectively for directly controlling the signal and for indicating the condition of the track-section, the latter controlling the continuity of the former, and the third wire forming a completion of circuit with both of the two wires first named, substantially as herein explained.

14. In a railway electric signal, the combination of a section of track, a signal and a controlling-battery located at the respective ends of said section of track, and three conductors extending from the battery to the actuating mechanism of the signal, to wit, a tripping-conductor having breaks therein, a track-conductor including the section of track and controlling the breaks in the tripping-conductor, and a continuous conductor forming a completion of circuit to the battery in conjunction with both the tripping-conductor and the track-conductor, substantially as explained.

15. In a railway electric signal, the combination of a section of track, a signal with suitable actuating mechanism located at one end of said track-section, an actuating-battery located at the other end of said track-section, and three conductors leading from the battery to the actuating mechanism of the signal, one of which controls the actuating mechanism and has breaks arranged therein, another of which is controlled by the condition of track to be protected and in turn is controlled by the breaks in the conductor first named, and the third of which conductors forms a common return or completing wire for circuits over the two conductors first named; and an insulating track instrument which is controlled by the approach of rolling-stock to the signal and which controls a switch introduced in the circuit through the actuating mechanism of the signal, substantially as herein explained.

16. In combination with a railway electric main signal and means for automatically setting the same by the passage of a train, an electrically-controlled supplemental or audible signal actuated by the setting of the main signal in conjunction with a switch controlling its circuit; said switch being itself controlled by the pressure of rolling-stock near the signal.

SLAUGHTER W. HUFF.

Witnesses:
WALTER ALLEN,
KATHERINE E. MANNING.