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AUTOMATIC SIGNALING SYSTEM FOR RAILWAYS.

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To all whom it may concern:

Be it known that I, WILLIAM N. OWEN, of Conway, in the county of Faulkner, State of Arkansas, have invented certain new and useful Improvements in Automatic Signaling Systems for Railways; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to signaling systems and appliances for use on railways, and particularly to that class of systems and appliances wherewith the engineer is signaled or given a warning indicating a dangerous condition or that the track is blocked by appliances located within the cab or within that part of the car or train where the engineer is stationed.

The objects of the invention are to provide a system and appliances for carrying the same into effect which shall be simple and comparatively cheap to install and maintain, which shall be automatic and certain in action, and which will be effectual in preventing collisions of trains running in either the same or opposite directions, as well as in preventing accidents due to misplaced switches or inability of the engineer to see the customary visual track-signals.

In carrying the invention into practice the track is divided into blocks of any desired length if the system be employed as the sole controlling system, or the blocks may correspond to the ordinary blocks if the system is used in connection with and supplementary to the ordinary block system employing manually-set visual signals. In the latter instance the system of the present invention serves as a check on the block-station operators and warns the engineer in case of a slip or a mistake on the part of the operator or a failure of the manually-set apparatus to operate properly.

In carrying the invention into practice a single line-wire only between block-stations is employed, with an earth-return, and by the employment of polarized relays and of automatic cut-outs operated electrically from the train or moving vehicle through suitable fixed and movable contact-pieces the apparatus will be set as the train or vehicle passes each block-station to give an alarm to a following train at that station and to alarm an approaching train at a station ahead of the train, and at the same time the apparatus previously set in rear of the train is automatically unset, so as to permit the passage of a train without giving an alarm. In other words, as a train proceeds along a track the apparatus at each end of the block in which it is traveling is set so as to bar the entry of another train into that block and as the train proceeds it automatically sets and preserves this condition in each succeeding block and restores the apparatus to normal conditions after it passes out of each block, provision being made to prevent the train from giving an alarm to its own engineer by reason of the setting of the apparatus by itself.

The invention consists in certain novel details of construction and combinations and arrangements of parts, all as will be described, and pointed out particularly in the appended claims.

In the accompanying drawings, Figure 1 is a diagrammatic representation of a section of track with three block-stations, one switch, and the diagrammatic representation of the portion of the system located on a locomotive or train. Fig. 2 is a similar view of one station on an enlarged scale. Fig. 3 is a view corresponding to Fig. 1 (the track being omitted) and showing a block system in duplicate with the stations alternating in order to doubly insure the blocking of trains. Fig. 4 is a diagrammatic view showing the operation of a system in connection with a visual or manually-set signal. Fig. 5 is a diagrammatic view of the switch mechanism shown in Fig. 1, but on an enlarged scale. Fig. 6 is a detail sectional view of the switch-contact illustrated in Figs. 1 and 5. Fig. 7 is a diagrammatic view of a crossing-alarm for use in connection with the system.

Similar letters of reference indicate the same parts.

Referring particularly to Fig. 1, the letter A indicates the track-rails of a single-track.
road, B the locomotive or car, and C C C, three block-stations, which, it will be understood, may be any desired distance apart, usually with sufficient distance to insure entire safety with trains running in either the same or opposite directions in each block.

A line-wire D connects each station, both ends of said line-wire being normally grounded at D' through an electrically-operated cut-out or switch D', the electromagnet D' controlling such switch being connected on one side with the line D, extending from the station in both directions to the other stations, and on the other side with a fixed contact piece or rail D', located alongside the track and in position to be engaged by or make electrical contact with a shoe or other preferred form of contact-piece D' on the locomotive or train. The contact piece or shoe D' is one terminal of a partial circuit on the locomotive embodying a battery D, the other terminal being grounded through the wheels of the locomotive. With such an arrangement an impulse will be sent from the battery D' over the line D in each direction from any station whenever the locomotive passes that station, because at the sending-station the controlling-magnet D' will automatically shift the switch D' at that point so as to cut out the ground connection, while at the other stations the circuit will be completed to the ground through the switches, and the controlling-magnets D' at these stations will not be affected in any manner whatsoever.

Polarized relays E and E' are located in the line-wires D at each station, the armatures E' and E of such relays constituting switches for closing local alarm-circuits E' E' at each station, said local circuits E' E' including fixed contact pieces or rails F F', located alongside the tracks, but out of line with the contact-piece D'. One of said contact-pieces, F, is located in advance of the contact-piece D' along the track and the other, F', in rear thereof and in position to contact with a movable contact piece or shoe G on the locomotive or train before and after the contacts D' D' have been in engagement. This shoe G is in electrical connection with a battery I on the locomotive, the opposite side of said battery being grounded through the wheels of the locomotive, as indicated at i. The opposite ends of the local or alarm circuits are grounded through the armatures E' E', as indicated at e, it being understood, of course, that each local circuit may be completed only when the locomotive is in position for the shoe G to engage the contact-piece F or F', as the case may be, and this will occur before the locomotive reaches position to complete a circuit through the contact-piece D' and again after it has passed the latter at each station.

The alarm-circuit on the locomotive includes a switch K, controlling local alarm-circuit and bell or other suitable device K', which will be operated whenever the circuit is completed and will remain in operation until the switch K is shifted out of engagement by the engineer. Any well-known form of appliance may be employed for this purpose, and detailed description of the same is thought to be unnecessary.

The arrangement of the line-circuits D and polarized relays is such that the relay controlling the alarm-circuit on one side of the contact-piece D' (or, as I shall hereinafter term it, the "operating-contact") is in electrical connection with the polarized relay controlling the local circuit on the opposite side of the operating contact-piece D' at the next adjacent station, and these relays are therefore operated to simultaneously open or close the said local circuits, which local circuits will hereinafter be termed the "alarm-circuits," because they are the circuits which control the sounding of the alarm in the locomotive.

The operation of the simple embodiment of the invention heretofore described is as follows: A locomotive proceeding from left to right, Fig. 1, will first effect contact between the shoes F and G; but if the line is clear, as it should be in its normal condition, the polarized relay E at that station and E' at the next succeeding station has opened and held the switches E' with the alarm-circuits open, and no alarm will be sounded in the locomotive. When the locomotive has advanced far enough for the shoes or contacts D' D' to engage, an impulse will be sent over the line-wires D in each direction, the magnet D' cutting out the ground at the sending-station. Under such circumstances the direction of the current through the relay E at the sending-station is such as to cause it to operate to close the alarm-circuit and also to effect a similar operation of the relay E' at the next succeeding station, while the relay E at the sending-station will be operated to open the alarm-circuit E' by shifting the switch E', and at the preceding station the relay E will be similarly operated to open its alarm-circuit. This manipulation will leave at the sending-station or one which the locomotive is passing an alarm-circuit E' closed by the switch E' and ready to be completed should a following train reach that station before the setting-locomotive leaves the block, and it also closes an alarm-circuit at the next station, so that it will be completed should a locomotive running in the opposite direction first reach that station. In either instance an alarm will be sounded in an approaching locomotive should it attempt to pass the station at either end of the block in which the locomotive which set the signals is running and at the same time the locomotive which has set the signals in the block will itself so set the signals that no alarm will be given its own engineer when it passes the alarm-circuit contacts located between the controlling contacts of the block.
To make the system effective with locomotives running in opposite directions on the same track, each locomotive is provided with contacts D and G on both sides, and inasmuch as the operation of the relays is dependent not alone upon the sending of an impulse over the line, but also upon the character of the impulse—i.e., whether positive or negative—it is desirable to provide a convenient means for shifting the poles of the battery in the controlling-circuit, so that a locomotive proceeding in one direction will send a positive current to line over the controlling-circuit and a locomotive proceeding in an opposite direction will send a negative current to line over the controlling-circuit. As a convenient means for effecting this result a simple pole-changer L is located in the controlling-circuit on each locomotive, and the engineer will shift the same in accordance with the direction in which the locomotive is running. From this it follows that a locomotive proceeding from right to left in Fig. 1 or in the opposite direction to that previously described will send a negative impulse to line over the operating-circuit at each station, the effect of such impulse being to set the switch E at the station it is passing and also the switch E at the next station, so as to alarm an engineer of any other train attempting to enter the block from either direction, and at the same time such impulse operates to release the switch E at the station the locomotive is passing and also the switch E at the station previously passed.

In order to avoid the necessity of making the contact shoes or rails F and F’ unduly long, which might be necessary in order that an engineer would be warned in time to enable him to bring his locomotive to a stop before reaching the operating-contact D, it is preferred that supplemental contacts or rails F’F’ be located some distance from the main contacts or rails, but in electrical connection therewith, as illustrated in the drawings, Figs. 1 and 2.

With this arrangement an engineer approaching a station will be given a preliminary warning and may get his engine under control, so that he may stop with the alarm-contacts G and F or F’ in engagement, where he will remain until the alarm-circuit is broken by the locomotive or train in the block ahead.

To doubly insure an effective automatic system, as well as to provide a system which, with a full clear block may be left between each two running trains, the systems described in connection with Fig. 1 may be duplicated and the stations arranged alternately. In Fig. 3 such an arrangement is shown, the stations C and C’ being alternated with the stations X and X’. The two systems are duplicates and work independently, as described in connection with Fig. 1; but it is obvious that through this arrangement the distance between two adjacent stations must of necessity always be left clear, and trains can proceed only in alternate blocks without sounding the alarm which will apprise the engineer of the dangerous condition ahead.

Where the system is used to indicate the position of manually-set visual signals—such, for instance, as are employed in the usual block systems or at yard or switch entrances—the arrangement is such that the alarm-circuit is broken at the manually-controlled apparatus whenever the visual signals are set to indicate a clear track; but at other times the alarm-circuit will be completed by the locomotive and an alarm will be sounded to give the engineer warning. This arrangement may be employed also in connection with switches to indicate whether the switch be opened or closed.

In Fig. 4, M indicates an ordinary mast having semaphores at the upper end adapted to be set manually to indicate either a clear track or danger, as the case may be. m indicates levers for moving the semaphores, although it will be understood that these levers may be of any usual or preferred type, and the circuits, to be presently described, may be closed by such levers or any of the moving parts of the semaphore system. N indicates contacts with which the levers m engage to partially complete alarm-circuits, said circuits extending from the ground through the levers m to switches N’, formed by the armatures of polarized relays N, and from the switches N’ through contacts N and suitable electrical connections to rails or contact-pieces N’, corresponding in location to the contact-pieces F F’ of Fig. 1. The polarized relays N are controlled by operating-circuits grounded on one side of said relays and terminating in shoes or contact-pieces N’, located alongside the track at front and rear of the contact-pieces N and in position to engage with the operating contact-shoe D on the locomotive.

The arrangement is duplicated on each side of the semaphore, as shown in Fig. 4 of the drawings, and in operation a locomotive approaching from either direction will first send an operating-current from the contact D through the polarized relay and shift the switch-lever N into engagement with the contact N’, when if the semaphore is at the position of danger the circuit will be complete at the semaphore-mast and the alarm in the locomotive will be sounded as soon as the contact G engages the contact N, but if the semaphore be at a position indicating a clear track no alarm will be sounded. After the engine has passed the semaphore the contact D’ will engage the first one of the contacts N, but the polarized relay operated by this circuit requires a current of opposite polarity to close the alarm-circuit, and as a result the alarm-circuit at this side of a semaphore will be opened and no alarm will be sounded in the locomotive no matter what the position of the
semaphore or controlling trains running in the opposite direction may be. In other words, the relays on opposite sides of the semaphore are operated oppositely by currents of the same polarity, and after a locomotive has passed the semaphore in either direction its current will operate to open the switch in the alarm-circuit and no alarm will be given to its engineer. This arrangement permits a train to take a siding at the semaphore and another train to pass without sounding an alarm in either train after passing the semaphore.

In Figs. 5 and 6 a similar arrangement is shown for indicating the position of a switch. The circuit arrangement is exactly similar to the circuit arrangement upon either side of the semaphore in Fig. 4 and has been similarly lettered; but the switch contact (see Fig. 6) is preferably inclosed in a water-tight cylinder P, which may be filled with oil to prevent the entry of moisture, and the movable member P' enters cylinder through a stuffing-box P' and is adapted to engage a fixed contact P'' when the switch is in open position and to move out of engagement with said contact, so as to break the alarm-circuit, when the switch is closed. In Fig. 7 a crossing-alarm is illustrated, the letter Q indicating a bell in a local circuit at the crossing, said circuit being made or broken by a switch-arm Q', controlled by a polarized relay Q'. From the polarized relay Q' its operating-circuit extends along the track in each direction to an operating-magnet Q' and terminates in a contact piece or rail Q", with which the contact-piece D' on the locomotive is adapted to engage. A ground connection is made at each end of the circuit inside of the controlling-magnet through the armature Q' of the controlling-magnet Q'. In operation the operating-circuit on the locomotive sends an impulse through the circuit from the shoe or rail Q' as it approaches the crossing. This impulse first breaks the ground connection at that end of the circuit by making the magnet Q' operative and then renders the polarized relay effective to close the local bell-circuit, which latter remains closed until the locomotive passes the contact Q' on the opposite side of the crossing, when an impulse is sent through the operating-circuit in the opposite direction and the polarized relay is made effective to break the local bell-circuit.

In all the arrangements described it will be observed that by the simple expedient of reversing the polarity of the operating-circuit on the locomotive the system is efficacious with locomotives running in both directions, and thus the system may be applied to single-track roads without change or alteration, although it will be understood that where used in connection with double-track roads or roads on which the rolling-stock moves in one direction only the necessity for changing the polarity of the operating battery or circuit on said locomotive does not exist.

The whole system, it will be observed, requires but simple electrical appliances, and there is no complication of contacts, switches, or apparatus, a single line-wire between stations answering all purposes.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In a railway signaling system, the combination with an alarm-circuit including a switch and an operating-circuit independent of said switch including a polarized relay for opening or closing the switch, of the alarm-circuit, a battery for the operating-circuit and means on the moving vehicle for completing said operating-circuit to render the alarm-circuit effective and means on the moving vehicle for closing the alarm-circuit when rendered effective by the operating-circuit, substantially as described.

2. In a railway signaling system, the combination of an alarm-circuit including a switch, an operating-circuit independent of said switch including a polarized relay controlling said switch and a moving vehicle having an electric generator and circuit connections for completing the operating-circuit and also connections for completing the alarm-circuit when the switch is set by the operating-circuit; substantially as described.

3. In a railway signaling system, the combination of the fixed track appliances embodying an alarm-circuit, an operating-circuit including a polarized relay controlling the alarm-circuit, a contact-shoe forming a terminal of the alarm-circuit and a contact-shoe forming a terminal of the operating-circuit, of the moving vehicle having contact-shoes for cooperating with the first-mentioned shoes successively, an electric generator and circuit connections for completing the operating-circuit when the operating-circuit shoes are in engagement and for completing the alarm-circuit when the alarm-circuit shoes are in contact and the relay set by the operating-circuit; substantially as described.

4. In a railway signaling system the combination of the following instrumentalities, to wit: an alarm-circuit located partly in fixed position along the track and including a switch for making and breaking the same and located partly on the moving vehicle with shoes for completing said circuit when brought into contact by the moving vehicle, an operating-circuit independent of said switch including a polarized relay controlling the switch for the alarm-circuit and located partly in fixed position beside the track and partly on the moving vehicle and shoes for completing said operating-circuit, the shoes for completing the alarm and operating-circuit being brought
into engagement at different times by the movement of the vehicle along the track; substantially as described.

5. In a railway signaling system the combination with a track equipment embodying a partial alarm-circuit having a terminal shoe adjacent to the track and a switch for making and breaking said circuit, a partial operating-circuit embodying a controller for said switch, a magnetically-controlled switch in a ground connection and having a terminal shoe adjacent the track of a vehicle equipment embodying a partial alarm-circuit with a terminal shoe adapted to engage the terminal shoe of said alarm-circuit adjacent the track to complete the operating-circuit, break the ground connection and control the switch of the alarm-circuit; substantially as described.

6. In a railway signaling system the combination of the following instrumentalities, to wit: an alarm-circuit located partly in fixed position along the track and including a switch for making and breaking the same, and located partly on the moving vehicle with shoes for completing said circuit when brought into contact by the moving vehicle, an operating-circuit including a magnet controlling said switch, a ground connection, a switch in said ground connection, a magnet controlling the last-mentioned switch, a terminal shoe located alongside the track, a shoe on the moving vehicle for contact therewith and circuit connections including a generator also on the vehicle for completing the operating-circuit; substantially as described.

7. In a railway signaling block system the combination with stations each embodying the following instrumentalities, to wit: a partial alarm-circuit having a contact-shoe terminal in proximity to the track and an electrically-operated switch for making and breaking said circuit, an operating-circuit having a contact-shoe terminal in proximity to the track, an electrically-operated switch controlling a ground connection, and branches leading one to the ground connection at the forward station on the line and the other through the polarized relay to the ground-station at the rear station on the line, of an equipment on the moving vehicle embodying a partial alarm-circuit with a contact-shoe terminal for engaging the terminal of the fixed alarm-circuit shoe, an operating-circuit including a contact-shoe terminal for engaging the contact-shoe of the operating-circuit, said contact-shoes being so disposed that the alarm-circuit is completed prior to the completion of the operated circuit and generators in said circuits; substantially as described.

8. In a railway signaling block system, the combination with stations each embodying the following instrumentalities to wit: a partial alarm-circuit having a contact-shoe terminal in proximity to the track, a switch for making and breaking said circuit, an operating-circuit having a contact-shoe terminal in proximity to the track, an electrically-operated switch controlling a ground connection, branches leading one to the ground connection at the forward station on the line and the other to the ground connection at the rear station on the line, said operating-circuit including a polarized relay controlling the switch in the alarm-circuit, of an equipment on the moving vehicle embodying a partial alarm-circuit with a contact-shoe terminal for engaging the terminal of the fixed alarm-circuit shoe, an operating-circuit with a contact-shoe terminal for engaging the contact-shoe of an operating-circuit, said contact-shoe being so disposed that the alarm-circuit is completed prior to the completion of the operating-circuit and generators in said circuits; substantially as described.

9. In a railway signaling block system the combination with stations each embodying the following instrumentalities, to wit: a partial alarm-circuit having a contact-shoe terminal in proximity to the track and a switch for making and breaking said circuit, an operating-circuit having a contact-shoe terminal in proximity to the track, a ground connection, a switch controlling said ground connection, an electric magnet between the ground connection and shoe for operating said switch and breaking the ground connection, a polarized relay controlling the switch of the alarm-circuit and branches leading one to the ground connection at the forward station on the line and the other through the polarized relay to the ground-station at the rear station on the line, of an equipment on the moving vehicle embodying a partial alarm-circuit with a contact-shoe terminal for engaging the terminal of the fixed alarm-terminal shoe, a partial operating-circuit with a contact-shoe terminal for engaging the fixed operating-circuit contact-shoe, said contact-shoes being so disposed that the alarm-circuit is completed prior to the completion of the operating-circuit and generators in said circuits; substantially as described.

10. In a railway signaling block system, the combination with stations each embodying the following instrumentalities, to wit: two partial alarm-circuits having contact-shoe terminals in proximity to the track and switches for making and breaking said circuits, a partial operating-circuit having a contact-shoe terminal in proximity to the track, a ground connection, a switch controlling said ground
connection, an electromagnet between the ground connection and shoe for operating said switch and breaking the ground connection, branches leading one to the ground connection at the forward station on the line and the other to the ground connection at the rear station on the line and polarized relays in said branches controlling the switches in the alarm-circuits, of an equipment on the moving vehicle embodying a partial alarm-circuit with a contact-shoe terminal for engaging the fixed terminals of the partial alarm-circuits along-side the track, a partial operating-circuit with a contact-shoe for engaging the fixed contact-shoe of the operating-circuit, said contact-shoes being so disposed that the operating-circuit is completed at a point intermediate the points of engagement of the contact-shoes of the alarm-circuits; substantially as described.

11. In a railway signaling system the combination of the following instrumentalities, to wit; two alarm-circuits located partly in fixed position along the track and each including a switch for making and breaking the same, and located partly on the moving vehicle with shoes for completing said circuits when brought into contact by the moving vehicle, an operating-circuit having a fixed shoe-terminal, with branches each including a polarized relay controlling one of the alarm-circuit switches, a portion of said operating-circuit being located on the moving vehicle together with contact-shoes, a generator and a pole-changer in the operating-circuit on the moving vehicle; substantially as described.

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