A. R. MUTTON.

TRAIN SIGNAL.

APPLICATION FILED JULY 1, 1912.

1,066,748.

Patented July 8, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

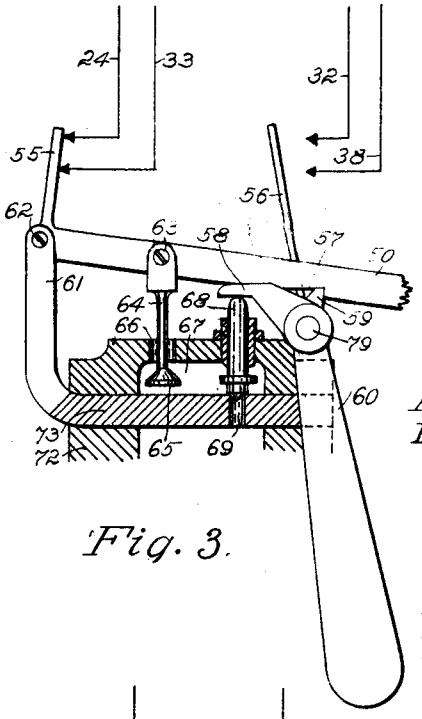


Fig. 3.

Fig. 4.

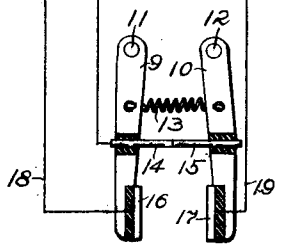
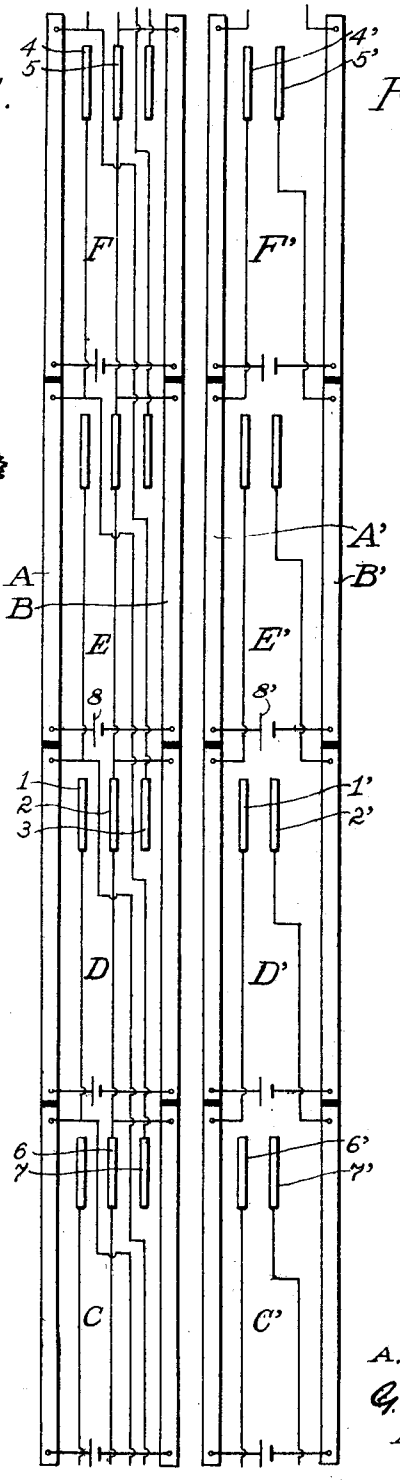


Fig. 2.



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2 SHEETS—SHEET 2.

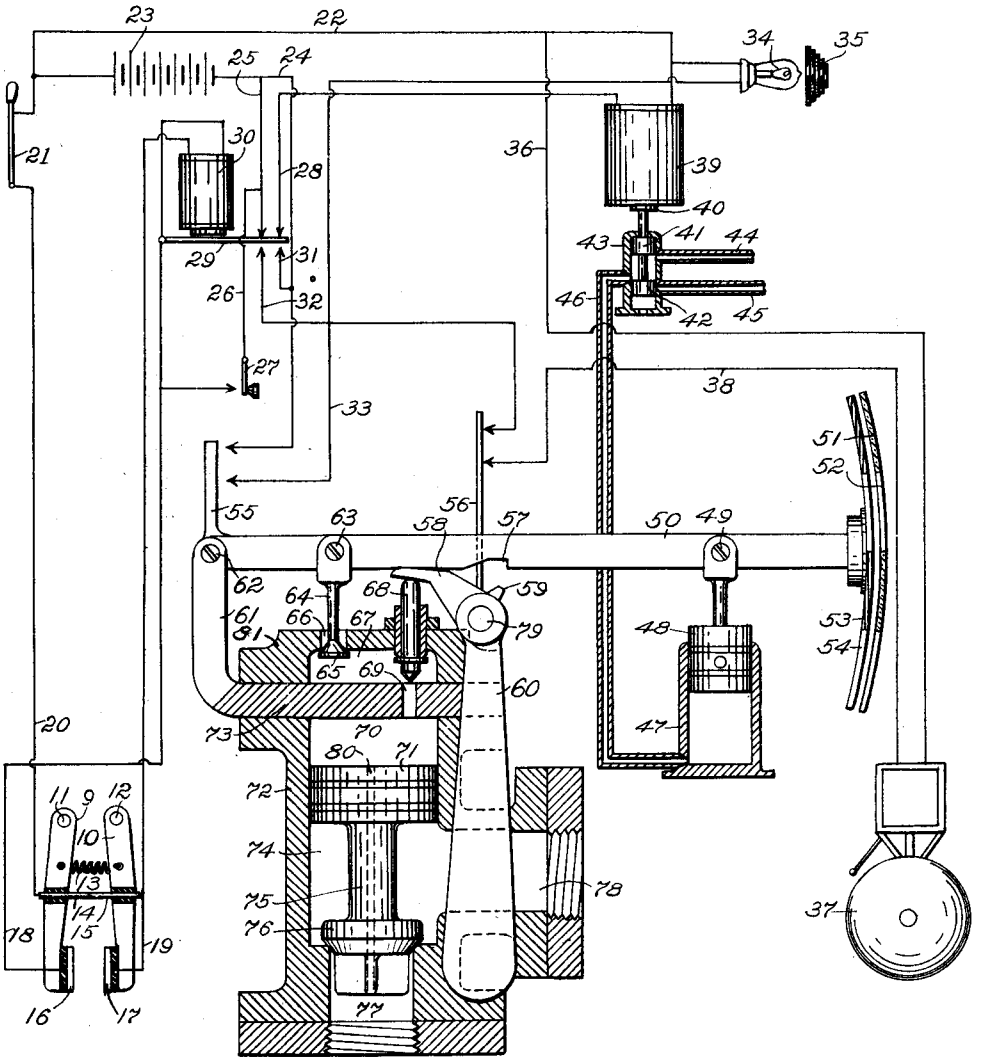


Fig. 5.

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UNITED STATES PATENT OFFICE.

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TRAIN-SIGNAL.

1,066,748. Specification of Letters Patent. Patented July 8, 1913.

Application filed July 1, 1912. Serial No. 706,964.

To all whom it may concern:

Be it known that I, ARTHUR R. MUTTON, a citizen of the United States of America, and a resident of Waterloo, Blackhawk county, Iowa, have invented certain new and useful Improvements in Train-Signals, of which the following is a specification.

My invention relates to improvements in actuating means for locomotive cab-signals and combined air-brake stops, and the objects of my improvements are these: to furnish in the cab of a locomotive suitable visual signals for either day or night use and also an audible alarm for the use of the engineer, and means for actuating the air-brake system of a train, all combined and co-actuated by suitable electric transmission means and automatic mechanical devices adequate to the purposes sought. These objects I have accomplished by the means which are hereinafter described and claimed, and which are illustrated by the following drawings, in which:

Figure 1 is a plan diagram, representing my system of electric contacts and their connections as used between and in coöperation with the rails of a single-track railway and adapted for the use of trains passing in either of opposite directions. Fig. 2 is a plan diagram, representing such a system as modified for use in coöperation with the rails of a double-track railway, or one in which the trains pass only in one direction thereover. Fig. 3 is a detail vertical transverse section of the valve-mechanism employed, in which the working parts are shown in the respective positions assumed by them when operating to actuate the cab-signals of a locomotive and to actuate the air-brakes of a train. Fig. 4 is an enlarged detail view of the locomotive contact-device adapted to coact with the track-contacts. Fig. 5 is a complete elevation, in diagrammatic form, of the electrical apparatus and mechanical working parts associated therewith, as carried in the cab of a locomotive for actuating cab-signals and actuating the air brakes, the mechanically-actuating parts being shown in vertical transverse section.

Similar characters and numerals of reference denote similar parts throughout the several views.

This application relates particularly to the track and engine electrical installations adapted to actuate the various signals of this device, and automatically operate the air-brake mechanism of the device and of a train.

This device is adapted to operate on the normal danger system, that is an electric current must pass through a relay and a solenoid of the engine equipment in order to show the way clear of obstruction and the electrical equipment in operative condition. In addition to this, the air-pressure in the air-reservoir must be complete in order that the mechanical or valve-regulating means of the device may operate normally to show a "way clear" indication, and be ready to set the air-brakes on any opening of said electrical circuit. So constructed and being in a normal working condition, any of the following will set the system in activity to stop the train upon which it is installed. Any body which may be so positioned across the rails to effect electrical conductivity therebetween, such as any iron tool or obstruction, the wheels and axles of another train, a hand-car, or car blown on the main line from a siding, a broken rail, loose connections, washed out track, open draw-bridge, weak or exhausted track or local cab battery, or anything else which would interfere with a closed circuit, will cause an automatic actuation of the mechanical parts to set the air-brakes on the engine and train. In case the air-pressure of the brake-system should for any reason very gradually lessen to become inefficient, the brakes would not be actuated, yet nevertheless the cab-signals will become visible or sound, as the case may be, to warn the engineer of danger indications.

The combined system comprises the following coöperating electric and mechanically working devices:

Track circuits.—Fig. 1 represents the track of a single-line railway adapted for passage of trains thereover in either of opposite directions. The sections of the track are insulated from each other at the ends, and each oppositely arranged pair of rails A and B of each rail section has a track-battery 8 cross-connected between them near one of their ends, conducting-wires being connected to the other ends of said rails and lead thence to their own respective contact-rails or plates, as follows: All the centrally located contact-rails 6, 2, 5, etc., are connected to a single medially located wire having

cross-connections to the rails B. Each opposite rail-section A, however, has an independent conducting wire leading to a contact-rail pertaining to that section. For instance, in part E of the rail-system, its rail-section A has conducting-wires leading in opposite directions into the system-parts C and F to the contact-rails 7 and 4 respectively. Each center contact-rail 6, 2 or 5 acts for all rail-sections B in either direction. A contact-rail (center) is located adjacent and opposite to each of the other contact-rails aforesaid pertaining to the rail-sections A.

Referring to Fig. 2, which is a plan diagram showing an adaptation of the system to track which is part of a double-track railway, and in which the trains pass in one direction only, it will be seen that some of the conductors and contact-rails are eliminated, leaving only those useful for the purpose, such as the contact-rails 6′, 1′ and 4′ for the rail-sections A′, and the contacts 7′, 2′ and 5′ for the opposite rail-sections B′. In this case, the contacts operate for the section immediately ahead of the section on which the train may be located, as the section C′ for the section D′, etc.

Engine equipment.—The engine equipment includes the following: A pair of lever-arms 9 and 10 on pivots 11 and 12 having at their lower ends and facing each other contact plates 16 and 17 respectively insulated therefrom and spaced apart. The arms are connected by means of a tension spring 13, and have each terminals 14 and 15 respectively normally in contact, and respectively insulated from the arms and in electrical contact with the wires 20 and 19 respectively, said wire 19 also leading to the contact-plate 17, while the contact-plate 16 is in circuit with a wire 18 leading to one terminal of a relay 30. The wire 19 leads to the other terminal of said relay, while the wire 20 leads through a switch 21 to one terminal of a local cab battery 23. By means of said connections and contacts the relay 30 is controlled by means of either the local battery 23, or by the track battery 8, as the case may be. The numeral 39 denotes a solenoid adapted to actuate a piston-valve composed of the connected spaced apart piston-heads 41 and 42 working in a small cylinder 43 and connected to its armature or core 40. The solenoid receives current only from the local battery 23 by way of a wire 22, and its circuit is closed and controlled through a wire 28 and the contact of the terminal of the latter with the pivoted armature 29 of said relay 30. The engine equipment also includes an electric-light and a movable visual target alarm and a bell or gong audible signal, and an automtic air-valve adapted to operate to set the air brakes of the train.

The automatic air-valve.—Referring especially to Fig. 5, the numeral 72 denotes a cylinder whose interspace 74 contains a reciprocatory plunger 75 having spaced-apart piston-valves 71 and 76, of differential areas at opposite ends. The lower piston-valve 76 is adapted to be seated to close a valve-seat 77 leading to the train air line of the train air-brake system. A port 78 in the side of the cylinder 72 and in communication with the interspace 74, exhausts to the atmosphere. The upper end of the cylinder 72 is closed by a plate 73 to leave thereunder and between it and the upper face of the piston-head 71 an interspace or chamber 70. A hollow casting 81 is seated upon said plate 73 and incloses an interspace 67 which is in communication with the other interspace 70 by means of a post 69 in said plate 73. In said casting 81 is a port 66 normally kept closed by means of a valve 65 on a stem 64, the latter pivoted at 63 to the lever 50, the latter pivoted at its left-hand end at 62 to an upright part 61 of the plate 73. A needle-valve 68 is seated in an opening in said casting 81 so as to be moved to close the orifice 69 in the plate 73.

The area of the lower face of the valve-head 76 is less than the area of the upper face of the upper valve-head 71. If we assume that the area of the head 76 is but one square inch while the area of the other head is three square inches, and further assuming that the air pressure below the head 76 is 60 pounds per square inch, the air in the chamber 70 above the head 71 would exercise a total pressure downwardly of 180 pounds as opposed to the upward pressure of sixty pounds on the lower head, and therefore the head 76 is held closed on its seat normally. The pressure in the chamber 70 is reached by admitting air from below the head 76 through a small central vertical bore 80 in said piston-body 76.

When the lever 50 is held in a horizontal position, as shown in Fig. 5, the small valve-head 65 is drawn up by it to close the port 66, but if anything is done to depress said lever, the valve 65 moves downwardly opening said port allowing the compressed air in the chamber 70 to escape by way of the port 69 through the chamber 67 and said port 66. Since the said ports are larger in area than the small bore 80 in the piston-body 75, the air in the chamber 70 will escape faster than air will be admitted through the bore 80, until the pressure above the head 71 will be less in total amount than that on the lower head 76, when the piston-body 75 will rise letting air move from below said head 76 to the port 78 and thence to the atmosphere, which operation sets the brakes and stops the train. This process of air equalization of pressures in not instantaneous, in fact is

gradual enough to permit the engineer to learn the situation because of the bell and visual alarms sounding at the same time, whereby he may use the following means to control the brakes until such time as he may wish to apply them himself.

The numeral 60 denotes a lever arm pivoted at 79 to the casting 81 and having an integral or fixed cam-head 58, and also a fixed detent 59 at its upper end. The engineer may shift this lever-arm or handle 60 to the right far enough to cause its detent 59 to become engaged in the notch 57 on the lower edge of the lever 50, while the cam-head 58 which rests upon the upper end of the needle-valve stem 68, pushes the latter down to close the port 69.

Solenoid actuated valve.—Referring to the small cylinder 43 and the connected piston heads 41 and 42, the numeral 44 denotes a pipe leading from the compressed-air reservoir into said cylinder, while the pipe 45 is an exhaust vent, and on the opposite side of the cylinder a pipe 46 leads to communicate with another cylinder 47 under a piston 48 whose stem is pivotally connected to the lever 50 at 49. When the piston-head 41 is down the port of the pipe 44 is closed and the other piston-head 42 is also down leaving the exhaust-pipe open so that the air can exhaust from under the piston 48 through the pipe 46. When the solenoid 39 is in circuit its core 40 lifts with the said piston-heads 41 and 42, letting air into the cylinder 43, pipe 46 and cylinder 47, and closing the exhaust pipe 45, and as the pistin 48 rises, it lifts up the lever 50 to a normal horizontal position.

Visible target signal.—This is used in daylight, and is composed of two parts, one stationary in front and the other fixed on the right-hand end of the lever 50 immediately behind the other, but moving up and down with said lever. The stationary part comprises fixed horizontal strips alternately arranged, of any opaque white substance and clear transparent glass as shown at 51 and 52 respectively. The movable part comprises alternated strips of like dimensions of red and of white material respectively, as shown at 53 and 54. When the lever 50 is in its normal horizontal position, as shown in Fig. 5, the white strips 54 are behind and are seen through the transparent strips 52 presenting in front a uniformly white appearance to the target, but when the lever 50 lowers, the red strips 53 fall to be seen through the strips 52, giving the target a very striking barred red and white appearance to indicate danger.

Bell and light signals.—The bell or gong alarm 37 is in circuit with the battery 23 by means of the conductors 22 and 36, and through the conductor 38 the bar 56 projected from the handle 69, the conductor 32, armature 29 and conductors 31, 24 to battery. The electric-lamp 34 behind a red glass cover 35 is in electric circuit by means of the wires 22 to said battery, and the conductor 33, projection 55 on the lever 59, conductor 24 back to battery.

Operation.—When the engine equipment is normal, circuit is closed from the battery 23, switch 21, wire 20, contacts 14, and 15, wire 19, relay 30 to the point where the wire 18 connects with the armature 29, through the armature to the first point of contact and back to the battery, the armature being held up by the energized relay. At the same time circuit is completed through the solenoid 39 from the left side of the battery, the wire 22, then returning by wire 28, armature 29, wire 25 to the battery. The core of the energized solenoid being lifted, the piston-heads 41 and 42 are actuated to admit air into the cylinder 47 as above described. Assuming that the train in progress brings its contact-plates 16 and 17 into contact with the contact-rails 6 and 7 respectively, the shoes 16 and 17 would be spread apart enough to open the circuit between the terminals 14 and 15, and the relay 30 would lose its magnetism and control over its armature 29, which would drop. Circuit would be completed however from the track-battery 8 along section-rail A, then over the wire from this rail to contact-rail 7 and to contact-plate 17, up wire 19 through the relay and down wire 18 to contact-plate 16 to contact-plate 6, thence back to battery 8, thus maintaining the engine circuit and equipment in a normal condition. When the contact-plates 16 and 17 leave the contact-rails 6 and 7, the tension of the spring 13 acts to close the circuit between the terminals 14 and 15. The device thus remains normal at all times, unless interrupted by any of the following causes: If there should be a train or similar conducting obstruction ahead which would short-circuit the current from the track-battery 8 through the wheels and axles of the train or through the conducting obstruction, the relay 30 would become demagnetized, the armature 29 fall, breaking the circuit through the wire 28 and solenoid 39, and the core of the latter with its connected piston-heads 41 and 42 would drop to permit air to escape from the cylinder 47. The lever 50 would then drop, finally automatically setting the air-brakes. As the armature 29 dropped, it closed a circuit through the conductors 31 and 32 while the arm 55 has been swung to the right closing the circuit with the conductors 24 and 33, and these actions together with the simultaneous swinging of the arm 56 to the right to close the circuit with the conductors 32 and 38, caused a lighting up of the lamp 34 and also an actuation of the gong alarm 37. Since an appreciable interval elapses be-

fore said mechanism would cause the setting of the air-brakes, and since the engineer would be advised by the light and bell alarm, or the target signal, of the broken circuit, he could act in this interval to prevent the setting of the brakes till he could control the train to stop at a point desired, by moving the handle 60 to the right, to act upon the valves as above described. It will be understood that when he shifts the handle 60 the contact will be broken between the bar 56 and the terminal of the wire 38, to stop the gong alarm, but the light signal 34 and the target will continue to show danger indications until everything becomes automatically cleared. When the engineer perceives the alarm indications and checks the application of the brackets in the manner described, he proceeds with caution into the next block. If during that time, the obstruction has removed, or the train ahead has moved from the sections ahead, such as E, and F, the contact-plates of his engine will engage with the contact-rails 2 and 3 respectively, causing current to pass the relay 30, closing the armature 29, energizing the solenoid, and by this means restoring through the above described intermediate actuating apparatus, everything into its normal condition. When necessary to test the electrical conductivity of the cab battery and electrically actuated devices, it may be done by opening the switch 21 and then closing the key 27 from the wire 26 to the wire 18.

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

1. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control terminals for said section electrically connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging-contacts for said control terminals carried by a train, signal mechanisms on the train electrically connected with said bridging contacts, a normally closed compound circuit including a source of current, a relay, and said bridging-contacts, and actuating means included in said circuit adapted to act when said relay is deënergized by a break in the track circuit to operate said signals to indicate danger.

2. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control terminals for said section electrically connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging-contacts for said control terminals carried by a train, signal mechanisms on the train electrically connected with said bridging contacts, a normally closed compound circuit including a source of current, a relay, and said bridging-contacts, and actuating means included in said circuit adapted to act when said relay is deënergized by a break in the track circuit to operate said signals to indicate danger and being irresponsive to a renewal of the train current therethrough so as to hold the signals to indicate danger until reset by renewal of the track current through said bridging contacts.

3. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control terminals for said section electrically connected with opposite rails of another of the sections, a pair of separable elastically connected bridging contacts for said control terminals carried by a train, signal mechanisms on the train electrically connected with said bridging contacts, a normally closed compound circuit including a source of current, a relay, and said bridging-contacts, actuating means included in said circuit adapted to act when said relay is deënergized by a break in the track circuit to operate said signals to indicate danger and means for resetting said actuating means to render certain of said signal mechanisms inactive.

4. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of each section, a control terminal in each section electrically connected to one of the rails of the same section and connected to each other by a continuous conductor, other control terminals in each section located on each side of the first mentioned terminal and spaced apart therefrom, one of the second-mentioned terminals being connected by means of a conductor to a rail in a section in advance and the other by a conductor to a rail in a section to the rear thereof on the side opposite to the said rail connections of the terminals on said continuous conductor, a pair of separable elastically-connected bridging contacts for one of the first and one of the second mentioned track terminals carried by a train, signal mechanisms on the train electrically connected with said bridging-contacts, a normally closed compound circuit including a source of current, a relay, and said bridging-contacts, and actuating means included in said circuit adapted to act when said relay is deënergized by a break in the track-circuit to operate said signals to indicate danger.

5. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of each section, a control terminal in each section electrically connected to one of the rails of the same section and connected to each other by a continuous conductor, other control termi-

nals in each section located on each side of the first mentioned terminal and spaced apart therefrom, one of the second-mentioned terminals being connected by means of a conductor to a rail in a section in advance and the other by a conductor to a rail in a section to the rear thereof on the side opposite to the said rail connections of the terminals on said continuous conductor, a pair of separable elastically-connected bridging-contacts for one of the first and one of the second-mentioned track terminals carried by a train, signal mechanisms on the train electrically connected with said bridging-contacts, a normally closed compound circuit including a source of current, a relay, and said bridging-contacts, actuating-means included in said circuit adapted to act when said relay is deënergized by a break in the track-circuit to operate said signals to indicate danger and being irresponsive to a renewal of the current therethrough so as to hold the signals to indicate danger until reset by renewal of the track-current through said bridging contacts.

6. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of each section, a control terminal in each section electrically connected to one of the rails of the same section and connected to each other by a continuous conductor, other control terminals in each section located on each side of the first-mentioned terminal and spaced apart therefrom, one of the second mentioned terminals being connected by means of a conductor to a rail in a section in advance and the other by a conductor to a rail in a section to the rear thereof on the side opposite to the said rail connections of the terminals of said continuous conductor, a pair of separable elastically-connected bridging contacts for one of the first and one of the second mentioned track terminals carried by a train, signal mechanisms on the train electrically connected with said bridging contacts, a normally closed compound circuit including a source of current, a relay, and said bridging-contacts, actuating means included in said circuit adapted to act when said relay is deënergized by a break in the track-circuit to operate said signals to indicate danger, and means for resetting said actuating means to render certain of said signal mechanisms inactive.

7. In combination, adjacent track rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control terminals for said section electrically connected with opposite rails of another of the sections, a pair of separable elastically connected bridging-contacts for said control terminals carried by a train, a normally closed compound circuit including a source of current and a relay on the train, in circuit with said bridging-contacts, electro-responsive devices, means in said compound circuit adapted to actuate said devices, display means associated with each of said electro-responsive devices, a motor part for brake control, and means for connecting said motor part to be governed by one of the electro-responsive devices of said circuit.

8. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control-terminals for said section electrically connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging contacts for said control terminals carried by a train, a normally closed compound circuit including a source of current in circuit with said bridging contacts, electro-responsive devices, means in said compound circuit adapted to actuate said devices, signaling mechanisms and display devices associated with each of said electro-responsive devices, a motor part for brake control, means for connecting said motor part to be governed by one of the electro-responsive devices of said circuit and means for resetting said motor part connections to render the motor part inactive.

9. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control-terminals for said section electrically connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging-contacts for said control terminals carried by a train, a normally closed compound circuit including a source of current in circuit with said bridging-contacts on the train, electro-responsive devices, means in said compound circuit adapted to actuate said devices, signaling mechanisms including a sounding apparatus associated with each of said electro-responsive devices, a motor part to be governed by certain of the electro-responsive devices of said circuit, and means for resetting said motor-part connections to render the motor-part and said sounding apparatus alone inactive.

10. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control-terminals for said section electrically-connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging-contacts for said control-terminals carried by a train, a normally closed compound circuit including a source of current in circuit with said bridging-contacts on the train, electro-responsive devices, means in said compound circuit adapted to actuate said devices, a signaling mechanism compris-

ing a stationary part composed of alternated bands of opaque and transparent substances and a part movable past the stationary part and covered with alternated bands of contrasted colors of like shape and dimensions as the transparent bands of the stationary part, said movable part being associated with and actuated by said electro-responsive devices.

11. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control-terminals for said section electrically-connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging-contacts for said control-terminals carried by a train, a normally-closed compound circuit including a source of current in circuit with said bridging-contacts, electro-responsive devices, means in said compound circuit adapted to actuate said devices, signaling mechanisms including a sounding alarm and a two-part target display-means, the latter comprising both fixed and movable targets, the movable target located behind the fixed target, and having its adjacent surface barred transversely with contrasting colors, the fixed target being formed of alternated transparent substance and opaque substance of the same color as one of the colors on the movable target, said movable target and said sounding-alarm being associated with said electro-responsive devices.

12. In combination, adjacent track-rail sections divided by insulation, a source of current connected across the rails of a section, a pair of separated control-terminals for said section electrically-connected with opposite rails of another of the sections, a pair of separable elastically-connected bridging-contacts for said control terminals carried by a train, a normally closed compound circuit including a source of current in circuit with said bridging-contacts, electro-responsive devices, means in said compound circuit adapted to actuate said devices, signaling devices including, first; an electric lamp, second; an electrically-actuated sounding alarm, and third, a two-part target signal, including a fixed part of one color having transparent parts, and a part movable in the rear of said fixed part and having its adjacent surface of two contrasted colors of which one is that of the fixed part, said signaling devices being associated with said electro-responsive devices and adapted to be actuated thereby when the track-circuit is broken, to light the lamp, sound said alarm, and shift the movable part relatively to the fixed part of the target to display the contrasting color of the movable through the transparent places of the fixed target.

Signed at Waterloo, Iowa, this 21st day of June, 1912.

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