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E. C. WILEY.

ELECTRIC SIGNALING APPARATUS FOR RAILWAYS.

No. 514,398. Patented Feb. 6, 1894.

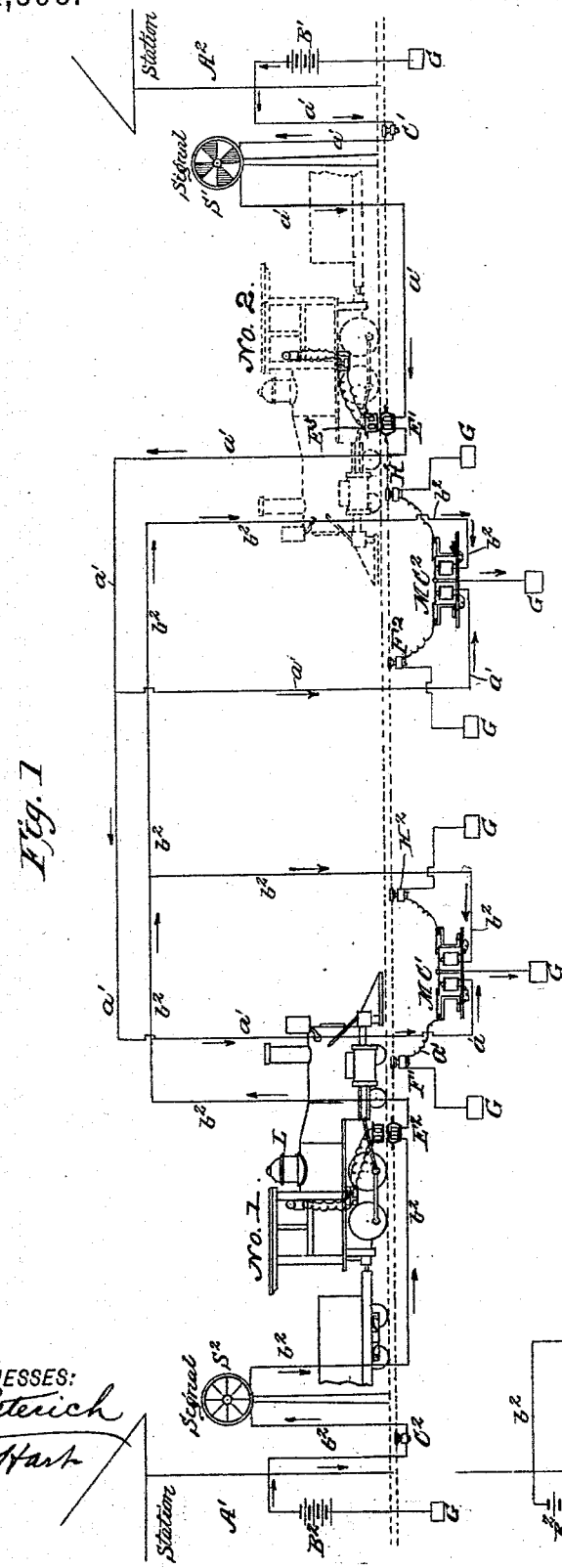

Fig. 1

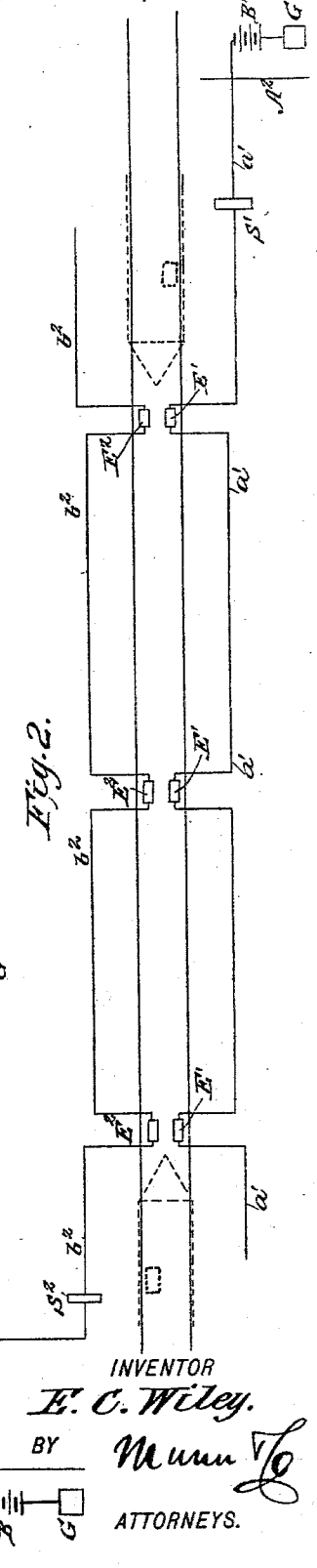

Fig. 2.

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Fig. 3

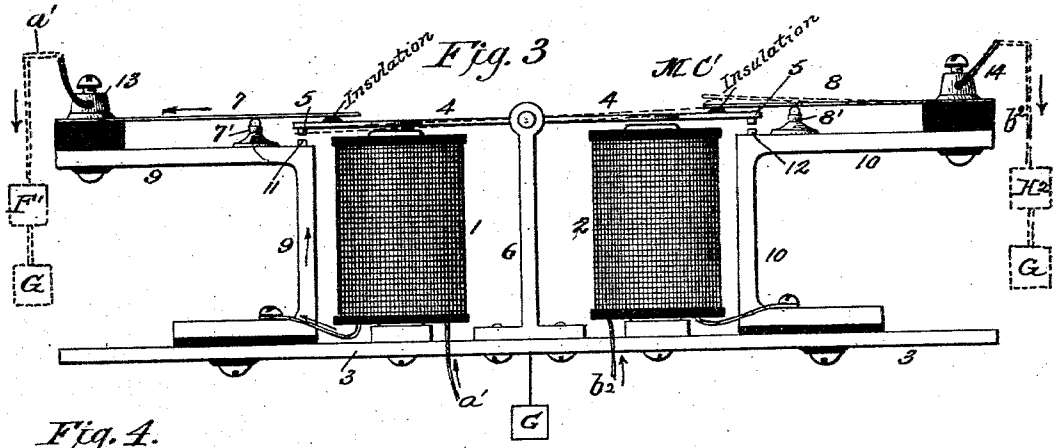

Fig. 4.

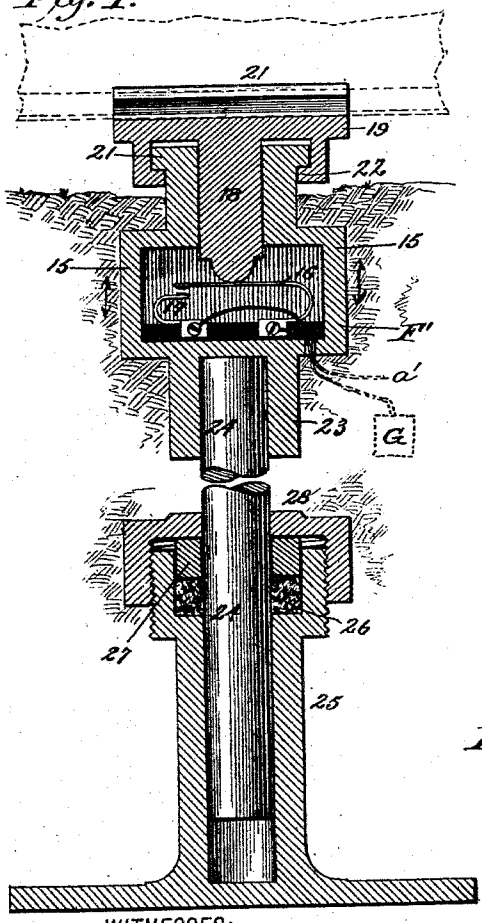

Fig. 5.

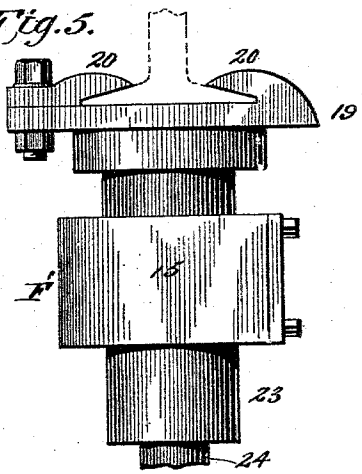

Fig. 6.

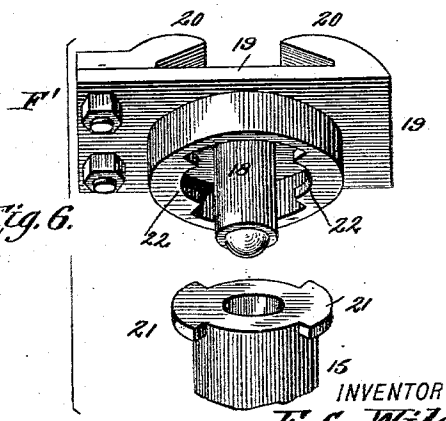

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Fig. 8.

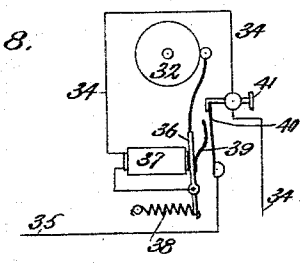


Fig. 7

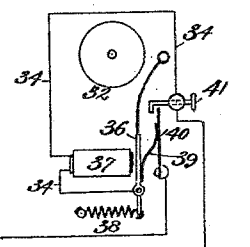
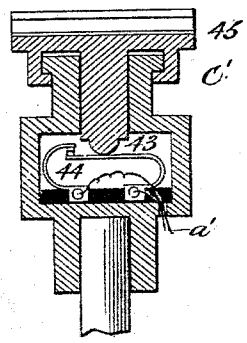


Fig. 9.



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UNITED STATES PATENT OFFICE.

EDGAR C. WILEY, OF BRISTOL, TENNESSEE, ASSIGNOR TO THE WILEY RAILWAY ELECTRIC SIGNAL COMPANY, OF SAME PLACE.

ELECTRIC SIGNALING APPARATUS FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 514,398, dated February 6, 1894.

Application filed May 11, 1893. Serial No. 473,847. (No model.)

To all whom it may concern:

Be it known that I, EDGAR C. WILEY, of Bristol, in the county of Sullivan and State of Tennessee, have invented a new and useful Improvement in Electric Railroad Signal Apparatus, of which the following is a specification.

My invention is in the nature of an improved electric railroad signal apparatus in which a system of electrical circuits and circuit closing and releasing devices along the line, are made to co-operate with a local circuit and signal bell on the train to apprise the engineer of any train of the presence of another upon the same section of track.

My invention consists in the peculiar construction and arrangement of parts whereby the above result is accomplished in a certain, practical, and comparatively simple way, which I will now proceed to describe with reference to the drawings in which—

Figure 1 is a diagrammatic view of the circuits, circuit closing and releasing devices shown in relation to the two terminal stations, the track, and two locomotives. Fig. 2 is a plan view of the circuits and track. Fig. 3 is an enlarged side view of a double acting circuit making and breaking device. Fig. 4 is an enlarged sectional view of the primary circuit closing device, which is actuated by the mechanical passage of the train. Fig. 5 is a side view and Fig. 6 are views in perspective of detached parts of the primary circuit closer. Fig. 7 is a view of the local bell circuit and induction circuit on the locomotive, shown in relation to the magnets in the road bed which induce or set into action the signal devices. Fig. 8 is a side view of the special arrangement of the signal bell, and Fig. 9 is a sectional view of the circuit breaker of the main line.

Before proceeding to describe the operation of the circuits and devices along the line, I would state that the principle of signaling employed by me comprises a series of electro magnets arranged in the road bed or along the line which are energized through contacts made by the mechanical passage of the train, and these energized magnets act by induction upon electro magnets carried by the locomotive which pass the stationary magnets of the road bed in such close proximity as to induce in the magnets of the locomotive a current strong enough to close a local bell circuit on the train and sound the signal. This is done however in a peculiar way as follows:

Referring to Fig. 7, E′ are the stationary electro magnets in the road bed contained in a suitable case for protection, and E^3 are the electro magnets carried by the locomotive which are arranged to pass in such close proximity to the electro magnets E′ as to cause the latter to set up by induction a current in the helices of electro magnets E^3 as the latter pass by. This feeble current passing through the wires 30 charges the inner helix *i m* of a double magnet 31. This causes the armature *a r* to close upon its pole and in doing so causes said armature to close upon plate *p l*. This armature *a r* and plate *p l* are the terminals of a separate local bell circuit 34—35 which includes a battery 33 and switch 42. It will thus be seen that when this bell circuit is thus closed the bell will ring, but as the induced current exists only for an instant in the inner helix, or while the locomotive is passing the stationary electro magnet E′ of the road bed, it will be seen that some provision must be made to hold the bell circuit closed after the locomotive passes by the stationary electro magnet, and for this purpose an independent outer helix is provided in the compound magnet 31, which outer helix is connected to the plate *p l* and is made one of the terminals of the local bell circuit, so that while the initial closing of the bell circuit is effected by induction, it continues to be held closed by the energy of the local battery 33 in the outer helix of 31, thus holding firmly the terminal armature *a r* up to the terminal plate *p l* so that the bell continues to ring after the locomotive has passed the inducing electro magnets. An essential condition, however, is that the signal bell should not operate by a make and break circuit, for if it did a break would occur between the armature *a r* and plate *p l*. This bell I arrange to operate in a vibrating manner by alternately closing through the bell magnets, and then through a short circuit, or shunt. Thus referring to top part of Fig. 7 when bell mag-

net 37 is energized, the current flows through 34—37—39 and 40. As soon, however, as armature 36 is attracted, spring 39 moves away from plate 40, and plate 40 is brought into a short circuiting contact with stop 41, and the current then passes, as in Fig. 8, from 40 to 41 direct without going through the magnet 37, whose armature 36 then flies back from the tension of spring 38 as it does ordinarily when a bell circuit is broken.

I will now describe the construction of the devices and arrangement of the circuits along the line. Referring to Fig. 1, A′ A² are two terminal stations. At A′ there is a battery B² one pole of which is connected to the ground at the station, and the other pole of which connects with the main circuit wire b^3, and runs through a circuit breaker C² (hereinafter described) thence through a semaphore or visual signal S², thence through the inducing magnets E², thence along the line b^2, descending at intervals to the circuit making and breaking devices M C′ and M C² (hereinafter described) and thence to the earth whenever the circuit is closed. At the opposite station A² there is another battery B′, circuit breaker C′, semaphore S′, inducing magnets E′ and line wire a' descending at intervals to the circuit making and breaking devices M C′, M C², and thence to the earth whenever the circuit is closed. On the left is shown in full lines a locomotive No. 1 equipped with the signaling apparatus heretofore described, and on the right a similar locomotive No. 2 in dotted lines. The object of this arrangement is to have along the track an open circuit which is grounded at points along the line by the locomotive in advance of the train so as to actuate by induction the signal bell of an approaching locomotive, and be opened again by the locomotive as it reaches the end of the route. Thus it will be seen that the two line wires a' and b^2 are on open circuits until grounded by the locomotive—the operation of which I will now proceed to describe. First, it is necessary to understand the construction of the instrument used along the line. Taking the locomotive No. 1 on the left it grounds the line a' of battery B′ at the point F′ energizing the inducing magnet E′ for the warning of the other locomotive, and when locomotive No. 1 gets to station A² it opens this main line circuit at C′. First I will describe the primary circuit closer F′ which is shown in detail in Figs. 4, 5 and 6. Referring to Fig. 4, 16 and 17 are two spring contacts which are normally held away from each other. One is connected to the main line a', and the other to the ground G as shown in Fig. 1. These two contacts are brought together by the passing of the locomotive which is made to depress the rail. For this purpose advantage is taken of the fact that any railroad rail will spring up and down as the locomotive passes over it from one-fourth to one-half of an inch. This rail is shown in dotted lines in Fig. 4, and is held in a clamp or chair composed, see Fig. 5, of the plate or cap 19 with flange 20, and a detachable flange 20 on the other side which is bolted to plate 19, the flanges being arranged on opposite sides of the base of the rail. The plate or cap 19 has upon its lower side a collar with segmental lugs 22, Figs. 4 and 6, that embrace the neck of the jar-like receptacle or housing 15 which has corresponding lugs 21 beneath which the lugs 22 are turned, so that it cannot come off. The plate 19 has also a central stem 18 which rests upon the spring contact 16 and forces it against 17 whenever plate 19 is depressed by the depression of the rail. On one side of the housing 15 is a detachable plate as seen in Fig. 5, by which access is given to the interior of said housing. As the motion for making contact between 16 and 17 is slight, and there may be considerable variation in the depression of the rail the entire housing 15 is made susceptible of yielding up and down to accommodate this variation independently of the making and breaking of contact between 16 and 17. For this purpose a rod or stem 24 is fixed in a downwardly projecting socket 23, and is made to enter a stuffing box 26 in a socket or casing 25 which serves as a friction device that holds it to any position, so that while the housing 15 may yield up or down to the unequal depression of the rail the contact is always certainly made by the initial movement and without damage to the parts. As shown in the drawings the housing 15 appears to be immovably embedded in the earth so as to preclude vertical motion. This, however, is not so in fact, for the natural elasticity of the earth surrounding the housing allows the housing and earth around it to yield together as the heavy weight passes over the rail. This is the construction of the primary circuit closer as seen at F′ in Fig. 1. The circuit breaker C′ on the right of the line is exactly like it, as seen in Fig. 9, except that its contacts 43 and 44 are separated by the depression of the rail.

I will now proceed to describe the apparatus shown in Fig. 3. This, see Fig. 1, is a double acting device that enables any locomotive, No. 1 for instance, to ground the line a' which induces a signal on the locomotive No. 2, but prevents locomotive No. 1 from grounding the line b^2 from which No. 1 is influenced inductively in the reception of signals. Referring to Fig. 3 a metal base plate 3 and a metal standard 6 are in permanent electrical connection with the earth at G. Fulcrumed on the top of the standard 6 is a double armature lever 4 carrying an armature on one side above electro magnet 1, and another on the other side above electro magnet 2. On plate 3 beside magnet 1 is an insulated bracket 9 bearing a contact 11 adapted to be struck by a contact 5 on the armature lever 4, and bearing also a contact 7′ upon which normally rests a flat spring 7 which is carried by an insulated binding post 13 which latter is through

line wire a' electrically connected to the primary circuit closer F' and the earth. The electro magnet 2 on the other side is equipped in precisely the same way, except that it is in connection with the primary circuit closer H^2. Normally the armature lever 4 has its contacts out of connection with the bracket contacts 11 and 12, and also out of electrical connection with the springs 7 and 8 by reason of small blocks of insulation marked "Insulation" on the drawings. Now the magnet 1 connects with one of the descending branches of the main line a' and the other magnet 2 connects with one of the descending branches of the main line b^2 at the same point along the line. Referring now to Figs. 1 and 4 together, when locomotive No. 1 reaches the primary circuit closer F' it grounds the line a' and energizes the inducing magnets E' of the whole line a', so that the other locomotive No. 2 may receive signals. The grounding of the line by locomotive No. 1 causes the current to flow as follows in the instrument Fig. 3. It enters magnet 1 at a', passes to bracket 9, to contact 7', spring 7, and thence to primary circuit closer F', and thence through the closed contacts 16 and 17, Fig. 4, to the earth. When this primary circuit is closed electro magnet 1, Fig. 3, is energized and attracts its armature on lever 4. This closes the contacts 5 and 11 and holds the circuit grounded permanently, or after the locomotive has passed the primary circuit closer. This new ground circuit cuts out the primary circuit closer F', Fig. 3, and flows through magnet 1 to bracket 9, through 11 and 5, to 4, to 6, to ground G. When magnet 1 attracts its armature and holds it, the lever 4 is tilted to the inclined position, shown in dotted lines, and this lifts spring 8 off the contact 8', and cuts out the primary circuit closer H^2, and as locomotive No. 1 passes over primary circuit closer H^2, it cannot ground the line b^2, the grounding of the latter being exclusively performed by the locomotive No. 2. When locomotive No. 1 reaches the next section it closes the primary circuit closer F^2, and as this short circuits the line a', the preceding instrument M C' is cut out and its armature lever 4 resumes its normal position. From the foregoing description it will be perceived that locomotive No. 1 grounds the line a' successively at F' and F^2, and energizes its inducing magnets from battery B', so that locomotive No. 2 can receive signals, and locomotive No. 2 moving in the opposite direction grounds the line b^2 successively at H' and H^2, and energizes the other set of inducing magnets which influence the signal on locomotive No. 1, and the double acting character of the instruments M C' and M C^2 serves to ground either line, but causes the grounding of either line on one side of said instrument, to disable the other side of the instrument, so that the same locomotive cannot ground both lines locomotive No. 1 acting exclusively on primary circuit closers F' and F^2, and locomotive No. 2 acting exclusively on primary circuit closers H' and H^2, and so on. When either locomotive reaches the end of its route it passes upon one of the circuit breakers C' or C^2, Figs. 1 and 9 and opens the entire line.

What I claim is—

1. In an electric railroad signal, a pair of circuits having normally open branches along the line, independent signaling circuits on the cars, primary circuit closers along the line operated by the passage of the cars, and a double acting circuit making and breaking device connected to both line circuits and also to the primary circuit closers, and arranged as described to connect one line to the ground and to be disabled for grounding the other line, by the passage of the cars in either direction substantially as shown and described.

2. In an electric railroad signal, a pair of circuits having normally open branches along the line, independent signaling devices on the cars operated by induction, primary circuit closers along the line operated by the passage of the cars, inducing magnets arranged in the main line to act upon the signal circuits on the cars, and a double acting circuit making and breaking device connected to both line circuits and also to the primary circuit closers and arranged as described to connect one line to the ground and to be disabled for grounding the other line by the passage of the cars in either direction substantially as shown and described.

3. In an electric railroad signal, a pair of circuits having normally open branches along the line, independent signaling devices on the cars, operated by induction, primary circuit closers along the line operated by the passage of the cars, inducing magnets arranged in the main line to act upon the signal circuits on the cars, a double acting circuit making and breaking device connected to both line circuits and also to the primary circuit closers, and arranged as described to connect one line to the ground and to be disabled for grounding the other line by the passage of the cars in either direction, and circuit breakers arranged in the main circuits at the ends of the route to be operated by the cars in passing into the station to open the main lines substantially as shown and described.

4. The double acting circuit making and breaking device consisting of two electro magnets 1 and 2 connected respectively to two open line circuits, a double armature lever 4 playing upon the poles of the magnets and having a permanent ground connection, and brackets or supports having contacts 11 and 12 for the armature levers, and other contacts 7', 8', insulated springs 7, 8, resting normally upon the contacts 7', 8' and electrically connected to a circuit closer having a ground connection, the said lever 4 being arranged to make a maintained ground connection on

one side and to cut out the primary circuit closer upon the other side substantially as shown and described.

5. The circuit making or breaking device, located beneath the rail of a railroad track, consisting of a movable part connected to the rail and a housing containing the contacts arranged to be operated upon by said rail-attached part a sliding frictional connection arranged beneath said rail and housing to accommodate the integral motion of the device for variations in the movement of the rail substantially as shown and described.

6. The combination of the housing 15 having lugs 21 and contacts within the housing, the rail plate 19 with adjustable flange 20 and lugs 22 substantially as shown and described.

7. The combination with the housing or case of a circuit closing device, of an attached stem 24 and casing 25 with stuffing box 26 for permitting an automatic frictional adjustment of the housing substantially as shown and described.

8. In a signal apparatus, a compound signal circuit consisting of an induction or secondary circuit, a local signal circuit, with battery, bell and bell magnets, and a compound relay magnet having two concentric helices, the one being in the induced circuit and the other in the signal circuit, an armature common to both, and a contact plate operated upon by said armature and forming one of the terminals of one of said helices substantially as and for the purposes described.

9. In a signal apparatus a compound signal circuit consisting of an induction or secondary circuit, a local signal circuit, and a compound relay magnet having two concentric helices, the one being in the induced circuit, and the other in the signal circuit, an armature common to both, a contact plate operated upon by the said armature and forming one of the terminals of one of the said helices, and a signal bell arranged to be operated as described by alternately closing the local circuit through the bell magnets, and then through a shunt without breaking the local circuit substantially as shown and described.

10. In a railway signaling apparatus, the combination with a visual signal, of a primary grounded circuit-closer, the grounded circuit-closing and contact breaking instrument, composed of two electro-magnets, an armature which is pivoted between and extends over both magnets, contacts on the frame of the instrument, springs which are insulated from such frame and arranged to bear upon the extremities of the armature, and electrical circuit connections, substantially as shown and described, whereby, when the primary circuit closer is operated by a passing train, an electrical circuit is completed through one portion of the main instrument and the circuit in the other portion is broken, thus insuring the signal being held to danger until the train by which it was operated shall have passed out of it, substantially as shown and described.

11. The combined circuit-closing and contact breaking instrument, composed of two electro-magnets, a pivoted armature which extends over such magnet and whose ends serve as contact points, springs arranged to bear upon the armature and holding it normally balanced, brackets or frame-pieces having contact points for said armature, and springs and being in circuit with the magnets but insulated from said springs, substantially as shown and described whereby the closing of a circuit through one of the magnets breaks contacts on the other side of the instrument, as specified.

12. A circuit closer adapted for attachment to a railway rail, and composed of a cap having a pendent pin, a hollow body portion, having a slidable connection with said cap spring contacts arranged in said body, and a friction device as specified.

13. The combination with a railroad rail, of a circuit closing device consisting of a hollow body, and a removable and slidable cap provided with flanges or claws adapted to engage the base of a rail and having a pin which enters a socket in the body and a spring contact forming part of the electrical circuit, whereby the vertical vibration of the rail as a train passes over it will make and break the circuit, as shown and described.

14. The combination with the circuit closer proper F′, of the friction rod 24, the anchor or socket 25, and a stuffing box arranged on the head of the latter for regulating the degree of friction, as shown and described.

15. The combined circuit-breaker and friction attachment, composed of a cap, a body portion on which said cap slides vertically, spring contacts, a friction rod attached to the body, and a friction socket for the rod, substantially as shown and described.

16. In a signaling apparatus, the combination with an electro-magnet fixed in the roadbed, and forming part of an electrical circuit of the audible signaling-apparatus, carried by a locomotive and consisting of an induction coil and a relay magnet in circuit, as specified, a battery, a bell alarm and magnet arranged normally in open circuit, with a bell hammer, and a spring contact which closes the shunt circuit simultaneously with the formation of the local circuit, as shown and described.

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