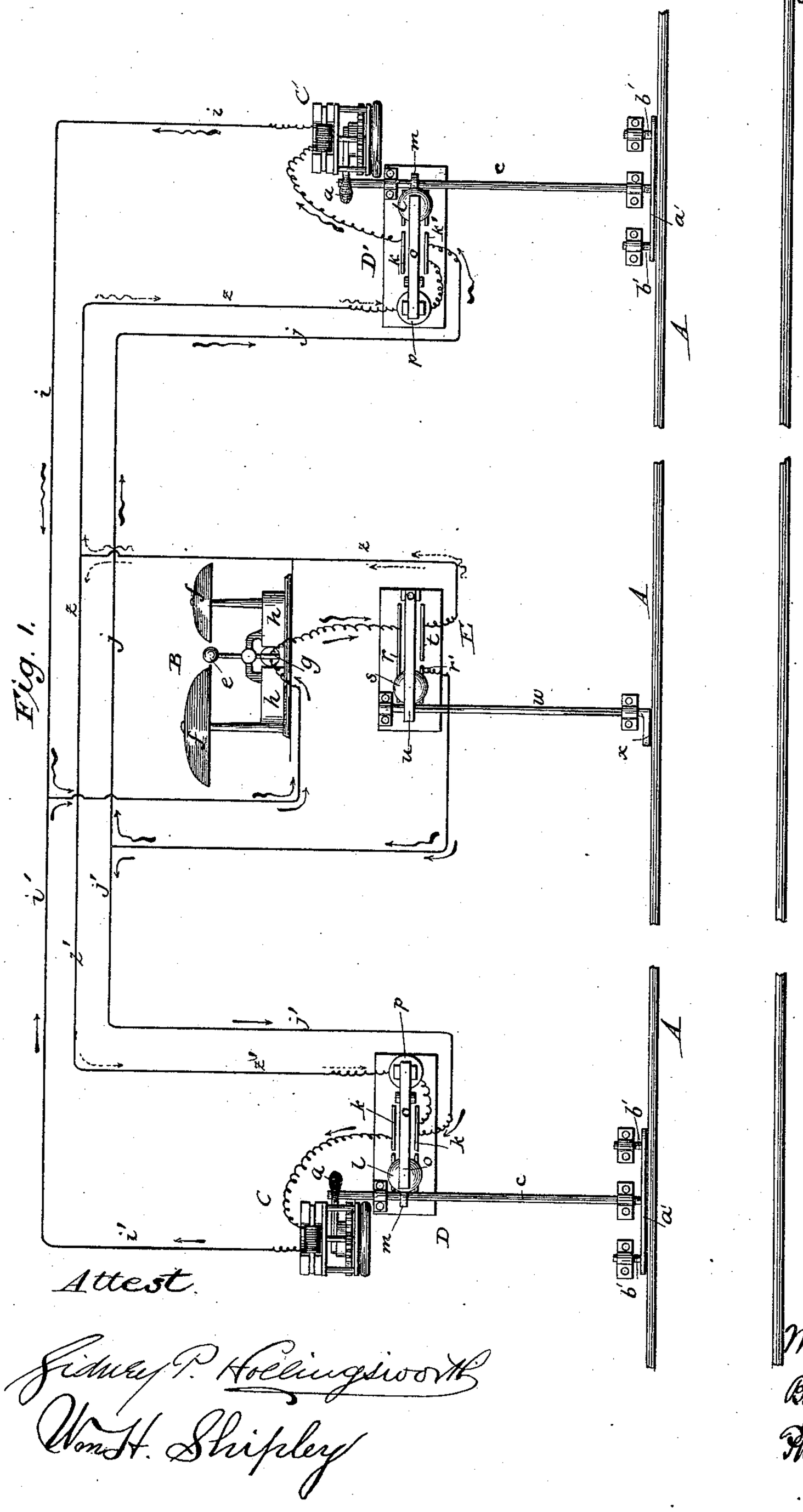
(No Model.)

2 Sheets—Sheet 1.

M. W. LONG.

ELECTRIC RAILWAY SIGNAL.

No. 345,642. Patented July 13, 1886.



Attest.

Sidney P. Hollingsworth

Wm. H. Shipley

Inventor

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By his Attorney

Philip T. Dodge.

(No Model.) 2 Sheets—Sheet 2.

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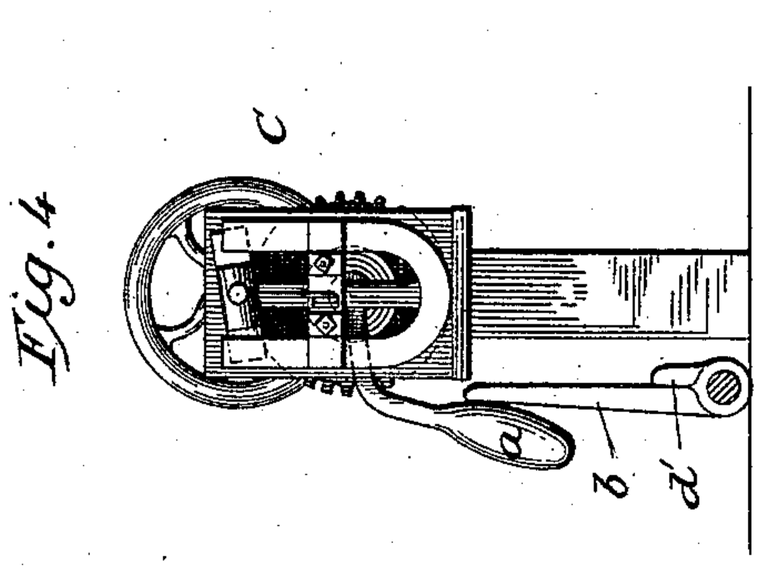

Fig. 4

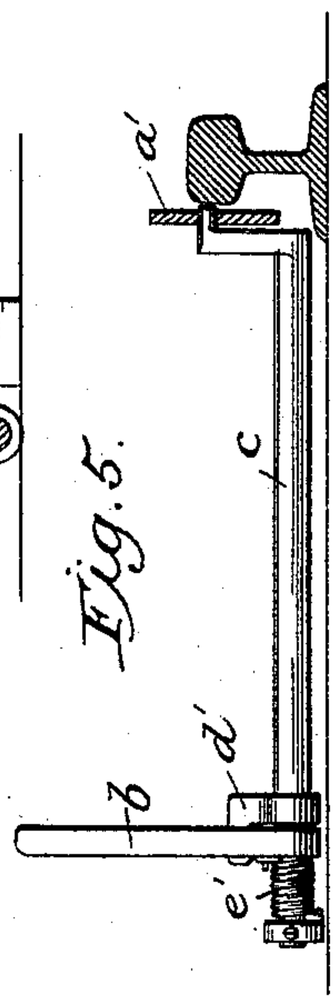

Fig. 5.

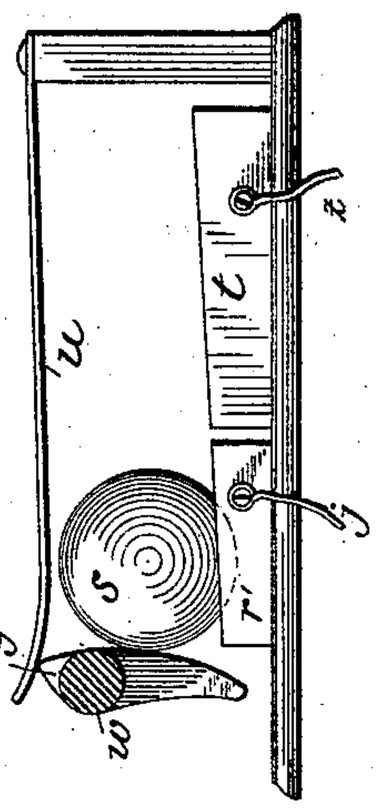

Fig 2.

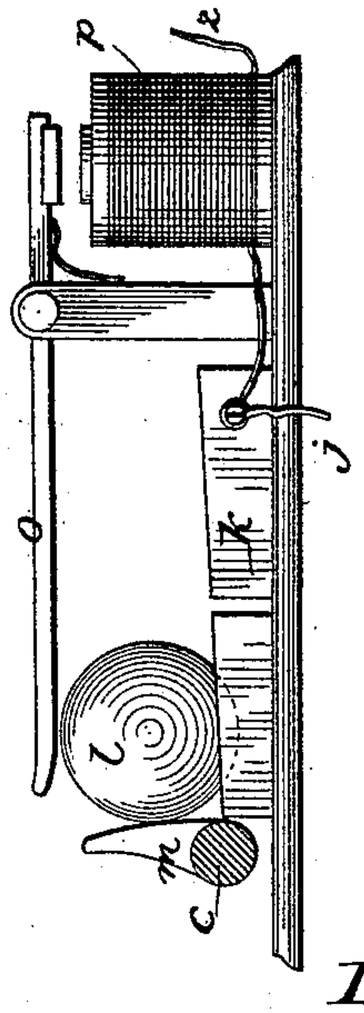

Fig. 3.

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UNITED STATES PATENT OFFICE.

MALCOLM W. LONG, OF HYDE PARK, MASSACHUSETTS.

ELECTRIC RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 345,642, dated July 13, 1886.

Application filed February 16, 1884. Serial No. 120,930. (No model.)

To all whom it may concern:

Be it known that I, MALCOLM W. LONG, of Hyde Park, in the county of Norfolk and State of Massachusetts, have invented certain Improvements in Electric Railroad-Signals, of which the following is a specification.

My invention has reference to a system in which railroad-trains, while still distant from a crossing or station, actuate a magneto-generator or dynamo-electric machine, thereby generating an electric current, which is conducted to and caused to operate the signal-instrument in advance of the train.

It relates more especially to signals designed for single-track roads over which trains move in both directions, and its particular aim is to combine with one signaling-instrument two generators located on opposite sides thereof, so that it may be actuated by trains advancing from either direction, and at the same time to prevent the trains from actuating said signal to sound it after having passed the same and while passing the second generator, and also to automatically cut out each generator and its connections while the other is in action, in order to reduce the resistance of the circuits to a minimum.

To this end it consists in a special arrangement of generators, circuits, and automatic circuit-controlling devices, hereinafter explained.

Referring to the accompanying drawings, Figure 1 is a diagram representing a railway with my apparatus arranged in connection therewith. Fig. 2 is a sectional elevation of the circuit-breaking device employed adjacent to the signal. Fig. 3 is a sectional elevation of the circuit-closing devices, one of which is employed adjacent to each generator. Fig. 4 is a sectional elevation illustrating the manner in which the generator is connected with and driven by the track-connections, which are commonly known, whatever their form, as "track-levers." Fig. 5 is an elevation of the same parts, looking lengthwise of the track.

Referring to Fig. 1, A represents the railway-track; B, an electric signal-instrument located adjacent to the track and to the crossing, station, or other point at which the signal is to be sounded or displayed.

C and C′ represent two magneto-generators located adjacent to the track on opposite sides of the signal, at such distances therefrom as circumstances may demand, the usual distance being from three to six hundred yards, each generator being provided with track-connections by which it is operated from passing trains, and being electrically connected with the signal-instrument in a manner which I will now explain.

The generators and all the connections at the two ends of the system are duplicates of each other. Each generator, which may be of any approved form or style, is provided with a vertically-moving arm, *a*, by which it may be set in motion, this arm being moved in one direction by a weight or spring, and in the opposite direction by an arm, *b*, attached to a rock-shaft, *c*, one end of which lies adjacent to the track, and is provided with an arm, plate, or other device to be actuated by the passing trains, the result being that the trains communicate motion to the shaft, and thence to the generator, which will be adapted to remain in motion for a considerable period of time after the passage of the train.

The generator and its connections may be such as represented in the patents to W. W. Gary, Nos. 257,819, 258,742, and 262,396, or otherwise constructed, provided they have essentially the same mode of action; but it is preferred to make use of the operating devices hereinafter explained.

The signal-instrument consists of a striker, *e*, vibrating between and acting upon two gongs or bells, *f*. It is provided with and receives motion through the influence of an electro-magnet, *g*, which vibrates between two fixed armatures, *h*. Two conducting-wires, *i* and *j*, serve to connect the helix of the signal-magnet *g* with the opposite poles of the magneto-generator C, so that when the circuit is closed and the generator set in action the electric current will be applied to operate the signal. In order to secure the proper action of the parts, the circuit is provided with a normally-open closing device, D, located adjacent to the generator, and with a normally-closed breaking device, E, located adjacent to the signal.

The circuit-closing device D, which is introduced into the conductor F, consists of two inclined parallel conducting rails or plates, *k*, insulated from each other, and of a metallic

ball, *l*, which serves to establish an electrical connection between the plates, and thus to close the circuit when rolled upward upon them, but which, when released, rolls automatically downward from the rails, so as to break the connection and open the circuit. The ball rests, when in its lower position, upon short rails, or in a pocket or other receptacle located in position to receive it as it passes from the conducting-rails. The movement of the ball in an upward direction to effect the closing of the circuit is effected by means of a short arm, *m*, secured to the beforementioned rock-shaft *c* in the manner represented in Fig. 3, the arrangement being such that the action of the rock-shaft to set the generator in motion has also the effect of moving the ball upward, and thus closing the circuit at the outer end. For the purpose of maintaining the circuit temporarily in a closed condition, I employ a gravitating arm or lever, *o*, arranged in position to act on top of the ball, and thus prevent the same from rolling downward from the conducting-tracks. The outer end of this detent-lever is provided with an armature acted upon by an electro-magnet, *p*, in the manner hereinafter more fully explained, whereby the detent is caused to release the ball in order that it may descend to open the circuit.

Passing now to the circuit-breaking device E at the signal-instrument, it will be perceived that it consists, principally, as shown in Figs. 1 and 2, of two inclined conducting-plates, *r* and *r'*, to which the terminals are connected, insulated from each other, and of a metallic ball which rests normally upon the lower ends of these plates, so as to establish an electric connection between them, and thus close the circuit. This ball may, however, be driven upward from the rails *r r'*, so as to destroy the connection between them, and thus open the circuit. For the purpose of supporting the ball when thus carried upward, and for other purposes which will be hereinafter explained, an additional inclined rail, *t*, is arranged to form a continuation of the rail *r'*, but is wholly insulated therefrom. This third rail, *t*, acts with the rail *r* to give support to the ball during the time that it is in its elevated position and the circuit is open, and also acts, whenever the ball is released, to secure its descent by gravity to the position in which it closes the circuit. For the purpose of retaining the ball in its upper position, so that the circuit may remain open, I make use of an elastic or gravitating arm, *u*, arranged, as plainly represented in Figs. 1 and 2, to bear on top of the ball and prevent it from rolling downward. To effect the upward motion of the ball, and the consequent breaking of the circuit, I provide a rock-shaft, *w*, one end of which has a depending arm to act upon the ball, while the opposite end is provided with an arm or other device, *x*, adapted to be acted upon by the passing trains. In the normal condition of the parts the ball stands at the lower ends of the rails, as represented in Figs. 1 and 2, the circuit being closed; but at the passage of each train the rock-shaft drives the ball upward and opens the circuit, which is held open through the action of the detent-spring *u* upon the ball. It is desirable to have the circuit remain open but a moment only, and for this reason the rock-shaft is provided with an upwardly-extending arm, *y*, which acts, as the shaft resumes its original position, immediately after the passage of the train, to lift the detaining-spring *u*, and thus permit the ball to roll downward to its original and normal position.

Referring again to the circuit-closing device D adjacent to the distant generator, it will be remembered that upon being operated by the train it was automaticlly locked in position to hold the circuit open. It is desirable that it shall so remain until the train has reached the signal-station, and that the circuit shall be then automatically opened at the generator. To effect this action I extend from the third rail, *t*, of the circuit-breaking device E at the signal a third conductor, *z*, which is connected with the helix of the electro-magnet *p* in the circuit-closing device D, and extends thence to the conducting-plate *k* of said device, thus producing a branch circuit.

The operation of the parts is as follows: The main circuit *i j*, embracing the signal-instrument, is normally closed at the central station and open at the generator. A train approaching the signal sets the generator C in action, and at the same time causes the device D to close the circuit. The generator continuing in action, the current is transmitted thence over the conductor *i*, through the signal to the plate *r*, thence through the ball *s* to the plate *r'*, and through the conductor *j* to the plate *k'*, and finally through the ball *l* and plate *k* to the generator. The generator continuing to act, the signal remains in operation until the train reaches the same, whereupon the track-connections cause the ball *s* to be driven upward from the conducting-plate *r'*, thereby breaking the main circuit, but closing the branch circuit through the plates *r* and *t* and the third conductor, *z*, and the magnet *p*, which latter actuates the lever *o* and releases the ball *l*. The ball thus released rolls downward from the plates *r r'*, thus opening the circuit at the outer end, and restoring the whole system to its original condition.

It is to be noted as a peculiarity of my system that the current produced by the generator is applied to break the main circuit, in which the generator is located, so as to leave the same normally open at its lower end, or, in other words, at the end adjacent to the generator.

As before stated, the generator and connections at the opposite end of the line are duplicates of those just described, and have the same mode of action. Trains advancing from the right operate one generator, while those advancing from the left operate the other.

The advantage of having each generator open automatically the circuit in which it is located lies in the fact that one generator and its connections are thus kept out of circuit while the other is in action. In other words, the arrangement secures the operation of the two generators and their respective circuits alternately. Were it not for this arrangement it would be necessary for the current from each generator to work over the entire system and overcome the resistance offered by the other generator, its magnet, and conductors. Another advantage lies in the fact that the signal is prevented from acting after the train has passed, although the generator may continue in action.

While it is preferred to make use of circuit opening-and circuit-closing devices in the form herein represented, it is to be noted that any equivalent mechanical devices which have the same effect in the system may be substituted therefor. In other words, I may employ adjacent to the generator any device which will close the circuit through the instrumentality of passing trains and open the same through the influence of the electric current, and may employ at the signal station any instrument which will have the effect of mechanically and positively breaking the circuit through the instrumentality of passing trains and immediately reclosing the same.

Referring again to the track-connections by which the generators are operated, it is advisable to construct them in such manner that the rock-shafts *c*, by which the generators are driven, will be operated by trains passing in one direction only. An excellent arrangement for this purpose is that represented in Figs. 1, 4, and 5, consisting of a vertical plate, *a'*, arranged at the side of and projecting slightly above the railway-rail and sustained at its end by upright links *b'*. The rock-shaft *c* is provided with an upright arm or crank, one end of which engages a vertical slot in this plate. The wheels of a train passing in either direction will act upon and depress the plate *a'*, which will move downward and forward in the direction in which the train is moved, thus imparting a rotary motion to the rock-shaft, which is turned in one direction or the other, according to the course of the train. This device is claimed by me in another application of even date herewith, and forms no part of the present invention. At the opposite end the rock-shaft is provided with an upright arm, *b*, hereinbefore mentioned, for imparting motion to the generator. Hitherto it has been the custom to attach this arm rigidly to the rock-shaft, the result of which was, that when the rock-shaft was turned in a backward direction—that is to say, in the opposite direction from that in which it actuates the generator—the arm *b* was thrown backward, away from the arm of the generator, and would, in rising to its normal position, strike against the same in a noisy and objectionable manner. To avoid this hammering action I now mount the arm *b* loosely on the end of the rock-shaft, and provide the latter with an arm, *d'*, fastened thereon and arranged to act against the rear side of the arm *b*, as shown. A spring, *e'*, coiled upon the shaft and secured at one end thereto, acts at the opposite end upon the arm *b*, to maintain the same normally in contact with the arm *b*. When the rock-shaft is turned forward to actuate the generator, the arm *d'* urges the arm *b* forward, causing it to lift the operating-arm of the generator. When, however, the rock-shaft is turned backward, its arm *d'* swings away from the arm *b*, which latter is thus permitted to remain at rest.

I do not claim herein the combination of two inclined conductors with a gravitating conducting-ball and means to be operated by passing trains to cause the ball to ascend the inclined surfaces. Neither do I claim herein the inclined conductors, in combination with the ball and a mechanical device to retain the ball in its elevated position; nor the combination of the inclined conductor, the conducting-ball, and means for effecting a downward pressure upon said ball; nor the combination of the conductor-ball and the pressure-spring with a rock-shaft having an arm to lift said spring, and a second arm to receive motion from passing trains, as these features and combinations are made the subject-matter of a separate application, No. 185,823, filed December 16, 1885.

Having thus described my invention, what I claim is—

1. In an automatic signal for a single track whereon trains are moved in both directions, an electric signal-instrument, two magneto-generators located on opposite sides of the signal, each provided with means whereby it may be set in motion by passing trains, electric circuits connecting the generators with the signal, a normally-open circuit-closing device located adjacent to each generator and arranged to automatically close the circuit when the generator is put in motion, an electro-magnet to actuate said device and effect the opening of the circuit, and a device located adjacent to the signal and provided with mechanical track-connections for momentarily breaking the circuits connecting the signal and the generators and directing the current through the circuit-opening magnet at that generator which is for the time being in action, whereby the current from each generator is caused to break that circuit only in which it is located, and leave said circuit open at the completion of the signaling operation.

2. The combination of the electric signal, the two magneto-generators located on opposite sides thereof, and each provided with track-connections, whereby it is operated from passing trains, the conductors *i j* and *i' j'*, connecting the respective generators with the signal, normally-open circuit-closing devices D and D', located adjacent to the generators, and each provided with means whereby it is caused to remain open, and with an electro-magnet, whereby its closing is effected, conductors *z*

and z', extending from said circuit-closing devices to the signal, and the device E, located adjacent to the signal, provided with mechanical track-connections, and adapted, as described, to momentarily break the main circuit between the signal and the generators and close the branch circuit passing through the magnets of the circuit-closing devices, whereby each generator is automatically put in circuit with the signal during the passage of a train therefrom toward the signal, and subsequently thrown out of circuit as the train leaves the signal.

3. In an automatic railway-signal, the combination, substantially as hereinbefore described and shown, of the magneto-generator and its track-connections, whereby it is actuated from passing trains, the electric signal-instrument, electric conductors connecting the generator and signal, and normally closed adjacent to the signal, the mechanism to automatically close the circuit when the generator is actuated, the electro-magnet and its connections to reopen the circuit adjacent to the generator, and the track-connections adjacent to the signal for automatically and momentarily diverting the current to the electro-magnet, as described, whereby the reopening of the circuit is effected at the completion of the signaling action.

4. The combination of the electric signal B, the circuit-closing device E, provided with mechanical track-connections, the generator C, the circuit-closing device D, the track-connections for operating the generator and circuit-closing device, the electro-magnet p, for opening the circuit-closing device, and the three conductors i, j, and z, arranged as described and shown.

5. In a railway-signal, the combination, substantially as described, of the two generators, the intermediate signal, and the device for closing the circuit between the signal and the respective generators alternately, consisting of a conductor, rails r, r', and t, the gravitating ball s, and the track-connection w, to operate said ball.

6. In combination with the conducting-plates r, r', and t, the gravitating ball, the detent u, and the rock-shaft, constructed, substantially as described, to move the ball and release the detent alternately.

7. In combination with the conducting-plates k and k', the gravitating conducting-ball, the arm or detent o, to retain the ball upon the conducting-plates, the electro-magnet to operate said detent, and the three conductors connected with the plates, as described and shown.

8. In a railway-signal, the device for alternately opening and closing two circuits, consisting of inclined rails r, r', and t, connected to the respective conductors, and the gravitating conducting-ball s, arranged to traverse said rails, as described, and connect the rail r alternately with the rails r' and t.

MALCOLM W. LONG.

Witnesses:
FRANCIS S. HESSELTINE,
JOHN B. TAFT.