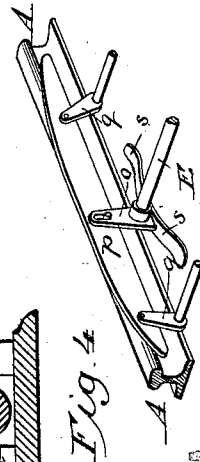
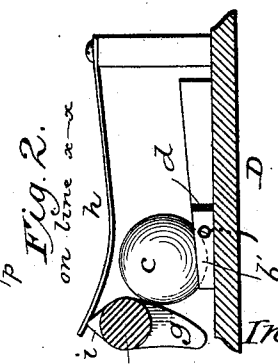
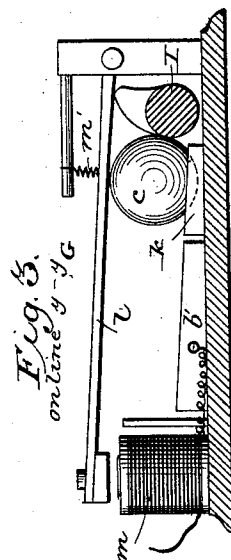
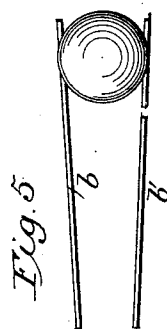
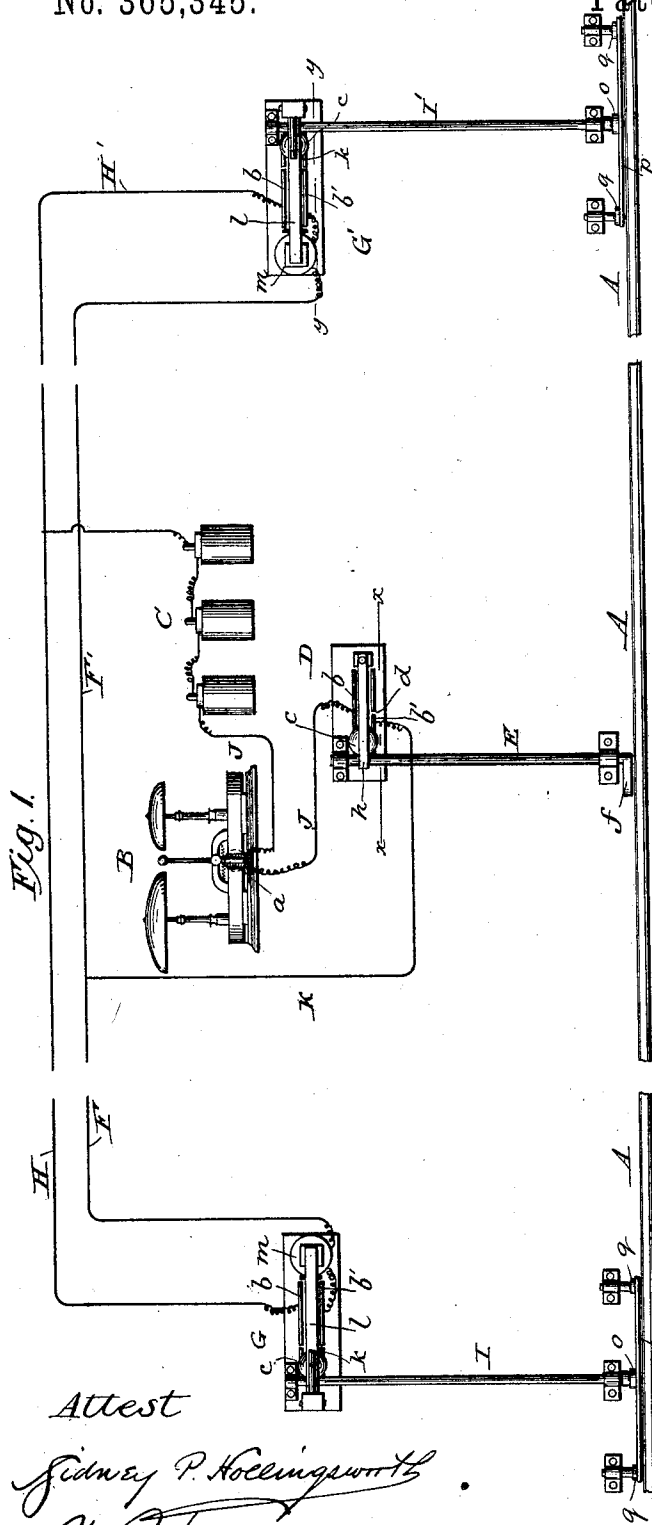


(No Model.)

M. W. LONG.
ELECTRIC RAILROAD SIGNAL.

No. 365,345.

Patented June 21, 1887.



Attest
Sidney P. Hockingworth
Wm. Kennedy

Inventor.
M. W. Long
By his Atty.
P. T. Dodge.

UNITED STATES PATENT OFFICE.

MALCOLM W. LONG, OF HARRISBURG, PENNSYLVANIA.

ELECTRIC RAILROAD-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 365,345, dated June 21, 1887.

Application filed December 16, 1885. Renewed February 10, 1887. Serial No. 227,179. (No model.)

To all whom it may concern:

Be it known that I, MALCOLM W. LONG, of Harrisburg, in the county of Dauphin and State of Pennsylvania, have invented certain
5 Improvements in Electric Railroad-Signals, of which the following is a specification.

My invention relates, principally, to what are commonly known in the art as "grade" or "crossing" signals, used to give warning at
10 crossings, stations, and other places of approaching trains. It has reference more particularly to signals for single-track roads, or roads over which trains pass in both directions.

15 It is the particular aim of my invention to provide a signal which may be automatically actuated by trains advancing toward the crossing from either direction, but which shall not be again actuated by the trains as they leave
20 the crossing. To this end I combine with a single signal-instrument controlling-circuits extending therefrom in both directions, and provided at their ends with circuit-controlling devices adapted to be actuated by passing
25 trains, the various parts being arranged with reference to each other in such manner that while each circuit will be set in action by a train passing toward the signal it will not be so
30 actuated by trains which are leaving the signal. The signal is also prevented from continuing in action after the train has passed the same.

Referring to the accompanying drawings, Figure 1 is a diagram illustrating my signal-system as applied to a railway. Fig. 2 is a
35 vertical section on the line *xx*, showing the instrument by which the normally-closed circuit is broken. Fig. 3 is a vertical section on the line *yy*, showing the instrument by which
40 the normally-open circuit is closed. Fig. 4 is a perspective view of the track-connections by which the circuit-controlling devices are actuated from passing trains. Fig. 5 is a modification of the circuit-closing rails.

45 A represents one of the rails of a single-track railway, and B a signal-instrument located adjacent to the crossing or other point at which the warning is to be given. The signal-instrument, which may be provided with
50 bells or visual devices, or both, may be of any ordinary or suitable construction, adapted to be actuated or controlled in its action by an electric current, many instruments of this char-

acter being familiar to those persons skilled in the art.

In the signal represented in the drawings, 55 the details of which will be hereinafter recited, *a* represents the electro-magnet by which it is operated. The coil of this magnet is connected by a conductor, J, with one side of a battery, C, and also with a circuit-controlling device, D, which stands normally in a closed
60 position, this device being mechanically connected, as will be presently described, with a track-lever, E, by means of which the device is caused to open the circuit whenever a train
65 passing the signal acts upon the track-lever.

From the circuit-controlling device D a conductor, K, leads to conductors F F', which are
70 extended in opposite directions along the railway to points at any required distance from the signal-instrument, usually to a distance of several hundred yards. These conductors are provided at their respective ends with circuit-controlling devices G G', which are in turn
75 connected by conductors H H', respectively, with the battery, as shown. The devices G G' maintain the circuits normally in an open condition; but they are connected with track-levers I and I', by means of which the circuits
80 are temporarily closed at the outer end, one at a time, whenever a train passes over either track-lever toward the signal.

Under a system arranged as above the operation is as follows: The two circuits being
85 open at the outer ends and closed at the middle, it follows that a train approaching the signal from the left will in passing operate the track-lever I and cause the device G to close the circuit, whereupon the current traversing
90 the conductor J to the magnet *a* of the signal device B, through the device D and the wires K, F, and H, will cause the signal to besounded. In like manner a train approaching the signal
95 from the right and operating the track-lever I' will cause the device G' to close the circuit at that end, the result of which will be to operate the bell, as in the preceding instance. It will be observed that, inasmuch as the circuit is open at one end whenever it is closed at the
100 other, the current will not pass beyond the signal, and that consequently the battery is required to work only over the circuit on one side of the instrument at a time.

Having thus stated the general action of the
105 apparatus, I will now describe the details

whereby the circuits are maintained in a closed condition at their outer ends until the train has passed the signal and then automatically broken.

5 Referring to the circuit-closing device D, which, it will be remembered, stands normally in a closed position, the terminals on opposite sides of the break are provided with two conducting plates or rails, *b* and *b'*, insulated from
10 each other, and the upper surfaces of which stand in an inclined position and give support to a metal ball or roller, *c*, resting upon them, and serving to transmit the current from one to the other. When free, this ball descends
15 by reason of its gravity and remains on the lower ends of the rails, thus maintaining the circuit in a closed condition. The rail *b'* is divided transversely at *d*, and has its upper end insulated or isolated from the remainder, as
20 well as from the other conductors, so that whenever the ball is rolled upward until it passes the point of division *d*, it ceases to connect the terminals, and thus breaks the circuit.

For the purpose of impelling the ball in an
25 upward direction at the proper time, I employ the device E, commonly denominated a "track-lever," consisting of a horizontal rock-shaft having at one end an arm, *f*, lying adjacent to the railway-rail and adapted to be depressed
30 by the periphery of the passing car-wheels, and having at its opposite end a depending arm, *g*, such as clearly represented in Fig. 2, adapted to act against the ball and drive the same upward whenever the arm *f* is de-
35 pressed.

In order to secure the proper action of the system, it is desirable to retain the ball *c* momentarily at the upper end of the rails, in order to prevent it from immediately descending and reclosing the circuit. For this purpose I provide a spring-arm, *h*, secured at one end to a fixed support, and arranged to bear at the opposite end on top of the ball. This arm
40 extends over and is acted upon by a lug, *i*, on the upper side of the rock shaft. When the shaft is turned by the action of the train, so as to throw the ball upward, the arm *i* passes from beneath the spring and allows the latter to descend upon the ball, whereby the ball is
45 prevented from rolling downward. As the rock-shaft resumes its original position after the passage of the train therefrom, the arm *i* lifts the spring *h*, and permits the ball to descend to its original position, the effect of
50 which is to close the circuit.

Passing now to the devices G and G', for controlling the outer ends of the circuits, it will be seen that they are constructed in duplicate. The terminals of the conductors are
60 attached to fixed plates *b b'*, which are insulated from each other, and the upper edges of which are inclined downward, as in the preceding device.

Adjacent to the lower ends of the conductors, but isolated therefrom, there is a pocket or receptacle, *k*, designed to receive and sustain a metal ball or roller, *e*, which in its nor-

mal condition rests upon the support out of contact with the rails *b b'*, the circuit being at such time open or broken. When, however,
75 the ball is projected upward from its seat, so as to rest upon the conductors *b b'*, it serves, as in the preceding instance, to transmit the current from one to the other, and thus close the circuit. When released, the ball rolls
80 downward and escapes from the rails, again opening the circuit. The upward movement of the ball to close the circuit is effected by means of the track-lever I', one end of which is provided with an upright arm to act be-
85 hind the ball, while the opposite end is connected with devices, hereinafter described, by which the passing trains are caused to rotate the shaft. When the ball is driven upward to close the circuit, the signal commences its
90 action.

As it is desired to have the signal remain in action until the train has reached or passed the same, it becomes necessary to provide means for retaining the ball on the upper
95 ends of the conductors *b b'* for such length of time as it is required to have the signal remain in action. This is accomplished by providing an arm or lever, *l*, pivoted at one end to a fixed support, and arranged when de-
100 pressed to bear on top of the ball, as represented in Figs. 1 and 3. The depression of this lever is effected by means of an armature applied to its ends and arranged to co-operate with an electro-magnet, *m*, placed thereunder
105 and mounted in the circuit-wire F', which connects the apparatus with the signal. It follows as a result of this arrangement that whenever the ball is driven upward to close the circuit the current passing through the
110 electro-magnet causes the same to immediately depress the arm *l*, the effect of which is to retain the ball in its elevated position and thus hold the circuit in its closed condition. The circuit remains in this condition until the train
115 reaches the signal, and, acting upon the track-lever E, causes the device D to break the circuit. The instant that this occurs the magnet *m* is discharged and the arm *l* permitted to rise under the action of the spring *m'*, applied
120 for the purpose, whereupon the ball rolls downward from the conducting-surfaces and again opens the outer end of the circuit. It will be remembered that the circuit is broken by the device D for a moment only, and that it is then immediately reclosed.

In the circuit-controlling devices it is preferred to employ upright plates or rails *b* and *b'*, with their surfaces inclined in the manner described and shown; but, if preferred, hori-
125 zontal plates, the edges of which diverge from each other, as represented in Fig. 5, may be employed, as a ball applied between these diverging edges will roll therefrom in the same manner as from the inclined surfaces.
130

In order to prevent passing trains from acting with objectionable violence on the track-connections I and I', I connect with each of said levers devices arranged as represented in

Fig. 4. The end of the rock-shaft adjacent to the track is provided with an upright arm, *o*, fixed thereon. This arm is provided with a crank-pin or stud, which enters a slot in the middle of an upright plate, *p*, the extremities of which are pivotally connected to the upper ends of supporting-links *g*, which have their lower ends mounted on fixed pivots, and which are preferably, but not necessarily, inclined, as shown, toward each other. The plate *p* lies adjacent to the side of the rail, its upper edge lying flush with or slightly below the rail at its ends and rising thence toward its middle, as plainly represented. At its inner end the shaft is provided with an upright arm, the lower surface of which is flattened and acted upon by a semi-elliptic spring, *s*, bearing upward thereunder, as shown. This spring tends to keep the two arms of the shaft upright and to maintain the plate in its elevated position. A train approaching from either direction will ride over the inclined edge of the plate *p*, and cause the same to move gradually downward and forward in the direction in which the train is moving, the plate rising to its original position under the influence of the spring as soon as it is relieved from the pressure of the wheels. In practice it is found that this arrangement is exceedingly advantageous, in that it permits the wheels of rapidly-moving trains to impart motion to the rock-shaft in a smooth and easy manner, and without the violent shock and concussion which arises when the wheels act in the usual manner directly on a swinging arm attached to the shaft. The arrangement is also advantageous, in that the rock-shaft is turned in one direction or the other according to the direction pursued by the train, instead of being turned in the same direction in both cases. This action is particularly advantageous when the shaft is used, as it may be, to operate magneto-generators or dynamo-electric machines, as it will cause the generator to be operated by trains moving in one direction, but not by trains moving in the opposite direction.

I am aware that in an annunciator to be operated by hand a push-button has been combined with a conducting-ball and with two inclined conductors, which the ball would ascend under the influence of the button, and this I do not claim.

I am also aware that signaling-instruments have been variously connected by electric circuits with track-connections serving to control the circuits; but I believe myself to be the first to invent an organization substantially such as herein described.

Having thus described my invention, what I claim is—

1. In a railway-signal, the combination, substantially as herein described and shown, in an electric circuit, of an electric battery or generator, an electric signal, a normally-closed circuit-controlling device adjacent to the signal, provided with track-connections whereby

passing trains are caused to open the circuit, a second and normally-open circuit-controlling device located at a distance from the signal and provided with track-connections whereby passing trains are caused to close the circuit, and an electro-magnet in the circuit, acting to retain the circuit in its closed condition at the distant point until it is broken at the signal.

2. In an automatic crossing-signal for single-track railways, the combination, substantially as hereinbefore described and shown, of an electric circuit embracing the following members: a battery or source of electricity, an electric signal adjacent to the crossing, a normally-closed circuit-controlling device located adjacent to the signal, and provided with track-connections whereby passing trains are caused to operate said device and open the circuit momentarily, two normally-open circuit-controlling devices located on opposite sides of and at a distance from the signal, and each provided with track-connections whereby said devices are caused to close the circuit, and an electro-magnet combined with each of said devices and adapted to retain the same in a closed condition until the circuit is broken at the signal, whereby the signal is caused to operate during the time that a train is passing from either end of the circuit toward the signal and stopped when the train reaches the signal.

3. In an electric railway-signal, the combination of a signaling-instrument, the circuit extending thence to a distant point on the track, a normally-open circuit-closing device located at the distant point and provided with track-connections by which it is closed, and an electro-magnet in said circuit, acting to maintain the same in a closed condition until the magnet is discharged by the breaking of the circuit at the distant point.

4. The combination of the terminals *b b'*, the gravitating ball or conductor *c*, co-operating therewith, the electro-magnet in circuit with said conductors, and the arm operated by said magnet to retain the ball in its elevated position, whereby the circuit is maintained in its closed condition until broken at a distant point.

5. In a circuit-controlling device, two terminals with inclined conducting-surfaces, combined with a gravitating conducting-ball thereon, and track-connections, substantially as described, adapted to be operated by passing railway-trains to cause the ball to ascend the inclined surfaces.

6. In a circuit-controlling device, the two inclined conductors and the rolling conductor operating in connection therewith, in combination with a pressure-arm, as *h*, adapted to hold the rolling conductor in forcible contact with the others.

7. In a railway-signal, the combination of a rock-shaft provided with an arm to receive motion from passing trains, and with a second arm, *o*, a vertically-movable plate, *p*, and two upright pivoted arms or links, *g*, sustaining

the ends of said plate, whereby the passing trains are enabled to communicate motion to the rock-shaft.

5 8. The rock-shaft provided with the upright arm at one end, combined with a spring tending to retain said arm in an upright position, the plate *p*, and the sustaining-links *q*.

9. In combination with two inclined conductors, *b* and *b'*, a rolling conductor, *e*, and a rock-shaft provided at one end with an arm to act upon the rolling conductor and provided at the opposite end with devices adapted to receive motion from passing railway-trains.

10. In combination with the inclined terminals and the rolling conductor, the spring *h*,

and the rock-shaft provided with an arm to act upon the rolling conductor, and with a second arm or finger to elevate the spring.

11. In combination with a railway-rail, a rock-shaft provided with a crank-arm and a longitudinal and vertically-movable plate connected to said crank-arm and to an inclined link, whereby the car-wheels in passing over said plate are caused to communicate a rotary motion to the shaft.

MALCOLM W. LONG.

Witnesses:

FRANCIS S. HESSELTINE,
JOHN B. TAFT.