(No Model.)

W. HADDEN.

RAILROAD SIGNAL.

No. 273,514. Patented Mar. 6, 1883.

Fig. 1.

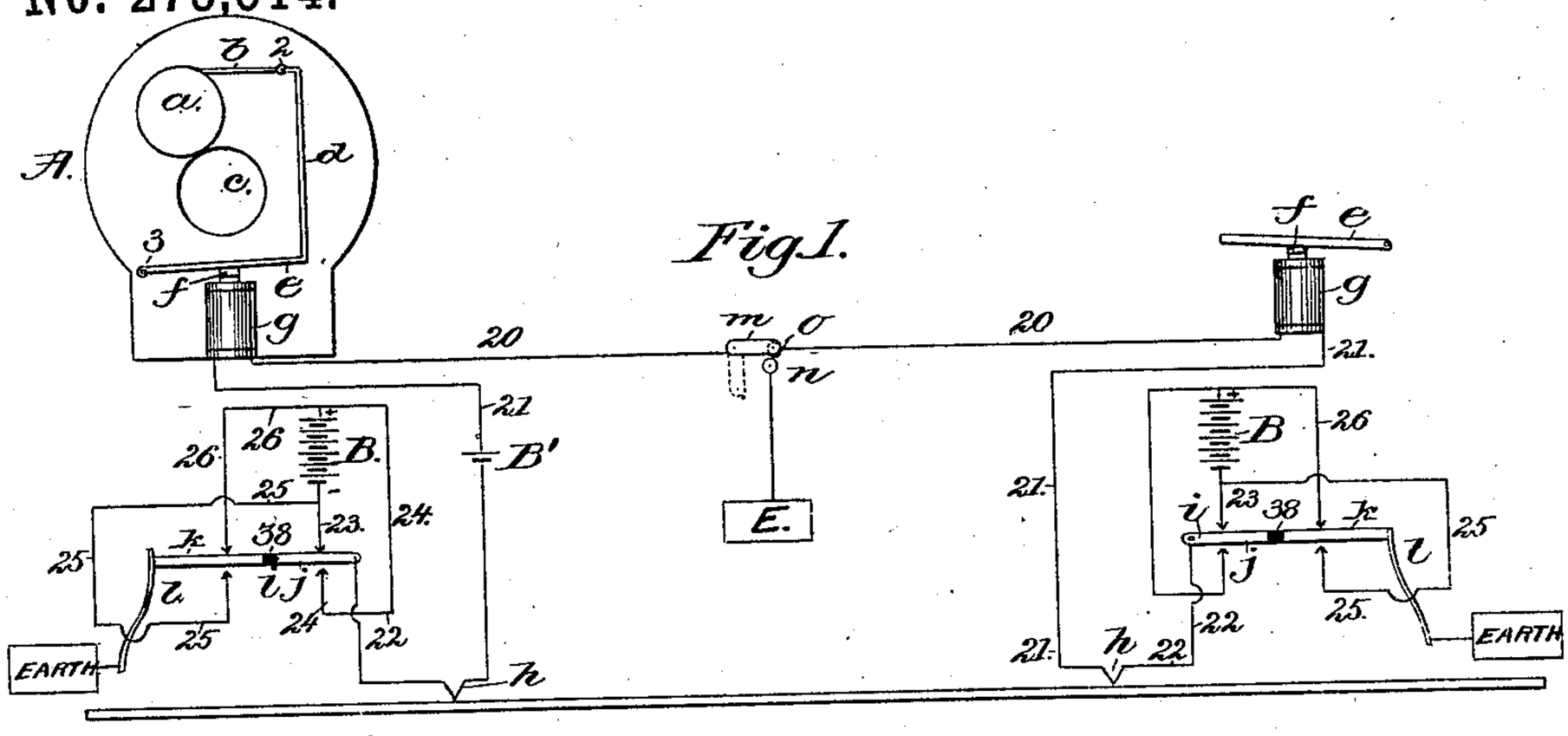


Fig. 2.

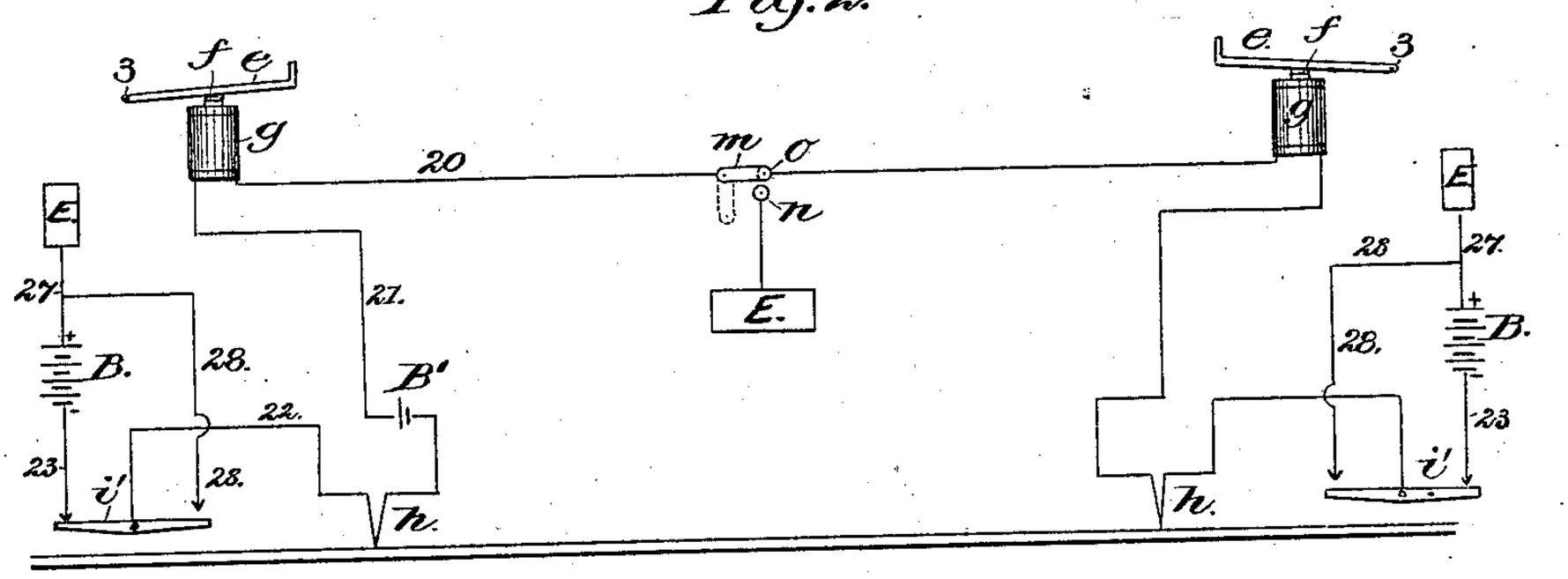


Fig. 3.

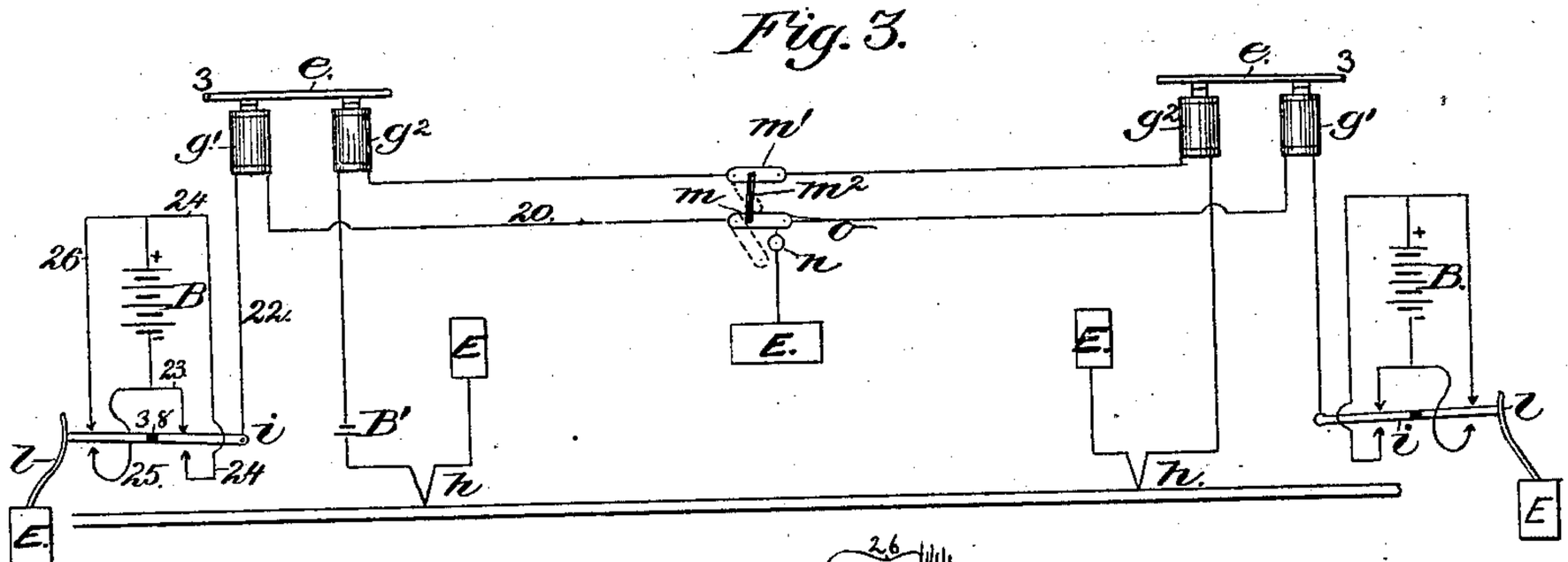
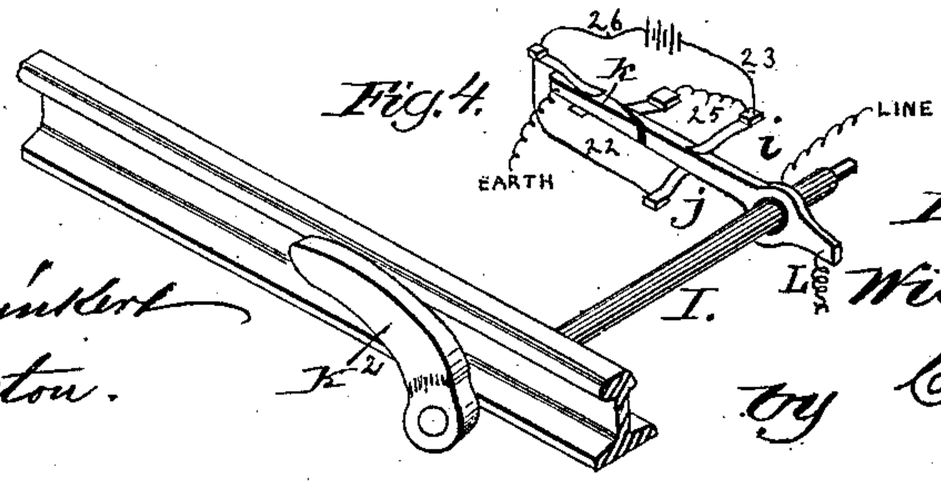


Fig. 4.



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UNITED STATES PATENT OFFICE.

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RAILROAD-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 273,514, dated March 6, 1883.

Application filed April 7, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HADDEN, of Brooklyn, Kings county, State of New York, have invented an Improvement in Railroad-Signals, of which the following description, in connection with the accompanying drawings, is a specification.

This invention relates to an electrical railway-signal apparatus of that class in which the signal is moved to one position, preferably the "safety" position, by the action of an electric current of short duration, automatically applied by the train when it becomes removed from the signal a sufficient distance to no longer require its protection, or, in other words, when it passes off from the block-section guarded by the said signal. After being thus moved by the actuating-current of short duration the signal is retained or locked by the action of a current which has not power, or is not properly applied, to move the said signal, but is sufficient to hold it, the said current remaining normally in action, but being momentarily interrupted by the action of a train passing a point where it requires the protection of the said signal, or, in other words, entering the block-section guarded by it.

The present invention has for its object to simplify the circuits employed; and it consists mainly in a novel arrangement of the batteries and conductors, in combination with novel circuit-controlling instruments actuated by the passing trains.

In a signal apparatus for a single-track railway upon which the trains run in both directions it is necessary to set a signal at the remote end of the section upon which the train is entering, to warn other trains moving in an opposite direction, or toward the said train by which the signal is set, as well as to set a signal at the point where the train enters the section, to warn trains following in the same direction, and both the said signals have to be restored to their normal or "safety" position when the train leaves the section, all these operations being independent of the direction in which the train traverses the section. The restoration of the signals at both ends of the section to their normal position by the action of the train leaving either end of the said section has been heretofore accomplished by extending the conductor from one pole of the battery through the actuating-magnets of all the signals to be operated simultaneously and to all the points from which they are to be operated, thus necessitating that the said conductor shall traverse the section twice, while the other pole of the battery is grounded, or has a conductor extending to the said points from which the signals are to be operated, so that the two conductors can be connected at the said points to thus complete the circuit of the battery through the said conductors and magnets.

In the present invention the actuating-battery is divided into two portions, which are located at the ends of the section or points from which the signals are to be operated by the train, the said portions of the battery each being controlled by an instrument operated by the passing train in such a manner as to throw them upon the line passing through the magnet, each battery being controlled by the instrument located near it in such manner that the double conductor extending the length of the block-section is not required. The two portions of the battery are preferably placed to normally oppose one another, thus producing no effect upon the magnet, and in this case the circuit-controlling instruments may be such as to remove the corresponding portion of the battery from the line, leaving the other to act unopposed, or, preferably, to reverse the position of the corresponding portion of the battery in the line, thus making the two portions act in conjunction when the said instrument is operated by the train. When the batteries are thus set in opposition to one another in the circuit containing the signal-actuating magnets, it will be seen that by grounding the said circuit at an intermediate point, or connecting it with the return-wire from the batteries, if a complete metallic circuit is employed, two independent circuits will be formed for the said batteries, each of which will operate the signals the magnets of which are in circuit therewith.

As herein shown, the same magnet is employed both to actuate and lock the signals, the said magnet being in a normally-closed circuit, having a small battery-power thereon, sufficient to enable the said magnet to hold

the armature up to the poles thereof, but not sufficient to enable it to move the said armature up to the poles when in its remote position or retracted therefrom. The actuating-batteries, which are normally opposed to one another, and consequently neutral, or may be, if desired, normally removed from the circuit, have sufficient power, when acting in conjunction or when acting unopposed, to move the said armatures from their remote position up to the poles of the magnet, where they will be retained by the action of the weaker current, after the said actuating-batteries have been removed or again set in opposition to one another.

Figure 1 is a diagram showing the circuits and circuit-controlling instruments constructed in accordance with this invention, the batteries being set in opposition to one another and the circuit-controlling instrument operated by the train being constructed to reverse the connection of the battery adjacent to it; Fig. 2, a similar diagram, in which the circuit-controlling instrument removes the battery controlled by it, leaving the other battery to act unopposed; Fig. 3, a modification in which independent magnets are employed to actuate and hold the signal; and Fig. 4, a perspective view, showing a form of apparatus that may be employed for controlling the circuits by the passing trains.

The signal *a* (one only of which is shown in Fig. 1, the others all being similar to it) consists of the usual colored banner or disk, which is mounted on an arm, *b*, pivoted at 2 in the inclosing-case A, which is mounted upon a post, or otherwise supported in suitable position relative to the track, to enable the said signal *a* to be seen by the engineer through the opening *c* in the said case A when the said signal is placed behind the said opening. The lever *b* is connected by a link or rod, *d*, with the free end of an armature-lever, *e*, pivoted at 3, and provided with an armature, *f*, for the electro-magnet *g*. The weight of the signal *a* is sufficient to turn it on its pivot 2 into position behind the opening *c*, except when the said weight is sustained by the attraction of the magnet *g* on the armature *f*. Thus when the magnet *g* is demagnatized the signal *a* drops into view through the opening *c*, and the armature *f* is by the same movement removed a definite distance from the poles of the magnet *g*, the weight of the signal forming a retractor for the said armature.

The main line 20 consists of a conductor connecting the magnets *g*, which are placed at the ends of a suitable length of track to constitute a block, upon which only one train is permitted to be at any one time. The other terminals of the magnets *g* at either end of the section are continued by wire 21 to a circuit-breaker, *h*, which is normally closed, but adapted to be automatically opened by the train in passing, and from which the circuit is continued by wire 22 to the circuit-controlling instrument *i*.

The actuating-batteries B have one pole, as the one marked, connected by wire 23 with a contact-point arranged to connect with one portion, *j*, of the circuit-controlling instrument *i* when in its normal position, and the same or negative pole is also connected by wire 25 with a contact-point arranged to connect with another portion, *k*, of the said instrument when depressed or moved from its normal position, which is done automatically by the train leaving the section of track guarded by the signal. The other pole of the battery is also connected by wires 24 26 with two contact-points, each arranged to be in contact with the other portion of the said key *i* than that connected with the negative pole in either position of the said key. The two portions *ik* of the said instrument are insulated from one another, as shown at 38, and one portion is connected, as before mentioned, with the lines 20 21 22, including the magnets *g*, and the other portion is connected by the contact-piece *l* with the ground or return wire, these connections remaining the same in all positions of the instrument.

The batteries B at each end of the section have similar poles connected with the corresponding portion of the circuit-controlling instruments *i* when in their normal position, as shown in full lines, Fig. 1.

The circuit may be traced as follows when the circuit-controlling instruments are in their normal condition: Beginning with the earth at one end of the section, the circuit passes by the contact-piece *l* to the portion *k* of the circuit-controlling instrument *i*, thence by wire 26 to the positive pole of the battery B, and from the negative pole thereof, by wire 23, to the portion *j* of the instrument *i*, thence by wire 22, through the circuit-breaker *h*, wire 21, magnet *g*, and wire 20 to the other end of the section, where it is continued through magnet *g*, wire 21, circuit-breaker *h*, wire 22, portion *j* of the instrument *i*, wire 23, battery B, wire 26, portion *k* of the instrument *i* and contact-piece *l* to the earth. The batteries B thus have like poles to line and like poles to the ground, and consequently neutralize one another, they being of equal strength. An additional battery, B′, is included in the circuit, the effect of which on the magnet *g* is sufficient to hold the armature *f* when near the poles of their magnets, but is not sufficient to cause the said armatures to move up to the poles when in their remote position, or when the signal *a* is in line with the opening *c*, indicating danger.

When one of the instruments *i* is depressed the portions *j k* thereof are brought into contact with the wires 24 25 and removed from the wires 23 26, so that the positive pole of the adjacent battery B is then connected with the line and the negative pole with the earth, and the said battery consequently acts in conjunction with the battery at the other end of the section. The two batteries B, when thus placed in conjunction, produce a sufficient force in the magnets *g* to attract their armatures from their remote position and raise the sig-

nals *a* out of sight, as shown in full lines, Fig. 1.

In operation, when a train enters the section from either end, the signal being raised, it first operates upon the instrument *i*, reversing the connections of the battery B at that end, which produces no effect upon the signal, as the armature *f* is already attracted to the poles of its magnet. As soon as the train passes the said instrument *i* is restored to its normal position, and the train in its further movement acts upon the circuit-breaker *h* at the same end of the section, which opens the circuit and wholly demagnetizes the magnets *g*, permitting their armatures to be retracted and the signals *a* to fall into the "danger" position. As soon as the train passes the said circuit-breaker *h* the latter closes, leaving the battery B′ on the circuit, which, as before mentioned, has not sufficient strength to move the armatures *f* from their remote position, so that the signals remain displayed, indicating that the section is occupied, and warning another train not to enter. When the train has traversed the section it first operates the circuit-breaker *h* at the other end thereof, which produces no effect upon the signals, as they are already in their "danger" position, and when it passes the said circuit-breaker the latter closes, after which the train, in leaving the section, operates the instrument *i*, reversing the connection of the adjacent battery B, thus causing the two batteries B to act in conjunction and giving the magnets *g* sufficient power to attract the armatures *f* and raise the signals. As soon as the train has passed the instrument *i* the latter assumes its normal position, the batteries B being again opposed, and the battery B′ then acting to retain the signals in the "safety" position. The circuit-controlling instrument *i* may be operated as shown in Fig. 4, it being mounted on a rock-shaft, I, provided with a treadle, k^2, arranged to be depressed by the flanges of the wheels, thus rocking the said instrument *i* on its pivotal point and changing the circuit-connections. The said parts will be restored to their normal position after the train has passed by the action of a spring, L, and they will preferably be made slow-moving, so that the spring will not have time to restore the device between the impulses of the successive wheels. The invention is not limited to the employment of a circuit-closer of this construction, and no claim is made for the said circuit-closer by itself.

It is sometimes desirable to operate the signals otherwise than by a train entering and leaving the section. For instance, if the block-section contains a railway-switch or a draw-bridge, or other cause for producing an obstruction or break in the line of the track, it is desirable for the attendant operating the said switch or draw-bridge to be able to set the signals to "danger," which may be done by breaking the circuit 20 by the electrical switch *m*, moving it to the position shown in dotted lines. After the obstructions or breaks in the track of the block-section are removed it is desirable to restore the signals to their "safety" position, which may be done by grounding both portions of the line 20, thus bringing the batteries B into two distinct circuits, in which they act independently upon the signals *g* in the said circuits. This may be done by providing a button or anvil-piece, *n*, for the switch *m*, connected with the ground, and so placed relative to the button *o*, upon which the switch *m* rests when closing the line 20, that in the return movement of the said switch from the dotted to the full line position it will rest on both of the said buttons simultaneously before it finally comes to rest on the button *o* alone. This will complete the circuit from the ground, connected with the button *n* through the switch *m*, and before-described circuits to the ground at one end of the section, and from the said button *n*, through the switch *m* and button *o*, through the circuit before described, to the ground at the other end of the section, thus causing each one of the batteries B to act independently upon the magnet *g*, between it and the switch *m*, and restoring the signals to the "safety" position, where they will be retained by the action of the battery B′, as before described, after the switch *m* has passed off from the button *n* and remains on the button *o* alone.

In the modification shown in Fig. 2 the circuit-controlling instruments *i′* are arranged to remove one of the batteries B from the circuit, leaving the other one to act unopposed, either one alone being sufficient to move the signal from the "danger" to the "safety" position. In this instance the line-wire 22 is connected with the circuit-controlling instrument *i′*, which naturally rests in contact with the wire 23, connected with the same pole of the battery B at each end of the section, while the other pole of the said battery is connected by wire 27 with the ground. A branch wire, 28, leads from the wire 27 to a contact-point, which will be touched by the instrument *i′* when acted upon by the train. In this construction, when the instrument *i′* is acted upon by the train leaving the section, it is disconnected from the battery B and connected with the wire 28, so that the battery B at the adjacent end of the section is removed from the circuit, which passes from the earth by wires 27 and 28 to the instrument *i′* and line, which it traverses, to the instrument *i′* at the other end of the section, and is completed by wire 23, battery B, and wire 27 to the ground. Either battery B alone is sufficient to move the signal, and in other particulars the apparatus operates the same as described in Fig. 1.

In the modification shown in Fig. 3 independent magnets are employed to move the signals, and to retain them when thus moved. The circuit of the actuating-magnets *g′* is the same as that of the magnets *g* in Fig. 1, except that there is no additional battery B′ and no circuit-breaker *h*.

The batteries B are of equal strength, and

when opposed to one another, as in the normal condition of the instruments *i*, the magnets *g'* are wholly demagnetized.

The holding-magnets g^2 are in an entirely independent circuit containing the battery B' and circuit-breakers *h*, the said magnets g^2, when acted upon by the said battery B', being sufficient to hold, but not to move, the armature-levers *e*. In this case, when the signals are to be operated from an intermediate point, the circuit of the magnets g^2 has to be broken to set the signals to "danger," and the circuit of the magnets *g'* has to be grounded to restore the said signals to the "safety" position, the circuit of the magnets g^2 being closed to retain them in said "safety" position before the said ground is removed from the circuit of the magnets *g'*. The circuit of the magnets *g'* may be operated by a switch, *m*, and anvil-pieces *n o*, the former connected with the ground, exactly as described in connection with the other figures, while the circuit of the magnets g^2 may be controlled by a switch, *m'*, mechanically connected by a link, m^2, with the switch *m*, and arranged to make contact with its button to close the circuit before the switch *m* is removed from the button *n*.

This invention is not limited to any particular construction of the circuit-controlling instruments *h* or *i*, or to the particular construction of the signal and its operating-levers, as any signal the movements of which are controlled by similar changes in the condition of an electro magnet or magnets may be employed. Any form of circuit-changing instruments arranged to be automatically operated by the train may be employed, numerous varieties of which are well known, having been fully described in prior English and United States patents. Circuit-controlling instruments suitable for this purpose will form the subject of another application for Letters Patent.

When it is not desired to operate the signals from any intermediate point in the section it is obvious that the batteries B may be normally removed from the circuit, or, in other words, the apparatus shown in Fig. 2 could be employed with the instruments *i'* normally in the opposite position to that shown—viz., in connection with the wire 28—and disconnected from the wire 23, so that when one of the said keys is depressed the adjacent battery would be thrown on the line instead of removed therefrom.

I claim—

1. The signal and the electro-magnet by which it is controlled, combined with two independent batteries, both normally in circuit with the said magnet, but acting in opposition to one another, and a circuit-controlling instrustrument for one of the said batteries, automatically operated by the passing train, by means of which the said battery is removed from opposition to the other in the circuit of the said signal-controlling magnet, substantially as and for the purpose described.

2. In a railway-signal apparatus, the combination of the signals, their actuating-magnets, and circuit therethrough, with independent actuating-batteries normally in circuit with the said magnets and opposed to one another, and corresponding independent circuit-changing instruments at each end of the block-section automatically actuated by the train, by means of which the battery at either end of the section may be made to act unopposed by that at the other end, substantially as described.

3. The signal and electro-magnet and its armature to operate it, combined with a normally-closed circuit through the said magnet, and generator therein of sufficient power to cause the magnet to hold the said armature when attracted, but insufficient to move it when retracted, and an actuating-battery normally inactive in the said circuit, and a circuit-controlling instrument therefor, operated by the train in passing, by which the said battery may be caused to act in the said circuit, substantially as and for the purpose described.

4. The signal and electro-magnet and armature by which it is actuated, combined with two batteries normally set in opposition in the circuit of the said magnet, and an electric switch, by means of which the conductor joining one pair of like poles of the said batteries may be connected with the conductor or ground forming the circuit-connection between the other pair of like poles, and an independent circuit thus formed for each battery, in which it acts unopposed, as and for the purpose described.

5. The signal-actuating electro-magnet and armature, and circuit through the said magnet, connected with one portion of a circuit-controlling instrument, the other portion of which is connected with the ground or other terminal of the circuit, combined with a battery having its two poles respectively connected with the two portions of the said instrument when in its normal position, the said poles also being connected with contact-points by which the said poles are connected in inverse order with the same portions of the said instrument when moved from its normal position, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM HADDEN.

Witnesses:
JOS. P. LIVERMORE,
JOHN D. GOULD.