(No Model.)

W. HADDEN.

RAILWAY SIGNAL.

No. 273,513. Patented Mar. 6, 1883.

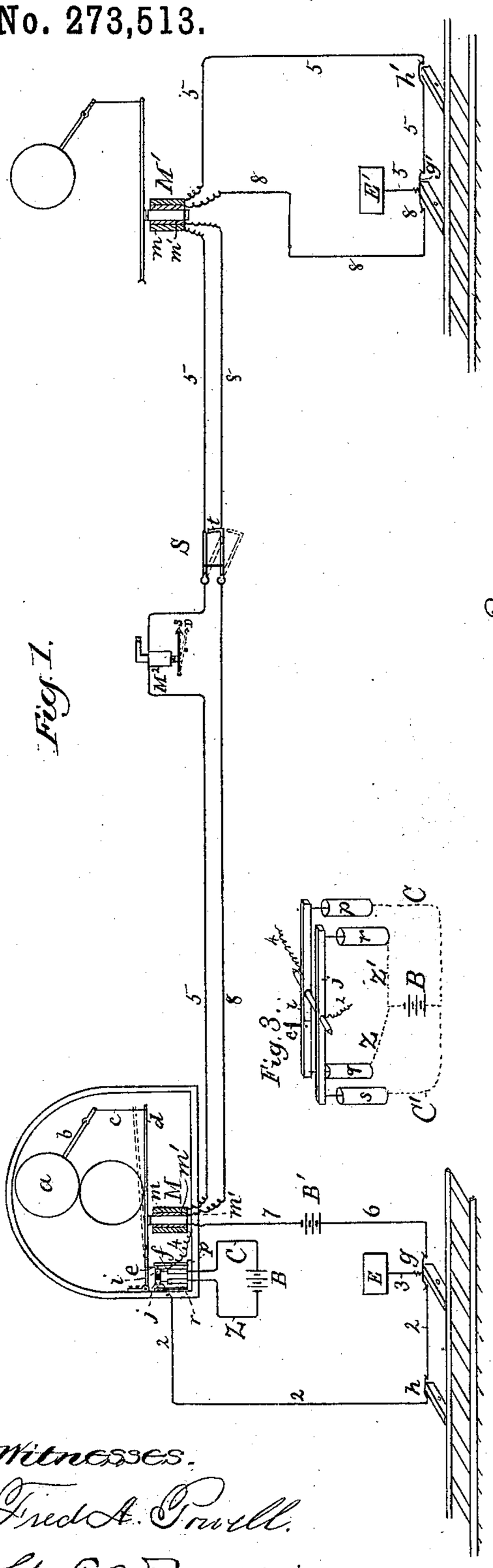

Fig. 1.

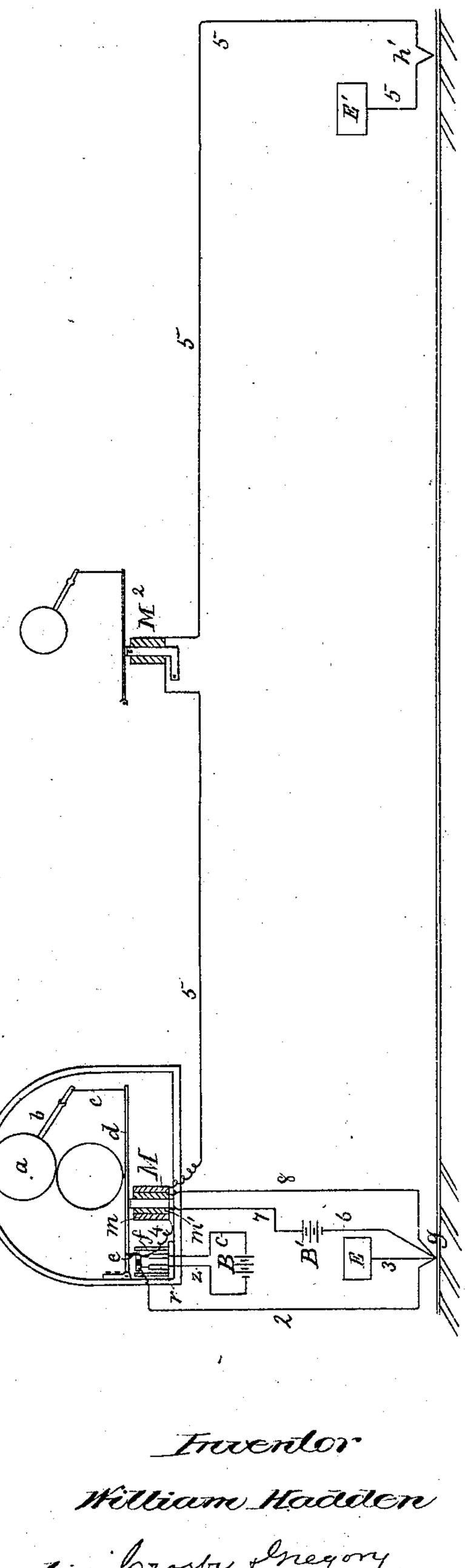

Fig. 2.

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UNITED STATES PATENT OFFICE.

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RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 273,513, dated March 6, 1883.

Application filed May 12, 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 Railway-Signals, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relates to railway-signal apparatus of that class in which the signal is normally held in its "safety" position by the action of an electric current upon an electro-magnet in a closed circuit, the said signal being set in the "danger" position by the interruption of the said current.

The present invention consists in the employment, in combination with the signal, of an actuating electro-magnet having two coils in independent circuits and a pole-changer for one of the said circuits, operated by the armature of the signal-actuating magnet or another magnet of similar construction in circuit therewith. When the armature of the magnet is attracted the pole-changer is in such position that the current controlled by it traverses its coil in the electro-magnet in such manner as to produce the same sort of magnetization as the current in the other coil thereof, so that it is magnetized to retain the said armature by the combined effect of both currents. When both the circuits are simultaneously broken by a circuit-breaking instrument included therein the armature is retracted, and in its movement actuates the pole-changer to reverse the polarity of one of the said currents, so that after their circuits have been closed by the circuit-breaker ceasing to operate the two currents will act in opposition in the cores of the magnet, so that the latter will not be magnetized sufficiently to attract the armature, and the signal will consequently remain in its "danger" position after the circuit-breaker, by which it was set to "danger," has ceased to operate—as by a train having passed beyond it. In order to again restore the signal to the "safety" position, one of the said circuits is provided with a circuit-breaker, which, when operated, leaves the current in the other circuit acting unopposed on the magnet, which is thereby magnetized with sufficient power to attract the armature, and in the said movement restore the pole-changer to its normal position, so that after the said circuit-breaker is again closed both circuits will again act in conjunction upon the magnet.

Figure 1 is a diagram illustrating a signal apparatus embodying this invention adapted to be used in connection with a single track over which trains pass in both directions; Fig. 2, a diagram illustrating the apparatus in a suitable form to be employed in connection with a double-track railway on which the trains pass over one track always in the same direction, and Fig. 3 a perspective view of the pole-changer.

The signal *a*, mounted on arm *b*, connected by link *c* with the armature-lever *d*, is substantially the same as in preceding applications filed by me, and consequently needs no further description, as it constitutes no part of the present invention. The said armature-lever *d* is provided with an armature operated by an electro-magnet, M, having two coils, *m* *m'*, and the said lever *d* is connected by a link, *e*, with the pole-changing device *f*, which may be and is shown substantially the same as in my application No. 60,114, filed May 1, 1882.

The battery B has one pole connected by wires C C′ with the mercury-cups *p* *s* and its other pole by wires Z Z′ with the cups *q* *r* of the said pole-changing device *f*, from one of the levers *i* of which the circuit is continued through the coil *m* of the magnet M, the other lever, *j*, being connected with the ground, and the current in the said circuit having its polarity reversed by the said pole-changer when the armature-lever *d* is retracted from the magnet by the movement of the signal to its "danger" position. The circuit of the battery B is as follows: From the pole-changer *f* one or the other of the poles of the said battery, according to the position of the said pole-changer, is connected by wires 2 and 3 with the ground E, near the same end of the section, while the other pole is connected by wire 4 with the coil *m* of the electro-magnet M, from which the circuit is continued by wire 5, including, if desired, coils of other magnets, M′ M², as many as may be desired, to the ground E′. The circuit of the other coil, *m'*, of the magnet M includes the battery B′, one pole of which is con-

nected by wires 6 and 3 with the ground at E, and the other pole of which is connected by wire 7 with the coil m' of the magnet M, from which the circuit is, in the single-track apparatus shown in Fig. 1, continued by wire 8, including the other magnets, if desired, to the ground E′ at the other end of the section. In the normal condition of the signal, when indicating "safety," the connection of the pole-changer f is such that the current of the battery B produces in the coil m of the magnet M a similar magnetic effect to the current of the battery B′ in the coil m^2, so that the said magnet is magnetized and the armature held or attracted by the combined power of both batteries. The circuits of both batteries B B′ are provided with a circuit-breaker, g, normally connecting the wires 2 and 3 and 3 and 6, Fig. 1, but adapted to be opened by a train entering the section, thus opening both circuits simultaneously and completely demagnetizing the magnet M, which thus permits the armature-lever d to be retracted, the signal to move to the "danger" position, and the pole-changer f to reverse the polarity of the current of the battery B, acting on the coil m of the magnet M. When the circuits are again closed the polarity of the current of the battery B, being thus reversed, will act on the coil m of the magnet M with the opposite effect to the current of the battery B′ on the coil m' of the magnet M, which is thus magnetized only by the difference in strength of the said currents, which is not sufficient to attract the armature d, and the signal consequently remains in the "danger" position after the circuit-breaker has become closed. The circuit of one of the batteries—as, for instance, the battery B—is provided with a circuit-breaker, h', operated by the train leaving the section, the circuit of the other battery, B′, being then closed, so that its current acts upon the coil m' of the magnet unopposed by the current of the battery B, and the said battery B′ is made of sufficient power to attract the armature d when thus acting alone and unopposed. It will thus be seen that by breaking the circuit of one only of the coils of the magnet M, as by the circuit-breaker h', the signal is restored, by the action of the other coil, to its "safety" position, and in such movement the pole-changer f is restored to its normal position, so that when the said broken circuit is subsequently closed the current therein will act in conjunction with the current which was uninterrupted in its action upon the magnet M, thus retaining the signal in the "safety" position until both circuits are again broken simultaneously, as before described. It is obvious that the same effect is produced on the magnet M′, having coils $m\,m'$ in the circuits of batteries B B′, respectively, as on the magnet M, and in fact on any number of magnets, having two coils included in both circuits, in the same relations to one another as in the magnet M. As it is necessary to have both circuits broken at the same time, in order to set the signal to "danger," the said circuits are both extended to all the points from which it is necessary to operate them.

In the form shown in Fig. 1, where the signals are to be operated by a train entering either end of the section, both circuits are extended entirely across the section, as shown, and provided with breakers $g\,g'$ at either end thereof for simultaneously breaking both circuits, they being operated by trains entering the section at either end. One of the said circuits is provided with breakers $h\,h'$, adapted to be operated after the breakers $g\,g'$ at the same end of the section by a train leaving the section, but before the said breakers $g\,g'$ by a train entering the section. Thus when a train enters upon the section with the signals at "safety," it produces no effect as it passes the breakers h or h', as only one of the circuits is then broken, and the signal is retained in the "safety" position by the action of the other circuit. As soon, however, as it passes the breaker g or g' adjacent to the said breaker h or h', both circuits are broken and the signals all set to "dangers," as before described. In passing off from the section, the signals being at "danger," no effect is produced when the train operates the breaker g or g'; but after it has passed and the said breaker g or g' is closed, the train operates the adjacent breaker h or h', thus leaving one of the circuits acting upon the magnet without the opposing effect of the other, thereby causing the signals to be restored to their normal or "safety" position, as desired.

It is obvious that a signal can be operated by a magnet in the circuit of the battery B alone, it being of such nature that the reversal of the current causes a change of position of the armature and signal actuated or governed thereby. Such a signal is shown as controlled by the magnet M^2, having a permanently-magnetized core, the permanent magnetization of which corresponds with the effect of the battery B′ and coil m' on the cores of the magnets M M′, so that when the current of the battery B is of its normal polarity it acts to increase the magnetism of the core of the magnet M^2, thus causing it to attract and retain its armature up to its pole. When, however, the said current is reversed by the action of the pole-changer f, the effect of the current is to neutralize the permanent magnetism, thus causing the magnet M^2 to cease to attract its armature, which, in Fig. 1, is shown as a pointer indicating the "safety" or "danger" condition of the circuit, according as it is opposite the letter S or D.

It will be understood that the magnet M, having coils included in both circuits, could be employed to control the movement of the pole-changer f, and that independent magnets could be employed to actuate all the signals, the said magnets being operated by the change of condition of the circuit of the magnet M.

In the form shown in Fig. 2 it is desired to

set the signal to "danger" only from one point, as the trains all enter one end only of the section and leave it at the other end. In this case the circuit of the battery B′ and coil *m′* of the magnet M is merely localized through the said battery, coil, and the breaker *g*, which connects the wires 2 3 and 6 8. The circuit of the reversing-battery B is, however, extended the entire length of the section, and provided with the breaker *h′*, by which it is broken to permit the local circuit of the battery B′ to act to restore the signal and pole-changer *f* to its normal condition, and thus cause the signal to be retained at "safety" after the circuit of the battery B is again closed at the breaker *h′*, the current then being of its normal polarity.

When desired to set the signal to "danger" and "safety" by instruments other than the breakers *g g′ h h′*, operated by the trains, this can be done by means of a switch, S, Fig. 1, consisting of two mechanically-connected switch-arms, which open both circuits simultaneously when moved from the full to the dotted line position and close the circuits again when restored to their full-line position. To restore the signal to the "safety" position it is necessary that one circuit should be closed before the other, so that the pole-changer *f* may be restored to its normal position by the action of one unopposed current before the other current is applied. This is accomplished by making the anvil-piece or the movable portion of one of the switch-arms with an extension, *t*, so that in the movement from the dotted to the full line position the circuit controlled thereby will be closed before the circuit controlled by other switch-arm.

I claim—

1. In a railway-signal apparatus, the electro-magnet having two coils in independent circuits combined with the pole-changing device in one of the said circuits, operated by the armature of the said magnet, substantially as and for the purpose described.

2. The combination of the electro-magnet having two coils in independent circuits, the circuit-breaker by which both said circuits are broken at the same time and the electro-magnet demagnetized, and the pole-changer in one of the said circuits, operated by the armature of the said magnet, whereby after the movement of the said armature from the poles of its magnet the current in the said circuit is made to act in opposition to the current in the other circuit on the cores of the said magnet, substantially as described.

3. The combination of the electro-magnet having coils in two independent circuits, the pole-changing device in one of the said circuits operated by the armature of the said magnet, whereby in the movement of the said armature from the poles of its magnet the current controlled by it is set in opposition to that in the other coil of the said magnet, and a circuit-breaker in one of the said circuits only operated by trains passing off from the section, whereby the magnet is acted upon by the unopposed current in the unbroken circuit, its armature attracted thereby, and the pole-changing device restored to the position in which both currents act in conjunction when the circuits are both closed, substantially as described.

4. The electro-magnet having two coils in independent circuits, combined with a pole-changing device operated by the armature thereof in one of the said circuits, and an electric switch having mechanically-connected arms, one for controlling each circuit, and provided with an extended contact for one of the said arms, whereby in closing the said switch one of the said circuits is closed before the other, substantially as and for the purpose described.

5. The combination of the electro-magnet having two coils in independent circuits, the pole-changing device for one of the said circuits operated by the armature of the said magnet, the circuit-breaker operated by trains entering the block-section by which both circuits are opened at the same time, and the circuit-breaker operated by trains leaving the section by which one circuit only is opened, substantially as and for the purpose 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,

W. H. SIGSTON.