(No Model.) 2 Sheets—Sheet 1.

W. W. LE GRANDE.

ELECTRIC RAILWAY SIGNAL.

No. 272,276. Patented Feb. 13, 1883.

Fig. 1.

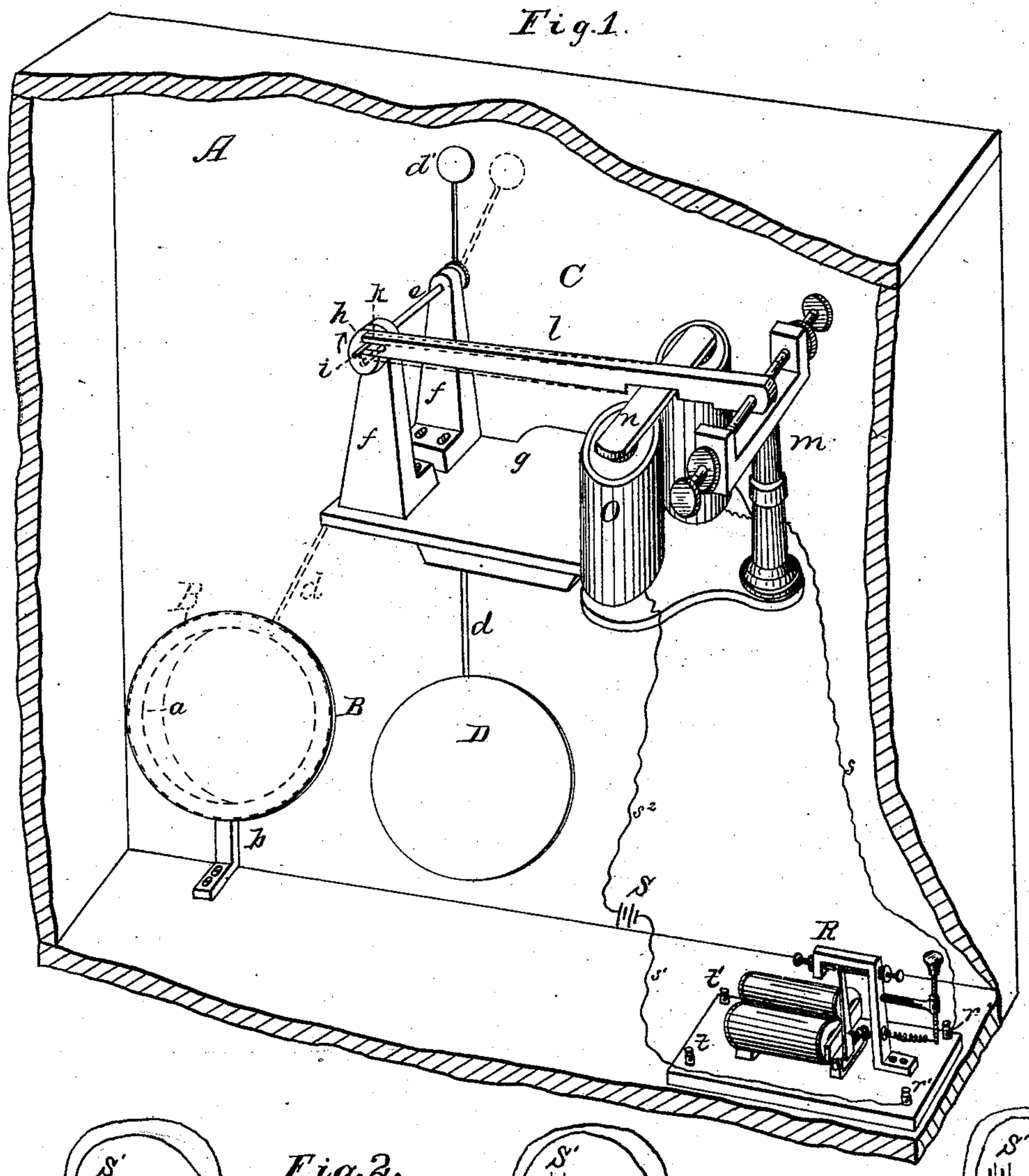
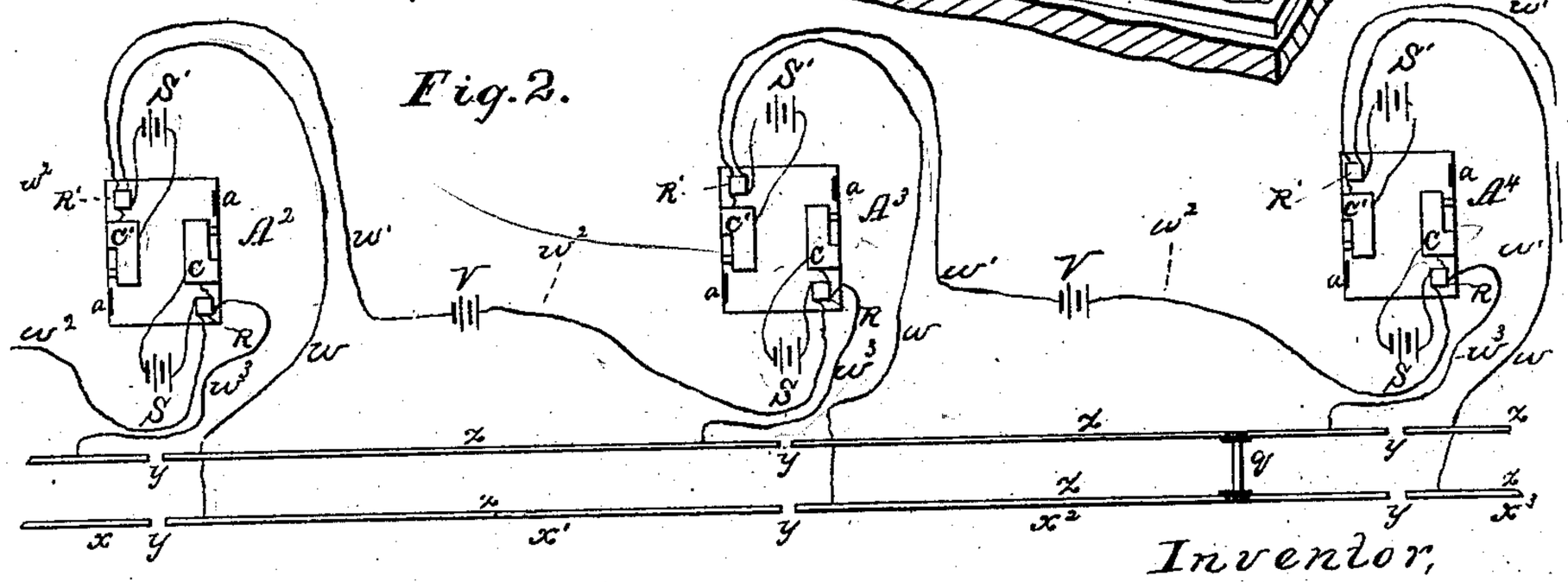


Fig. 2.



Witnesses,
A. G. Hyltunen
D. A. Kane

Inventor,
W. W. Le Grande,
by J. M. Yznaga,
Attorney.

(No Model.) 2 Sheets—Sheet 2.

W. W. LE GRANDE.

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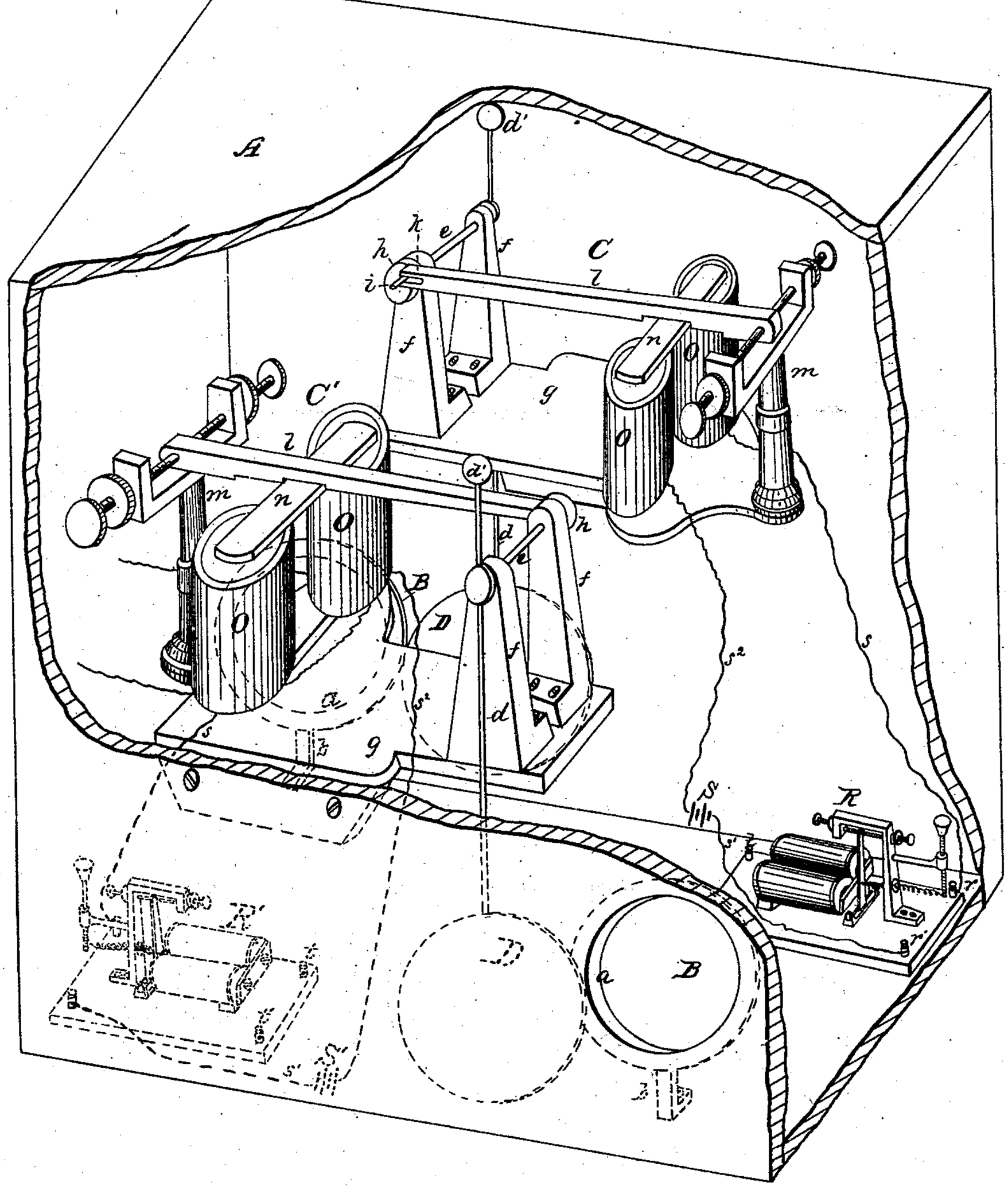
Fig. 3



Witnesses,
A. G. Hrylmuy.
D. D. Kane

Inventor,
W. W. LeGrande,
by J. M. Yznaga.
attorney

UNITED STATES PATENT OFFICE.

WILLIAM W. LE GRANDE, OF LOUISVILLE, KENTUCKY, ASSIGNOR OF THREE-FOURTHS TO GEORGE WOLF, F. DE FUNIAK, AND T. J. POTTINGER, ALL OF SAME PLACE.

ELECTRIC RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 272,276, dated February 13, 1883.

Application filed August 29, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. LE GRANDE, a citizen of the United States of America, residing at Louisville, in the county of Jefferson and State of Kentuckey, have invented certain new and useful Improvements in Electric Railway-Signals; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to open circuits for simultaneously operating railway-signals located at the opposite ends of a section of track to be protected thereby, its object being to secure a constant resistance in such circuits, and thereby insure the uniform working of electro-magnetic signal-instruments arranged therein.

To this end the invention consists mainly in the combination, with an overground line extending between the two ends of a railway-track section, and electro-magnetic signals arranged in said line at the opposite ends thereof, of the two lines of rail forming said track-section and connected to said overground line as parallel terminals, one line of the rails being connected to the overground line at one end of the section, and the other being connected thereto at the opposite ends of said section, so that, at whatever point the two lines of rails may be connected by the wheels and axles of a car or locomotive traveling thereon, the resistance of the circuit traversed by the current of a battery will be always the same.

The invention also consists in certain minor features having in view economy and convenience of construction, and which will be hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a perspective view of an electro-magnetic signal-instrument designed for use in my improved circuit. Fig. 2 is a diagram illustrating my improved circuit and a preferred manner of connecting electro-magnetic signals therein at the opposite ends of a section of railway-track. Fig. 3 is a perspective view of a double signal-box containing two apparatuses arranged for use in relation to different track-sections.

Referring to Fig. 1 of the drawings, the letter A indicates the inclosing-box having a circular opening formed in its side wall, as shown in dotted lines at *a*. Inside the box and a little behind said opening is arranged a stationary signal-disk, B, supported on a standard. *b*, the stationary signal-disk being ordinarily visible through the opening *a*.

The letter C designates the signal-moving instrument, and D, the movable signal operated thereby. The signal D is carried by a pendulum-rod, *d*, which carries a counterweight, *d'*, at its upper end, and is intermediately secured rigidly to one end of a shaft, *e*, which has its bearings on vertical standards *f f*, projecting from a base-plate, *g*, which is secured to the side wall of the box. Upon the opposite end of the shaft *e* from the signal-rod is secured a disk, *h*, having a crank-pin, *i*, projecting from its face. This pin *i* is embraced by a fork, *k*, formed at the end of an armature-lever, *l*, which is fulcrumed in the usual manner upon a standard, *m*, fixed upon the base-plate, and carries an armature, *n*, arranged to be attracted by the cores of an electro-magnet, O, which is also supported by the base-plate *g*. When the signal-rod *d* hangs in a vertical position, as shown in full lines in Fig. 1, the signal D is hidden behind the box-wall, and the stationary disk B is visible through the opening *a*. When the signal-rod is in this position the pin *i* of the disk *h* stands a little to one side of the vertical in the direction of the lever *l*, so that said pin will be off the "dead-center" with respect to the downward pressure of the upper prong of the fork *k*, which rests upon the pin. It will now be observed that if the forked end of the lever moves downward it will act upon the pin *i* to turn the disk *h* and shaft *e* in the direction of the arrow and throw the signal-rod and signal to the position indicated by dotted lines, thus placing the movable signal D in front of the stationary signal B, exposing the former through the opening *a*, and hiding the latter. Supposing the stationary signal B to be white, to indicate "safety," and the movable signal D to be red, to indicate "danger," it will be seen

that when instrument C is not operated—that is, the armature *n* not attracted to force the lever *l* downward—the danger-signal will be in the position shown in full lines, and hidden behind the box-wall, and the white signal B will be visible through the opening *a*, indicating "safety;" but when the instrument is operated and the armature is attracted, the lever *l* will throw the red signal D to the position shown in dotted lines, and indicate "danger."

In practice in railway-signaling, the electro-magnet O is to be charged for operating the instrument by means of a local battery, the opening and closing of the circuit of which is controlled by an ordinary relay included in a main-line circuit, and this main-line circuit is arranged to be broken and closed automatically by a car or train on a railway-track, as will be hereinafter explained.

The letter R indicates a relay inclosed in the box with the signal-operating instrument, and having one of its local binding-posts, *r*, connected with one terminal of the coils of magnet O by a wire, *s*, its other local binding-post, *r'*, being connected by a wire, *s'*, with one pole of a local battery, which is conventionally indicated at S, while the opposite pole of said battery is connected by a wire, s^2, with the other terminal of the magnet-coils. The main-line binding-posts *t* and *t'* are to be connected in a main-line circuit in the usual manner, and it will be obvious that when the main-line circuit is closed the relay will be operated to close the local circuit and cause the operation of the signal C. The relative weights of the counter-weight *d'* and the signal D are so adjusted that when the magnet O is not charged, and the armature consequently not attracted, the signal-rod *d* will swing freely to its vertical position, the pin *i* forcing upward the lever *l*, and causing the armature *n* to be retracted from the poles of the magnet to a position where it is ready to be again attracted for operating the signal. By this arrangement I avoid the use of a retracting-spring for the armature, such springs being unreliable when exposed to frequent variation of temperature, as is necessarily the case in railway-signal apparatus. I, moreover, cause the signal itself to replace the parts in position for its operation after being once operated, and thus secure a prompt co-operation between the signal and its moving devices. It will be observed that the signal-rod hangs freely in a position from which its movement is least opposed by gravity when the armature *n* is farthest removed from the poles of the magnet, and the least under the influence of the attractive power of the magnet-cores when charged; but as the signal is moved to one side in an upward arc and the opposition of gravity to its movement increases, the armature approaches the magnet-cores, which thus are enabled to exert an increased attractive force upon it, which compensates the increased resistance of gravity to the movement of the signal. I am thus enabled to use less battery-power and a less powerful and expensive magnet than would be the case were the strongest resistance opposed to the power of the magnet when its armature is farthest from its poles, as is usually the case. The counterpoise-weight is so regulated that the least resistance consistent with its prompt return will be opposed to the initial movement of the signal.

In Fig. 3 I show a double signal-box containing two signal-moving instruments and two relays. These instruments are for convenience arranged in reverse positions, the instrument C' being arranged to swing its movable signal for exposure in the opposite direction to that of instrument C. The instruments are otherwise precisely similar in their construction and connections. Such a double box is arranged at each signaling-point in the system of block signaling circuits illustrated in the diagram Fig. 2, and each relay of the box is connected in the same short main line with one of the relays in another similar box at another signaling-point, the two boxes being located at opposite ends of a section of railway to be protected thereby, so that when the main-line circuit connecting the boxes is closed a movable signal will be displayed at each end of the block or section.

Referring to the diagram Fig. 2, the letters *x*, *x'*, x^2, and x^3 indicate separate sections of railway, lines of rails of which are insulated or separated slightly from each other at the points *y*, which are the signaling-points. The rails *z* of each line of the sections respectively are electrically connected to form portions of the main line.

The letters A^2, A^3, and A^4 indicate double signal-boxes, such as shown in Fig. 3.

The letters C C' and R R' designate the signal-moving instruments and relays, respectively, as in Fig. 3. The relay R of box A^3 has one of its binding-posts connected by a wire, w^3, with one of the lines of rails of section of track *x'*, and its other binding-post is connected by a wire, w^2, with one pole of a main-line battery, V, the other pole of which is connected by a wire, *w'*, with one binding-post of the relay R' in the box A^2 at the other end of the section, and the other binding-post of this relay R' is connected by a wire, *w*, with the opposite line of rails of section *x'* from that to which the relay of box A^3 is connected. The wires *w* *w'* w^2 w^3 constitute the overground-line, and the two lines of rails of a track-section are the parallel terminal portions thereof, between which only will connection be made for closing the circuit. These lines of rails being connected at different ends with the opposite terminals of the overground-line, it will be readily seen that, at whatever point connection is made between these lines of rails, the whole length of the closed main circuit will be the same and the resistance thereof constant, so that the instruments may have a uniform resistance and adjustment, which may be deter-

mined with ease and accuracy, and their proper working thereby secured. It will now be seen that if the two lines of rails of the section of track x^2 be electrically connected, the circuit of the main-line battery V will be closed through the relays R and R′ of the boxes A^3 and A^4, and these relays will close the circuits of the local batteries S and S′, which actuate the signal-instruments C and C′ of the two boxes, and cause them to display danger-signals at the openings *a a* of the boxes, respectively. This display of danger-signals at the opposite ends of the section will occur every time the two lines of rails are connected by the wheels and axles of a car or train, (which, in the present instance, is represented by the pair of wheels and connecting-axles shown at *q*,) and will give notice that a train or car is on the section. As soon as the car or train passes off the section the main-line circuit will be broken and the danger-signals will be hidden, as already explained, and the stationary safety-signals become visible. The relays R R′ of each pair of boxes are connected, the same as described for boxes A^3 and A^2, and consequently a danger-signal will be exhibited at each end of each track-section or block whenever a car or train is thereon, and the engineer of a locomotive approaching the section at either end will see a danger-signal displayed to warn him that a train or car is on the section he is approaching. By this arrangement of main circuits I am enabled to use small and inexpensive main-line batteries, and to readily locate any faults which may occur on the main line.

The term "parallel or lapping terminals," herein employed means one line of the rails being connected to the overground line at one end of the section, and the other line connected to said overground line at the other end of the section.

I am aware that it is not new to provide an electric circuit with parallel or lapping terminals for the purpose of maintaining a constant resistance while the points of connection between said terminals may be changed, and I do not claim such a circuit, broadly.

What I claim is—

1. In a system of electric railway-signaling, the combination, with an overground line extending between the two ends of a railway-track section and electro-magnetic signals arranged in said lines at the opposite ends thereof, of the two lines of rails forming said track-section and connected to said overground line as parallel or lapping terminals, substantially as and for the purpose set forth.

2. The combination, with the overground line, the lines of rails forming parallel or lapping terminals thereof, and a main battery included in circuit, of the relays at opposite ends of the track-section, the two local-battery circuits arranged to be opened and closed by said relays simultaneously, and the electric magnetic signal-moving instruments included in said local circuits, respectively, substantially as described.

3. The combination, with a series of separate railway-track sections and an overground line for each section, said overground lines having the separate lines of rails of their respective track-sections connected thereto as parallel or lapping terminals, substantially as described, of the double signal-boxes located at the adjacent ends of each two sections and containing each two electro-magnetic signal apparatuses, which are connected in the overground lines of the two sections, respectively, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM W. LE GRANDE.

Witnesses:

E. CLARK,

T. J. POTTINGER.