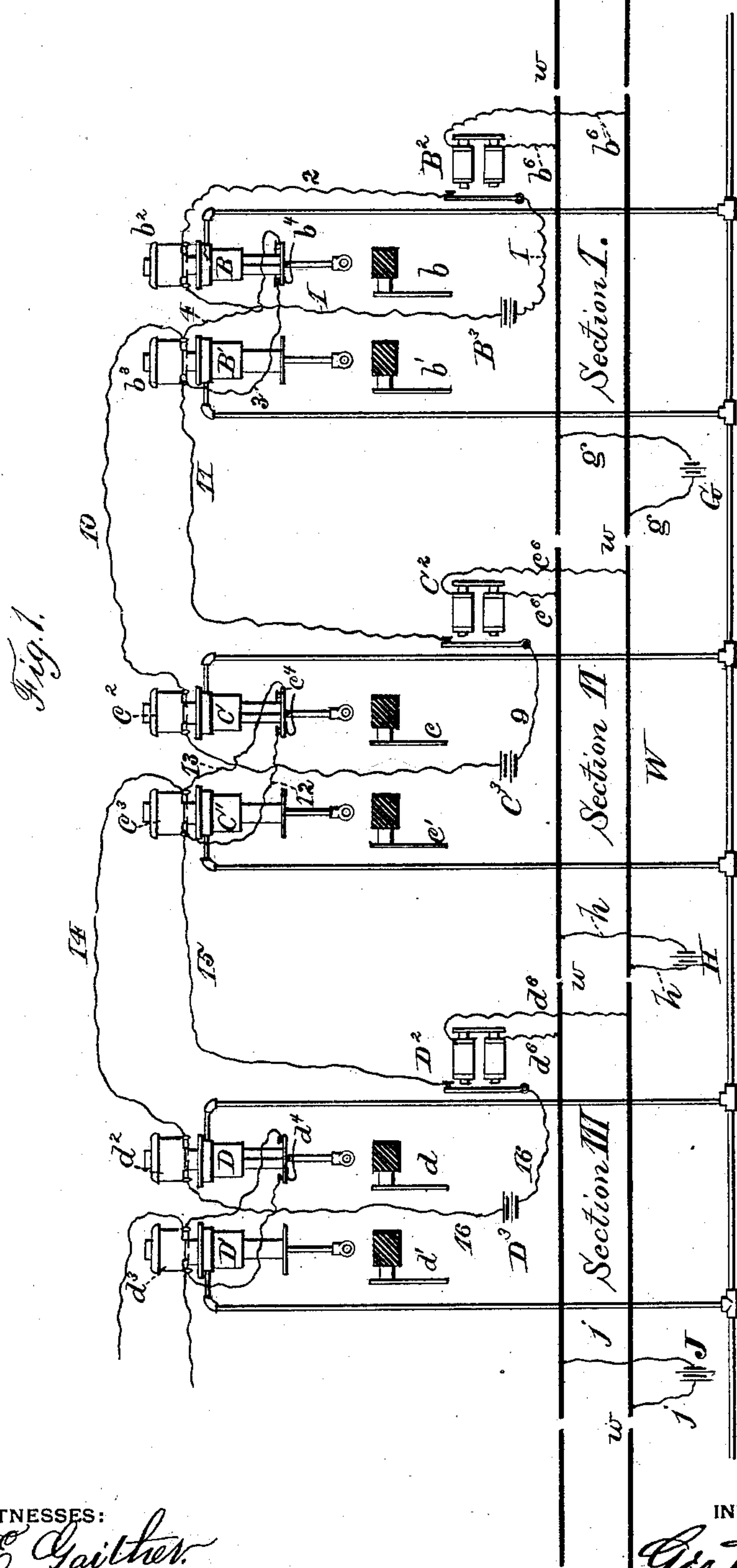


G. WESTINGHOUSE, Jr.

RAILWAY ELECTRIC SIGNALING APPARATUS.

No. 360,638.

Patented Apr. 5, 1887.



WITNESSES:

H. E. Gaither.
R. H. Whittlesey.

INVENTOR,

Geo. Westinghouse Jr.
by J. Howard Bell
Att'y.

(No Model.)

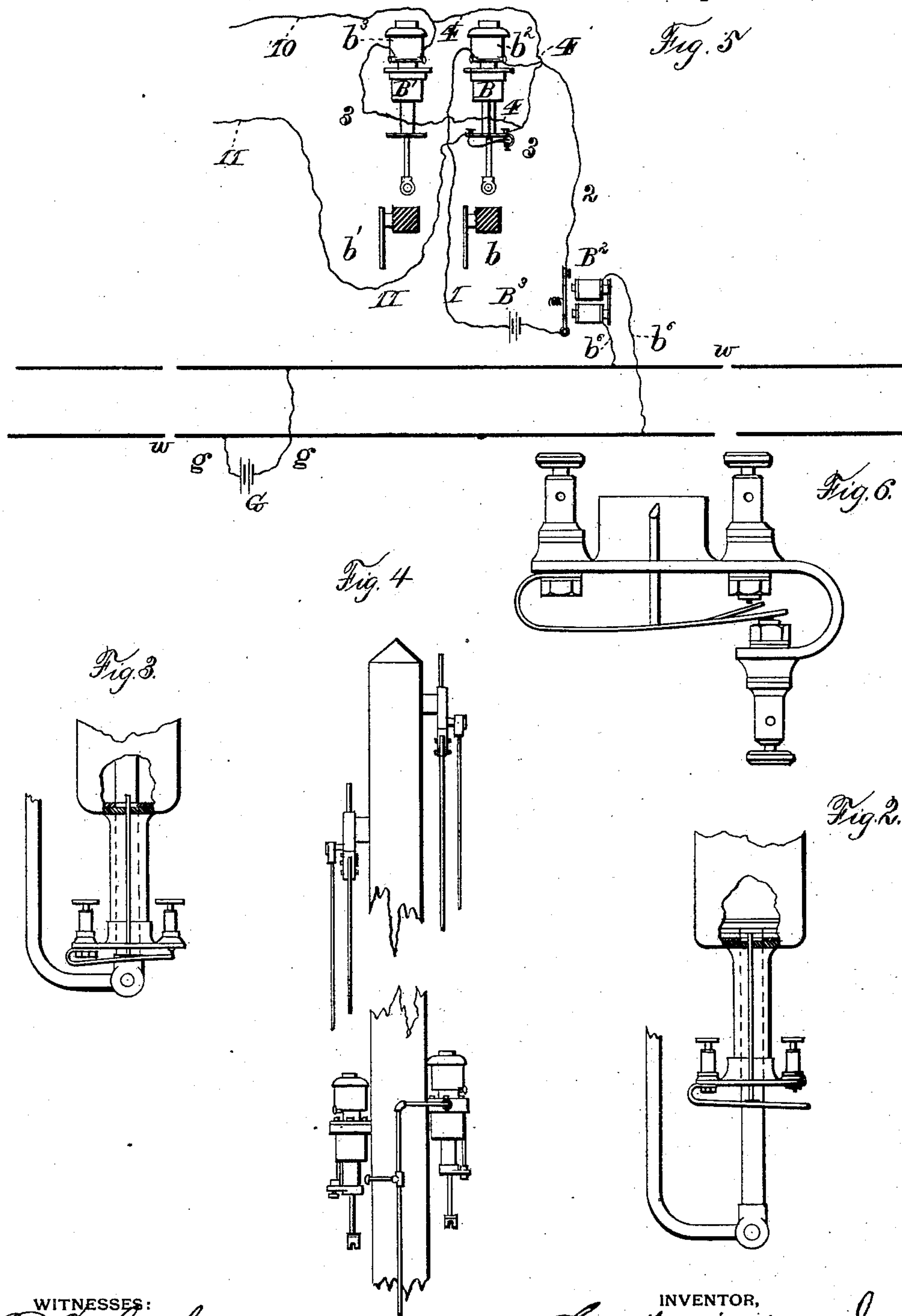
2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

RAILWAY ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 360,638, dated April 5, 1887.

Application filed August 25, 1886. Serial No. 211,816. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered a certain new and useful Improvement in Railway Electric Signaling Apparatus, of which improvement the following is a specification.

In the accompanying drawings, which make part of this specification, Figure 1 is a diagrammatic plan illustrating the application of my invention; Figs. 2 and 3, views, partly in elevation and partly in section, showing a circuit-shunter open and closed, respectively; Fig. 4, a view in elevation showing a danger and a cautionary signal and their respective operating mechanisms supported upon a single post; Fig. 5, a diagram illustrating a modification in the arrangement of the local circuits between the danger and cautionary signals, and Fig. 6, a view in elevation of a circuit-shunter adapted for employment therewith.

My present invention, which is an improvement upon that for which Letters Patent of the United States No. 270,867 were granted and issued to me under date of January 16, 1883, relates to the class of electrically-actuated automatic signaling mechanism for railways, known as the "closed circuit rail-system," and its object is to obviate risk of collision due to a train following too closely another in advance.

My improvements consist in certain novel devices and combinations of apparatus, hereinafter set forth, whereby proper danger and cautionary signals are set by a train in passing from one section or block of a railway to another, and, after being displayed in rear of said train for a sufficient period to protect it from a following train, are successively cleared to permit the passage of such following train correspondingly with the movement of the train in advance, and the automatic setting of signals of other sections by said train in its progress.

In the practice of my invention the operation of the signals governing the blocks or sections is wholly automatic, being effected by the movements of trains and independent of the action of telegraph-operators. Upon the passage of a train upon a block or section

a danger and a cautionary signal are set at or near the commencement of said section, and upon the entrance of the train on the next succeeding section similar signals are set for said succeeding section, and the danger-signal only of the previous section is cleared, the cautionary signal of the previous section remaining displayed as long as any portion of the train remains on said succeeding section, after which it is likewise cleared, such successive conjoined setting and independent clearing of the initial danger and cautionary signals of the successive blocks or sections being automatically and continuously effected by the movement of the train throughout the line.

The drawings illustrate the application of my invention to one line, W, of a double track divided into a series of sections, which may be of any desired length and number, in this instance three only being shown, marked, respectively, I, II, and III. The sections are, as will be seen, independent of telegraph-stations, but may be combined with the same when used for the operation of block or signal towers, as described and shown by me in a separate application for Letters Patent of even date herewith. (Case B.)

In the operation of my invention, a train entering upon the first section will shift to danger position a danger-signal and a cautionary signal located at or near the beginning of said section. Upon the passage of the train to the second section similar signals are set for said section, the danger-signal governing the first section is cleared, and the cautionary signal at the beginning of the first section, the indications of which signal relate to the second section, remains displayed at "danger" until the entire train has passed off the second section. The danger and cautionary signals on each succeeding section are successively set to danger, the setting of the cautionary-signal on each section immediately succeeding that of the danger-signal, and the signals are cleared independently throughout the whole series of sections in the line of road.

Referring to the drawings, the line of railway is divided into the sections I, II, and III, at the end of which the rails of each line are insulated in any proper manner, as at *w*, the successive rails in each line between insulated points being connected so as to maintain a continuous conducting-line for electricity, as by

the Robinson closed-track-circuit system, and the two lines of rails of the sections are connected by wires *g*, *h*, and *j*, at or near one end of each section, respectively, with batteries G, H, and J. At or near the opposite ends of the sections the two lines of rails are connected by wires *b*⁶, *c*⁶, and *d*⁶, respectively, with relays B², C², and D². The movement of trains is assumed to be from right to left, as indicated by the arrow.

Danger and cautionary signals *b b'*, *c c'*, and *d d'*, which may be of the semaphore or the banner type, as preferred, are located, in pairs, adjacent to the commencement of each of the several sections. Said signals are respectively connected with and adapted to be operated by any suitable form of signal-operating mechanism, whether actuated by clock-work, direct action of the armature of a magnet, or by fluid under pressure—in this instance being shown as of the electro-pneumatic description. Under such construction the signals *b b'*, *c c'*, and *d d'* are respectively connected to the piston-rods of cylinders B B', C C', and D D', the pistons of which are operated by the combined action of fluid-pressure and electricity, and the signals are set and cleared by the movements of said pistons.

In order to afford space for illustrating the connections more clearly, the danger and cautionary signals and their operating mechanisms are in Fig. 1 shown as separately supported; but in practice I prefer to connect each pair of signals and cylinders to a single post, as shown in Fig. 4. The construction of the cylinders and their operating mechanism need not be herein at length described, as they do not, *per se*, constitute part of my present invention, and are, moreover, set forth in an application for Letters Patent of the United States filed by me August 7, 1886, Serial No. 210,266.

A relay, B², having its magnet connected by wires *b*⁶ with the two lines of rails of the track W, is located adjacent to the commencement of the first section, in circuit with a battery, G, connected by wires *g* with both lines of rails. The armature and contact-point of the relay B² are connected by wires 1 2, respectively, with a battery, B³, and with the binding-posts of the magnet *b*² of the cylinder or other mechanism, B, which operates the danger-signal *b* at the commencement of the first section, I. A circuit-shunter, *b*⁴, which is normally open, and which is closed by the movement of the signal-operating mechanism B in setting the signal *b* to "danger," is connected by the wires 3 4 with the binding-posts of the magnet *b*³ of the signal-operating mechanism B', which actuates the cautionary signal *b'* on section I. Relays C² D² and batteries C³ D³ are provided for the pairs of signals *c c'* and *d d'* at the commencement of the sections II and III, and the magnet of the danger-signal-operating mechanism of each section after the first is put in circuit with the battery and relay of said section and with the magnet of the cautionary-

signal-operating mechanism on the next preceding section.

In operation the entrance of a train upon the first section from the right in the direction of the arrow short-circuits the current of the battery G through the rails and the wheels and axles of the train, thereby demagnetizing the relay B² and breaking the current of the local battery B³, which, as before stated, is through the magnet *b*² of the cylinder B by wires 1 and 2. The resultant release of the armature of the magnet *b*² effects movement of the piston of the signal-operating cylinder B and causes the danger-signal *b* to be displayed. In this operation the circuit-shunter *b*⁴ is closed, thereby short-circuiting the magnet *b*³ of the cautionary-signal-operating mechanism B' through the wires 3 and 4 and causing the cautionary signal *b'* to be displayed. The short-circuiting of the magnet *b*³ causes the circuit of the battery C³ to pass through the wires 3 and 4, instead of through the greater resistance of the coil of wire in the magnet *b*³. As the train enters section II the first result is to short-circuit the battery H of said section, and thereby to demagnetize the relay C², break the circuit of the battery C³, and release the armature of the magnet *c*² of the signal-operating mechanism C through the wires 9, 10, and 11, thus causing the danger-signal *c* of section II to be displayed. In displaying the signal *c* the circuit-shunter *c*⁴ is closed, thereby cutting out the magnet *c*³ of the signal-operating mechanism C' through the wires 12 and 13 and causing the cautionary signal *c'* to be displayed. When the last pair of wheels of the train leaves section I, the danger-signal *b* of said section only is cleared, and this is effected by restoring the circuit through the battery G on the track and closing the armature of the relay B², which closes the circuit of the local battery B³ through the magnet *b*² and wires 1 and 2, and consequently draws down the armature of the magnet *b*², allowing pressure to enter the cylinder B, and drawing down the signal *b* to "safety." The cautionary signal *b'* on section I still remains displayed at "danger," inasmuch as it depends for its clearing upon section II, on which the train has just entered, being unoccupied, and it, as well as the signals *c* and *c'*, will remain at "danger" as long as the train or any portion of it remains on section II. The signals *d d'* on section III are similarly set when the train enters said section, and the cautionary signal on section I and the danger-signal of section II are cleared when the rear of the train passes off section II, such successive setting and clearing of signals being automatically effected by the movement of the train as it passes from section to section, successively, throughout the line of road. The rear of the train is thus continuously protected by a cautionary signal at the commencement of the section in rear of that over which the train is passing, and by a cautionary and a danger-signal at the commencement of the section which it occupies, and the

engineer of a following train is made aware whether one section or a greater distance intervenes between his train and a train in advance.

5 Each cautionary signal, as at b' , is operated in two ways: first, by the home signal, as at b , going to "danger" and closing the circuit at b' , and, second, by breaking the circuit through the relay of the next section in advance, as at
10 C^2 , by the passage of a train on the rail-circuit of said section.

In lieu of the local circuits between the danger and the cautionary signals being operated as described, and as shown in Fig. 1, they may
15 be arranged as in Fig. 5, a circuit-shunter of the description shown in Fig. 6 being employed, said circuit-shunter being normally closed to maintain circuit through the magnet of the cautionary-signal-operating mechanism, and
20 when opened by the movement of the danger-signal-operating mechanism, in setting said signal, serving to short-circuit the magnet of the cautionary-signal-operating mechanism. It is provided with a supplemental contact-spring, as shown, so that the circuit which it
25 makes when open shall be established before the contact which it makes when closed is broken.

I do not limit myself to the employment of
30 any special construction of signals, circuit-breakers, or of signal-operating mechanism, as any of the known and approved forms of signals which are capable of operation through mechanism which is actuated by the passage
35 of a train over a track-instrument or on an insulated section of railway track, and any description of signal-moving mechanism adapted to be so operated would be the equivalents of the corresponding devices which have been
40 adopted for the illustration herein of a practicable application of my improvements.

I claim herein as my invention—

1. In an automatic signaling apparatus, the combination of an insulated track-section, a
45 danger and a cautionary signal located in the line of said section, a signal-operating mechanism connected with and adapted to operate each of said signals, a circuit-shunter connected with the danger-signal-operating mechanism, an electric circuit connecting said circuit-shunter with the cautionary-signal-operating mechanism, an electric circuit connecting the danger-signal-operating mechanism of one section and the cautionary-signal-operating mechanism of the preceding section
55 with a local battery and relay, and electric circuits connecting the track-section with said relay and with a track-battery, substantially as set forth.

60 2. In an automatic signaling-apparatus, the combination of a series of insulated track-sections, a danger and a cautionary signal located on the line of each track-section, a signal-operating mechanism connected with and
65 adapted to operate each of said signals, a circuit-shunter connected with each danger-signal-operating mechanism, electric circuits

connecting each cautionary-signal-operating mechanism with the circuit-shunter of the danger-signal-operating mechanism located in
70 the same section therewith, and electric circuits connecting each danger-signal-operating mechanism with a track circuit, a relay, and a local battery, and in the sections succeeding the first with a preceding-cautionary-signal-operating mechanism, substantially as set
75 forth.

3. In an automatic signaling apparatus, the combination of a line of railway-track divided into electrically-insulated sections, a danger
80 and a cautionary signal located on the line of each track-section, a track-battery and a relay connected in circuit with each section, a local battery in circuit with the armature of each relay, a signal-operating mechanism adapted
85 to actuate each signal, a circuit-shunter connected with and operated by each danger-signal-operating mechanism, electric circuits connecting each cautionary-signal-operating mechanism with the circuit-shunter of a danger-signal-operating mechanism, and electric
90 circuits connecting the danger-signal-operating mechanism of each section with the local battery and relay of said section, and in the sections succeeding the first with a preceding
95 cautionary-signal-operating mechanism, substantially as set forth.

4. In an automatic signaling apparatus, the combination of a series of track-circuits electrically connected in sections, a relay included
100 in each of said circuits, a signaling-circuit opened and closed by said relay, and a danger-signal-operating mechanism and a cautionary-signal-operating mechanism actuated by the relay of each section through said circuits,
105 each cautionary-signal-operating mechanism being electrically connected with a danger-signal-operating mechanism on one section and with a signaling-circuit and danger-signal-operating mechanism on a succeeding section,
110 substantially as set forth.

5. In an automatic signaling system embracing two or more blocks or sections of track, the combination of a track-circuit extending from end to end of each section, a relay in
115 each track-circuit, a signaling-circuit operated by each relay, a danger and a cautionary signal operating mechanism located on the line of each section, the danger-signal-operating mechanism being operated by the signaling-circuit, wires connecting each cautionary-signal-operating mechanism with the danger-signal-operating mechanism located in the same section therewith, and wires connecting each danger-signal-operating mechanism subsequent to the first with a preceding cautionary-signal-operating mechanism, substantially
125 as set forth.

In testimony whereof I have hereunto set my hand.

GEO. WESTINGHOUSE, JR.

Witnesses:

R. H. WHITTLESEY,

C. M. CLARKE.