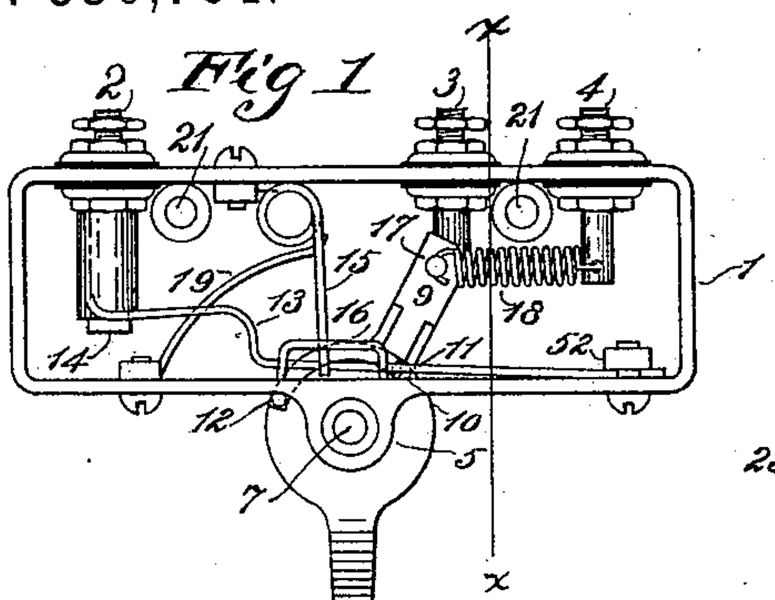
(No Model.) 3 Sheets—Sheet 1.

F. P. SNOW.

ELECTRIC BLOCK SIGNAL.

No. 536,764. Patented Apr. 2, 1895.

Fig 1



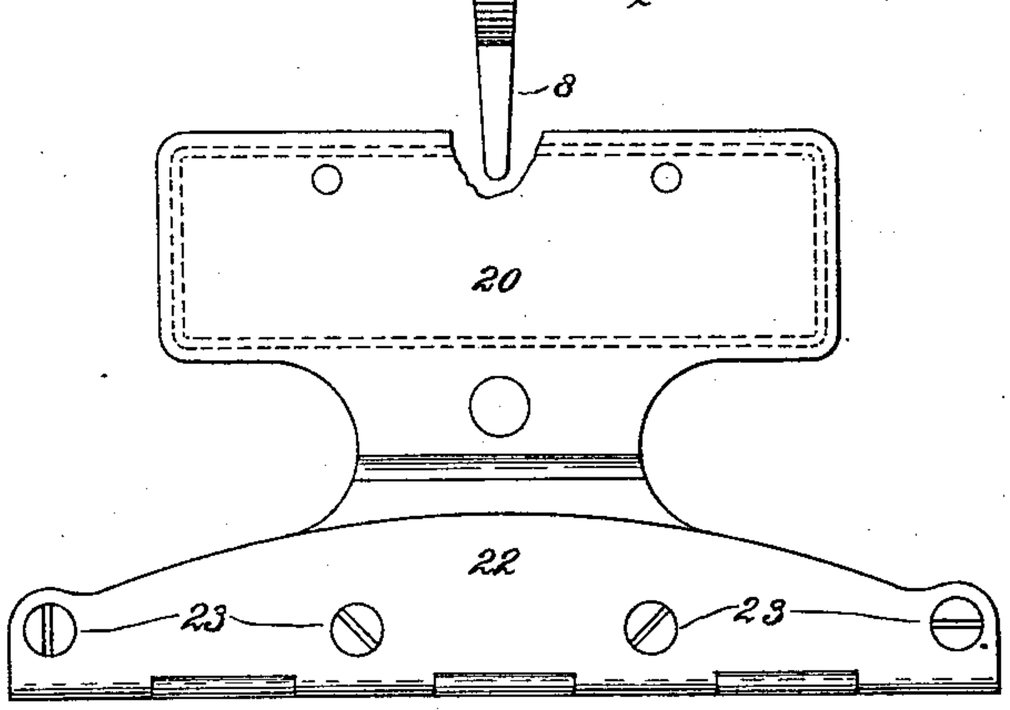


Fig. 2.

Fig. 3.

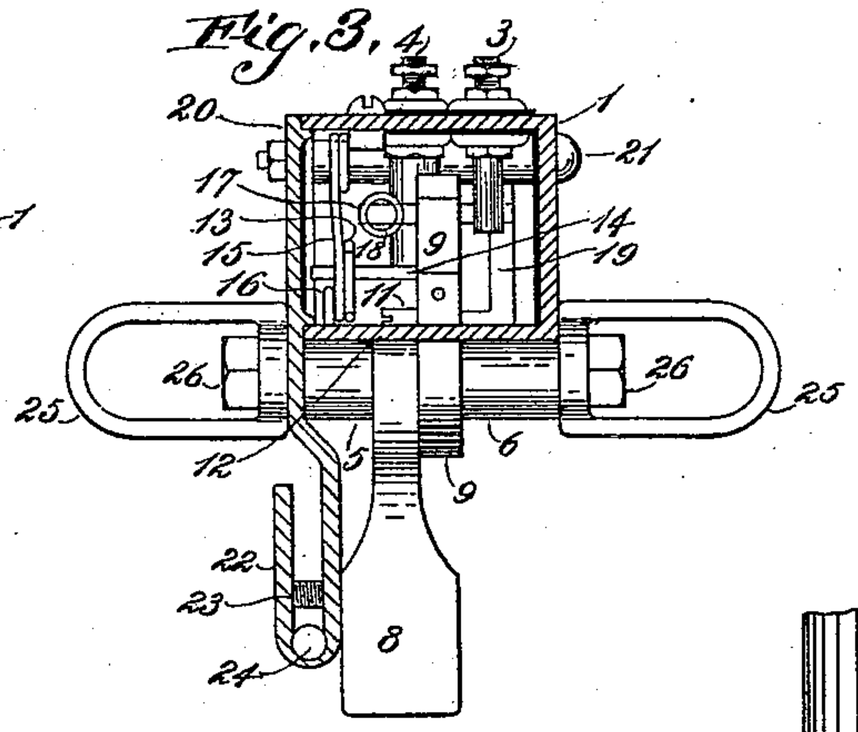


Fig. 4.

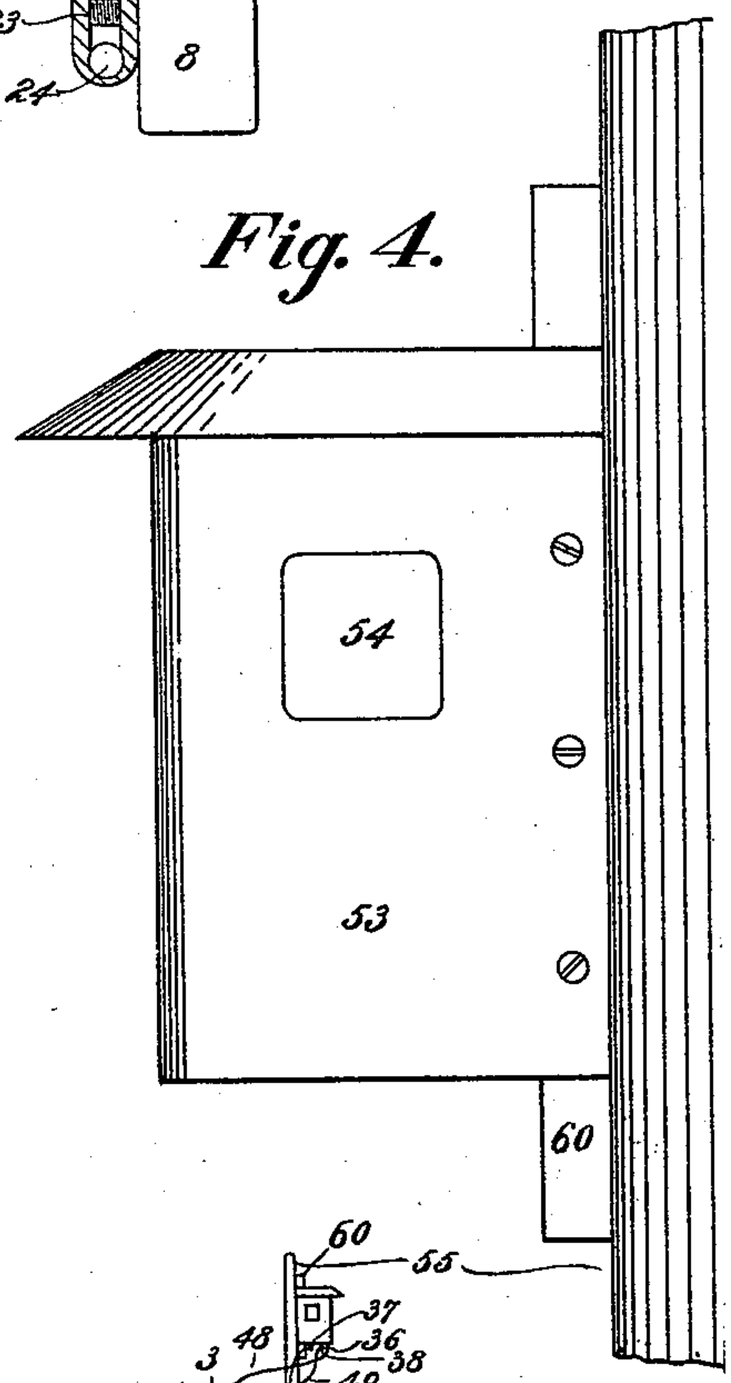
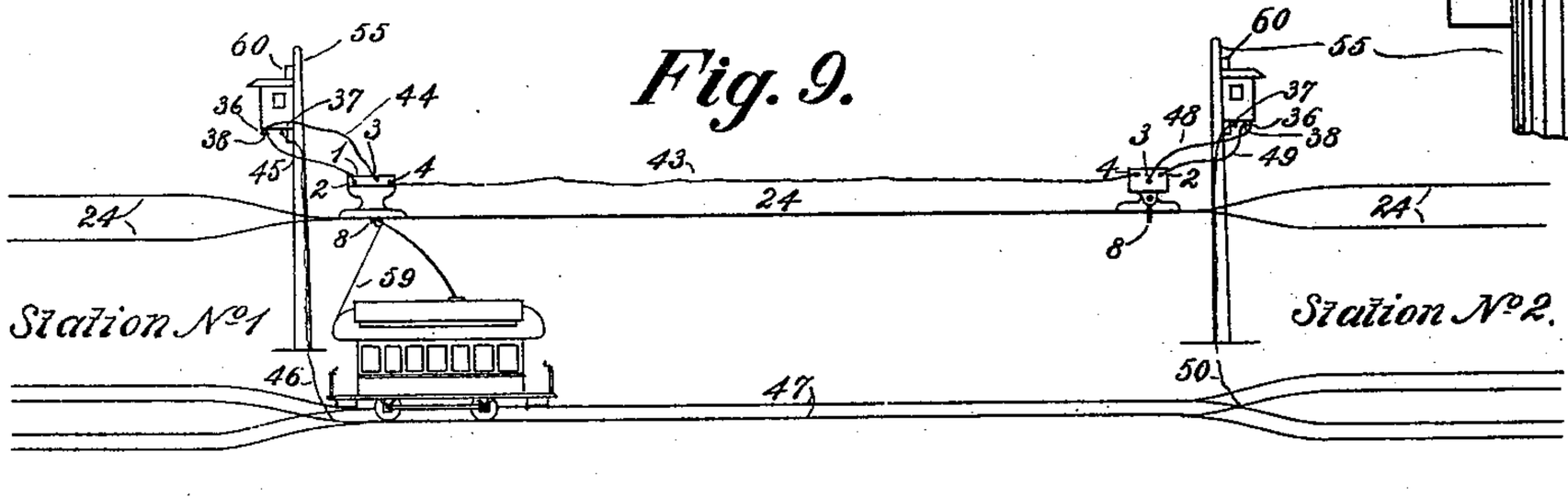


Fig. 9.



Witnesses:
Henry A Wolcott.
John Darby

Fred P. Snow, Inventor:
by
Willard Eddy, Attorney:

(No Model.) 3 Sheets—Sheet 2.

F. P. SNOW.

ELECTRIC BLOCK SIGNAL.

No. 536,764. Patented Apr. 2, 1895.

Fig. 5.

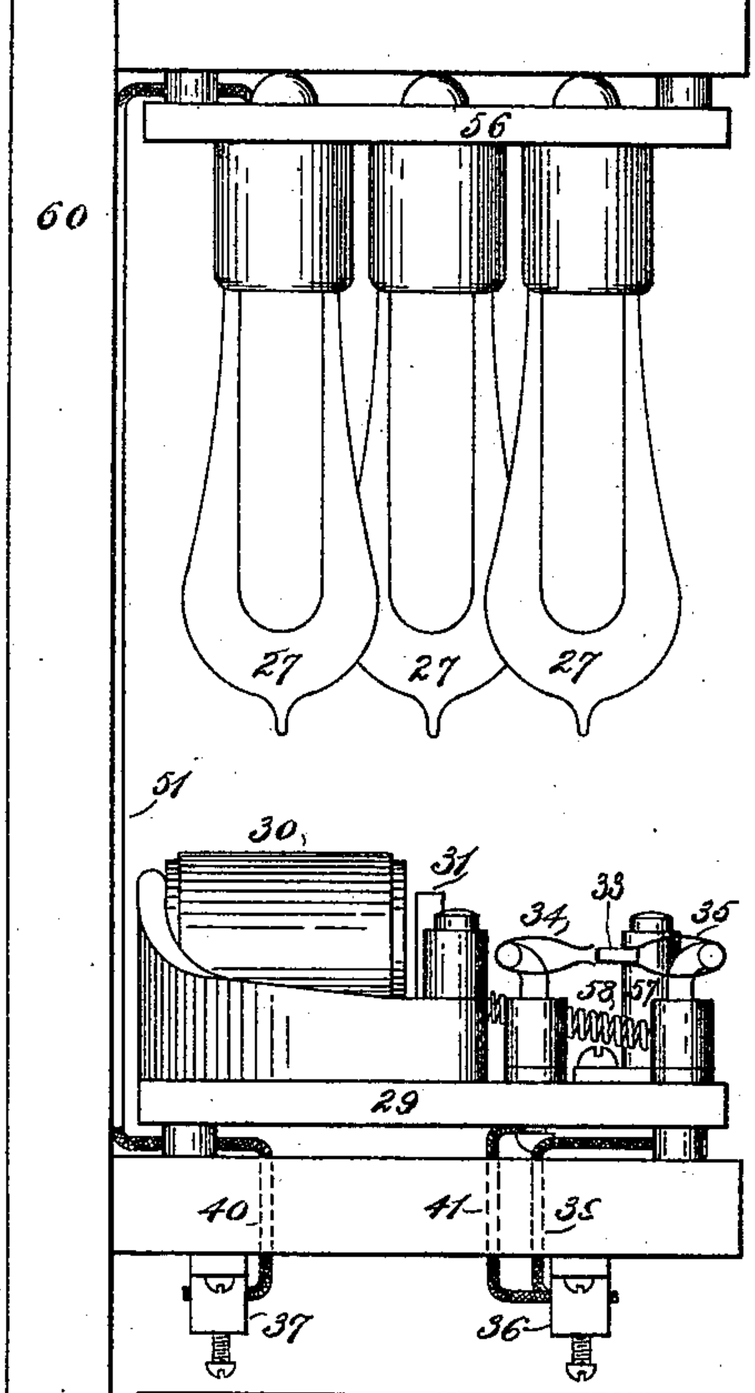


Fig. 6.

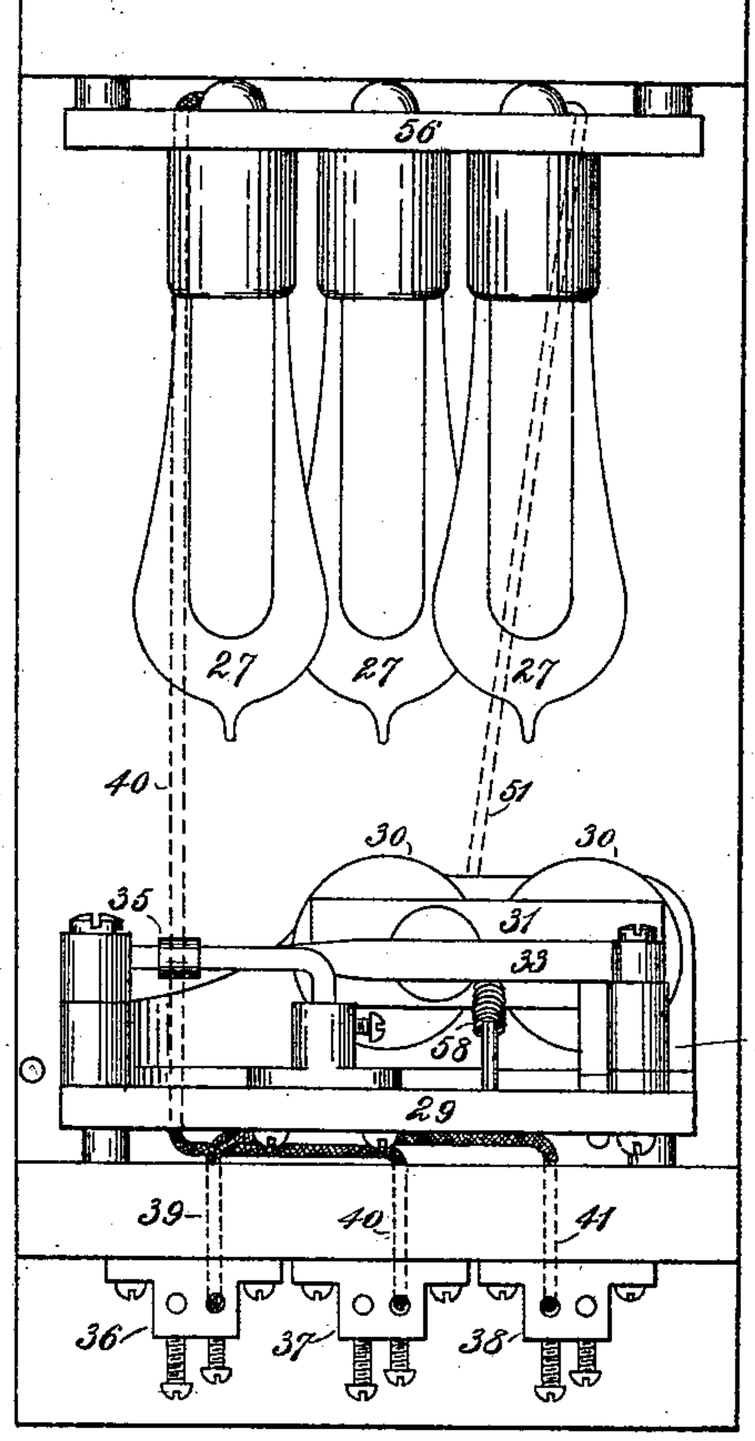


Fig. 7.

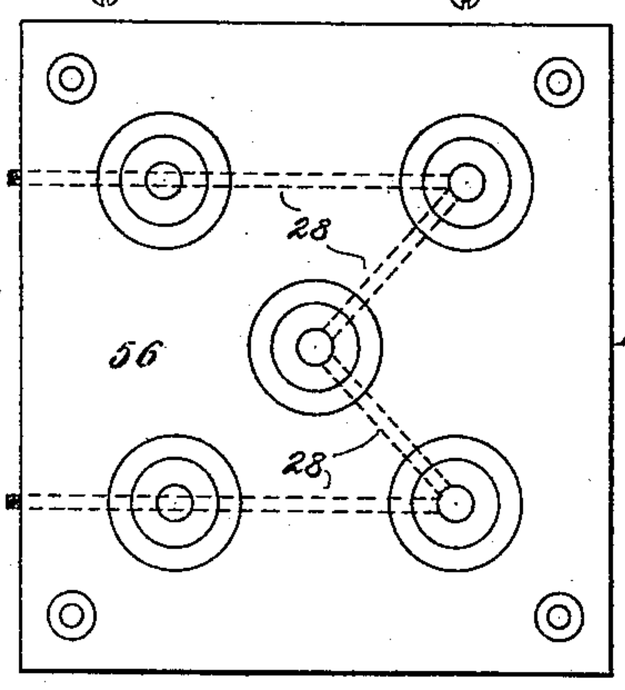
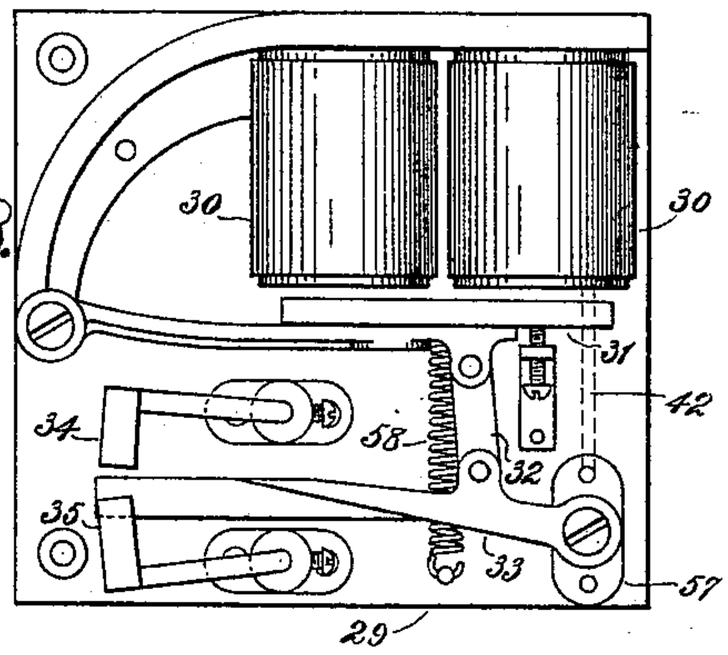


Fig. 8.



Witnesses:
Henry A Wolcott.
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(No Model.) 3 Sheets—Sheet 3.

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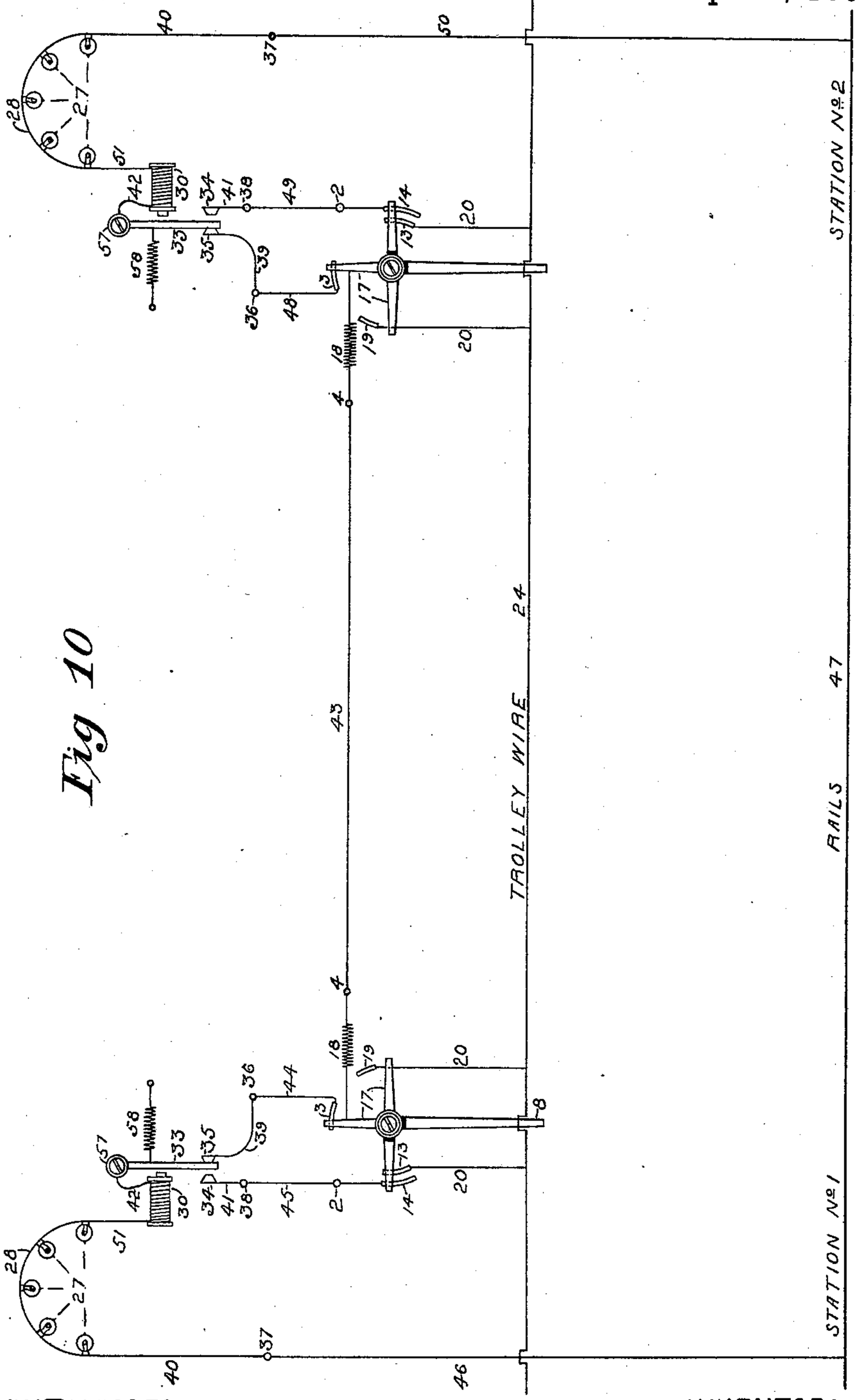

Fig 10

WITNESSES:
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INVENTOR:
Fred P. Snow,
By Willard Eddy Atty.

UNITED STATES PATENT OFFICE.

FRED P. SNOW, OF LYNN, MASSACHUSETTS.

ELECTRIC BLOCK-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 536,764, dated April 2, 1895.

Application filed April 27, 1894. Serial No. 509,238. (No model.)

To all whom it may concern:

Be it known that I, FRED P. SNOW, of Lynn, Essex county, Massachusetts, have invented certain new and useful Improvements in Electric Block-Signals, which improvements are described in the following specification and are illustrated by the accompanying drawings.

This invention relates to automatic electric signaling apparatus for electric railways, and is designed to prevent collisions between cars moving simultaneously in opposite directions upon a single track of such railway. Collisions of this kind, sometimes called head-on collisions, are especially to be apprehended upon electric railways, as now constructed, because of the frequent use of single tracks for such railways, and because of the curves and characteristic deviousness of such tracks; whereby the prospect before the car is often much cut off.

My improved signaling apparatus is intended to be used separately in connection with separate blocks, or sections, of track, upon which cars are run in opposite directions. Each section, as here intended, consists of a piece of single track, lying between two stations, which may for convenience be termed station No. 1 and station No. 2. At these stations the signals and the necessary side-tracks, or turn-outs, are located.

It is an essential object of the invention, therefore, to display a danger signal at station No. 1, whenever a car enters upon the section at station No. 2; and a like signal at station No. 2, whenever a car enters upon that section at station No. 1; and to withdraw the signal at either station, whenever a car passes off the section at the other station, or passes the signaled station in either direction. To accomplish these results, I use an electric signal, signal circuit and car-operated electric switch at each such station, and a circuit-controlling circuit between the stations.

The best manner in which I have contemplated applying the principles of my invention is shown in said drawings, in which—

Figure 1 is a front elevation of a switch-box, shown with the front side of the box removed, and containing a car-operated switch, which is constructed in accordance with the requirements of my invention. Fig. 2 is a front elevation of the front side of such switch-box, including a clamp, by which the box is mechanically and electrically connected with the trolley wire. Fig. 3 is a cross section of the switch-box on the section line *x*—*x* in Fig. 1. Fig. 4 is a side elevation of a lantern, constructed in accordance with the principles of the invention, and attached to a post, or other stationary support. Fig. 5 is a side elevation of the contents of such lantern, including incandescent electric lights and an electric switch. Fig. 6 is a front elevation of the contents of the same lantern. Fig. 7 is a plan of the lamp support, contained in the upper part of the lantern, and viewed from below. Fig. 8 is a plan of the last mentioned switch and the insulating platform, upon which the switch is set in the lower part of the lantern. Fig. 9 is a diagrammatic view of a section of electric railway, which is equipped with block signals in accordance with this invention. Fig. 10 is a diagram of the circuits, which are involved in the use of the invention.

In Figs. 1, 3 and 9, the numeral 1 denotes a switch-box, having three insulated binding-posts, 2, 3 and 4, which extend through the top of the box, into its interior. This box is provided underneath with two lugs, 5 and 6, holding a pin 7, on which are pivoted two switch-levers, 8 and 9. The free end of lever 8 hangs below the box, for occasional engagement with passing trolleys. The head of the same lever, having the general form of a thick disk, has a portion of its upper edge cut away, so as to form a shoulder 10, designed to engage a pin 11, which projects laterally from the contiguous head of lever 9. The head of lever 8 is also provided with a laterally projecting pin 12. To make room for these contiguous lever heads, a hole is cut through the floor of box 1. Within this box is an elastic brass rod 13, whose one end is attached to the floor of the box by clamp 52, and whose other end, being free, tends to rest upon a contact-piece 14, which forms the foot of binding-post 2. Rod 13, when resting upon contact-piece 14, occupies a portion of the path of pin 12; and is capable of being lifted from such contact, when that pin rises. A spring 15, which is attached interiorly to the top of box 1, extends down between rod 13 and a guiding rod 16, into the path of pin 12, for the purpose of prompting and assisting the return of lever 8 to its normal vertical position, whenever that pin and spring are brought into mutual engage-

ment by the deflection of that lever from that position. Lever 9 is armed with an insulated brass pin 17, which is connected with the foot of binding-post 4 by a spiral spring 18, and is stopped by the foot of binding-post 3. Attached to the floor of box 1, is an elastic contact strip 19, whose free end is adapted to make a sliding contact with pin 17, when the latter is moved away from binding-post 3. The front, or cover, 20, which closes switch-box 1, is fastened on by rubber-covered screw-bolts 21. This cover, being extended downward below the box, is provided with a clamping-plate 22, and with clamping screws 23, whereby the switch-box is firmly attached to the trolley-wire 24, and is electrically connected therewith. Pin 7, passing through the lugs 5 and 6 of the box, as described, is provided with two looped washers 25, which are held in place upon the opposite ends of that pin by nuts 26. These looped washers serve as attachments for guys, which are not shown in the drawings, but which support both box 1 and the trolley-wire 24.

The cover 53 of the lantern, which is shown in Fig. 4, is preferably made of sheet iron. It has a window 54 in each of its three exposed sides, and colored glass in each window. The back 60 of the lantern is attached to post 55.

In Figs. 5, 6 and 10, the numerals 27 denote incandescent electric lights within the lantern. In connection with a system using five hundred volts, it is convenient to use five such lights of about one hundred volts each. These lights are arranged in series in the upper part of the lantern, and opposite the windows 54. They are connected by wires 28, and are attached to the under side of an insulating platform 56, in the relative positions which are indicated in Fig. 7. Upon a like insulating platform 29, in the lower part of the lantern, is an electromagnet 30, whose armature 31 is connected by link 32 with a brass switch-lever 33, as is shown in Fig. 8. This lever is pivoted at one end upon a bracket 57, is provided with a retractile spring 58, and is adapted to make and break contact with the adjustable switch-points 34 and 35.

Under the floor of the lantern are three binding-posts, 36, 37 and 38, which are connected by wires 39, 40 and 41 with switch-point 35, lights 27 and switch-point 34 respectively. The coils of magnet 30 are connected with lights 27 by wire 51, and with bracket 57 by wire 42.

The remaining external connections of the switch-box and lantern remain to be stated, including the connection between stations.

It is premised that station No. 1 is provided with a switch-box and lantern, such as are above described; and that station No. 2 is provided with a like switch-box and lantern; but that the two switch-boxes are set in such a manner that the corresponding ends of the same shall face in opposite directions, as indicated in Fig. 9. At station No. 1, binding-posts 3 and 36 are connected by wire 44; binding-posts 2 and 38 by wire 45; and binding-posts 37 by wire 46 to the rail 47, or to the ground, as representing the negative pole of the generator by which the system is actuated. At station No. 2 like connections are made by wires 48, 49 and 50, respectively. Binding-posts 4 of the two switch-boxes are connected with each other by wire 43, which is the only wire necessary to be strung from station to station.

Such being the mechanism and connections of my invention, its operation is such that the described mechanism is wholly out of circuit and inoperative, whenever there is no car upon the guarded section; but when a car, entering upon that section, passes station No. 1, a branch circuit from the trolley wire to the track is closed through the lights and magnet at station No. 2, at first by the way of wire 43, and afterward by the way of switch-point 34, so that a colored light is shown at the last-mentioned station; and when a car, entering upon the same section, passes station No. 2, the like danger signal is in like manner displayed at station No. 1; and when a car passes either station, the lights at that station are extinguished by the interruption of the local circuit through them. The manner in which these effects are produced will appear from a more particular description. So long as no car passes onto the section, the levers 8 of the switch-boxes 1, hang down in the vertical position which is indicated in Figs. 1, 3 and 9; and no current passes through any part of the special mechanism of the invention; but when a car, moving toward station No. 2, as indicated in Fig. 9, passes station No. 1, the trolley wheel of that car engages for an instant the lever 8, which is at the last mentioned station, so that said lever swings first in the direction in which the car is moving and then swings back to its original vertical position, in the pathway of the trolley wheel. At the same time, lever 9, by reason of the engagement of shoulder 10 and pin 11, is first swung backward and then released; so that the insulated pin 17, starting from its position of rest in contact with the foot of binding-post 3, is first separated from such contact, and then is brought into sliding contact with contact-strip 19, and afterward is immediately retracted to its original position by the spiral spring 18. During the instant of the described contact between pin 17 and strip 19, of station No. 1, current passes through the lights of station No. 2 by the following course, namely: from the trolley wire 24 successively through the dependent portion of cover 20, box 1, contact strip 19, insulated pin 17, spiral spring 18, and binding-post 4 at station No. 1, wire 43 from station to station, and binding-post 4, spiral spring 18, insulated pin 17, binding-post 3, wire 48, binding-post 36, wire 39, switch-point 35, switch-lever 33, bracket 57, wire 42, magnet coils 30, wire 51, lights 27 and their interconnecting wire 28, wire 40, binding-post 37, and wire 50 to the rails 47, at

station No. 2. The current which passes in the delineated course actuates magnet 30, whereby switch-lever 33 is moved into contact with switch-point 34, and out of contact with switch-point 35. So a local connection is established at station No. 2 from the trolley wire to the ground by the following course namely: from the trolley wire successively through the dependent portion of cover 20, box 1, switch-rod 13, contact-piece 14, binding-post 2, wire 49, binding-post 38, wire 41, switch point 34, switch-lever 33, bracket 57, wire 42, magnet coils 30, wire 51, lights 27, wire 40, binding-post 37, and wire 50 to the rails 47. The first delineated course, namely, that through wire 43 from station to station, may for convenience be termed a circuit-controlling circuit, and the last delineated course, namely, that through the local switch-point 34, may for convenience be termed a local signal circuit. Under the described distribution of current, the magnet 30, being included in the circuit-controlling circuit, and also in the local signal circuit, first establishes a contact, as described, between switch-lever 33 and switch-point 34, and then maintains that contact so long as the local signal circuit remains unbroken. In this manner the lights 27, constituting a danger signal at station No. 2, warn all cars against entering the guarded section at that station; and continue so to do, until the switch-box at that station is in turn operated by a passing car. When the same station is passed by a car from the direction of station No. 1, lever 8 of the switch-box at station No. 2 is swung by the trolley-wheel in the direction in which the car is moving, and is immediately returned to its original vertical position by its own weight and by the action of spring 15 upon pin 12. By this excursion and return of lever 8, pin 12 is caused first to engage and then to disengage switch-rod 13, so that the contact of switch-rod 13 and contact-piece 14 is momentarily interrupted and is then resumed. In this way, the local signal circuit being broken between parts 13 and 14, the danger signal at station No. 2 is extinguished. At the same time switch-lever 33, by the operation of spring 58, is thrown back to its original position of contact with switch-point 35 and away from switch-point 34. The entire apparatus, therefore, stands as at the beginning; and each car, or train, subsequently passing over the section in the same direction, produces a repetition of the effects already described; and if a car passes over the section in the opposite direction, a like danger signal is in like manner displayed at station No. 1, so long as the car is upon the section, and is in like manner withdrawn, as the car passes off the section.

If a car should enter upon the guarded section at either station, as for example at station No. 2, in disregard of the danger signal there displayed, a double result follows, namely: First, the lights are displayed at station No. 1 in the manner already described; and, second, the lights at station No. 2 are extinguished. The second effect is produced by a momentary interruption of contact between switch-rod 13 and contact-piece 14 in the switch-box at station No. 2. Such interruption is caused by an upward blow, which is administered to switch-rod 13 by pin 12, when lever 8, being released from engagement with the passing trolley-wheel, rebounds beyond a vertical position under the momentum of its own weight and the impulse from spring 18. This interruption of contact breaks the local signal circuit, and extinguishes the lights, at station No. 2.

The identity of my invention does not depend upon the use of electric lights, for any other form of visible or audible signal, which is actuated or controlled by an electric current, can readily be used in place of such lights; nor upon the use of the described clamping mechanism, whereby the switch-box is attached to the trolley-wire, for the same parts may be attached by soldering, or by any other convenient method; nor upon the use of an overhead trolley wire with trolley and trolley-wheel, for the same function may be performed by an underground conductor and an electric brush, or by any other desired mechanism for transferring current from the generator at the power house to the motor in the car; nor upon any special mechanism for engaging the car-operated switch, for that switch may be operated through any convenient appliance, carried by the car, instead of being actuated by the trolley-wheel.

A modified form of the described circuit breaker is indicated in Fig. 10.

Other and extensive modifications, and substitutions of equivalents, consistent with the principles and mode of operation of my invention, will occur to persons who are skilled in the art to which my invention relates.

Such being the nature and operation of my electric block-signal for electric railways, I claim as my invention--

1. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal, a two-point switch, an electromagnet, actuating such switch, and a normally open local circuit from the track, through such signal and switch magnet, the movable member of such switch, and one of the points of said switch to the trolley wire, at one of said stations, in combination with a normally open circuit, extending from the other of the points of said switch to the trolley wire, at the other of said stations, and means for opening and closing said circuit substantially as and for the purpose specified.

2. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal, a two-point switch, an electromagnet, actuating such switch, and a normally open local circuit from the track, through said signal, said switch

magnet, the movable member of said switch and one of the points of said switch to the trolley wire, at one of said stations, in combination with a normally open circuit, extending from the other of the points of said switch to the trolley wire at the other of said stations, and car-operated mechanism for opening and closing said circuits, substantially as and for the purpose specified.

3. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal at each of said stations, a two-point switch at each of said stations, two electromagnets, actuating such switches respectively, two normally open local circuits, one at each station, from the track through the local signal, the local switch magnet, the movable member of the local switch and one of the points of that switch to the trolley wire, in combination with two normally open circuits, provided with means for opening and closing the same, and extending respectively from the other of the points of said switches to the trolley wire by the way of a wire, which extends from station to station, and is common to both said last-mentioned circuits, substantially as and for the purpose specified.

4. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal at each of said stations, a two-point switch at each of said stations, two electromagnets, actuating such switches respectively, two normally open local circuits, one of which is located at each station, and extends from the track through the local signal, the local switch magnet, the movable member of the local switch and one of the points of that switch to the trolley wire, and two normally open circuits, each of which extends from the other of the points of one of said switches to the trolley wire by means of a wire, which leads from station to station, and is common to both said last-mentioned circuits, in combination with a car-operated switch and circuit-breaker at each such station, substantially as and for the purpose specified.

5. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal at each of said stations, a two-point switch at each of said stations, two electromagnets, actuating such switches respectively, and two normally open local circuits, one of which is located at each station, extends from the track through the local switch magnet, the movable member of the local switch and one of the points of that switch to the trolley wire, and operates the signal at the same station, in combination with a normally closed connection from one such switch to the other, two normally open connections from such normally closed connection to the trolley wire, one at each station, and car-operated circuit-controlling mechanism at each station, substantially as and for the purpose specified.

6. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal and an electromagnet at each station, a two-point switch, actuated by such electromagnet, at each station, a normally closed connection from the track at either station through the signals and magnets at both stations to the track at the other station, two normally open local circuit connections from said normally closed circuit to the trolley wire at each station, in combination with car-operated mechanism at each station for opening and closing such connections, substantially as and for the purpose specified.

7. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal at each station, an electric switch and switch magnet at each station, a normally open local circuit from the track through such signal and magnet to the trolley wire, at each station, and a normally open circuit-controlling circuit, which is capable of being closed at either station from the trolley wire at that station through the signal and magnet at the other station to the track at such other station, in combination with car-operated circuit-controlling mechanism at each station, substantially as and for the purpose specified.

8. A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal at each station, an electric switch and switch magnet at each station, a normally open local circuit from the trolley wire through such signal and magnet to the track, at each station, and a normally open circuit-controlling circuit connection, which is capable of being closed at either station from the trolley wire at that station through the switch magnet at the other station to the track at such other station, in combination with car-operated mechanism at each station for opening and closing such circuits and connections, substantially as and for the purpose specified.

9. A section of electric railway track between two stations, a trolley wire, accompanying such track, two electrically operated or controlled signals, one at each such station, two local signal circuits, one for each such signal, two electro magnets, included in said circuits respectively, and two electric switches, which are actuated by said electro magnets respectively, in combination with car-operated circuit-controlling mechanism at each station, and circuit-controlling circuits, extending from the switch at each station to the trolley wire at the distant station, substantially as and for the purpose specified.

In testimony whereof I hereunto set my name in the presence of two witnesses.

FRED P. SNOW.

Witnesses:
GEO. WHITE,
FRED H. EASTMAN.