No. 774,897. PATENTED NOV. 15, 1904.

H. W. SOUDER.

BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILROADS.

APPLICATION FILED DEC. 7, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

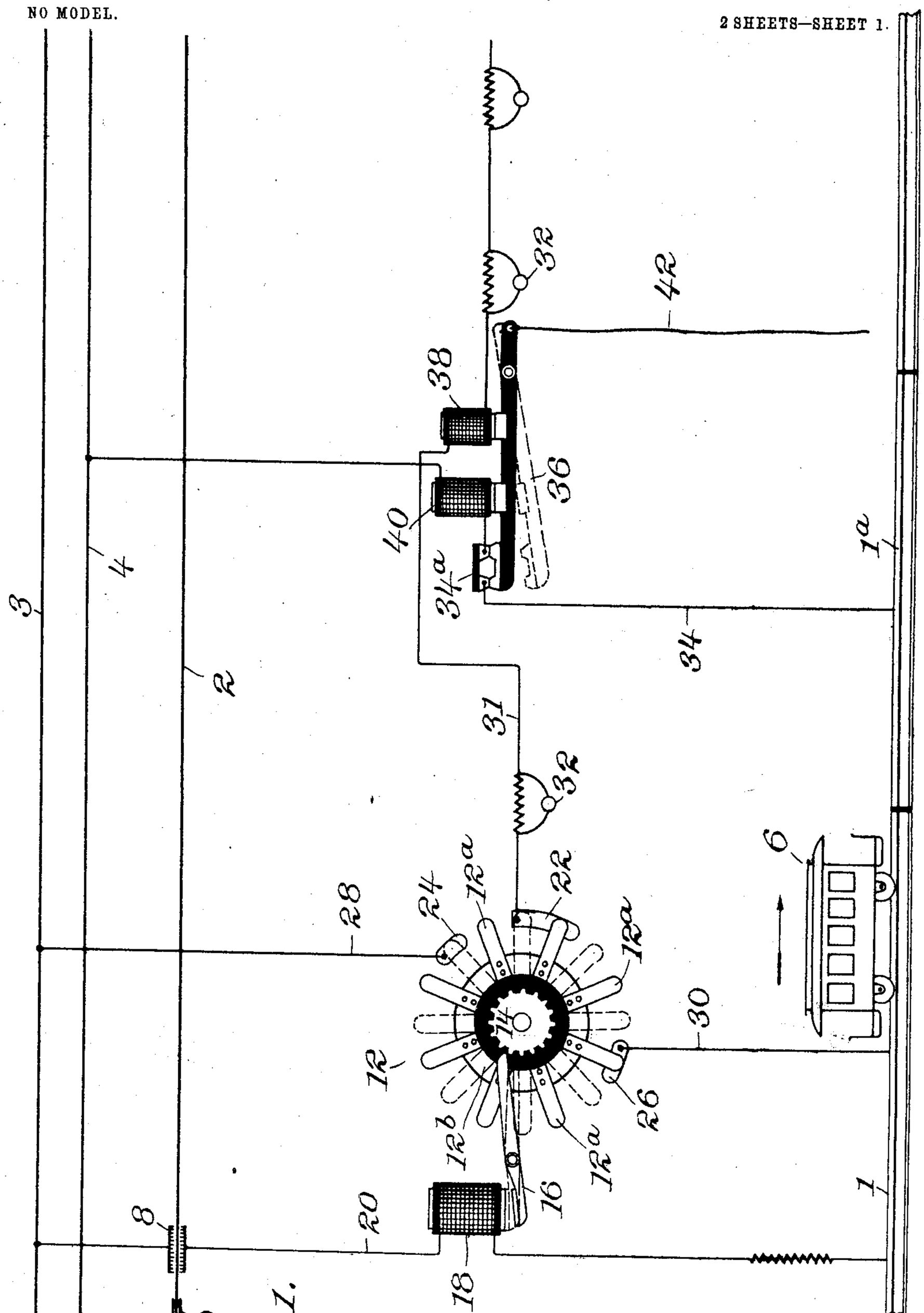

Fig. 1.

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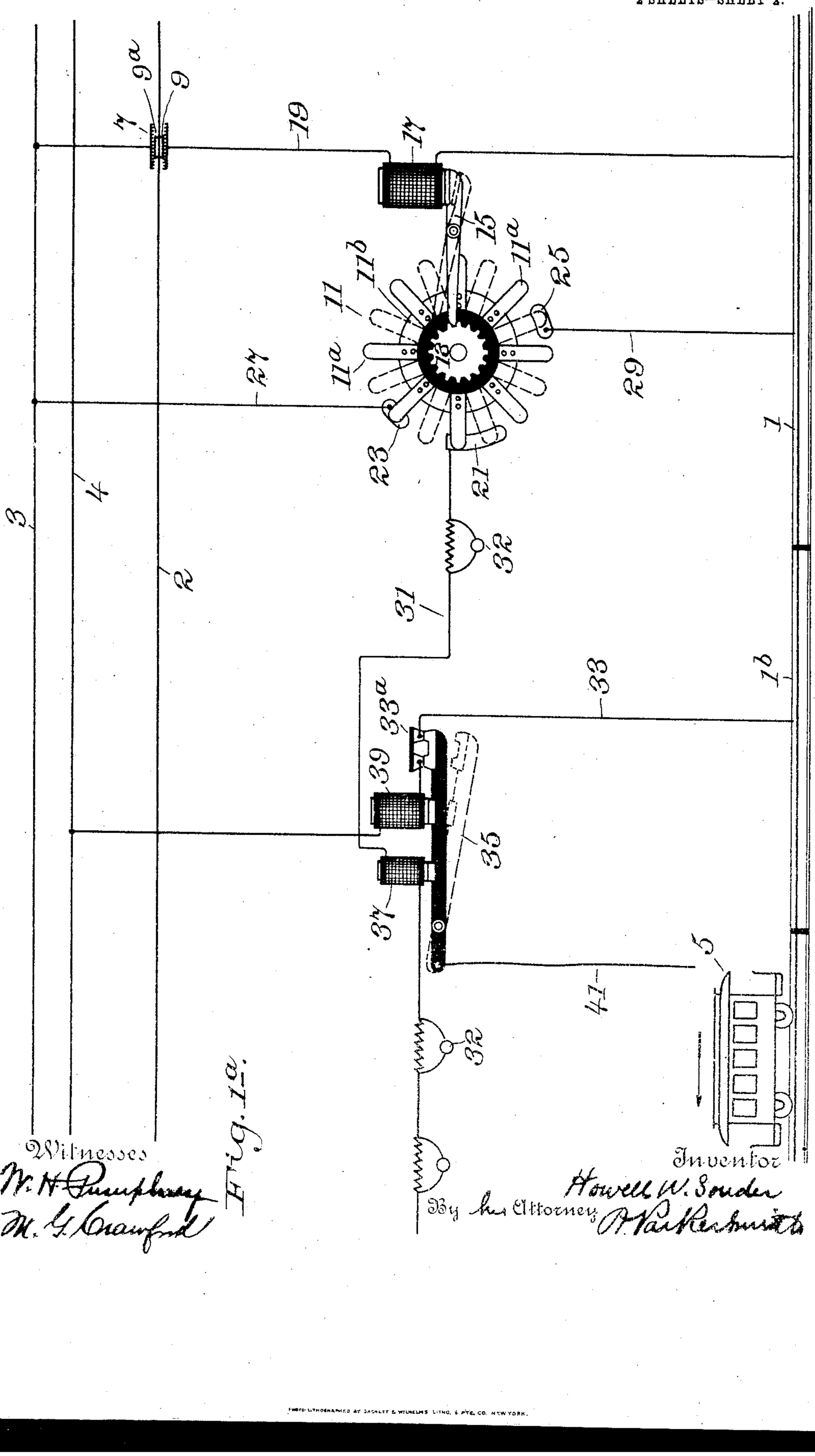

Fig. 1a.

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No. 774,897. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

HOWELL W. SOUDER, OF TAMAQUA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO W. D. ZEHNER, OF LANSFORD, PENNSYLVANIA.

BLOCK-SIGNAL SYSTEM FOR ELECTRIC RAILROADS.

SPECIFICATION forming part of Letters Patent No. 774,897, dated November 15, 1904.

Application filed December 7, 1903. Serial No. 184,022. (No model.)

To all whom it may concern:

Be it known that I, HOWELL W. SOUDER, a citizen of the United States of America, and a resident of Tamaqua, county of Schuylkill, State of Pennsylvania, have invented certain new and useful Improvements in Block-Signal Systems for Electric Railroads, of which the following is a specification.

My invention relates to electric block-signal systems in general; and it more specifically consists of a simple and cheap block system designed to be used on electric trolley-roads and embodying as one of its elements a safety device for disabling the power-circuit whenever a car enters a block already occupied by another car.

One arrangement of circuits embodying my invention is illustrated in the accompanying two sheets of drawings, in which—

Figure 1 is a diagrammatic representation of the circuits and controlling mechanism therefor at one end of the block, and Fig. 1^a is a similar diagrammatic representation of the circuits and apparatus controlling the same at the other end of the block, the two figures of drawings taken together representing one complete block of a road equipped with my system.

Throughout the drawings like reference-figures indicate like parts.

1 represents the railroad-track, which also serves as a ground connection for the electric circuits, with the exception of the insulated rail-sections 1^a 1^b, one located near each end of the block, which are insulated from the ground and from the rest of the track for a purpose hereinafter to be explained.

2 represents a trolley-wire, 3 the feed-conductor, and 4 a return-conductor, where a metallic return-circuit is employed.

5 and 6 represent cars going in opposite directions, as indicated by the arrows, car 5 having passed a little way into the east end of the block and car 6 being about to enter the west end of the same block.

7 represents a normally open contact device located at the east end of the block and adapted to be closed upon the passage of a car into the block, as by contact with the trolley-wheel 9 of such car. 8 is a similar contact device located at the west end of the block, and 10 represents the trolley-wheel of the car 6 about to strike said contact device 8 and close the circuit.

11 represents a rotary circuit-controller at the east end of the block, and 12 a similar rotary circuit-controller at the west end of the block. The circuit-controller 11 has a series of circumferentially-separated contact-sections 11^a 11^a, which are conductively connected by the conductor 11^b or equivalent means and which are evenly distributed about the circumference of the circuit-controller, the angular distance between any two adjacent contact-sections 11^a being constant and uniform. In the same way the circuit-controller 12 is provided with contact-sections 12^a and a conductor 12^b, connecting the same together. The circuit-controller 11 is mounted on a rotating shaft provided with a ratchet-wheel 13 and the controller 12 on a similar shaft provided with a ratchet-wheel 14. These ratchet-wheels are operated by the pawls 15 and 16, which are respectively controlled by the magnets 17 and 18 in the circuits 19 and 20, which extend from the contact devices 7 and 8 to the ground.

The signal-conductor or work-conductor 31 extends along each block and includes a series of signal devices of any convenient form, such as incandescent electric lamps 32 32, &c. This signal-conductor has a stationary terminal 21 at the east end of the block and a similar terminal 22 at the west end of the block, which are in the arcs of travel of the circumferential contact-pieces on the respective circuit-controllers and so proportioned as to always have one of said contact-sections bearing on it at each position of the circuit-controller during its step-by-step rotation by the pawl-and-ratchet mechanism before described.

A feed connection 27 extends from the feed-wire 3 and has a stationary terminal 23 in the arc of travel of the contact-sections 11^a of the circuit-controller 11; but this contact or terminal 23 is so proportioned that one of said contact-sections 11^a will bear on it only at every other position of the circuit-controller in the

course of its step-by-step rotation by the pawl-and-ratchet mechanism. The feed connection 28 and contact piece or terminal 24, similarly arranged, are provided for the circuit-controller 12. A ground connection 29 has the stationary terminal 25 similarly located with reference to the controller 11, and the ground connection 30 has the contact-terminal 26 similarly located with reference to the controller 12. The contacts 23 and 25 are so located that when one of the rotating contact-pieces 11^a bears upon one of these stationary contact-pieces no contact-piece bears upon the other. The same is true with reference to the contacts 24 and 26 and the rotating contacts 12^a.

The insulated contact-section 1^b is connected with the return-conductor 4 by means of the circuit 33, and the insulated rail-section 1^a is similarly connected by means of the circuit 34. Each of these circuits has a break, as at 33^a and 34^a. The break 33^a may be closed by the circuit-controlling device 35, and the break 34^a is similarly controlled by the circuit-breaker or circuit-controlling device 36 when the circuit-breakers are in the positions shown in full lines; but the circuits are opened when the circuit-breakers fall into the positions indicated in dotted lines. The circuit-closers are normally pulled up into the position to bridge their respective breaks by the magnets 37 and 38, which are included in the signal or work circuit 31. These circuit-controllers are also controlled by the second set of magnets 39 and 40, which are respectively included in the circuits 33 and 34. Cords 41 and 42 serve as manually-operated means for resetting the circuit-breakers.

The operation of my invention is as follows: Normally when any given block is empty the two circuit-controllers 11 and 12 are so set that the signal-circuit 31 is connected at both ends either to the feed-wire 3 or to the ground—that is to say, the circuit-controller 11 is either in the position shown in dotted lines and the circuit-controller 12 in the position shown in full lines or the reverse, the result being that no current passes through the signal-circuit 31 in either case. Assuming that the circuit-controller 11 is in the position shown in dotted lines and the circuit-controller 12 in the position shown in full lines, if now a car enters one end of the block, as the east end, its trolley-wheel 9 will close the contact 7, as indicated at 9^a, energize the magnet 17, and actuate the pawl 15. This will rotate the circuit-controller 11 one tooth. There being twice as many ratchet-teeth on the ratchet-wheel as there are contact-sections 11^a, this will move the contact-sections 11^a through a distance equal to half the angular distance between them, and one of the said contact-sections will be moved on to the feed-terminal 23, and the contact-section formerly resting on the ground-terminal 25 will be moved off the same. As one of the radial contact-sections is still left on the work-circuit terminal 21, this will establish a current from the feed-wire 3 through the wire 27, contact 23, radial contacts 11^a, and conductor 11^b to signal-wire contact 21, through the signal-wire 31, to contact 22, through the radial contacts 12^a, conductor 12^b, ground-contact 26, and wire 30 to the ground. This will light all the incandescent lamps 32 and afford the information to the motorman of another car approaching the block that said block is occupied. When the car reaches the west end of the block, as it passes out it operates the circuit-controller 12 by rotating it one tooth of the ratchet, thereby shifting the radial contacts out of engagement with the ground-contact 26 and into engagement with the feed-contact 24, thereby looping the signal-conductor into shunt with the feed-conductor 3 and shutting off the current from the lamps 32. The unlighted lamps will convey the information to the motorman of any car now approaching the block that the same is open, and if said car approaches from the west, as indicated by the car 6, its trolley-wheel 10 will close the contact-maker 8, energize the magnet 18, operate the pawl 16, move the circuit-controller one tooth farther, so that another radial contact bears on the ground connection 26, thereby reëstablishing the circuit from the wire 27 through the signal-conductor 31 and the wire 30 to the ground and again causing the lamps to glow. On passing out of the east end of the block the same car will energize the magnet 17, rotate the circuit-controller 11 one tooth, throwing the contacts 11^a out of connection with the feed-contact 23 and into connection with the ground-contact 25, thereby looping the signal-conductor 31 into shunt with the ground and extinguishing the lamps. It is evident that if after the car 5 has entered the block and moved the circuit-controller 11 into the position shown in full lines the car 6 also enters the block from the opposite direction it will throw the circuit-controller 12 into the dotted-line position, and both grounds being cut out the lamps 32 will all be extinguished, thus advising the motorman of car 5 that car 6 has overrun its signals, causing him to proceed with caution under control or to stop his car until the lamps are relighted, according to instructions issued. If car 6 backs out of the block, it turns the circuit-controller 12 another tooth and reëstablishes the connections which existed before it entered the block and again causes the lamps to glow, affording the information to the motorman of car 5 that the block has been cleared. As an additional safety device and a means for absolutely preventing the second car from passing beyond a short distance into the block when the same is already occupied I employ the insulated rail-sections 1^a and 1^b and the

circuit connections therefor above described. It is evident that whenever there is current in the signal-conductor 31 the magnets 37 and 38 will be energized and the circuit-breakers 35 and 36 held up in the full-line positions, thereby closing the breaks 33^a and 34^a in the return connections for these insulated track-sections, and consequently the circuit through the car-motors will be complete and the cars may run in the usual manner. If, however, after one car, as 5, has entered the block another car, as 6, enters said block, it will, as previously described, shut off the current from the signal or work conductor 31 and deënergize the magnets 37 and 38. This will cause the circuit-breakers 35 and 36 to drop into the dotted-line positions, unless they are otherwise held up, and will open the return-circuits 33 and 34 for the insulated track-sections 1^a and 1^b. Consequently when car 6 runs onto the insulated section 1^a current will be cut off from its motor, and it will stop. This will absolutely prevent the second car from continuing on into the unoccupied block. The motorman of car 6, however, by pulling the cord 42 can reset the circuit-controller 36, and upon reëstablishing the circuit 34 the magnet 40 will become energized and hold such circuit-controller in position, so that the car 6 will have the necessary power to back out of the block, when the normal conditions will be reëstablished. The magnets 39 and 40 also have the additional function of preventing the second car entering the block from disabling the first car should the same happen to be on its insulated track-section at the moment of such entry of the second car. It is evident that if car 5 were on the insulated section 1^b at the moment car 6 entered the block the current passing through the car-motor and the return-wire 33 would keep the magnet 39 energized, so that the circuit-breaker 35 would be held up in spite of the deënergizing of the magnet 37, and the power-circuit would be maintained for car 5, but would be broken, as before, for car 6 the moment the latter entered upon its insulated track-section 1^a.

While the operation of the system has been described for cars entering the block from opposite directions, it is evident that it would work in the same way for cars entering the block successively from the same end, so that the system is a closed block system, permitting only one car to enter the block at one time from either direction.

The advantages of the invention comprise its simplicity and economy, a very cheap form of circuit-controller and a small amount of wiring being necessary, its sure and automatic action under all conditions of service, and the absolute factor of safety introduced by the power-disabling apparatus called into operation when the signals are disobeyed.

It is evident, of course, that various changes could be made in the details of construction illustrated without departing from the spirit and scope of my invention. The circuit-controllers and their operating-magnets and cooperating contacts have been shown diagrammatically, and various different mechanical embodiments of the principle involved could be used in actual practice. The constant-current connection between the signal-wire and both circuit-controllers might be secured by other means than through the same circumferentially-separated contact-sections which coöperate with the feed and ground connections. Other forms of mechanism for rotating the circuit-controllers might be substituted. The form of circuit-breaker coöperating with the insulated track-sections might be varied and the electromagnetic apparatus for operating the same changed so long as the hereinbefore-described result was secured. The return-circuit from the insulated track-section to the power-house might not be by way of a special return-wire 4, as indicated, but could be carried around the insulated rail-joints to the power-house in any other well-known manner. It is also evident that the signal system herein described might be used without the insulated-rail-section attachment and, conversely, that said insulated-rail-section attachment might be used on other signaling systems; but the same is most perfectly designed to coöperate with the system herein described, as the same being intended for cheap constructions the necessity for positive safety devices in connection therewith is increased. All of these and other modifications of the apparatus herein described I should consider matters of mere mechanical and electrical skill and as being still within the boundaries of my invention.

Having therefore described my invention, what I claim as new, and desire to protect by Letters Patent, is—

1. In an electric block-signal system the combination of a signal-conductor extending along the block, signals operated by the current carried thereby, a feed connection at each end of the block, a ground connection at each end of the block, a rotating circuit-controller near each end of the block, provided with circumferentially-separated contact-sections conductively connected and evenly distributed about its circumference, a stationary terminal near each end of the block for the signal-conductor, on which terminal at least one of the circuit-controller's contacts always bears at any period of the controller's rotation, terminals for the feed and ground connections so located that when a controller-contact bears on either, the other is disconnected, and means operated by a car entering or leaving the block for rotating the circuit-controller nearest that end of the block, half the angular distance between two contact-points.

2. In an electric block-signal system the

combination of a signal-conductor extending along the block, signals operated by the current carried thereby, a feed connection at each end of the block, a ground connection at each end of the block, a rotating circuit-controller near each end of the block, provided with circumferentially-separated contact-sectionsconductively connected and evenly distributed about its circumference, a stationary terminal near each end of the block for the signal-conductor, on which terminal at least one of the circuit-controller's contacts always bears at any period of the controller's rotation, terminals for the feed and ground connections so located that when a controller-contact bears on either, the other is disconnected, and means operated by a car entering or leaving the block for rotating the circuit-controller nearest that end of the block, half the angular distance between two contact-points, said last-mentioned means comprising an electromagnet and circuit-controlling means for the same.

3. As an element in an electric signaling system, the combination of a rotating circuit-controller divided into a series of circumferentially-separated contact-sections, the angular distances between the centers of any two adjacent contact-sections being uniform throughout, and means giving the controller a step-by-step rotary movement always in one direction, each step being equal to one-half the angular distance between the centers of two adjacent contact-sections, together with a work-circuit terminal, a feed-connection terminal and a ground-connection terminal, all arranged in the path of rotation of the controller-contacts.

4. As an element in an electric signaling system, the combination of a rotating circuit-controller divided into a series of circumferentially-separated contact-sections, the angular distances between the centers of any two adjacent contact-sections being uniform throughout, and means giving the controller a step-by-step rotary movement always in one direction, each step being equal to one-half the angular distance between the centers of two adjacent contact-sections, together with a work-circuit terminal, a feed-connection terminal and a ground-connection terminal, all arranged in the path of rotation of the controller-contacts, the feed and ground terminals being so disposed that only one of them can touch a controller-contact at any one time, and the work-circuit terminal being so disposed that it always touches at least one of the controller-contacts.

5. In a block-signal system for electric trolley-roads, the combination of a block provided with an insulated section of track near each end, a circuit connection for each such section, a circuit-breaker in each circuit connection, a magnet controlling said circuit-breaker, a signal-circuit in which the magnets for any one block are included, current-supply connections for the signal-circuit and means whereby a car entering the block while another car is already in that block will cut off the current supplied to the signal-circuit and deënergize the magnets.

6. In a block-signal system for electric trolley-roads, the combination of a series of blocks each provided with an insulated section of track near each end of each block, a return-circuit connection for each section, a normally open circuit-breaker in each return-circuit connection, a magnet controlling each circuit-breaker, a signal-circuit in which the magnets for any one block are included, current-supply connections for the signal-circuits at each end of each block, and signal-circuit-controlling apparatus which sends a current through the signal-circuit while one car is in a block, but cuts off said current when a second car enters the block.

7. In a block-signal system for electric railroads, the combination of a block provided with electrically-operated signals, an insulated section of track near one of said signals, a power-circuit connection for each such section, a circuit-breaker in said circuit connection, a magnet controlling said circuit-breaker, a circuit in which the electrically-operated signal device and the said magnet are included, current-supply connections for this circuit and circuit-controllers therefor operated by the passing cars.

8. In a block-signal system for electric trolley-roads, the combination of a block provided with an insulated section of track near each end, a circuit connection for each such section, a circuit-breaker in each circuit connection, a magnet controlling said circuit-breaker, a signal-circuit in which the magnets for any one block are included, current-supply connections for the signal-circuit and means whereby a car entering the block while another car is already in that block will cut off the current supplied to the signal-circuit and deënergize the magnets, together with a second magnet in each circuit connection for an insulated track-section, said magnet also controlling the operation of the circuit-breaker.

9. In a block-signal system for electric trolley-roads, the combination of a block provided with an insulated section of track near each end, a circuit connection for each such section, a circuit-breaker in each circuit connection, a magnet controlling said circuit-breaker, a signal-circuit in which the magnets for any one block are included, current-supply connections for the signal-circuit and means whereby a car entering the block while another car is already in that block will cut off the current supplied to the signal-circuit and deënergize the magnets, together with a second magnet in each circuit connection for an insulated track-section, said magnet also con-

trolling the operation of the circuit-breaker, and manually-operated means for closing said circuit-breaker.

10. In an electric block-signal system, the combination of a signal-conductor extending along the block, signals operated by the cureent carried thereby, a feed connection having a terminal near each end of the signal-conductor, a ground connection having a terminal near each end of the signal-conductor, a circuit-controller near each end of the block permanently connected with the signal-conductor, and alternately connected with the feed-terminal and the ground-terminal, and means operated by a car entering or leaving the block to alternate said connections.

Signed at Lansford, Pennsylvania, this 10th day of November, 1903.

HOWELL W. SOUDER.

Witnesses:
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