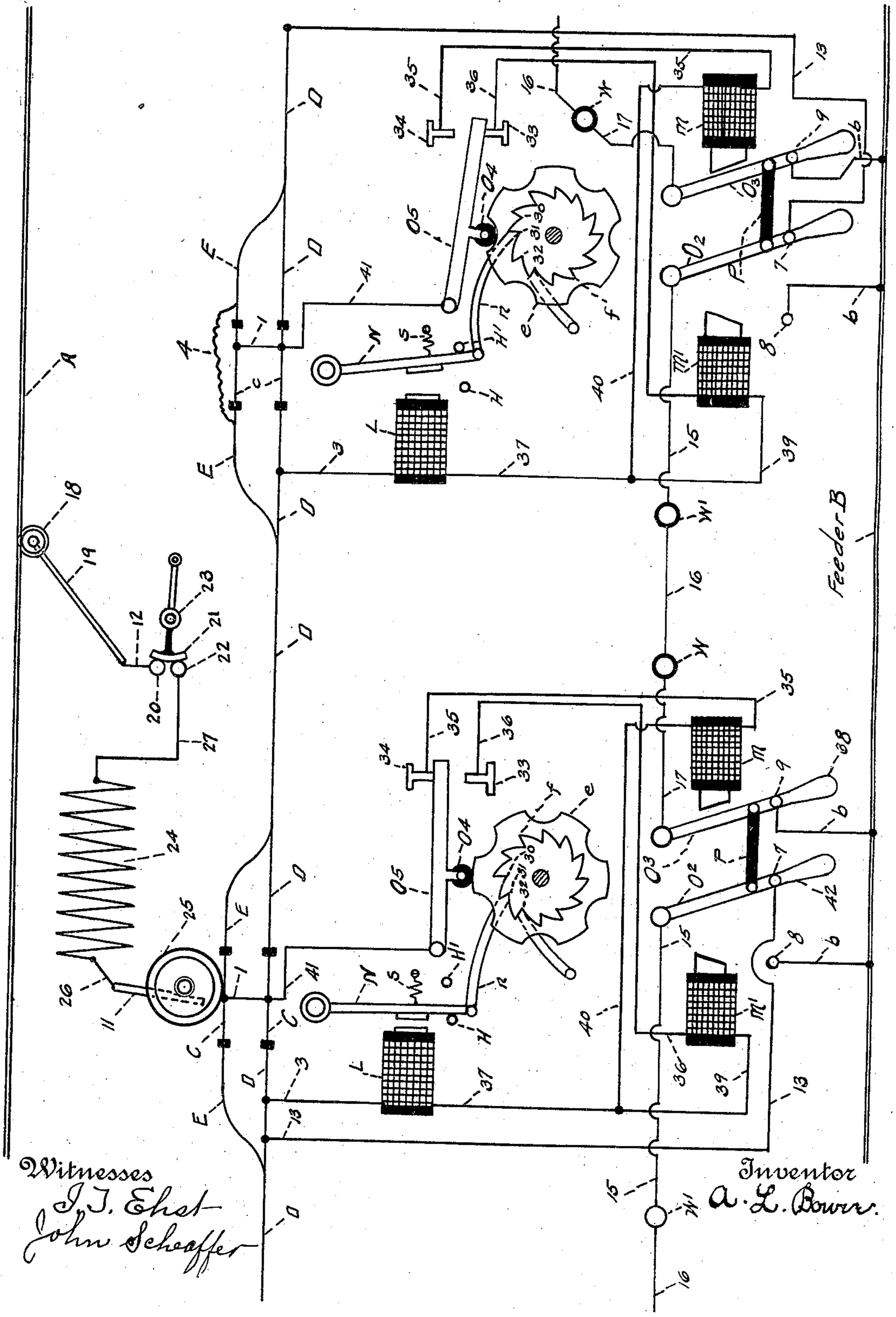
No. 810,705. PATENTED JAN. 23, 1906.

A. L. BOWER.

BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS.

APPLICATION FILED JAN. 10, 1903.



Witnesses
I. J. Ehst
John Scheffer

Inventor
A. L. Bower.

UNITED STATES PATENT OFFICE.

ABRAM L. BOWER, OF BOYERTOWN, PENNSYLVANIA.

BLOCK-SIGNAL SYSTEM FOR ELECTRIC RAILWAYS.

No. 810,705. Specification of Letters Patent. Patented Jan. 23, 1906.

Application filed January 10, 1903. Serial No. 138,498.

To all whom it may concern:

Be it known that I, ABRAM L. BOWER, a citizen of the United States, residing at Boyertown, in the county of Berks and State of Pennsylvania, have invented a new and useful Block-Signal System for Electric Railways, of which the following is a specification.

My invention relates to improvements in signal systems for electric railways in which the signals are operated by relays, which in turn are energized when a car passes over an insulated rail or rails forming a part of the two main rails of the road-bed. It differs from other systems which show or throw signals at two or more points to indicate that a certain block or section of track is occupied by a train or car in that the change of signals is produced automatically without necessitating the operator's leaving the car. Means are also provided for operating it manually when so desired. Furthermore, means are provided on the car for altering the operation of the signals at any time.

A further object is to employ signal-circuits which are supplied with current only when the corresponding section of the track is unoccupied, thus lighting the signal-lamps only when the safety-signal is desired.

The drawing forming a part of this specification illustrates apparatus embodying the principles of my invention.

In the drawing, A designates the trolley-conductor of an electric railway.

B is the main supply-feeder, which has branches *b b* leading to the signaling apparatus located at the turnouts.

D represents the rails of the main track, and E represents the rails of the siding. Both rails of the track are not shown in the drawing.

C C represents pairs of insulated rails in the turnouts or adjacent to them. These insulated rails in each turnout are longer than any car and are connected together by wire 1. Those in the turnout are located opposite each other, and likewise those in the main rails are located opposite each other.

L L are the track-relays connected to the main rails by wire 3 and to the insulated rails in the manner to be described later. Wire 4 connects the rails in front of the insulated rails with the rails behind them, thus preserving the continuity of the earth-conductor. Relay L operates an armature-lever N when that relay is momentarily energized by a passing car. A pivoted arm O^5 is provided below with a projection resting upon a small wheel O^4, supporting the arm upon the notched or indented periphery of a break-wheel *e*. This device is adapted to shift the switch-arm alternately into engagement with contact 34 above and with contact 33 below. The break-wheel *e* is joined to the ratchet-wheel *f*, upon the upper surface of which the pawl *n* rests. A spring S tends to pull and hold the armature-lever N away from relay L. Stops H and H′ limit the movement of lever N. Two other relays M and M′ are used in connection with relay L. Two switch-arms O^2 and O^3 are connected together by a bar of insulating material P. These switch-arms serve as pole-changers and are adapted to be drawn alternately toward relays M and M′.

Three contacts 8, 7, and 9 are placed in the path of the switch-arms. Contacts 8 and 9 are connected to the main feeder B by branches *b b*. Contact 7, which is the middle contact common to both switch-arms, is connected to the rail D by wire 13. Arm O^2 connects with the advance signal-circuit through wire 15, and arm O^3 with the rear signal-circuit through wire 17. Arm O^2 is adapted to touch contact 8 when drawn toward relay M′ and is also adapted to touch contact 7 when drawn toward relay M. Likewise arm O^3 is adapted to touch contact 7 when drawn toward relay M′ and is also adapted to touch contact 9 when drawn toward relay M. Arm O^3 is connected to arm O^2 in the turnout in the rear by wire 17, light *w* at that end of the intervening section, line wire 16, light *w′* at the other end of the section, and wire 15.

The insulated rails are connected by wire 41 to switch-arm O^5. This switch-arm completes the circuit through relay L in two ways, according to its position. Wire 35 leads from contact-point 34 to relay M, and wire 40 leads from relay M to wire 37, which is connected to the second electrode of relay L. Wire 36 leads from contact-point 33 to relay M′, and wire 39 connects that relay with wire 37. The circuit is divided between wires 37 and switch-arm O^5.

When arm O^5 occupies its lower position, the circuit through the relays is as follows: from insulated rails C through wire 41, arm

O^5, contact-point 33, wire 36, relay M′, wire 39, wire 37, relay L, and wire 3 to the rails D. When arm O^5 occupies its upper position, the circuit is as follows: from insulated rail C through wire 41, arm O^3, contact-point 34, wire 35, relay M, wire 40, wire 37, relay L, and wire 3 to rails D. When the switch-arm O^5 is in its upper position, relays L and M are in the circuit from the insulated rails C to rails D and when in its lower position relays L and M′ are in that circuit. Switch-arms O^2 and O^3 are provided with handles 42 and 38 to permit their operation manually.

A wheel 25 of a car is connected by wire 26 to a resistance 24 on the car. Wire 27 connects the other end of the resistance to contact-point 22 in relation to contact-point 20, which connects with the trolley-wire A through wire 12, trolley-pole 19, and trolley-wheel 18. A bar of metal 21 is adapted to be moved by a lever 23, so as to connect points 20 and 22 or disconnect them at will. No extra apparatus need be used on the car if the motors be used as resistance and the controller as the switch 23, and to operate the signals it will be necessary only to have part or all of the power turned on while crossing the insulated rails. To prevent the operation of the signals, the power may be turned off while crossing the insulated rails.

The operation of the device is as follows: When the line is clear, the switch-arms are all turned, so that a line-wire is connected to the main feeder B at one end by means of either contact 8 or 9 and branch *b* and at the other end to the rails by contact 7 and wire 13. The current flows through the various line-wires, lighting the lights *w* and *w′* in each section. In the drawing the car is shown as having passed over the track from right to left. Before the car had approached the turnout on the right the arms O^5 were horizontal The ratchet-wheels and break-wheels were in the position shown on the left, but with the pawl in notch 30 and with the switch-arms O^2 and O^3 in the left-hand position. Lights *w* and *w′* of the section shown in the drawing were lighted. The circuit was as follows: from feeder B through branch *b*, (on the right,) contact-point 8, arm O^2, wire 15, light *w′*, wire 16, light *w*, wire 17, arm O^3, contact-point 7, and wire 13 to the rails. When the car passed onto the insulated rails, the current from the feed-wire flowed through the following circuit: from wire A, through wheel 18, pole 19, wire 12, contact 20, plate 21, contact 22, wire 27, resistance 24, wire 26, brush 11, the wheels 25, insulated rail C, wires 1 and 41, arm O^5, contact-point 34, wire 35, relay M, wire 40, wire 37, relay L, wire 3, to the rails D D. The current energizes relays L and M. Relay M draws the switch-arm to the right-hand position, and relay L draws armature-lever N forward, permitting pawl *n* to slide from notch 30 to notch 31. With switch-arm O^3 of the left-hand side of the drawing in the left-hand position and switch-arm O^2 of the right-hand side of the drawing in the right-hand position the circuit through lights *w* and *w′* of the intervening section is as follows: from the earth-conductor D on the right, through wire 13, contact-point 7, arm O^2, wire 15, light *w′*, wire 16, light *w*, wire 17, arm O^3, contact-point 7, and wire 13 to the earth connection. No current flows through the lights and a car at the left-hand turnout does not receive a safety-signal from light *w* there. When the car leaves the insulated rails at the right-hand side of the drawing, relay L is deënergized and spring S pulls the armature-arm back and turns the ratchet-wheel one point and wheel O^4 drops into a notch on the periphery of wheel *e* and connects arm O^5 with contact-point 33. The same results take place when the car reaches the next turnout on the left-hand side of the drawing, pulling the switch-arms to the right, as is shown. Then the circuit through the rear line-wire is as follows: from the main feeder B to branch *b*, contact-point 9, arm O^3, wire 17, light *w*, wire 16, light *w′*, wire 15, arm O^2, contact-point 7, wire 13 to the earth-conductor, again lighting the lights intervening and allowing another car to enter the section. When the car leaves the insulated rail, the armature-lever N is drawn back by the spring S and pawl *n* turns the break-wheel one point and shifts arm O^5 to connect with contact-point 33. When another car reaches the insulated rails on the right, the current flows through the relays as follows: from the feed-wire A, through the car, through rail C, wire 1, wire 41, arm O^5, contact-point 33, wire 36, relay M′, wire 39, wire 37, relay L, and wire 3 to the other rail. The switch-arms O^2 and O^3 are drawn to the left and the safety-signal is no longer displayed at the end of the intervening section. The circuit is as follows: from branch *b* of the main feeder B, through contact-point 8, arm O^2, wire 15, light *w′*, wire 16, light *w*, wire 17, arm O^3, contact-point 9, to branch *b* of the main feeder B. No current flows. The results are the same with cars going in either direction. No two cars should be permitted to occupy the signaling position in a turnout at the same time. Thus cars succeeding each other turn the switch-arms alternately to the right and left positions and on leaving the insulated rail alternately set the track instrument to connect relays M and M′ alternately in the circuit, producing the results described.

Certain parts of the apparatus may be duplicated, and switch-arms O^2 and O^3 may be operated independently of each other.

Where a single insulated rail is used instead of a pair of insulated rails in the main track and in the turnouts, wheel 25 of the car must be insulated from the other wheels

of the car, and an extra resistance must be used, and the controlling-switch 23 must be distinct and separate from the controller of the car. Then the switch 23 should be turned to connect contacts 20 and 22 only when in the vicinity of the insulated rails.

What I claim as new, and desire to secure by Letters Patent, is the following:

1. In a block-signal system for electric railways, the combination with the track divided into blocks or sections, of insulated rail-sections between adjacent blocks, a feed-wire extending along the railway, a circuit-changing switch at the end of each block, main signal-wires extending from one of said switches to the other, said switches arranged to connect the main signal-wires terminating therein alternately to the feed-wire and to the common return of the power-circuit, magnets to operate said switch, and electrical means coöperating with a car to energize said magnets alternately as successive cars arrive upon the insulated track-section at the end of block, substantially as described.

2. In a block-signal system for electric railways, the combination with the track divided into blocks or sections, of insulated rail-sections between adjacent blocks, a feed-wire extending along the railway, a circuit-changing switch at the end of each block, main signal-wires extending from one of said switches to the other, said switches arranged to connect the main signal-wires terminating therein alternately to the feed-wire and to the common return of the power-circuit, magnets to operate said switch, a circuit divided into two branches, one of said magnets connected in each of said branches, a magnet connected in circuit common to both branches, means operated by said third magnet to energize said switch-operating magnets alternately as successive cars arrive upon the insulated track-section adjacent thereto, substantially as described.

3. In a block-signal system for electric railways, the combination with the track divided into blocks or sections, of insulated rail-sections between adjacent blocks, a feed-wire extending along the railway, a circuit-changing switch at the end of each block, main signal-wires extending from one of said switches to the other, said switches arranged to connect the main signal-wires terminating therein alternately to the feed-wire and to the common return of the power-circuit, magnets to operate said switch, a circuit divided into two branches, one of said magnets connected in each of said branches, a magnet connected to circuit common to both of said branches and in circuit with the insulated rails, a movable contact device, means coöperating with the last-named magnet to bring said contact device into electrical connection with said branches alternately, electrical connection between said contact device and the adjacent insulated track-section, a trolley-wire and means to complete the circuit from the said trolley-wire to the said insulated track-section when a car arrives thereon, substantially as described.

4. In a block-signal system, the combination with a section of track, of traffic-controlling devices in connection with a line-wire terminating in a switch, which coöperates alternately with a branch of the feed-wire and the return-conductor; two magnets in relation to the switch; a divided circuit, one of said magnets being included in each branch of the circuit; a switch-arm arranged to be included alternately in the branches of said divided circuit, a ratchet-wheel; a pawl for said ratchet-wheel actuated by an armature, a third magnet included in both branch circuits for operating the armature, a break-wheel provided with a notched periphery, said break-wheel arranged for operation by said ratchet-wheel, the second switch-arm resting upon the notched or indented periphery of the break-wheel, operative devices for energizing and deënergizing the circuit, together with the rails forming the return-conductors, and an insulated rail-section connected to the switch controlling the branch circuits, substantially as described.

5. In a block-signal system, a series of blocks, insulated rails between the blocks, divided circuits terminating in the rails, each circuit having an insulated rail for one terminal, a magnet included in and controlled by both branch circuits, said magnet operating a commutating device controlling each circuit, the commutating device serving to connect the branch circuits alternately with the main circuit, an additional magnet in each branch of the divided circuit, switch-arms in relation to these magnets, line-wires terminating in a switch at each end, said switch being adapted to coöperate alternately with branches of a current-supply wire and the return-conductor, together with traffic-controlling devices adjacent to the turnouts, and devices for energizing and de-energizing the divided circuits, substantially as described.

6. In a block-signal system for electric railways, the combination with a series of blocks, signal-lamps connected with line-wires terminating in switches at the turnouts, a feed-wire having a branch at each turnout, an earth-conductor having a branch at each turnout, the switches coöperating with the branches of the feed-wire and the return-circuit alternately, a main local circuit with two branch circuits at each turnout, a magnet included in and controlled by both branch circuits, said magnet operating an armature, pawl, ratchet-wheel, and a commutating device serving to connect the branch circuits alternately with the main lo-

cal circuit, a magnet in each branch circuit and in operative relation to the switches and adapted to move them alternately forward and backward, a trolley-conductor, and means coöperating with a car to complete a circuit from said trolley-conductor through one of said local branch circuits at a time, when the car arrives at a given section of track, substantially as described.

ABRAM L. BOWER.

Witnesses:
IRWIN T. EHSH,
J. H. FUNK.