No. 778,356. PATENTED DEC. 27, 1904.

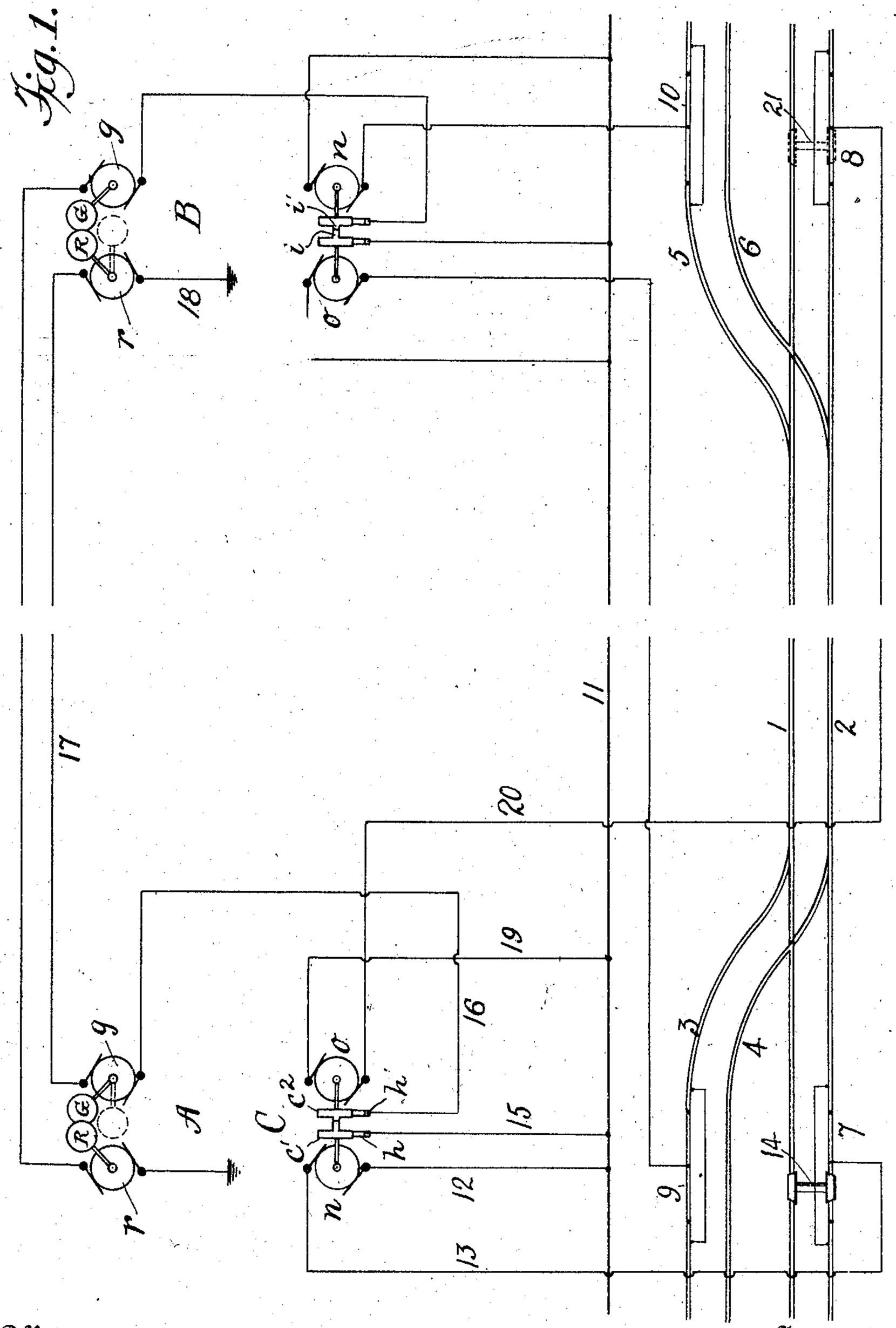
F. L. FULLER & C. S. BANGHART.

RAILWAY SIGNAL.

APPLICATION FILED MAR. 21, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3.

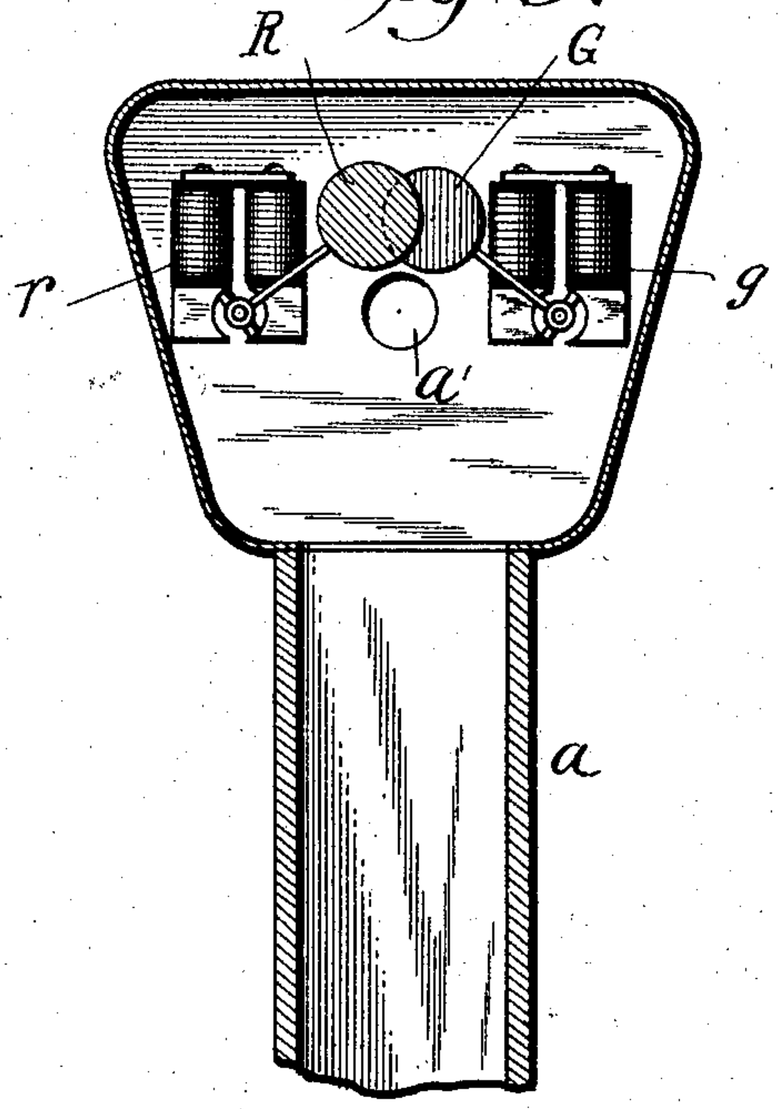
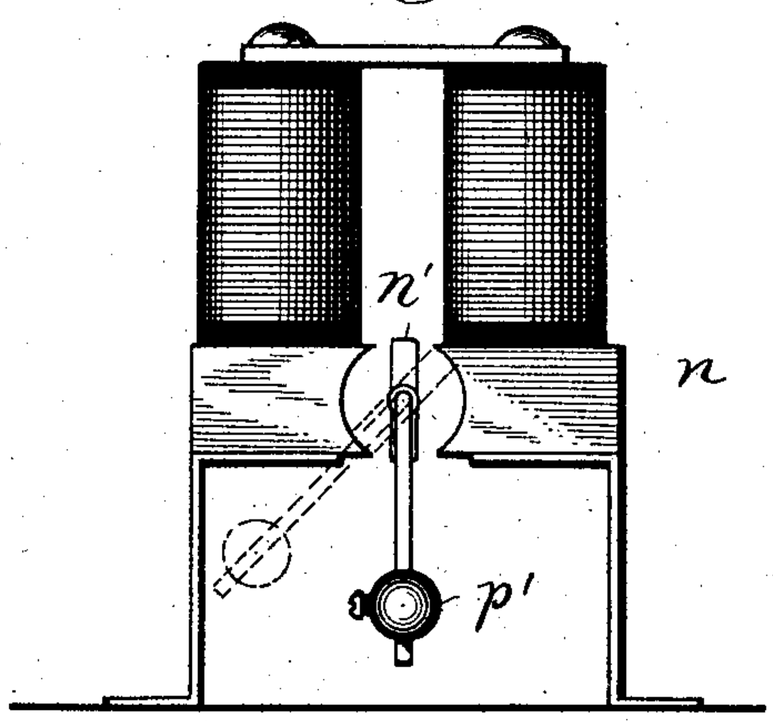


Fig. 4.



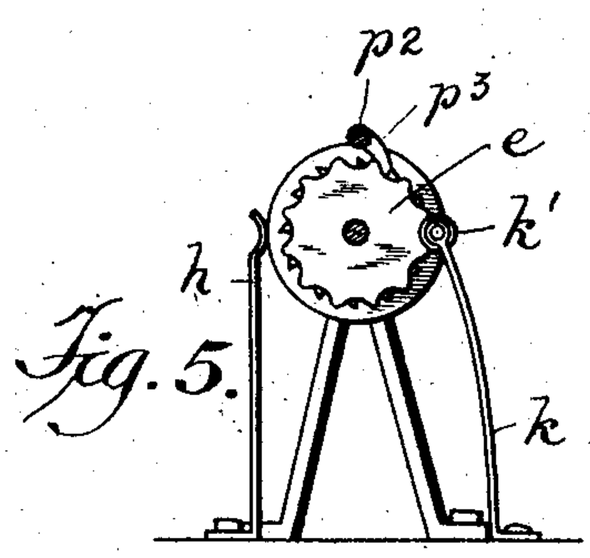
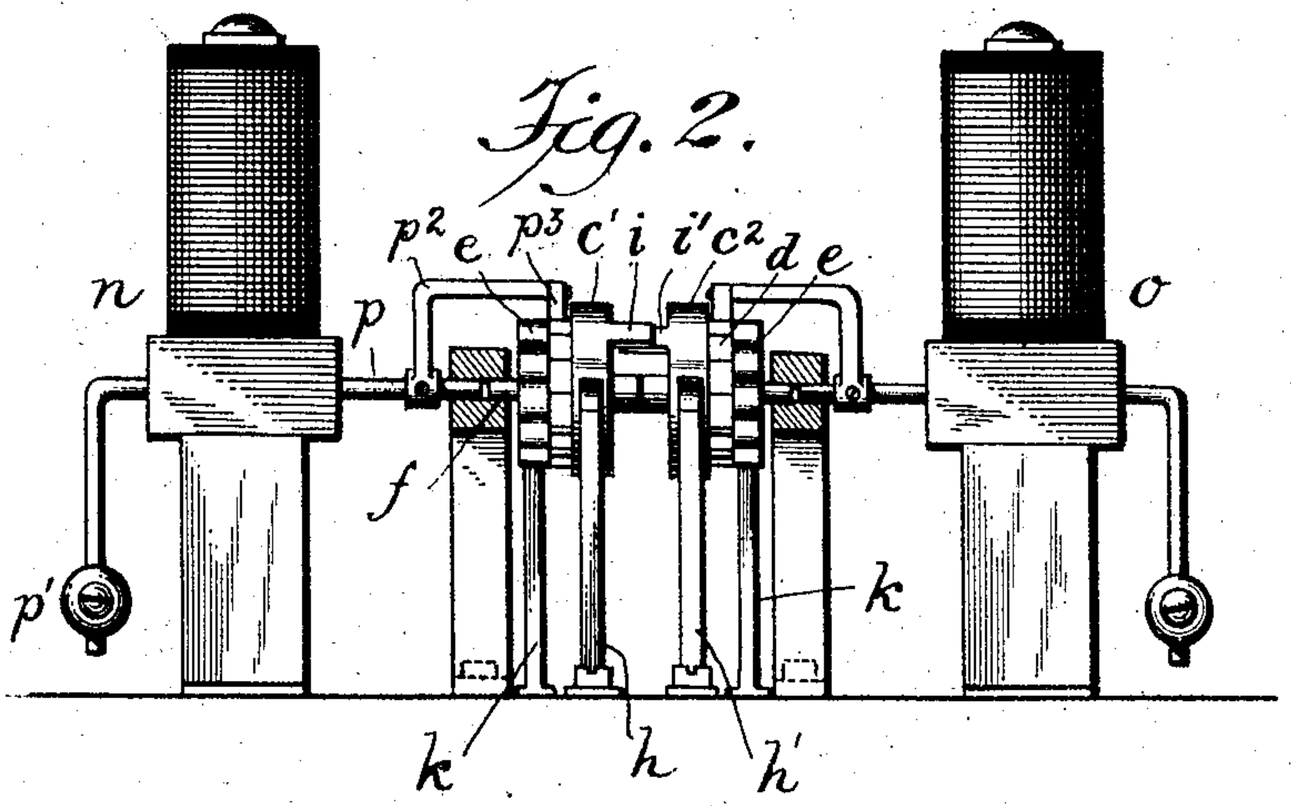


Fig. 5.

Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANK L. FULLER AND CHARLES S. BANGHART, OF NEW YORK, N. Y.

RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 778,356, dated December 27, 1904.

Application filed March 21, 1904. Serial No. 199,131.

To all whom it may concern:

Be it known that we, FRANK L. FULLER, residing in the borough of Manhattan, and CHARLES S. BANGHART, residing in the borough of Queens, in the city of New York and State of New York, citizens of the United States, have invented certain new and useful Improvements in Railway-Signals, of which the following is a full, clear, and exact description.

This invention relates to railway-signals. It is especially adapted for single-track trolley-roads.

The object of the invention is to provide a signal which shall be entirely automatic in its operation, certain in its action, and simple in construction.

There are two general classes of signals for trolley-cars now in operation, one comprising hand-operated switches at each end of the blocks into which the road is divided, which require the car to stop and the motorman or conductor to leave his post to throw the switch, and, second, automatic systems in which the trolley-wheel strikes a contact mounted upon or adjacent to the trolley-wire to operate the signals. The first system is not a safe one, since it depends entirely upon manual operation, and it has been found in practice that cars will sometimes pass the switches without operating the signals, often resulting in an accident of some character. The automatic system is not certain in its action for the reason that the trolley sometimes leaves the wire or by reason of the sagging of the wire or other displacement the proper contact is not effected, and the signals are accordingly not operated. In accordance with our invention we operate the signals by the mere passage of the car into and out of the block, and so long as it remains upon the track the setting of the signals is accomplished. This is done by insulating a short section of the track-rail from the ground and allowing the car itself to close the circuit from said section to the ground through its wheels and axles, such closure completing a circuit to a circuit-controller which controls the signals. The power-current used to propel the cars may be used for the signals or an entirely separate source of current may be used. In any case passage of the propelling-current through the car does not in any way influence the signaling mechanism, so that whether the controller of the car be "on" or "off" or the trolley be on or off the wire it will make no difference in the operation of the signals, as their circuits are entirely independent of the car, the latter serving only as a body of metal to close the signal-circuit at the proper time.

Our invention also embodies other features of circuits and apparatus which will be fully brought out in the following description with reference to the accompanying drawings.

Figure 1 is a diagram of the circuits and apparatus constituting our invention. Fig. 2 is a side elevation of the rail or circuit-controlling mechanism. Fig. 3 is a section through the signal-head, showing the motive devices for the signals. Fig. 4 is an end view of the circuit-controlling motor. Fig. 5 is a detail of the circuit-controlling mechanism.

The single-track road will be divided into blocks, as usual, the limits of which are determined by turnouts, where cars are to pass each other.

In the drawings, 1 and 2 indicate the main rails of a block, 3 and 4 being the rails of the turnouts at one end and 5 and 6 those at the other. These rails are all supposed to be electrically bonded, as usual, to form a return-circuit for the power-current. In the present instance if we consider the signal to be operated by the power-circuit the rails will also form the return-circuit therefor. If the signal is operated by a separate source of current, the rails will likewise form a part of the circuit. At each block limit one of the main track-rails has two short insulated sections 7 and 8, which are successively operative in connection with the cars as they pass from one block to another. Likewise the turnouts have similar insulated sections 9 and 10 also operative in connection with the cars. At each block limit there are two signals A and B, only one of which being shown in the drawings, since they operate in couples to actuate one signal at each end of the block—that is to say, the signal A at one block coöperates with the signal B at the next block limit,

while the signal B at the same location as the signal A coöperates with the signal A of a preceding block. It is therefore considered unnecessary to show in the drawings more than one pair of coöperating signals. The signals are mounted on a post *a*, carrying a box at its upper end having an opening *a'* through which the signals are displayed. Each signal is equipped with two disks, G being a green disk and R a red disk. They are normally held in an elevated position, as shown in Fig. 3, by energized electric motors *g* and *r*, but will fall by their own weight into a position across the opening *a'* when the circuit of the motors is opened.

Corresponding to each of the signals is a relay or circuit-controller C. This consists of two metallic disks *c'* and *c*², insulated from each other and in connection with a ratchet-wheel *d* and a stop-wheel *e*, loosely mounted on a shaft *f*.

h and *h'* are contact-springs bearing upon the respective disks, and *k k* are spring-arms carrying rollers bearing against the notched rims of the respective stop-wheels *e* to hold the disks firmly at any point to which they may have been rotated. Each disk has a contact-finger *i* or *i'* extending into such relation with each other that they will collide and electrically connect the two disks when they are in the same radial plane.

n and *o* are two electric motors adapted to respectively rotate the disks *c'* and *c*² step by step in accordance with impulses of current sent through them. Each motor consists of a field-magnet, pole-pieces, and an iron armature, the latter indicated at *n'* and being mounted on a shaft *p* and held in a neutral position with respect to the poles by a weight *p'*, so long as no current is flowing through the motors. When the motor is energized, the magnetic attraction swings the armature to the position shown in dotted lines in Fig. 4, in which position the weight balances the magnetism and the shaft remains substantially stationary. On each of the shafts *p* is a bent arm *p*², carrying a pawl *p*³, which engages with the ratchet-wheels *d d*. Hence whenever an impulse of current is sent through the motor the corresponding disk *c'* or *c*² is rotated a distance depending upon the oscillation of the shaft which is arranged to be equal to the length of one tooth on the ratchet-wheel. When current is withdrawn from the motor, the weight oscillates the shaft in the opposite direction and the pawl merely slips over the tooth of the ratchet-wheel and assumes a position behind the next tooth, the disk being held stationary by the roller *k'*, seated in a notch of the stop-wheel *e*.

In the description of the operation which follows the circuits will be described.

Assuming the block to be clear, a car entering from the left on the main track will as soon as it runs upon the insulated section 7 close a circuit through the motor *n* as follows: from the feeder 11 (which we will assume to be connected to one side of the power-generator at the station supplying current to the line, the other side being grounded) by wire 12 to the field-magnets of motor *n*, wire 13, insulated rail-section 7 in rail 2, car-wheels and axle 14, and rail 1 to ground. The field-magnet of motor *n* thus being energized will swing its armature to the position shown in dotted lines in Fig. 4, thus oscillating shaft *p* and causing disk *c'* to be moved the angular distance of one tooth of the ratchet-wheel through the engagement of the pawl with the latter. This will separate the two projections *i* and *i'* and open the following circuit: from feeder 11, by wire 15, disk *c'*, disk *c*², wire 16, signal-motor *g*, wire 17, signal-motor *r*, (at the distant end of the block,) and wire 18 to ground. Signal-motors *g* and *r* being deënergized, the green signal at the entrance to the block and the red signal at the end of the block are dropped and displayed. The green signal notifies another car approaching from the left that there is a car already in the block traveling in the same direction and that the block may be entered and traversed with caution. A car approaching from the right is informed by the red signal that the block ahead is already occupied by a car approaching and that it must not be entered under any circumstances. When the first car passes off from the insulated section 7, the armature of motor *n* returns to the full-line position, (shown in Fig. 4,) the disk *c* meanwhile being held in the position to which it was previously turned by the roller *k'*. The circuit of the signal-motors will therefore remain open while the car is traversing the block. When the car reaches the end of the block, it runs over the insulated rail-section 8, which closes another circuit as follows: from feeder 11, by wire 19 to motor *o*, wire 20, insulated rail-section 8, car wheels and axle 21 and ground. Motor *o* being energized causes disk *c*² to rotate in the same direction that *c'* previously rotated, thus bringing its lug *i'* again into the same radial plane as the lug *i* and closing the signal-circuit which was opened by the car on its entrance to the block. Both signals then go to "clear" and the block is open for the entrance of a car at either end, the first car to enter getting the right of way. If the first car be followed into the block by a second, the latter will again actuate motor *n* and cause disk *c'* to move another tooth length away from the lug *i'*. Hence when the first car passes out of the block, the lug *i'* is moved only half the distance toward the lug *i*, and the circuit being still open the signals remain set to protect the second car. When the latter passes out of the block, the signals go to "clear." In like manner any number of cars moving in the same direction can be allowed to enter the block under a

cautionary signal, while all cars so entering will be protected from a head-on collision by the red signal at the exit of the block.

Cars moving in the opposite direction will operate the signals in exactly the same manner through contact with the rail-sections 10 and 9 in the turnouts of the main track. For instance a car passing onto section 10 will energize motor *n*, and thus break the circuit to signal-motors *g* and *r*, setting a caution-signal at the entrance and a danger-signal at the exit of the block, which signals are cleared when the car passes onto section 9 at the next turnout.

It is obvious that the source of current for the signals may be a battery, one pole of which is connected with the conductor 11, while the other is connected with the main rail 1 of the track. It is also obvious that instead of insulating the section of the rail itself we may place a contact bar or rail close to one of the track-rails, to be struck by a shoe carried by the car, the shoe being in electrical connection with the wheels and axles, so as to ground the bar when the car passes. It will therefore be understood that the insulated contact or rail referred to in the claims which follow cover either a track-rail section or a special contact-rail.

It is evident that either direct or alternating current can be used for the signal-circuits by adopting properly-constructed motors.

Having described our invention, we claim—

1. In a railway-signal, the combination of a grounded track-block, a section of one rail at one end of the block being insulated, a source of electricity grounded on one side, a circuit-controller, a circuit including the circuit-controller and connected at one end with said source and at the other with said insulated rail-section whereby the circuit will be closed through the wheels and axles of a car, and a signal operated by said circuit-controller and a second insulated track-section at the opposite end of the block and means controlled thereby whereby a train having first operated the signal will then reverse it.

2. In a railway-signal, the combination of a grounded track-block, a section of one rail at one end of the block being insulated, a source of electricity grounded on one side, a circuit-controller, a circuit including the circuit-controller and connected at one end with said source and at the other with said insulated rail-section whereby the circuit will be closed through the wheels and axles of a car, a signal at each end of a block and a circuit including both signals and controlled by said circuit-controller and a second insulated track-section at the opposite end of the block and means controlled thereby whereby a train having first operated the signal will then reverse it.

In witness whereof we subscribe our signatures in presence of two witnesses.

FRANK L. FULLER.
CHARLES S. BANGHART.

Witnesses:
ROE S. JOHNSON,
G. W. BRICKER.