(No Model.)

R. M. HUNTER.

ELECTRIC RAILWAY.

No. 480,850. Patented Aug. 16, 1892.

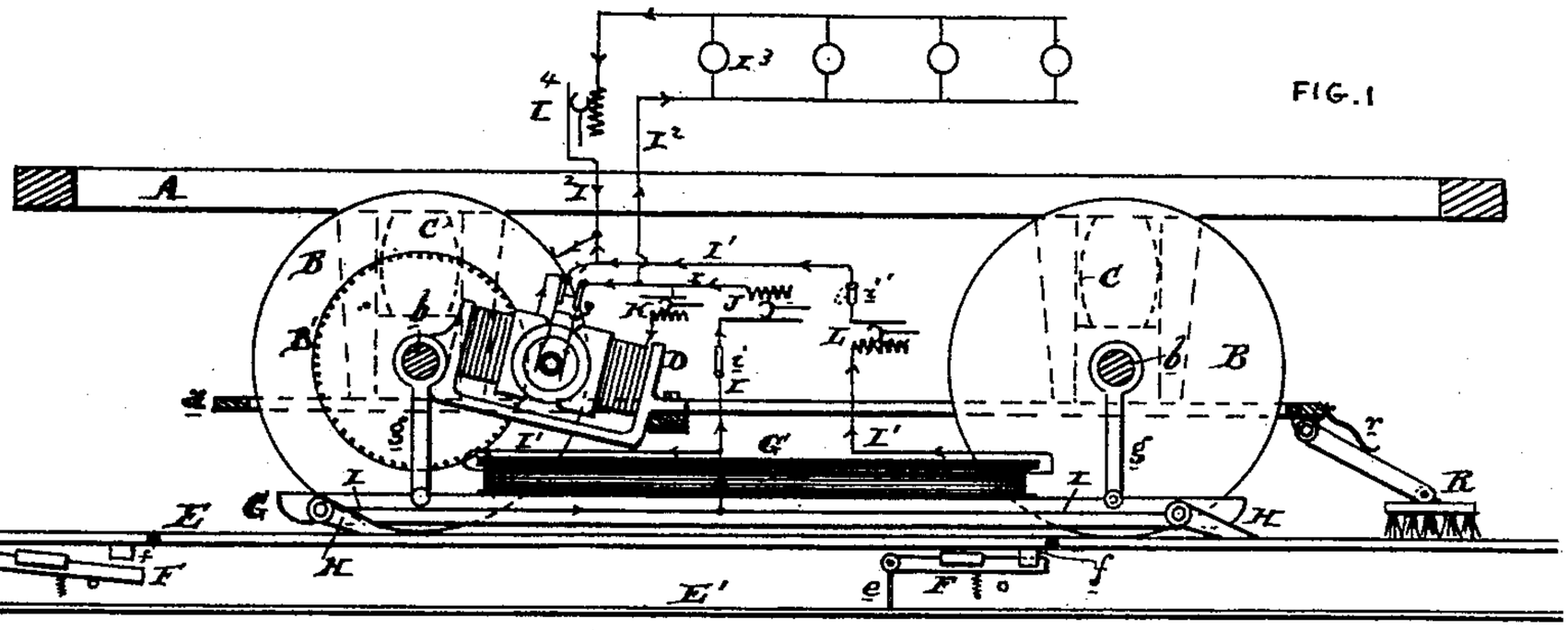


FIG. 1

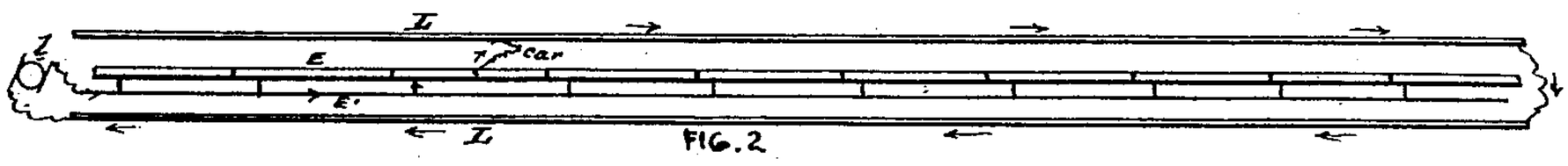


FIG. 2

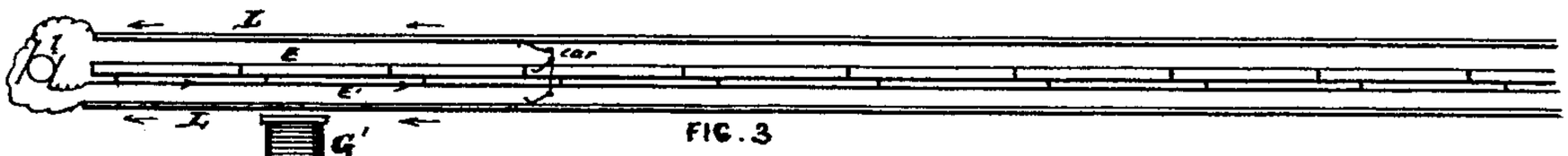


FIG. 3

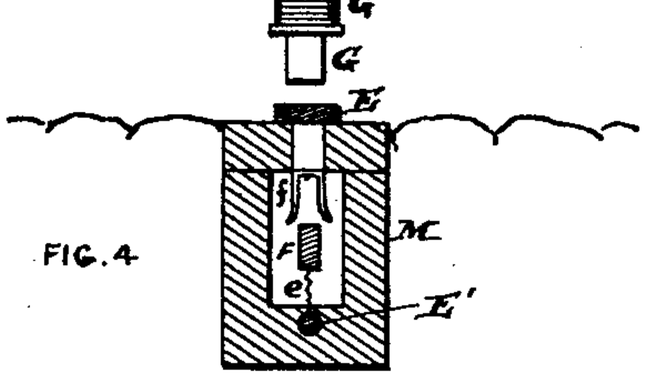


FIG. 4

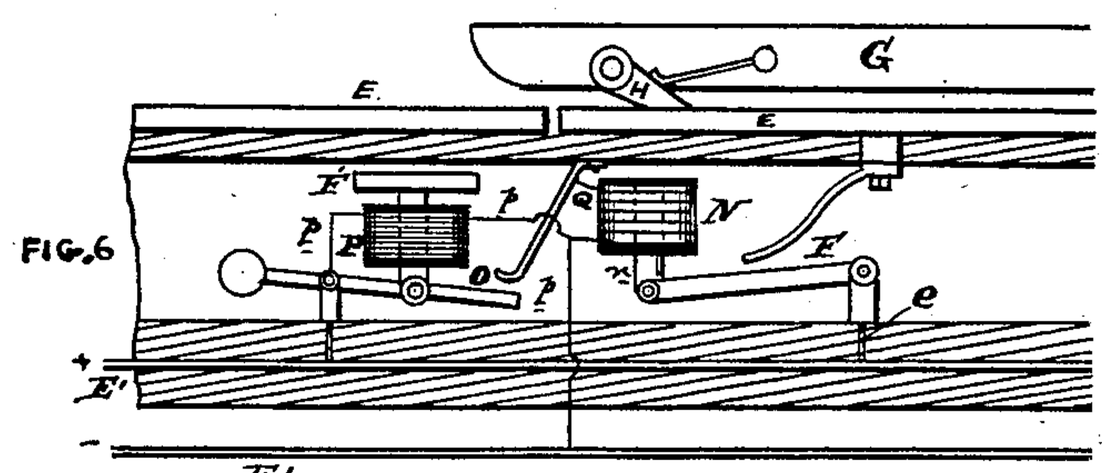


FIG. 6

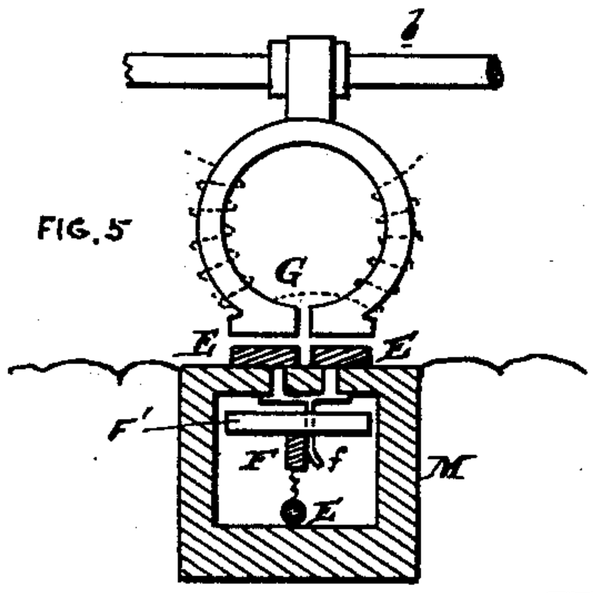


FIG. 5

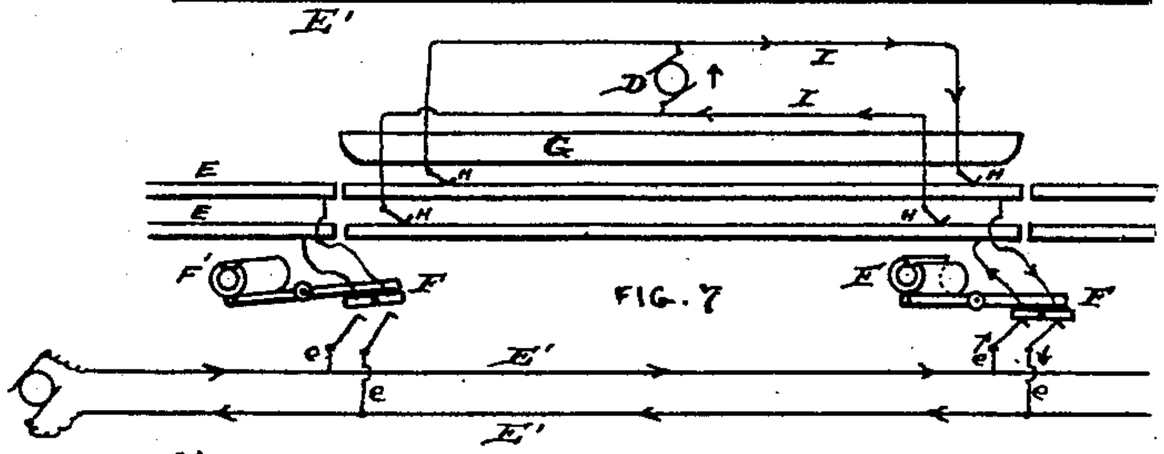
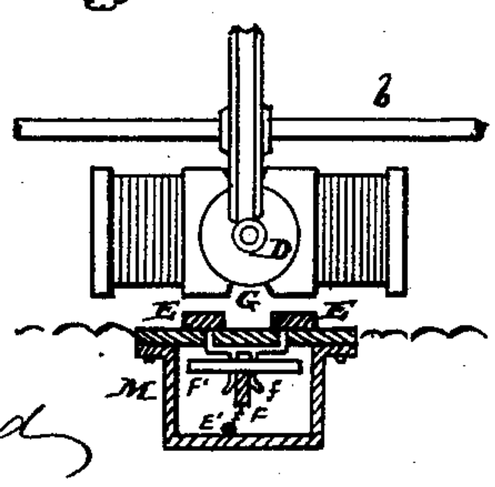


FIG. 7



Attest

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FIG 8

UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF BOSTON, MASSACHUSETTS.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 480,850, dated August 16, 1892.

Application filed May 28, 1887. Serial No. 239,621. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Electric Railways, of which the following is a specification.

My invention has reference to electric railways; and it consists in certain improvements, all of which are fully set forth in the following specification and shown in the accompanying drawings, which form part thereof.

The object of my invention is to provide means for supplying the electric current from a surface conductor, which shall be cut out of circuit except as the vehicle is passing over it. By this means the use of a slotted conduit is obviated, and there is no danger to persons or animals touching the conductors.

In carrying out my invention I provide a working conductor, preferably in sections of short length, arranged above the surface of the ground or road-bed, and the conductor receives its current from a supply or line conductor, which may be buried, suspended, or otherwise arranged along the roadway. The connection between the supply-conductor and working conductor is made and broken by a magnetically-actuated switch actuated only upon the passing of an electrically-propelled vehicle. To operate these switches, the vehicle is provided with a magnet—either a permanent magnet, electro-magnet, or simply an electro-helix—which is arranged close to the line of the switches, and as the vehicle passes above a switch it is attracted by said magnet and operates to put the working conductor into circuit with the supply-conductor. As soon as the vehicle passes the magnetically-operated switch falls back and opens the circuit. The switches are inclosed in tight cases or compartments, so as to be out of danger of dust, dirt, &c., and may be actuated through their surrounding casing.

There are a large number of details which are explained hereinafter.

I wish it to be understood that while the invention is especially applicable to surface street-car propulsion in thickly-populated cities it is equally applicable to elevated roads or to constructions in which the circuits are in part or all elevated.

In the drawings, Figure 1 is a sectional elevation of a car and structure embodying my invention. Figs. 2 and 3 are plan views showing two methods of coupling up the rails or conductors as return-circuits and illustrates the complete circuit of the railway. Fig. 4 is a cross-section of the supply and working conductors, the switch, and their inclosing case and support, and also shows the end view of the magnet carried by the car or vehicle. Fig. 5 is a similar view showing a modified form of magnet on the car. Fig. 6 is a longitudinal sectional elevation showing a modification of switch devices for putting the working conductor into and out of circuit. Fig. 7 is a diagram showing the circuits, switches, &c., when two sectional working conductors and two supply-conductors are used; and Fig. 8 is a similar view to that of Figs. 4 and 5, showing the use of the motor as the switch-operating magnet.

A is the vehicle, and is supported on the axles *b* by springs C or otherwise.

B are the wheels.

D is the motor, and is shown as supported by the axle and the motor or truck frame *a*. A pinion on the motor-shaft meshes with a spur-wheel B′ on the axle. Arranged in the track between the rails or otherwise is a sectional working conductor E, having each section insulated from the next.

E′ is the supply-conductor, and connects with the sections of working conductor by branch circuits *e* and magnetically-actuated switches F, which may open by gravity or by a spring.

The vehicle is provided with a magnet G, preferably made long, and hung by links *g* from the axles, whereby it is supported close above the working conductor E and over the line of the switches F. If the magnet were to strike an obstruction, it would swing back and rise up to pass over it, and thus avoid breakage. The collectors H are preferably carried by the magnet G, and would then ride up with it in case of obstruction. As shown, the magnet is about the length of

the sections of the working conductor, and the two collectors H of similar current are arranged at a distance apart about equal to the length of the section, also.

I is the motor-circuit, and connects with the collectors H, supplying current through the motor D and then connecting with the return-conductor through the wheels of the vehicle or otherwise. The motor-circuit may be broken by a switch *i* and may be provided with a resistance-changer J. The motor may have a current-reverser for the armature and a resistance-changer K for the field-magnets.

I^2 is a lighting-circuit on the car, having the electric lamps I^3 and a resistance-changer I^4 to control the current flowing over said circuit, and said circuit is arranged in shunt relation with the motor. The magnet G may be a permanent magnet or an electro-magnet. In Figs. 1, 4, and 8 it is shown as an electro-magnet. The helix G of this switch-operating magnet is in a circuit I′, which is arranged in shunt relation to the motor and is provided with the circuit-breaker *i′* and resistance-changer L to vary the strength of the magnet. This magnet G may be simply a straight magnet or may be like a horseshoe, (see Fig. 5,) in which latter case the north and south poles would come close together over the conductor E and switch F. By means of the resistance-changers J, K, L, and I^4 the currents flowing over the various circuits on the car or vehicle can be regulated.

If the conductor-sections E are made of iron or magnetizable metal, then the magnets G need not be so long, as the sections E will be magnetized so long as the magnet G is above any portion of them, and this magnetized conductor will in turn attract the switches and cause them to put the conductor-sections E in circuit as the car passes over them.

The switches F are arranged in a tight case or compartment M, and when raised may press against the spring-contact *f*, connecting with the conductor E. The switch F may be formed of any material of good conductivity and may have a flat or horseshoe part F′ of magnetizable material, either of soft iron or magnetized steel, being a simple pivoted or hinged lever, or it may be somewhat more complicated, as shown in Fig. 6. In this construction we have the main switch F, adapted to close the branch *e* and connect the supply-conductor E′ with the working conductor E. This switch F is operated by a core *n*, which works in a helix N. This helix is in an open circuit Q, which may be closed by a circuit-closer O, actuated by the magnet on the car, which attracts the part F′, as before. When the circuit is closed, the current passes from one supply-conductor E′, through helix N, to the other supply or the return conductor and makes a strong positive contact between the supply-conductor and working conductor. If desired, the magnet F′ may be made strongly magnetic by a helix P, fitted around it and in a closed shunt-circuit *p* of high resistance, and this helix, if positively secured to the part F′, may be properly counterbalanced. There are a large number of kinds of circuit-closers or switches which could be used. Hence I do not limit myself to any particular kind, so long as it shall operate directly or indirectly by a magnet carried by the traveling vehicle.

The magnet G may consist simply of the helix without the core, and such helix would act in the same manner as if a core were used, but not so strongly.

The magnet G, whatever be its construction, may act directly upon the switches F or by induction. It may magnetize the conductor E, and they in turn, assisted by the magnet, will act upon the switches. In place of using an additional magnet G, the motor field-magnets may be utilized for that purpose with good effect. Such a construction is illustrated in Fig. 8.

The supply-conductor E′ may be embedded in the earth or in a closed trough or may be supported on posts or in any convenient manner, provided that it is well insulated.

In Fig. 7 all of the foregoing parts are duplicated, showing the outgoing and return working conductors in sections and the switches F with horseshoe-magnets F′. If desired, the conductor E may be made in two parallel bars, as indicated in Fig. 5, so that they will become polarized to correspond to the north and south of the magnet G, and this will increase the effect on the magnet F′ of the switch.

Hinged to the vehicle, ormore preferably to the motor frame or truck, is a cleaning-brush R, which is pressed against the conductor E by a spring or by its own weight to keep the conductors clean.

If desired, the rails may be used as the return-conductor, in which case they would be coupled, as shown in Fig. 2 or Fig. 3. In Fig. 2 the rails are connected at the distant end, and then the near end of one of the rails is connected with one pole of the generator, the other pole of which is connected with the supply-conductor E′. In Fig. 3 both rails are coupled by their near ends to the generator. In Fig. 2 the line-resistance from generator through motor and return is the same for all positions of the motor on the line. In Figs. 2 and 3, L may be considered the rails or separate return-conductors. It is also evident that the working conductor E might be one of the rails divided into sections, and the return-conductor would be the other rail, these details being mere matters of judgment and comprehended in the broad scope of my invention.

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

1. The combination of a working conductor arranged parallel to the railway, a supply-conductor, a magnetically-actuated switch to connect or disconnect said supply and working conductor, a traveling vehicle, a motor to

propel said vehicle, receiving electricity from said working conductor, and a magnet carried by said vehicle, having its north and south poles brought close together in close proximity to the magnetically-actuated switch.

2. The combination of a working conductor arranged parallel to the railway and made of magnetic material, a supply-conductor, a magnetically-actuated switch to connect or disconnect said supply and working conductor, arranged close to said working conductor, a traveling vehicle, a motor to propel said vehicle, receiving electricity from said working conductor, and a magnet carried by said vehicle, having its north and south poles brought close together in close proximity to the working conductor magnetically-actuated switch.

3. The combination of a working conductor arranged parallel to the railway, a supply-conductor, a magnetically-actuated switch to connect or disconnect said supply and working conductor, a traveling vehicle, a motor to propel said vehicle, receiving electricity from said working conductor, and an electro-magnet carried by said vehicle, having its north and south poles brought close together in close proximity to the magnetically-actuated switch.

4. The combination of a working conductor arranged parallel to the railway, a supply-conductor, a magnetically-actuated switch to connect or disconnect said supply and working conductor, a traveling vehicle, a motor to propel said vehicle, receiving electricity from said working conductor, an electro-magnet carried by said vehicle, having its north and south poles brought close together in close proximity to the magnetically-actuated switch, and means to vary the power of said electro-magnet.

5. In an electric railway, a working conductor arranged along the railway, a supply-conductor parallel thereto, magnetic switches to connect and disconnect said working conductor with the supply-conductor, a traveling vehicle, a magnet on said vehicle to automatically operate said switches as a vehicle passes over them, and a connection between said magnet and axle or axles of the vehicle, capable of longitudinal movement, whereby the magnet will remain at a substantially fixed distance from the ground, but may easily ride over an obstruction.

6. The combination of a vehicle, a longitudinal collector-frame hung by parallel links from the axles and capable of longitudinal motion, current-collecting devices carried by said frame, and a working conductor over which said collecting devices travel.

7. In an electric railway, a working conductor arranged along the railway, a supply-conductor parallel thereto, magnetic switches to connect and disconnect said working conductor with the supply-conductor, a traveling vehicle, a magnet on said vehicle to automatically operate said switches as a vehicle passes over them, and a cleaning-brush resting upon the working conductor and connected to the vehicle.

8. In an electric railway, a working conductor arranged along the railway, a supply-conductor parallel thereto, magnetic switches to connect and disconnect said working conductor with the supply-conductor, a traveling vehicle, a magnet on said vehicle to automatically operate said switches as a vehicle passes over them, and a hinged cleaning-brush resting upon the working conductor and connected to the vehicle, and means to press it upon said working conductor.

9. The combination of a sectional working conductor, a supply-conductor, magnetically-actuated switches connecting said supply and working conductor sections, an electrically-propelled vehicle receiving current from said working conductor, means, substantially as described, carried by the vehicle to actuate said switches when the vehicle passes above them, the return-conductor, and an electric generator having its poles connected, respectively, to the supply and return conductor, but to opposite ends thereof, whereby the resistance from the generator through the motor and return is substantially the same for all positions of the motor on the line.

10. The combination of an exposed sectional working conductor, an insulated supply-conductor, magnetically-actuated switches to intermittently connect the supply-conductor with the sections of the working conductor, an electrically-propelled vehicle receiving current from said working conductor, a magnetizing helix carried by the vehicle and arranged within magnetizing distance of the switches, and a collecting device carried by the vehicle and making contact with the working conductor within the range of influence of the helix.

11. The combination of positive and negative line or supply conductors, a branch circuit between them, a switch to break said circuit, an electro-magnet in said circuit, a working conductor, a switch actuated by said magnet to connect or disconnect said working conductor with one of the line or supply conductors, a magnetically-actuated switch to close said branch circuit, a traveling vehicle, and means, substantially as described, carried by said vehicle to operate said magnetically-operated switch.

12. The combination of positive and negative line or supply conductors, a branch circuit between them, a switch to break said circuit, an electro-magnet in said circuit, a working conductor, a switch actuated by said magnet to connect or disconnect said working conductor with one of the line or supply conductors, a magnetically-actuated switch to close said branch circuit, a closed circuit including a helix to keep said switch magnetized, a traveling vehicle, and means, substantially as described, carried by said vehicle to operate said magnetically-operated switch.

13. The combination of a vehicle, an electric motor to propel the same, the line-switch-actuating electro-magnet, a source of electric supply, a motor-circuit, a shunt-circuit around the motor and including the switch-actuating electro-magnet, an electric-light circuit in shunt relation with the motor, and independent means to regulate the current passing to the motor and switch-actuating electro-magnet and also to the electric-light circuit.

In testimony of which invention I hereunto set my hand.

RUDOLPH M. HUNTER.

Witnesses:
RICHD. S. CHILD, Jr.,
E. M. BRECKINREED.