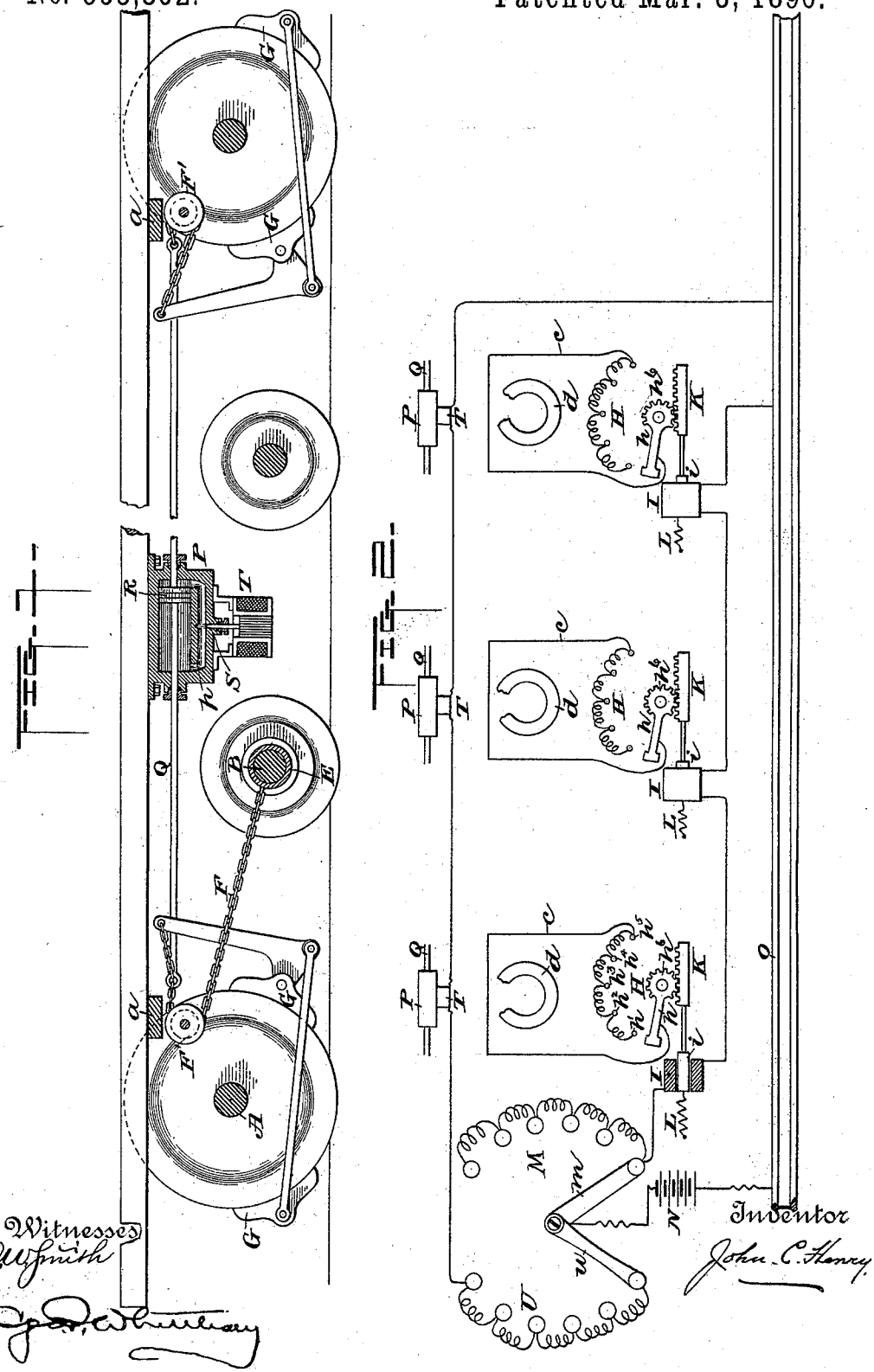
(No Model.) 2 Sheets—Sheet 1.

# J. C. HENRY.

## ELECTRIC RAILWAY BRAKE.

No. 555,862. Patented Mar. 3, 1896.



Witnesses
C. W. Smith
Geo. C. Whittlesey

Inventor
John C. Henry

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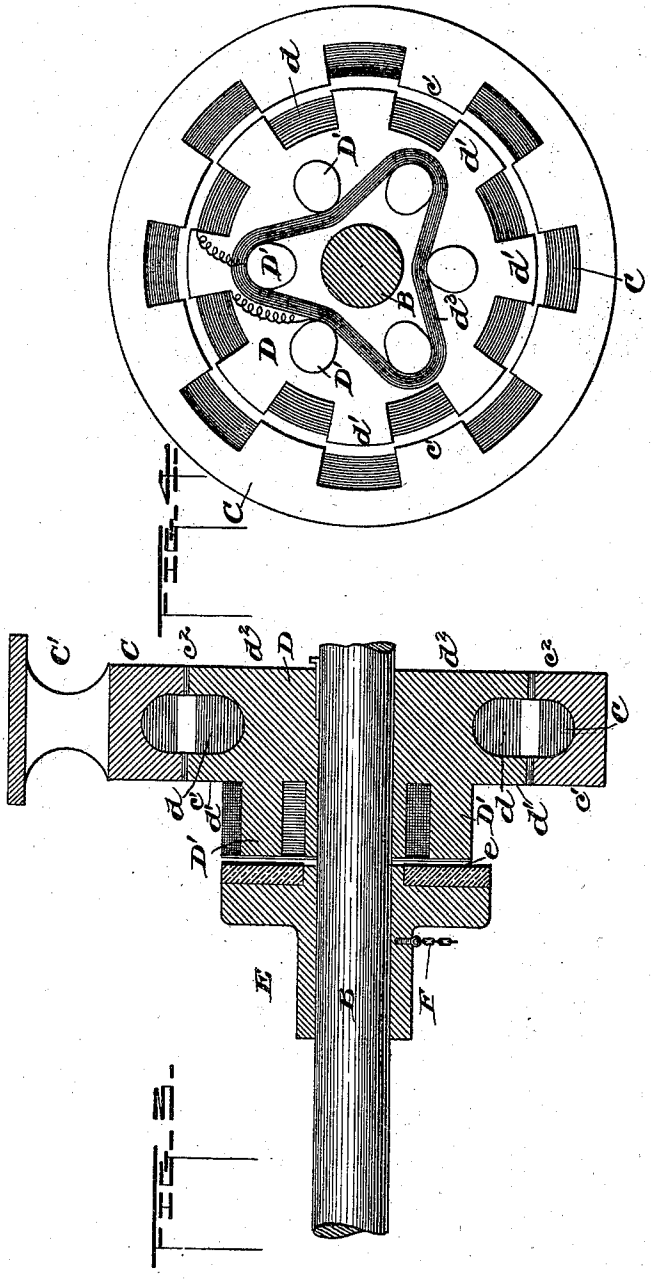


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# UNITED STATES PATENT OFFICE.

JOHN C. HENRY, OF WESTFIELD, NEW JERSEY.

## ELECTRIC RAILWAY-BRAKE.

SPECIFICATION forming part of Letters Patent No. 555,862, dated March 3, 1896.

Application filed July 3, 1895. Serial No. 554,812. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN C. HENRY, a citizen of the United States, residing at Westfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Electric Railway-Brakes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The invention relates to improvements in brakes for railway-cars and is an improvement on my Patent No. 499,543. As set forth in said patent, the general plan is to supply one of the axles on each car with a combined dynamo and magnetic clutch. Ordinarily no current is generated by the dynamo; but when it is desired to retard the movement of the car then by closing the circuit across the dynamo-terminals either manually or automatically the generator induces an alternating current which actuates powerful magnets, which in turn close the magnetic clutch and cause a drum normally loose on the axle to wind up the brake-chain. By controlling the amount of current generated through and by a rheostat any desired pressure may be obtained against the brake-shoes. Should the car-wheels stop rotating from any cause the dynamos stop inducing current and the magnetic clutch is released. The brake is of the momentum class, which utilizes the energy of the moving mass to retard its own motion. In the dynamo and clutch the circuits in the moving parts—*i. e.*, the armature and clutch—are closed and have no connection with the external circuits. The use of brushes, collectors, &c., is entirely avoided. In my said patent the field-magnet terminals on each car extend to spring-couplings at each end of the car and the circuit is completed throughout the entire train. The terminals lead to a rheostat under the engineer's control.

My present improvement consists in making the field-circuit of each generator entirely separate from the others, each of said field-circuits being controlled by its own rheostat, which is operated by an electromagnet, all of said magnets being in series with a battery on the locomotive and controlled by a rheostat in the cab. I also provide on each car a locking mechanism for the brake-rod, controlled by an electromagnet which is in circuit with a rheostat in the locomotive.

In the drawings, Figure 1 is a side elevation in section of the trucks of an electric car equipped with my improved brake. Fig. 2 is a diagram of the circuits. Fig. 3 is a section of the magnetic clutch, and Fig. 4 is an end view of the same with the winding-drum removed.

The generators and clutching mechanism are composed of three parts, all of which are arranged concentrically around one of the axles of the truck. I have shown trucks of the so-called "maximum-traction" type, the driving-axle A, to which the motor is geared, having larger wheels than the other axle, B. I prefer to utilize this small axle B for my generator because of its high speed of rotation and freedom from other mechanism.

The field-magnet C is stationary. It is an annular casting surrounding the axle B and supported by a bracket C′ secured to the truck-frame. It has an external peripheral groove to receive a winding *c* of insulated wire, whose terminals are connected with a rheostat, as hereinafter described. Each face of the annulus has an interiorly-projecting flange, the two flanges being notched at regular intervals to form pairs of pole-pieces $c'$ $c^2$. When a current of electricity is passed through the coil *c* the pole-pieces become polarized, those around one face, as $c'$, being of opposite polarity to the others, $c^2$.

Keyed upon the axle B is the armature D. It consists of a grooved wheel, having in the groove a winding *d* of insulated wire. A series of pole-pieces $d'$ $d^2$, corresponding in number with the poles of the field-magnets, project from each edge of the wheel, and the armature is arranged within the field-magnet A, so that the pole-pieces $c'$ $d'$ and $c^2$ $d^2$ lie in the same planes, respectively.

Projecting from one face of the armature are one or more magnet-cores D′, around which the winding $d^3$ is carried, its terminals being

connected with those of the armature-winding $d$ to form a closed circuit. The faces of the cores D′ lie in the same plane of rotation. Loosely mounted on the axle B is a drum E, having a magnetic face $e$ adjacent to the cores D′. When more than one core D′ is used, the winding $d^3$ is arranged to give opposite polarities to adjacent cores, and the face of the drum has alternate magnetic and non-magnetic sections. These parts constitute my magnetic clutch, which is covered by my said Patent No. 499,543. When the cores D′ are magnetized they attract the drum E and compel it to rotate with them, thereby winding up the brake-chain F and applying the brake-shoes G. Since the only obstacle to the sliding of the face $e$ on the cores D′ is the magnetic attraction, it is evident that this can be so regulated as to permit the drum to slip before the brakes are applied hard enough to slide the car-wheels.

On each car is a rheostat H, one terminal of which is connected with one terminal of the field-coil $c$. The other field-terminal is connected with the contact-arm $h$ of the rheostat, so that as said arm moves over the contact-points $h'$ $h^2$, &c., the resistance of the field-coil is gradually lessened. Adjacent to each contact-arm is a solenoid I, whose axially-movable core $i$ is suitably connected with the contact-arm so as to actuate the same, as by means of a rack K and a segment-gear $h^6$ on the hub of the arm $h$. A spring L tends to draw the core $i$ out of the solenoid when the current is weakened or cut off. This movement of the core brings the arm $h$ into contact with the contact-points $h'$ $h^2$, &c.

The solenoids I are all in series with each other and with a rheostat M and battery N, the circuit being conveniently completed through the track-rail O, connections between the cars being made by suitable couplings.

The operation is as follows: When running, the rheostat M is cut out of the solenoid-circuit, as shown in Fig. 2, the arms $h$ being thrown over to the position shown, so as to open all the field-circuits of the generators, and therefore no current is generated, and the brakes are not operated. When the brakes are to be applied the engineer moves the switch $m$ of the rheostat M so as to include part of the resistance-coils in the circuit. This diminishes the strength of the current and allows the springs L to move the cores $i$ and bring the arms $h$ into contact with the point $h'$ or $h^2$, thereby closing the field-circuits of the generators and permitting them to energize the clutches. By including more of the rheostat M the resistance of the generator-rheostats is lessened, thereby increasing the braking effect.

Should the train break in two, the circuit of the solenoids will be broken and all the brake-circuits will be instantly closed at their highest capacity.

In the operation of a brake system of this kind the pressure with which the brakes are applied bears a constant ratio to the speed of the train, so that the pressure is slackened as the speed lessens. It is sometimes desirable to hold the brakes on with the maximum pressure, irrespective of the speed. To effect this I provide a liquid-locking device controlling the brake-rod. In its preferred form this comprises a cylinder P bolted to the frame of the car and having a stuffing-box at each end to permit the rod Q to pass through it, one end of said rod being connected with the chain F, which passes around a pulley F′ located on the truck near its center bearing $a$, and the other end of the rod being similarly connected with the brake-lever on the other truck. Inside the cylinder the rod carries a piston R. A by-pass $p$ connects the ends of the cylinder, and both cylinder and by-pass are filled with a liquid, such as oil. A valve S is arranged to close the by-pass at will, said valve being actuated by an electro-magnet T. All these magnets are connected in series with a rheostat U, which has a switch $u$ connected with the battery N. Normally all the resistance of the rheostat U is in circuit, preventing the battery from energizing the magnets T, so that the valves S are open and the pistons R can move to and fro without obstruction, the liquid being transferred through the by-pass from one end of the cylinder to the other; but if the engineer wishes to hold the brakes on at any given pressure he moves up the switch $u$, letting some of the battery-current into the valve-magnet circuit, and thereby closing the valves partially or wholly. This obstructs the flow of the oil and retards or wholly checks the movement of the piston R and rod Q, and thereby prevents the brakes from slacking off.

Having thus described my invention, what I claim is—

1. In a momentum-brake, the combination with a car of a magnetic clutch, a dynamo-electric generator on the car, and in power connection with one of the car-axles, and in electrical connection with said clutch; a circuit-closer on the car controlling the circuit of the said dynamo-electric machine; an electric actuating device for said circuit-closer, and means on the locomotive for regulating said electric device.

2. The combination with a plurality of cars, of a liquid retarding and locking device on each car connected with the brake-rod, electrical controlling devices for each car, and a battery and rheostat located at some given point on the train, and in circuit with all of said controlling devices, substantially as described.

3. The combination with a car, of an electrically-controlled electric brake and an electrically-controlled brake-rod retarding and locking mechanism, a separate rheostat in circuit with each electrical controlling device, and a battery common to both circuits, substantially as described.

4. The combination with a maximum trac-

tion-truck, of an automatic or momentum brake having its clutching device located on the axle of the smaller wheels, and a brake-chain actuated by said clutching device and running therefrom to a point near the center pin of the truck, and connected with the brake-levers, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN C. HENRY.

Witnesses:
S. W. TOWNSEND,
N. D. HINSDALE.