No. 632,932. Patented Sept. 12, 1899.

J. E. WILLIAMSON.

ELECTRIC BRAKE.

(Application filed Oct. 13, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

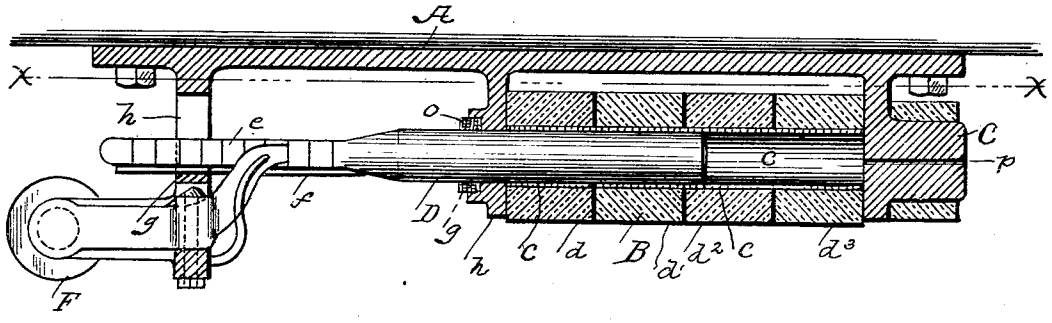
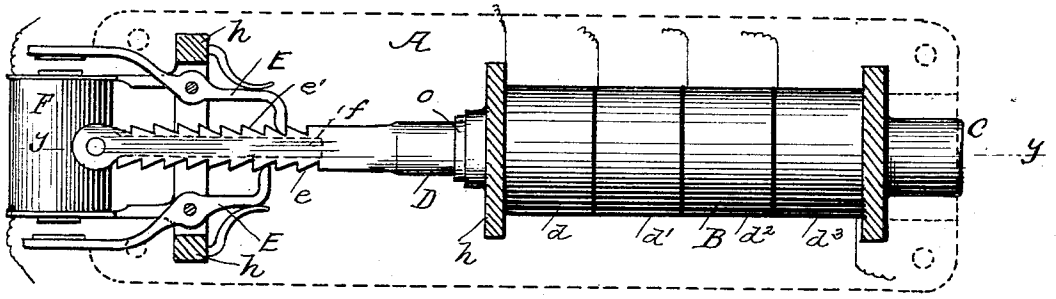


Fig. 2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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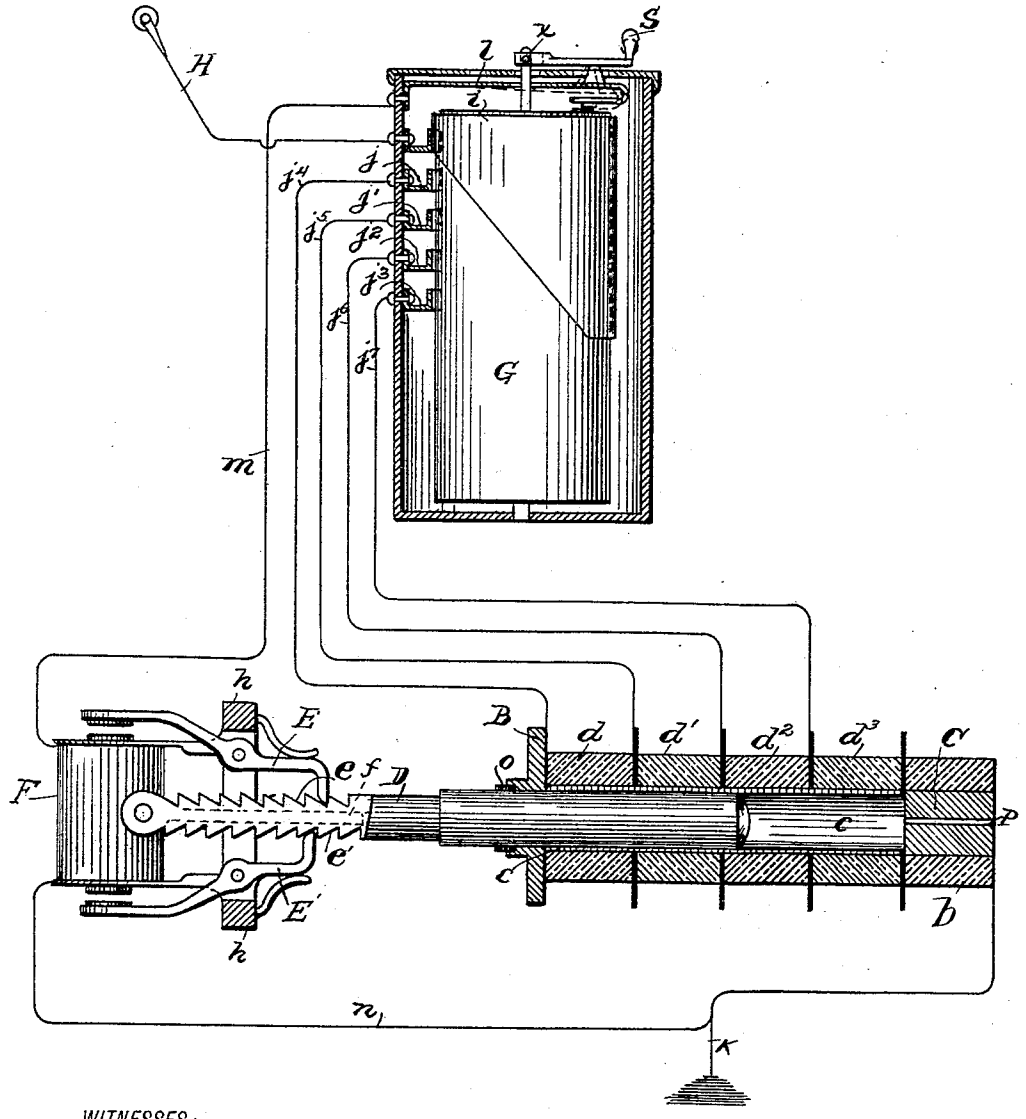
Fig. 3



WITNESSES:

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UNITED STATES PATENT OFFICE.

JAMES E. WILLIAMSON, OF ALLEGHENY, PENNSYLVANIA.

ELECTRIC BRAKE.

SPECIFICATION forming part of Letters Patent No. 632,932, dated September 12, 1899.

Application filed October 13, 1897. Serial No. 655,039. (No model.)

To all whom it may concern:

Be it known that I, JAMES E. WILLIAMSON, a citizen of the United States, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electric 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 pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification, in which—

Figure 1 indicates a longitudinal section, on line *y y* of Fig. 2, of my improved electric brake. Fig. 2 is a longitudinal section on line *x x* of Fig. 1. Fig. 3 is a sectional elevation of controller, a longitudinal section of the solenoid, a plan view of release-magnet, and a diagrammatic view of circuits.

My invention relates to brakes for cars, and is especially adapted to electrically-propelled street-railway cars.

The object of my invention is to produce a simple and efficient electric brake that may be used in conjunction with the ordinary hand-brake and in which the current, not only to apply the brakes, but also to release the same, is but momentarily used; and to this purpose my improvement consists in the novel construction and arrangement of parts hereinafter set forth, and particularly pointed out in the claims, reference being had to the accompanying drawings, which are made part hereof, in which like reference characters indicate like parts wherever they occur.

Referring now to said drawings, A is an electric brake mechanism comprising the solenoid B, the rear end of which terminates in a solid end of soft iron, which, provided with a coil *b*, as shown, forms the magnet C, which may be integral with the solenoid or suitably secured thereto. Said solenoid consists of a cylinder *c*, having coils *d*, *d'*, d^2, and d^3, arranged thereon in series and composed of copper and German-silver wire for the purpose of obtaining a varying resistance in the several sections of said solenoid. The coils of said several sections of the solenoid and of the magnet are so connected as to form a continuous coil having varying resistance in its several sections and in the magnet-coil *b*—as, for instance, the first section may be coiled to carry current of five hundred volts, one ampere, in which case said section must be coiled with German-silver wire and copper wire connected, to produce the required ohms resistance. In the second section an increasing ampere and decreasing resistance is produced by coiling the same with a less number of convolutions of German-silver wire, and so through the several sections of the solenoid and the magnet-coil the current is regulated and the resistance gradually reduced by reducing the quantity of German silver in the coils thereof. D is a core adapted to be operated in said cylinder *c* when said solenoid is energized by the electric current. The outer end of said core on both sides of the same is provided with a series of teeth or corrugations *e* and *e'*, the teeth *e'* being of less length than the teeth *e*. The lower side of said core D is provided with a tongue *f*, adapted to engage in a notch *g*, formed in the front standard *h*, to prevent said core being driven or moved sidewise. In other words, it forms a guide for said core extension.

E and E' are brake-retention bars suitably secured in the standard *h* on each side of the core and normally held in engagement with the teeth thereon by spring tension. F is a magnet arranged between the outer end of said retention-bars and adapted when energized to attract the same, whereby they are thrown out of engagement with the serrations or teeth on the core. The forward end of said core is in any suitable manner connected with the ordinary brake-lever.

G is a controller located on the car and having a contact-plate *i*, adapted to be successively brought in contact with the contacts *j*, *j'*, j^2, and j^3, whereby the current passing through said controller from the trolley H or other source of electric supply is transmitted through the conductors j^4, j^5, j^6, and j^7 to the several sections of the solenoid and to the solid magnet, whereby the same is energized and causes the core to be moved inwardly of the cylinder of said solenoid, the first section being composed of coils of copper and the last of German-silver wire to obtain different resistances.

k is a wire from the magnet-coil *b* to the ground.

The top of the controller G is provided with a spring-contact *l* above the contact-plate *i* and normally out of contact therewith, the said contact-plate being attached to or connected with the drum of the controller, which is adapted to be turned or rotated by the handle or lever *s*, whereby the plate *i* is successively brought in contact with the contacts *j*, *j'*, *j*², and *j*³. These contacts are also secured in a controller in the usual way. When it is desired to make contact with said plate *i* and with said spring-contact *l*, the motorman or operator presses his lever downward, which is jointed at *x* to admit of this, and thereby makes contact between said contact-plate and said spring-contact, thus cutting out the solenoid and passing the current from the controller to the magnet F by means of the conductor *m*. *n* is a wire from said magnet F to ground. *o* is a ring surrounding said core and supported in any suitable manner on the standard *h* and formed of felt or any other suitable material for the purpose of keeping said core free from dirt, &c. The rear end of said cylinder *c* may be provided with an air-vent *p* to enable the air in said cylinder to escape.

The operation of my device is as follows, viz: The solenoid and trolley or other source of electric supply being in circuit, electric current is transmitted to said solenoid and magnet-coil and energizes the same. The motorman or operator by turning his controller-lever is enabled to cut out or short-circuit successively the several sections of the solenoid with the trolley, whereby the core is drawn inwardly of the solenoid-cylinder and the brakes set with gradually-increasing speed and force—as, for instance, when it is desired to set the brakes slightly and gradually the motorman by throwing his controller-lever in position to bring contact *j* in contact with contact-plate *i* enables trolley-current to pass to the first, or section *d* of the solenoid, to and through the other sections of the same, and through the magnet-coil *b* to the ground by means of the conductor *k*, enabling the brakes to be gradually applied with minimum force, and by cutting out successively the first, or sections *d*, *d'*, and *d*² of the solenoid, the brakes may be applied with increasing speed and force, from the fact that the sections of the solenoid not in circuit with the trolley are cut out and the section or sections then in circuit with the trolley is or are coiled to offer less resistance than either of the cut-out sections, and finally, as in case of emergency, when all the sections of the solenoid but the last are cut out the current passes to and through said section to the magnet-coil to the ground, which energizes said magnet, as heretofore stated, withdrawing the core beyond the center of the line of force and applying the brakes with the greatest speed and maximum force. Immediately the core is moved by the solenoid the current may be cut out of the solenoid, the retention-bars serving to hold the brakes as applied. When it is desirable or necessary to release the brakes, the motorman by depressing his lever throws trolley-current into the release-magnet by means of the spring-contact, the contact-plate *i* and the conductor *m* attracting the retention-bars, thus releasing the core and brakes and permitting the retraction of the brake-springs to restore the core to its normal position.

What I claim, and desire to secure by Letters Patent, is—

1. In an electric brake mechanism, the combination, substantially as set forth, of a solenoid, comprising a resistance-coil and a solid end or magnet having a coil therearound, the said resistance-coil being arranged in sections in series, means to supply electromotive force to said several sections and to the magnet-coil, a core arranged in said solenoid, adapted to be moved thereby, and adapted to be connected with the brake chain or rod, means to engage said core and prevent its withdrawal from the cylinder of the solenoid when the same is deënergized, and means to release said core.

2. In an electric brake mechanism, the combination, substantially as set forth, of a solenoid, comprising a resistance-coil arranged in sections in series, and a solid end or magnet, the several sections of said solenoid having different resistances, means to supply motive force to said several sections, a core arranged in said solenoid and adapted to be moved thereby, the outer end of said core having an extension provided with serrations or teeth, and adapted to be connected with the brake rod or chain, retention-bars adapted to engage the teeth on the end of said core, and a magnet arranged between said retention-bars adapted when energized to attract the said bars.

3. In an electric brake mechanism, the combination, substantially as set forth, of a solenoid, comprising a resistance-coil arranged in sections in series, and a solid magnet having a coil therearound, means to supply motive force to the several sections of the solenoid and to the magnet, a core arranged in said solenoid adapted to be moved thereby, the outer end of said core being adapted to be connected to the brake, and a controller having a contact-plate adapted to be thrown in circuit with contacts in circuit with the several sections of the solenoid.

4. In an electric brake mechanism, the combination, substantially as set forth, of a solenoid, a resistance-coil arranged in sections in series, and a solid end or magnet, a core arranged in said solenoid and adapted to be moved by said solenoid and magnet, the outer end of said core being adapted to be connected with the brake rod or chain, a controller in circuit with the trolley or other source of electric supply having a contact-plate adapted to be thrown successively in circuit with contacts in circuit with the several sections of

said solenoid, a spring-contact adapted to be thrown in contact with said plate, means to prevent the withdrawal of the core from said solenoid when said solenoid and magnet are deënergized, and a magnet in circuit with said spring-contact and adapted to release the core of said solenoid.

In testimony that I claim the foregoing I hereunto affix my signature this 11th day of October, A. D. 1897.

JAMES E. WILLIAMSON. [L. S.]

In presence of—

K. T. MEADE,

C. A. WILLIAMS.