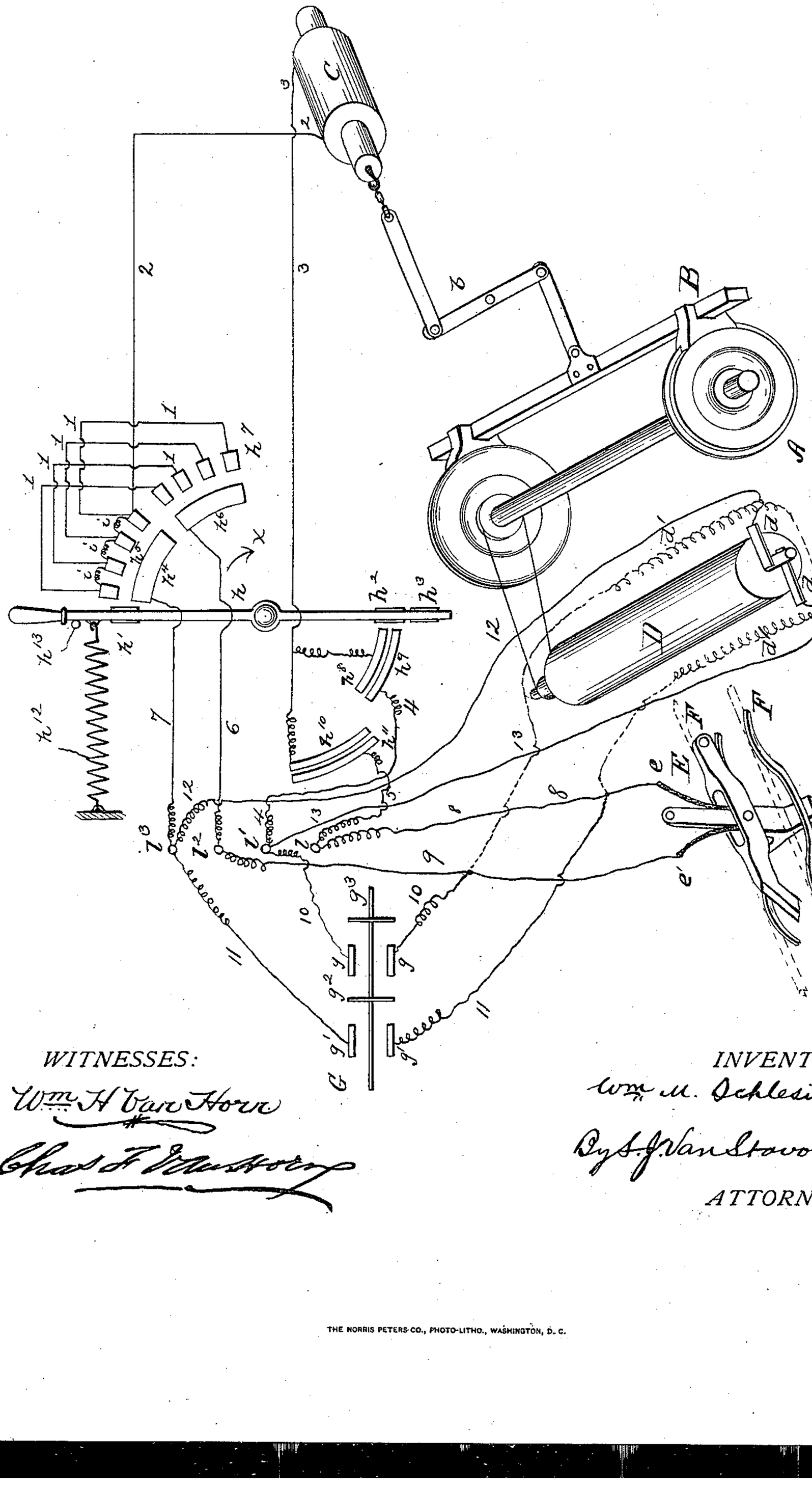
(No Model.)

W. M. SCHLESINGER.

METHOD OF OPERATING ELECTRIC BRAKES FOR ELECTRICALLY PROPELLED CARS.

No. 441,330. Patented Nov. 25, 1890.



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METHOD OF OPERATING ELECTRIC BRAKES FOR ELECTRICALLY-PROPELLED CARS.

SPECIFICATION forming part of Letters Patent No. 441,330, dated November 25, 1890.

Application filed January 28, 1888. Serial No. 262,195. (No model.)

To all whom it may concern.

Be it known that I, WILLIAM M. SCHLESINGER, a subject of the Queen of Great Britain, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in the Method of Electrically-Operated Electric Brakes for Electrically-Propelled Cars, of which the following is a specification.

My invention has relation to electrical braking appliances for electric-railway systems, comprising a source of electric supply in circuit with electric motors on the car for propelling the same.

Heretofore the electrical brakes for the cars in the above-described system of electrical railways have been operated either by the armature-current alone or by the line or supply current alone. By the "armature-current" is meant the current which is generated in it or in the motor after it is cut out of the line or supply circuit preparatory to applying the brakes, which current is generated by the momentum of the car revolving the armature of the motor and momentarily converting it into a generator between the interval of applying the brakes and the time at which the car comes to a state of rest. The use of either the armature or the line or supply current alone for operating the brake appliances, as heretofore done, is accompanied by respective advantages and disadvantages, which in some respects are so nearly balanced that there is practically no decided advantage in using one or the other separately, except as hereinafter particularly noted. Thus in the use of the armature-current alone the following advantages are gained: First, no external energy—*i. e.*, the line-current—is spent or used in stopping the car; second, the car is not only stopped by the brake appliances, but also indirectly by the consumption of energy of the motor when acting as a generator for the time being, and, third, the slowing down of the speed of the car due to these two reasons is therefore very rapid; but these advantages are overbalanced by the disadvantage that after the car slows up the motor does not generate sufficient current to bring the car quickly to a full stop, especially if it is upon a grade—that is to say, from a high speed the car slows up quickly, but from a slow to a still slower speed for fully stopping the car the slowing up is so very gradual that the use of the armature-current for operating the brake appliances has heretofore been deemed impracticable, as its action is too slow upon a level and does not stop the cars upon a grade.

The use of the line or supply current alone, either for slowing down the speed of the car or for bringing it to a full stop, has the disadvantage that it requires a large expenditure of outside energy or of the line or supply current; but in using it the brakes can be put on or applied as quickly as power is calculated for doing so, and can be kept on as long as desired to hold the car upon a grade, as well as upon a level. It is for this last-described advantage that the use of line or supply currents for operating the electrical brake appliances of a car is most commonly employed or deemed the best available for the purpose.

It is obvious that if the electrically-actuating brake appliances of a car could be operated at will either by the armature-current or by the line or supply current, the former being used for quickly slowing up the speed of the car when this only is to be done without coming to a full stop and for doing so preparatory to successively using the line-current to bring the car to a full stop when needful, an economical and effective electrically-actuated system of car-braking would be secured, which would combine the advantages derived from using either the armature or the line or supply currents singly without being subject to either of their disadvantages. To accomplish this described result is the object of my invention; and it consists of a method of electrically applying the brakes of an electrically-propelled car, which consists in first cutting the electric motor for the car out of the line or supply current for the motor, then using the armature-current of the motor for applying the brakes to quickly slow down the speed of the car from a high to a slow speed, and then using the line or supply current to quickly slow down the speed of the car from a slow to a still slower speed and bring the car to a standstill, if required, as hereinafter more particularly described and claimed.

Referring to the accompanying drawing,

which illustrates my improvements in connection with a system of electric-railways having line-connections and an electric generator separate from the car, and is a diagram, partly in perspective, of part of the running-gear of a car and its brake appliances, part of the electric motor or its armature therefor, contact-plow or current-collector, part of the line-conductors, switches, and circuit-connections, including resistances therein for regulating the consumption of power for carrying my invention into practice.

A represents a pair of wheels for the running-gear of a car; B, the brake-shoes therefor having lever or other connections b with the armature or core of an electro-magnet or solenoid C for operating said arms; D, the armature for the electric motor for the car, the shaft of which is suitably geared to one of the axles of the running-gear of the car in the usual or other desired way; E, the current-collector in contact with a portion of a line of conductors F F, and G a switch for cutting the car-motor or its armature D out of and placing it in the line-circuit F F or in a loop or branch therefrom, all of which may be constructed and arranged for operation relatively to one another upon the car in the usual manner or otherwise, as desired.

H represents another switch or regulator, composed of a pivoted lever h, having at one end a contact-bridge h' and at its opposite end two contact-bridges h^2 and h^3, all of which are suitably insulated from one another, as desired. Circumferentially arranged in relation to the center or pivot-point of lever h and in line with the contact-bridge h' are two series of segmental plates or contacts h^4 and h^5 and h^6 and h^7, the plates h^4 and h^6 being single plates and the plates h^5 and h^7 consisting of a number or series of plates, as shown. Between the plates h^5, in any suitable manner, are preferably located suitable resistances i, which resistances place said plates in circuit series with one another, and from each of the plates h^7 leads a wire or connection 1 to the correspondingly-located plate of the series of plates h^5 to put any one of the plates h^7 in series with the plates h^5 and resistances i. Consequently no separate or additional resistances need be inserted in the circuit-connections for plates h^7. From the last or one of the end plates of the series of plates h^5 leads a wire 2 to one side of the solenoid or magnet C.

h^8 and h^9 and h^{10} and h^{11} represent other pairs of segmental contact-plates correspondingly located about the center or pivot-point of the lever h in line, respectively, with the contact-plates h^2 and h^3 on said lever. The plates h^8, h^9, h^{10}, and h^{11} are single plates, as shown. Plates h^8 and h^{10} are in circuit with wire 3, leading to the other side of the magnet or solenoid C. From plate h^9 a wire 4 leads to a binding-post l' and from plate h^{11} a wire 5 leads to a separate binding-post l. Plate h^6 is connected by a wire 6 to another binding-post l^2 and plate h^4 by wire 7 to a separate binding-post l^3. From binding-posts l and l^2, respectively, lead wires 8 and 9 to the current-collector wires e and e', and from binding-posts l' and l^3, respectively, lead wires 10 and 11 to current-collector wires e and e'; or they may connect with the wires 8 and 9, as shown. These wires 10 and 11, respectively, include the fixed contact-plates g and g', suitably insulated, of the switch G. The circuit of the wires 10 and 11 is suitably closed or opened through switch G by pushing the movable contacts g^2 and g^3 into or out of contact with the plates g' and g, respectively, in any suitable manner, either manually or otherwise.

The lever h of regulator H is preferably provided with a retracting-spring h^{12} and a stop h^{13}, whereby said spring normally acts to pull the lever over against the stop h^{13} and normally open the circuit-connections through the regulator, as shown in the drawing.

The operation is as follows: To propel the car or place its motor in a branch or loop circuit with the line-conductors F F by way of the current-collector E, the movable contacts g^2 g^3 of the switch G are pushed or placed in contact with the switch-plates g' and g, respectively. This movement closes the circuit of the wires 10 and 11 to binding-posts l^3 and l', and thence by way of wires 12 and 13, respectively, from said binding-posts to the brushes d for armature D or the motor. The line-current must then necessarily pass to the motor or armature D by way of wires 12 and 13, as described, because the connections 7 and 4, leading from binding-posts l^3 and l' to the regulator H, are then open. To apply the brakes B at any time while the car is in motion, the movable contacts g^2 g^3 are first pushed out of contact with the plates g' g to open switch G, as shown in the drawing, and cut the motor or armature D out of the line-circuit, whereupon the momentum of the car converts the motor into a generator. The lever h is then moved in the direction indicated by arrow x in the drawing to cause its plate h' to bridge the contacts h^4 and h^5 and its plate h^2 to bridge the contacts h^8 and h^9, whereupon the circuit of wires 12 and 13, including armature D, is completed by way of binding-posts l^3 l', wires 7 and 4, plates h^4, h', h^5, and h^8, h^2, and h^9, and wires 2 and 3, respectively, through solenoid or magnet C, which is then energized by the armature-current to apply the brakes and quickly slow the speed of the car from a high to a slow speed. As the plate h' of lever h passes over the successive plates h^5, the resistances i are successively cut out of the armature-circuit as the strength or intensity of its current diminishes by reason of the slowing down of the speed of the car, and when the plate h' contacts with the end plate h^5 to the right of the series of said plates in the drawing all of the resistances i are cut out of the armature-circuit, at which point the strength of the armature-current is

weakest. This armature-current then may alone be used for slowing down the speed of the car; but if it is not sufficient to actuate the brakes to stop the car, the movement of lever *h* is continued in the direction above described until its plate *h'* bridges the contacts h^6 h^7, and its plate h^2 bridges the contacts h^{10} and h^{11}, whereupon the armature D is cut out of the circuit of magnet or solenoid C, and it is included in or is in a loop or branch from the line-conductors, which loop comprises wire 2, one of the wires 1, resistances *i*, one of the plates h^7, plates *h'* and h^6, wire 6, binding-post l^2, wire 9, current-collector E, wire 8, binding-post *l*, wire 5, plates h^{11} h^3 h^{10}, and wire 3, whereupon the line-current from the conductors F F energize the solenoid C to quickly slow down the speed of the car from a slow to a still slower speed until it is brought to a state of rest, and is maintained in such a position, whether upon a level or upon a grade, so long as the line-current is utilized for applying the brakes, as above described. To relieve the brakes, the lever *h* of regulator H is let go off, whereupon its spring h^{12} reacts to return it to its normal position and cut the solenoid C out of the branch from the line-conductors. The switch G is then operated to place the motor or armature D in circuit with the current-collector E, as first above described, to again start and propel the car. The resistances *i i* serve, it will be noted, both for the armature and the line-circuits. Hence the consumption of power is regulated, as desired, by moving the contact-plate *h'* to successive plates h^7 h^7 of the series of the same in the well-known manner used for adjustable resistances, and the solenoid C is at all times protected.

I have shown and described my improvements in connection with an electrically-propelled car the motor of which is supplied by a line-current; but it is obvious that they are equally applicable to a car having a battery or generator located upon it for supplying a current to the motor.

From the foregoing it will be noted that the circuit-connections 2 3 for the magnet or solenoid C are preferably normally open and lead to switch H; that the outside armature-circuit 10 13 and 12 11, which includes switch G, leads to the supply or line circuit, or is a loop or branch therefrom, and said armature-circuit has a branch 4 7, which is normally open and leads to switch H, and that the supply or line circuit has a branch or loop 5 8 6 9, preferably normally open, and also leading to switch H. Hence by suitably manipulating switch G the armature or motor is cut out of or placed in the line-circuit or in a loop therefrom without changing the normal condition of the remaining circuits, and when cut out, as above described, and by suitably moving the lever *h* of switch H the circuit of the solenoid C may be closed through or shifted to the outside circuit 7 12, 4 13 of the armature D alone, or successively to it and to the line-circuit or its loop or branch 5 8, 6 9, whereby said solenoid may be energized only by the armature-current when the motor is acting as a generator, or successively by the armature-current and by the line or supply current.

The field magnets *d d'* for the armature D may be included in a branch from the wires 10 and 11, or otherwise, as desired.

I do not herein claim the devices herein shown and described, as they form the subject-matter of a separate application, filed August 26, 1887, Serial No. 247,976, for which Letters Patent were granted to me March 6, 1888, No. 378,980.

What I claim is—

1. The method herein described for operating or applying electrically controlled or actuating brakes on an electrically-propelled car, which consists of first cutting the car-motor out of the generator or supply current or circuit to convert said motor into a generator driven by the momentum of the car, and then successively using the armature-current of the motor and the line or supply current to successively actuate said brake appliances, substantially as set forth.

2. The method herein described for operating or applying electrically controlled or actuating brakes on an electrically-propelled car, which consists in first placing the brake appliances in the armature-circuit of the car-motor when running as a generator, and then shifting their circuit to that of the supply or generator circuit for said motor, substantially as set forth.

3. The method herein described for electrically applying the brakes of an electrically-propelled car, consisting in successively shifting the circuit of the brake electrically-actuating devices to a circuit having a source of supply of gradually-decreasing intensity and volume, and then to a circuit having a source of supply of constant intensity and volume, substantially as set forth.

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

WILLIAM M. SCHLESINGER.

Witnesses:

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CHAS. F. VAN HORN.