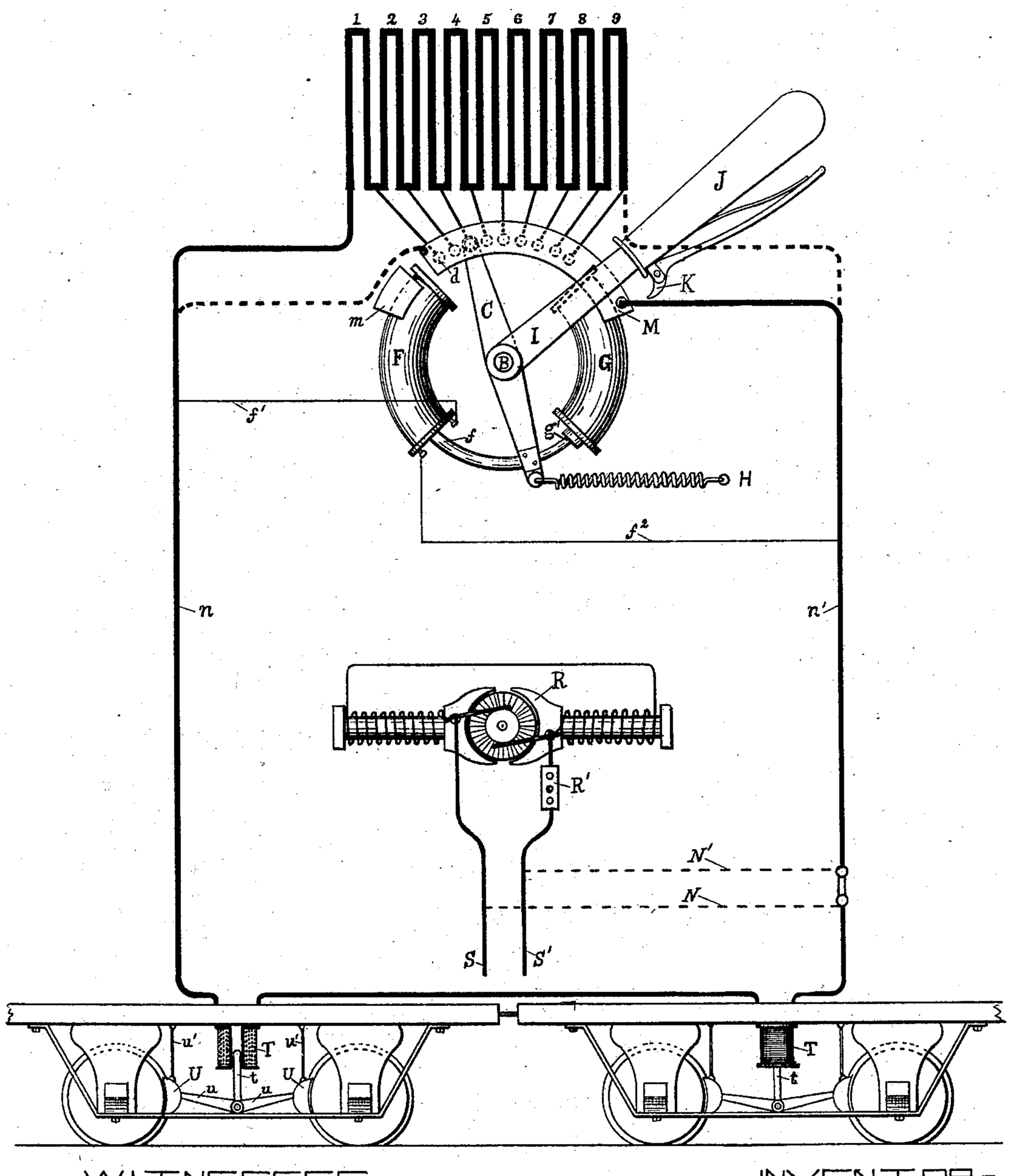
(No Model.)

E. E. RIES.

METHOD OF OPERATING ELECTRIC BRAKES.

No. 356,964. Patented Feb. 1, 1887.



-WITNESSES-

David Fisher

Albert H. Henderson

-INVENTOR-

Elias E. Ries.

UNITED STATES PATENT OFFICE.

ELIAS E. RIES, OF BALTIMORE, MARYLAND, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO EDWARD O. PUNCHARD, OF BOSTON, MASS.

METHOD OF OPERATING ELECTRIC BRAKES.

SPECIFICATION forming part of Letters Patent No. 356,964, dated February 1, 1887.

Application filed November 4, 1885. Serial No. 181,808. (No model.)

To all whom it may concern:

Be it known that I, ELIAS E. RIES, of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Methods of Operating Electric Brakes for Railways, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

In electric-brake apparatus heretofore used considerable difficulty has been met with in operating the brake devices, owing to the abruptness with which the brakes are applied when the brake-magnet circuit is closed, and the sudden concussion and strain upon the moving portions of the brake mechanism, due to the immediate application of the entire energy of the brake-actuating current. Another objection usually encountered in brake apparatus of this class is, that no provision is made for increasing and diminishing the power exerted by the brake-shoes upon the periphery of the car-wheels.

The object of the present invention is to overcome these difficulties, so that the brakes may be gradually applied and their power held under complete and perfect control, and I attain this object in a simple, practical, and efficient manner by means of the method hereinafter described and claimed.

The drawing accompanying this specification shows an elevation of the running-gear of a portion of two cars with the brake mechanism and the solenoids or electro-magnetic devices for operating said mechanism attached, and a diagram view of the operating-circuits and the regulating or current-transmitting apparatus preferably employed, which apparatus is more fully described in a separate application filed in the Patent Office on the same date herewith, and bearing the Serial No. 181,807, reference to which should be had.

Referring to the drawing, 1 2 3 4 5 6 7 8 9 is a diagram representation of a storage or secondary battery, the cells of which are preferably connected in series. The connection with the brake or working circuit is made from the terminal of cell 1 of the secondary battery through the wire *n* to the brake electro-magnets or solenoids T, (which may be either connected in series, as shown, or in multiple arc or parallel,) then back by wire *n'* to the curved contact-plate M of the regulating apparatus. From this point the circuit is completed through the circuit-closing or switch lever I, (said lever being provided with a handle, J, and a segment-pawl, K, by means of which, respectively, it can be moved and retained in any desired position over the contact-plate M,) then through the shaft B, through the pivoted contact arm or lever C, and thence through one of the contact-points *d* to the terminal of the cell with which such point is connected. A portion of the current flowing through the brake devices and the circuit-wires *n* and *n'* is diverted and caused to flow through a solenoid, F, that is placed in a derived circuit and forms part of the regulating apparatus.

Directly opposite the solenoid is a dash-pot or regulating-cylinder, G, whose function is to regulate the motion and prevent the too rapid entrance of the core *f* into the solenoid when the latter is energized. A spiral spring, H, serves to return the contact-lever C, together with the core *f* and piston-rod *g'*, which are firmly secured to the contact-lever, to their normal position, so that the lever C will rest upon the first contact to the left when no current is passing through the solenoid F.

The operation of the devices, as far as described, is as follows: When the circuit-closing lever I is moved from its normal (open) position on the left of the apparatus to a point on the curved plate M—say to the extreme right of the apparatus—only the current from the first cell of the secondary battery will flow through the brake-circuit. The solenoid F, however, being now energized to a certain degree by the derived current passing through it, now begins to attract the core *f* and moves the contact-lever C to the second contact-point, thus throwing two cells into the brake-circuit and proportionately increasing its own force. This process continues, each additional cell thrown into the brake or working circuit also increasing the force with which the core *f* is drawn into the solenoid; but as the dash-pot is adjusted to limit and regulate the rate of

motion of its piston-rod the movement of the contact-lever across the face of the contact-points *d* is rendered uniform, and additional cells are thrown into the brake-circuit until the entire battery is included therein. If, however, it is not desired to send the entire strength of the battery into the brake-circuit, all that is necessary is to move the switch-lever I along the curved contact-plate M, but not so far to the right as before, it being retained in position by the segment-pawl K. The operation will then be the same as before, except that when the lever C has moved forward sufficiently it will come in contact with a projection on the lever I, and its further motion thereby arrested. In this manner, it will be seen, the current transmitted to the brake-circuit and to the translating devices located therein is not only gradually applied and the brake mechanism thereby protected from undue strain and consequent wear, but the strength of the current to be transmitted can be accurately adjusted, and can be varied at will to suit any emergency. Furthermore, the length of time required for the current in the brake-circuit to reach its maximum strength is directly dependent upon the adjustment of the dash-pot or governing device, and this can be so arranged that the application of the brakes will not only always be uniform, but produce the best results in the shortest space of time.

In practice the regulating apparatus is placed in the cab of the motor-car, if the car is used as a motor, within convenient reach of the driver or person in charge, and the cells of the secondary battery are likewise carried in a suitable position on said car, the connections with the brake devices, if more than one car is used, being made in any desirable manner, this feature of the circuit arrangements forming no part of my present invention.

It will be readily understood that instead of connecting the cells of the storage-battery in series they may be arranged in any other suitable manner, and the connections with the regulating apparatus can be so made as not to interfere with the use of the battery for other purposes—such, for instance, as for electric lighting.

The means employed for charging the battery will differ according to the additional uses to which it is to be put, and according to the kind of railway upon which it is operated. One method of accomplishing this object in the case of electric railways is shown in another application for Letters Patent pending herewith, (Serial No. 188,082,) and another application will shortly be filed embracing features adapted to be used in this connection in the case of steam and other railways.

It may sometimes be preferred, especially in the case of electric railways of that class in which one or more conducting-rails or contact-surfaces are employed to convey the propelling-current to the motors from one or more generating-stations, to dispense with the secondary battery and operate the brake devices from the current that operates the motors. When this method is employed, the operation of the regulating or current-transmitting apparatus remains the same; but a series of resistances is used in place of the secondary battery and a few slight changes made in the connections, which will now be described.

Referring to the drawing, let 1 2 3 4 5 6 7 8 9 represent a suitable resistance connected at regular intervals with the contact-points *d*, as shown. The wire *n* in this case connects with the plate M, as indicated by the dotted lines, and the wire *n'* connects with the terminal of resistance marked 9.

R represents the electro-dynamic motor, which in the organization now being described would be located on the motor-car. The connection between the motor and the conductors extending along the line of way is not shown in the present drawing, but may be made in any well-known or desirable manner—such, for example, as shown in my applications for Letters Patent numbered 177,379 and 189,631. The brake-circuit wire *n'* is opened at any suitable point and connected by means of the wires N N' with the conducting-wires *s s'*, leading to the motor, preferably in the manner shown, so as to be in a derived circuit or in multiple arc with the motor. Now, when the contact-lever C is in its normal position at the left and the circuit is closed by moving the switch-lever I to the right, as before, all the resistance from 2 to 9 will be included therein. This will make the resistance of the circuit so large in proportion to the resistance of the motor-circuit that only a comparatively weak current will at first flow through the electro-magnetic brake devices and through the actuating-solenoid F. As the contact-lever C is moved forward under the influence of the solenoid F it gradually diminishes the resistance of the brake-circuit by throwing out additional portions of the total resistance, thereby causing a corresponding increase in the amount of current flowing through the brake-circuit and in the power developed by the electro-magnetic brake devices. This operation is automatically continued, unless intentionally interrupted or stopped by the position of the hand-lever J, until the contact-lever has reached the end of its travel and cut out all the artificial resistance, whereupon the resistance in the brake-circuit will be considerably lower than that of the motor-circuit, and the greater portion of the current will, in consequence, be diverted from the motor-circuit into the brake-circuit. In this manner the brakes are not only operated with constantly-increasing force until they are applied to their fullest extent, but the flow of current to the motor is automatically diminished in nearly the

same proportion as that to the brake-circuit is increased. Thus the sweep of the contact-arm, which, as before stated, can be adjusted to take place in any desired interval of time, serves the double purpose of cutting off the supply of current to the motor and applying the brakes to the train without necessarily interfering with the proportion of current received by other motors on the line of way.

Having thus described my invention, what I claim is—

1. The herein-described method of controlling the application of an electric current from a source of electricity to one or more translating devices, which consists in first sending a portion of the said current to such translating devices, and in then causing the current thus transmitted, or a portion thereof, to gradually increase the amount of current flowing to such devices from the said source of electricity until the said current has reached the desired strength, substantially as set forth.

2. The herein-described method of controlling the application of an electric current from a source of electricity to one or more translating devices, which consists in first limiting the amount or strength of current to be transmitted to said devices during the act of closing the circuit thereof, and then causing a portion of the current thus made to flow through the circuit to automatically and gradually increase the amount of current transmitted until it has reached the required strength, substantially as set forth.

3. The herein-described method of transmitting an electric current from a source of electricity to one or more translating devices, which consists in first sending a portion of the current to such translating devices by primarily closing the circuit in which the said translating devices are located, and then utilizing the transmitted current, or a portion thereof, to further control the supply of current to the translating devices by causing it to operate or set in motion a suitable current regulating or transmitting apparatus, substantially as set forth.

4. The herein-described method of transmitting a current of electricity to one or more translating devices, which consists in primarily closing the circuit from a source of electricity through a suitable regulating or transmitting apparatus located in a shunt or branch of the circuit containing the translating devices, and then causing said apparatus, under the influence of the current thus transmitted, to automatically and gradually increase the amount or strength of current flowing through the circuit containing the translating devices, substantially as described.

5. The herein-described method of operating electric brakes for railways, which consists in first sending but a small portion of the entire available brake-current to the electro-magnetic brake devices, and then causing a portion of the transmitted current to automatically and gradually increase the flow of additional current to the brake-magnets until they have reached their maximum strength.

6. The herein-described method of operating electric brakes for railways, which consists in first sending but a small portion of the entire available brake-current to the electro-magnetic brake devices, and in then automatically increasing the amount of current transmitted, so that the brake devices will be brought up to their maximum or desired strength within a predetermined interval of time.

7. The herein-described method of operating electric brakes for railways, which consists in first sending but a small portion of the entire available brake-current to the electro-magnetic brake devices, and in simultaneously therewith setting in motion a suitable current-transmitting and speed-regulating device to gradually and automatically apply the remaining portion of the current to the said brake devices within a uniform period of time.

8. The herein-described method of operating electric brakes for railways, which consists in first determining and limiting the amount of current to be transmitted to the electro-magnetic brake devices at the moment when the circuit to said devices is first closed, and in then automatically and uniformly increasing the flow of current to the brake devices until it has reached the predetermined or limited strength, substantially as set forth.

9. The herein-described method of operating electric railway-brakes by means of an electrical current from a suitable source of electricity, which consists in primarily sending a portion of the current to the electro-magnetic brake devices for partially energizing the same, and in then automatically and gradually increasing to any desired extent the amount or strength of current transmitted to the said devices by means of mechanism operated by a portion of the transmitted current itself.

10. The herein-described method of operating railway-brakes by means of an electrical current from a suitable source of electricity, which consists in first passing a portion of said current to the brake-circuit through a suitable current regulating or transmitting device, and then causing the current so transmitted, or a portion thereof, to operate the said device to increase the working strength of the current flowing to the brake apparatus, substantially as set forth.

11. The herein-described method of transmitting a current of electricity to one or more translating devices, which consists in primarily closing the circuit from a source of electricity through a series of resistances in the circuit with said translating devices, and then, through the instrumentality of the current thus caused to traverse the circuit, operating a suitable device for gradually and uniformly throwing out or reducing the resistance of the first-named circuit.

12. The herein-described method of trans-

mitting a current of electricity from a normally-closed working-circuit to a normally-open derived working-circuit, which consists in first closing the last-named circuit through an artificial resistance so as to divert only a small amount of current into the circuit, and then causing said diverted current, or a portion thereof, to gradually diminish or eliminate the resistance from the said circuit, and thereby increase the amount of current flowing therein from the first-mentioned circuit.

ELIAS E. RIES.

Witnesses:
LEOPOLD RIES,
A. GROSS.