No. 720,917. PATENTED FEB. 17, 1903.

J. C. HENRY, DEC'D.

S. A. HENRY, EXECUTRIX.

ELECTRIC BRAKE.

APPLICATION FILED APR. 1, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

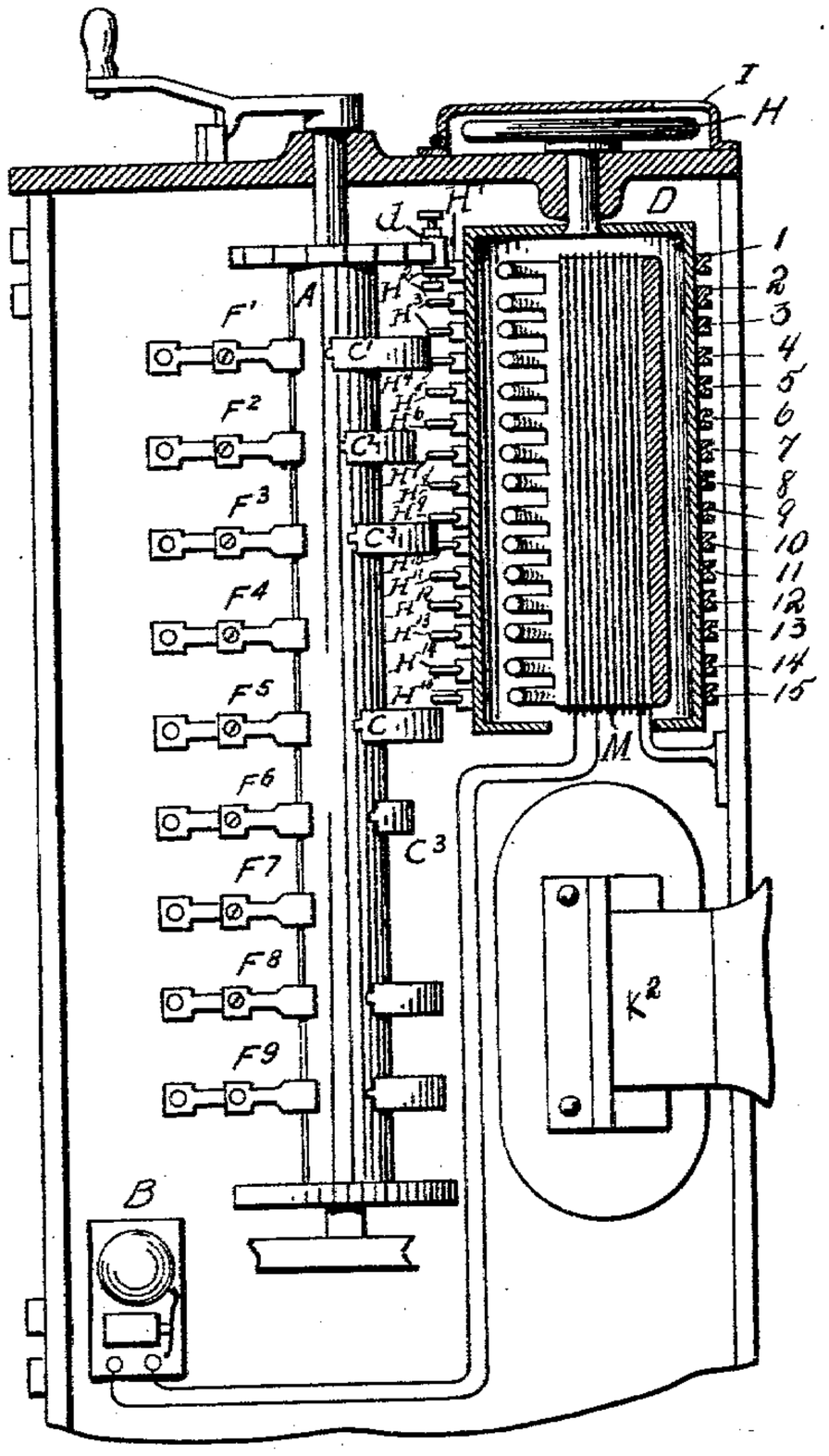

FIG. 1

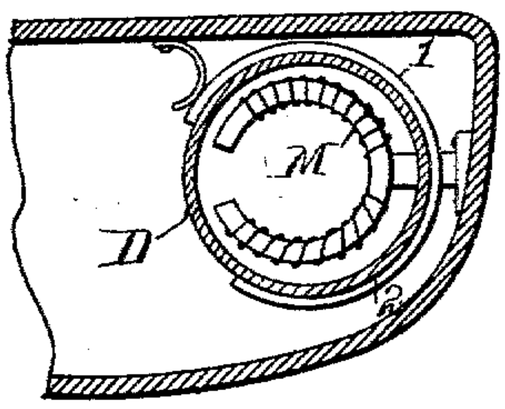

FIG. 2

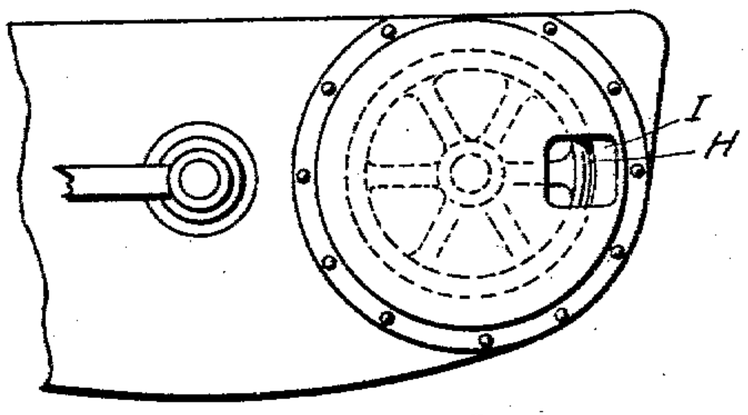

FIG 3.

WITNESSES:

INVENTOR.

John C. Henry

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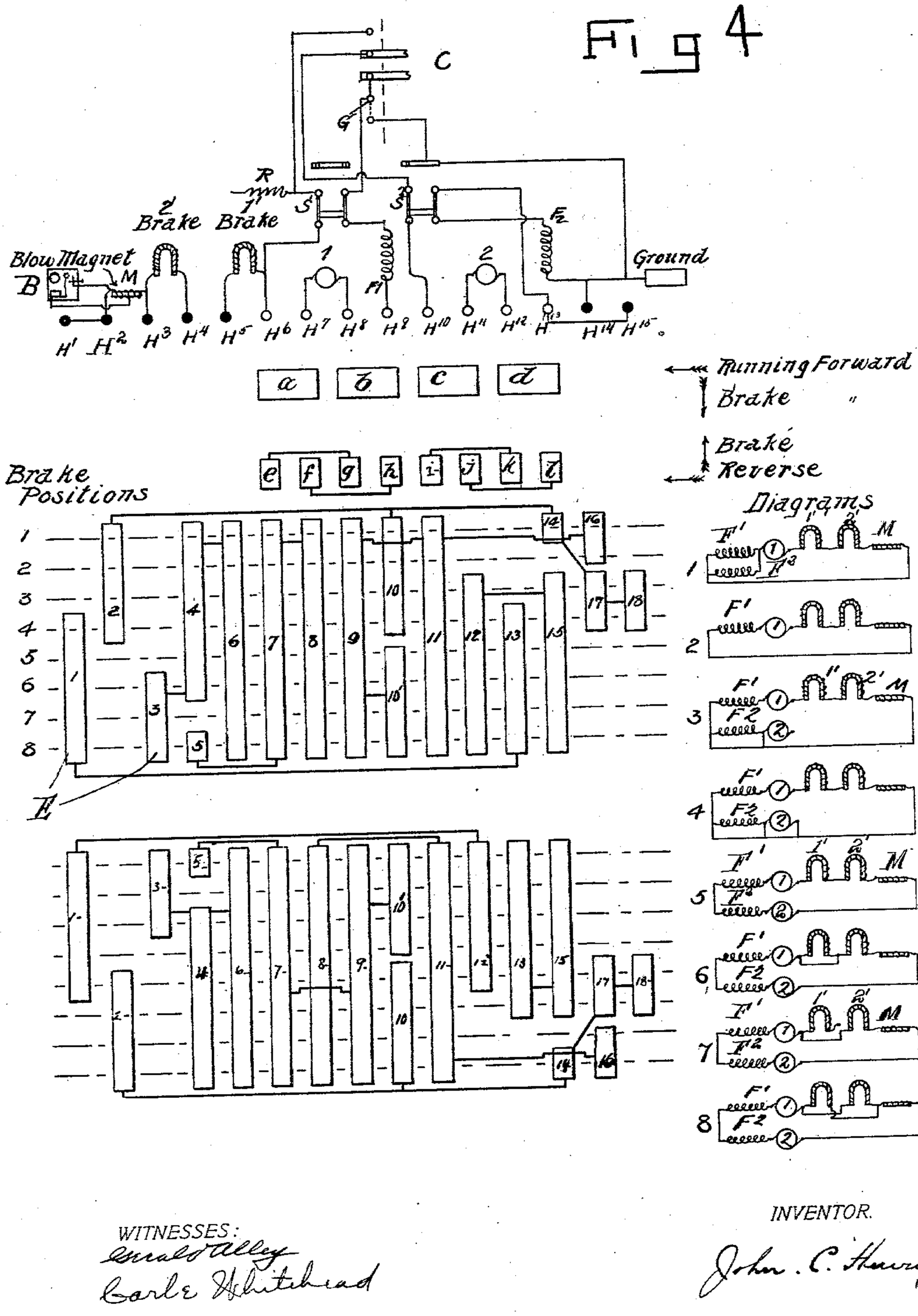
NO MODEL. 2 SHEETS—SHEET 2.

Fig 4



WITNESSES:
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Earle Whitehead

INVENTOR.
John C. Henry

UNITED STATES PATENT OFFICE.

JOHN C. HENRY, OF DENVER, COLORADO; SUSIE A. HENRY, EXECUTRIX OF SAID JOHN C. HENRY, DECEASED, ASSIGNOR TO STANLEY ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

ELECTRIC BRAKE.

SPECIFICATION forming part of Letters Patent No. 720,917, dated February 17, 1903.

Application filed April 1, 1901. Serial No. 54,003. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. HENRY, a citizen of the United States, residing in Denver, county of Arapahoe, State of Colorado, have invented certain new and useful Improvements in Electric Brakes, of which the following is a specification.

My improvements relate more particularly to additions to the ordinary series-parallel controller which enable it to also be used in the operation of an electric brake. The improvements consist in certain changes or modifications of the well-known types of controllers which enable them to be used to stop the car as well as to run it.

In the drawings I have shown the ordinary series-parallel controller having its cylinder removed, a larger one substituted therefor, and a wheel substituted for the ordinary reverse-handle, one which will permit of the cylinder's complete rotation. This new cylinder not only contains the ordinary reverse connections, but also connections to complete the circuit through the motors when acting as generators in a local circuit in which are included the brake-magnets and also contacts which enable said motors and brake-magnets to be grouped together in various ways, so as to increase the retardation of the cars.

In the drawings, Figure 1 is a partly-sectional elevation of the improved controller; Fig. 2, a horizontal section showing the reverse and brake cylinder. Fig. 3 is a top view of the controller; Fig. 4, a development of the controller-cylinder, showing its relation to the translating devices. Diagrams 1 to 8, inclusive, show the course of the current through the various translating devices when the brake is being operated.

The controller-cylinder A, of insulating material, with attached segments C′ C², &c., is mounted on a shaft in the casing and operated by a handle, as usual, to bring such contacts into connection with fixed terminals F′ F², &c. Alongside this cylinder is mounted the reverse and brake cylinder D, having segments 1 to 18 coöperating with fixed contacts H′ to H¹⁵. This brake-controller and reverse-switch D is capable of being operated only when the main controller is in off position, being held at other times by the ordinary interlocking mechanism, (indicated at *d* in Fig. 1.) Instead of a lever I prefer to use a wheel to move said controller forward and backward, and in order to prevent said wheel from being moved except a step at a time I cover it over, leaving but a small opening at its side, as shown at I in the drawings. In order to economize space and avoid the danger of sparking from one contact to another, I locate a blow-magnet M in fixed position inside of the cylinder, said magnet consisting of a split magnet with its coils wound parallel to its length.

K² represents the ordinary blow-out magnet for the main controller-cylinder.

In order to notify the motorman that he is using an excessive current, I arrange a bell B in connection with one of the blow-out magnets and adjust it so as to respond to overloads only. This bell is an ordinary alarm-bell, such as is used for call-bells, and is included in a branch or shunt connection from the brake-magnet circuit. As the power required to operate it will be slight, this connection may be tapped from an intermediate part of the blow-coil, as shown in Fig. 4, so as to form a shunt to only a portion of such magnet-coil. It is obvious that by adjusting the sensitiveness of this bell in the usual manner it may be made to respond to any desired current as representing a condition of overload.

At the top of Fig. 4 are represented diagrammatically the ground and main controller connections of the motors, brake-magnets, and blow-magnet, with a line of contacts H′ to H¹⁵, to which they are connected. Below these contacts H′ to H¹⁵ are represented three groups of contacts coöperating with certain of the contacts H′ to H¹⁵ and carried by the reversing-cylinder—namely, a group of contacts *a* to *l*, performing the ordinary reversing functions when the motors are connected with the power-circuit under the control of the main controller, a series or group of contacts 1 to 18, intended for operation only when the motors are disconnected from the line and controlling the braking action in one direc-

tion, and a duplicate series of contacts 1 to 18, (shown at the bottom of Fig. 4,) performing a similar function to the series shown above them, but operated in the reverse position of the reversing-cylinder. The lines marked brake positions 1 2, &c., in Fig. 4 for the upper or first group of braking-contacts represent the lines of contact of contacts H′ H^2, &c., with the contacts 1 2, &c., in successive positions of the cylinder corresponding to diagrams 1 2, &c., on the right of Fig. 4.

The contacts *a* to *l*, inclusive, on the cylinder D represent the contacts ordinarily employed in reversing the motors by means of the standard controller. They engage the motor and current terminals H^6 to H^{13} in the ordinary manner when the car is being driven. When the main circuit is broken and the fingers H′ to H^{15} engage the corresponding contacts 1 to 18 on the cylinder, the local current passes through both motor-fields in parallel, armature No. 1, the two brake-magnets in series, and the blow-magnet coil. This short-circuits the motor No. 1, causing it to generate current in the brake-magnet circuit and to retard the car.

It will be seen by tracing the current in the development through the various positions that the braking force increases gradually until the eighth position has been reached, which is the one having the least resistance in its circuit, and consequently exerts the greatest braking force. Thus in diagram 1 the motor-fields are in multiple and the brake-magnets in series, the current passing from armature No. 1 through contacts H^7, 8, 7, and H^6, brake-magnet 1′, contacts H^5, 6, 4, and H^4, brake-magnet 2′, contacts H^3, blow-magnet M, and bell B to contacts H^2 2 10 H^9, field F′, switch S′, ground G in the controller C, also from contact 2 via contacts 14 H^{13}, switch S^2, field F^2 to ground G, from "ground" through contacts H^{14}, 16, and 9, and contact H^8 back to armature 1. The circuit in position 2 is traced as above given for position 1, except contact 14 being open-circuited with the fixed contact H^{13}. (See Fig. 4.) The branch of the circuit through field-magnet F^2 is broken, and field-magnet F′ therefore takes all the current, resulting in development of more current in armature 1 and a correspondingly stronger braking effect. Position 3 brings contacts 12 15 17 18 into play, short-circuiting field F^2 by connection H^{14} 17 18 H^{15}, and switch S^2. The circuit for this position is the same as that for the positions above noted as far as contact 14, whence it continues to contact 17 H^{14} to ground, from ground in the controller through switch S^2, fixed contact H^{10}, contacts 11 and 9, fixed contact H^8, back to armature 1. Armature 2 is still open-circuited at contact H^{12}; but in the next stop (position 4) this connection is closed and said armature is on short circuit through contacts H^{11}, 12, 15, H^{13}, H^{15}, 18, 17, 14, 2, H^2, H′, 1, 13, and H^{12}. The corresponding field being still short-circuited, and therefore deënergized, armature 2 is still ineffective in producing current; but in the next position (5) the connections at 18 and at 2 are opened, breaking at the same time the short circuit around field F^2 and the short-circuit connection for armature 2. The current then passes from both armatures and both fields in series, the current passing from armature 1 through contacts H^7 8 7 H^6, brake-magnet 1′ H^5 6 4 H^4, brake-magnet 2′, the blow-magnet, contacts H^2, H′, 1, 13, and H^{12}, to armature 2, from said armature through contacts H^{11} 12 15 H^{13}, switch S^2, field F^2, ground, then to ground G in controller C, and through switch S′, field F′, and contacts H^9, 10′, 9, and H^8 to the other side of armature 1. As both armatures and field are now acting, the braking effect is correspondingly increased. In position 6 contact 3 is closed with contact H^3, thus short-circuiting brake-magnet 2′, the current passing as above described, except that instead of passing the brake-magnet 2′ it passes through contacts H^4, 4, 3, and H^3. Position 7 is similar, except that the circuit of brake-magnet 2′ is broken. These are only transition positions leading to position 8, wherein both brake-magnets are connected in parallel, the current passing from armature 1, as above traced, to contact H^6, then through brake-magnet 1′, contacts H^5, 6, 4, and 3 to contact H^3, and also through contacts 7 5 H^4 and brake-magnet 2′ to contact H^3, thence through the armatures and fields in series, as above described. This position with the brake-magnets in parallel is the most powerful in braking action, as the total amount of resistance in circuit is a minimum and the amount of current flowing is therefore a maximum.

It will be noted that positions 3 and 4 do not affect any change in the braking effect from position 2; but in the reverse movement it is desirable to perform the operation in positions 4 and 3—namely, short-circuiting the armature and the field of motor 2 in passing from position 5 to position 2, so as to avoid the flashing at the contacts which would result from operating the armature under a strong field. The change in diagram 6 is for a similar purpose, the brake-magnet being short-circuited, so as to discharge its magnetism before operating it in position 7, this last step being a necessary preliminary to putting it in parallel, (position 8.) The steps or positions 1, 2, 5, and 8, however, form a series of gradually-increasing braking effect.

The second or lower group of braking-contacts at bottom of Fig. 4, also numbered 1 to 18, correspond exactly to the upper group 1 to 18, but are reversely placed, so as to produce the same braking effect when the reversing-cylinder is moved to either side. This group of contacts being on a cylindrical surface will, in fact, be next to the row of contacts *a* to *d*, so that in turning beyond the row of contacts this group of braking-con-

tacts will be brought into operation just as the other group is brought into operation on turning beyond the row of contacts *e* to *l*.

It will be understood that while this is shown as an improvement or modification of the ordinary controller the same may be used in wholly independent relation. The improvements may be contained in a separate case and occupy a position close to the regular controller.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The combination of a power-circuit, a motor, a reversing-switch and a brake-magnet, said reversing-switch having contacts to connect the motor with the power-circuit to drive the motor in either direction and also having contacts and connections to connect the motor in local circuit with the brake-magnet to give a braking effect.

2. The combination of a power-circuit, a plurality of motors and brake-magnets, a reversing-switch having contacts to connect the motors with the power-circuit to cause them to be driven in either direction, said reversing-switch also having a series of contacts and connections to connect the motors and brake-magnets in a local circuit with variable resistance to produce a variable braking effect.

3. The combination with a plurality of brake-magnets, of a switch having contacts and connections adapted and arranged to connect said magnets with a source of current and to vary the connections of said magnets from series to parallel or vice versa.

4. The combination of a plurality of motors and a brake-magnet circuit, of a switch adapted to control the reversing of said motors and having contacts and connections adapted and arranged in different positions of said switch other than the motor-reversing positions to connect the brake-magnets in series or in parallel relation with the motors.

5. A controller having its switch operated by a circular wheel, with a cover for said wheel having an opening through which a limited part of said wheel is exposed in position to be accessible to the hand of the operator to turn the wheel a limited part of a revolution at a time.

6. In an electrically-propelled vehicle, having a power-circuit, a motor, a controller and a reversing-switch, the combination with a local circuit comprising the motor, brake-magnets, a blow-magnet, and an alarm adjusted to respond to excessive current, of contacts on the reversing-switch to open, close, and vary the resistance in said local circuit.

7. In an electrically-driven vehicle the combination of a power-circuit, motors, a controller and a reversing-switch, said reversing-switch comprising a rotatable drum having the reversing-contacts thereon, a local circuit comprising the motor, brake-magnets, a blow-magnet situated within said drum and an alarm adjusted to respond to excessive current, and contacts on said drum to open, close and vary the connections of the motors and brake-magnets in said local circuit.

In testimony herewith I have hereunto set my hand and seal, this 6th day of March, A. D. 1901, in the presence of two witnesses.

JNO. C. HENRY. [L. S.]

Witnesses:

CARLE WHITEHEAD,

D. CARL HENRY.