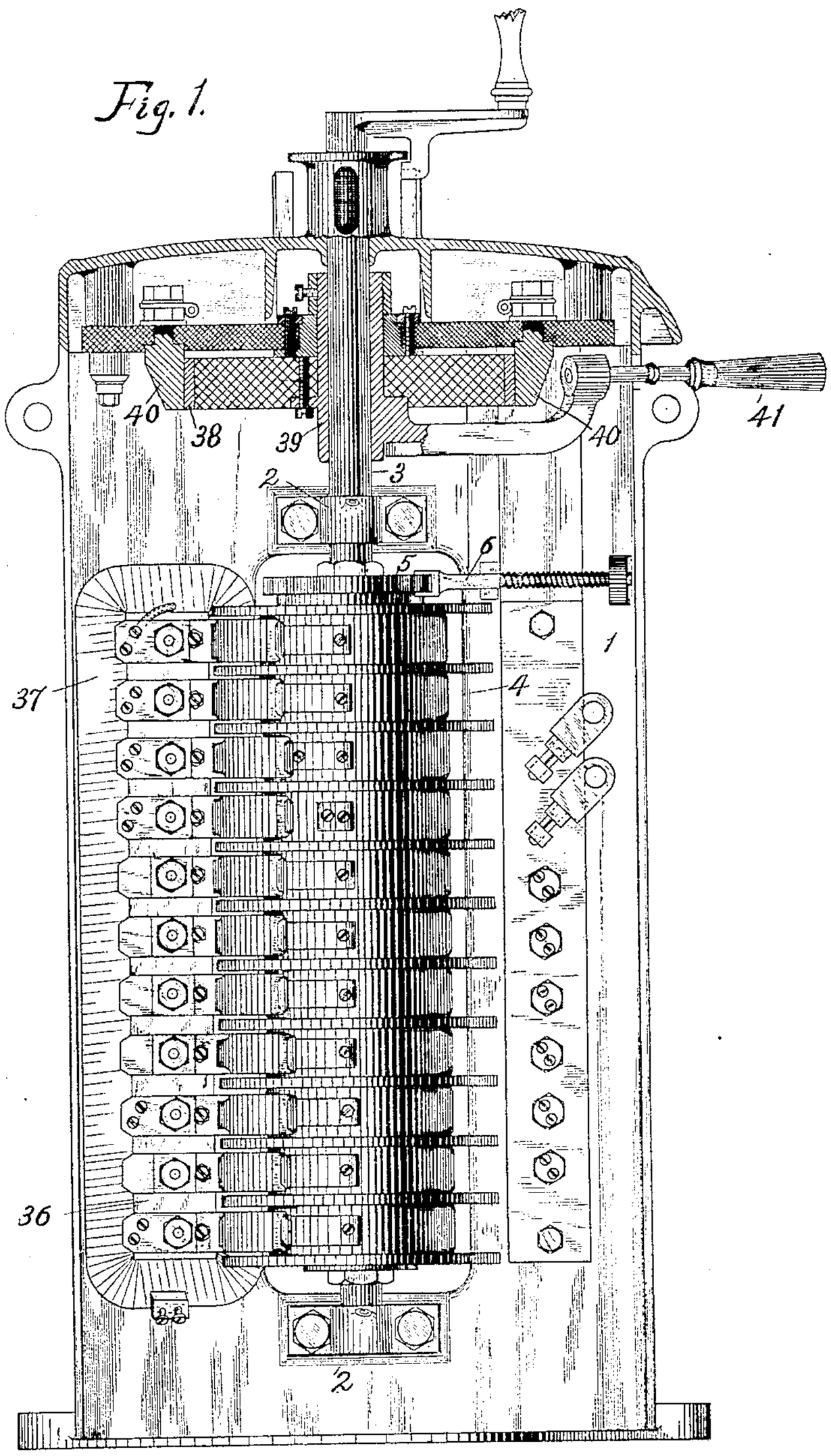
(No Model.) 2 Sheets—Sheet 1.

H. P. DAVIS.

METHOD OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS.

No. 582,115. Patented May 4, 1897.

Fig. 1.



WITNESSES:
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(No Model.) 2 Sheets—Sheet 2.

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METHOD OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS.

No. 582,115. Patented May 4, 1897.

Fig. 3.

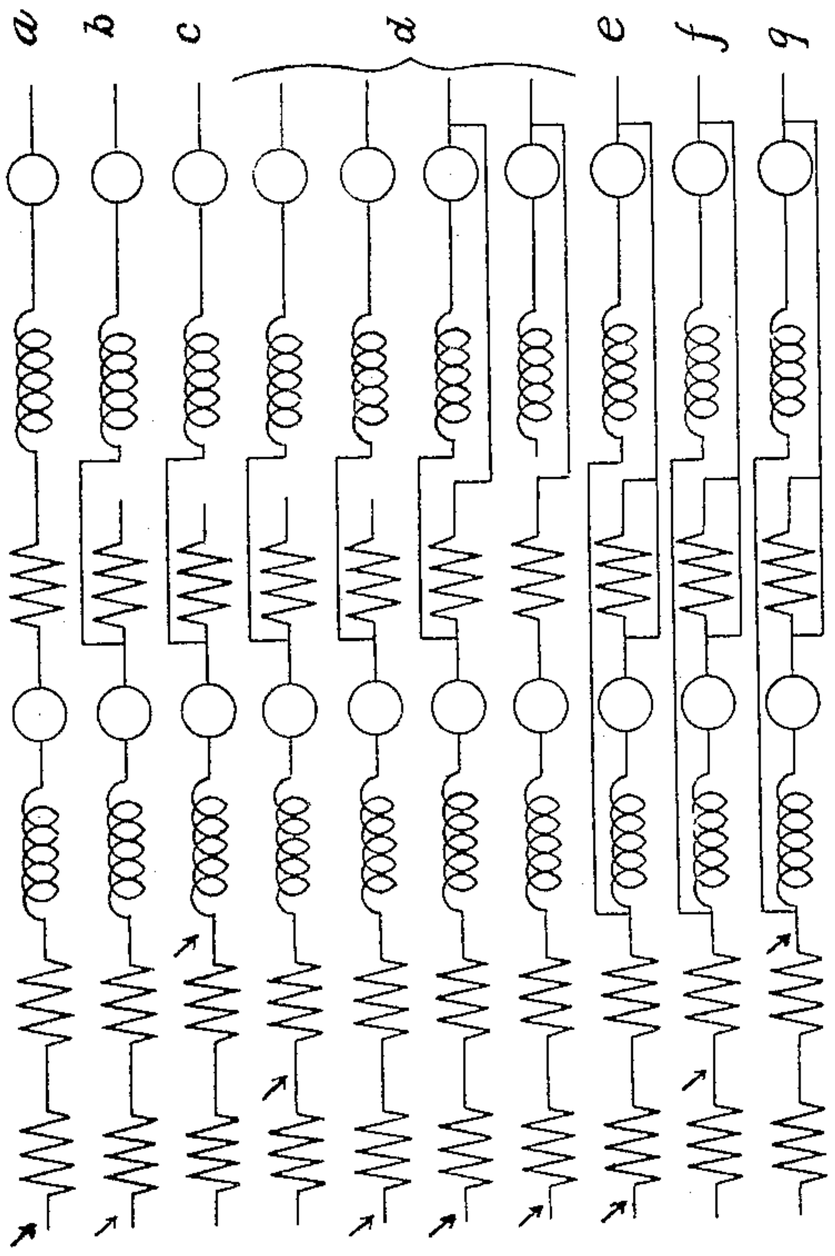
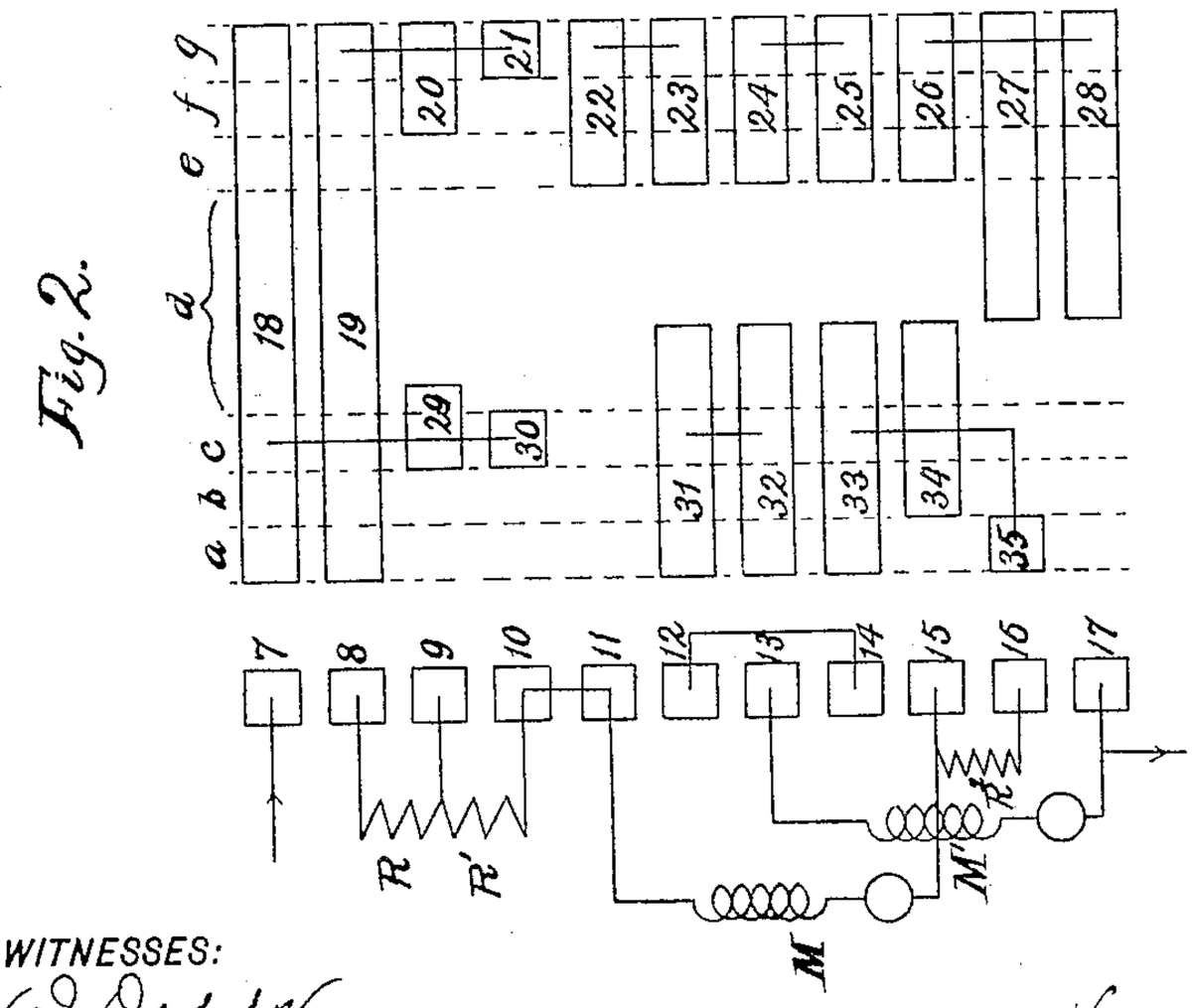


Fig. 2.



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UNITED STATES PATENT OFFICE.

HARRY P. DAVIS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, OF SAME PLACE.

METHOD OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 582,115, dated May 4, 1897.

Application filed January 14, 1895. Serial No. 534,832. (No model.)

To all whom it may concern:

Be it known that I, HARRY P. DAVIS, a citizen of the United States, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of and Means for Controlling Electric Motors, (Case No. 626,) of which the following is a specification.

My invention relates to methods of and means for controlling electric motors, and more particularly to motors employed for the propulsion of railway-vehicles; and it has for its object to provide such method and means which shall be simple and effective, and which will serve to produce desired changes in speed quickly but gradually, and to prevent, as far as possible, injury to the contacts due to the formation of arcs during changes from one combination or connection to another.

In the drawings, Figure 1 is a front elevation of a controller made in accordance with my invention, the cover and wiring being removed and the upper portion of the frame and the reversing-switch being shown in section. Fig. 2 is a diagram of the development of the controller-drum, showing also the stationary contacts and the connections of the motors and rheostats therewith. Fig. 3 is a diagram illustrating the connection of the motors and resistances in the various relations and positions which they assume during a single rotation of the controller-drum.

Referring to the drawings in detail, 1 is the base or frame of the controller-stand, and 2 are bearings supported thereby in which is journaled a shaft 3, which is operated by means of a crank and handle in the usual manner.

4 is the controller drum or cylinder, which carries at one end a notched disk 5, with which engages a spring-pressed pawl 6.

Stationary contacts 7 to 17 are mounted alongside the controller-drum and are bolted to the core or pole 36 of a magnetizing-coil 37. These contacts bear upon a series of contact strips or plates 18 to 35, carried by the controller-drum.

The parts above described are in all respects like those described and claimed in my application filed January 14, 1895, Serial No. 534,831, and no claim is made specifically thereto in this application.

The movable contacts 38 of the reversing-switch are carried by a sleeve 39, surrounding the upper portion of the shaft 3, and these contacts engage with the stationary contacts 40 and are actuated by a handle 41, rigid with the sleeve 39.

Referring now more particularly to Figs. 2 and 3 of the drawings, M and M′ represent the motors which are to be controlled, and R, R′, and R^2 the resistances. The various positions of the controller-drum with reference to the stationary contacts 7 to 17 are represented by letters *a*, *b*, *c*, *d*, *e*, *f*, and *g*.

It will be seen that in the position *a* of the controller the circuit will be through contacts 7, 18, 19, and 8, resistances R and R′, contacts 10 and 11, motor M, resistance R^2, contacts 16, 35, 33, 14, 12, 31, 32, and 13, and motor M′ to the ground. In this position of the controller-drum the minimum amount of current will flow through the motors and the car will therefore be running at its lowest speed.

In position *b* the resistance R^2 is cut out, leaving the resistances R and R′ in circuit with the two motors in series, thus providing for an additional flow of current and consequently a higher rate of speed.

In position *c* all the resistances are cut out, leaving the two motors in series, in which position there is a maximum flow of current for a series connection and therefore a maximum speed of the car.

In position *d* the following changes occur: First, the resistance R′ is inserted, the motors being still in series; second, the resistance R is added to the resistance R′, the motors remaining in series; third, the motor M′ is connected in shunt around the resistance R^2, the resistances R and R′ remaining in series with the motor M; fourth, motor M′ is cut out and all three resistances are connected in series with the motor N. These changes (designated by *d*) are made very rapidly, there being no notches in the disk 5 corresponding to the several positions which are comprised under this designation. On account of the rapidity with which these changes are made

the speed of the car will not be materially affected by the reduction of the current due to the reinsertion of the resistances and the cutting out of one of the motors, but the changes specified are important for the reason that in cutting out one of the motors preparatory to making a change from series to parallel connection the current to be interrupted should be as small as possible in order that there may be a minimum amount of arcing at the terminals.

In position *e* resistances R and R′ are in circuit, resistance R^2 being cut out and the two motors being connected in parallel. In position *f* resistances R and R^2 are cut out, leaving the motors in parallel and resistance R′ in circuit.

In position *g* the motors are connected in parallel without external resistance, this being therefore the position in which the maximum current is taken and the maximum speed secured, the change in speed up to this point being gradual by reason of the change from series to parallel connection and the gradual cutting out of the resistance in circuit.

By the method of control set forth above I am enabled to make the desired change from series to parallel connection quickly without causing a sudden and violent change in the speed of the car, which is liable to occur if the connections are not properly arranged.

The method also obviates to a considerable degree the formation of arcs at the contacts when they are separated.

I claim as my invention—

1. The method of controlling mechanism operated by two electric motors, comprising the following steps, connecting the motors in series with resistances, cutting out one of the resistances, shunting one of the motors through the resistance previously cut out, at the same time leaving the other motor and resistances in circuit, cutting out said shunted motor, and finally connecting the motors in parallel, substantially as described.

2. The method of controlling mechanism operated by two electric motors comprising the following steps, connecting the motors in series with resistances, cutting out the resistances in order to reach a running position, and then reinserting a portion of the same, shunting one of the motors and then cutting it out, connecting the motors in parallel without the resistance previously in shunt, then cutting out all the resistances, substantially as described.

3. The method of controlling mechanism operated by two electric motors comprising the following steps: connecting the motors in series with resistances, cutting out of part and then the whole of said resistances, reinserting a part of the resistances, shunting one of the motors through the remaining resistance, cutting said motor out of circuit, connecting the motors in parallel without the resistance previously in shunt, and finally cutting out all the resistances.

4. The combination with a base provided with bearings, reversing-switch, stationary contacts, and a magnet core or pole, of a shaft mounted in said bearings and having a controller-drum rigidly mounted thereon, a series of stationary contacts bolted to said core or pole, a coil for magnetizing said core and contacts, a sleeve carrying the movable reversing-switch contacts and mounted upon the controller-drum shaft to turn independently thereof, and a handle rigidly connected to said sleeve, substantially as described.

In testimony whereof I have hereunto subscribed my name this 10th day of January, A. D. 1895.

HARRY P. DAVIS.

Witnesses:
WESLEY G. CARR,
HUBERT C. TENER.