(No Model.)

H. P. DAVIS.

METHOD OF AND MEANS FOR CONTROLLING ELECTRIC CARS.

No. 527,947. Patented Oct. 23, 1894.

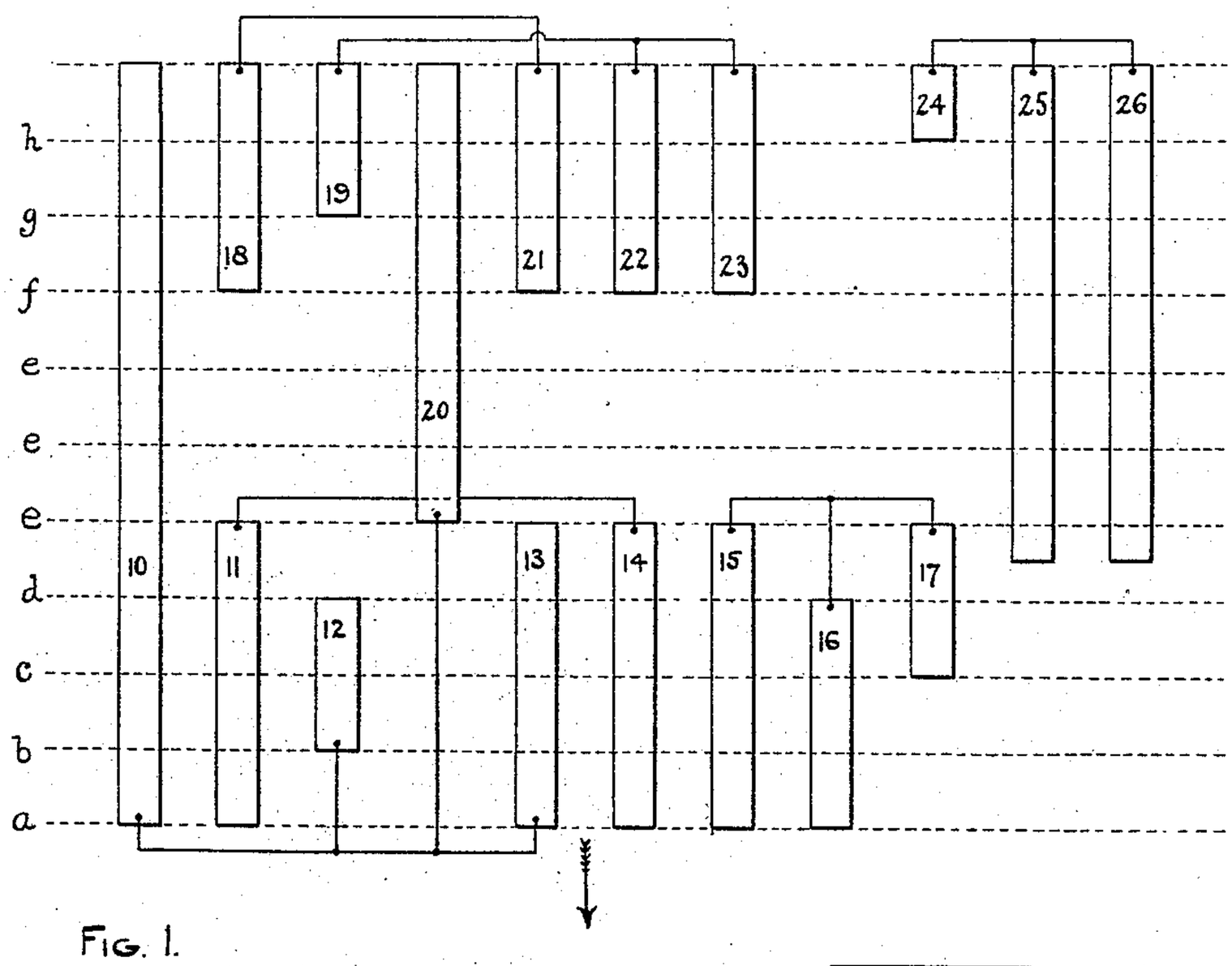


FIG. 1.

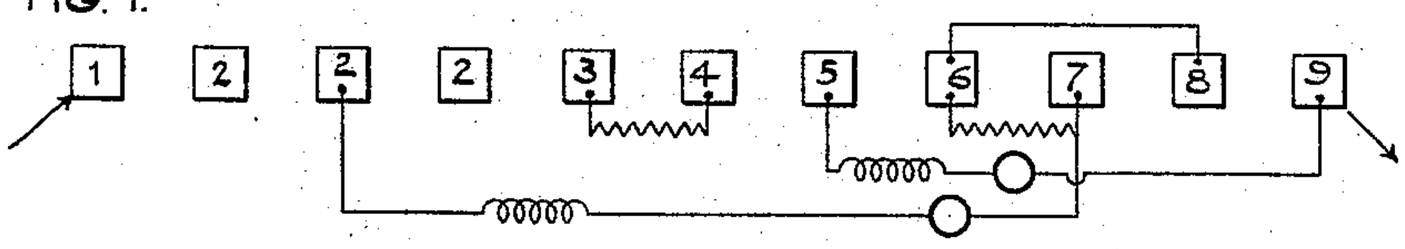
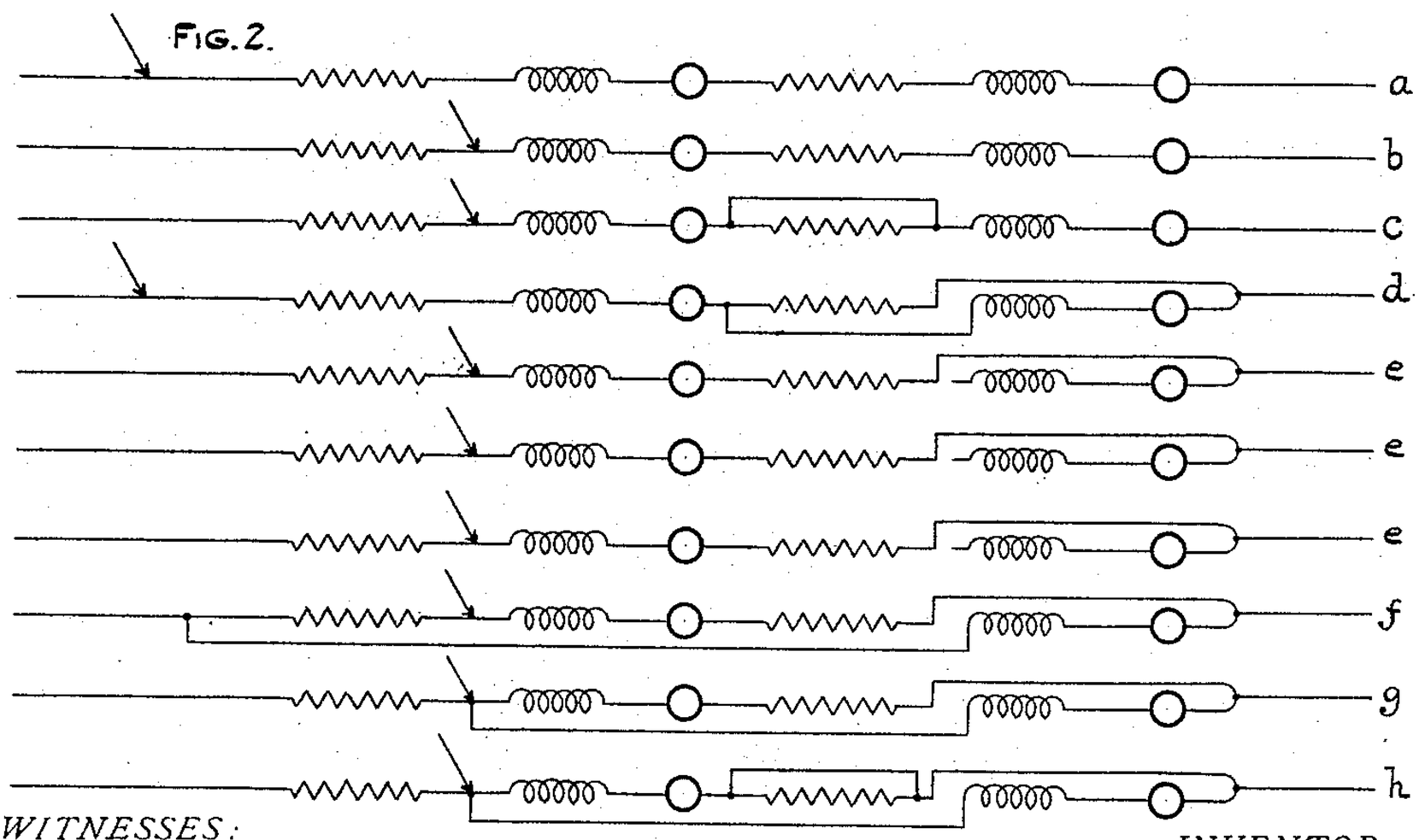


FIG. 2.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND MEANS FOR CONTROLLING ELECTRIC CARS.

SPECIFICATION forming part of Letters Patent No. 527,947, dated October 23, 1894.

Application filed March 29, 1894. Serial No. 505,534. (No model.)

To all whom it may concern:

Be it known that I, HARRY P. DAVIS, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of Controlling Electric Cars, (Case No. 587,) of which the following is a specification.

The object of my invention is the provision of a method whereby electric cars may be controlled with a minimum liability to flashing or sparking when changes of connection are made, and the jerks incident to changes in speed may be lessened.

My invention also contemplates the use of motors on street cars in such a manner that each motor shall be worked to the same degree; neither of the two motors usually used being given more work to do than the other.

My invention has particular relation to that class of electrically propelled cars wherein two motors are used which are alternately coupled in series and in parallel.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a development of a cylindrical switch adapted to be used in carrying out my method of control, and Fig. 2 is a series of diagrams illustrative of the connections occurring in different positions of the switch.

My switch is, in the form shown, composed of the contacts shown from 1 to 9, inclusive, in Fig. 1, the three contacts numbered 2 being electrically but one. They may indeed, if desired, be replaced by a single long contact covering the space in the direction of the row of contacts, occupied as shown by the three contacts. Upon the surface of a cylinder, or if desired otherwise disposed for action, are the strips 10 to 26, inclusive.

By sliding the strips over the contacts in the direction of the arrow, various combinations of connections may be made, which will secure the arrangement of motors and resistances shown in the second figure. For convenience of illustration, Fig. 1 has been divided into ten parts to exhibit ten successive positions of the switch, in each successive position the row of contacts 1 to 9 being supposed to be in the position indicated by successive transverse lines on the figure.

My switch belongs preferably to that class wherein the connections with the trolley, the ground and the parts of the motors, are permanently made with the various contacts 1 to 9, as shown, the changes in connections being made by bringing different sets of these contacts into different electrical relations with each other and with the strips 10 to 26.

The contacts 1 to 9 are connected as follows: The two terminals of one of the motors are connected to contacts 2 and 7. The terminals of the other motor extend to 5 and 9, while one of the resistances intended to produce speed variations, has its terminals extending to 3 and 4, and the other to 6 and 7. The interconnections of the various strips are plainly shown in the figure, and repetition of these connections here would be unnecessary. The contact 1 is connected to the trolley which is in turn connected with the source of current as is usual, while contact 10 is connected permanently with the ground.

As will be seen by examination of Fig. 2, the changes in connections are accomplished by virtually moving the point of connection of the trolley with the motor system from one point to another of the permanent connections, and at the same time making such cooperating breaks and short circuits at certain points of the system as may be necessary.

Considering Fig. 2, arrangement *a* corresponds to the first position in Fig, 1, also marked *a*. Here, as is usual, the motors and the resistances are placed in series for starting the car. In positions *b* and *c* the two resistances are successively cut out or rather short circuited, thus leaving the two motors on the car simply in series, without any additional resistance. In position *d* the trolley connection is again brought to the beginning of the row of devices, and one of the resistances is thus brought again into series with the system, but the other resistance is at the same time thrown into shunt around one of the motors, preparatory to cutting out the same. In position *e*, this cutting out occurs, and, as shown, a large part of the switch is adapted to the producing

of this arrangement, in order that the motorman may be obliged to maintain this condition of things for more than an instantaneous period of time. It is necessary that too rapid a transition should not occur between positions *d* and *f*. In position *f* the two motors are thrown into parallel arrangement, a resistance being thrown into series with each of the motors. In position *g*, one of these resistances is thrown out of circuit, and attention is called to the fact, that, by my arrangement of switch, the cutting out of this resistance occurs in that branch wherein is situated the motor which was cut out of circuit in position *e*. Thus the greater amount of work is given in position *g* to that motor which, in position *e* had nothing to do, having been cut out of circuit. The amount of work done by the two motors is thus balanced, and an undue strain is not brought upon one of the two motors, as is the case where the same motor is always relieved. The last step is of course to produce position *h*, wherein the two motors are simply in parallel arrangement, without any resistances in circuit.

It is evident that the same succession of electrical arrangements may be produced by different specific means from those herein shown, but my invention covers the method of control shown, independently of the switches used to carry it out.

What I claim is—

1. The method of operating street cars driven by two electric motors, which consists in connecting said motors in series, cutting out one of said motors, connecting the two in parallel with resistances, and diminishing the resistances in series with the two motors successively, the resistance in series with the motor previously cut out being the first cut out, substantially as described.

2. The method of changing from parallel to series arrangement in street cars driven by two electric motors, which consists in throwing a resistance in series with one of said motors only, then putting a resistance in series with the second motor; cutting out said second motor, and then throwing said second motor in series with the first motor, substantially as described.

In testimony whereof I have hereunto subscribed my name this 26th day of March, A. D. 1894.

HARRY P. DAVIS.

Witnesses:
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HAROLD S. MACKAYE.