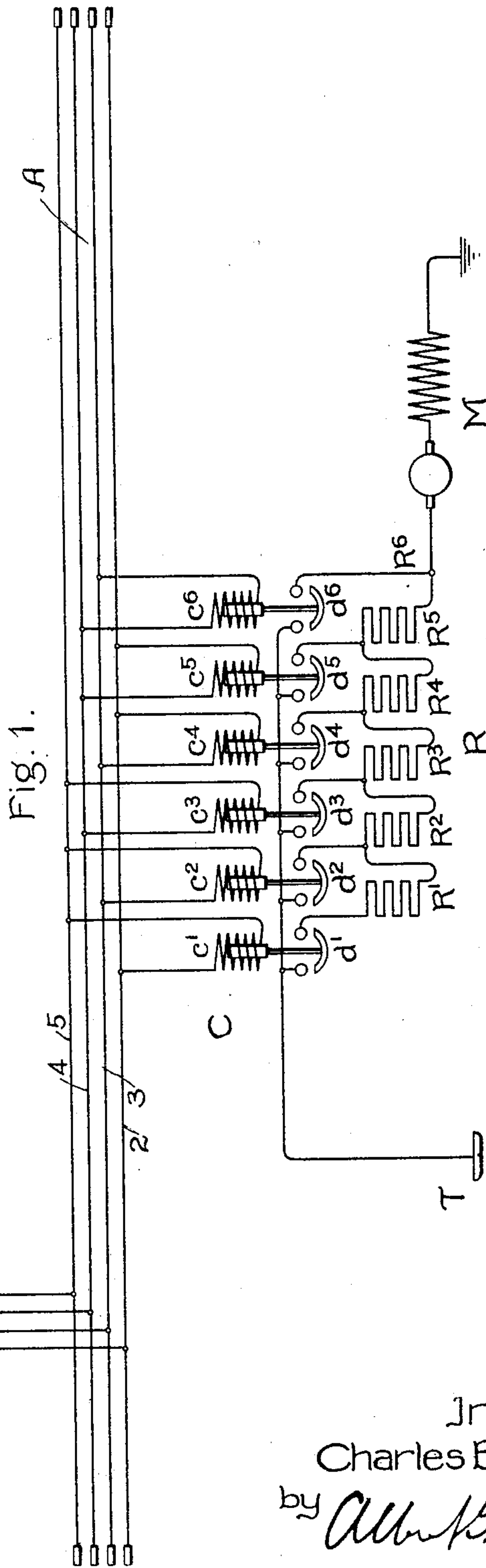
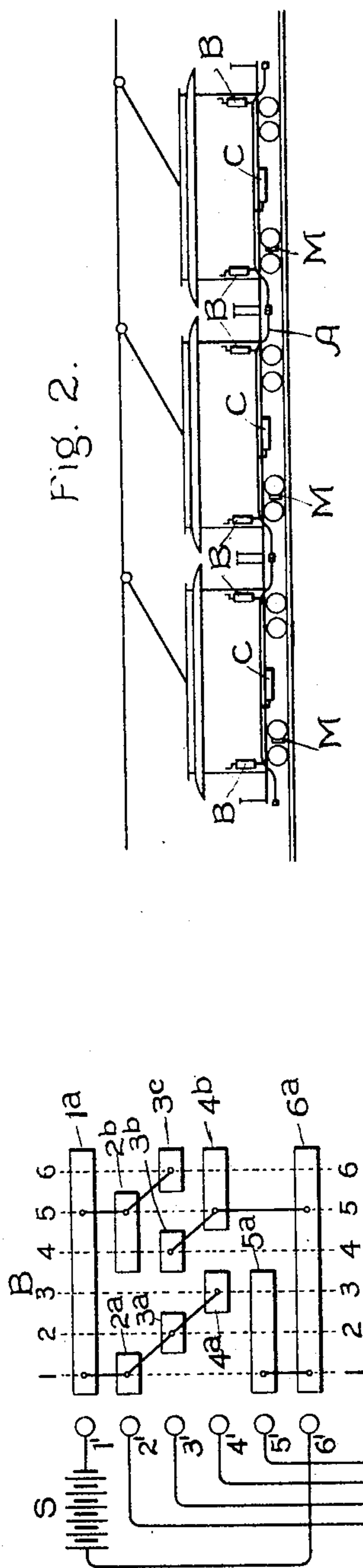


C. E. BARRY.
SYSTEM OF MOTOR CONTROL.

(Application filed Jan. 29, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:

Levi A. Bell.
Benjamin D. Hill.

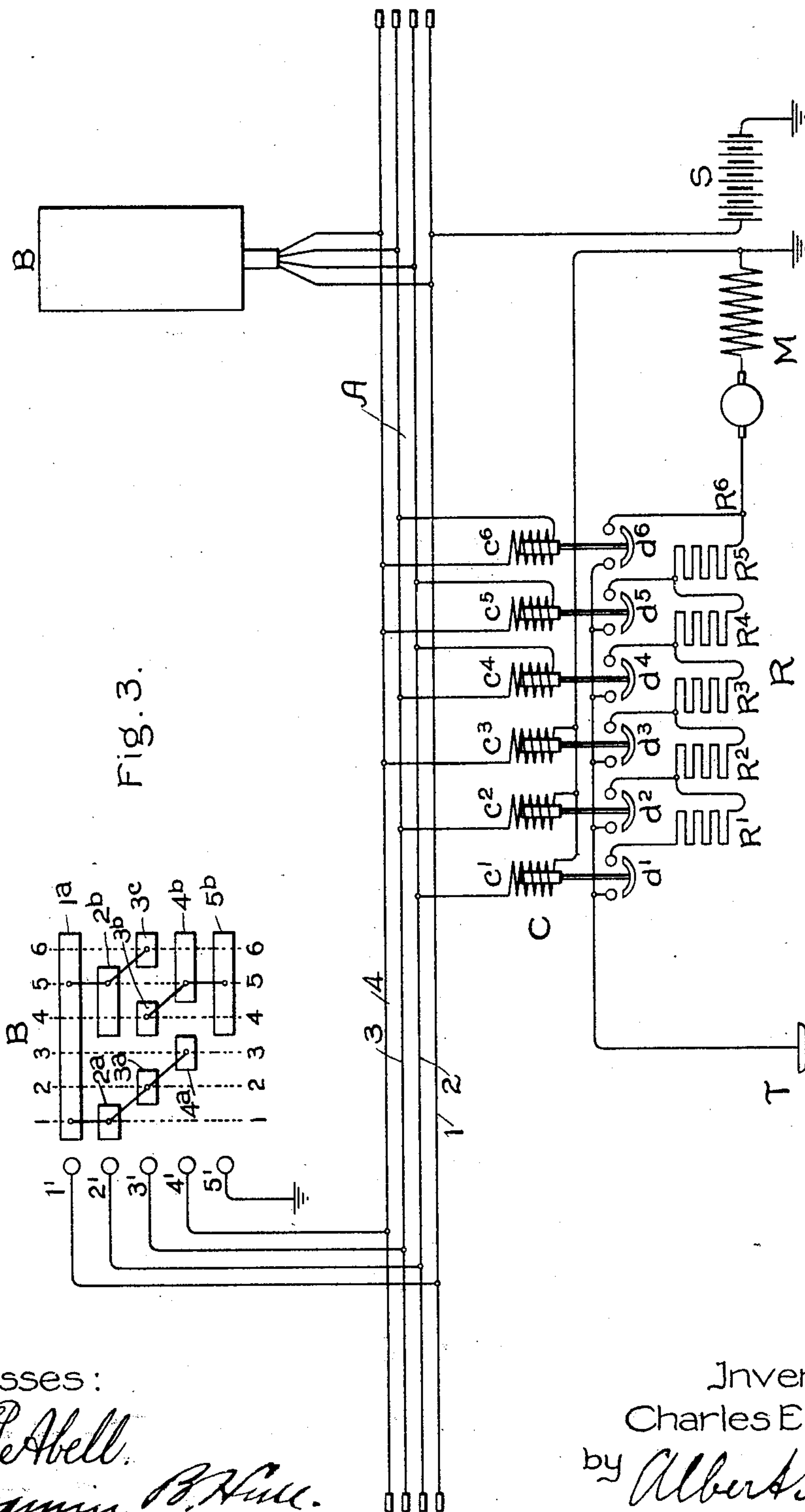
Inventor,
Charles E. Barry.
by *Albert B. Davis*
Atty.

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(No Model.)

2 Sheets—Sheet 2.



Witnesses:

Lewis De Bell
Benjamin B. Hill

Inventor.
Charles E. Barry
by *Albert B. Dan*
Atty

UNITED STATES PATENT OFFICE.

CHARLES E. BARRY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE
GENERAL ELECTRIC COMPANY, OF NEW YORK.

SYSTEM OF MOTOR CONTROL.

SPECIFICATION forming part of Letters Patent No. 671,259, dated April 2, 1901.

Application filed January 29, 1900. Serial No. 3,123. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. BARRY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Systems of Motor Control, (Case No. 1,520,) of which the following is a specification.

My invention relates to those systems of control for electric motors in which the motor-controller is actuated from a so-called "master-controller" situated at a point removed from the motor-controller, and is particularly adapted for a train-control system in which it is desired to actuate the motor-controllers on all the cars from one or more master-controllers situated at any desired point or points on the train.

More particularly, my invention relates to those systems in which a number of electromagnetically-actuated devices are employed for operating either directly or indirectly the contacts of the motor-controller. In such systems it is customary to run a separate train-conductor to the master-controller for each electromagnetic device or where a number of devices are operated simultaneously for each set of simultaneously-operated devices, it being of course understood that the corresponding devices on the several cars of the train are connected to the same train-conductor. The windings of the several electromagnetic devices are connected at one end to one of the train-conductors and at the other end to a common conductor or to ground, and there are thus required at least as many train-conductors as there are devices to be successively operated.

It is the object of my invention to so organize the system that the contacts of the motor-controller may be operated from a less number of train-conductors than there are electromagnetic devices.

Referring to the drawings, Figure 1 is a diagram illustrating one of the applications of my invention. Fig. 2 is a diagram showing the application of my invention to a train system, and Fig. 3 is a diagram showing a modified system.

In Fig. 1, A represents the conductors of a motor-control system, these conductors being

separately indicated by the numerals 2, 3, 4, and 5.

C represents diagrammatically a motor-controller comprising electromagnetic devices c' to c^6 , inclusive, having their windings connected to the said conductors and having their moving parts operatively connected to the contacts d' to d^6 , inclusive, which latter control the resistance R in the circuit of the motor M. Inasmuch as such controllers are well known in the art I have not deemed it necessary to illustrate the mechanical details of construction.

S represents a source of current-supply for actuating the several contacts of the motor-controllers, which, as shown, is a storage battery, although it may be any desired source, and B is a master-controller for connecting the conductors in various combinations to the source of current-supply. The master-controller is shown with its contacts developed on a plane surface, as is customary in diagrammatic illustration.

Under the system of connections heretofore employed the four conductors shown would suffice to operate only three contact devices, connected as the first three contact devices are connected in Fig. 1 of the drawings—that is, with the actuating-coil of the first contact device connected between the conductor 2 and the common conductor 5, the actuating-coil of the second contact device connected between the conductor 3 and the conductor 5, and the actuating-coil of the third contact device connected between the conductor 4 and the conductor 5. With the actuating-coils of the several contact devices thus connected the conductors are divided into sets corresponding in number to the number of the contact devices to be actuated; but by my invention I connect the actuating-coils of the contact devices across every pair of conductors, thus enabling me to actuate as many contact devices from any given number of conductors as there are combinations of such conductors taken two at a time. With four conductors six contact devices may be actuated, and with n conductors a number of contact devices may be actuated equal to the combinations of n quantities, taken two at a time. The windings of the several electro-

magnetic devices are so proportioned that the corresponding contacts will be operated whenever the full potential of the source is applied at their terminals and so that they will not be operated on half-potential.

When the fixed contacts 1' to 6', inclusive, of the master-controller lie along the line 11 in Fig. 1, the full potential of the storage battery will be applied through the cross-connected contacts 1^a, 2^a, and 5^a 6^a of the master-controller to the conductors 2 and 5. The full potential of the source will thus be applied to the actuating-coil of the electromagnetic device *c'*, connected by these conductors, and the contact *d'* will be actuated. At the same time current will be supplied from the conductors 2 and 5 to the windings of the electromagnetic devices *c*² and *c*⁴, connected in series, and to the windings of the devices *c*³ and *c*⁵, also connected in series; but because these windings are connected two in series across the source each coil will be supplied with only one-half of the potential of the source and will not therefore be operated. As the master-controller is moved from its first to its second position the full potential of the storage battery will be applied through the cross-connected contacts 1^a and 3^a of the master-controller to the conductors 3 and 5 before the circuit of the conductor 2 is broken at the contact 2^a. The electromagnetic device *c*² will therefore be actuated before the conductor 2 is disconnected from the source and the contact device *d*² closed before the contact device *d'* is opened. When the master-controller is moved into its third position, the storage battery will be connected across the conductors 4 and 5 by way of the cross-connected contacts 1^a 4^a and 5^a 6^a and the electromagnetic device *c*³ will be actuated, the corresponding contact device being closed before the contact device *d*² is opened. In the fourth position of the master-controller the storage battery will be connected across the conductors 2 and 3, this time by way of cross-connected contacts 1^a 2^b and 3^b 6^a, and the electromagnetic device *c*⁴ will be actuated and the contact *d*⁴ closed. In the fifth position of the master-controller the storage battery will be connected across the conductors 2 and 4 and the electromagnetic device *c*⁵ will be actuated and the contact *d*⁵ closed. In the last position of the controller the storage battery will be connected across the conductors 3 and 4 and the electromagnetic device *c*⁶ will be actuated to close the contact *d*⁶. The several contacts of the master-controller will thus be successively actuated, each one being closed just before the previous contact is opened, until in the last position of the controller only the contact *d*⁶ will be closed. In each position of the master-controller a number of the actuating-coils will be supplied with current, but, as in the first position of the controller, only one of the actuating-coils will be supplied with full potential. In the first posi-

tion of the master-controller the motor-circuit will be closed at the contact *d'* and current entering through the trolley-shoe T will pass through all the sections of the resistance R to the motor M and to ground. As the other contacts of the motor-controller are successively actuated in the successive positions of the master-controller, the various sections of the resistance R will be gradually cut out until in the last position of the controller the motor M will be connected across the line without any resistance in its circuit.

In order to adapt my system to simultaneously control any number of motor-controllers from a single master-controller—as, for example, a train-control system—it is only necessary that the conductors A should be extended throughout the train and the corresponding electromagnetic devices of the several motor-controllers connected between the same train-conductors. Such a system of connections is now well known in the art, and in Fig. 2 I have shown a train comprising a plurality of cars, the conductors A being connected from car to car by means of couplings and each of the cars being provided with a master-controller at each end.

In Fig. 3 I have illustrated a modified system in which but three train-conductors are used to operate six contact devices, a ground connection taking the place of the fourth conductor, and I have also shown the source of current-supply, which in this case, as before, is indicated as a storage battery connected to a conductor leading throughout the train, as is customary in train systems, so that when any one master-controller is operated all the storage batteries will be connected in multiple to supply current to the actuating-coils of the various controllers. In this figure I have shown two master-controllers connected to the conductors A in a manner common in train control systems, the one on the left being shown in diagram and the one on the right in outline. When the master-controller in Fig. 3 is in its first operative position, with the contacts 1' to 5', inclusive, resting along the line 11, the storage battery will be connected between the conductor 2 and ground, and the full potential of the source will be applied to the actuating-coil of the electromagnetic device *c'*, and the contact device *d'* will be actuated. At the same time current will be supplied, as before, at half-potential through *c*⁴ and *c*² and *c*⁵ and *c*³. In the second position of the master-controller the second contact will be similarly actuated, and in the third position of the master-controller the third motor-contact will be operated. In the fourth position of the master-controller one terminal of the storage battery will be connected to the conductor 2 and the conductor 3 will be connected to ground. Full potential will therefore be applied to the actuating-coils of the electromagnetic devices *c*⁴ and *c'*, thus actuating both of the contacts *d*⁴ and *d'*; but it is evident that the actuation of

the contact d' at this time will have no effect on the motor-circuit. In the fifth position of the master-controller the fifth and the second contacts are similarly actuated, and in the last position of the master-controller the sixth and the third motor-contacts are actuated.

Although I have illustrated my invention in connection with a controller having only six contact devices controlled from four conductors or from three conductors and ground, it is evident that a controller having a larger number of contacts may be operated in a similar manner by increasing the number of said conductors and applying the same system of connections, and although I have for convenience in illustration shown my invention in connection with a controller which merely varies the resistance in a motor-circuit it is evident that the principle of operation is the same, irrespective of the particular type of controller used, and that it might as well be applied to a controller adapted to connect a plurality of motors in series or parallel or, indeed, to a controller adapted to make any desired connections.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A controlling system comprising, in combination, a plurality of conductors, electromagnetic devices connecting said conductors in sets equal to or greater in number than the number of said conductors, and a master-controller for supplying current to different sets in different positions of the controller.

2. In combination, a plurality of electromagnetic devices, a controlling system therefor, comprising a number of conductors less than the number of said devices, and a master-controller for connecting said conductors in different combinations equal to or greater in number than the number of said conductors.

3. A controlling system comprising, in combination, a plurality of conductors, electromagnetic devices connected between each of said conductors and a common conductor, and other electromagnetic devices connected in other relations between the same conductors.

4. In combination, a plurality of electromagnetic devices, a controlling system therefor, comprising a number of conductors less than the number of said devices, a source of current-supply, and means for connecting said conductors in various combinations to said source to successively operate said electromagnetic device.

5. In combination, a plurality of electromagnetic devices, a controlling system therefor, comprising a number of conductors less than the number of said devices, a source of current-supply, and a master-controller for supplying current to successively actuate said electromagnetic devices.

6. In combination, a plurality of electromagnetic devices, a controlling system therefor, comprising a number of conductors less than the number of said devices, and means for connecting a constant potential source to said conductors to successively operate said electromagnetic devices.

7. In combination, a plurality of conductors constituting a controlling system, electromagnetic devices greater in number than the number of said conductors and connected to the same, a source of current-supply, and means for connecting the said source successively to the several electromagnetic devices.

In witness whereof I have hereunto set my hand this 26th day of January, 1900.

CHARLES E. BARRY.

Witnesses:

BENJAMIN B. HULL,
C. L. HAYNES.