No. 808,268. PATENTED DEC. 26, 1905.

T. VON ZWEIGBERGK.

CONTROLLING SYSTEM.

APPLICATION FILED APR. 25, 1904.

2 SHEETS—SHEET 1.

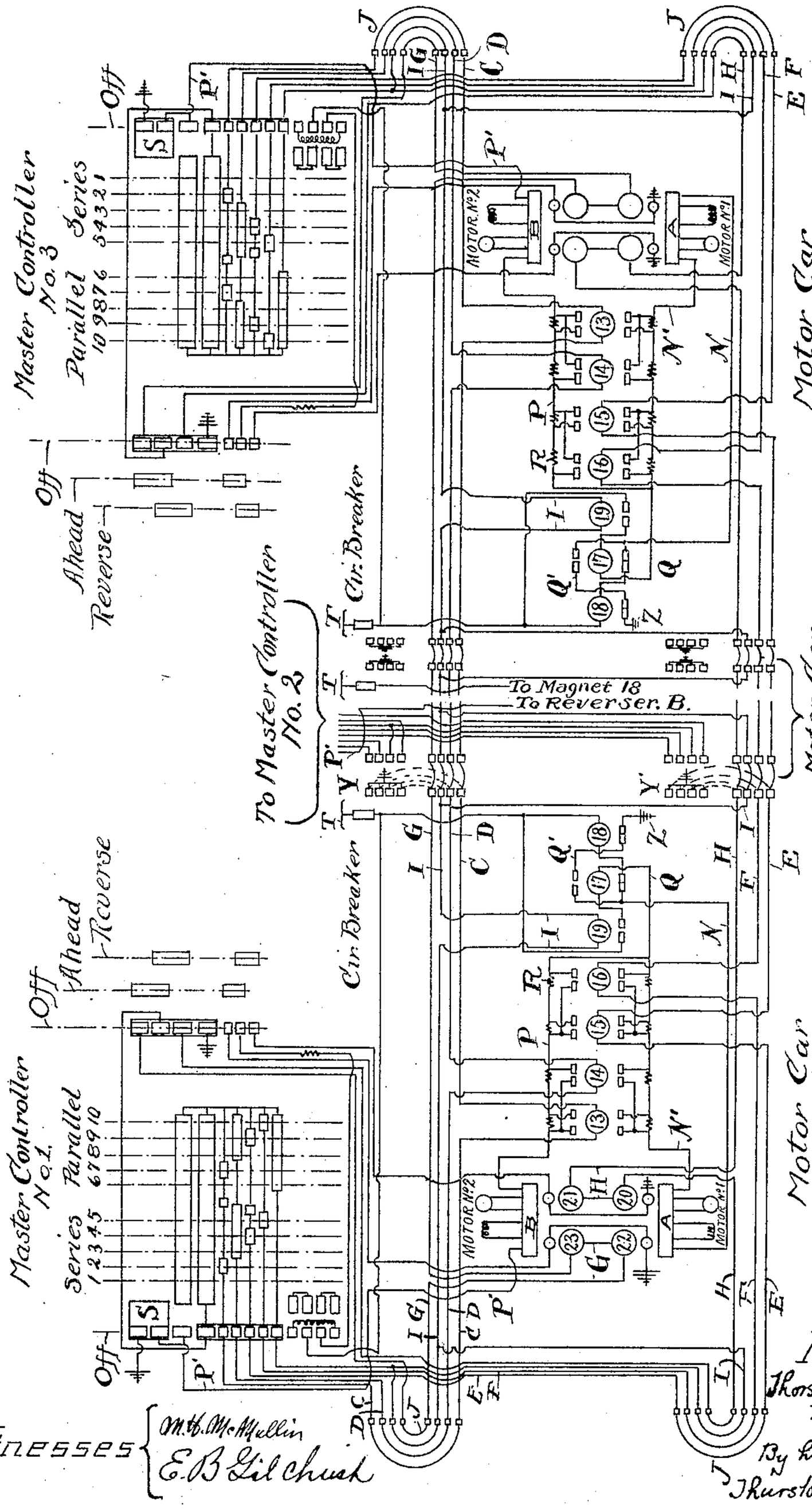


Fig. 1.

Witnesses
M. H. McMullin
E. B. Gilchrist

Inventor
Thorsten von Zweigbergk
By his attorneys
Thurston & Bates.

No. 808,268. PATENTED DEC. 26, 1905.

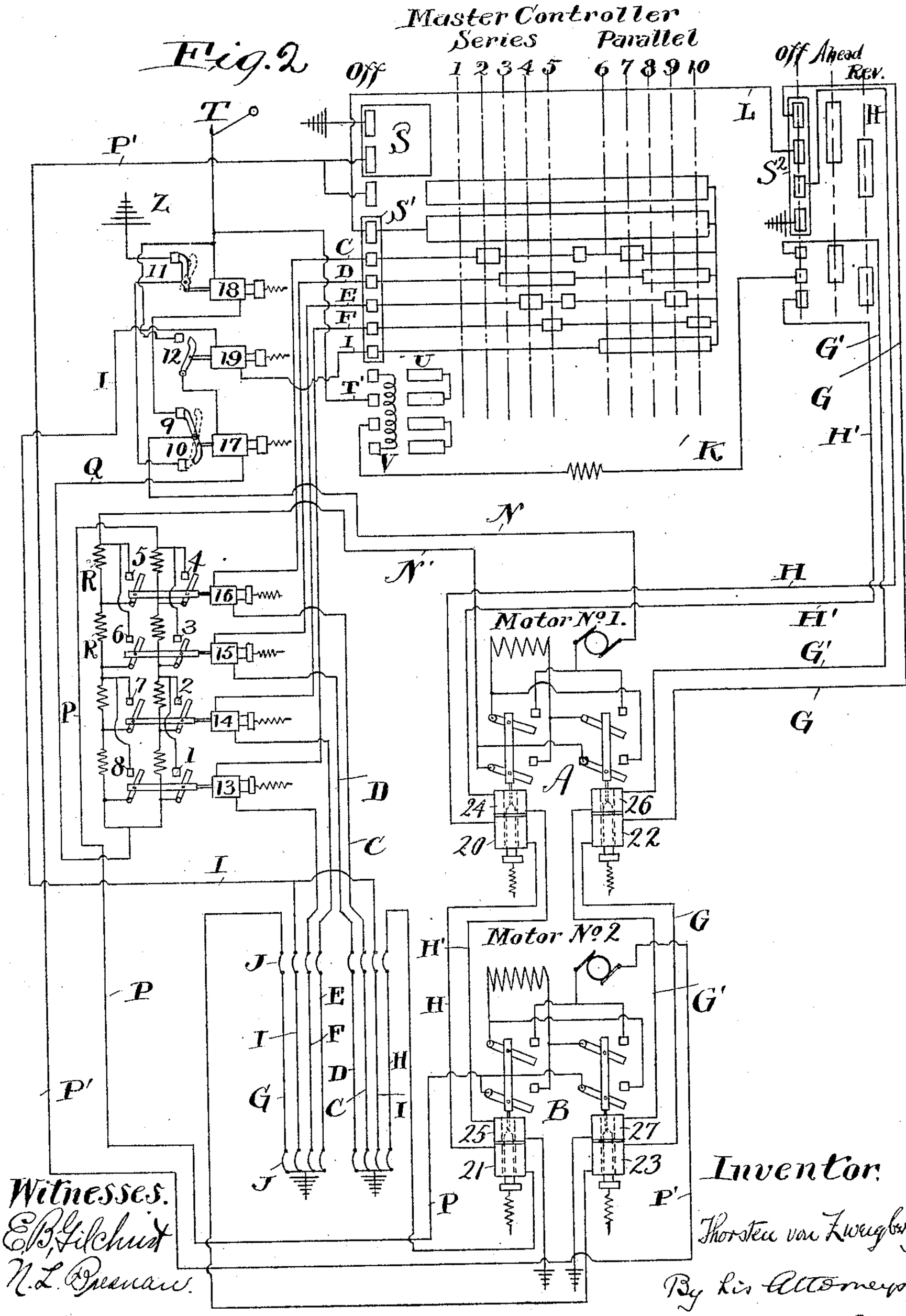
T. VON ZWEIGBERGK.

CONTROLLING SYSTEM.

APPLICATION FILED APR. 25, 1904.

2 SHEETS—SHEET 2.

Fig. 2



Witnesses.
E. B. Gilchrist
N. L. Brennan.

Inventor.
Thorsten von Zweigbergk,
By his Attorneys,
Thurston & Bates.

UNITED STATES PATENT OFFICE.

THORSTEN VON ZWEIGBERGK, OF LANCASTER, ENGLAND.

CONTROLLING SYSTEM.

No. 808,268. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed April 25, 1904. Serial No. 204,684.

To all whom it may concern:

Be it known that I, THORSTEN VON ZWEIGBERGK, a citizen of the United States, residing in the county of Lancaster, England, have invented a certain new and useful Improvement in Controlling Systems, of which the following is a full, clear, and exact description; reference being had to the accompanying drawings.

The object of this invention is to provide an efficient system for the control of a train of electric cars from any desired car.

A master-controller is provided on each car, and an automatic controller of the magnetic type is also provided on each car, and the circuits are so arranged that any one of the master-controllers may concurrently operate all of the automatic controllers. I have arranged the circuits in such a way that on each car, except the one where the master-controller is operated, one motor is grounded through the idle master-controller of that car at its off position, and the other motor in case they are coupled in parallel is grounded directly on each car. On the car where the master-controller is operated one of the motors is grounded at the operative positions by train-wires running through the whole length of the train, the other motor in parallel position being grounded directly in that car. Contact plugs and couplers carry the train-wires from one car to the next, and at the final car these wires are grounded either directly or through the master-controller on that car. The advantage of grounding only one motor of the train through the train-wires instead of thus grounding one or both motors of each car is that smaller train-wires can be used. The automatic installation comprises switches and magnets for operating them, (which constitutes the automatic controller,) as well as automatic magnetic reversers for the motors operated directly on the motor-circuit itself. The arrangement of circuits, controllers, and reversers will now be more fully described and the essential characteristics thereof set out in the claims.

The drawings are diagrams illustrating the invention.

Figure 1 represents a train of three motor-cars. In this figure the master-controller and the automatic installation of car No. 2 are omitted; but it is to be understood that they are similar to those of cars Nos. 1 and 3. Fig. 2 represents one of the master-controllers, together with the automatic installation of one car.

Referring more particularly to Fig. 2, the master-controller is shown as having ten operative positions, five series and five parallel. Associated with it is a reversing-switch, indicated by the contact-plates and fingers at the words "Off," "Ahead," and "Reverse." The automatic controller consists of magnets 13 to 19, inclusive, and contacts 1 to 12, inclusive, operated thereby. The two automatic reversers for the motors are indicated as A and B and consist of switches operated by the magnets 20 to 23, inclusive. When the magnets are not energized, the switches stand open by means of springs or otherwise, as desired. The magnets 13, 14, 15, and 16 are controlled by the lines F, E, D, and C from the master-controller. The line I from the master-controller leads to the magnet 19. Lines K and L from the master-controller lead to the reversing-switch, and from this switch lines H and G lead through the magnets 20 and 21, 22 and 23, respectively. The current comes in from the contact-shoe or trolley T via the line N, which leads to motor No. 1. From motor No. 1 runs a line N′ through the various resistances R to line P, which leads to motor No. 2. From this motor the line P′ leads to the master-controller. By following the lines N N′ P P′ to the contact-plate S and thence to the ground it will be seen that in "off" position the motors are permanently connected in series and grounded, the break being effected by the reversers, which are controlled by the reversing-switch. Therefore to start the car it is only necessary to close the reversing contacts. Besides the main magnets 20 to 23 of the reversers they have shunt-magnets 24 to 27, inclusive. These are permanently grounded and are connected by the lines H′ and G′ with the reversing-switch. When the reversing-switch is at the off position, these lines are open, in the "head" or "reverse" positions, however, one or the other of them come into connection with the line K, leading to the master-switch. This line is open at the master-switch, except when it is passing from off to the first series position. In such movement the master-switch first brings into action a set of contact-plates U, which connect the line T′ from the trolley through a blow-out V with the line K to the reversing-switch, and thence via the line G′ or H′ through the shunt-magnets 26 27 or 24 25, respectively, to the ground. This energizes these magnets to set the reversers A and B from the off to the ahead

or reverse position, respectively, thus closing the breaks at the reversers and starting the motors, all of the resistances R being in circuit. Immediately following the closing of the circuit through the reversers by the energization of the shunt-magnets the line P′ becomes connected by the master-controller with the line L to the reversing-switch, where it is connected through the line G or H, through the main magnets 22 23 or 20 21 of the reversers, to the train-lines G and H, which at the other end of the train are grounded. These magnets therefore hold the reversers closed. In the second series position part of the current passes from the master-controller through the reverser-magnets, as before, and part passes via the line C through the magnet 16 to the train-wire C, which, it is to be understood, is ultimately grounded. This energizes the magnet 16, closing contacts 4 and 5 and cutting out the resistance governed thereby. In the third series position part of the current flows via the line D through magnet 15 to the grounded train-line. This closes contacts 3 and 6 and cuts out their resistance. So, also, in the fourth and fifth series positions part of the current passes via the line E and F through magnets 14 and 13 and closes contacts 2 and 7 and contacts 1 and 8, thus finally cutting out all the resistance. In passing from the last series to the first parallel position the contact-plates of the master-controller are arranged to gradually cut in all the resistances. In position No. 6 (the first parallel position) part of the current passes via the line I through the magnet 19 and along this wire, which is a grounded train-wire. The energization of the magnet 19 closes the contact 12. This establishes a line Q from the trolley through magnet 17. This opens contact 9 and at the same time closes contact 10. Contact 9 being open, the magnet 18 is deënergized, and the contact 11, which it has held open, thus falls closed. The result is that the former line N from the trolley is open at 9, while a new line Q is established, which divides between the resistances and passes half by the line N′ to reverser A and half by the line P to reverser B. From reverser A the line N continues via the line Q′, now closed at 10 and 11, to the ground Z. From reverser B the line continues via P′ through the master-controller to the train-wires. Thus the motors are placed in parallel position, one being grounded directly and the other through the train-wires. In positions 7, 8, 9, and 10 the connections are the same as in position 6, except the energization of the magnets 16, 15, 14, and 13, successively cuts out resistance. By the described arrangement of going from series to parallel the first motor cannot be grounded until the circuit from the trolley is actually broken.

In the description so far I have referred particularly to the motors which are on the car where the master-controller is operated. When these motors are in series, the circuit therefrom continues via one or more of the train-wires. With the motors in parallel one of them is grounded directly on this car, and the circuit of the other continues by the train-wires. The operation of any master-controller affects all the cars alike, except that the ground connection which is established by that controller at idle position is necessarily disconnected and the train-wires are used for the ground of one motor of that car, as already explained. On all the other cars, however, the motors find their ground through the idle master-controller of that car for series positions and half through the master-controller and half directly via the line Q′ for parallel positions. In further explanation of this reference may be had to Fig. 1. There motor-car No. 2 is condensed; but its installation is the same as that of car No. 1 or No. 3. It has also a master-controller grounded at off position. Now the current flowing from first motor-car, where we will suppose the master-controller is operated, via the train-wires passes through the various magnets of the automatic controller of each car, operating them all alike and is finally grounded at the last car. Multiple flexible connections or jumpers J make connection, so that these wires are all connected with the contact-plates S′ and S² of the last master-controller. S′ is connected with S² by the line L, and S² is grounded, since this controller is at the off position, and this grounds all the train-lines C, D, E, F, G, H, and I. The train-wires thus carry the ground for one motor on car No. 1 and operate the automatic controller and reversers of each car. Each car receives current directly from a trolley T through a suitable circuit-breaker, and this current passes through the motors of that car (either in series or in parallel, according to the automatic controller of that car) and finds its ground directly on each car via line P′ and contact-plate S of the master-controller of that car for series positions, and for parallel positions half via this ground and half via the direct ground Z of each car. The train-wires are thus relieved from carrying the ground connection for all the motors, and much smaller wires can be used, thus reducing the cost of the installation.

The train-wires are grouped in two sets of four, the line I having a branch from one set to the other to make an equal number in each set. This allows the use of two similar jumpers, with four wires each to couple each car with the next and to couple in the master-controllers at the two ends of the train. On intermediate cars, though the lines C, D, E, F, I, G, and H from the master-controller are unconnected to the train, the line P′ remains permanently connected with the contact-finger which engages plate S and establishes the

ground at the off position of that master-controller. If but one car were used on the train, its train-wires would be grounded on that car by jumpers connecting the sockets at the ends of those wires with additional sets of sockets Y and Y′, which are grounded on the car. If more than one car is used, these additional sockets are idle.

I claim—

1. In a controlling system, in combination, a motor, an automatic controller therefor, a master-controller for the automatic controller, a ground connection for the motor through the master-controller at off position.

2. In a controlling system, in combination, a plurality of motors, a plurality of controllers therefor, ground connections from the motors through the controllers at off position, and means independent of the controllers for maintaining the motor-circuits open when all the controllers are at off position.

3. In a controlling system, in combination, a plurality of motors, a plurality of controllers corresponding thereto, ground connections for the motors through their corresponding controllers at off position, and an additional ground for any motor whose controller is in use.

4. In a controlling system, the combination of a plurality of motors, a plurality of controllers therefor, circuits leading from the source of supply through the motors to the controllers, ground connections from the controllers at off position, and means independent of the controllers for maintaining the circuit from the source of supply when all of the controllers are at off position.

5. In a controlling system, in combination, a train of motor-cars, a controller on each car, circuits so arranged that one motor on each car but one is normally grounded through the idle controller of that car at off position, and other circuits for grounding a motor on the car where the controller is in use.

6. In a controlling system, in combination, a plurality of motors, a plurality of automatic controllers for operating them, a plurality of master-controllers each of which is adapted to operate the automatic controllers, ground connections from the motors through the master-controllers at off position, and means for maintaining the motor-circuits open when all of the master-controllers are at off position.

7. A controlling system, for a train of motor-cars comprising the combination of an automatic controller on each car, and a master-controller on each car adapted to govern all the automatic controllers, each master-controller being normally connected with one of the motors of its car to form a ground for that motor, and an additional ground connection for that master-controller which is operated.

8. In a controlling system, in combination, a train of motor-cars, automatic controllers on each car, a master-controller, train-circuits leading therefrom for operating the automatic controllers, said circuits carrying a ground connection for one motor on that car where the master-controller is operated, and means for grounding the motors on the other cars independently of the train-circuits.

9. In a controlling system, in combination, a train of motor-cars, an automatic controller on each car, a master-controller on each car, circuits for governing the automatic controllers from one master-controller, said circuits also constituting the ground-leads from one of the motors on the car where the master-controller is operated, and circuits arranged so that one motor on each of the other cars is normally grounded through the idle master-controller of that car at off position.

10. A controlling system for a train of motor-cars consisting of an idle grounded controller on each car except one, an active controller on such excepted car to govern the motors of all the cars, and a ground connection for one of the motors on the car where the controller is operated, which ground connection is made via the train-wires which control the various motors and leads to one of the idle controllers at off position.

11. In a controlling system, the combination of a plurality of motors, automatic controllers for governing them, a master-controller for governing the automatic controllers, conductors leading from the master-controller to the automatic controllers and the motors, the same conductors forming a part of both the motor-circuit and the automatic-controller circuit.

12. In a controlling system, the combination of a train of motor-cars, each car having a motor and an automatic controller therefor, a master-controller for concurrently operating said automatic controllers, train-lines leading from the master-controller to the automatic controllers and to the motors, the same lines constituting a part of the motor-circuit and the automatic-controller circuits.

13. In a controlling system, the combination of a train of motor-cars, each car having a motor and an automatic controller therefor, a master-controller for concurrently operating said automatic controllers, train-lines leading from the master-controller to the automatic controllers and to the motors, the same lines constituting part of the motor-circuit and the automatic-controller circuit, and carrying the ground for one of the motors on the car where the master-controller is operated, and other means for grounding one of the motors on each of the other cars.

14. In a controlling system, the combination of a train of motor-cars, each car having a motor and an automatic controller therefor, a master-controller for concurrently operating said automatic controllers, train-lines leading from the master-controller to the automatic controllers and to the motors, the same lines con-

stituting part of the motor-circuit and the automatic-controller circuits, automatic reversers on each car for the motors thereof, and circuits for the reversers which constitute a part of the motor-circuit.

15. In a controlling system, the combination of a train of motor-cars, automatic reversers on each car for the motors thereof, circuits for the reversers which constitute a part of the motor-circuits, and additional circuits for the reversers adapted to throw them from off to an operative position before the motor-circuits are established.

16. In a controlling system, the combination of motors, a controller, automatic reversers for the motors, circuits for the reversers which constitute a part of the motor-circuit, additional circuits for the reversers adapted to throw them from off to an operative position before the motor-circuits are established, and means operated by the controller for connecting said additional circuits with the source of current while the controller is moving from the off to the first series position.

17. In a controlling system, in combination, a motor, an automatic reverser therefor, said reverser including two operating-magnets, a controller, circuits leading therefrom to the motor and the reverser and so arranged that the controller may direct the motor-current through one magnet of the reverser to hold it in an operative position, and an additional circuit leading from the other magnet to the controller, the controller being arranged to direct current through the last-mentioned magnet to throw the reversers and thereby close the motor-circuit.

18. A system of controlling motor-cars on which there is a motor, an automatic reverser therefor, and a controller, comprising means for directing a temporary current through the reversers to close the motor-circuit, and means for thereafter controlling the motor-current while it flows through the automatic reversers.

19. The combination of a motor, an automatic reverser therefor having a main and a shunt magnet for operating it, a controller, a main circuit normally connecting the motors with the trolley but open at the reverser, said controller operating to first close a temporary circuit through the shunt-magnet to close the break in the main circuit thereat, the main circuit thereafter continuing through the main magnet of the reverser.

20. In a controlling system, in combination, a pair of motors, a controller therefor, magnets and contacts operating when the controller moves from series to parallel to open the trolley-line therebefore established to the first motor and close a line from the trolley through the resistance to the two motors and close a line from the first motor to the ground.

21. In a controlling system, in combination, a pair of motors, an automatic controller therefor consisting of contacts and magnets, a master-controller for directing the motor-current through said magnets to operate said contacts, said magnets and contacts operating when the master-controller moves from series to parallel to open the trolley-line therebefore established to the first motor and close a line from the trolley through the resistance to the two motors and close a line from the first motor to the ground, said ground connection being established independently on each car after the former trolley connection is opened.

22. The combination of a pair of motors, a series circuit therefor passing from the source of supply through normally closed contacts to the first motor, then through the resistance to the second motor, and then to the ground, a controller for cutting out such resistance, an additional line to the ground adapted to be connected in by the controller on parallel positions, a magnet in said additional line, a branch line from the trolley to the other side of the resistance and passing through normally open contacts which are adapted to be closed by said magnet, said last-mentioned additional line including a magnet adapted to open the contacts on the series line from the trolley to the first motor.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

T. VON ZWEIGBERGK.

Witnesses:
W. J. SULIS,
WM. PIERCE.