

No. 771,523.

B. AIKMAN.

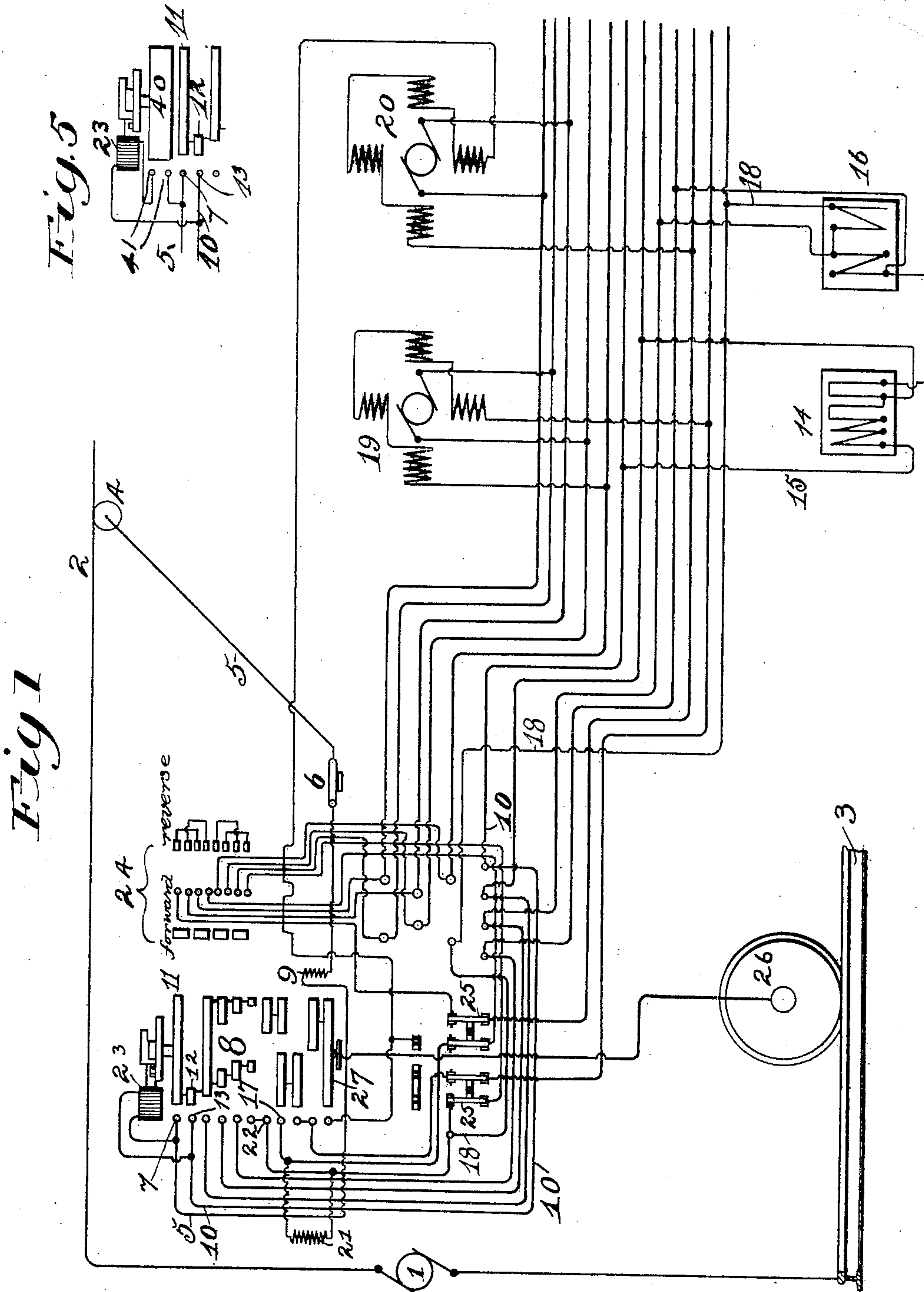
PATENTED OCT. 4, 1904.

CIRCUIT CONTROLLER FOR ELECTRICALLY PROPELLED VEHICLES.

APPLICATION FILED AUG. 31, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



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Inventor:-
Bert Aikman
by George L. Bragg
his Attorney

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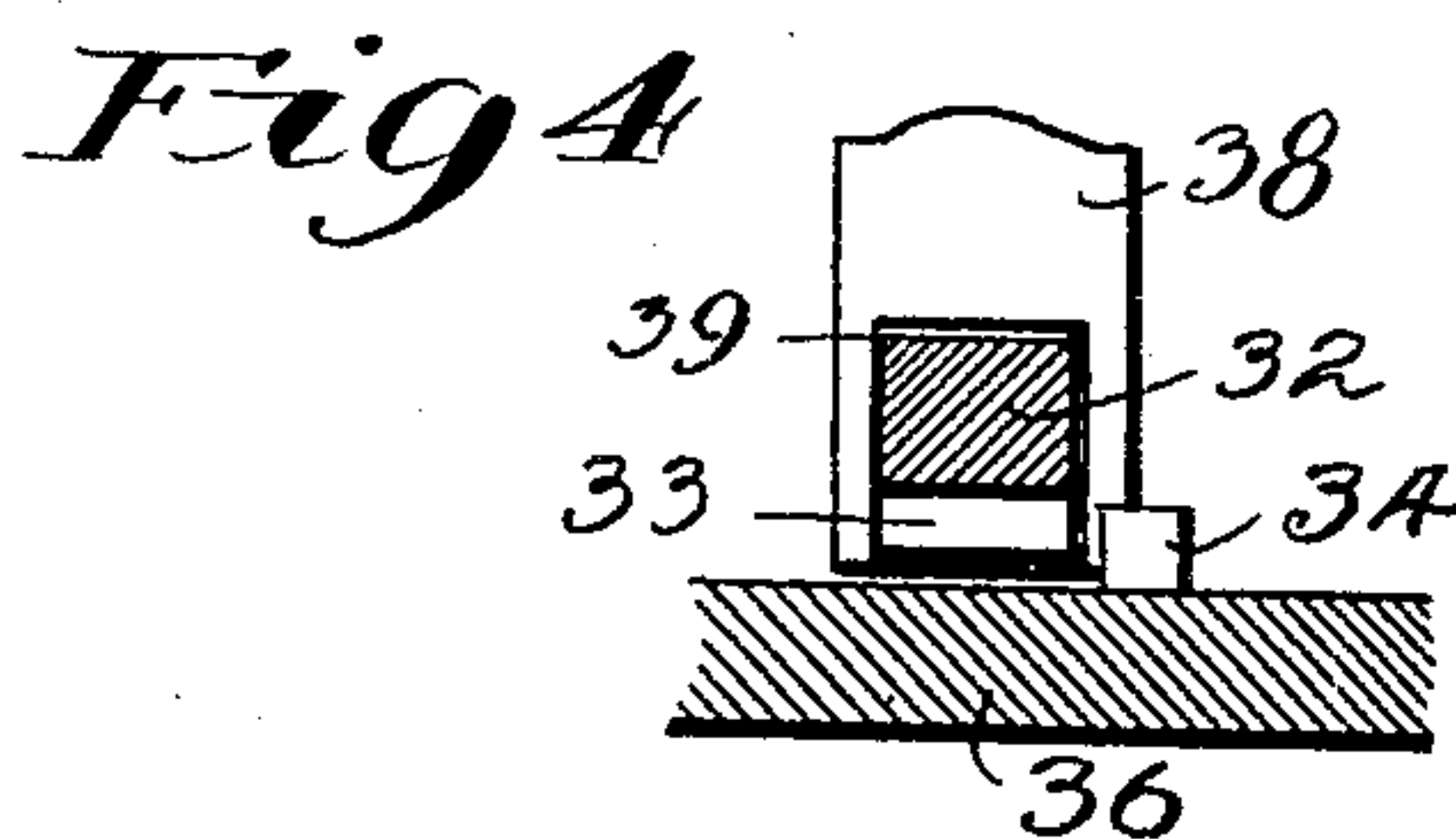
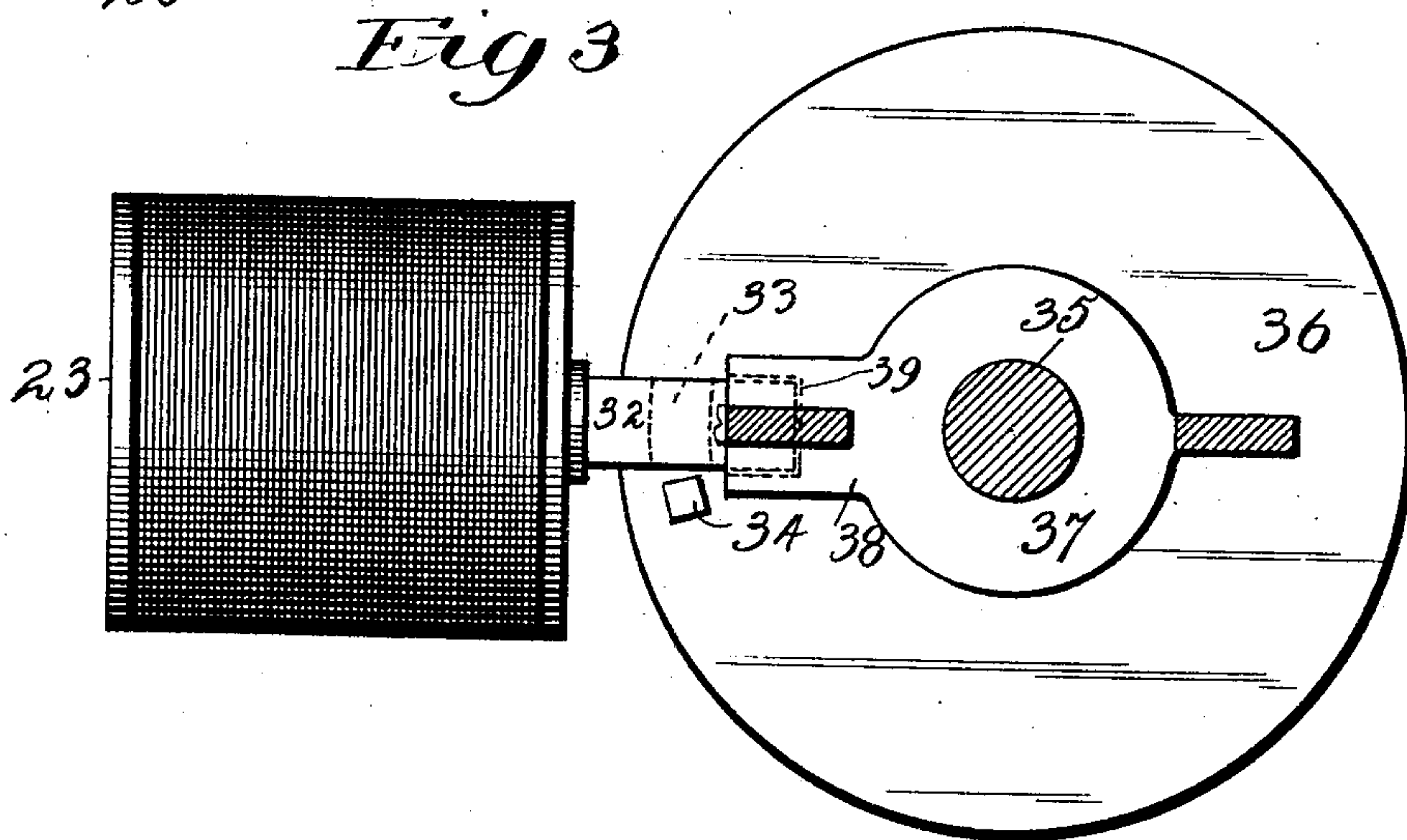
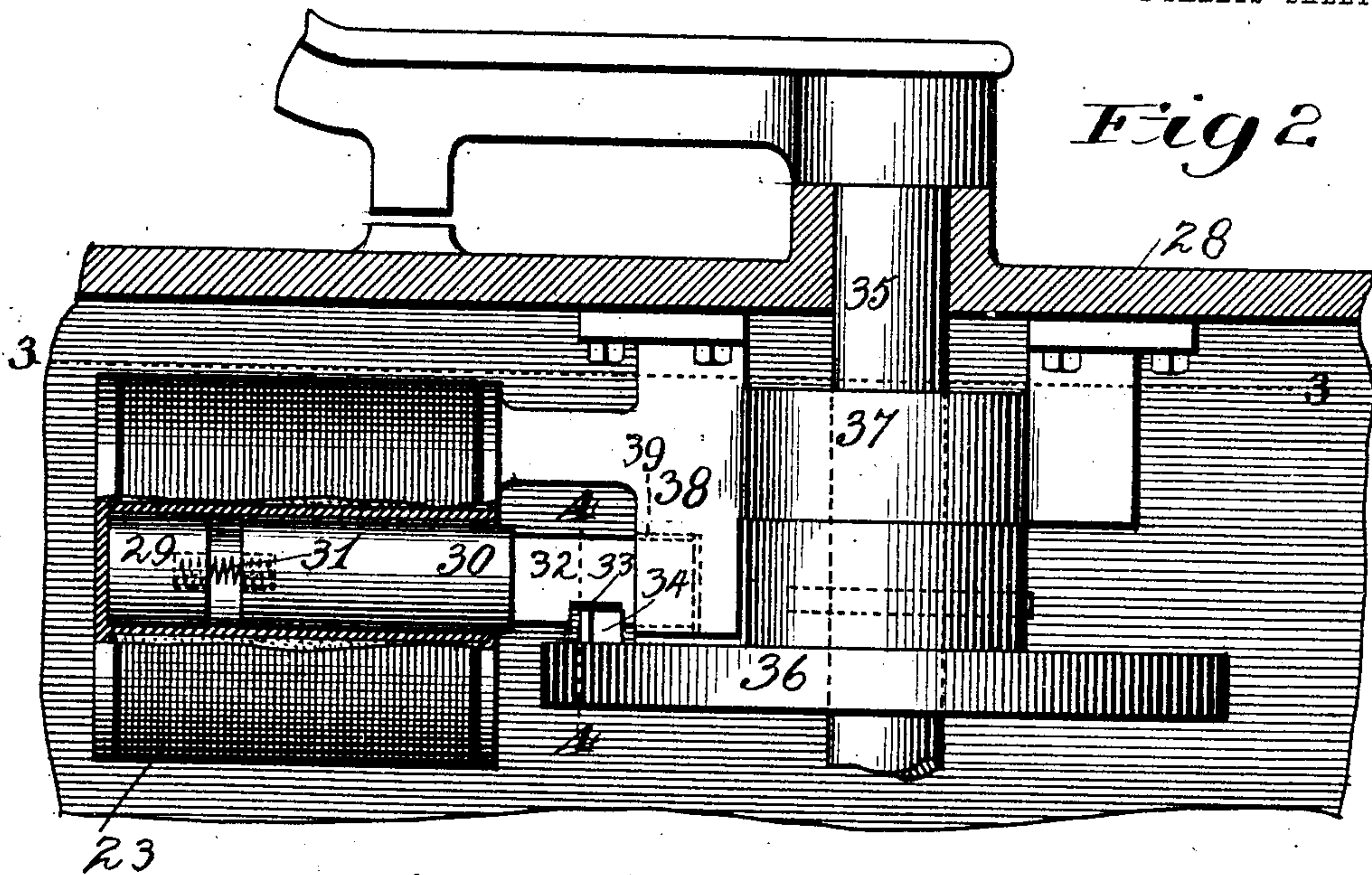
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UNITED STATES PATENT OFFICE.

BERT AIKMAN, OF CHICAGO, ILLINOIS.

CIRCUIT-CONTROLLER FOR ELECTRICALLY-PROPELLED VEHICLES.

SPECIFICATION forming part of Letters Patent No. 771,523, dated October 4, 1904.

Application filed August 31, 1903. Serial No. 171,410. (No model.)

To all whom it may concern:

Be it known that I, BERT AIKMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Circuit-Controllers for Electrically-Propelled Vehicles, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to electrically-propelled vehicles, and has for its object the provision of means in association with the vehicle-motor controller that will prevent the operation of the controller in the event of ground upon the armature or field of a vehicle-motor or the resistance or car-wiring.

Generally speaking, my invention comprises an electromagnetically-controlled detent automatically thrown into position to lock the controller upon the occasion of abnormal ground upon the motive apparatus. The electromagnet that controls this detent has one terminal connected or adapted for connection with that portion of the electrical equipment which should not be directly grounded, yet which may through accident become grounded. The other terminal of said electromagnet is connected or adapted for connection with a conductor extending to a grounded source of current which serves to complete circuit through said electromagnet, and thereby place the detent in place to prevent the controller from being effectively moved from its initial position.

In the preferred embodiment of the invention one terminal of the electromagnet controlling the detent is connected with the trolley, and thereby with the trolley-wire and one terminal of the generator, while the other terminal of said electromagnet is connected or adapted for connection with all of the wiring, resistance, and motor-windings that may become accidentally grounded, and thereby connected with the remaining terminal of the generator. In other words, the association of the detent-controlling electromagnet with the trolley-circuit is such that where an abnormal ground is present current from the main generator will pass through the electromagnet

and operatively energize the same, while said magnet will fail to be energized where the motor upon the vehicle and the associated wiring are limited to their normal ground connection.

In the preferred embodiment of the invention the electromagnet is of high resistance and is included or adapted for inclusion in parallel with a pair of looping-contacts that are included in series with the trolley-circuit when the controller is free to operate and is operated its first step or that step required to connect the trolley with the resistances and motors. The high-resistance electromagnet therefor is always in condition to have circuit closed therethrough when an accidental ground is present before the controller has taken its initial step in effecting control of the vehicle motive apparatus, the controller in the idle condition serving to maintain the circuit including the motors open.

To those skilled in the art it is obvious that the normal ground-path for the vehicle motive apparatus is not present until the controller has taken its said first step, at which time the electromagnet cannot operate, as it is of high resistance and has been included in parallel with the aforesaid looping-contacts and the controller-contacts that have been caused to electrically connect the looping-contacts.

I will explain my invention more fully by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic representation of an electric-railway system, showing the improved controller of my invention. Fig. 2 is a view in elevation, partially in section, of that portion of a controller embodying my invention. Fig. 3 is a plan view on line 3 3 of Fig. 2. Fig. 4 is a view in cross-section on line 4 4 of Fig. 2, and Fig. 5 indicates diagrammatically a modification in the circuits of the guard or detent-controlling electromagnet.

Like parts are indicated by similar characters of reference throughout the different figures.

I have indicated a trolley-circuit that contains a generator 1, a trolley or conductor 2, extending along the line of travel, and a return

conductor or rail 3, which is usually known as a "ground-return," as such return-conductor usually rests upon the ground. I do not wish to be limited, however, to this narrow significance of the term "ground," as it is obviously immaterial whether the rail is insulated or uninsulated from the ground, the invention being of service in either event to prevent the operation of the controller where a short-circuit connection between the motive apparatus and the return to the generator occurs.

The vehicle-circuits and apparatus are diagrammatically indicated and are generally familiar to those skilled in the art, and a general description thereof will therefore only be given. Current is conducted from the trolley-wire 2 to the motive apparatus upon the vehicle by means of a trolley-wheel 4, carried by the vehicle, that is connected by a conductor 5, through the canopy-switch 6, to the initial brush 7 of the series-parallel controller 8, the winding 9 of a blow-out magnet being illustrated for a purpose well understood. The conductor 5 may be connected with a vehicle-conductor 10 by the electrically-connected segmental conductors or strips 11 12, moving with the rotating barrel or cylinder of the controller, that serves to connect the brush 13, which is a terminal of conductor 10, in series with the brush 7 in a manner well understood to those skilled in the art. The conductor 10 extends to the speed-regulating resistance 14 by conductor 15, which latter resistance is connected with the speed-regulating resistance 16, which in turn is connected with the controller-brush 17 by means of the conductor 18. As is well understood by those skilled in the art, the resistances are subdivided into coils that are connected with various brushes of the controller, while the traction-motors 19 and 20 upon the vehicle have their armatures and fields also connected with the various brushes of the controller.

A well-known reversing-switch 24, provided to control the direction of rotation of the vehicle's motors, is illustrated in a well-known arrangement. As the switching and controlling devices are well understood to those skilled in the art, a detailed description thereof will not be essential. It is well understood that the rectangular parts 11 12, &c., represent contacts mounted upon a common rotating support, while the circular portions 7 13, &c., represent brushes having stationary mountings. The same is true with respect to parts of similar illustration of the reversing-switch 24. I provide a resistance-coil 21 of high resistance between the conductors extending from the brushes 17 and 22, for if it were not for this connection of high resistance the guard-magnet 23 would respond to accidental grounds upon a portion only of the apparatus, as connection between said magnet and the remainder of the apparatus would be

lacking, as will be readily understood from an inspection of the drawings. Circuit-breakers 25 in well-known circuit arrangement are illustrated, and as their purpose and function are so well understood no further description of them will be given. The controllers 8 and 24 govern the various ways in which the motors and resistances shall be interposed between the trolley 4 and the traction-wheels or running-gear 26, moving upon the rails 3, the lowermost plate 27 of the controller preferably having direct ground connection with the said running-gear.

Having now generally described well-known vehicle-motor-controlling apparatus and circuits, I will now specifically set forth the purpose and characteristics of the guard-magnet 23 and the mechanism operated thereby. The ground-magnet is desirably of high resistance, so that when circuit from the generator 1 may find paths in addition to that afforded by said magnet the magnet will not interfere with the controlling mechanism. In the arrangement shown the high-resistance magnet is included in bridge between the conductors 5 and 10, so as to be connected in parallel with the group of contacts 7, 11, 12, and 13, which condition is rendered possible only in the event of the vehicle motive apparatus being free of abnormal ground connection, as will be presently set forth. In other words, when the controller is permitted by the magnet to operate the switching means 7, 11, 12, and 13 shunt said electromagnet, so that it cannot operate when the normal ground is put onto the apparatus. It will be seen that when the controller is "off" the circuit through the motor is open or idle. The only possible path for current from the trolley is by way of the magnet 23 to any accidental or abnormal ground that may be upon the armature or field of either motor or upon either of the resistances or its sections or any of the wiring of the motive and controlling apparatus, the high resistance 21 enabling the protection by the magnet 23 of motive apparatus embracing two motors and two sets of resistances. The magnet 23 is desirably, though not necessarily, mounted at the upper end of the casing 28 of the controller. The electric magnet is most desirably in the form of a solenoid, having a core that is made up of two parts of 29 and 30, that are separated by a spring 31, normally effecting separation between the sections of the core, but permitting section 30 to be drawn toward section 29 when circuit is operatively established through said magnet upon the presence of an abnormal ground, as hitherto set forth. The core-section 30 is continued into a detent 32, that is provided with a groove-way or channel 33 in its under face that normally registers with a block 34, rotating with the shaft 35 of the controller, said block in this instance being mounted upon a wheel 36, fast upon said shaft. When the magnet is

deenergized, the controller may be freely rotated. When it is energized upon the occasion of an abnormal ground, groove 33 is moved out of the path of the block 34 to prevent the controller from effecting connection of the trolley with any of the motive apparatus of the vehicle.

A bearing 37 is provided for the upper end of the shaft 35, being mounted upon the upper part of the controller-casing. Said bearing is provided with a continuation 38, that is carried past the center of the electromagnet, a pocket 39 being provided in said continuation for receiving the detent and acting to hold the same against violent displacement when impacted by the block or blocking element 34.

It may be desirable to secure an absolute disconnection between the trolley and the vehicle-wiring when the controller is idle, while at the same time providing means whereby the magnet 23 may operate upon the occasion of abnormal ground before the controller can effect connection between the trolley and vehicle-wiring, to which end the arrangement indicated in Fig. 5 may be employed. I have shown in Fig. 5 a break in the bridge-conductor connecting the magnet 23 between the conductors 5 and 10. A plate 40 upon the controller-shaft serves to engage brushes 41 in said bridge-conductor to complete said conductor before the plates 11 and 12 become effective in connecting the trolley with the motor-wiring.

It is obvious that changes may readily be made in the embodiment of the invention shown without departing from its spirit, and I do not, therefore, wish to be limited to the precise apparatus illustrated. It is obvious that other means than those illustrated may be employed for effecting the dissociation of the electromagnet 23 from the circuit. I do not wish to be limited to switching apparatus that shunts the magnet from circuit, nor do I wish to be limited to a system where said magnet is excluded.

I claim—

1. In an electric-traction system the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, traction-motors with their regulating resistances upon said vehicle, a series-parallel controller governing said motors and their resistances, an electromagnet of high resistance in series with the trolley and the motor-wiring, a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet, and switching means governed by said controller for excluding said electromagnet, substantially as described.

2. In an electric-traction system, the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, a traction-motor with its regulating resistance upon said vehicle, a controller governing said motor and its resistance, an electromagnet of high resistance in series with the trolley and the motor-wiring, a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet, and switching means governed by said controller for excluding said electromagnet, substantially as described.

3. In an electric-traction system, the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, a traction-motor with its regulating resistance upon said vehicle, a controller governing said motor with its resistance, an electromagnet in circuit with the trolley and the motor-wiring, a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet and switching means governed by said controller for excluding said electromagnet from circuit, substantially as described.

4. In an electric-traction system the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, traction-motors with their regulating resistances upon said vehicle, a series-parallel controller governing said motors and their resistances, an electromagnet of high resistance in series with the trolley and the motor-wiring, a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet, and means governed by said controller preventing the operation of said detent by said magnet, substantially as described.

5. In an electric-traction system, the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, a traction-motor with its regulating resistance upon said vehicle, a controller governing said motor and its resistance, an electromagnet of high resistance in series with the trolley and the motor-wiring, a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon

the energization of said electromagnet, and means governed by said controller preventing the operation of said detent by said magnet, substantially as described.

5 6. In an electric-traction system, the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, a traction-motor with its regulating resistance upon said vehicle, a controller governing said motor with its resistance, an electromagnet in circuit with the trolley and the motor-wiring, a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet, and means governed by said controller preventing the operation of
10 15 20 said detent by said magnet, substantially as described.

7. In an electric-traction system, the combination with a vehicle, of electric-traction-motor mechanism thereon for effecting its propulsion, controlling means for said motor mechanism serving, when "off," to prevent operative connection between the motor mechanism and its source of current, electromagnetically-governed means adapted when the controlling means is "off" to lock the same, said electromagnetically-governed means being connected to be subject to current passing through abnormal ground or short-circuit connections with said traction-motor mechanism,
25 30 35 substantially as described.

8. In an electric-traction system, the combination with a vehicle, of electric-traction-motor mechanism thereon for effecting its propulsion, controlling means for said motor mechanism serving when "off," to prevent operative connection between the motor mechanism and its source of current, electromagnetically-governed means adapted when the controlling means is "off" to lock the same, said electromagnetically-governed means being connected to be subject to current passing through abnormal ground or short-circuit connections with said traction-motor mechanism and means governed by said controlling means, preventing the operation of said magnet, substantially as described.
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9. In an electric-traction system, the combination with a vehicle, of an electric traction-motor with its resistance for effecting the propulsion of the vehicle, a controller regulating the association of said motor and resistance with the source of current and serving when "off" to prevent operative connection between said motor with its source of current, and electromagnetically-governed means adapted to prevent the operation of said controlling means when "off" said electromagnetically-governed means being connected to be subject to current passing through abnormal
55 60

mal ground or short-circuit connections with the said traction-motor, substantially as described. 65

10. In an electric-traction system, the combination with a vehicle, of an electric traction-motor with its resistance for effecting the propulsion of the vehicle, a controller regulating the association of said motor and resistance with the source of current and serving when "off" to prevent operative connection between said motor with its source of current, and electromagnetically-governed means adapted to prevent the operation of said controlling means when "off" said electromagnetically-governed means being connected to be subject to current passing through abnormal ground or short-circuit connections with the said traction-motor, and means governed by said controlling means, preventing the operation of said magnet, substantially as described. 70 75 80 85

11. In an electric-traction system, the combination with a vehicle, of a trolley-conductor extending along the line of the vehicle's travel, a source of current for supplying the trolley-circuit, electric-traction-motor mechanism upon the vehicle for effecting its propulsion, controlling means for governing the connection of said traction-motor with said source of current, and serving when "off" to prevent the operative connection of the motor with said source of current, electromagnetically-governed means for preventing said controlling means from operating when in an "off" position having one terminal in connection with the trolley-conductor and the other with the vehicle-motor wiring to respond to abnormal grounds, substantially as described. 90 95 100

12. In an electric-traction system, the combination with a vehicle, of a trolley-conductor extending along the line of the vehicle's travel, a source of current for supplying the trolley-circuit, an electric traction-motor with its regulating resistance, controlling means for governing the connection of said traction-motor and resistance with said source of current serving when "off" to prevent operative connection of said motor, and electromagnetically-governed means for preventing said controlling means from operating when "off" having one terminal in connection with the trolley-conductor and the other with the vehicle motor and resistance wiring, substantially as described. 105 110 115

13. In an electric-traction system, the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, traction-motors with their regulating resistances upon said vehicle, a series-parallel controller governing said motors and their resistances, an electromagnet of high resistance in series with the trolley and the motor-wiring, 120 125

and a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet, substantially as described.

14. In an electric-traction system, the combination with a source of current, of a trolley-conductor extending along the line of travel, a vehicle, a trolley carried thereby to convey current between the trolley-conductor and the vehicle, a traction-motor with its regulating resistance upon said vehicle, a controller governing said motor and its resistance, an electromagnet of high resistance in series with the trolley and the motor-wiring, and a detent controlled by said electromagnet, the controller being adapted for locking engagement with said detent when said detent is operated upon the energization of said electromagnet, substantially as described.

15. In an electric-traction system, the combination with a vehicle, of a source of current electric traction-motor mechanism upon the vehicle for effecting its propulsion, controlling means for governing the connection of said traction-motor with said source of current, serving when "off" to prevent operative connection of the motor with said source of current,

rent, electromagnetically-governed means for preventing said controlling means from operating when in an "off" position having one terminal in connection with the source of current and the other with the vehicle-motor wiring to respond to abnormal grounds, substantially as described.

16. In an electric-traction system, the combination with a vehicle, of a source of current for supplying the trolley-circuit, an electric traction-motor with regulating resistance, controlling means for governing the connection of said traction-motor and resistance with said source of current serving when "off" to prevent operative connection of said motor, and electromagnetically-governed means for preventing said controlling means from operating when "off" having one terminal in connection with the source of current and the other with the vehicle motor and resistance wiring, substantially as described.

In witness whereof I hereunto subscribe my name this 27th day of August, A. D. 1903.

BERT AIKMAN.

Witnesses:

GEORGE L. CRAGG,
CARL H. CRAWFORD.