No. 771,785. PATENTED OCT. 4, 1904.

W. G. LOWRIE.

ELECTRIC RAILWAY SYSTEM.

APPLICATION FILED JUNE 21, 1901.

NO MODEL.

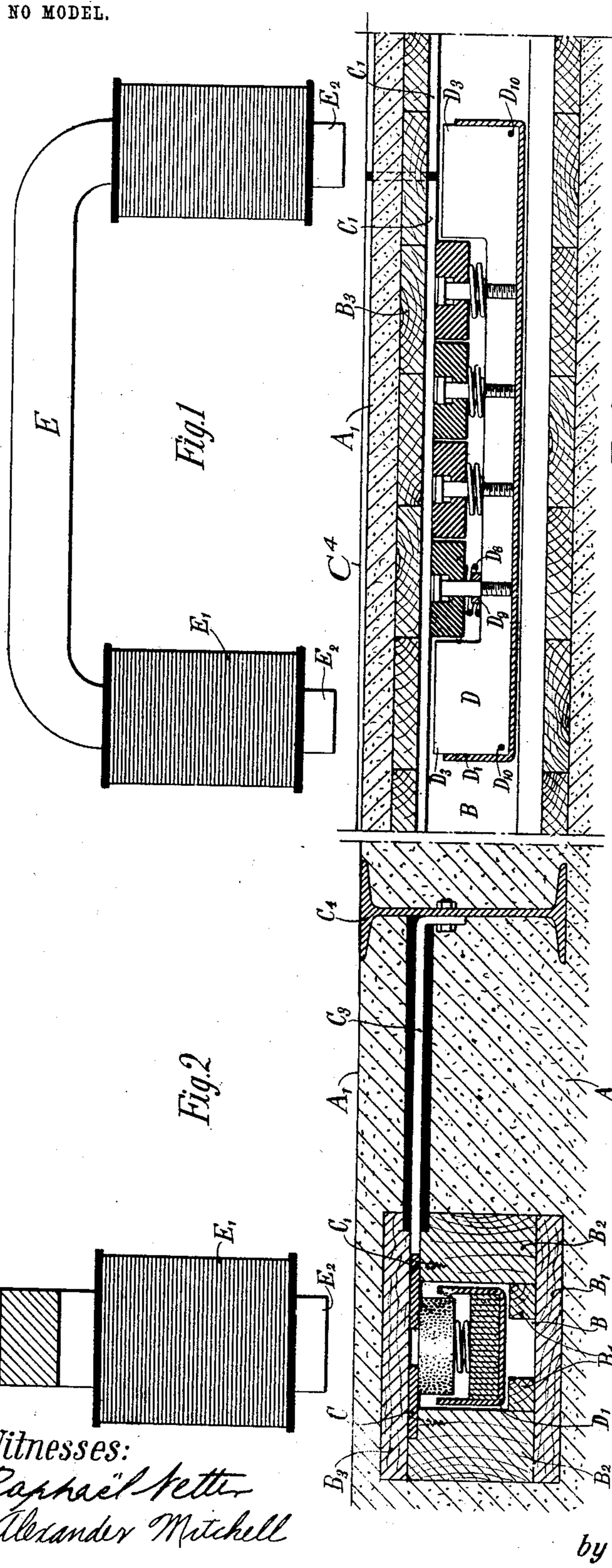

Fig. 1

Fig. 2

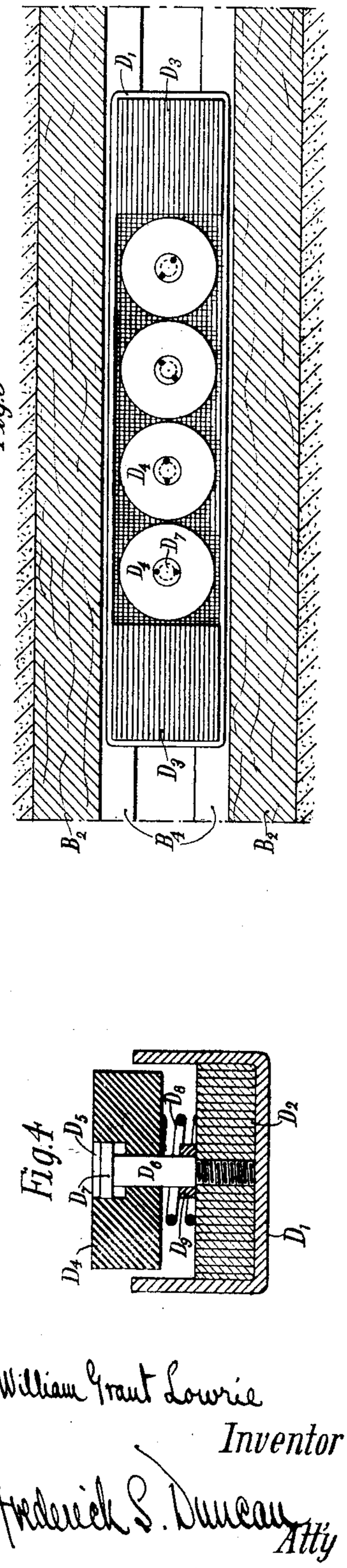

Fig. 3

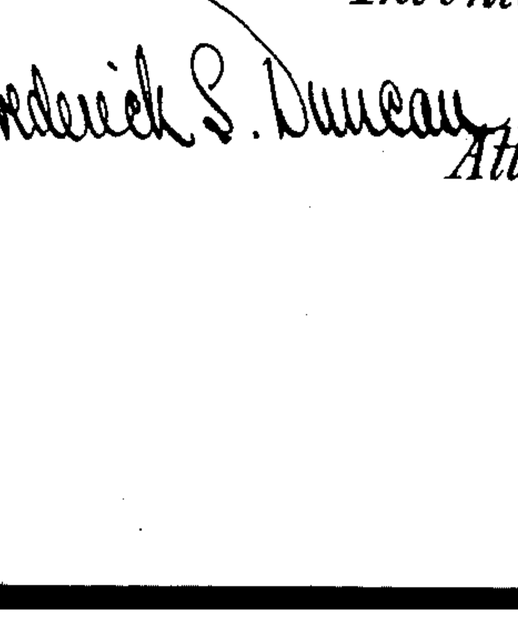

Fig. 4

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No. 771,785. Patented October 4, 1904.

UNITED STATES PATENT OFFICE.

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ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 771,785, dated October 4, 1904.

Application filed June 21, 1901. Serial No. 65,424. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM GRANT LOWRIE, a subject of the King of England, residing in the borough of Manhattan, city of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Electric-Railway Systems, of which the following is a specification, reference being had to the drawings accompanying and forming part of the same.

My invention relates to improvements in electric-railway systems in which a conduit is employed containing a continuous and a discontinuous electric conductor, the sections of the discontinuous conductor being respectively connected to the sections of a discontinuous contact-rail external to the conduit, there being a movable trolley mounted so as to make a traveling connection between the discontinuous and continuous conductors.

My present invention consists in certain novel means in connection with such a system, and its exact scope will be pointed out in the annexed claims.

In the accompanying drawings, in which like references designate similar parts in the various views, Figure 1 is a vertical longitudinal section through the conduit and trolley contained therein, the parts being shown in section and the position of the car-magnet being indicated above the conduit. Fig. 2 is a transverse section of the same. Fig. 3 is a horizontal section view of the conduit, showing the trolley in position therein; and Fig. 4 is an enlarged transverse sectional view of my trolley.

The conduit B is composed of the members B′, B², and B³, formed of suitably-prepared wood or other suitable material and secured together in any desired order so as to form a conduit, as indicated. In practice this conduit is mounted along the line of the electric railway between the rails upon which the car moves and as close as practicable to the surface of the roadway A′. As indicated in the drawings, the paving material is asphalt A; but any good material may be used, and the conduit is usually firmly embedded in the same or with suitable insulation material interposed. My system is of course equally applicable to use on elevated roads and in other places where the conduit need not be under ground. Within the conduit and supported on or by the side members B² of the same is the continuous metallic conductor C, which is connected in any suitable way with a supply of electricity such as is adapted to operate the electric motor upon the car. The discontinuous conductor C′ is also supported on the other side of the conduit from the continuous conductor C. These conductors must be arranged opposite to each other horizontally and are preferably supported by the side members of the conduit, but may be supported on the under face of the top member or on the upper face of the bottom member or otherwise, so long as they are horizontally opposite. By "horizontally opposite" I do not mean that they must be in the same horizontal plane, although this is the usual and preferable construction, but simply that they must be on opposite sides of the conduit instead of vertically opposed to each other. Each section of the discontinuous conductor C′ is connected by a bar or other suitable connection C³ with the adjacent section of the sectional contact-rail C⁴, which is embedded in the paving material so that its upper surface is exposed, so that through any suitable contact-maker current may be supplied to the car. In Fig. 1 I have shown this sectional contact-rail C⁴ as slightly raised above the street-level, so as to indicate its sectional character. I have shown the sectional contact-rail as considerably removed from the conduit, so that this rail may be made of iron or steel without in any way disturbing the magnetic control of the car-magnet over the trolley within the conduit. If the contact-rail be made of a non-magnetic conductor, as copper, it may be located above the conduit. If desired, the contact-rail C⁴ may be suitably insulated from the surrounding paving mate-

rial, and I have indicated insulating material about the connector C^3. A marked advantage in having the conductors supported otherwise than by the top member of the conduit is that when it is desired to inspect the conduit the top member may be removed without interfering with the regular action of the system. Within the conduit moves the trolley D, which is here shown as composed of a metallic casing D′ of brass or, if desired, of magnetic material, which supports a series of vertical plates D^2 of soft iron, each one of these plates being provided with upwardly-projecting pole-pieces D^3 at either end of the same. These plates are held in position within the casing by two pins or rivets D^{10} at either end of the same, which secure each one of the plates firmly within the casing. A series of vertical bolts D^6 is secured to the trolley, so as to project upward along the central part of the same, as indicated in Fig. 1, and each one of these bolts serves to hold a carbon contact-bridge D^4, preferably of disk shape, for making contact between the continuous conductor C and the discontinuous conductor C′. In position such carbon bridges are allowed considerable vertical play upon said bolts, a spring or springs D^8, mounted beneath the carbons, serving to press the same upward until in contact with the two conductors C C′. A spacing block or washer D^9 is mounted below each contact-piece and is formed of such a height that contact between the conductors C C′ and other parts of the trolley than the carbon contacts is prevented, since the contact-carbons D^4 are limited in downward movement and can never drop to such an extent that the pole-pieces D^3 or bolt-heads D^7 could come in contact with any part of the conduit. Of course as the carbon contacts wear away in the normal operation of the trolley the height of the spacing-blocks D^9 can be suitably varied, so that they always subserve this function. Plates to form a laminated body for the trolley may be differently shaped and fastened together than above described.

The car carries the magnet E, which is energized during the operation of the car by two coils E′, which produce strong magnetic activity in the pole-pieces E^2 of the magnet. This magnet therefore acts upon the iron body of the trolley and attracts the trolley upward and at the same time compels its movement within the conduit and keeps it under the car-magnet. The exact position of the trolley with respect to the car-magnet will of course vary to some extent, and the laminated structure of the trolley is of great assistance in constantly maintaining the control of the car-magnet over the trolley. All Foucault or eddy currents within the body of the trolley are prevented by this laminated structure, while otherwise a sudden movement of the car causing some slight displacement of the magnet with respect to the trolley would by reason of these currents considerably reduce the pull of the magnet upon the trolley, as when starting or when meeting obstructions. As the trolley moves along under the car-magnet connection is always made under the car between the continuous conductor C and the discontinuous conductor C′, and thereby with the section of the contact-rail C^4, which is adjacent to the car, in such way that the car is always supplied with current, and at the same time only one or more portions of the sectional-surface contact-rail remains charged in the roadway.

While the form of trolley above described has many advantages, other forms of trolleys may be used—as, for example, solid-iron trolleys—and other forms and arrangements of the carbons on the trolley may be employed, and it may be possible in some instances to use other contact pieces and bridge than carbon of any suitable form. In the form of trolley illustrated and described the springs D^8 are strong enough to keep the disks in contact with the conductors even when the trolley is not raised by the magnet. With this construction if the trolley should for any reason become separated from the car the section of the track where the trolley is would be alive, and therefore this form should preferably be used only where low-tension currents are employed. In other cases the springs D^8 should either be omitted or made too weak to cause contact between the disks and the conductors when the trolley is not lifted, in which event the separation of the trolley from the magnet renders the track dormant. The use of carbon contacts in this connection, however, is very valuable, since sparking is thus largely prevented and since no lubricant is required between the carbon and the surface of the conductors within the conduit, the carbon acting as a self-lubricant. By the term "carbon" I intend to include graphite, plumbago, or any other form thereof. Any shape of contact-piece may be used; but it will also be noted that by having these contact-pieces in disk form rotation about their supporting-bolts is allowed and the exact points of bearing-surface can vary from time to time in the operation of the device, so as to avoid side rubbing and to make the wear uniform over substantially the whole surface of the block. The carbon contact-pieces may be suitably strengthened, if desired, by compounding it with a tougher substance in suitable forms.

It will be noticed that I have provided two supporting-strips B^4 at the bottom of the conduit, so that if the action of the car-magnet ceases the trolley will thereupon be supported by these strips and the springs upon the trolley will still press the contact-disks up against the conductors. By employing a number of

contact-disks a very much better action of the trolley results, and the joints between the two sections of the discontinuous conductors C′ are bridged over without the possibility of any injurious sparking.

It will be observed that during the normal operation of the device the car-magnet draws the trolley upward and lifts the same clear of the supporting-strips B^4, so that the whole weight of the trolley is supported by the car-magnet, and consequently the desired contact of the contact-pieces with the conductors is maintained, which contact is made more regular by the springs D^8. The power of the car-magnet can be suitably regulated so as to obtain any desired pressure of the disks against the conductors.

An important feature of my invention as herein illustrated lies in the fact that the conductors are at the same time the guide or support rails for the trolley. Thus a single contact-piece or set of contact-pieces serves the double purpose of forming a bridge for the passage of the electric current between the conductors and of forming the bearings for the moving trolley. The use of carbon for these contact-pieces makes practicable a sliding instead of a rolling contact on the guide-rails and accomplishes the very beneficial results of making an excellent electrical connection without sparking and of making a self-lubricating bearing on the guide-rails. Another important feature of this arrangement of parts is that the contact of the bridge forming the electrical connection between the conductors is on the under side of the conductors and that the pull of the magnet upon the trolley therefore keeps this contact constant; but this arrangement need not always be observed.

While it is preferable that there should be a continuous carbon connection from one conductor to the other, in some instances only the contact-points need be of carbon connected by a bridge of conducting material. In some instances, as above suggested, the contact-points may be made of other material than carbon.

The location of the conductors on opposite sides of the conduit, as described, permits the use of a comparatively shallow conduit, and the general construction of both conduit and trolley is simpler and less expensive than any heretofore suggested.

In using the word "conduit" I do not intend to restrict myself to a closed conduit, as I realize that for some purposes it may be desirable to omit one or more of the walls and that my invention would still be present if only the horizontally opposite conductors and guide or guides and trolley are used. For most purposes, however, the closed conduit is necessary. Means for draining and for ventilating such conduit may be provided when necessary.

While I have described my invention as illustrated in the accompanying drawings, I do not wish to be limited to the exact construction shown therein or to the other embodiments herein suggested, since many modifications of my device can be made which would embody many of the advantages made possible by my invention. Several of the embodiments of my invention herein referred to are made the subject of application for United States Letters Patent pending simultaneously herewith—to wit, Serial No. 65,425, filed June 21, 1901

It may be desirable to arrange my system so as to avoid the necessity of using the car-rails as a return-conductor. This may be done by duplicating the parts above described—that is, by providing either in a single conduit having the sets of conductors suitably insulated or in separate conduits two sets of continuous and discontinuous conductors and two trolleys and an external sectional contact-rail for each of said sets of conductors. Thus one set of conductors and contact-rail will serve as the direct conductor, conveying the current through the motor, and the other contact-rail and set of conductors will serve as the return-conductor for the current, suitable contact means between the motor and the second contact-rail being provided. The broad pole-faces of a car-magnet or the pole-faces of two car-magnets are located above the two trolleys, causing the same always to travel opposite to each other. If desired, a slot may be left between the two conduits, and a bar of insulating material may be used to connect the trolleys.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electric-railway system, a continuous conductor, a horizontally opposite discontinuous conductor each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along said conductors and a plurality of spring-pressed disk-shaped contact-pieces mounted on said trolley to engage both of said conductors.

2. In an electric-railway system, a conduit, conductors in said conduit, a trolley having a magnetic body to move in said conduit and rotary carbon contact-pieces mounted on said trolley to slidingly engage said conductors.

3. In an electric railway, a continuous and a discontinuous conductor, a trolley movable along said conductors and a plurality of spring-pressed disk-shaped contact-pieces mounted on said trolley to engage both of said conductors.

4. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley

movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor.

5. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor.

6. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor, said bridge forming bearings engaging the conductors which serve as a guide for said trolley while in motion.

7. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor, said bridge forming bearings engaging the under sides of the conductors which serve as a guide for said trolley while in motion.

8. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor, said bridge forming bearings engaging the conductors which serve as a guide for said trolley while in motion, and carbon sliding bearings for said trolley as it slides along said conductors.

9. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and carbon bearings engaging the under sides of the conductors which serve as a guide for said trolley while in motion.

10. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley constituting an armature for said magnet and a bridge forming an electrical connection between the continuous conductor and the sections of the sectional conductor and being provided with carbon contact-pieces at the points of contact with said conductors.

11. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a carbon bridge forming an electrical connection between the continuous conductor and the sections of the sectional conductor.

12. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet said trolley having an armature of magnetic material for said magnet and a carbon bridge forming an electrical connection between the continuous conductor and the sections of the sectional conductor, said bridge also making sliding bearings for said trolley against said conductors.

13. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said

magnet and a rotating bridge of conducting material forming a sliding electrical connection between the continuous conductor and the sections of the sectional conductor and guiding said trolley while in motion.

14. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a sliding bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor and bearings engaging the conductors which guide said trolley while in motion.

15. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a disk-shaped bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor guiding said trolley while in motion.

16. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a disk-shaped bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor and bearings engaging the conductors which guide said trolley while in motion.

17. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding in the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a plurality of bridges of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor.

18. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having an armature of magnetic material for said magnet and a plurality of bridges of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor and bearings engaging the conductors which serve as a guide for said trolley while in motion.

19. In an electrical railway system, a continuous conductor, a horizontally opposite discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a trolley movable along the line of said conductors under the influence and corresponding to the movement of a car-magnet, said trolley having a laminated armature of magnetic material for said magnet having external poles at either end of the same and a bridge of conducting material forming an electrical connection between the continuous conductor and the sections of the sectional conductor and bearings engaging the conductors which guide said trolley while in motion.

20. In a magnetically-actuated trolley, a series of plates suitably held together and having upwardly-projecting pole-pieces at their extremities, and a contact-bridge supported on said plates.

21. In a magnetically-actuated trolley, a series of plates suitably held together and having upwardly-projecting pole-pieces at their extremities, and a spring-pressed contact-bridge supported on said plates and vertically movable in respect thereto.

22. In a magnetically-actuated trolley, a series of vertically-arranged plates suitably held together and having upwardly-projecting pole-pieces at their extremities, and a contact-bridge supported on said plates, and a spring mounted between said plates and said contact-bridge, whereby said bridge is allowed a limited vertical movement.

23. In a magnetically-actuated trolley, a series of vertically-arranged plates suitably held together and having upwardly-projecting pole-pieces at their extremities, and a disk-shaped bridge supported on said plates, and a spring mounted between said plates and said contact-bridge, whereby said bridge is allowed a limited vertical movement.

24. In a magnetically-actuated trolley, of a magnetic body having an upwardly-projecting pole-piece at each end, and a carbon contact-bridge mounted on said body.

25. In a magnetically-actuated trolley, of a magnetic body having an upwardly-projecting pole-piece at each end, and a spring-pressed carbon contact-bridge mounted upon said body

between said pole-pieces, and a supporting-block under said bridge.

26. In a magnetically-actuated trolley, a discontinuous conductor, each section of which is electrically connected with a corresponding section of a discontinuous feed-rail, a continuous conductor arranged horizontally opposite said discontinuous conductor, a trolley movable along said conductor under the influence of a car-magnet, said trolley having self-lubricating bearings to engage said conductors while in motion.

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