(No Model.) 3 Sheets—Sheet 1.

D. E. JOHNSON.

MEANS FOR THE ELECTRICAL PROPULSION OF VEHICLES.

No. 418,843. Patented Jan. 7, 1890.

Fig. 1.

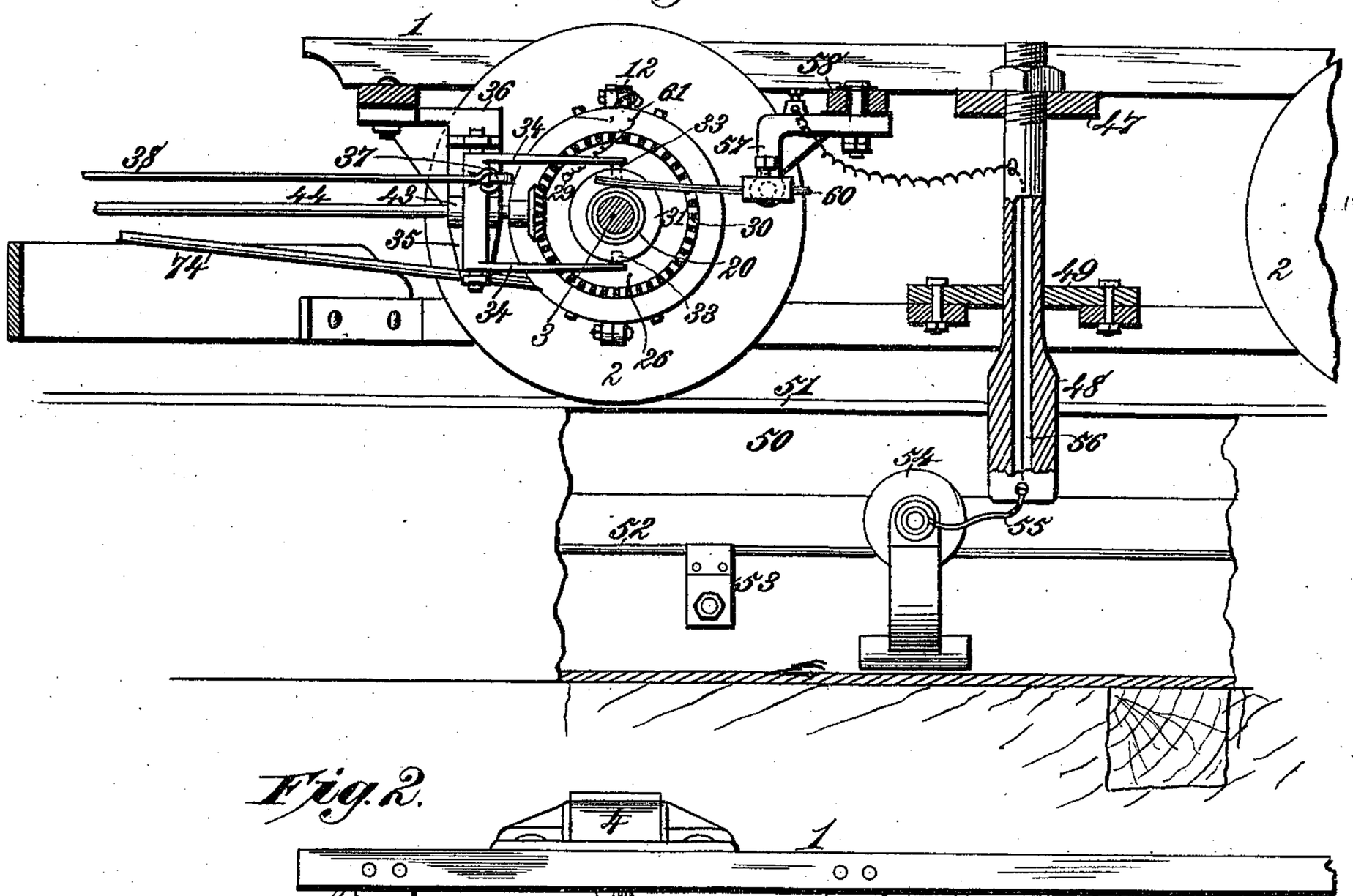
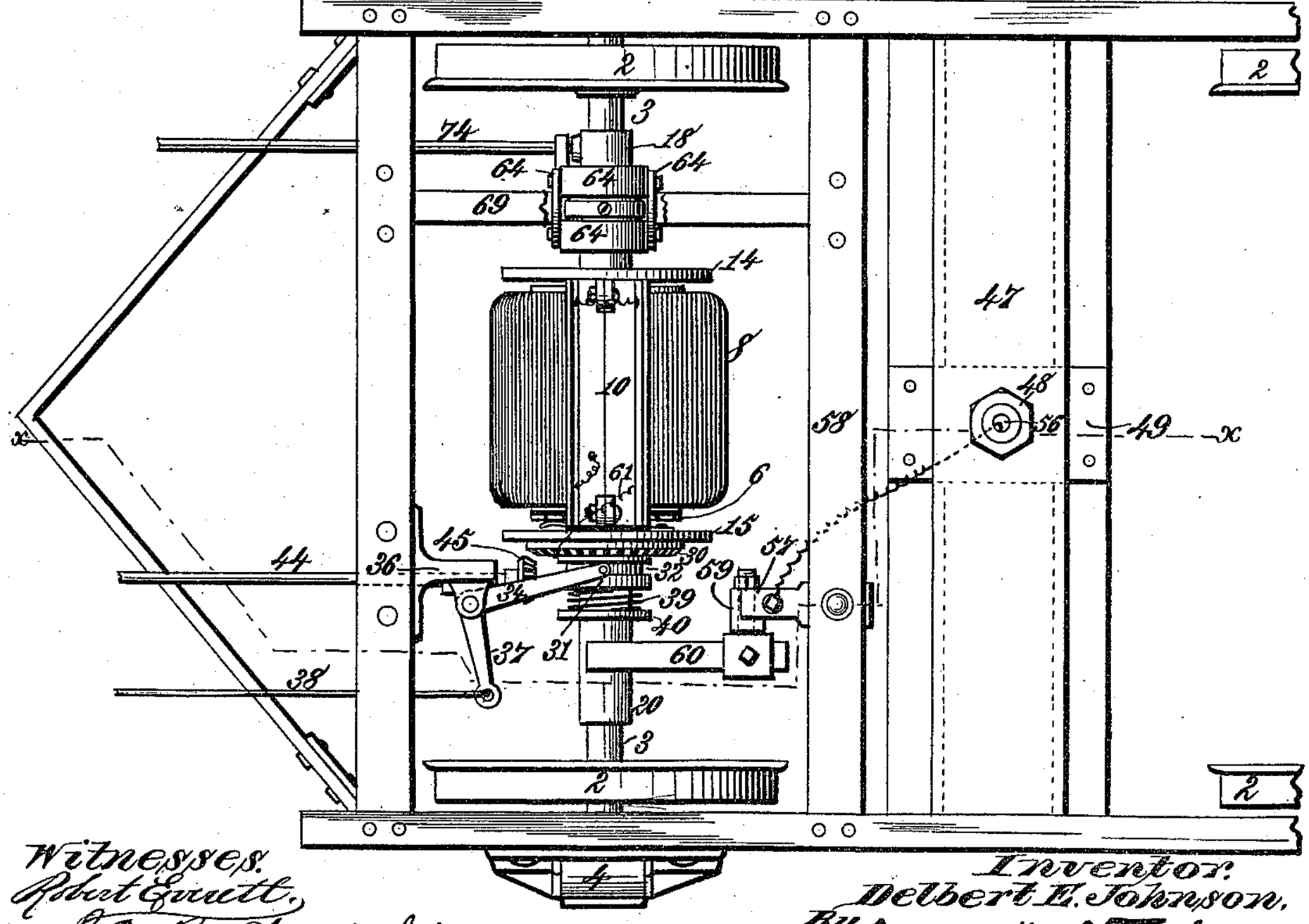


Fig. 2.



Witnesses.
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J. A. Rutherford.

Inventor:
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(No Model.) 3 Sheets—Sheet 2.

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MEANS FOR THE ELECTRICAL PROPULSION OF VEHICLES.

No. 418,843. Patented Jan. 7, 1890.

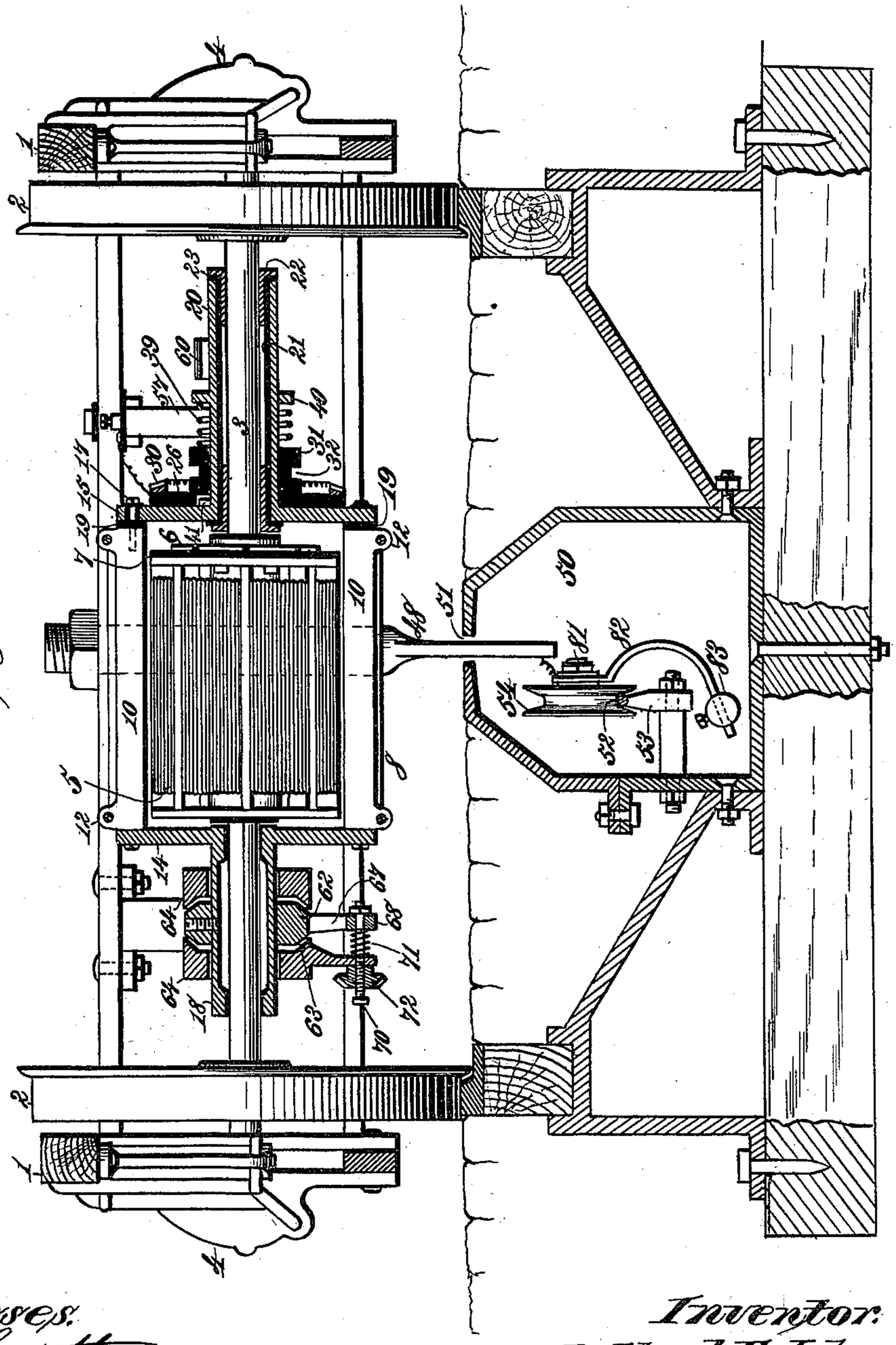

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

D. E. JOHNSON.

MEANS FOR THE ELECTRICAL PROPULSION OF VEHICLES.

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Fig. 4.

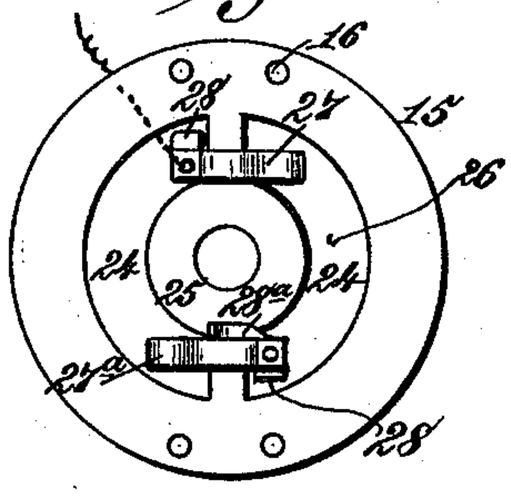


Fig. 5.

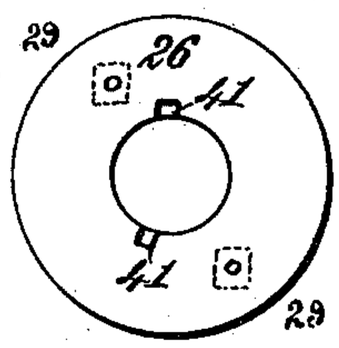


Fig. 6.

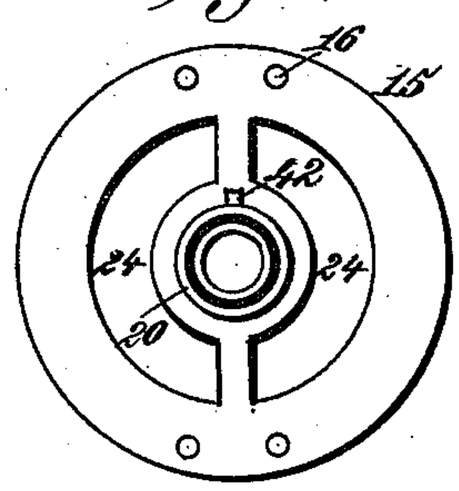


Fig. 7.

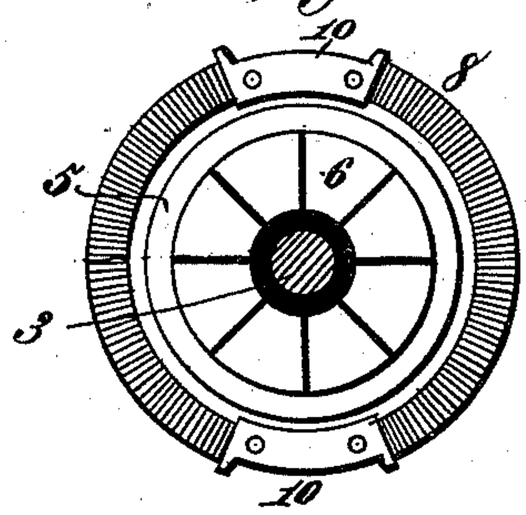


Fig. 8.

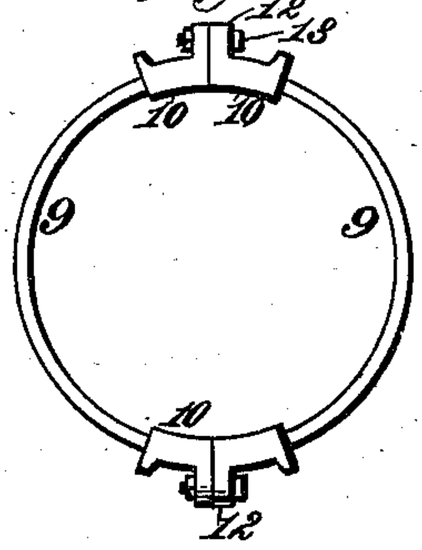


Fig. 11.

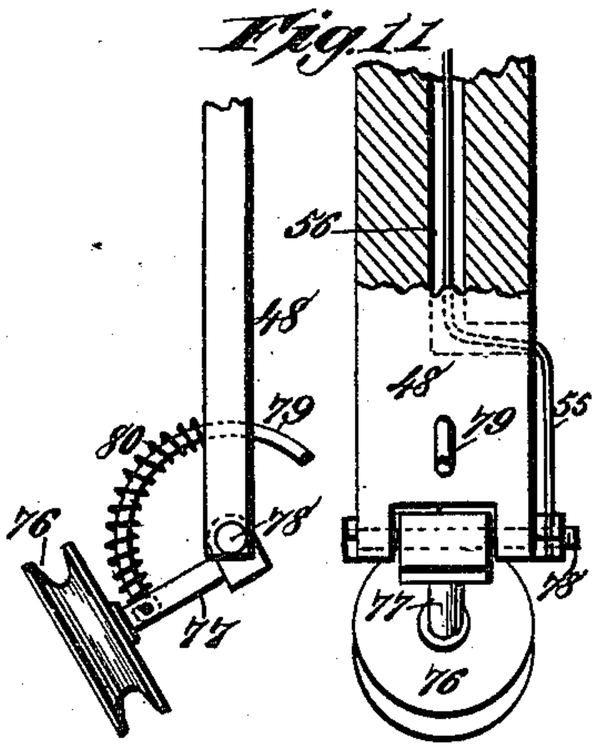


Fig. 9.

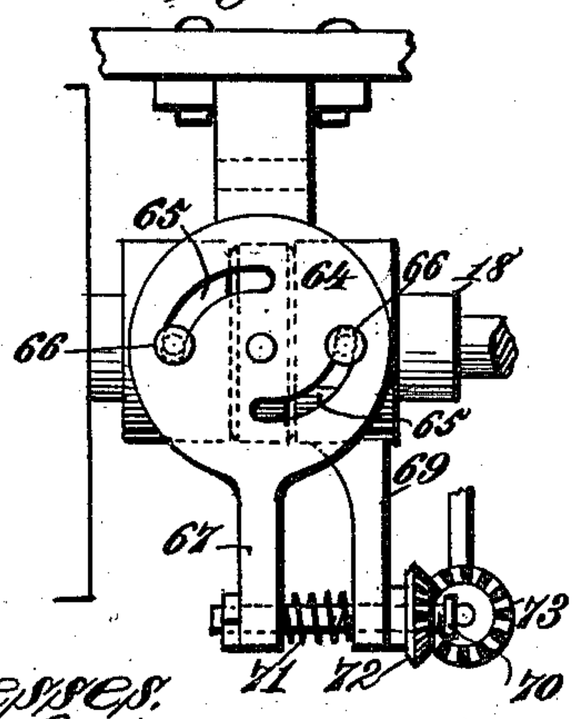
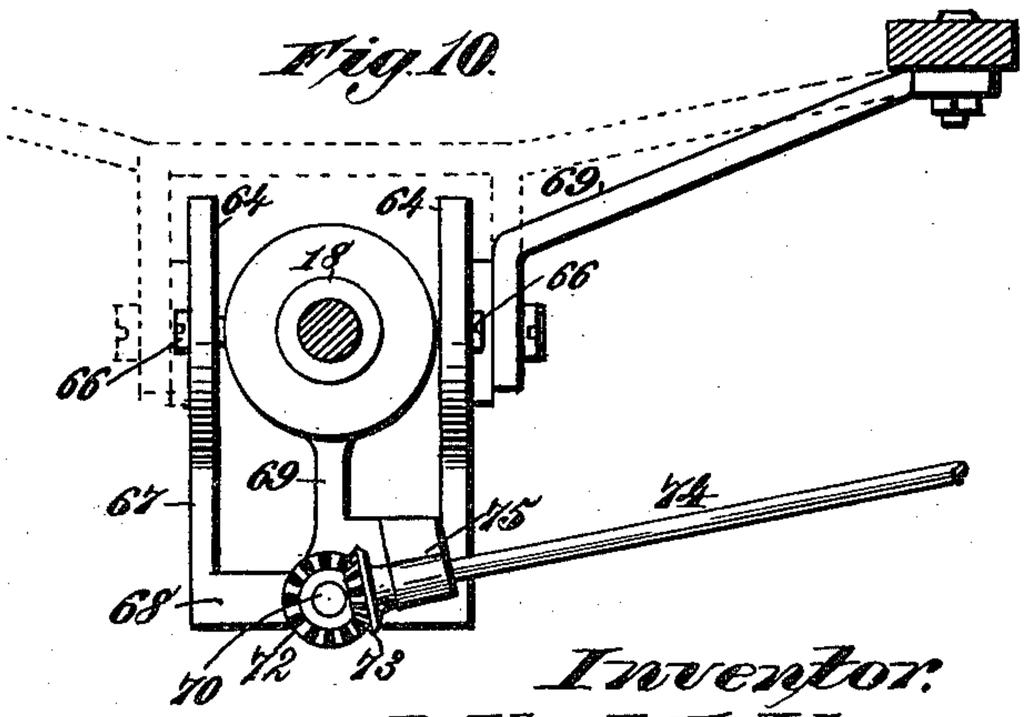


Fig. 10.



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Delbert E. Johnson.
By
James L. Norris.
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UNITED STATES PATENT OFFICE.

DELBERT E. JOHNSON, OF ATLANTA, GEORGIA.

MEANS FOR THE ELECTRICAL PROPULSION OF VEHICLES.

SPECIFICATION forming part of Letters Patent No. 418,843, dated January 7, 1890.

Application filed March 7, 1889. Serial No. 302,305. (No model.)

To all whom it may concern:

Be it known that I, DELBERT E. JOHNSON, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented new and useful Improvements in Means for the Propulsion of Vehicles by Electric Force, of which the following is a specification.

My invention relates to means for the propulsion of railway-cars and other conveyances by electric energy, and the purpose thereof is to so organize the motor and apply it to the running-gear of the car or locomotive that its power shall be communicated directly thereto without the intervention of gearing or other connection, and to provide means whereby the high speed developed by the current may be maintained without imparting too great speed to the movement of the car.

It is my purpose, also, to provide simple means whereby the rapidity of travel of the car or locomotive may be varied to any degree desired without in any measure varying the electro-motive force or cutting off the current, and without employing inserted resistances, multiplying gearing, or other means heretofore used for the purpose.

It is the purpose of my invention, also, to provide an electric motor of this type with suitable means whereby the speed of revolution of the armature and field may be reciprocally varied, to combine therewith a simple and easily-operated reversing device, whereby the current may be caused to travel in the opposite direction and produce rotation in a reverse direction, and to combine with the oppositely-rotating elements novel and simple means whereby any suitable degree of resistance may be applied to the rotation of the field by the operator standing on the deck of the car or locomotive.

It is also the purpose of my invention to provide simple and novel means whereby the current may be taken from an underground wire in such manner that the latter shall be protected from water, ice, and other obstructions, while the contact is retained thereon by gravity, or by gravity and other forces combined, thus dispensing with a positive connection between the same and the contact-arm which penetrates the conduit.

To these several ends my invention consists in the novel features of construction and new combinations of parts hereinafter fully described, and then definitely pointed out in the claims following this specification.

Referring to the accompanying drawings, Figure 1 is a vertical longitudinal section of a portion of a railway-truck, the section-plane being indicated by the line $x\ x$, Fig. 2. Fig. 2 is a plan view of the parts shown in Fig. 1. Fig. 3 is a vertical section upon the plane $y\ y$, Fig. 1. Fig. 4 is an elevation of the interior face of that one of the disks supporting the field-magnet upon which the plate carrying the commutator-brushes is mounted, showing the manner of mounting said brushes. Fig. 5 is a face elevation of the brush-carrying plate detached. Fig. 6 is a transverse section of the shaft or axle, showing the disk of Fig. 4 with the brush-carrying plate removed to illustrate the detent or feather on the hub by which the commutator-brushes are locked in two positions. Fig. 7 is an end elevation of the armature, showing the commutators with the field-magnet in place, the disk supporting the latter being removed and the shaft or axle being in section. Fig. 8 is an elevation of the field-magnet, showing its construction. Fig. 9 is a detail front elevation of the friction clutch or brake by which the rotation of the field-magnet is controlled. Fig. 10 is a detail side elevation of the parts shown in Fig. 9. Fig. 11 is a detail view of a modified construction of contact-wheel, the figure giving two elevations from different points.

In the said drawings, the reference-numeral 1 denotes the ordinary frame-work of a railway-truck, suitable for any form of car, and having any construction that may be preferred, said frame being provided with suitable running-gear consisting of wheels 2, having axles 3, the body of the car or other conveyance being supported by journal-boxes 4. These parts form no portion of my invention, and are only shown so far as is necessary to a complete understanding thereof.

Mounted directly upon one of the axles 3, to which it is rigidly connected, although in-

sulated from electrical contact therewith, is an armature 5, which may be of any known or desired type. A convenient form for the purpose is that illustrated, in which the terminals of the ring-coils are connected to adjacent commutator-plates 6 of segmental shape, mounted upon an insulating-disk 7 at one end of the armature, the opposite terminals of two adjacent coils being connected to each one of the commutator-plates. In its construction, however, the armature as well as other parts of the motor may be widely varied, certain points or features only, which will be specified hereinafter, being essential to the purposes in view.

Surrounding the armature 5 is the field-magnet 8, which is composed of a two-part cylindrical shell 9, of soft iron, divided in a central longitudinal line into two equal parts. Upon the meeting edges of each of these semi-cylindrical portions are division-pieces 10, provided with flanges 12, having apertures which receive bolts 13, uniting the sections. The magnet is wound in any suitable manner, the only condition to be observed being that it shall have perfect equilibrium when mounted upon an axis which is central to the cylinder or shell 9, in order that it shall remain poised at any point in its circle of rotation. The divisional construction shown in Fig. 8 is for the purpose of enabling the field-magnet to be removed readily with the least possible dismemberment of the motor. I may employ the construction shown in Fig. 7, wherein the magnet is not divisional. The field-magnet is supported in position by circular plates 14 and 15, of conducting material, which are provided with apertures 16 near their peripheries to receive screws or bolts 17, which pass into the ends of the division-pieces 10. The plate 14 is provided with a sleeve or hub 18, surrounding the axle or shaft 3 and turning freely thereon, and this plate is in electrical contact with the division-pieces 10 of the magnet. The circular plate 15 is insulated by means of strips or plates 19, of hard rubber, and the attaching screws or bolts are insulated by means of collars of the same material, said collars having flanges which lie between the heads of the screws or bolts and the insulating-plates 19. Upon the plate 15 is formed or mounted a hub or sleeve 20, having an interior lining 21, of insulating material—such as hard rubber—of such diameter as to receive metallic bushings 22. These bushings rest and revolve freely upon the axle or shaft 3, being provided with flanged heads, which are also carefully insulated by collars 23.

The circular plate 15 is provided with two opposite openings 24, extending over about one hundred and eighty degrees of arc, or a little less, and so located that a continuous annulus of metal 25 is left surrounding the axis. Covering these openings is an insulating-plate 26, of circular form, upon the inner face of which, at diametrically-opposite points, are mounted the commutator-brushes 27 and 27^a, consisting of copper plates attached by one end to insulating-blocks 28, their free ends pointing in opposite directions and having a double curve to enable them to move in both directions upon the commutator-plates. One of the brushes 27 is wholly insulated from the circular plate 15; but the other 27^a is provided with a lip or extension 28^a, which is in constant electrical contact with the annulus 25. Upon the outer face of the brush-plate is mounted a binding-post or other fastening 29 for the conducting-wire, which is connected to the brush 27 and to one of the pole-pieces 10 of the field-magnet.

Upon the outer face of the brush-plate 26 is a miter-gear 30, and supporting said plate is a collar 31, having a circumferential slot 32, which receives pins 33, mounted in the end of the branches of a bifurcated lever 34, which is pivoted upon a drop-bearing 35, carried by a bracket 36 on a cross-rail of the truck-frame. The forked lever 34 is provided with an arm 37, by which it may be operated through the medium of a rod, chain, or wire 38. The collar 31, which is movable longitudinally upon the sleeve or hub 20, is normally thrown against the circular plate 15 by a spring 39, coiled upon the sleeve between a collar 40 thereon and the movable collar 31. When resting upon or against the circular plate 15, a notch 41 in the collar carrying the brush-plate engages a detent or lug 42 on the sleeve to prevent circular displacement. When the bifurcated lever 34 is operated to withdraw the brush-plate from the disk 15, the notch in the collar is disengaged from the detent.

Mounted in a suitable bearing 43, which forms part of the drop-bearing 35, is a shaft 44, carrying upon its end a small miter-gear 45, which is normally out of mesh with the miter 30 on the brush-plate when the latter is resting against the disk 15. When the lever 34 is actuated, however, these gears are thrown into engagement, and by rotating the shaft 44 by any suitable means the brush-plate may be rotated through one-half of a revolution, when its notch 41 engages with a second detent 46 on the sleeve 20. By this means the current is reversed and revolution in an opposite direction is imparted.

From a suitable cross beam or strip 47 upon the truck-frame depends a current-plow 48, which may be strengthened or supported by a second and lower brace 49. This arm is of metal and has any suitable construction by which it may penetrate the conduit 50 through a slot 51 in the top plate. Within the conduit is arranged the conductor 52, mounted upon the supports 53. From a traveler or contact-wheel 54, running upon the conductor, the construction of which will be described hereinafter, a wire 55 leads to the current-plow 48, which is provided with a longitudinal opening 56, receiving said wire. From this opening it emerges at the upper portion

of the plow, and is led to a binding-post mounted on a conducting-brush bracket 57, which is insulated upon a support 58. In a pivotally-mounted seat 59 on the conducting-bracket 57 is a brush 60, having electrical contact with the sleeve 20.

The course of the current with the organization described will be as follows: from the conductor 52, by way of the traveler or contact-wheel, through the wire 55, conducting-bracket 57, brush 60, sleeve 20, and annulus 25 on the disk 15, the brush 27^a having a lip in electrical contact with the annulus 25; thence, traversing the ring-coils of the armature 5, it emerges through the brush 27 and passes by way of the wire 61 to the pole-piece of the field-magnet. After traversing the coils of the latter it emerges through the disk 14 and its sleeve and passes by the shortest path to the rails.

Upon hub or sleeve 18, carried by the circular plate 14, is formed or mounted a collar or encircling annulus 62, of any suitable form, a convenient construction being that shown, in which the collar is separately formed and held by a set-screw, its angles being turned off to form two beveling surfaces 63 upon opposite sides of the collar. Upon the sleeve 18, upon each side of the collar 62, are mounted friction-disks 64, within which the sleeve may freely revolve when there is no controlling frictional contact with the collar 62. The faces of these disks adjacent to said collar are cupped or turned out in such manner as to fit upon the beveling surfaces 63 of the collar. Upon opposite sides of the shaft or axle are arranged plates 64, each provided with two spiral slots 65, which engage with pins 66 projecting from the periphery of each friction-disk 62. Upon each plate 64 is formed an arm 67, which drops below the axle, and the ends of these arms are connected rigidly by a cross-brace 68. Both are supported by a bracket 69, bolted to the truck-frame and having one or more drop-plates swiveled to the slot-plates 64. Upon one of the friction-disks is mounted a drop-bearing 69, through the lower end of which passes a screw-threaded shaft 70, having its end swiveled in the center of the cross-brace 68. A strong coiled spring 71 is mounted on the threaded shaft 70 and bears against the cross-brace 68, and on the end of the drop-bearing 69 is mounted a miter-gear 72, with which a second miter 73 meshes, the latter carried by a shaft 74, which catches a bearing in a bracket 75 on the drop-bearing 69. The miter 72 is provided with a female screw-thread which meshes with the thread on the shaft, whereby rotation of the miter will draw the cross-brace toward the drop-bearing, partly rotating the plates 64 and causing their spiral slots to run upon the pins 66 on the friction-disks. This operation causes said friction-disks to closely grip the collar 62, their beveling surfaces giving a powerful friction-clutch upon the beveling faces 63 of the collar. The degree of frictional contact may be rendered sufficient to entirely arrest the revolution of the field-magnet, or it may, on the other hand, be so slight as to offer no impediment to its movement. Between these extremes the adjustment admits of infinite variation.

In taking up the current from the conduit I employ a traveler or contact-wheel 76, having any suitable form, but journaled upon an arm 77, the end of which is pivotally mounted upon an axis 78 on the lower end of the current-plow 48. To this arm 77 is connected a curved brace 79, which is bent in an arc struck from the pivotal axis 78. This brace passes freely through an opening in the current-plow 48, and a spring 80 is coiled upon it between the latter and the arm 77, said spring pushing at both ends and holding the traveler down upon the conductor. The wire 55 may be attached to the axis 78, and thence carried into the longitudinal cavity in the current-plow, or it may be connected in any other suitable manner.

I may dispense with the curved brace and use any form of spring between the arm 77 and the current-plow 48, or I may dispense with the spring as well and depend upon gravity alone to preserve the contact between the traveler and conductor.

In place of the conductor described I may journal the traveler upon an axis 81, projecting from the end of a flat plate 82, which is curved to carry it free from the supports of the conductor, and its end then bent beneath the latter and loaded by a weight 83. This weight, being adjustable, may be placed at such a point with relation to the center of gravity as to preserve the traveler or contact wheel in a perfectly vertical position. The electrical connection between the same and the drop-plate 48 may then be made by means of a simple wire 84.

The operation of the parts described is as follows: The current being switched on, the car being at rest, rotation will be imparted to the field-magnet only, which will revolve at the full speed of the electro-motive force employed. To start the car, the operator, by means of any suitable crank-shaft, imparts rotation to the shaft 74, by which the friction-disks on the sleeve 18 are caused to clutch the collar 62. The frictional contact is applied with increasing force, in order to avoid the tendency to sudden jerks or starts in the movement of the car. By its means the field-magnet is prevented from revolving at full speed, and a corresponding impetus is imparted to the armature upon the axle 3, which is increased in exact proportion to the retarding force applied to the field-magnet. As the armature, if revolving at full speed, would produce far too rapid revolution of the axle and a correspondingly rapid movement of the car, this speed is divided up between said armature and the oppositely-rotating field, the latter by its increasing and dimin-

ishing speed compensating the diminishing and increasing speed of the armature. In this manner and by means of the friction devices and the mechanism for operating the same any desired speed may be imparted to the car. Upon stopping, the friction-disks are wholly released and the brakes are applied in the usual manner. The manner of reversing has already been described.

By the contact-wheel or traveler constructed in the manner hereinbefore described I am not only able to locate the conducting-cable at a point where it is removed from beneath the slot, and thereby avoid the accumulation thereon of water, dust, and various impurities, but I am also able to preserve a constant and positive contact between the conductor and the traveler or contact-wheel, which will not be disturbed by the rise and fall of the car-body, due to the unavoidable inequalities of the road or to the freezing of condensed moisture upon the cable.

It should be noted that, whereas I have described my invention as embodied in certain specific types of mechanism, I do not confine myself to any one of said forms, inasmuch as I may employ any form of motor suitable for the purpose, as well as any construction of friction brake or clutch or reversing mechanism whereby the revolution of the field-magnet may be retarded or arrested or reversed. I may also actuate the motor by a current taken from an overhead wire or from secondary or storage batteries. It should also be noted that although I have shown and described the armature as mounted on the shaft or axle, and the field-magnet as surrounding it and rotating in the opposite direction, I may reverse this arrangement by placing the field-magnet upon the axle and causing the armature to surround it.

Having thus described my invention, what I claim is—

1. In an electric motor, the combination, with a shaft, of an armature rigidly mounted thereon, a field-magnet surrounding said armature and supported by circular plates having sleeves revolving loosely upon the shaft, one of said sleeves being provided with a friction-collar, and a friction-clutch composed of two disks riding on the sleeve on opposite sides of the collar, and means for engaging said disks with and disengaging them from the collar, substantially as described.

2. In an electric motor, the combination, with an armature rigidly mounted upon a shaft or axle, of a field-magnet having substantially cylindrical form and supported by circular plates or disks having sleeves or hubs which rest upon said axle or shaft, one of said disks with its sleeve being wholly insulated from both axle and field-magnet, while the other with its sleeve is in electrical contact with both, and a brush resting upon the hub or sleeve of the insulated disk to supply the current, substantially as described.

3. In an electric motor, the combination, with an armature rigidly mounted upon an axle or shaft, of a field-magnet supported by circular plates or disks, each having a sleeve or hub surrounding and capable of revolving freely upon said axle or shaft, one of said disks with its sleeve being wholly insulated from and the other in electrical contact with said shaft, a brush resting upon the insulated sleeve to supply the current, and a friction-clutch acting upon a collar on the sleeve of the other disk, substantially as described.

4. In an electric motor, the combination, with an armature rigidly mounted upon an axle or shaft, of a field-magnet supported by circular plates or disks which receive screws passing into the projecting ends of the pole-pieces of the magnet, said disks being provided with sleeves surrounding the axle, one of which with its disk is wholly insulated, while the other is in electrical contact with both field and axle, a brush resting upon the insulating-sleeve, an insulating-plate covering slots or openings in the insulating-disk, commutator-brushes mounted upon said plate, one of which brushes is provided with a lip having constant electrical contact with said insulated disk, and means for rotating said plate through a semi-circumference to reverse the current, substantially as described.

5. In an electric motor, the combination, with an armature, of a field-magnet revolving upon supports mounted upon the same axis with the armature, one of said supports being wholly insulated from while the other is in electrical contact with both the magnet and the axis, a brush having electrical contact with the insulated support, an insulating-plate carrying the commutator-brushes, one of which has permanent electrical contact with the insulated support of the field-magnet, and means for shifting the commutator-brushes and for retarding or arresting the revolution of the supports carrying the field-magnet, substantially as described.

6. In an electric motor, the combination, with an armature rigidly mounted upon an axle or shaft, of a field-magnet supported by circular plates or disks having sleeves or hubs which surround said axle, one of said disks with its sleeve being wholly insulated from while the other is in electrical contact with both the field-magnet and the axle, an insulating brush-plate carrying the commutator-brushes, one of which is in permanent electrical contact with the insulated supporting-disk, a collar supporting the brush-plate, a forked lever having pins lying in a circumferential slot in the collar, a miter-gear normally out of mesh with a miter on the outer face of the brush-plate, and means for operating the forked lever to bring said miters into engagement to rotate the brush-plate and reverse the current, the parts being locked in either position by a notch engaging with a detent on the sleeve carrying the collar, substantially as described.

7. In an electric motor, the combination, with an armature rigidly mounted upon an axle or shaft, of a field-magnet carried by circular plates or disks, each having a hub or sleeve capable of revolution upon the axle carrying the armature, a friction clutch or brake composed of two disks riding upon one of said sleeves and embracing or inclosing a collar rigid thereon, plates lying parallel with the axis of said sleeve and having spiral slots receiving pins projecting from the disks, and means operated from the deck of the car or other conveyance for turning said plates upon a central axis, substantially as described.

8. In an electric motor, the combination, with an armature, of a field-magnet mounted on supports capable of rotating freely upon the same axis with the armature, a friction clutch or brake composed of two disks loosely mounted on a hub upon one of said supports and inclosing a collar rigid thereon and having opposite traveling surfaces, plates lying on both sides of said disks and parallel with their axis, said plates having spiral slots receiving pins on said disks, a threaded shaft tapped through an arm depending from one of said disks and having its end swiveled in a cross-brace connecting the slotted plates, a miter-gear meshing with a similar miter-gear on the threaded shaft, a spring coiled on the latter, and means for operating the miter-gears, substantially as described.

9. In an electric motor, the combination, with a current-plow, of a traveler or contact-wheel journaled on an axis pivotally connected to the plow, a curved brace or guide pivoted to the axis and passing loosely through an opening in the plow, and a spring coiled on said brace or guide to throw the traveler downward upon the conductor, substantially as described.

10. In an electric motor, the combination, with an armature mounted directly upon the shaft or axle of a car, of a field-magnet mounted on supports which are capable of free revolution on said axle, one of said supports being wholly insulated from and the other in direct electrical contact with the field on the axle, an insulating brush-plate carrying two commutator-brushes, one wholly insulated and the other in permanent electrical contact with the insulated support, a brush having contact with the latter and connected through the current-plow with the cable, and an electrical connection between the insulated brush and the field-magnet, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

DELBERT E. JOHNSON.

Witnesses:
GEO. W. REA,
JAMES A. RUTHERFORD.