(No Model.) 3 Sheets—Sheet 1.

C. J. VAN DEPOELE.

ELECTRIC RAILWAY MOTOR CAR.

No. 422,266. Patented Feb. 25, 1890.

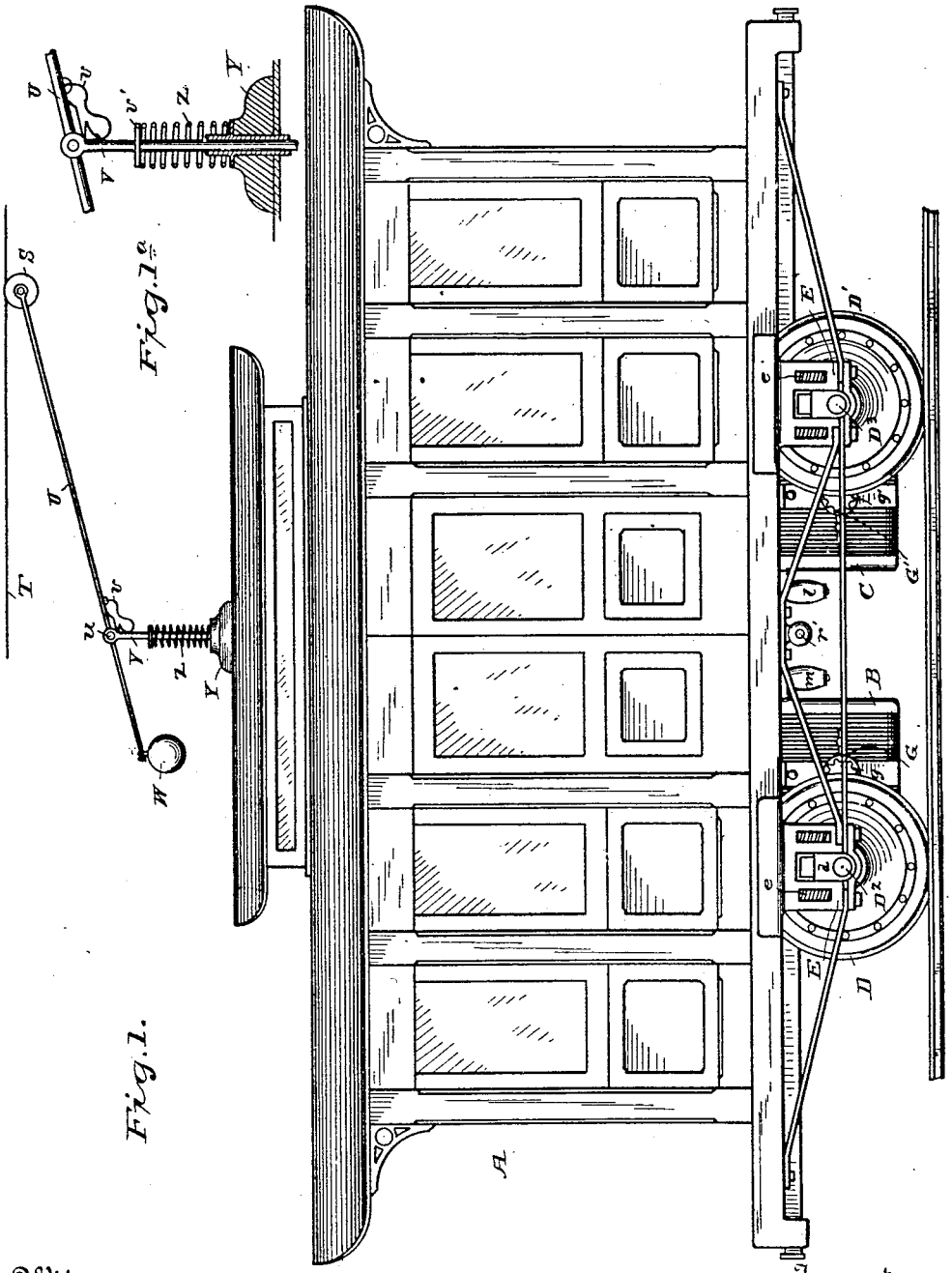

Fig. 1.

Fig. 2.

Witnesses
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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

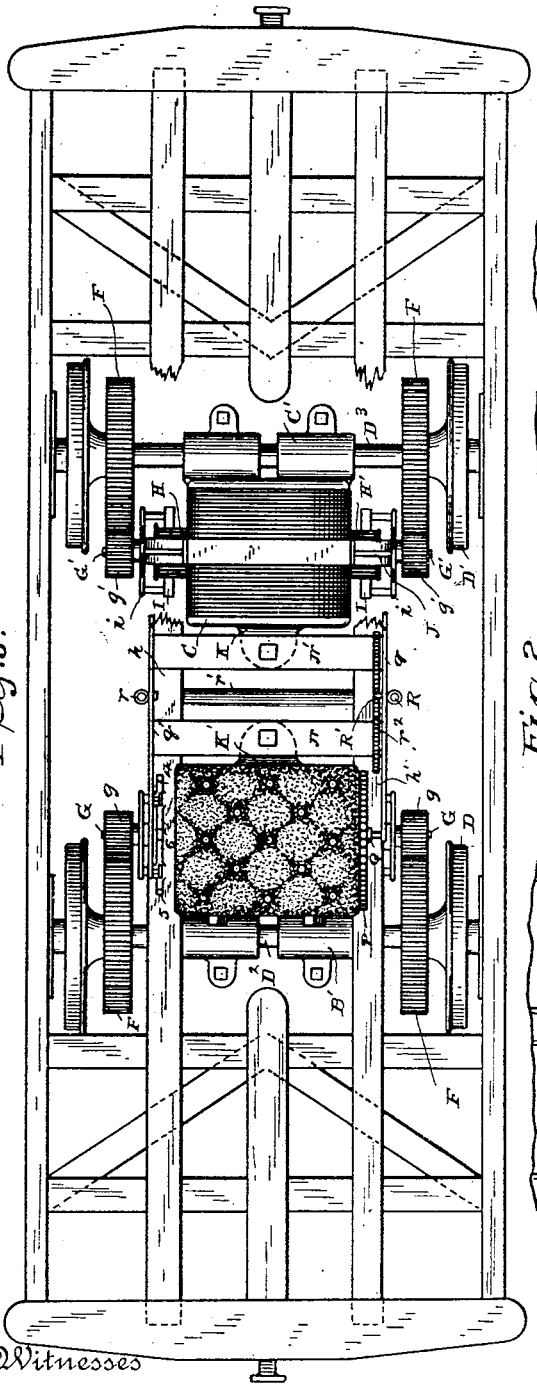
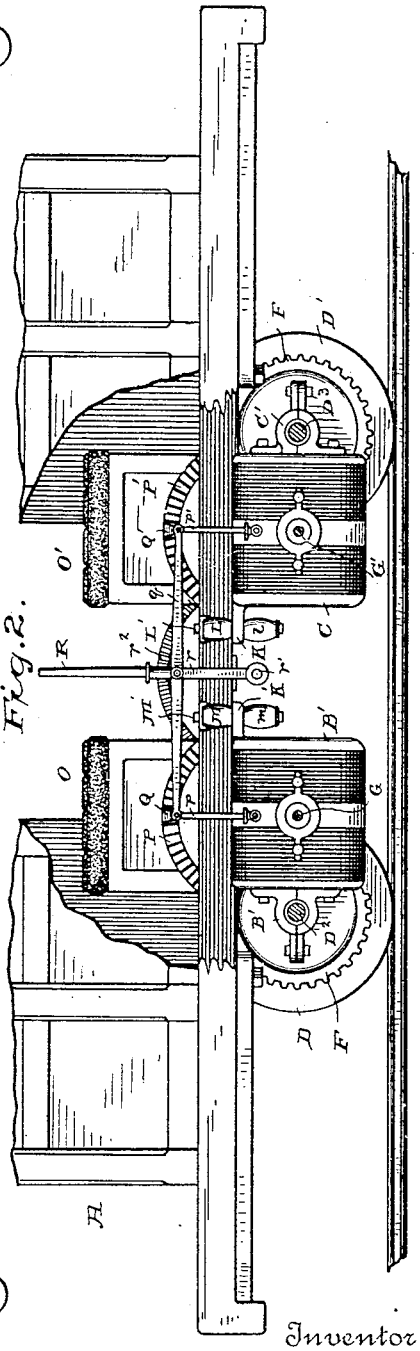


Fig. 2.



Witnesses

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Inventor

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(No Model.)

3 Sheets—Sheet 3.

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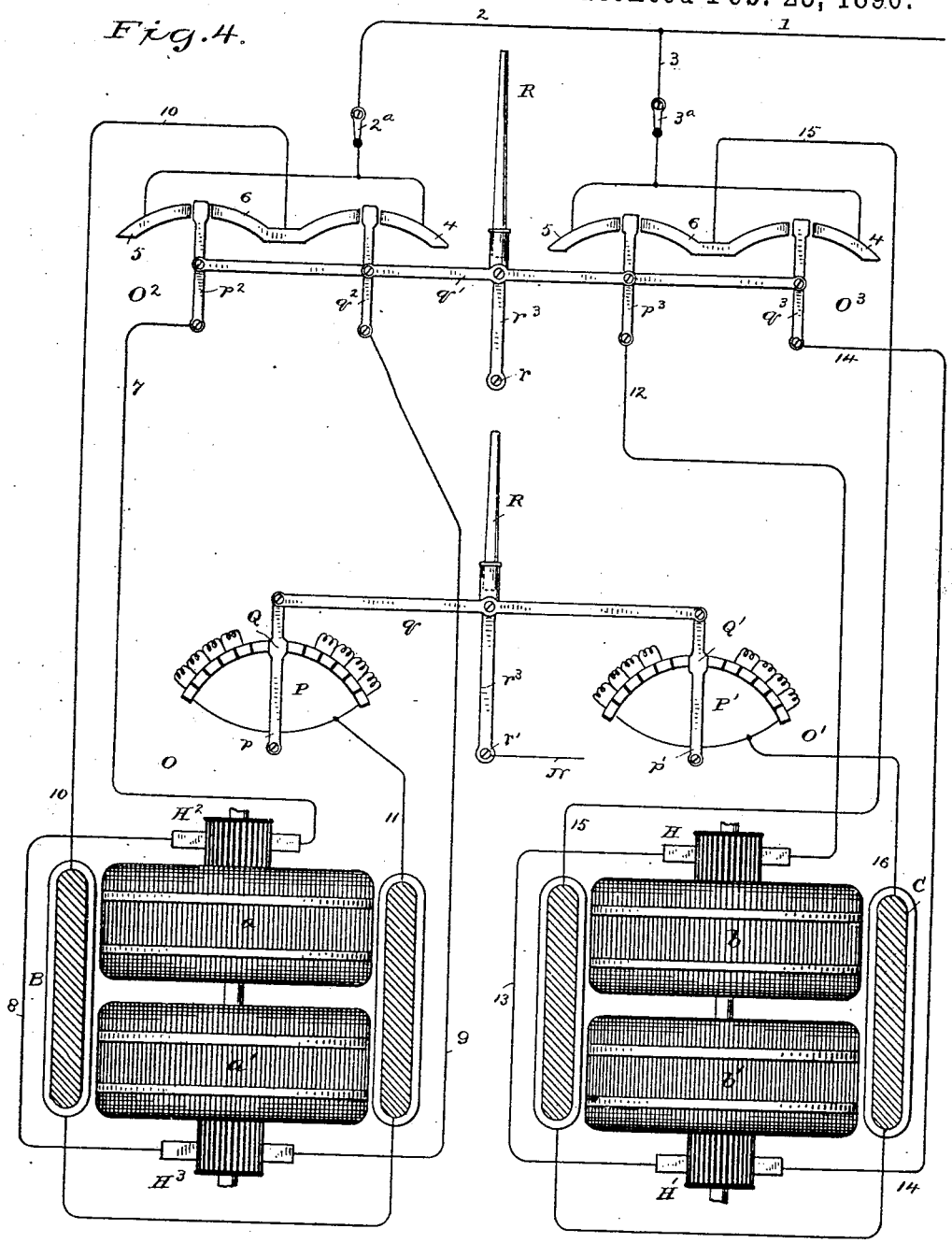
Fig. 4.



Witnesses
H. A. Lamb
C. L. Stutevant.

Inventor
Charles J. VanDepoele
By his Attorney
Frankland Jarman.

UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN, MASSACHUSETTS.

ELECTRIC-RAILWAY MOTOR-CAR.

SPECIFICATION forming part of Letters Patent No. 422,266, dated February 25, 1890.

Application filed December 27, 1889. Serial No. 335 132. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Electric-Railway Motor-Cars, of which the following is a description, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

My invention relates to electric railways and to means and mechanism for propelling vehicles therealong, and particularly to an arrangement and organization of a motor-car designed to act and to be employed as a locomotive-engine in drawing trains along the line of way.

The invention is also intended to be applied upon single passenger-cars, which may or may not be employed in connection with tow-cars, the propelling apparatus being capable of such disposition as to leave room for passengers or freight.

The most important features of the invention relate to the application of electrically-developed motive power to the propulsion of the vehicle, incident to which is the disposition of the parts to secure the greatest mechanical advantages, and also the utmost facility and convenience in the matter of regulating and controlling the movements and speed of the car.

A structure embodying my invention and illustrating the principles thereof is shown in the accompanying drawings, and will be hereinafter fully described, and referred to in the appended claims.

In the drawings, Figure 1 is a view in elevation, showing a motor-car to which my invention has been applied. Fig. 1ª is a sectional view of the mechanism for supporting the contact-arm. Fig. 2 is also a view in elevation, but is partly broken away to show a complete side elevation of the propelling mechanism. Fig. 3 is a plan view of the frame of a car with portions thereof broken away in order to more clearly illustrate the propelling mechanism, one of the resistance-boxes being also removed to fully expose the motors. Fig. 4 is a diagrammatic view showing the motor-controlling circuits and operating mechanism.

As seen more clearly in Fig. 2, the car A is propelled by two electric motors B C, geared to the driving-wheels D D′ and flexibly sustained with respect thereto and to the body of the car. The wheels D D′ may be of the ordinary well-known construction, and their axles D^2 D^3 are mounted in boxes *d*, sustained in pedestals E, within which are arranged vertically-acting springs *e*, which, being thus interposed between the axle-boxes and the body of the car, constitute spring-supports for the latter. Driving-gears F are placed upon and secured to the axles D^2 D^3. The motors B C are provided at their rear ends with strong divisible and removable extensions B′ C′, preferably of brass or other diamagnetic metal, and the said extensions B′ C′, being suitably lined, are mounted upon the respective axles and constitute sleeve-bearings, by which the rear ends of the motors are sustained upon the axle which each is to drive, and their front ends are radially movable with respect thereto. The armature-shafts G G′ of the said motors are provided with driving-pinions *g g′*, arranged in mesh with the driving-gear F. The driving-gears F are made as large as possible with respect to the size of the carrying-wheels and the armature-pinions *g g′* as small as may be with due respect to wear and tear. The smaller the pinions *g g′* the faster may the armatures of the motors rotate, the power exerted upon the wheels of the car being of course in direct proportion to the armature speed and the torque thereof. As shown, each armature-shaft is provided with a driving-pinion at each end, although, of course, a single driving connection might be employed with a suitable support at the other end of the armature-shaft. Commutators and commutator brushes are provided for each armature.

In the form of motor here shown, and which is of the type of machine seen in my patents, Nos. 275,549, April 10, 1883, and 304,378, September 2, 1884, instead of a single armature, I divide the same, putting two armatures on each shaft, as indicated in Fig. 4. This is not essential, but has the advantage of dividing the potential and reducing the danger to the insulation.

Two commutators H H′ H^2 H^3 are provided upon each armature-shaft, one for each arma-

ture, and each commutator is provided with a pair of brushes I. The brushes I are sustained in position by frames *i*, adjustably supported upon the yokes J.

The extremities of the armature-shaft G G′ are braced and sustained by strong diamagnetic metallic yokes J, which are secured to the field-magnets of the motors.

From the foregoing it will be understood that each motor is rigidly mounted at one of its ends upon the car-axle and that their rotating parts are geared to their respective axles in a manner permitting radial movement of the free ends thereof; also, that the armature-shafts are securely sustained at each end by suitable bearings carried by yokes J, connected with the metallic parts of the field-magnets of the motor, so that the parts are all self-contained and securely connected.

In order to prevent injurious effects upon the gearing from the starting and stopping of the motors and from the jarring incident to the movements of the vehicle, the front or free ends of the said motors are flexibly connected with the under side of the car-body, so that not only do the said motors move radially with the spring action of the car, but they may have some independent radial movement of their own.

The front ends of the motors are provided with projections K K′. These projections are strong metallic lugs, which may be formed upon or attached to the free extremities of the motors. The said projections K K′ are arranged between buffer-springs L *l* M *m*, and the said springs are sustained upon vertical bolts or rods L′ M′. The vertical bolts L′ M′ are secured to strong transverse supports N N′, which may be in the form of channel-iron, as indicated. The bars N N′ are secured to two of the strong longitudinal frame-pieces *h h*′ of the bed of the car. The projections K K′ of the motors are capable of moving freely upon the vertical supports L′ M′, and they will move thereon as the upper or lower springs are compressed. Obviously in starting the motors the torque of the armature will cause the free ends of the motors to move radially up or down, according to the direction, which movement will be cushioned by one or other of the springs between which the projections K K′ are sustained. In stopping the motors the momentum of the armature will cause the motors to strain radially in the other direction, thereby compressing the opposite set of buffer-springs. The spring movements just referred to will of course diminish the excessive pressures between the pinions and driving-gears, thereby preventing damage from sudden excessive strain—such, for example, as stripping the teeth from the pinions.

The motors B C may be of any desired or preferred type designed for operation on a multiple-arc circuit, and they may of course be supplied with current from a circuit arranged in any convenient manner or position with respect to the railway. I have, however, shown an upward-pressure overhead traveling-contact arrangement.

Each motor is provided with an adjustable resistance capable of being introduced to a greater or less extent in the working-circuits of the motors. The commutator-brushes of the said motors are preferably operated in fixed positions and the forward or backward movement of the motors controlled by reversing-switches which are arranged to be operated in connection with the resistances, as will appear. The adjustable resistances may be of any ordinary type and are disposed in any convenient manner in the boxes O O′, which I have arranged directly above the motors, where they will act as seats for the driver in whichever direction the car is moving. They will also be as near the motor as possible.

The reversing-switches are indicated at O^2 O^3, and are so placed that they may be controlled by the resistance-operating mechanism. Another object in so arranging the parts is, that I am thereby enabled to operate ooth sets of resistances simultaneously, and also both of the reversing-switches, whereby a simple means is provided for governing all the movements of the locomotive.

Upon the exterior of each of the boxes O O′ is arranged a curved series of insulated terminals P P, representing the subdivisions of the resistances, and upon each motor is pivotally secured a lever *p p*′, carrying at its outer extremity a contact Q Q′, adapted to engage the terminals of the said resistances. The switch-levers *p p*′ are connected by a transverse bar *q*, which is connected to a hand-lever R, also pivotally sustained. The said hand-lever is arranged in convenient position between and connected to the bar *q*, whereby the operator can, when seated upon either of the resistance-boxes O O′, move both switch-levers and so regulate and control the movements of the motors simultaneously and as desired.

The motor-car is designed to run in either direction with equal facility, and the resistance-boxes O O′ form convenient seats for the motor-man in whichever direction the car is moving. The hand-lever R is removably connected to a short pivoted arm *r*, which might be separately mounted, but which, as here shown, is sustained upon a rock-shaft *r*′. The rock-shaft *r*′ and the bearings of the switch-levers *p p*′ should, of course, be in the same plane, in order that the parts may all move together. The upper part of the arm *r* is provided with some form of spring-detent or a friction device R′, which engages the notched surface of a sector r^2, which, in connection with a detent R′, operates to hold the switch-levers in any position to which they may be moved through the operation of the lever R. The rock-shaft *r*′ extends transversely of the bed of the car to a point on the

opposite side of the main supporting-sill $h\,h'$, and is there provided with an upwardly-extending portion r^3, having a socket to receive the hand-lever R, which may, therefore, be placed upon either side of the car to suit the convenience of the operator.

Reversing-switches $O^2\,O^3$ are provided, one for each motor, and said switches are for convenience located near and may be secured upon the exterior of the resistance-boxes O O' at the sides opposite to those upon which the terminals P P' are disposed. The said reversing-switches $O^2\,O^3$ are provided with movable levers $p^2\,q^2\,p^3\,q^3$; and said double set of levers are connected, respectively, by insulating-links $O^4\,O^5$, said links being connected by a transverse bar q', which is pivotally jointed to the arm r^2 upon the rock-shaft r'. The levers $p^2\,q^2\,p^3\,q^3$ are pivoted in substantially the same plane as are the levers $p\,p'$, and being actuated by a transverse connecting-rod q', connected with the bar q through the rock-shaft r', the resistance and reversing switches will be moved simultaneously and to the same extent.

In Fig. 4 I have shown the circuits and connections between the motors, the resistances, and the reversing-switches. It will be noted that when no current is flowing through the motor-circuits the switch-levers are in vertical position, which therefore represents zero. The switch-levers, being all connected to the rock-shaft r', are arranged to be actuated by the hand-lever R, and to be moved thereby either forward or backward, as desired. The circuits and connections are such that as the hand-lever is moved forward to the first forward division of the terminals P P' the motor-circuits will be closed and the motors caused to rotate in a direction to move the car forward, and the extent of the terminal surfaces of the resistance-switches is such that they may be moved forward until the last terminal of th resistance has been reached, at which point all the resistance will be cut out and the full current be permitted to pass through the motors. When it is desired to stop the motors, the lever R is brought again to a vertical position, when the switch-levers are all at zero and the current is completely cut off. A rearward movement of the lever R will produce corresponding but opposite results.

As indicated in the diagram, two motors are arranged and connected by means of the switches $O^2\,O^3$ to be operated in multiple arc, although I could readily arrange them to be operated in series with each other, if desired, and it must be understood that, although I have shown resistances in circuit with the field-magnets of the said motors, I might substitute therefor the construction shown in my patents, Nos. 394,035 and 394,036, of December 4, 1888, or No. 347,902, August 24, 1886, or in No. 304,324, of May 28, 1889.

The circuits as shown are as follows: The supply-current entering through conductor 1 divides and passes through conductors 2 3 to the contact-surfaces 4 4 5 5 of the reversing-switches $O^2\,O^3$. The conductors 2 3 should each be provided with manual switches $2^a\,3^a$, as indicated, so that either of the motors may be cut out, if desired. The contact-surfaces 4 4 5 5 represent the same polarity and are, as indicated, placed at the extremities of the switches. The central portions of the switches are occupied by contact-surfaces 6 6. The contacts 4 4 5 5 6 6 are arranged to form a pair of double segments, and the levers $p^2\,q^2$ are pivoted so that they may be rocked forward or backward upon the contact-surfaces of the switch O^2, the levers $p^3\,q^3$ being similarly disposed with respect to the contact-surface of the switch O^3.

As indicated, the contacts 4 4 5 5 represent one side of the motor circuit or circuits and the contacts 6 6 the other. The levers $p^2\,q^2\,p^3\,q^3$ are shown in their zero positions—that is, between the extremities of the several contact-surfaces and out of contact therewith. When the said levers are moved in the direction of the arrow, the levers $p^2\,p^3$ will receive the supply-current and the levers $q^2\,q^3$, engaging the contact-surfaces 6 6, will represent the other side of the circuit and the motors will rotate in one direction. When the switch-levers are moved in the opposite direction, the switch-levers $q^2\,q^3$ will receive the supply-current and the levers $p^2\,p^3$ engage the surfaces 6 6. With a proper disposition of the local circuits of the motors this will result in reversing the direction of rotation of the armatures thereof. As previously described, the switches $O^2\,O^3$ and the resistance-terminals P P' are all so arranged with respect to each other that they will reach their zero-points simultaneously, and may be operated either forward or backward therefrom in unison. As seen in full lines, the switch-levers are all at zero. Movement in the direction of the arrow will place them in positions indicated in dotted lines. Under these circumstances the circuits will be as follows: from positive switch-lever p^2 by conductor 7 to commutator H^2 of armature a, thence by conductor 8 to commutator H^3 of armature a', thence by conductor 9 to switch-lever q^2, thence through contact-surface 6 and conductor 10 to the field-magnet coils of the said motor B, and thence by conductor 11 to the coils of the rheostat O, issuing thence by contact Q and lever q to the negative conductor N. Current entering through switch-lever p^3 passes through conductor 12 into armature B by commutator H, thence by conductor 13 to commutator H' through armature b', thence by conductor 14 to switch-lever q^3, thence through contact-surface 6 by conductor 15 to the field-magnet coils of the motor C, and thence by conductor 16 to the rheostat O', and to the return-conductor through the contact Q and the levers $q\,q$.

Any form or construction of apparatus embodying the features of that just described

may of course be employed, the same being shown diagrammatically by way of illustration only. It will also be understood that I may substitute for the rheostats O O' the combination of rheostat and rheostatic coils shown in my patent, No. 394,035. Furthermore, the resistance, *per se*, may be dispensed with entirely, as pointed out in my patent, No. 347,902. Instead of the double armatures above referred to, a single double-wound armature provided with two commutators might, of course, be employed without in any way departing from the invention, as also might single-circuit armatures.

As previously suggested, the supply-current may be collected and delivered to the motor-circuits by any desired form of contact device, which may be arranged in a conduit or overhead, as preferred. I have, however, in connection herewith shown an upward-pressure contact device carrying at its extremity a grooved metallic wheel S, which engages and makes traveling contact with a suspended electric conductor T. The contact S is carried at the outer extremity of an arm U, which is hinged to a vertical standard V, and upwardly spring-pressed by any suitable form of spring—such, for example, as the spring *v*, which is connected to the arm U and to the standard V. The action of the spring *v* may be assisted by a counter-weight W at or near the lower extremity of the arm U. The vertical standard V is mounted in a strong base-piece Y, suitably secured to the top of the car and desirably insulated therefrom. The base Y is preferably of metal, and is provided with a vertical opening, within which the standard V may move vertically, and also be free to rotate upon a vertical axis. The standard V is made of any desired length to permit vertical adjustment in accordance with the undulations of the suspended conductor *r*. A suitable collar *v'* is secured near the upper portion of the standard V, and between said collar and the top part of the base Y is placed a strong coiled spring Z. The spring Z, being exterior to the standard V and acting against the under side of the collar *v'*, serves to force the standard upward, holding it at a height above the top of the car, depending upon the strength and length of the said spring Z and the weight of the parts sustained thereby. The contact device just described is therefore capable of a walking-beam movement of the arm U upon its hinge *u*, giving it a considerable range of vertical adjustment from that point alone, while in passing unusually low places in the conductor the entire contact device would be depressed toward the top of the car by the downward movement of the standard V through compression of the spring Z. The arm U, being thus hinged upon the transverse axis and pivoted to swing freely about a vertical axis, is capable of the utmost freedom of movement, and may readily be turned toward either end of the car according to the desired direction of movement thereof.

It will be understood that many minor modifications and changes may be made in the hereinbefore-described apparatus without departing from the invention, and I therefore do not limit myself to the exact details, many of them being particularly described by way of illustration only.

This application being a division of the one hereinbefore referred to, it will be understood that the matters herein shown and described but not claimed are not abandoned to the public, but continue to form the subject-matter of claims which are still in the parent case.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motor-car, the combination, with two or more motors arranged to propel the same, of adjustable resistances in circuit with the armature or armatures of the motors, and means, substantially as described, for operating all the said resistances simultaneously.

2. In a motor-car, the combination, with two or more motors arranged to propel the same, of adjustable resistances in circuit with the armature or armatures of the motors, and means, substantially as described, for operating all of said resistances simultaneously and from a single point.

3. In a motor-car, the combination of two or more motors arranged to propel the same, adjustable resistances and reversing-switches for each motor, and means for operating all the resistances and reversing-switches simultaneously.

4. In a motor-car, the combination, with two or more motors arranged to propel the same, of adjustable resistances and reversing-switches for each motor, and means for operating all the resistances and reversing-switch simultaneously and from a single point.

5. In a motor-car, the combination, with a motor sleeved at one end upon each of the driving-axles thereof, of spring-supports for the free ends of said motors, said supports connected to the frame of the car-body, geared connections between the armature-shaft of said motors and the axles to be driven, a resistance-box and reversing-switch for each motor, both arranged to be operated by a single lever, and mechanical connections between said switch-levers, whereby they may be operated in unison and from a single point.

6. In an electric-railway motor-car, the combination, with two or more motors arranged to propel the same, of adjustable resistances for each motor, reversing-switches, also for each motor, switch-levers arranged to engage the successive terminals of the resistances and switch-levers adapted for operating the reversing-switches, a connecting-piece uniting the switch-levers, and a hand-lever attached.

to the connecting-piece, whereby all the switch-levers may be operated simultaneously.

7. In a motor-car, the combination of two or more motors arranged to propel the same, an adjustable resistance for each motor, a reversing-switch, also for each motor, switch-levers for the resistances and for the reversing-switches, said switching-levers being adapted to be moved forward or backward and to be neutral when in mid-throw, a hand-lever, and connections therefrom extending between the switch-levers, whereby the same may be moved forward or backward simultaneously and as desired.

8. The combination, with two or more electro-dynamic motors, of adjustable resistances and reversing-switches for each motor, and mechanical connections for operating all the switching-levers simultaneously, the said switch-levers being in neutral positions when in mid-throw, and the parts being so arranged, respectively, that the switching-levers when moved in one direction will gradually cut out the resistances, and vice versa for reversing.

9. A contact device for motor-cars, comprising an upwardly-spring-pressed contact-carrying arm provided with a contact device at its free end hinged upon a transverse axis upon a rotatable vertically-moving standard, and a spring supporting said standard.

10. An upward-pressure contact for motor-cars, comprising a contact-carrying arm hinged transversely upon a vertical axis and arranged to swing freely upon said vertical axis, and automatic means for vertically adjusting the support of the contact-carrying arm.

11. A contact device for motor-cars, comprising a contact-carrying arm provided with a contact device at its free end and hinged upon a transverse axis, and provided with a spring near its lower extremity for imparting an upward pressure to its free end and a counter-weight coacting with the tension-spring.

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

CHARLES J. VAN DEPOELE.

Witnesses:
JOHN W. GIBBONEY
B. L. KILGOUR.

Correction in Letters Patent No. 422,266.

It is hereby certified that in Letters Patent No. 422,266, granted February 25, 1890, upon the application of Charles J. Van Depoele, of Lynn, Massachusetts, for an improvement in "Electric-Railway Motor-Cars," an error appears in the printed specification requiring the following correction, to wit: After line 10, page 1, the following paragraph should be inserted: *This application is a division of my prior application, serial No. 325,268, filed September 27, 1889;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 4th day of March, A. D. 1890.

[SEAL.]

CYRUS BUSSEY,
Assistant Secretary of the Interior.

Countersigned.

C. E. MITCHELL,
Commissioner of Patents.

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[SEAL.]

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Assistant Secretary of the Interior.

Countersigned.

C. E. MITCHELL,
Commissioner of Patents.