(No Model.) 4 Sheets—Sheet 1.

R. M. HUNTER.

ELECTRIC RAILWAY.

No. 566,984. Patented Sept. 1, 1896.

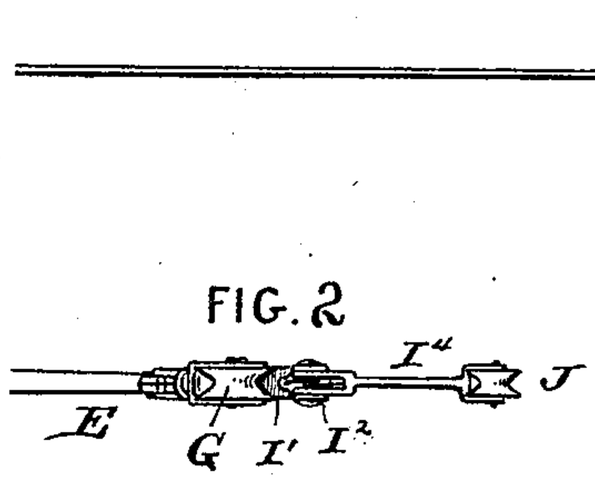

FIG. 2

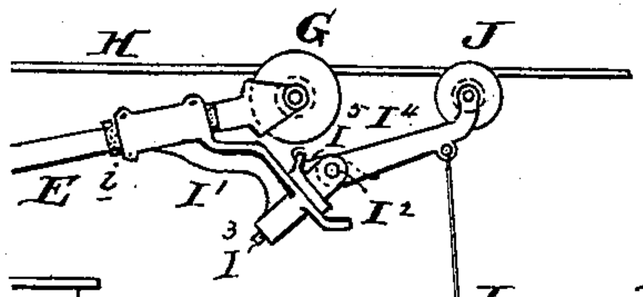

FIG. 3

FIG. 1

(No Model.) 4 Sheets—Sheet 2.

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ELECTRIC RAILWAY.

No. 566,984. Patented Sept. 1, 1896.

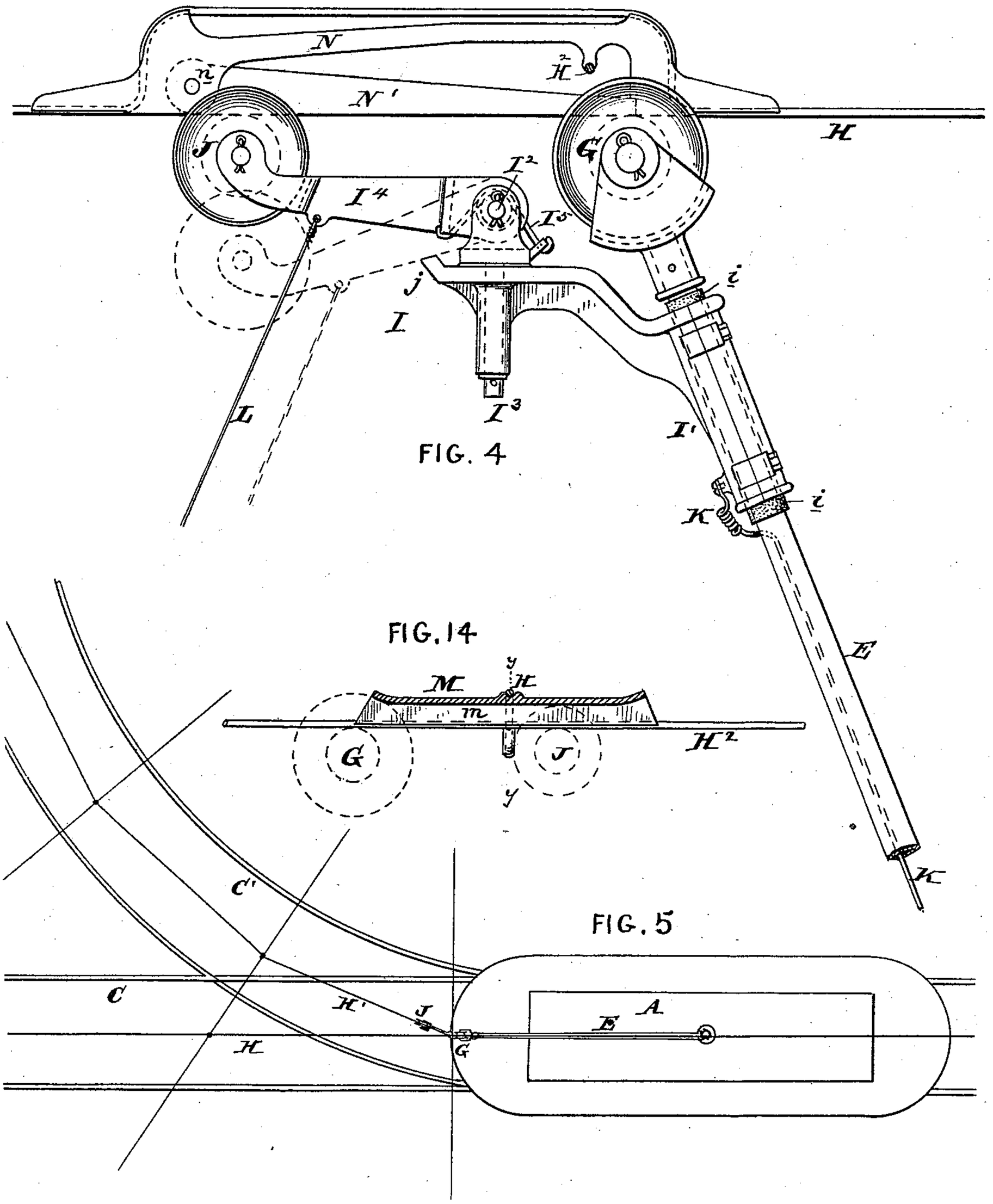

FIG. 4

FIG. 14

FIG. 5

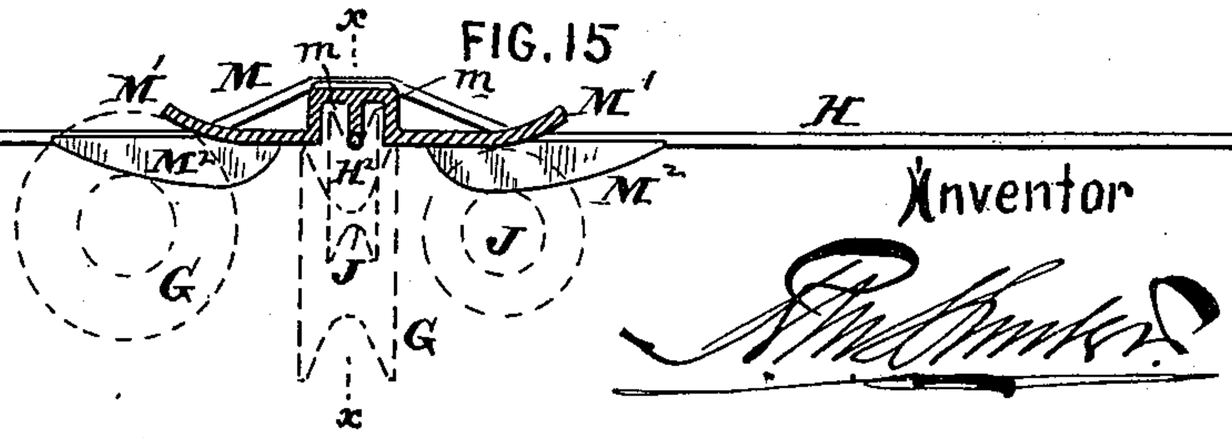

FIG. 15

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Wm. L. Evans
R. M. Kelly.

Inventor
R. M. Hunter

(No Model.) 4 Sheets—Sheet 3.

R. M. HUNTER.

ELECTRIC RAILWAY.

No. 566,984. Patented Sept. 1, 1896.

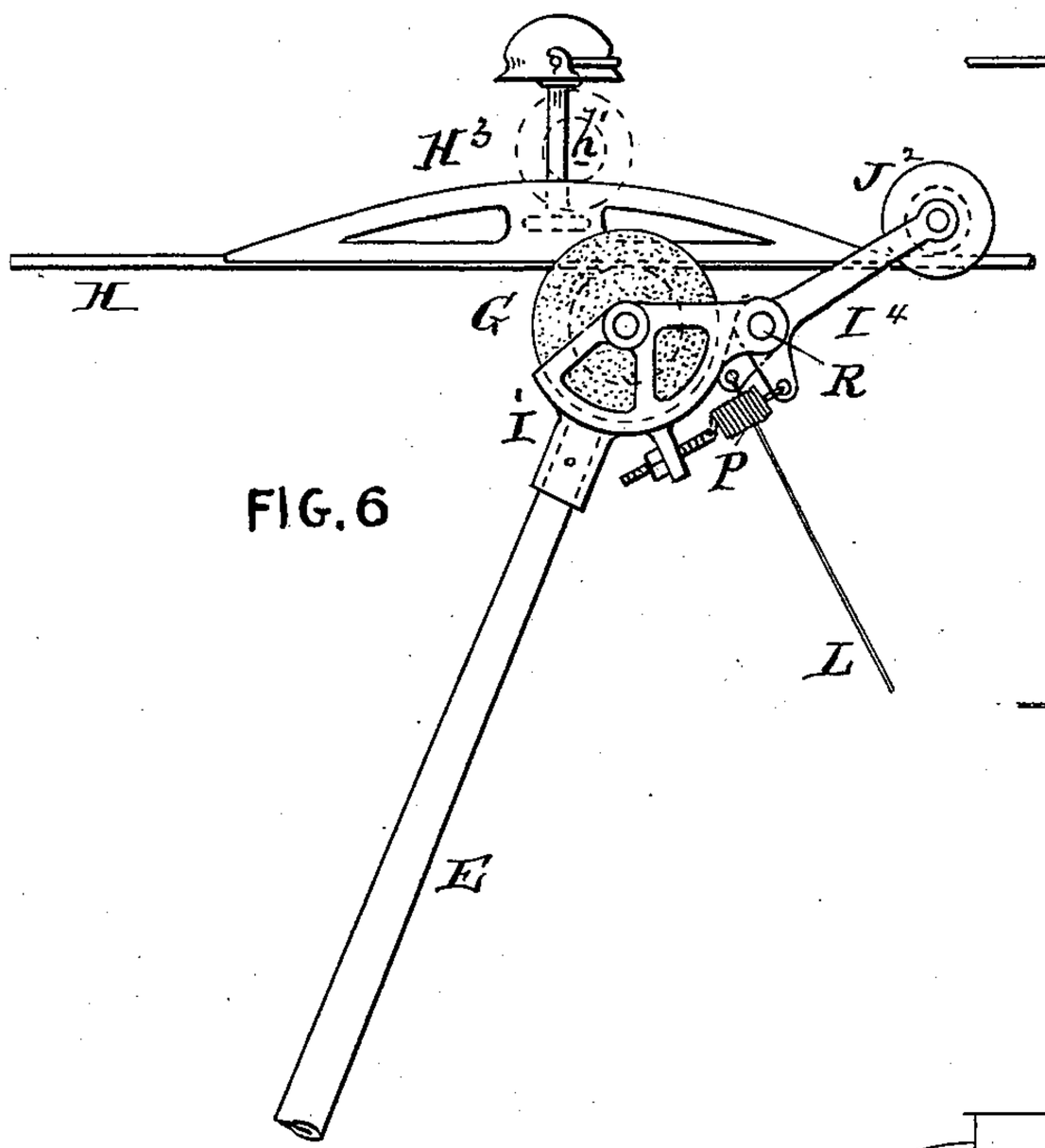

FIG. 6

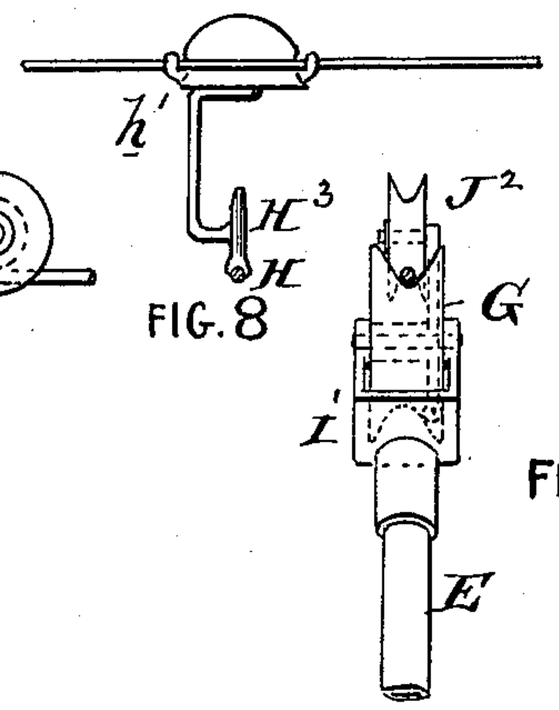

FIG. 8

FIG. 7

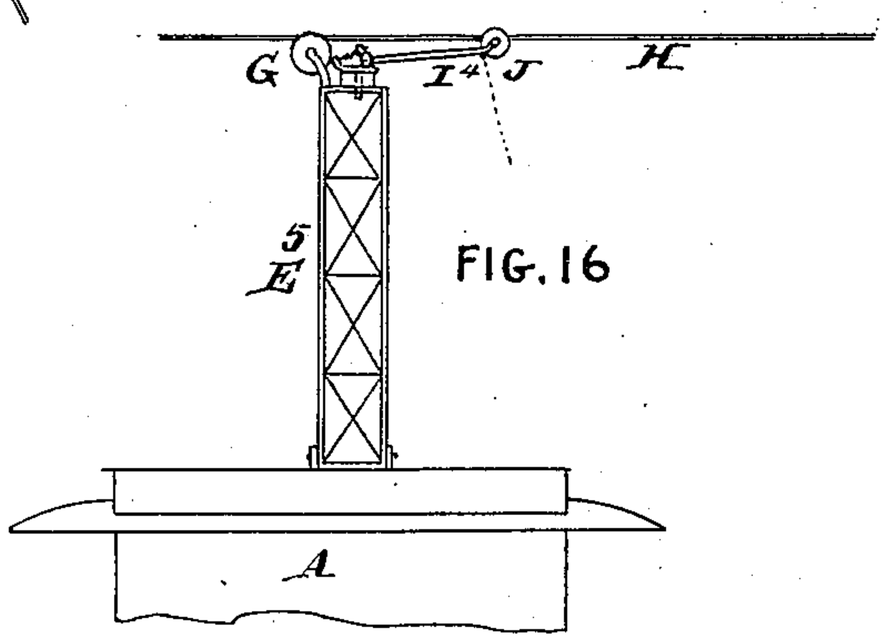

FIG. 16

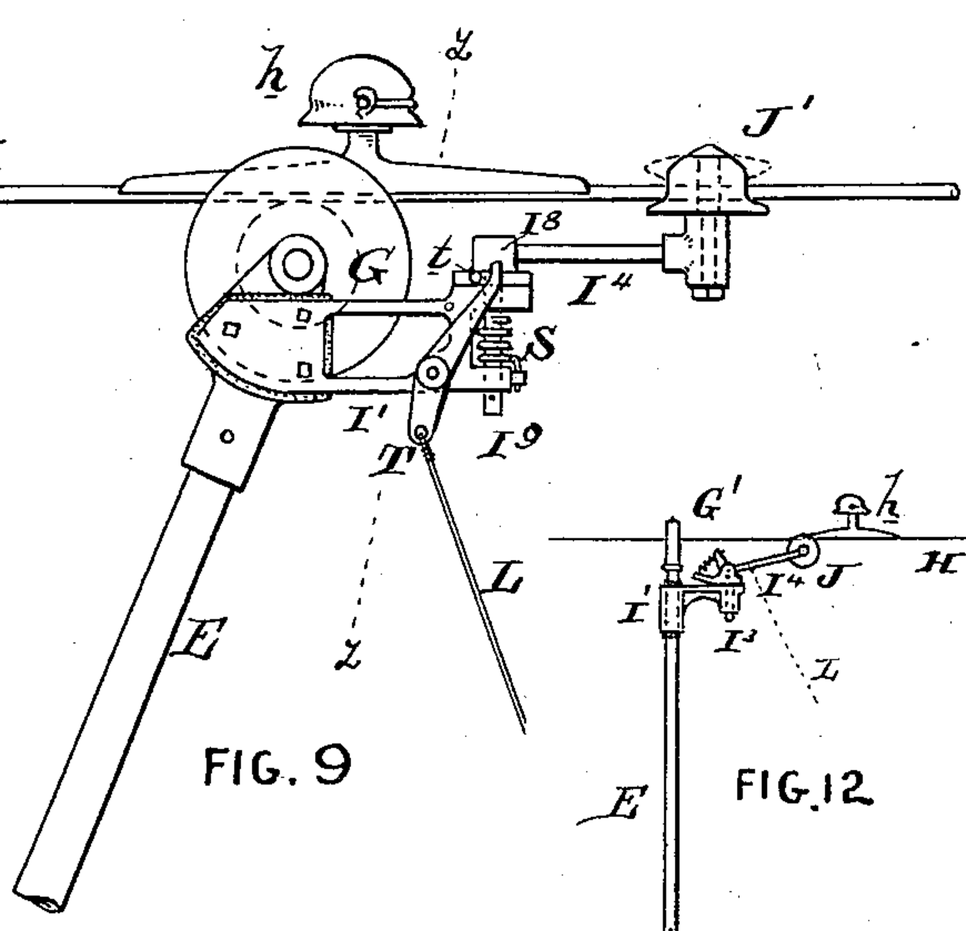

FIG. 9

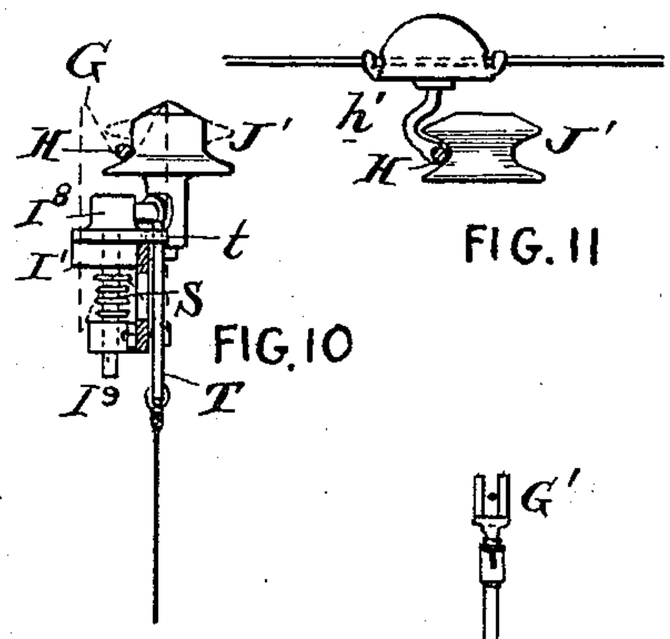

FIG. 10

FIG. 11

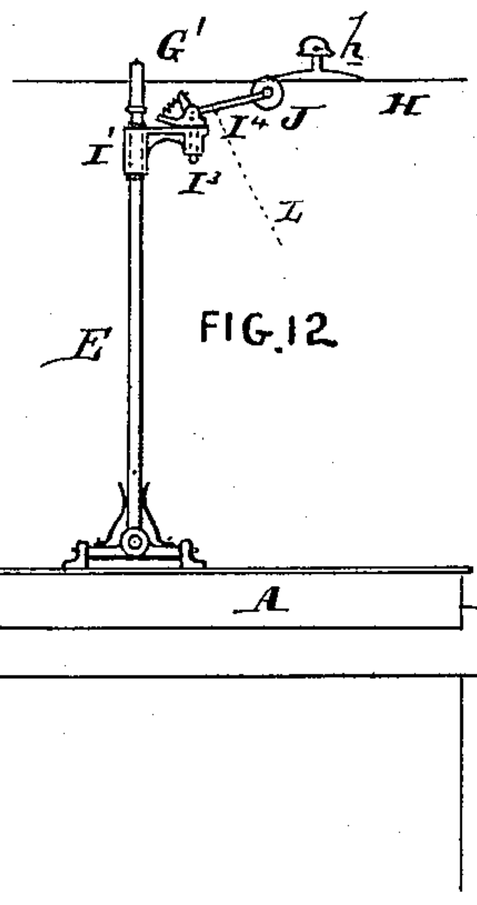

FIG. 12

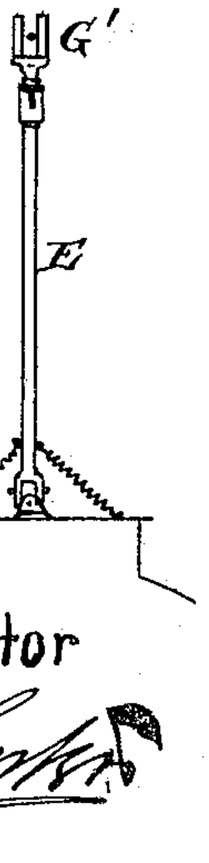

FIG. 13

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Wm. L. Evans
R. M. Kelly

Inventor
R. M. Hunter

(No Model.)

4 Sheets—Sheet 4.

R. M. HUNTER.

ELECTRIC RAILWAY.

No. 566,984. Patented Sept. 1, 1896.

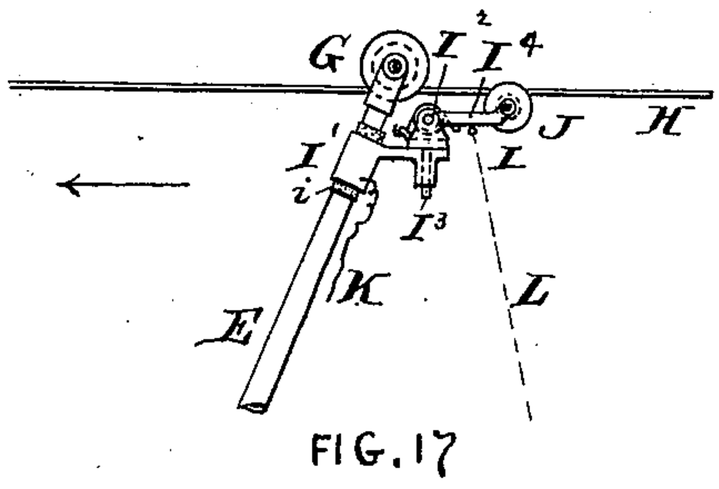

FIG. 17

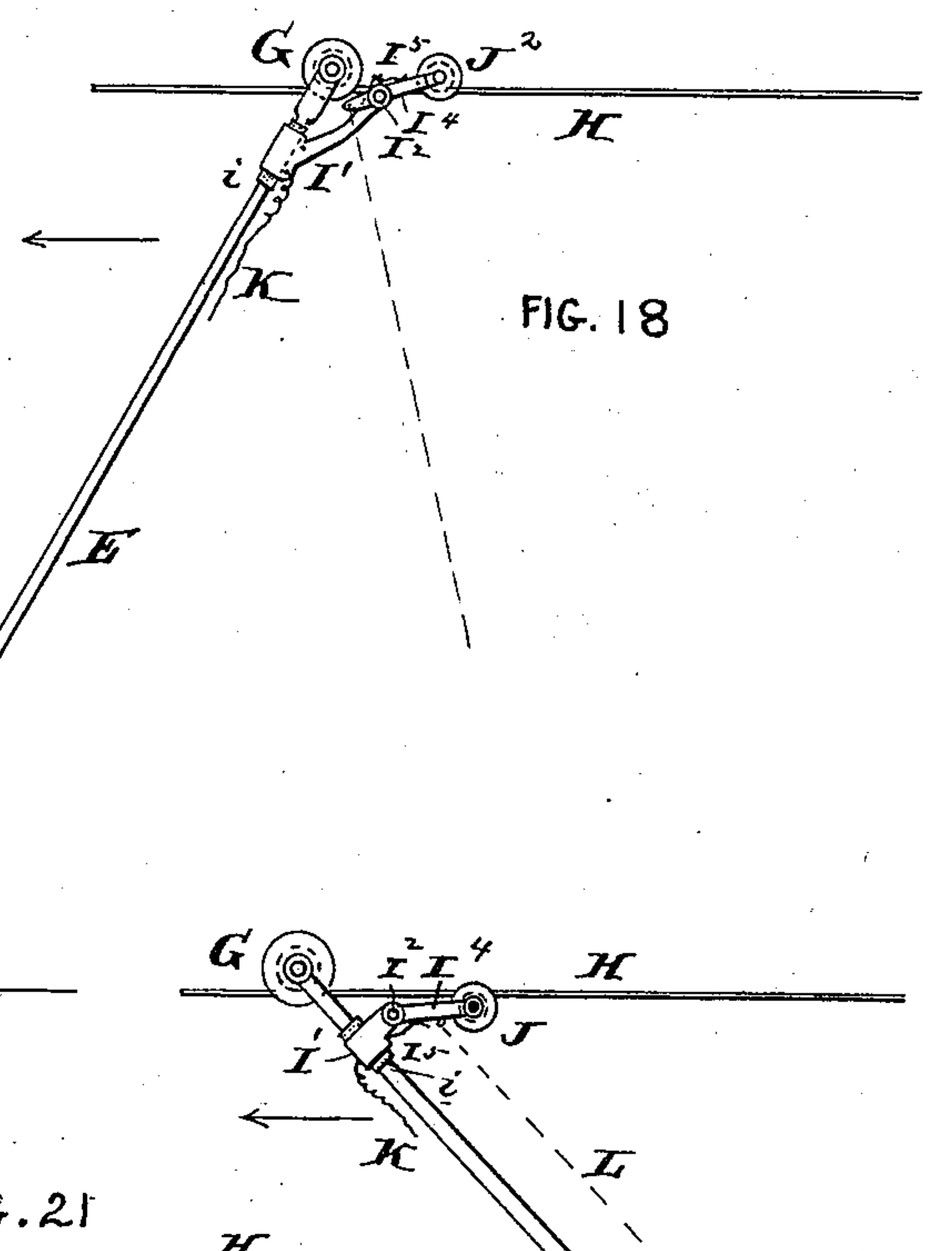

FIG. 18

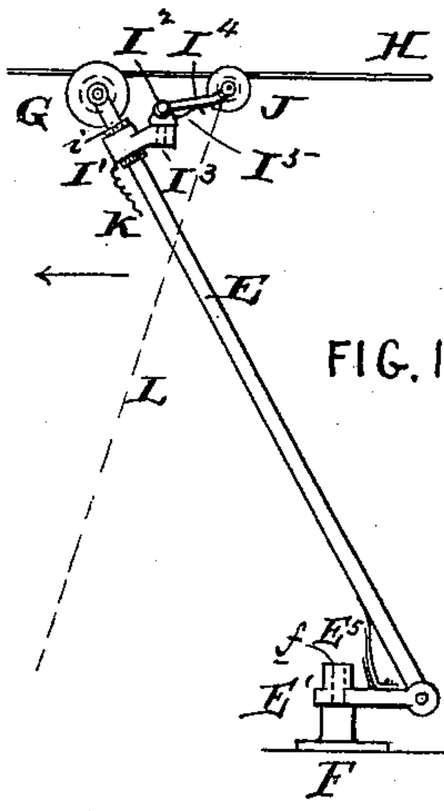

FIG. 19

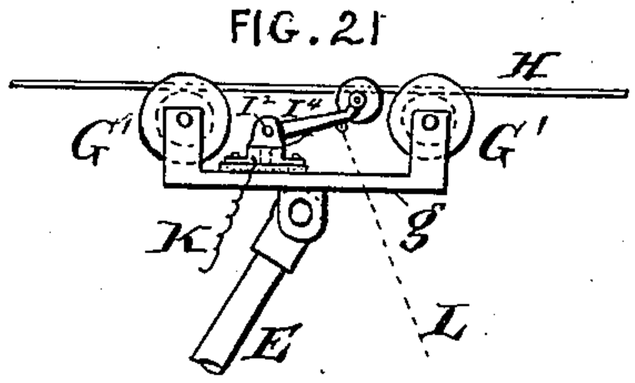

FIG. 21

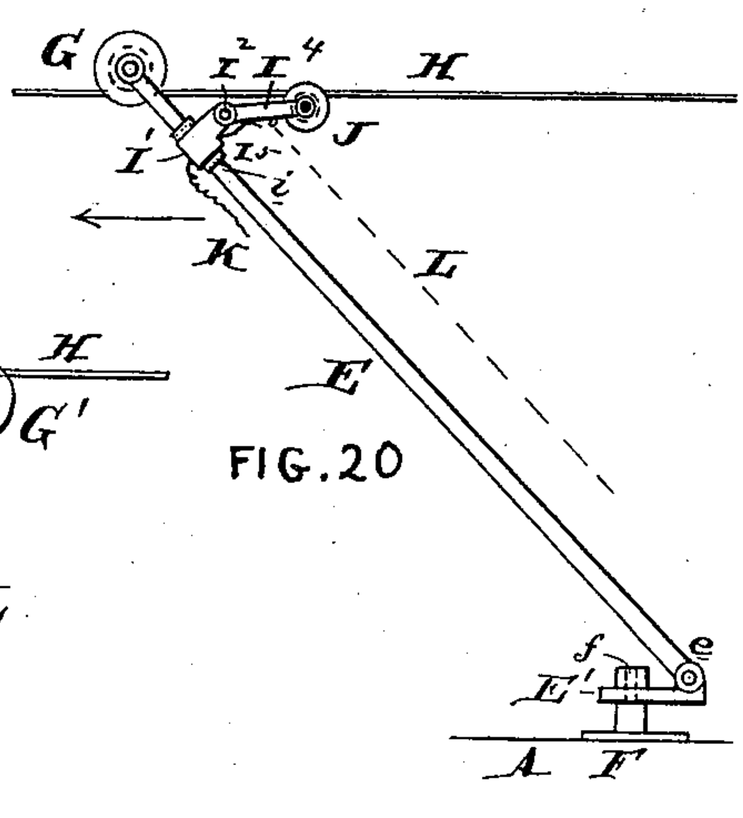

FIG. 20

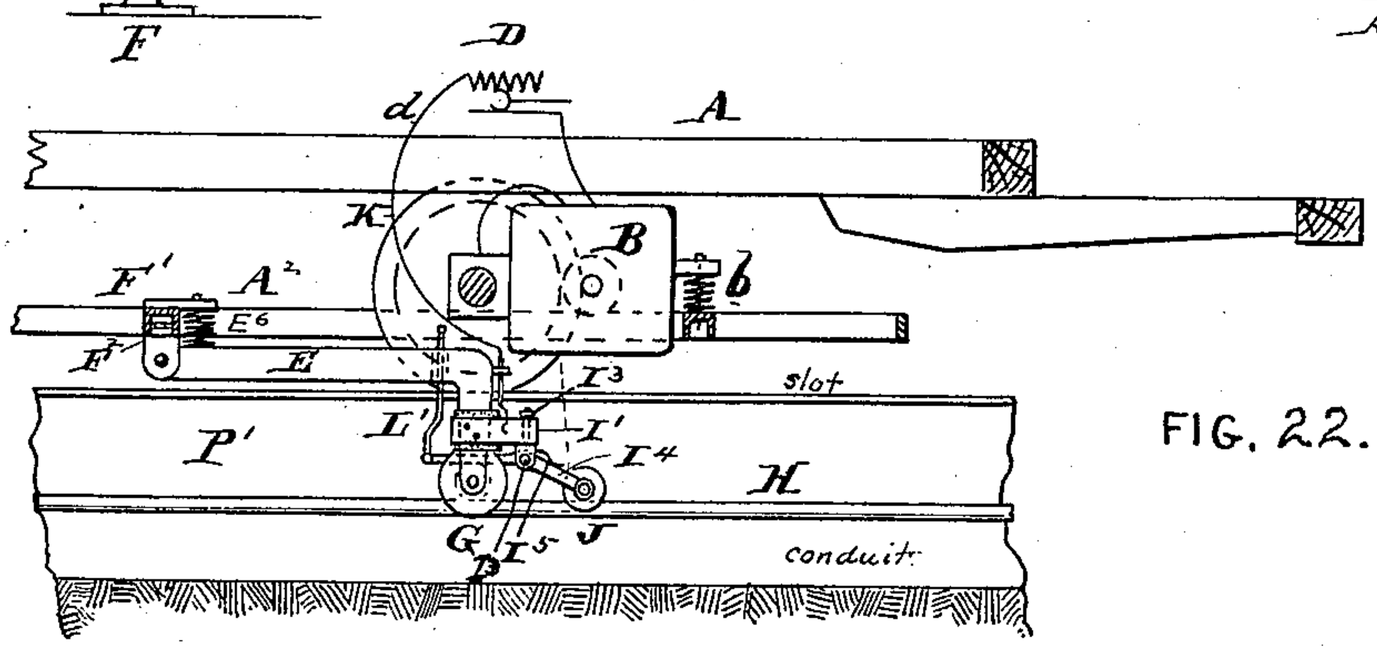

FIG. 22.

Attest

Wm. L. Evans

R. M. Kelly

Inventor

R. M. Hunter

UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 566,984, dated September 1, 1896.

Application filed February 3, 1896. Serial No. 577,798. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Electric Railways, of which the following is a specification.

My invention has reference to electric railways; and it consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof. This application, (Case 287,) has reference to electric railways, and comprehends more particularly certain improvements in means for collecting current from a suspended conductor and conveying the same to a motor upon the car. Heretofore I have obtained Letters Patent No. 398,402, dated February 26, 1889, and No. 400,916, dated April 9, 1889, among others, for an improved current-collecting device comprising a long upwardly-extending arm hinged to the top of the car on a universal joint and provided at its free end with a grooved contact-wheel pressed upwardly against the under side of the conductor to maintain contact therewith by the action of spring devices arranged adjacent to the car and acting upon the base of the upwardly-extending arm. With such construction it was necessary to insure mechanical contact by the employment of a very strong spring, owing to the length and leverage of the arm and the great weight of the current-collecting device. When the said collecting device was brought into contact with obstructions of any kind, such, for instance, as supports, repaired places in the conductor, switches, &c., the blow to so large a body caused considerable vibration and jumping and the consequent excessive sparking, which not only destroyed the conductor, but also the collector-wheel itself. Furthermore, owing to the excessive upward pressure, it frequently happens that the friction upon the trolley wheel or contact is so great that the same fails to revolve, and under this condition a flattened surface is formed in the groove and excessive sparking results, which is increased by the excessive jumping of said wheel after the journals have been loosened. Sparking at the contact produces roughness and consequent weakness, together with excessive noise. My present invention is to overcome these objections, while at the same time retain all the advantageous features of a current-collecting device of the character heretofore in common use and set out in my aforesaid patents, to wit: the connection between the suspended conductor and the traveling car whereby the free end of the arm is required to follow any irregularities and varying contour, either lateral or vertical, of the said suspended conductor, but without the disadvantages of the mechanical construction when employed in the direct course of the current from the said conductor.

In carrying out my invention I provide a frame of any suitable construction having a mechanical connection with the car at the base and with the top, bottom, or sides of the suspended conductor at the free end, so that the said frame is moved by the car and guided by the conductor. The mechanical connection between the frame and the conductor may be of insulating material or formed in any other manner, provided it does not act as a current-collecting device. The object is to make a good mechanical construction or frame which shall at its free end always be kept in close position relatively to the suspended conductor, and thus form immediately adjacent to the said conductor an excellent support for a current-collector or trolley device *per se*, which shall be pivoted thereto and moved thereby. The current-collecting device may consist of a contact wheel or shoe adapted to run against the under side or side or the top of the suspended conductor by a light spring capable of causing the contact to follow the irregularities in the surface of the conductor, switches, crossings, repaired places and hangers, but under no necessity to exercise a controlling action with regard to the alinement of the conductor relatively to the track, since the frame to which it is pivoted acts as the mechanical guide for the trolley. In this manner the current-collecting device proper is arranged close to the conductor and is pivoted at its point of pull almost in a horizontal line with its contact, and hence its direction of pull is very nearly longitudinal with the alinement of the conductor, and consequently there is little or no tendency for

the trolley to jump the conductor and produce sparking. Furthermore, any irregularity or jarring which may be produced at the free end of the frame will not be transmitted to the trolley, since it is very light, and the resulting action of its spring action is such that it will maintain its contact irrespective of said vibrations. Broadly considered, it is immaterial to my invention what form of current-collecting device is pivoted or connected to the upper end of the frame carried by and moving with the car and guided at its free end by the conductor itself. Furthermore, the trolley is connected with the upper end of the frame with provision for lateral motion sufficient to enable it to stand at a great angle to the line of the car without in the least throwing the collector-wheel out of proper running course with the conductor. This also avoids excessive sparking. Broadly considered, it is immaterial how the sustaining-frame may be guided by the suspended conductor; that is to say, that while one end is connected to the car the other end may be provided with a guiding part which may be moved against the under side, upper side, or sides of the suspended conductor, and the trolley be connected to or carried by the said frame close to the suspended conductor and be also made to make contact with either the under, upper, or sides of the suspended conductor, as preferred. It will thus be seen that the invention, broadly considered, is to provide a positive and practical mechanical connection or frame extending from the car close to the contact-point at the suspended conductor and guide the said frame by the said suspended conductor, so that the pivot-point of the trolley or collecting device shall be arranged close to the suspended conductor itself and thereby insure a perfect construction of the trolley *per se*.

In applying my improvements I connect to the trolley proper a rope for pulling the contact-wheel into and out of electrical connection with the suspended conductor, and the construction is such that the trolley may be entirely removed from the suspended conductor without in the least disturbing the mechanical guiding connection of the supporting-frame structure which carries the trolley, but which does not make electrical connection with the suspended conductor or act as the means for collecting the current. While the cord is so arranged that the trolley may be manipulated independently of its supporting-frame, I prefer to arrange the structure so that an excessive or continuous drawing down of the cord will finally be capable of drawing down the supporting-frame also; but this latter function may be performed by a second cord if so desired. Reversely, it will be observed that in adjusting the frame to the suspended conductor it is first brought into mechanical connection with the suspended conductor, so as to be properly guided by it; and when this is done the further manipulation of the cord brings the trolley itself into position and contact.

My invention will be better understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of an electric railway with a portion of the car in section, showing the embodiment of my invention. Fig. 2 is a plan view of the upper part of the current-collecting device and its guiding-frame. Fig. 3 is a side elevation of a portion of my improvements when the suspended conductor is required to come down close to the roof of the car, as in passing through tunnels or under bridges. Fig. 4 is an enlarged side elevation of the upper portion of Fig. 1, and also shows a crossing conductor and switch. Fig. 5 is a plan view showing an electric railway embodying my improvements where one track branches from another. Fig. 6 is a side elevation of a modification of my improvements. Fig. 7 is an end elevation of Fig. 6. Fig. 8 is an elevation with the suspended conductor in section, showing the form of suspension-hanger employed in Fig. 6. Fig. 9 is a side elevation of another modification of my invention. Fig. 10 is a sectional elevation of same on line *z z*. Fig. 11 is an elevation of the suspended hanger employed in Fig. 9. Fig. 12 is a side elevation of another modification of my invention. Fig. 13 is an end elevation showing the general character of the supporting-frame illustrated in Fig. 12. Fig. 14 is a sectional elevation of the crossing-switch on line *x x* of Fig. 15, to which my invention is applicable. Fig. 15 is a cross-section of the same switch on line *y y* of Fig. 14. Fig. 16 is a side elevation of another modification of my invention. Fig. 17 is an elevation of a further modification of my improvements, showing the sustaining-frame guided upon the upper side of the suspended conductor. Figs. 18 to 21 are further elevations of modifications of my invention on the same general improvements, and Fig. 22 shows my invention applied to a suspended conductor located within a conduit.

Referring to Sheets 1 and 2, comprising Figs. 1 to 5, A is an electric car and is provided with an electric motor B for mechanically propelling it, the said motor being shown as hinged to the car-axle at one end and suspended at *b* at the other end upon an independent frame A^2, carried by the axle and upon which the car-body is suspended by spring A′. C are the rails and act as the return-conductor, if desired. D is the current-controlling device and may be made on the series-multiple type set out and claimed in my Patent No. 385,055, of June 26, 1888. E is a frame, shown as made in the form of a pole, and is movably connected at the bottom with the car A and guided at its top or upper end by a grooved wheel or guide G, guided upon the suspended conductor H, which acts as a guide-rail. The conductor H is shown as suspended by insu-

lated suspension devices or hangers *h*. The connection between the frame E and the car may be made in any suitable manner, that shown being illustrated as one manner of providing for the necessary connection. As illustrated, the lower end of the frame E is hinged on a transverse axis *e* with a frame E′, which is pivoted upon a vertical pin *f*, carried upon a bed-plate F, secured to the top of the car. E^4 is a link connecting with a block E^3, which presses upon a spring E^2, interposed between the said block and frame E, so that the rearward depression of the frame will put the spring E^2 under compression, so that the tendency of the spring E^2 is to hold the frame E in an upright position and insure the wheel G running positively upon the suspended conductor H. The spring E^2 is made of great tension, so as to sustain the entire weight of the frame E, together with the current-collecting device to be hereinafter described. The transverse axis *e* permits the frame E to rise and fall at its end G to correspond to variations in the elevation of the suspended conductor, and the vertical pivot-pin *f* permits the frame E to move more or less laterally at its guide-wheel end to correspond to curvatures or lateral displacements of the said suspended conductor. Suitably bolted or clamped to the upper end of the frame E and insulated from it, as at *i*, is a frame I′, which acts as the primary part or support for the current-collecting device I. A secondary part I^3 is pivoted to the part I′ on a substantially vertical axis, but this of course is changed with every change in the obliquity of the frame E. I^4 is a rearwardly-extending trolley-arm and is pivoted to the secondary frame I^3 on a transverse axis I^2 and is pressed upward by the spring I^5 of any suitable construction. The free end of the frame I^4 carries a grooved contact-wheel J. A cord L is connected to the frame I^4 and extends downward to the rear of the car. When the said cord is pulled, the trolley-arm and contact are depressed or moved away from the suspended conductor H, as indicated in dotted lines in Fig. 4, so that the electrical connection is entirely broken with the suspended conductor, while the frame E and its guiding-wheel G still maintain their mechanical and guiding characteristics. When it is desired to completely lower the guiding-frame as well as the trolley, such as is necessary in case of making overhead repairs during the running operation of the car, the trolley-frame will strike the projection *j*, and then a further pulling of the cord L will draw down the frame E, together with the trolley.

In cases where the suspended conductor is necessarily depressed, so as to get close to the roof, as in passing under bridges or through tunnels, the operation of my improved device is illustrated in Fig. 3. In this figure it is seen that what is a vertical axis in Figs. 1 and 4 for the frame I^3 is no longer a vertical axis, but is decidedly oblique. The collector-arm I^4, however, under the action of the spring I^5, swings about the transverse axis I^2 and maintains electrical connection with the suspended conductor H, thus being able to ride completely above and over the guiding-wheel G, taken in the direction of the guiding-frame E. It will thus appear that the trolley is supported close to the suspended conductor with provision for every possible movement which could be demanded of it under any conditions of working, and being pivoted close to the suspended conductor there is no tendency for it to leave the said conductor, and consequently a very light spring I^5 is all that is required. The spring E^2 must, however, have a power sufficient to sustain the frame E in its upright position, as well as sustaining the weight of the trolley proper, together with the downward tendency of the spring I^5 upon the free end of the frame E, which latter spring of course acts to move the guiding-wheel G away from the suspended conductor. In practice, however, the spring I^5 is so light that this mechanical tendency is of no serious objection. The current is supplied from the trolley proper by connecting the frame I′ with a conductor K, which may be brought down to the car in any suitable manner, either outside or through the guiding-frame E, the former being shown in Fig. 1 and the latter in Fig. 4. The lower end of the conductor K is brought into electrical connection with a ring *k*, with which the motor-circuit *d* is connected by a suitable brush, The motor-circuit leads to the controller D. and by the use of electrical conductors supplies current to the motor B.

In Fig. 5 I have shown a case where a branch track C′ leads from the main track C. In this figure it will be seen that the curved or polygonal suspended conductor H′ leads into the main-line suspended conductor H at such an angle that when the guiding-frame E is on the main-line conductor the trolley contact-wheel J may be on the branch conductor H′, and this illustrates one of the special advantages of having the trolley movably connected close up to the suspended conductor and within a few inches of its point of contact. In this case both of the grooved wheels J and G lie in the plane of the respective conductors, which is a feature that could not take place where the current-collecting device *per se* was hinged to the car and required to directly press against the suspended conductor above, as illustrated in my Patents Nos. 398,402 and 400,916 hereinbefore referred to.

Referring to Sheet 3, and especially to Figs. 6, 7, and 8, we have the supporting-frame E, provided at the top with a grooved guide-wheel G, shown as formed of insulating material and running against the under side of the suspended conductor H. The frame I′ is directly secured to the supporting-frame E and also supports the grooved insulating guide-

wheel G as well as the trolley. The trolley or collecting wheel J^2 is a grooved metal wheel shown as running upon the upper side of the suspended conductor and connected by a pivoted arm I^4 with the frame I', so as to be movable upon a transverse axis R, close to the suspended conductor H. A spring P, which is made adjustable, operates upon the free arm of the trolley and holds the contact-wheel with an elastic pressure upon the conductor. The cord L is connected to the trolley-arm I^4 in such a manner that pulling upon the cord causes the contact-wheel J^2 to be elevated from the suspended conductor, and then by the proper manipulation of the cord the supporting-frame E is drawn down as in the former case. In this figure the suspended hanger H^3 is shown as of suitable depth, so that the lateral upwardly-extending arm *h'*, leading to the insulator, connects with its side, as clearly shown in Fig. 8, the construction being such as to permit the contact trolley-wheel to be guided up over the support for the hanger, as indicated in dotted lines in Fig. 6.

Referring now to the construction shown in Figs. 9, 10, and 11, we have the supporting-frame E with its guiding-wheel substantially as shown in Sheets 1 and 2. The frame I' is properly insulated from and carried by the frame E. Pivoted to this frame I' is a frame I^8, movable upon a vertical axis I^9, turned in one direction by a spring S. The frame I^8 has the trolley-arm I^4, extending rearwardly and carrying at its free end a casting upon which a vertical pin extends as a journal-bearing for the contact-wheel J', which is arranged to press or rest upon the side of the suspended conductor H, which is supported from above, as indicated at *h*. The spring S holds the contact-wheel J' in running contact with the side of the suspended conductor-wheel, while guiding-wheel G of frame E, which is insulated from the contact-wheel and collector, generally insures the proper vertical elevation of the trolley, so as to bring it close to the suspended conductor H. The cord L acts upon a lever T, pivoted to the frame I', and said lever when the cord is pulled operates upon a pin *t* on the frame I^8 with the object of moving the trolley-wheel J' laterally away from the conductor. After this is done a continual pulling upon the cord L will draw the guiding-frame E down toward the car. Reversely the guiding-wheel G is first placed in position against the conductor, and the further loosening of the cord L will then insure the trolley-contact J' moving laterally into proper position against the conductor. If desired, the upper portion of the trolley-wheel J' may be flanged, as indicated in Fig. 11, but in this case it is desirable that the hanger *h'* shall be curved, as indicated in this figure.

Referring to Figs. 12 and 13, we have a vertically-arranged guiding-frame E, having two upright guiding-wheels movable upon vertical axes, as indicated at G', between which the suspended trolley-conductor H is received. With this construction the suspended conductor guides the frame E laterally and insures it following the alinement of the conductor. The lower end of the frame E is connected to the car in any suitable manner, but preferably so as to be held vertically with provision for lateral motion. The frame I' is insulated from and carried by the frame E, as in previously-described case, and the trolley-wheel J is connected at the rear end of the arm I^4, which is pivoted with provision for universal movement on the frame I' similarly to what is clearly illustrated in Figs. 1 to 4.

Referring to Fig. 16, we have upon the top of the car an extended frame E^5, formed, as shown, of light trusswork, and upon the upper part of the said frame, close to the suspended conductor, is pivoted, with provision for universal motion, the trolley, which is furnished with a rearwardly-extending arm I^4 and collector-wheel J, making an underrunning contact with the suspended conductor. This frame E^5 is arranged vertically and hinged upon a longitudinal axis upon the car, so as to be laterally movable at its upper end, and is guided by a suitable guiding-wheel G, which runs against the under side of the suspended conductor.

In Fig. 17 I show another modification of my invention, in which the supporting-frame E has its grooved guiding-wheel G running upon the upper side of the suspended conductor and the trolley I carried upon the frame E, as in the case of Fig. 4, but with the trolley-wheel J running against the under side of the suspended conductor, corresponding to the reverse of what is illustrated in Fig. 6, that is to say, the contact-wheel runs against the under side of the conductor, while the guiding-wheel, which does not collect current, runs upon the upper side of the conductor.

In the construction shown in Fig. 18 we have a structure very similar to that illustrated in Fig. 6, except that in this case the guiding-wheel G, as well as the trolley-contact J^2, is made to run upon the upper side of the suspended conductor H. In this case the frame I', which is insulated from the supporting-frame E, has pivoted to it on a transverse axis I^2 the trolley-arm I^4, carrying at its free end the contact J^2. A spring I^5 presses the contact upon the conductor. The frame E is shown as pivoted at *e* on a transverse axis to the frame E' or close to the car, and which latter frame is pivoted upon a vertical axis *f* of a base-plate F, secured to the roof of the car.

In the construction shown in Fig. 19 we have a construction very similar to that shown in Fig. 1, with the exception that the supporting-frame E is inclined forward or in advance of its pivoted joint with the car.

This construction would also be similar to that shown in Fig. 17 if the trolley-wheel G of Fig. 17 were placed against the under side of the suspended conductor and the frame E tilted forward.

In Fig. 20 we have substantially the construction shown in Fig. 17, but with the supporting-frame E inclined forward. The suspended conductor supports the upper end of the frame E, while the car supports its lower end, and the trolley is carried by the said frame E close up to the suspended conductor H and is provided with a spring-actuated contact-wheel J, running against the under side of the suspended conductor. In this construction, as well as that of Figs. 17 and 18, the suspended conductor directly supports the frame E and assists in supporting it in the construction shown in Fig. 6.

Referring to Fig. 21, the supporting-frame E has pivoted at its top a frame *g*, in which two guiding-rollers G′ G′ are journaled at a distance apart to run against the under side of the suspended conductor H. Intermediate of these guiding-rollers is arranged the current-collecting device proper, I. The collector-wheel J runs against the under side of the suspended conductor H and is carried by a rearwardly-extending arm I^4, pivoted to the frame *g* on a universal joint, as in the other cases, and preferably properly insulated therefrom. From an examination of this figure it will be seen that the trolley proper is supported upon a truck or carriage, and this latter is in turn bodily carried upon the end of the frame E and held against the under side of the suspended conductor H by the springs E^2, acting upon the frame E close to the car, as shown in Fig. 1. The cord L may be operated, as in the previous case, by first removing the trolley from the conductor, then the rear guiding-wheel G, and finally the forward guiding-wheel. In applying the trolley the reverse operation takes place.

In Fig. 22 is illustrated the application of my improvements to a suspended conductor arranged within a conduit P′. Referring to this figure, B is the motor arranged upon the car A and is hinged to an axle and supported by a spring *b* upon an independent frame A^2. E is the supporting-frame and is hinged upon a transverse axis to the frame F^2, which is connected upon a vertical axis F′ with the independent frame A^2. The rearward end of the frame E is bent downward to extend through the slot and carries the grooved guiding-wheel G, guided upon the upper side of the conductor H or upon its side adjacent to the car. A spring E^6 may be employed to press the guiding-wheel G more firmly upon the conductor, if desired. A frame I′ is suitably secured to and insulated from the frame E, and to this frame the trolley is connected, with provision for vertical and lateral motion. As shown, the grooved contact-wheel J runs upon the upper side of the suspended conductor and is carried at the rear end of the arm I^4, which is pivoted upon a transverse axis I^2 to the frame I^3, movable upon a vertical axis in the frame I′. A spring I^5 presses the trolley-arm downward to maintain contact of the wheel J with the suspended conductor. A rod or wire L′ connects with the rear end of the trolley-arm I^4, so as to permit the arm to be moved to remove the trolley-wheel from the conductor when necessary, and corresponds in substance to the trolley-cord L.

It will be observed that all of these constructions comprehend the same general features, generically considered, that is to say, the collecting device proper is pivoted close to the suspended conductor and is pulled by a connection arranged close to and pulling in the direction of the said conductor, and the said trolley or collecting device is bodily supported close to the said conductor by a supporting-frame of suitable character, which is itself connected at one end to the car and guided at its other end directly by a mechanical connection on the suspended conductor itself, thereby constituting a frame movable in all directions to compensate for variations in the line of the suspended conductor relatively to the track.

In Fig. 4 I have shown a form of crossing track-switch which may be employed in connection with my invention if so desired. H H^2 are the crossing-conductors. N is a frame carrying said conductors at different elevations. The conductor H is bridged so as to form an open space below the conductor H^2. A pivoted bridging-arm N′ is hinged at *n* to the frame N and adapted to fall downward by gravity, so as to allow the trolley or collecting device to pass freely under the suspended conductor H^2. When, however, the trolley passes under the conductor H, the guiding-wheel on the frame E first raises the arm N′ and then supports it in that position until the trolley-wheel J passes upon it, thus throwing the switch-arm into proper position before the trolley-wheel is required to move upon it. This obviates any excessive duty being put upon the trolley and in a great measure prevents sparking, which would result if the weight on the arm N′ were great relatively to the tension on the spring I^5.

Another form of crossing-switch adapted to my invention is shown in Figs. 14 and 15. In this case the crossing is shown as formed of a rigid plate M, having transverse grooves *m* for the conductor H^2 and wings M^2 for the conductor H. When the trolley passes under conductor H^2, the wheels G and J may have their flanges received in the grooves *m*, as indicated in Fig. 14, or if the guiding-wheel G is made wide it may be caused to ride upon the under surface of the plate M, while the trolley or collecting wheel J maintains its connection with the conductor H^2, as shown in Fig. 15. In the case where the collecting device passes under the conductor

H the guiding-wheel G mounts the incline M′ and moves along the under side of the plate M, while the trolley-wheel J mounts the wings M^2 and then runs upon the under surface of the plate M, and finally leaves the crossing by running off the opposite wing M^2 onto the conductor H.

Any other forms of crossings or switches may be employed, and these would be modified or varied to suit the particular modification or type of my invention which may be used.

I do not confine myself to the details herein set out, as they may be varied in numerous ways without departing from the principle of my invention.

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

1. A railway, a suspended conductor arranged along said railway, an electrically-propelled car, and a frame having one end connected to the car and the other end guided by the suspended conductor, in combination with an independent trolley or current-collecting device universally hinged or jointed to and carried by said frame close to the suspended conductor and making a spring-actuated contact with said conductor, and an electric circuit leading from said trolley device and including the electric motor on the car.

2. A railway, a suspended conductor arranged along said railway, an electrically-propelled car, a frame having one end connected to the car and the other end guided by a grooved guiding-wheel running against the under side of the suspended conductor, in combination with an independent trolley or current-collecting device universally hinged or jointed to and carried by said frame close to the suspended conductor and having a grooved contact-wheel running against the under side of the suspended conductor and making a spring-actuated contact with said conductor, and an electric circuit leading from said trolley device and including the electric motor on the car.

3. The combination of a railway, a suspended conductor arranged along the railway, a supporting-frame jointed to the car at one end and having a mechanical guiding device for its other end guided by the suspended conductor, a spring device arranged adjacent to the car for holding the frame in an upright position, an independent current-collecting device consisting of a wheel running against the suspended conductor and carried by a laterally-movable arm hinged to the supporting-frame adjacent to the suspended conductor and the guiding-wheel, and an electric circuit connecting the current-collecting device with the electric motor on the car.

4. The combination of a railway, a suspended conductor arranged along the railway, a supporting-frame jointed to the car at one end and having a mechanical guiding device for its other end guided by the suspended conductor, a spring device arranged adjacent to the car for holding the frame in an upright position, a current-collecting device consisting of a wheel running against the suspended conductor and hinged to the supporting-frame adjacent to the suspended conductor and insulated from the guiding device thereof, an electric circuit connecting the current-collecting device with the electric motor on the car, and a trolley-cord connecting with the trolley proper and adapted to first draw the trolley contact-wheel away from the suspended conductor to break the electric circuit and then remove the supporting-frame.

5. The combination of a railway, a suspended conductor arranged along the railway, an electrically-propelled car, a frame jointed to the car at its lower end and provided with a grooved guiding-wheel for mechanically guiding its upper end against the suspended conductor, a trolley-sustaining frame carried by the supporting-frame insulated from the guiding-wheel, a trolley-arm hinged to the trolley-sustaining frame, a spring to press the trolley-arm upward, a grooved contact-wheel carried by the free end of the trolley-arm and making an underrunning contact with the suspended conductor, and an electric circuit connecting the trolley with the motor on the car.

6. The combination of a railway, a suspended conductor arranged along the railway, an electrically-propelled car, a frame jointed to the car at its lower end and provided with a grooved guiding-wheel for mechanically guiding its upper end against the suspended conductor, a trolley-sustaining frame carried by the supporting-frame insulated from the guiding-wheel, a trolley-arm hinged to the trolley-sustaining frame, a trolley-spring to press the trolley-arm upward, a grooved contact-wheel carried by the free end of the trolley-arm and making an underrunning contact with the suspended conductor, an electric circuit connecting the trolley with the motor on the car, and a spring of greater power than the trolley-spring for sustaining the supporting-frame in position between the suspended conductor and the car.

7. The combination of a railway, a suspended conductor arranged along the railway, an electrically-propelled car, a frame jointed to the car at its lower end and provided with a grooved guiding-wheel for mechanically guiding its upper end against the suspended conductor, a trolley-sustaining frame carried by the supporting-frame insulated from the guiding-wheel, a trolley-arm hinged to the trolley-sustaining frame, a trolley-spring to press the trolley-arm upward, a grooved contact-wheel carried by the free end of the trolley-arm and making an underrunning contact with the suspended conductor, an electric circuit connecting the trolley with the motor on the car, a spring of greater power than the trolley-spring for sustaining the sup-

porting-frame in position between the suspended conductor and the car, and a trolley-cord connecting with the trolley-arm for operating the trolley and supporting-frame successively.

8. The combination of a railway, a suspended conductor, an electrically-propelled car, a supporting-frame hinged to the car with provision for universal movement and having its free end provided with a grooved guiding-wheel, a spring device for pressing the guiding-wheel of the supporting-frame against the suspended conductor so as to insure the said supporting-frame being properly guided thereby, and a trolley consisting of a trolley-arm having provision for vertical and lateral motion close to the suspended conductor carried by the supporting-frame close to the suspended conductor, a contact-wheel carried by the trolley-arm and making a running contact with the suspended conductor, and a spring acting upon the trolley-arm adjacent to its pivot and close to the suspended conductor for pressing the contact-wheel against the conductor.

9. The combination of a railway, a suspended conductor, an electrically-propelled car, a supporting-frame hinged to the car with provision for universal movement and having its free end provided with a grooved guiding-wheel, a spring device for pressing the supporting-frame in mechanical connection with the suspended conductor so as to insure the said supporting-frame being properly guided thereby, a trolley-arm hinged to the supporting-frame with provision for vertical and lateral motion close to the suspended conductor, a contact-wheel carried by the trolley-arm and making a running contact with the suspended conductor, a spring acting upon the trolley-arm adjacent to its pivot for pressing the contact-wheel against the conductor, and insulating means for insulating the trolley proper from the guiding-wheel of the supporting-frame.

10. The combination of a railway, a suspended conductor, an electrically-propelled car, a supporting-frame hinged to the car with provision for universal movement and having its free end provided with a grooved guiding-wheel, a spring device for pressing the supporting-frame in mechanical connection with the suspended conductor so as to insure the said supporting-frame being properly guided thereby, a trolley-arm hinged to the supporting-frame with provision for vertical and lateral motion close to the suspended conductor, a contact-wheel carried by the trolley-arm and making a running contact with the suspended conductor, a spring acting upon the trolley-arm adjacent to its pivot for pressing the contact-wheel against the conductor, insulating means for insulating the trolley proper from the guiding-wheel of the supporting-frame, and a trolley-cord to pull the trolley away from the conductor without disturbing the mechanical connection of the guiding-wheel with the conductor.

11. In an electric railway, the combination of a railway, a suspended conductor extending along the railway, an electrically-propelled car, a supporting-frame hinged to the car and having its weight supported thereby and provided at its free end with a grooved mechanical guide, a spring to sustain the weight of the supporting-frame and hold it in an upright position with its guide pressing against the suspended conductor, a trolley-contact electrically independent of the guide hinged to the supporting-frame close to the suspended conductor and spring-pressed against the said conductor, and an electric circuit extending from the trolley to the motor.

12. In an electric railway, the combination of a railway, a suspended conductor extending along the railway, an electrically-propelled car, a supporting-frame hinged to the car and having its weight supported thereby and provided at its free end with a grooved mechanical guide, a spring to sustain the weight of the supporting-frame and hold it in an upright position with its guide pressing against the suspended conductor, a trolley electrically independent of the guide consisting of a laterally and vertically movable rearwardly-extending arm carrying a grooved collector-wheel and hinged to the supporting-frame close to the suspended conductor and spring-pressed against the said conductor, and an electric circuit extending from the trolley to the motor.

13. In an electric railway, the combination of a suspended conductor extending along the railway, an electrically-propelled car, a frame hinged to the car and having a guide running against the suspended conductor, a powerful spring device to hold said frame with provision for universal movement in operative position, a trolley hinged to the upper end of the frame and making a contact with the conductor, a relatively weak spring for the trolley to press its contact against the conductor with an elastic pressure and opposed to the action of the powerful spring, and an electric circuit connecting the trolley with the motor on the car.

14. In an electric railway, the combination of a suspended conductor extending along the track, an electrically-propelled car, a frame connected upon the top of the car so as to have its weight supported thereby and further having its upper end movable to or from the car and suspended conductor, a mechanical guide carried upon the upper or movable end of the frame and moving against the under side of the suspended conductor to guide the upper end of the frame, a trolley consisting of an underrunning contact pivoted to the frame close to its mechanical guide whereby the application of power to move the trolley is close to the suspended conductor, and an

electric circuit electrically independent of the mechanical guide extending from the trolley to the motor.

15. In an electric railway, the combination of a suspended conductor extending along the track, an electrically-propelled car, a frame pivoted upon the top of the car so as to have its weight supported thereby, a mechanical guide carried upon the upper or movable end of the frame and moving against the under side of the suspended conductor to guide the upper end of the frame, a trolley electrically independent of the mechanical guide consisting of an underrunning contact pivoted on a transverse axis to the frame and near its mechanical guide so as to be capable of moving over the said guide to maintain its contact with the suspended conductor when the frame is moved rearwardly and downward as in passing under bridges, &c., and an electric circuit independent of the mechanical guide extending from the trolley to the motor.

In testimony of which invention I hereunto set my hand.

R. M. HUNTER.

Witnesses:
ERNEST HOWARD HUNTER,
R. M. KELLY.