(No Model.) 4 Sheets—Sheet 1.

E. W. HEALD.

ELECTRIC RAILWAY.

No. 385,928. Patented July 10, 1888.

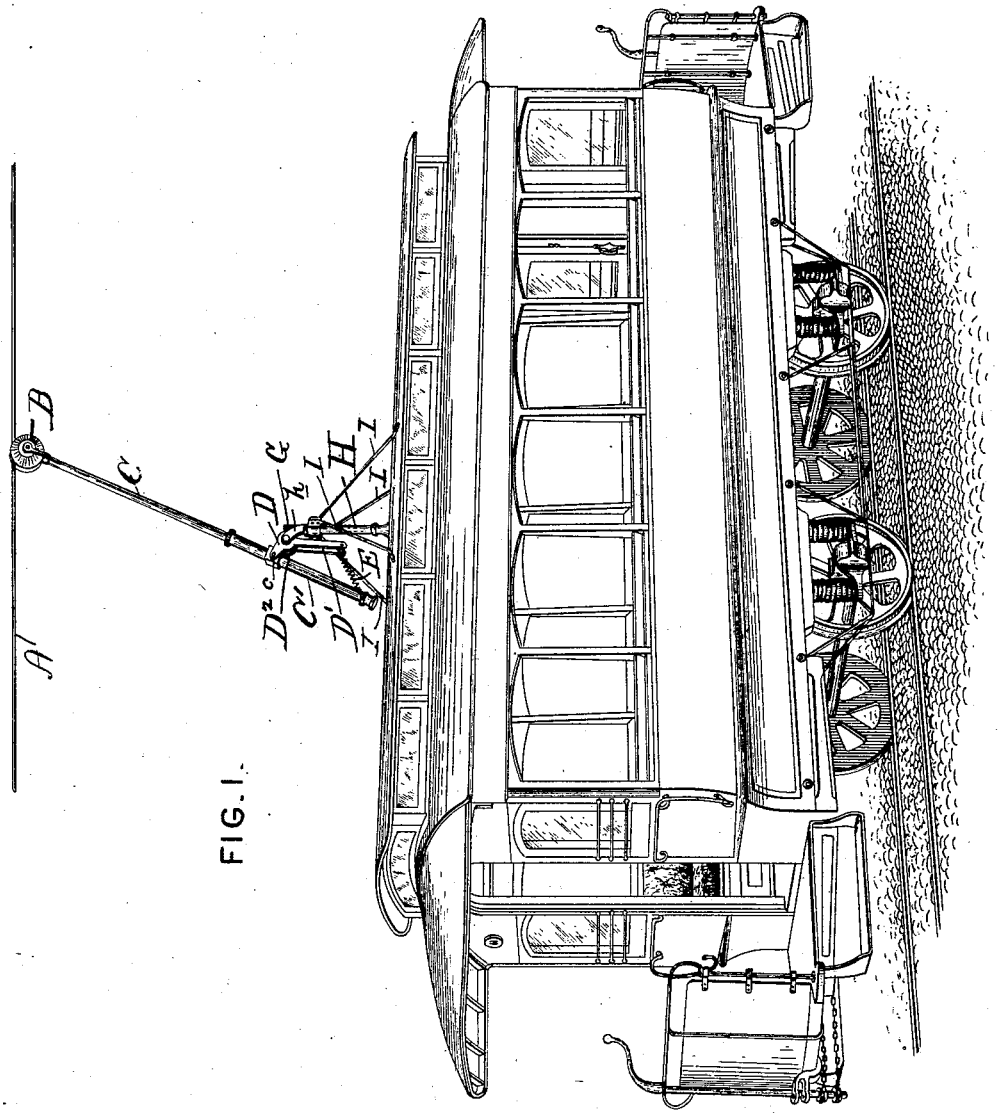

FIG. 1.

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Edwin W. Heald,
by his Atty
Wm. J. Taylor.

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FIG. 5.

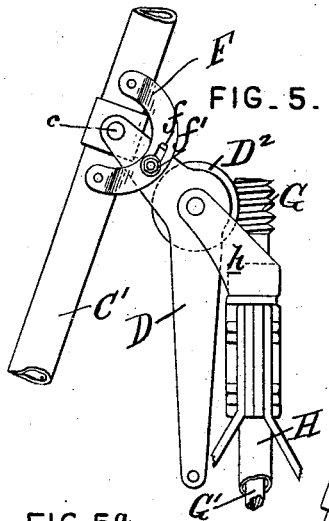

FIG. 5a.

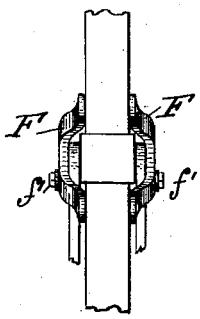

FIG. 2

FIG. 3.

FIG. 4.

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FIG. 6.

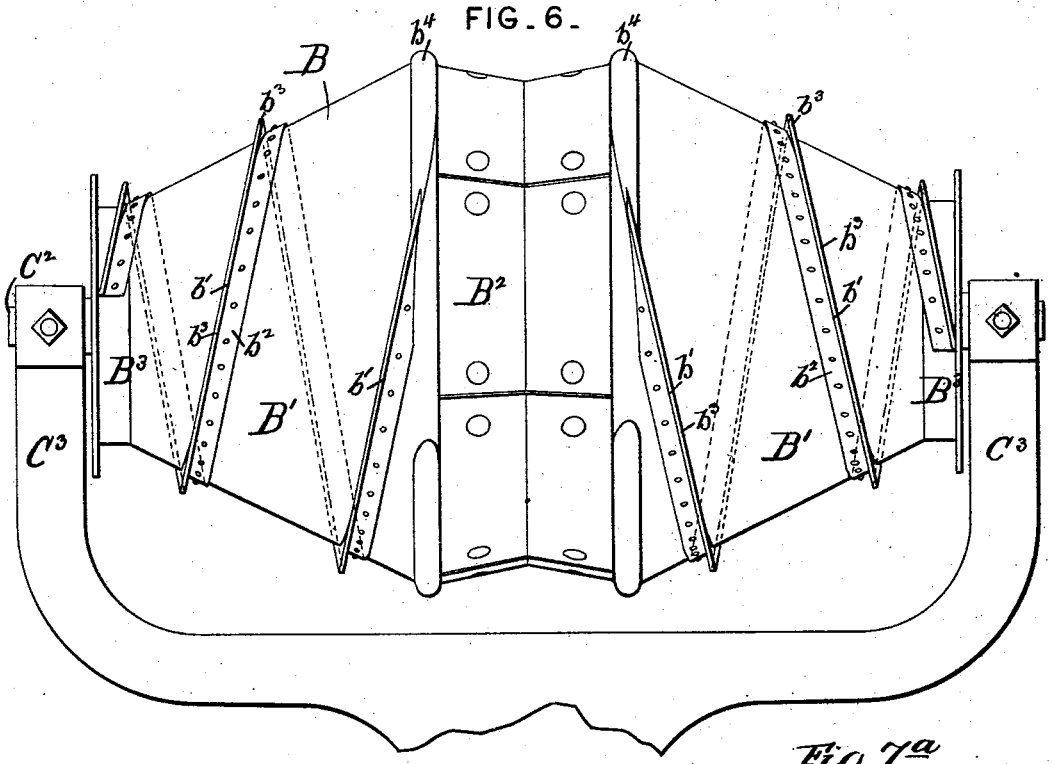


FIG. 7.

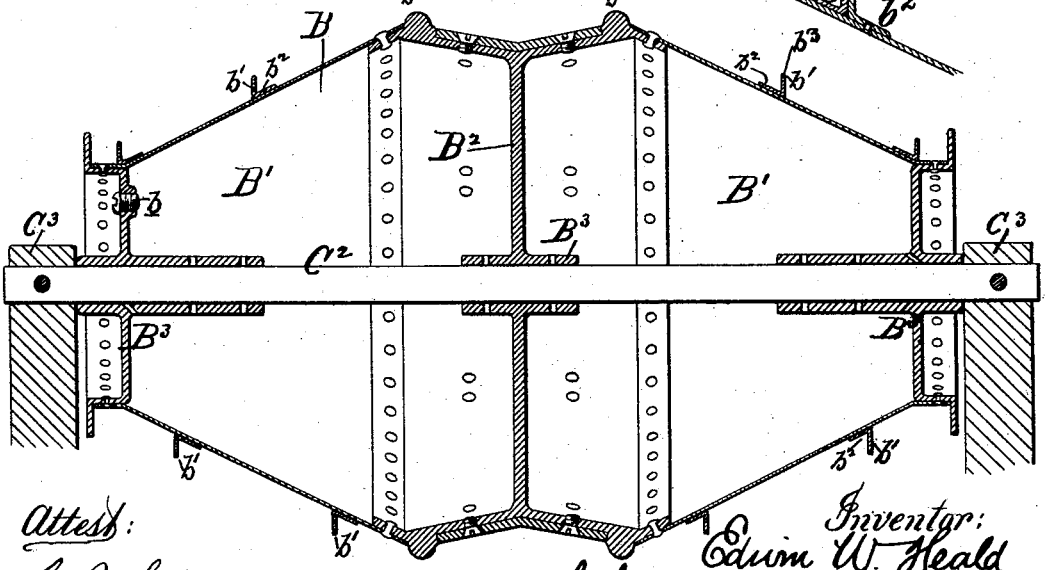
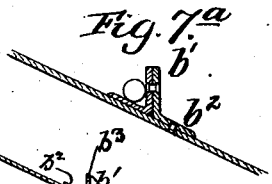


Fig. 7a.



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(No Model.) 4 Sheets—Sheet 4.

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ELECTRIC RAILWAY.

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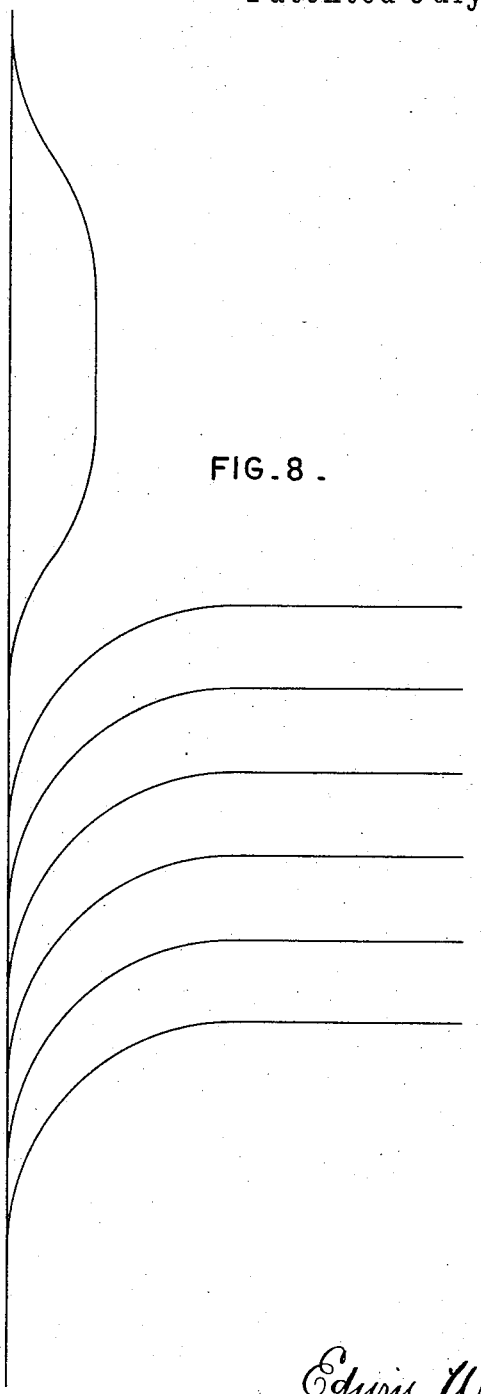

FIG. 8.

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UNITED STATES PATENT OFFICE.

EDWIN W. HEALD, OF WILMINGTON, DELAWARE.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 385,928, dated July 10, 1888.

Application filed April 21, 1888. Serial No. 271,376. (No model.)

To all whom it may concern:

Be it known that I, EDWIN W. HEALD, a citizen of the United States, residing at Wilmington, in the county of New Castle and State of Delaware, have invented certain new and useful Improvements in Electric Railways; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to electric railways of that class in which the "current" is delivered to the electric motors on the car from overhead conductors supplied with current from a dynamo or other generator of electricity at a central station or from several stations along the line.

My improvements are directed to the supporting and conducting connections between the car and the overhead conducting or line wire which supplies the current.

The objects of my improvements are to improve the operation of such devices, to insure proper and efficient contact and conductivity at all times during the running of the car and the safe contact of the conducting-trolley with the supply-wire from beneath, to avoid too great lateral play of the trolley relatively to the wire, so as to avoid the escape of the trolley from beneath the wire and its elevation above it from either side, to compensate for the vibrations or jolts of the car, to automatically return the trolley to its normal central position beneath the wire notwithstanding lateral vibration of the trolley to either side of the center, and to provide means for readily shifting the trolley or conducting-connections when the end of the route is reached and from within the car, so that the trolley may be readily adjusted to trail under and in contact with the conducting-wire according to the direction of travel of the car and without necessitating external shifting or reversing appliances for the trolley or its support or turning the car end for end; but the various objects of my invention will more fully and clearly appear from the following detail description of the apparatus, while the subject-matter claimed by me will be particularly recited in the summary at the close of this specification.

The accompanying drawings illustrate so much of an "overhead-conductor" electric railway as is necessary to an understanding of my improvements, and therein—

Figure 1 is a view of a street-car and an overhead electrical conductor with my improved conducting-connections and their supports and rigging between them. Fig. 2 is a view of my improved devices, mostly in elevation, and as supported upon the top of the car, which car-top is shown in section; and Figs. 3 and 4 are details of the locking and shifting parts or elements of said devices. Fig. 5 is a view similar to that of Fig. 2 as to the upper portions of my improved devices, showing more particularly the side brackets or guides of the bell-crank rocking levers, which prevent lateral vibration of the trolley-rod upon its pivotal connection between said levers; and Fig. 5ª is a front view of said side brackets or guides, showing the backward and forward rocking trolley-rod between them. Fig. 6 is a view in elevation of the trolley of my improved device, which is the revolving cylinder or drum to make contact with the overhead conducting-wire in conveying the current to the motor. Fig. 7 is a longitudinal section therethrough to show its construction more clearly, and Fig. 7ª is a modification of the trolley guide-flange. Fig. 8 is a diagram showing the switches and turn-outs on the line, or at one terminus thereof, with which my improvements are adapted to operate.

The overhead wire A is or may be hung as usual, and runs substantially parallel with and over the center of the track. The electric "current" (so called) is or may be supplied to this conducting-wire by a dynamo-electric machine or other generator of electricity at a central station or at one end of the line, or from several stations along the line, as usual. It supplies current to the motor on (and which drives) the car by means of a conducting or contact trolley or drum, B, which travels beneath and is held in contact with the wire, being supported by connections which, with certain improvements in the trolley itself, constitute my present improvements. Said trolley B is mounted on the upper end of a supporting and carrying rod, C, (preferably a non-conducting rod of wood,) which is fitted at its

lower end in a pipe-extension, C', so as to form virtually a continuation or part thereof. Said pipe-extension C' is pivoted or trunnioned between the short arms of two bell-crank levers, D D', as at *c*, so that said pipe-extension of the trolley-rod C may rock on its pivotal connection with said bell-crank levers, which levers carry or support said rod. The lower end of said trolley-rod extension and the lower ends of the long arms of said bell-crank levers are connected by a spring or springs, E, which have a tendency to draw the lower end of the trolley-rod over toward the lower ends of the bell-crank, while permitting a yielding motion of the trolley-rod on its pivotal connection with the bell-crank and the quick return to the position determined by the tension of the spring when the rod and trolley suddenly dips from any cause, it being understood that the spring E holds the trolley up against the conducting-wire with a firm contact.

In order to prevent the pivoted trolley-rod, which in operation trails or inclines rearwardly, (as usual, and as shown in Fig. 1,) if it should be connected from the conducting-wire, from being thrown over past the perpendicular by the action of the rod-springs E, and, in addition, to prevent any lateral play of the rod upon the bell-cranks which might happen, owing to wear or loose pivoting, I rigidly secure to the pipe-extension C' of the trolley-rod two side plates, brackets, or guides, F F, (shown in Figs. 5 and 5*,) whereby the trolley-rod may rock freely in the line of the car with said guides, while they prevent all lateral motion of the trolley-rod on its pivotal connection with the levers D D'; and should the trolley-rod escape or be freed from any cause it cannot rock over to or past the perpendicular, for the guide or bracket plates limit the rocking of the rod in this direction by a curved slot, *f*, in the brackets and fixed studs *f'* on the levers D D'.

The bell-cranks D D' are pivoted to a fulcrum or ear-pieces, *h*, and are virtually one crank, and have fitted between them and firmly united thereto a gear wheel, D^2, which meshes with a worm-gear, G. This worm-gear G is keyed upon the upper end of a central operating-shaft, G', which passes down through and has its bearings in a turning sleeve, H, to the upper end of which is keyed the fulcrum or ear-pieces *h* for the bell-crank levers D D'. Said sleeve H is fitted to turn in suitable bearings at the upper ends of the standards I I I I, which standards may be four in number and rise from the car-top to support and brace the entire upper part of the apparatus.

The lower end of the turning sleeve H passes down through the car-top and through a suitable casting, J, to give it bearing therein, and inside the car is fitted with a hand-wheel, H', by which to readily turn said sleeve from within the car. This hand wheel H' is fitted with a (preferably spring) latch or catch, *h'*, with a lug or nose, h^3, fitted to engage either one of two notches, *j j'*, in a flange, J^2, of the casting J, so as to lock the hand-wheel and its sleeve, upon which it is keyed, from turning beyond the extent limited by the play of the locking lug or nose h^3 of the latch *h'* in the notches *j j'*, which should be slight. One wall of the locking-notches is formed by extended lugs or fingers j^2 j'^2, and the play of the latch *h'* on its pivot is insufficient to clear it of said fingers. Consequently the shifting hand-wheel H' and sleeve H can only be turned a half-rotation upon releasing the catch or latch *h'*, and this across the shorter wall of the locking-notch, whereby the hand-wheel carrying the turning-sleeve H can simply be turned back and forth a half-rotation with a locking-notch at each side of the casting J. This suffices for shifting or reversing the inclined trolley-rod at each end of the route, and a half-turn of the carrying-sleeve H is all that is required, the parts being locked at the end of the shifting or reversing operation.

Provision is made by the central operating-shaft, G', and its worm-gear G for dipping or rocking the trolley-rod downward when the trolley is to be disengaged from the conducting-wire, (as when the trolley-rod is to be shifted,) and the lower end of said shaft G' (which passes down through the turning sleeve H) is fitted with a hand-wheel, G^2, for turning said shaft, and by the rotation of its gear G causes, by the gear-wheel D^2 the rocking of the bell crank levers on their pivots, and thus dip the rod C sufficiently to clear the wire and permit the sleeve H to be turned to shift the apparatus. This operating shaft and gear connection also determines the degree of tension to be exerted by the springs E upon the trolley B through the rod C relatively to the conducting-wire, for the gear-connection determines how high the trolley shall rise. The springs E are merely returning or compensating devices to insure proper contact notwithstanding unevenness in road or wire and to take up or compensate for jolts or other disturbances.

A wing or butterfly nut, G^3, working on the shaft G', is a convenient means for locking it to the hand-wheel H' of the turning sleeve H when necessary and to secure the operating-shaft in its proper adjustments.

The trolley B of the apparatus is peculiar, and consists of two conical-shaped tubes or cones, B' B', (preferably of sheet-copper,) united at their larger ends by a stouter central connection or casting, B^2, to which they are riveted or otherwise secured, the smaller ends of said cones being fitted with end bearings, B^3 B^3, (in the shape of brass castings preferably,) to fit the trolley (or thus constituted drum B) to be readily revolved on a central axle, C^3, extending between the forked arms C^2 C^2 of a suitable frame or casting mounted on the upper end of the trolley-rod C. The barrel shape of the trolley or drum makes it very stout, and when in contact with the wire it revolves freely. The drum takes off the current from the wire as it is drawn along in contact with

the wire by the car, and the electricity is or may be conducted to the motor on the car by means of insulated wires, which make good electrical connection between the trolley or its journals and the binding-posts or connections of the motor in well-known ways.

The bearings B^3 B^3 B^3 of the trolley may have oil-holes for oiling, and one of the end bearings or castings, B^3, may have a plug, *b*, to admit the injection of a small quantity of oil to the interior of the trolley cylinder or drum to be tossed about and lubricate the parts and bearings.

The opposite tapered or cone ends B′ B′ of the trolley B are each fitted with a spiral flange, *b′*, leading to the V-shaped central portion, B^2, of the drum, and are for the purpose of directing the wire to the center of the drum when the trolley dips and springs back out of "true" or the center line, as is apt to be the case many times during a trip of the car, owing to unevenness of the track and running of the car, &c. The wire thus caught on the cone-surface runs on the parallel flange b^2 of the angle-flange *b′*, and thus prevents wear of the body of the trolley, while the upright part b^3 of said angle-flange, being spirally arranged, directs the wire to its proper central V-shaped working-surface of the drum formed by the section B^2 thereof. This central V-shaped section, B^2, also insures smooth running of the trolley. Said central section, B^2, has two annular curved or rounded bosses or ribs, b^4 b^4, cut away at the terminus of the spiral flange, so as to offer no obstruction to guiding the trolley centrally upon the wire, and these bosses also serve to readily shift the wire off the trolley or drum in "turning out" or leaving the main wire or in being switched off onto a switch-wire, the trolley always following the car.

As most of the wear on the trolley or drum is on the central section, B^2, I fit it with a supplemental wearing-surface consisting of sections of preferably screw-attached copper plates, as clearly shown in Figs. 6 and 7, so that when worn they may be readily replaced, and as provision is made by the spiral flange for taking the wear off the taper part of the drum or trolley, and as it may be readily replaced, I have provided a trolley which will last indefinitely and not need to be soon thrown away from wear of the wire, as was the case heretofore.

In Fig. 7ª I show a modification of the angle-flange *b′*, in that it is riveted by its parallel flange b^2 permanently to the cylinder, while it has a readily-detachable wearing-flange for the wire secured thereto, so as to enable it to be readily removed and a new wearing surface substituted, as required.

In operation, with the parts properly adjusted, travel is had from one end of the line to the other without shifting of the trolley or any attention on the part of the driver or conductor of the car. When the terminus is reached, the trolley-rod is readily dipped and shifted by the hand appliances in the car and the connections before described, and the return journey may be commenced. In turning out, as with single-track lines, the trolley, having but slight play, follows the car, and the main wire is readily shed or shifted off the trolley by the curved boss b^4, and the new or "turn-out" wire as readily and effectually guided into the groove of the trolley. The same remarks apply to switching, and several switch-lines as well as a turn-out have been illustrated by the diagram Fig. 8 of the drawings.

I claim as my invention—

1. The combination, with a trolley bearing upward against a conducting-wire and its supporting and carrying connection on top of the car, of a shifting or reversing operating mechanism therefor fitted within the car-roof, substantially as described.

2. The combination, with a trolley adapted to bear upward against a conducting-wire and its supporting and carrying connection on top of the car, of a sleeve to shift said connection from the inside of the car and fitted with an operating-handle and locking device, substantially as described.

3. The combination of the trolley-rod, its pivoted supporting-lever, a dipping-shaft, and gearing between said shaft and lever, whereby the trolley-rod may be dipped or inclined, as desired.

4. The combination of the trolley-rod, the bell-crank lever to which it is pivoted, the returning-spring between said rod and lever, a dipping shaft geared with said lever, and a handle to operate said shaft, whereby the relation of said rod to the conducting-wire may be determined by said dipping-shaft, while the spring maintains yielding contact.

5. The combination of the trolley-rod, its pivoted supporting-lever, the turning sleeve upon which said lever is pivoted so as to be adjusted thereon, the handle to turn said sleeve, a dipping-shaft passing through said sleeve, gearing between said shaft and said pivoted lever, and a handle for said shaft, whereby the trolley-rod may be dipped or inclined by the dipping-shaft and the apparatus reversed by the said turning sleeve, substantially as described.

6. The combination of the conducting-wire, the trolley, and the turning sleeve which supports and carries the trolley-rod and its connections, with a fixed notched locking-plate, and a locking device between said sleeve and plate, substantially as described.

7. The combination, with the supporting-lever and the trolley rod or standard pivoted thereon, of side guides fixed to said trolley-rod and preventing lateral motion of said rod upon said lever, substantially as described.

8. The trolley fitted with a spiral flange upon its cone end leading to the center of the trolley and with a portion thereof substan-

tially parallel with the surface of the trolley to take the wear of the wire, substantially as described.

9. The trolley made up of three main sections, to wit: two cone end sections and a central section having a depression or groove for the wire, substantially as described.

10. The trolley having a central V-shaped or depressed section fitted with corresponding detachable wearing-plates, substantially as described.

11. The trolley having a depression or groove for the conducting-wire to run in, and at each side thereof a curved or rounded annular boss cut away to shed or shift a leaving wire, substantially as described.

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

EDWIN W. HEALD.

Witnesses:

WM. J. PEYTON,

EDW. F. SIMPSON, Jr.

Corrections in Letters Patent No. 385,928.

It is hereby certified that in Letters Patent No. 385,928, granted July 10, 1888, upon the application of Edwin W. Heald, of Wilmington, Delaware, for an improvement in "Electric Railways," errors appear in the printed specification requiring correction as follows: In line 14, page 1, the word "motors" should read *motor;* in line 76, same page, the word "device" should read *devices;* in line 25, page 2, the word "connected" should read *disconnected*, and in line 98, same page, the word "causes" should read *cause;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 17th day of July, A. D. 1888.

[SEAL.]

D. L. HAWKINS,
Assistant Secretary of the Interior.

Countersigned:

BENTON J. HALL,
Commissioner of Patents.