(No Model.) 2 Sheets—Sheet 1.

E. THOMSON.

TROLLEY ARM FOR ELECTRIC RAILWAYS.

No. 440,665. Patented Nov. 18, 1890.

Fig. 1.

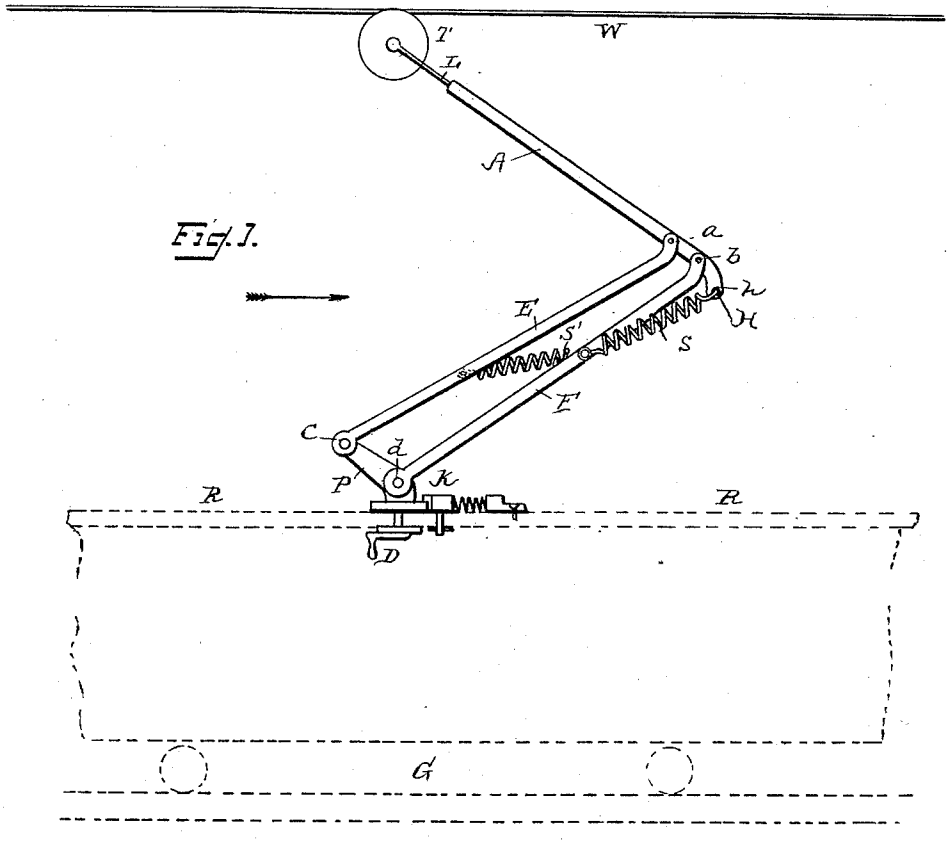


Fig. 2.

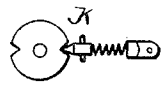


Fig. 3.

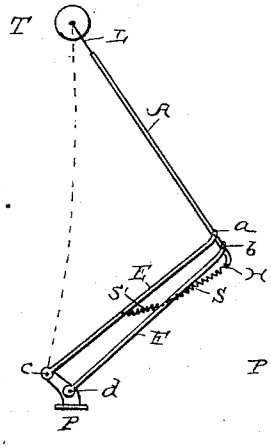
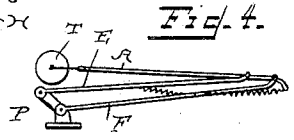


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

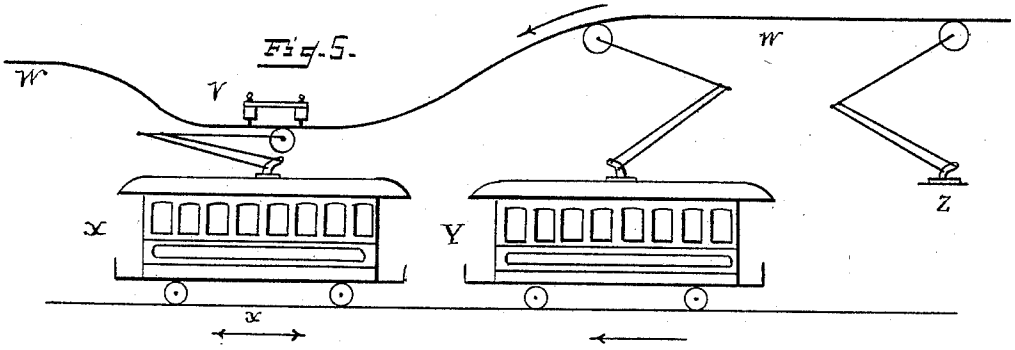


Fig. 6.

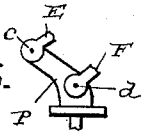


Fig. 7.

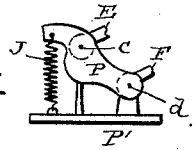


Fig. 8.

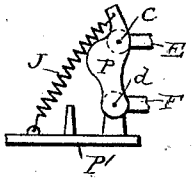


Fig. 9.

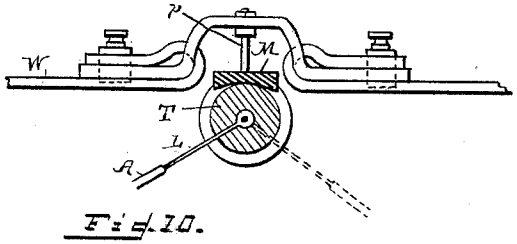
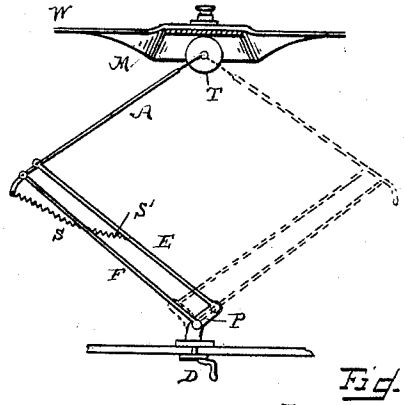


Fig. 10.



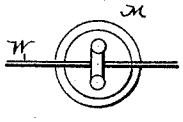


Fig. 11.

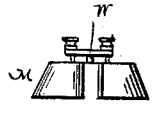


Fig. 12.

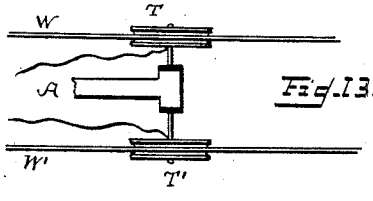
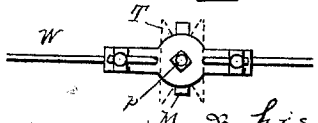


Fig. 13.

Fig. 14.



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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS.

TROLLEY-ARM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 440,665, dated November 18, 1890.

Application filed March 5, 1889. Serial No. 301,911. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented a certain new and useful Contact or Trolley Arm for Electric Railways, of which the following is a specification.

My invention relates to devices used with vehicles of any character for maintaining a constant electrical connection between the vehicle and a conductor over or to one side of the vehicle, and which conductor is a part of an electric circuit for feeding devices upon the car with electric current from any source for motive power or other purposes.

My invention relates more particularly to devices for supporting an arm or lever which carries a trolley or conducting-piece of any character moving in contact with the conductor beside or over the track, and also to a way of reversing the position of the devices when desired.

I have hereinafter illustrated my invention as applied to a contact or trolley arm which extends upward from the vehicle to a conductor over the same; but it will be readily understood from the subjoined description that the same construction is applicable to cases where the conductor is to one side of the vehicle and either above or below the horizontal line passing through the support of the trolley-arm, so that the trolley-arm will extend from the vehicle sidewise, either horizontally or at an angle.

The invention is designed especially for use, however, under those conditions where the distance between the vehicle and the wire or conductor varies.

The object of my invention is to cause the roller or contact carried by the arm to be carried directly over the center of the length of the car when the wire is above the car, a feature of great importance, especially in rounding curves.

A further object is to cause the contact or trolley to adapt itself to very great variations in the distance of the fixed wire or conductor from the car, while at the same time bearing on the wire or conductor with a uniform or nearly uniform pressure.

Another object of the invention is to permit free movement of the car in either direction without adjustment or reversal of the supporting devices for the trolley or contact, even though there should be great changes in direction of the conductor—as, for instance, in the case of a wire or conductor inclined sharply from horizontal position—where it dips to pass under arches, bridges, or other obstructions.

Other features of my invention have for their object the ability to reverse the position of the supporting devices for a movable contact or trolley without interrupting the supply of electricity to the vehicle through such supports. This is important where lamps on the vehicle are to be kept lighted without interruption when the reversing takes place.

My invention consists, essentially, in the combination, with the trolley or contract arm and a pivoted supporting-rod or bar to which said arm is hinged, of a supplemental rod or bar pivoted and also hinged to the trolley or contact arm in proper manner to swing or turn in a parallel direction with the first, as will be more particularly hereinafter described.

My invention consists, further, in certain details of construction and proportions of parts, to be presently set forth, and also in the means hereinafter described and claimed for maintaining a supply of current to the vehicle at the time of reversal of the contact-supporting mechanism.

In the accompanying drawings, Figure 1 is a side elevation of apparatus embodying my invention, shown as applied to a railway-vehicle. Fig. 2 shows the supporting-base of the devices in plan. Figs. 3 and 4 illustrate the condition of the supporting mechanism when greatly extended and when fully contracted. Fig. 5 illustrates a condition under which the devices are of special utility. Figs. 6, 7, and 8 illustrate modifications in a detail of the apparatus. Figs. 9 and 10 show in modified forms a means for permitting reversal without breaking connection. Fig. 11 is a plan of a modification of the device shown in Fig. 10; and Fig. 12 is an end view of that shown in Fig. 9. Fig. 13 illustrates a double trolley and two wires or conductors connected,

respectively, with the two poles of the source of electric energy. Fig. 14 is a plan of the device, Fig. 9, and illustrates the manner of use of such device.

In Fig. 1, W is an overhead wire or conductor, and R R the roof or convenient part of a car or vehicle traversing a track G, underneath which car an electric motor receives electric energy from W for operating the electric motor which propels the car or for other purpose.

T is a trolley or other suitable contact device, suitably mounted on an arm A, which is preferably elastic to some extent or provided with an elastic plate or portion L between the main or lower portion and the trolley or wheel bearings. The wheel T is a deep grooved roller by preference.

Jointed or hinged to A, at *a* and *b*, are the supporting arms, rods, or bars F, and a supplemental rod or bar E, which rods or bars are at *c d* respectively pivoted or jointed, so as to be capable of swinging up and down or toward and away from conductor W. The bearings or pivots *c d* are carried on a projection P or other suitable support, as shown, secured or mounted to some part of the car R R—as, for example, to its roof. The distance between *a* and *b* is somewhat less than that between *c* and *d*, the proportion being, say, as three to two, though the preferable and desirable proportion is two to one, approximately—that is to say, if the distance between the pivotal points of support of the rods or bars E F be eight inches the distance between the points *a b* of hinging or jointing to the trolley or contact arm would be four inches. It is essential for the best action that the distance between *c d* should thus exceed that between *a b*. The pivotal points *c d* are arranged in a line which makes an angle of forty-five degrees or less with the line in which the vehicle moves. I preferably make this angle about thirty-five degrees, or even somewhat smaller.

The length of the bars or arms E F may vary; but for best results in fulfilling all objects may be nearly equal.

To a prolongation of arm A, preferably bent downward, as at *h*, is attached a spring S, the other end of which spring is attached to a convenient point in the length of pivoted rod or support F. Arms or rods E and F may be similarly united by a second spring S′, though this is not essential if spring S be of sufficient range and power.

The support P is preferably mounted in any suitable way so as to be capable of rotation, as by a handle D, in a plane transverse to the plane in which the rods or bars E F swing. With an overhead wire the plane of rotation of the support P is a horizontal plane, or approximately such. By this means the position of the parts A E F may be reversed when the direction of movement of the vehicle is reversed. The parts are shown in their normal position in Fig. 1, the direction of movement of the car being indicated by the arrow. A suitable spring-catch K, adapted to enter notches in the rotatable plate from which arm P projects, may be used to hold the parts in position when reversed. With the parts so constituted no difficulty will be found in running backward or forward while maintaining contact with the wire W, since the spring S (assisted by S′, if desired) tends to open or increase the angle between the arms E, F, and A, and extend the trolley or contact. The range covered by this movement is very great.

Fig. 3 shows the nearly full extension upward with the relative position of parts.

Fig. 4 shows the complete collapse or lowest position of the wheel T. In passing from position Fig. 3 to position Fig. 4 the wheel or contact describes a nearly vertical line midway of the length of the car.

Should, as in Fig. 5, the wire W take a dip under a railroad track or trestle V of but little height, the device accommodates itself, and the car X may be run back and forth freely. The car Y may be even driven toward V with the trolley-arm A presented, as shown, and no difficulty will be experienced. The wheel T will lower itself freely and automatically pass under V, running on the wire W W. The preferable direction or position for the parts is, however, that shown at Z, when running toward V, though either of the positions allow motion either forward or backward freely.

The support P, carrying pivots *c d*, has been shown as fixed, (see Fig. 6,) giving a definite position to the pivots at all times.

To provide for the trolley-wheel slipping off the wire W and getting caught in the supports or suspensions of the same (an accident which may occur when the wheel T precedes the points *a b*, as in Fig. 5 at Y) I provide any suitable means for allowing the whole compound arm to be thrown over or drop back out of the way. This is accomplished by making the support upon which the rods or bars E F are pivoted a movable one, capable of swinging in the line of movement of the car under abnormal stress, but ordinarily held from such movement. In Fig. 6 the support is shown as fixed as in the previous figures.

In Fig. 7 I show a construction adapted to secure the result just stated. P is the support, and P′ a base to which P is pivoted, but rather firmly held in place by a powerful spring J. The arms E and F are pivoted to P, as in former figures. An abnormal pull, tending to move the arms to the right, extends the spring and allows such a position as in Fig. 8 to be taken. When the parts are relieved, they return by the action of spring J.

Instead of J, I might use any other device, as a string or cord, which will give way or yield under great strain, or a detent which unlocks with excessive strain may be employed.

Other modifications can be made giving

similar effects; but this part of my invention is of minor importance, providing, as it does, for an accident which is unlikely to happen.

An uninterrupted flow of electricity to the vehicle on the reversal to dotted-line position, Figs. 9 and 10, of the devices which support the contact or trolley is provided for in the following way: In the first place, it will be observed that the trolley or contact is mounted on the arm A so as to be in vertical position over the center, on which the support P for the arms and rods turns. Therefore, if the contact were flat or of considerable surface, or of suitable form on its contact-surface, to permit it to turn on the conductor, the desired reversal of the supporting devices to the positions indicated in dotted lines, Figs. 9 and 10, without break of connection could be made without further provision, because the contact device would not be swung out in the arc of a circle away from the wire, but would turn on itself, as it were. In the case of a trolley grooved to fit the wire it is obviously not practicable to rotate the trolley on the wire; but the same capacity for reversal exists in this case, owing to the mounting of the trolley over the center of rotation of the support P and the devices carried thereby, it being only necessary to swivel the support or bearings of the wheel T at the point of mounting on the arm A, so as to permit rotation of the arm with relation to the wheel at the point of swivel-connection in line with the center of rotation of support P. The swiveling of the trolley at the point of connection with the arm A and in line with the center of rotation of P is not always desirable, although, as is obvious, there is, owing to the mounting of the trolley over the center of rotation of the supporting devices, the capacity of reversal without loss of contact.

To obviate the use of the swivel-connection, while at the same time utilizing the principle of mounting the trolley or other contact device over the center of rotation of the supporting devices therefor, I employ in connection with the line-wire a reversing platform, table, or bearing to receive the trolley or contact and of proper form to permit the same to rotate on its vertical axis or on practically the same axis as the supporting devices for it. One form of such a device is shown in Fig. 10, and is of very simple character. It consists simply of a plate M of conducting material and flat or even dished on its lower surface, where it forms a contact with the traveling contact or trolley. If of considerable extent, as in Fig. 11, it may be simply flat. Being flat or a shallow inverted dish form, the trolley or other contact may turn thereon without losing connection therewith. The plate is connected with any source of energy for supplying current to the vehicle during the operation. For convenience it is connected to the line-wire, which is shown secured to the top thereof and in electrical connection with it. The contact-surface is arranged to form a continuation of the surface of the line-conductor on which the trolley travels, and it is also preferably provided with guides at its opposite sides to guide the trolley or other contact device back onto the conductor. This device may be inserted at the termini of the line or at any desired points.

A modification which it is often desirable to use with grooved trolleys is shown in Fig. 9. Here the bearing is adapted to receive the grooved trolley, and is rotatable on a pivot *p* mounted in a support, to which the ends of the line-wire are clamped. The bearing may fit the groove of the wheel and be of proper shape to guard against displacement of the wheel in the reversing operation. The parts are of conducting material and are in electrical connection with the line for the purpose already mentioned. Any form of bearing or platform having proper electrical connections and adapted to permit or aid rotation of the wheel or contact about a vertical axis or axis coincident with the axis of rotation of the supporting devices for the contact or wheel without losing its electrical connection with the source of energy will obviously serve the purpose. Of course, though only one trolley-wheel is shown, the arrangements may be modified to carry two or more, or when outgoing and return conductors W W′, Fig. 13, are used parallel in a horizontal plane there may be a single wheel for each wire, as T T′, carried by the single structure, as indicated in Fig. 1. In this case the wheels are insulated from each other and separate connections carried from them to the motor and other devices on the vehicle.

What I claim as my invention is—

1. The combination, with a vehicle and a line-wire supplying electric energy thereto, of a trolley or contact arm, a pivoted supporting rod or bar to which said arm is jointed, and a supplemental pivoted rod or bar extending in the same direction as the first and also hinged or jointed to the arm, as described, so as to swing in a parallel plane with the other.

2. The combination, with the vehicle, of the trolley or electric contact arm, a pivoted supporting rod or bar jointed to the arm, an extensor-spring connected to the arm and bar, and a supplemental pivoted rod or bar hinged or jointed to the arm between the trolley or contact end thereof and the point of connection of the main supporting-rod.

3. The combination, with the electric contact or trolley arm, of two supporting rods or bars pivoted on a suitable support and connected to the arm by joints or pivots placed nearer together than the distance between the pivotal points of support of said rods.

4. The combination, with the contact or trolley arm carried by the vehicle, of the two pivoted supporting rods or bars hinged or jointed thereto at points approximately one-half or less the distance between the pivoted points of support of the same.

5. The combination, with the contact or trolley arm, of the two rods or bars hinged or jointed thereto and pivoted on a line which makes an angle of forty degrees or less with the line of movement of the vehicle, as and for the purpose described.

6. The combination, with the conducting wire or rod and the vehicle supplied with electric energy therefrom, of a pivoted supporting rod or bar borne by the car, a contact or trolley arm jointed to said bar at an angle, and an extensor-spring connecting the rod and arm, as and for the purpose described.

7. The combination, with a vehicle and a line-wire from which electric energy is supplied to the vehicle, of a traveling contact or trolley carried by a rotatable support upon the vehicle and in a vertical or nearly vertical line over the center of rotation of said support, whereby the position of the devices carrying said contact may be reversed without interruption of electrical connection to them by simply rotating such support.

8. The combination, with a contact or trolley arm, of a supporting-base rotatable upon the vehicle and a contact or trolley mounted on the arm in line with the center of rotation of the support, whereby the position of the carrying devices may be reversed without removing the trolley or contact from connection with the wire or conductor.

9. The combination, with the line-wire and the trolley or contact mounted over the center of rotation of its supporting devices, of a bearing in connection with the line-wire for receiving said contact and permitting it to rotate on a vertical axis or axis substantially coincident with the axis about which its supporting devices rotate.

10. The combination, with the traveling electric contact and supporting devices therefor mounted on a rotatable support, of a line-wire and a rotatable bearing electrically connected with said line-wire and adapted to form a bearing or contact for the traveling electric contact, as and for the purpose described.

11. The combination, with the traveling contact or trolley carried by devices mounted on a rotatable support, of a reversing bearing or platform connected with a source of energy for receiving and maintaining connection with the contact or trolley when the same rotates on its own axis with its supporting devices.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 28th day of February, A. D. 1889.

ELIHU THOMSON.

Witnesses:

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A. L. ROHRER.