(No Model.)

M. D. LAW.

UNDERGROUND TROLLEY.

No. 555,959. Patented Mar. 10, 1896.

Fig. 1

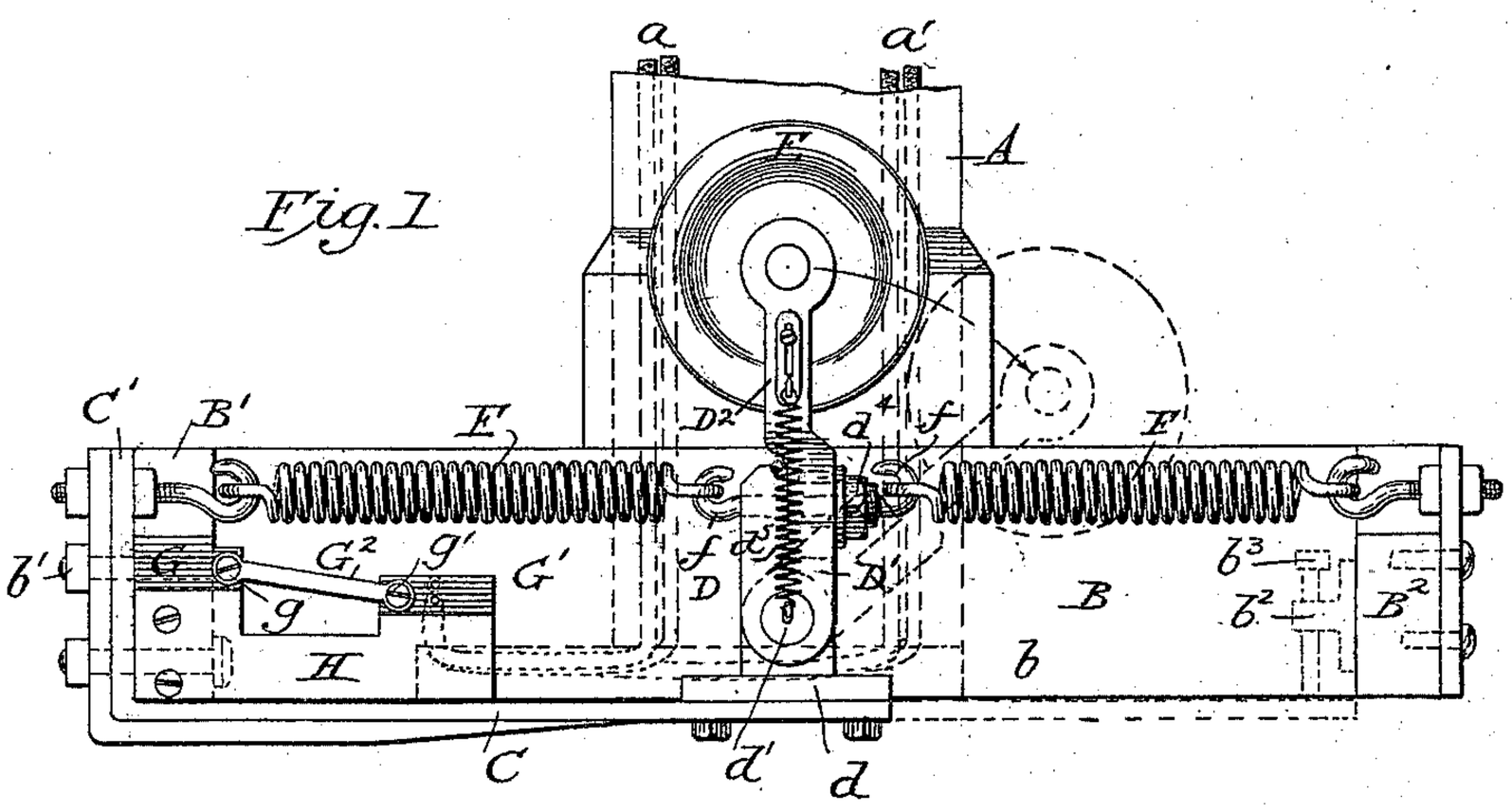


Fig. 3.

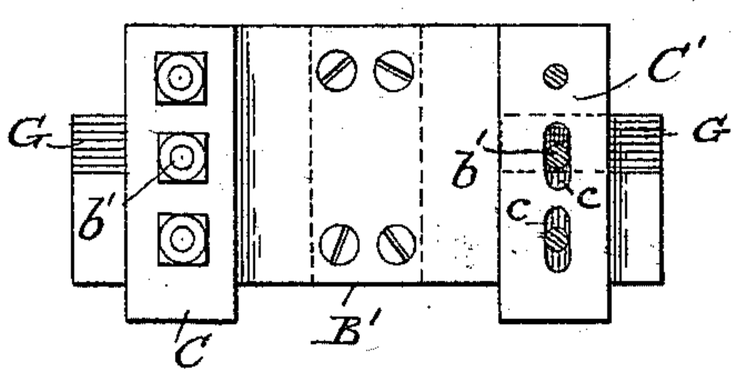


Fig. 4

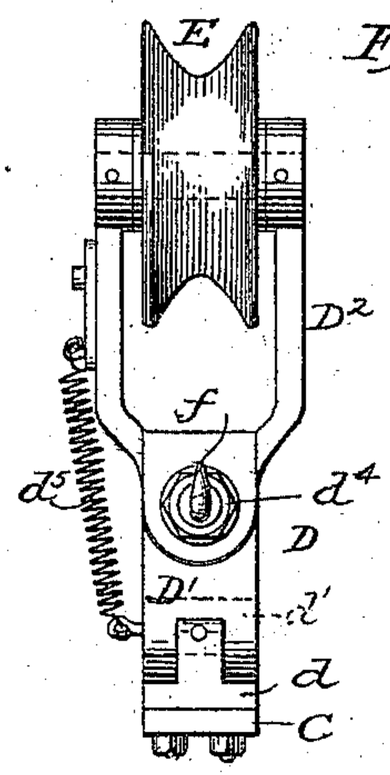
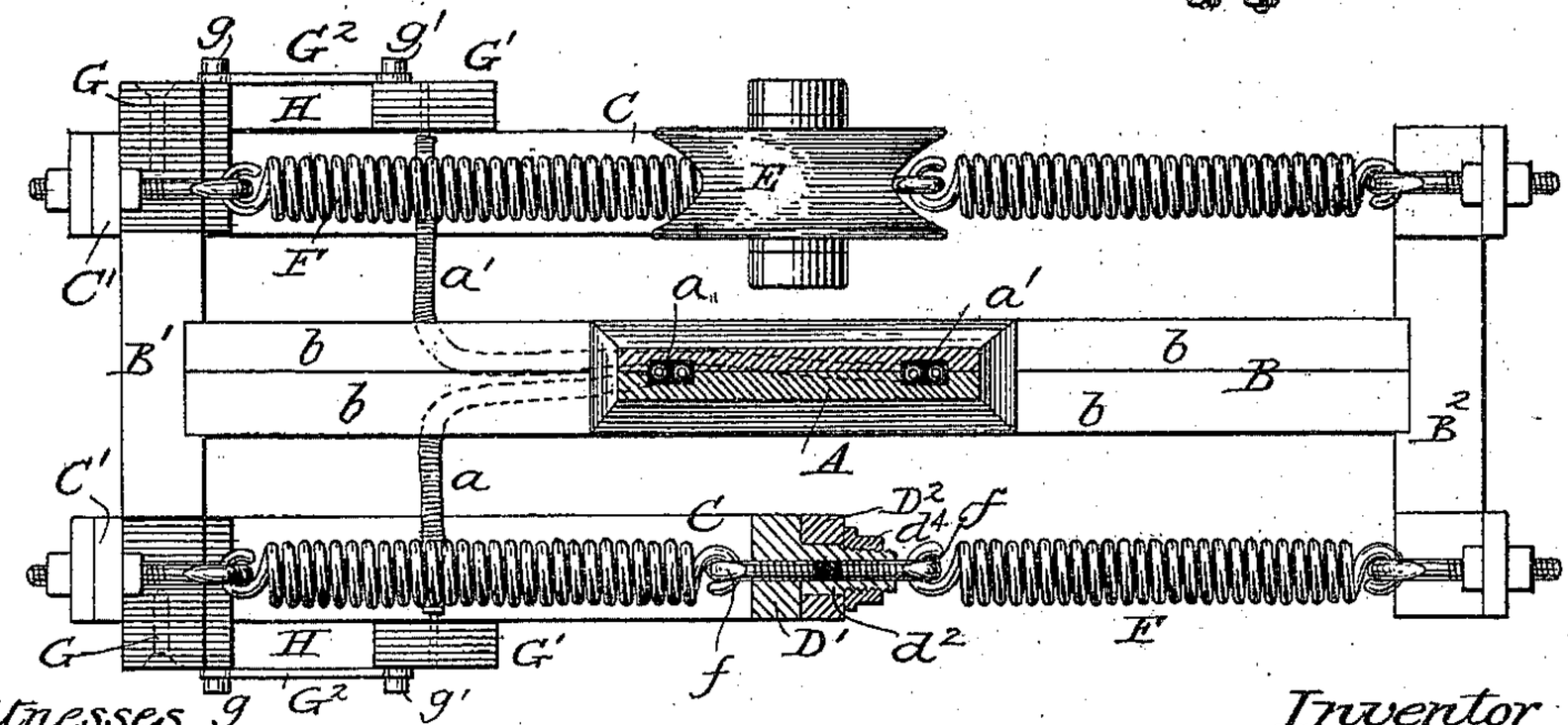


Fig. 2.



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UNITED STATES PATENT OFFICE.

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UNDERGROUND TROLLEY.

SPECIFICATION forming part of Letters Patent No. 555,959, dated March 10, 1896.

Application filed May 9, 1895. Serial No. 548,690. (No model.)

To all whom it may concern:

Be it known that I, MYRON D. LAW, of Washington, in the District of Columbia, have invented certain new and useful Improvements in Underground Trolleys; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to trolleys designed to travel in contact with electric conductors arranged within a slotted conduit.

One object of the invention is to avoid the complication in construction and secure better and more perfect insulation combined with durability in use.

Another object of the invention is to so construct a trolley of this character that its direction of movement may be reversed at will without liability of injury to the trolley or to the conductors with which it is in contact.

Another object of the invention is to so arrange the trolley-arms with relation to the supports as to present a minimum surface for the lodgment of dirt thereon, at the same time securing a maximum of insulation.

With these and minor objects in view the invention consists in the matters hereinafter described in detail and then pointed out in the claims at the close of the specification.

In the accompanying drawings, Figure 1 is a side elevation of a trolley embodying my improvements. Fig. 2 is a plan view thereof, partly in section. Fig. 3 is an elevation of one end of the trolley-base. Fig. 4 is an elevation of one of the trolley-arms.

In carrying out my present invention the lower end of the trolley-leg A carries a rigid longitudinal base comprising a central bar B, constructed of insulating material and quite narrow throughout its length and provided at its ends with cross-heads B′ and B², also of insulating material, to one of which—say B′—is secured two horizontal vertically-yielding arms C, extending one on each side of the trolley-leg, each having pivoted thereto at a point about opposite the central line of the trolley-leg A the lower end of a vertical trolley-arm D, the upper end of said arm carrying a current-collector, (herein shown as a trolley-wheel E.)

The main part of body B of the longitudinal base is constructed of two strips *b b*, preferably of vulcanized fiber, each having a central rabbet of a depth equal to half the thickness of the trolley-leg A, said strips being secured together face to face and to the trolley-leg, which latter is secured snugly in the slot formed by the central rabbets. The bottom of the trolley-leg A terminates short of the lower edges of the strips *b b*, and said strips are grooved longitudinally to receive the lower ends of the connecting-wires *a a′*, which ends, after passing from the trolley-leg, are led toward the cross-head B′.

The cross-heads B′ B² are rigidly secured to the ends of the strips *b b*, and to the outer ends of one of them—say B′—spring-arms C are secured to extend to or past the trolley-leg A on either side thereof, said arms being parallel with the sides of the insulating-strips *b b* of the supporting-frame B and somewhat remote therefrom. As illustrated, these spring-arms C have the form of the flat leaf-springs, their fixed ends C′ being bent upward at right angles and provided with vertically-elongated slots *c* to receive bolts *b′*, by which they are adjustably secured to the cross-head. At their free ends they are fitted with fulcrum-blocks *d*, to which the lower ends of the trolley-arms D are pivoted. These trolley-arms D are each composed of two members, the lower one, D′, being connected to the fulcrum-block *d* by a transverse pivot-bolt *d′* to permit of the oscillation of the arm in a vertical plane parallel with the supporting-frame B. The upper member, D², is connected to the upper end of the lower member by a longitudinally-arranged pivot *d²* to permit of a limited oscillation of said upper member in a direction at right angles to the length of the supporting-frame. As shown, the fulcrum-block *d* consists of a block or plate of metal provided with a centrally-arranged vertical lug, and the lower end of the member D′ of the trolley-arm is bifurcated to straddle said lug. Said member D′ is pivoted to the arm by a pivot-bolt *d′*, which passes through apertures in the forks of the arm and in the

lug, and is rigidly secured to the latter by a set-screw or other suitable means. By this arrangement I reduce the wear to a minimum and prevent that which would result were the pivot-bolt fixed to the forks of the arm and journaled in the aperture of the lug of the fulcrum-block. The upper end of the lower member, D′, of arm D is provided with a cylindric boss d^2, arranged at right angles to the pivot-bolt d', and the upper member of the said arm is provided with a socket to fit said boss, thus permitting the oscillation of the upper member, D^2, thereon. These trolley-arms D are each held normally in a vertical position by two coiled springs F, one extending from each cross-head B′ and B^2, and their adjacent ends being connected to the trolley-arm. A convenient means of attaching the springs to the trolley-arm is shown in the drawings, wherein the boss d^2 is tapped and two hooks f f with threaded shanks are screwed therein.

The boss d^2 projects beyond the outer face of the upper member, D^2, of the trolley-arm, and is threaded to receive a nut d^4, which prevents displacement of the said upper member and affords a bearing-shoulder therefor. The upper member of the trolley-arm is preferably bifurcated, as shown, the trolley-wheel being mounted between its arms. By this arrangement the journal of the trolley-wheel is supported at both ends, avoiding side strain thereon, and moreover the trolley-wheel is protected at both sides from contact with foreign objects.

The tension of the spring F may be adjusted in any convenient manner—as, for instance, by connecting the outer ends thereof to the cross-heads B′ and B^2 by adjustable screw-bolts or hooks, as shown. This screw-bolt at one end passes through the upturned end of the spring-arm C and is connected directly with the spring F, so that more or less current can pass through said bolt and spring to the trolley-arm and the trolley.

The spring-arms C may be formed of one or more leaves, two being shown, and are so shaped and proportioned with respect to the length of the trolley-arms that the upper or contact surface of the trolleys supported thereby will be, when the trolley-arms are in a vertical position, as shown in full lines in Fig. 1, in a plane a little above the plane of the conductors with which they are to run in contact. These spring-arms C are also of such strength and tension that under normal conditions of use they will not be depressed from the contact of the trolleys with the line conductors, as the trolley-arms will stand slightly rearward with respect to the direction of travel, as in the dotted lines, Fig. 1, and the trolleys be held in contact with said conductors by the tension of one or the other of the coiled springs F, as the case may be. Upon a reversal of movement of the trolley, however, consequent upon a reversal of direction of a car or other vehicle to which the trolley is fitted, said spring-arms will be depressed to the extent required to permit the trolley-arms to rise to a vertical position and thereby assume a rearward inclination with relation to the direction of movement. Should the tension of these spring-arms C become weakened from use, they may be adjusted to a higher position by means of the elongated slot c and bolts b', hereinbefore described. At the right hand of Fig. 1 I have shown by dotted lines another means for adjusting the position of these spring-arms. In this instance the free ends of the spring-arms are extended and terminate adjacent to the cross-head B^2, while brackets b^2 are secured to said cross-head, said brackets carrying set-screws b^3, by the manipulation of which the free ends of the spring-arms C with which said screws are in contact may be depressed or relieved of pressure, thereby depressing or elevating the trolley-arms borne thereby.

In constructing trolleys I prefer to interpose a fuse between the trolley-wheels or collectors and the connecting-wires a a' where they leave the trolley-leg A, and in the construction shown this is conveniently accomplished by attaching to the cross-head B′ contact-blocks G, which have metallic connection with the spring-arms C, and leading one of the connecting-wires a a' to another contact-block G′, these blocks being connected by a fuse-strip G^2.

As shown, an insulating-block H is rigidly secured to each end of the cross-head B′ and carries at one end the metal block G, bearing a binding post or screw g, one of the bolts b' which secures the spring-leg C to the cross-head passing through said block G and establishing metallic contact between said block and the spring-arm C. Upon the other end of the iusulating-block H is secured the other metal block, G′, having a binding-screw g', one of the connecting-wires a a' being carried across the space between the strips b b and the block G′ and secured in a suitable manner to the latter, and a suitable fuse-strip G^2 being connected at its end with said blocks G and G′ by means of the binding-screws g and g'. By this arrangement I preserve the skeleton form of the trolley-base and its adjuncts, and secure a maximum of insulation between the metallic parts traversed by the working and return currents, thus avoiding liability of short-circuit through the trolley under any ordinary conditions of use or wear.

In practice I prefer to employ means for maintaining the upper member of the trolley-arm D in alignment with the lower member, so that the trolley-wheel will be deflected laterally only under exceptional circumstances—as, for instance, should the line conductors, one or both, depart from their normal position parallel with the slot of the conduit. A convenient means for attaining this result is herein illustrated, the same consisting of a coil-spring d^5, one end of which is secured to

the lower member of the trolley-arm, the other end thereof being adjustably secured to the upper member of the said arm. These springs act both as compression and expansion springs, they being so adjusted upon the trolley-arms that the spring will be compressed by lateral movement of the trolley-wheel in one direction and extended by a movement of said wheel in the opposite direction, the spring being free from tension when the arm is upright and being made of wire having considerable stiffness, thereby normally maintaining the upper member, D^2, of the arm in vertical alignment with the lower member, D′, thereof.

I have shown the trolley-arms D as provided with a single spring d^5; but it is obvious that a spring or springs of other form may be used and that the spring may be arranged or disposed otherwise than in the particular manner illustrated. I prefer, however, the construction illustrated, because simple in construction and affording facility for repairs, while also serving as a bond-wire to carry the current should the pivotal joint become an imperfect conductor through continued use.

In practical operation it has been demonstrated that the skeleton form of this trolley-base and its adjuncts is a feature of great importance, as it presents but little surface for the lodgment of mud or dirt. In other words, I am enabled by this form of base to interpose between the metallic parts carrying current bars of insulation of considerable length but of little width or thickness horizontally, so as to afford ample insulating material in a form which avoids liability of accumulation on the top surface thereof of mud, dirt, or salt in a manner to bridge over the insulation and thus electrically connect the metallic conducting parts at opposite sides of the circuit. This feature is of especial importance where salt is used on the snow on the tracks in winter, as it is found that the salt-saturated water or brine reaching the trolley will soon make a deposit of crystallized salt upon the trolley and upon all parts thereof which can be reached by the water, which deposit produces short-circuiting wherever it is so located as to bridge over or electrically connect exposed metallic surfaces.

Aside from the above considerations, a trolley made in accordance with my present invention has the further special advantages that it may be more cheaply constructed than any of a similar character known to me, and by the feature of the vertical oppositely-swinging trolley-wheel in use effects a saving of time and labor, as the direction of motion of a car provided with this trolley can be changed at will, the shifting of the trolley-arms being entirely automatic and requiring no attention.

I claim as my invention—

1. A trolley device, comprising a trolley-leg provided at its lower end with a skeleton base, a horizontal, vertically-yielding trolley-supporting arm attached at one end to the end of the base remote from the leg, a vertical trolley-arm mounted on said supporting-arm by a transverse pivot permitting movement of the vertical arm in a vertical plane in both directions, and oppositely-acting springs applied to said vertical arm and tending to maintain the same in vertical position, substantially as described.

2. A trolley device, comprising a trolley-leg, provided at its lower end with a base, consisting of a longitudinal bar of insulating material provided with a cross-head at its end, a horizontal vertically-yielding supporting-arm, attached at one end to the said cross-head, a vertical trolley-arm pivoted on said supporting-arm and swinging in a vertical plane, and oppositely-acting springs applied to said vertical arm and tending to maintain the same in vertical position, substantially as described.

3. A trolley device, comprising a trolley-leg provided at its lower end with a skeleton base, a horizontal, vertically-yielding supporting-arm attached at one end to the end of the base remote from the leg, a vertical trolley-arm mounted on said supporting-arm, and oppositely-acting, horizontally-arranged, contractile springs connected at their inner ends with the said vertical arm, and secured at their outer ends to the skeleton base, substantially as described.

4. A trolley device, comprising a trolley-leg, provided at its lower end with a skeleton insulating-base, a horizontal, trolley-supporting arm, consisting of a leaf-spring attached at one end to the base at a point remote from the leg, a vertical trolley-arm mounted on said horizontal arm by means of a transverse pivot, permitting movement of the vertical arm in both directions in a vertical plane, and oppositely-acting springs applied to said vertical arm and tending to maintain the same in vertical position, substantially as described.

5. A trolley device comprising a trolley-leg, provided at its lower end with a base consisting of a longitudinal bar of insulating material provided with a cross-head at its end, a horizontal supporting-arm consisting of a leaf-spring arranged parallel with the longitudinal bar and attached at one end to the said cross-head, a vertical trolley-arm pivotally mounted on said supporting-arm and adapted to swing in a vertical plane, and oppositely-acting springs applied to said vertical arm and tending to maintain the same in vertical position, substantially as described.

6. A trolley device, comprising a trolley-leg provided at its lower end with a base consisting of a longitudinal bar of insulating material having cross-heads at its opposite ends, a horizontal arm consisting of a leaf-spring secured to one of said cross-heads, a vertical trolley-arm pivoted to said spring-arm, and springs secured to opposite sides of the trolley-

arm and to the opposite cross-heads and tending to maintain the vertical arm upright, substantially as described.

7. A trolley device comprising a trolley-leg provided at its lower end with an insulating-base, a vertical trolley-arm connected with said base by a vertically-yielding support, said trolley-arm being provided with a horizontal pivot admitting of a lateral movement of the trolley, and a spring attached to the trolley-arm above and below the pivot thereof, and serving both to restrain the trolley from lateral movement and as an electrical connection between the upper and lower parts of the arm, substantially as described.

8. A trolley device, comprising a trolley-leg, provided at its lower end with an insulating-base, a vertical trolley-arm connected with said base by a vertically-yielding connection, said trolley-arm being provided with a horizontal pivot admitting of the lateral movement of the trolley, and a coiled spring adjustably connected with the parts of said trolley-arm above and below its said pivot, substantially as described.

9. A trolley device comprising a trolley-leg provided at its lower end with an insulating-base, a horizontal supporting-arm consisting of a leaf-spring secured to the said base, an upright trolley-arm pivotally supported upon said supporting-arm, springs tending to maintain the trolley-arm in vertical position, and means for adjusting the height of the said trolley-arm, substantially as described.

10. A trolley device comprising a trolley-leg provided at its lower end with an insulating-base, a horizontal supporting-arm consisting of a leaf-spring which is connected with the said base by vertically-adjustable connections, a vertical trolley-arm pivoted to the said supporting-arm, and springs applied to said vertical arm and tending to maintain it in vertical position, substantially as described.

11. A trolley device comprising a trolley-leg provided at its lower end with a skeleton base having a longitudinal bar of insulating material provided with a cross-head, a horizontal, vertically-yielding supporting-arm secured at one end to the cross-head of said base, a vertical trolley-arm connected with said supporting-arm by a transverse pivot, said trolley-arm being provided with a horizontal pivot admitting of lateral movement of the trolley-wheel, and springs connected with the vertical trolley-arm and arranged to resist the movement of the upper end of said trolley-arm, both laterally and longitudinally with relation to the base, substantially as described.

12. A trolley device comprising a trolley-leg provided at its lower end with a skeleton base having a longitudinal bar of insulating material provided with a cross-head, a horizontal supporting-arm consisting of a leaf-spring secured to the cross-head and arranged parallel with said longitudinal bar, a vertical trolley-arm connected with the supporting-arm by a transverse pivot and provided with a horizontal pivot admitting of lateral movement of the trolley, oppositely-acting springs connecting the said upright arm with the base and tending to maintain said arm in its upright position and a spring connecting the parts of said arm above and below its said horizontal pivot and acting to restrain the upper part of the arm from lateral movement, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

MYRON D. LAW.

Witnesses:
C. A. NEALE,
K. H. BANKS.