

(No Model.)

W. D. M. HOWARD.  
SUBTERRANEAN ELECTRIC CONDUIT.

No. 596,812.

Patented Jan. 4, 1898.

Fig. 2.

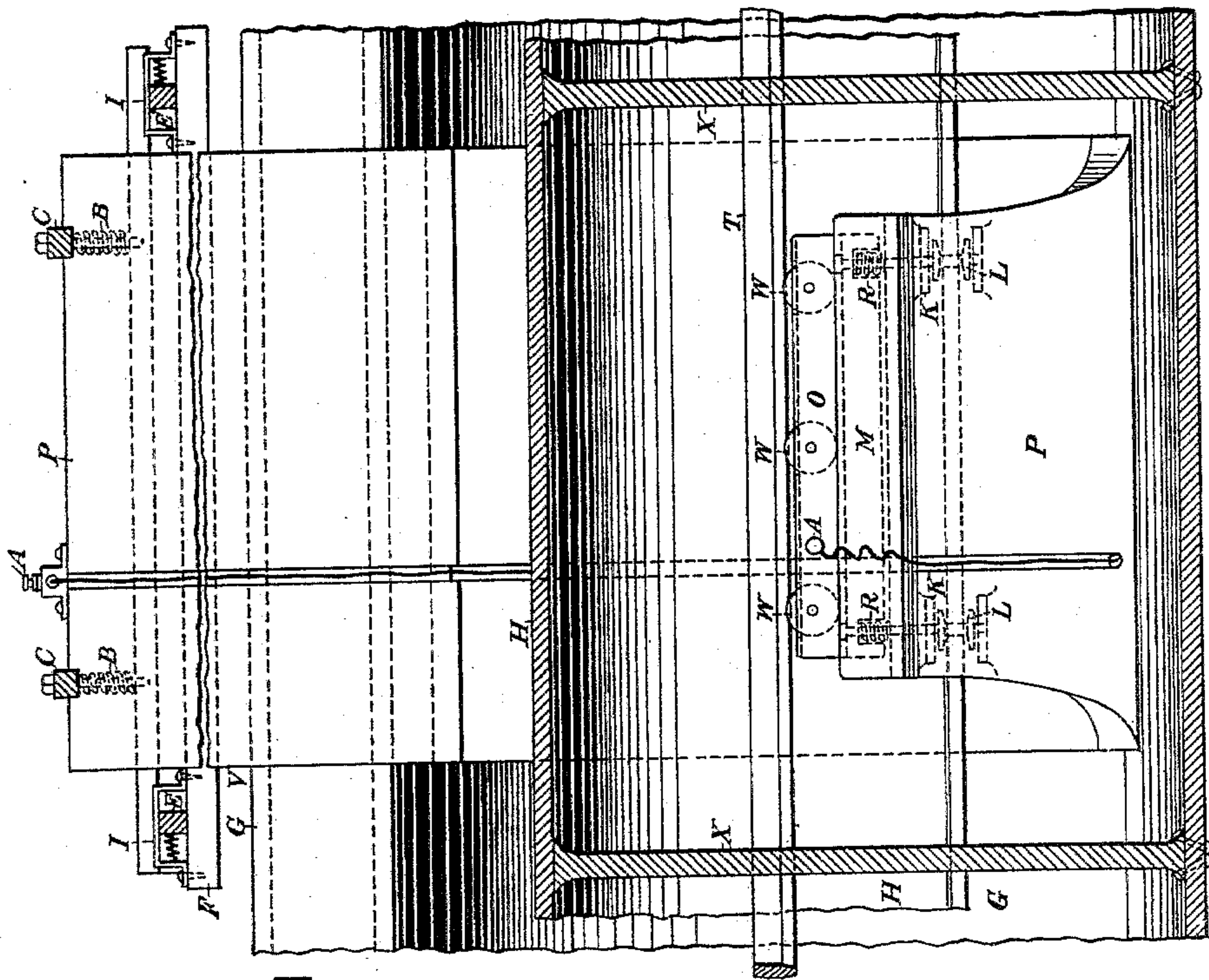
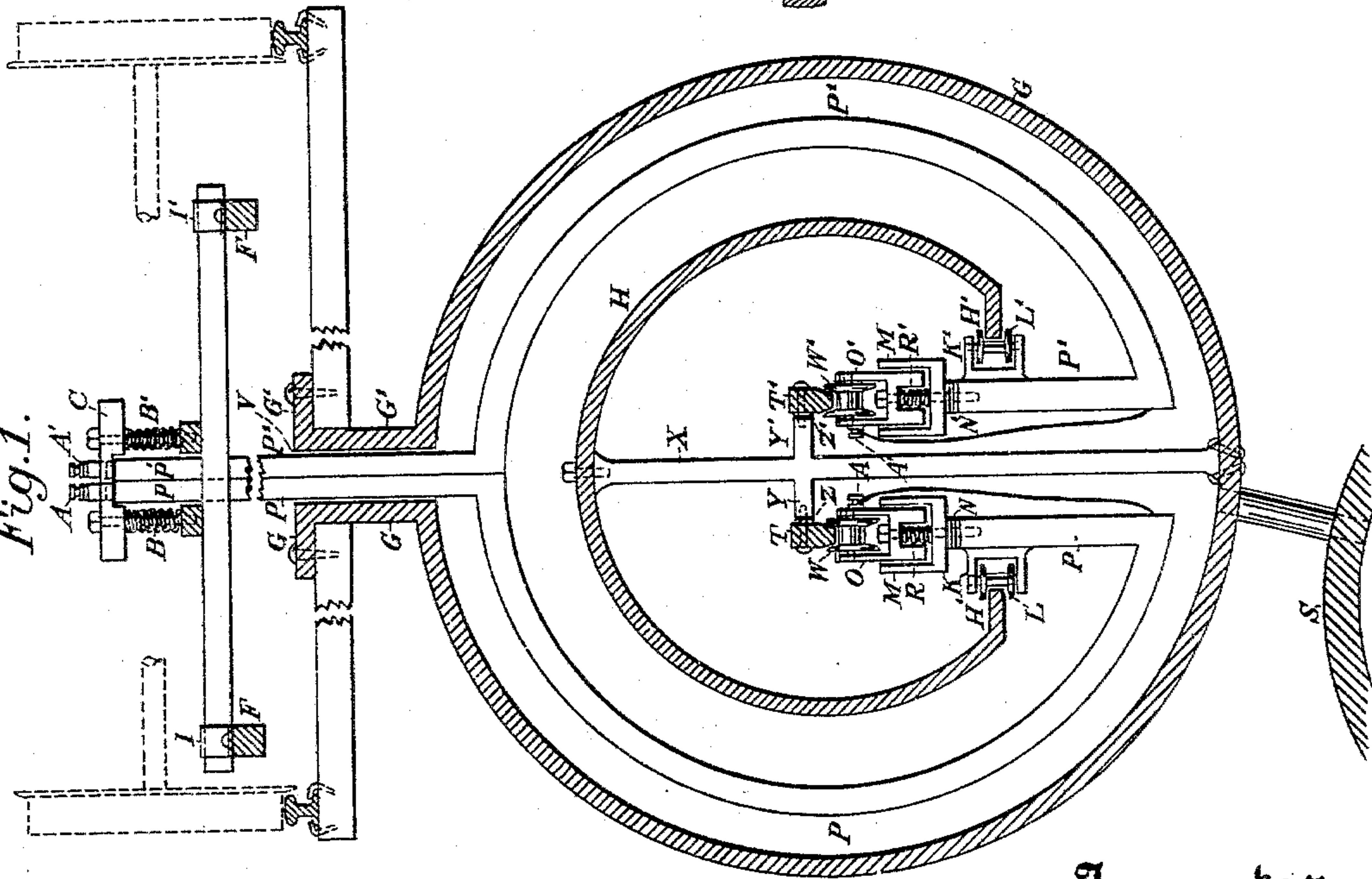


Fig. 1.



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# UNITED STATES PATENT OFFICE.

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## SUBTERRANEAN ELECTRIC CONDUIT.

SPECIFICATION forming part of Letters Patent No. 596,812, dated January 4, 1898.

Application filed June 18, 1897. Serial No. 641,239. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM DAVIS MERRY HOWARD, a citizen of the United States, residing at Redwood City, county of San Mateo, State of California, have invented an Improvement in Subterranean Electric Conduits; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to a means for transmitting and supplying the electric current to movable objects, and is more especially designed to provide a subterranean electric conduit within which the trolley wires, rods, or tracks are suspended, insulated, and protected from the action of moisture, the tendency to leakage, and induced currents; and it consists in certain details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a transverse section showing one view of my invention. Fig. 2 is a longitudinal section.

The object of my invention is to transmit underground electric currents from conducting or trolley wires to a moving object with a high degree of safety, economy, efficiency, and durability, both mechanical and electrical, thus conveying a current of high electrical efficiency at a small cost of maintenance and avoiding the use of the unsightly poles and naked wires employed in ordinary trolley systems, together with the danger arising from such wires on account of the necessary high voltage of the current carried by them.

This invention is especially adaptable to the transmission of an electric current to street-cars for the purpose of supplying power to drive the same.

My conduit consists of two concentric tubes, made of iron or other suitable materials, the outer tube G inclosing the inner tube H, which is held in position by iron columns or standards centrally fixed in the bottom of the outer tube and having the inner tube bolted or otherwise secured to the upper ends. The radius of the inner tube is equal to about two-thirds that of the outer tube. The outer tube has a longitudinal slot V made in the upper part of its periphery, the tube being

turned so as to form a radial channel between the periphery of the tube and the upper end and having lips turned outwardly, as shown at G', and adapted to be fixed to the ties or other surface-supports, whereby the parts are properly maintained in position and a continuous channel is formed, through which connection is made from the car or other object on the surface to the interior of the tube. The interior tube does not form a complete cylinder, but is left open at the bottom for about one-fourth the circumference. The edges at this point are turned inwardly, as shown at H, so as to form guide-rails for the plow or carrier P', the operation of which will be hereinafter described.

In the interior tube H and fixed to the standard X are two arms Y and Y', which support the two trolley-wires T and T' by means of connections which are suitably insulated from the supports Y and Y', as shown at Z and Z'. The trolley-wires and all working parts are thus contained and protected within the interior tube H, so that no water or other foreign matter which may enter the slot V can obtain access to the tube H, and, if deemed necessary or convenient, either or both tubes may be lined or covered with any insulating paint or other suitable coating, which will prevent all loss of electric current by radiation, and all short-circuiting, with its accompanying dangers, is reduced to a minimum. By this construction the trolley-wires are also given a high electrical insulation from conductivity and leakage.

The outer conduit-tube G is connected at convenient intervals with the sewer shown at S, whereby it may be always kept dry and clean.

The electric current is transferred from the trolley-wires T T' to the moving object, or the circuit is completed by means of the plow or carrier P P'. This is made up, as shown in the present case, of two steel or iron plates, curved to be concentric with and lying between the outer and inner tubes G and H, as shown. These plates have radial extensions passing up through the slot formed in the outer tube at V, and they are suitably fastened together by rivets or bolts at the top. At the lower end these plates P and P' are bent at such an angle as to extend approxi-



mately vertically upward into the inner tube H, and they have fixed upon their upper edges and within the inner tube directly under the trolley-wires the steel or iron cases M M'. These are insulated from the plow or carrier, as shown at N N', and within these cases are placed bearings O and O', in which the trolley-wheels W and W' are journaled. Springs R R' situated below these cases act to continually thrust or force them upwardly, so that the trolley-wheels W W' are kept in constant and perfect contact with the wires T T'.

At the point where the plows P P' pass between the inner edges H' of the lower part of the tube H are suitably-attached bearings K K', within which the guide-wheels L L' are journaled. These wheels are so journaled that they run along the interior edges of H and H', which thus form guide-rails to retain the plows P P' in their proper relation with the trolley-wires, and the trolley-wheels are thus prevented from jumping or leaving the wires. The plow extremities and the cases M M' are thus always held in the same internal position with relation to the tube and trolley-wires while the plow travels along. This plow is suspended from the moving car by a suitable frame or truss in the following manner:

F F' are two horizontal beams attached rigidly to the body of the car and parallel with the line of travel thereon. Upon these beams are fixed the guides I I', and within these guides the transverse beams E and E' are movable, these beams standing at right angles with the beams F and F'. Springs upon each side of the beams E and E' act to keep these beams in a normally central position. At the same time they allow freedom for the several different movements that will take place when the car passes around curves, and the plow by these means is allowed to adjust itself to the curvature of the slot V. These springs at the same time relieve the plow from any jars or jerks caused by the violent stopping or starting of the car.

The beams D and D', fixed near the center of the beams E' and parallel with the beams F and F', form guides to the plow P, which rises and falls between them, actuated by irregularities as the rollers L travel upon the guides H', and the springs D and D' acting with an upward thrust tend to hold the plow in its proper position.

The operation of the device will be as follows: The plow being attached to a moving car and entered in the conduit with its guide-wheels L L' traveling upon the inner edges of the tube H, as shown at H', the trolley-wheels W W' are retained in electrical contact with the wires T T', thus completing the circuit through the motor on the moving car. The trolley-wheel-bearing cases M M' being insulated from the plow, as shown at N N', the electric current is conveyed from the trolley-bearings at the binding-screw A, as shown,

by means of insulated copper wire. This wire is preferably countersunk in a groove or channel below the surface of the plates P P' and suitably protected to prevent the compression or injury of the insulation. This wire passes around the curvature of the plates P P' and up between them to the binding-posts, (marked A A'.) From this point the connections are made in the usual manner through the motor-circuit. (Not here shown.) The return-current may either be grounded, or, as shown in the present case, it passes along an insulated copper wire from the binding-post A, and this wire follows the surface of the plow-lug P' in the same manner as the previously-described wire follows the surface of the plate P. The negative circuit is then completed through the trolley-wheels W' to the wire T', thus completing a metallic circuit.

I have described this apparatus as being applied to a car moving upon the track on the surface of the ground, but it is manifest that the current may be conveyed in this manner to any moving object to which it is desired to convey such current safely and economically and all dangers and drawbacks attendant upon the overhead-trolley system are avoided.

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

1. The combination with a conduit provided with a slot or channel, of a hollow tube interior to the conduit, having a channel in its bottom and inturned edges forming guide-rails, vertical standards fixed in the conduit and passing through the channel of the tube and into the interior of said tube, and secured to the inner circumference thereof, trolley wires or rods within the tube and supported from the standards, and a plow having guide-wheels to engage the inturned edges of the tube.

2. In an underground electrical conduit, an exterior tube having a continuous longitudinal open slot or channel in its upper surface, an interior tube having an open channel in its lower surface, standards fixed in the bottom of the exterior tube extending upward through the channel in the interior tube, the latter being fixed to the upper ends of the standards, arms extending from the standards, trolley wires or rods supported from the arms upon each side of the standards, having insulating devices between the rods and the suspending arms.

3. In an underground electrical conduit, an exterior tube and an interior tube concentric therewith, the exterior tube having an open continuous slot extending longitudinally in its upper portion, the interior tube having an open channel in the lower surface, through which channel supporting-posts fixed to the bottom of the exterior tube extend and are secured to the upper part of the interior tube, arms extending from said standards, trolley



rods or conductors insulated and suspended from said arms, plows or carriers consisting of curved plates concentric with and intermediate between the outer and inner tubes, the upper ends of said plates extending outwardly through the channels in the outer tube to form connection with the moving object and the lower edges being upturned, extending into the inner tube, cases supported upon the upturned inner ends of the plates with trolley-wheels journaled thereon adapted to form contact with the trolley-conductors.

4. In an underground electrical conduit, concentric tubes supported one within the other, the outer one having an open continuous slot or channel at the top, the inner one having an open channel at the bottom with inturned edges, plows or carriers formed of metallic plates extending through the slot in the outer tube and connecting with the moving object, said plates being curved concentric with and between the outer and inner tubes having their lower edges turned upward with trolley-wheel carriers supported therefrom, said carriers consisting of cases with spring-supported interior boxes within which the trolley-wheels are journaled, trolley-wires supported within the interior tube so that the trolley-wheels form contact therewith, and guides projecting from the upturned lower edges of the plates adapted to travel upon the guides of the inner tube.

5. In an underground electrical conduit, an exterior tube with a continuous longitudinal slot at the top, an interior tube concentric therewith supported upon standards extending upwardly from the bottom of the outer tube to the top of the inner tube, arms extending from said standards, trolley-conductors suspended and insulated from said arms upon each side of the standards, plows or carriers connected with the car or moving object consisting of plates extending from the car downwardly through the channel in the outer tube and bent cylindrically between the two tubes concentric therewith having the lower edges upturned, guide wheels or rollers upon the exterior faces of the upturned edges adapted to travel upon the guiding edges of the interior tube, cases insulated from and supported upon the upturned edges of the plows, journal-boxes mounted upon springs within said cases having trolley-wheels journaled within them so as to form a continuous spring-pressed contact with the trolley-wires, and conducting-wires extending from said trolley-wheel, supported within grooves or channels in the plow-plates and connecting with bind-

ing-posts upon the moving car or object from which binding-posts circuits may be completed through the motors of the cars.

6. An underground electrical conduit, consisting of concentric tubes channeled and supported with relation to each other as shown, plows or carriers extending respectively through the channels in the outer and inner tubes and bent into a form concentric between the outer and inner tubes, trolley-wires supported within the inner tube from fixed standards, trolley-wheels carried by spring-pressed journal-boxes upon the upwardly-projecting edges of the plow-plates and forming contact with the trolley-wires, conducting-wires connecting therewith passing through protecting grooves or channels in the plow-plates and connecting with binding-posts upon the car-body, bars fixed upon the car-body transversely to the line of motion, other bars extending longitudinally resting upon the first-named bars with guiding slots or channels on the first-named bars through which the second-named bars pass with springs pressing upon opposite sides thereof whereby said bars and connected parts are allowed to yield in passing curves or irregularities and be returned to their normal positions.

7. An underground electrical conduit exterior and interior concentric tubes having continuous longitudinal channels respectively in the top of the exterior and the bottom of the interior tube, plows connecting with the car or moving object and formed of plates secured together passing down through the slot in the exterior tube, thence diverging in cylindrical form, concentric with and between the outer and inner tubes, said plates having upturned lower edges upon which trolley-wheels are carried and insulated therefrom, trolley rods or conductors supported from standards within the inner tube with which the trolley-wheels form continuous elastic spring-pressed contact, guides by which the plates are carried with relation to the guides of the inner tube, attachments to which the upper edges of the plow-plates are secured and springs pressing upwardly from said carrier whereby the plow-plates are retained constantly in a normal position with relation to the tubes and parts carried thereby.

In witness whereof I have hereunto set my hand.

WILLIAM DAVIS MERRY HOWARD.

Witnesses:

S. H. NOURSE,  
JESSIE C. BRODIE.