(No Model.) 5 Sheets—Sheet 1.

M. SHOEMAKER.

ELECTRIC RAILWAY SYSTEM.

No. 457,870. Patented Aug. 18, 1891.

FIG. 1.

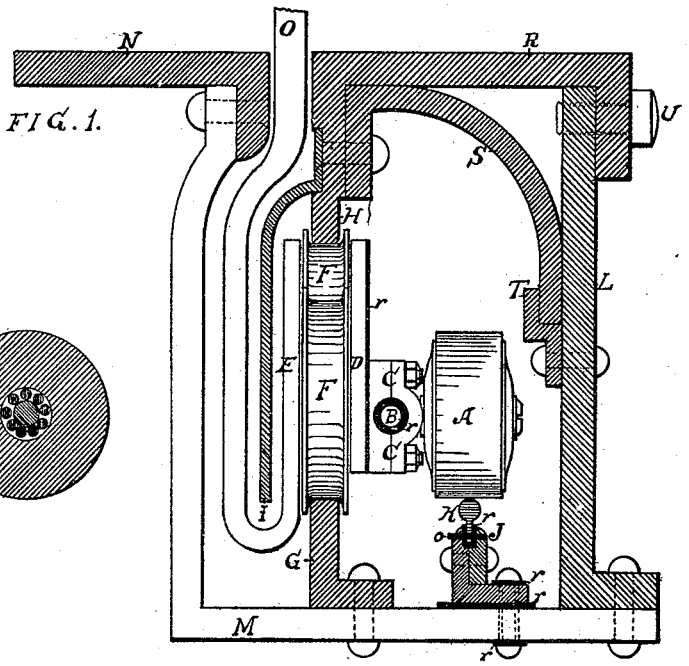


FIG. 2.

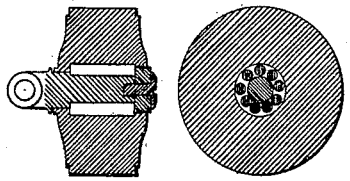
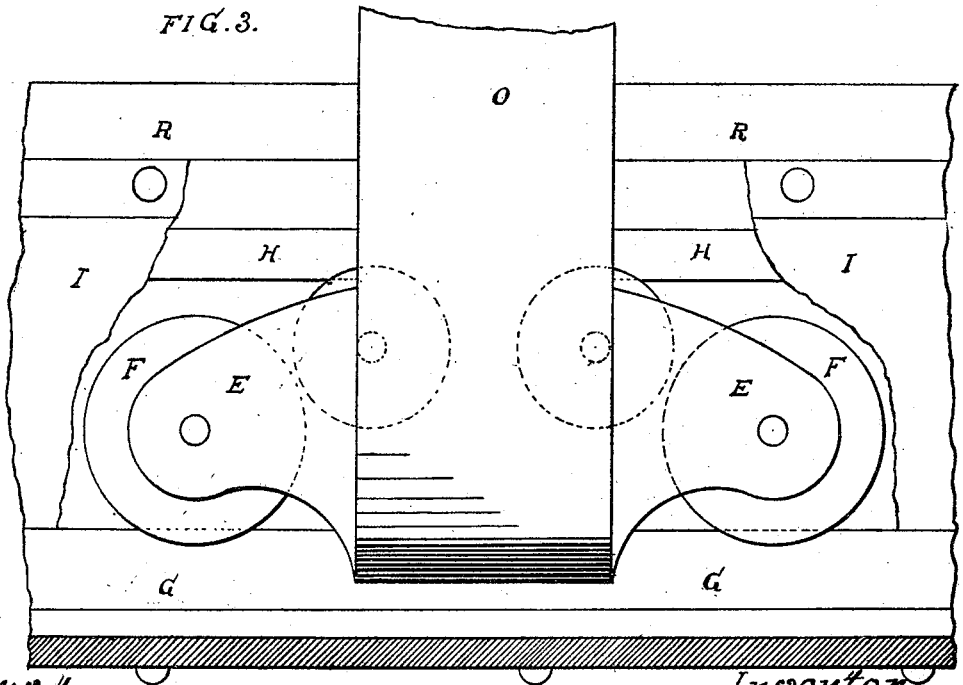


FIG. 3.



Witnesses:
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Wilfred W. Beach

Inventor:
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per A. I. Batchelder
Attorney.

(No Model.) 5 Sheets—Sheet 2.

M. SHOEMAKER.

ELECTRIC RAILWAY SYSTEM.

No. 457,870. Patented Aug. 18, 1891.

FIG. 4.

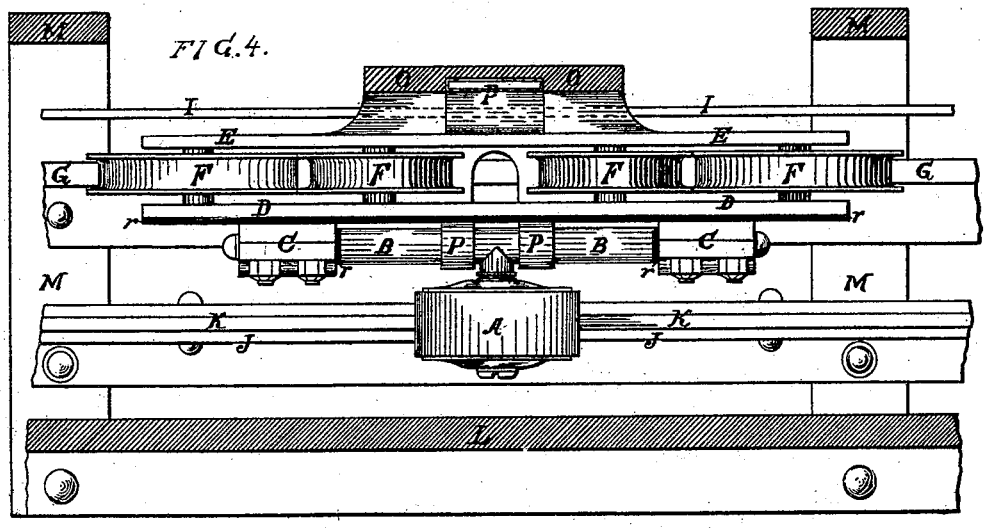
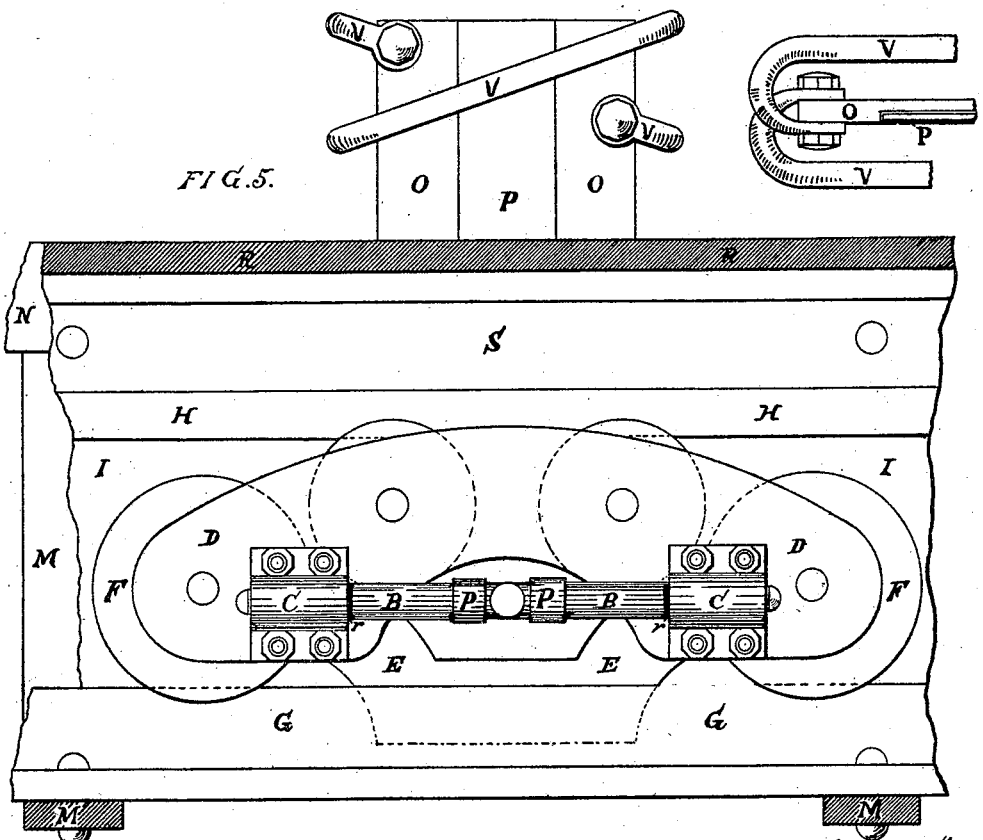


FIG. 5.



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(No Model.) 5 Sheets—Sheet 3.

M. SHOEMAKER.

ELECTRIC RAILWAY SYSTEM.

No. 457,870. Patented Aug. 18, 1891.

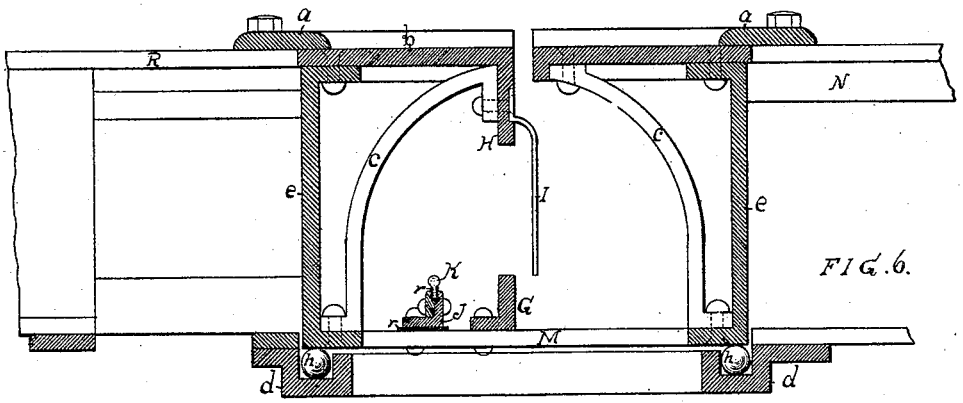

FIG. 6.

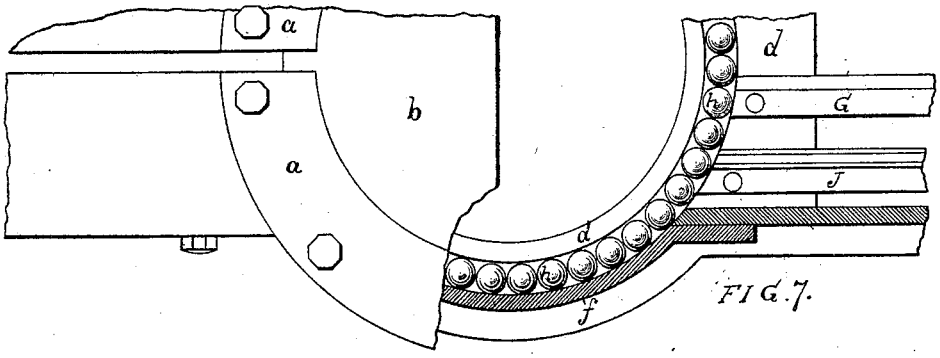

FIG. 7.

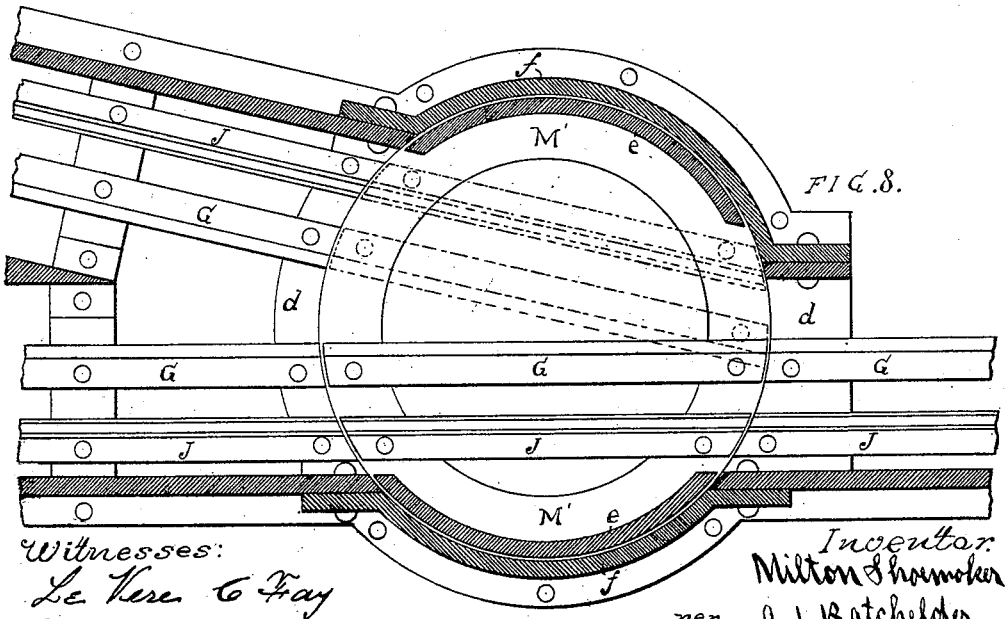

FIG. 8.

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M. SHOEMAKER.

ELECTRIC RAILWAY SYSTEM.

No. 457,870. Patented Aug. 18, 1891.

FIG. 9.

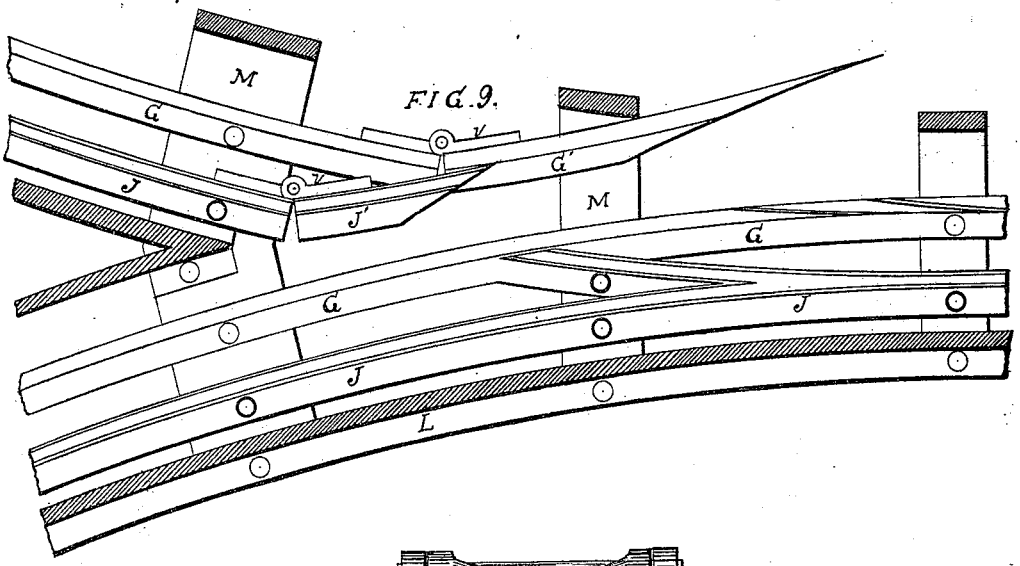


FIG. 10.

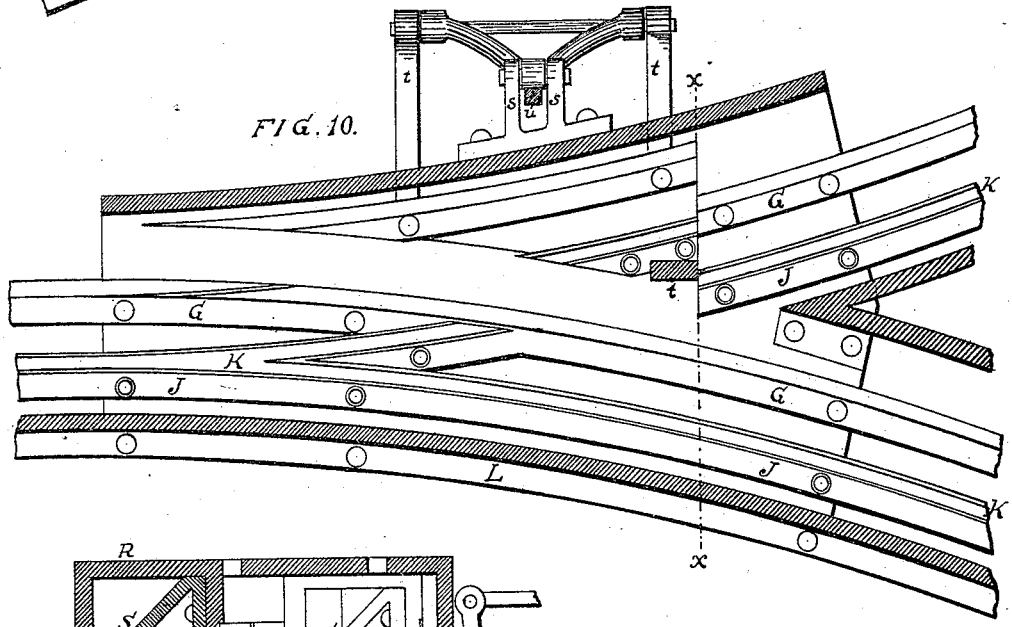
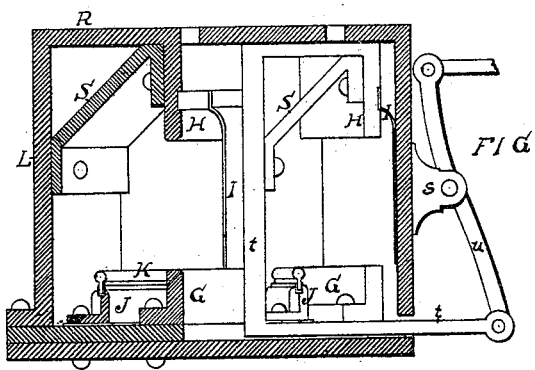


FIG. 11.



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(No Model.) 5 Sheets—Sheet 5.

M. SHOEMAKER.

ELECTRIC RAILWAY SYSTEM.

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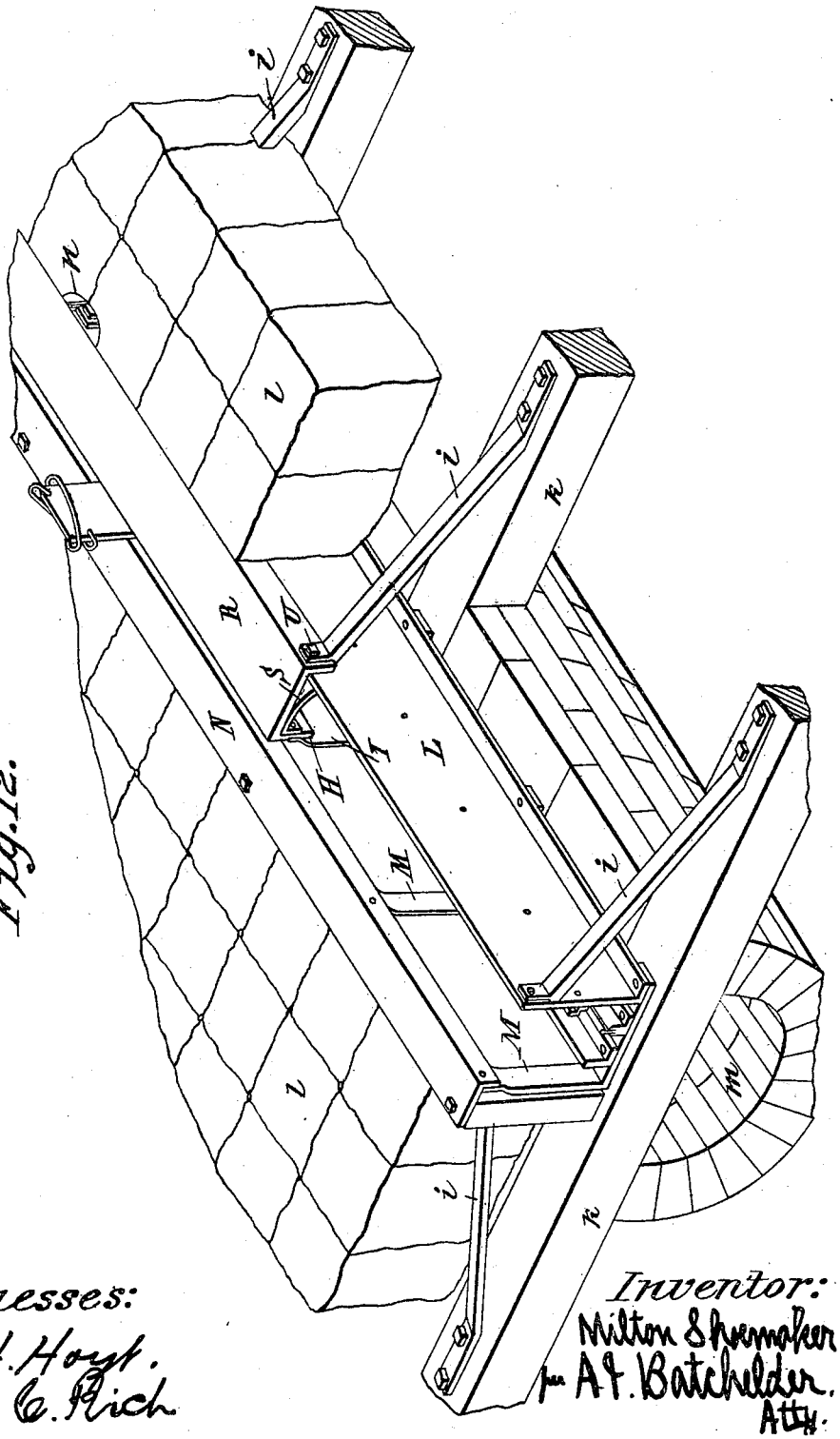

Fig. 12.

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Inventor:
Milton Shoemaker
by A. F. Batchelder.
Atty.

UNITED STATES PATENT OFFICE.

MILTON SHOEMAKER, OF SIOUX CITY, IOWA, ASSIGNOR OF TWO-THIRDS TO JAMES W. MARTIN, OF SAME PLACE, AND JASON PASSMORE, OF DUNCANNON, PENNSYLVANIA.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 457,870, dated August 18, 1891.

Application filed November 3, 1890. Serial No. 370,254. (No model.)

To all whom it may concern:

Be it known that I, MILTON SHOEMAKER, a citizen of the United States of America, residing at Sioux City, in the State of Iowa, have invented certain new and useful Improvements in Electric-Railway Systems, of which the following is a specification.

My invention has relation to electric railways; and the object is to provide a system for operating cars by means of electricity without the use of poles, overhead wires, or any wires whatever, except the one through which the current of electricity is conducted. I accomplish this by means of a continuous underground metal case, through which passes a continuous wire made of copper or other suitable metal and running in a grooved wooden plate provided with a continuous strip of insulating material, said continuous underground metal case being provided with a railway, in combination with a trolley-carriage provided with an arm or slot-bar extending upward and intended to pass along the slotted upper surface of the metal case, said upwardly-extending arm or slot-bar being provided with peculiar-shaped draft-irons, which connect with the car by means of chains or cables, the upper surface of said metal case being on a level with the surface of the ground and having its longitudinal slot protected from the ingress of water, snow, ice, or any injurious débris by a metal shield, which inclines downward over the working parts in such a manner as to also protect them from any of the above-named foreign substances, said water, snow, ice, &c., being deflected away by means of said metal shield into a conduit below or at one side, provided separately for the reception of the same. My invention therefore provides means of operating cars by electricity by means of an underground wire completely insulated, without losing power in any way by reason of outside influences.

My invention therefore consists in the novel construction of the parts and their combination, as will be hereinafter fully described, and particularly pointed out in the claims.

I have fully and clearly illustrated my invention in the accompanying drawings, wherein—

Figure 1 is a view of a transverse vertical section of the slotted continuous underground metal case. Fig. 2 is a view of a longitudinal and transverse section of trolley, showing anti-friction bearings. Fig. 3 is a view of a longitudinal vertical section of the trolley-carriage, showing back side of the carriage, with the upwardly-extending arm or slot-bar as it passes through the slotted upper surface of the metal case. Fig. 4 is a view of a horizontal section, looking down on trolley-carriage and tracks, showing carriage and trolley in position. Fig. 5 is a view of a longitudinal vertical section of the trolley-carriage, showing front side of the carriage with the pivot-bar, wooden boxes, and insulation, also showing top of the upwardly-extending arm of the trolley-carriage, with the draft-irons, which connect with the car by means of chains or cables. Fig. 6 is a view of a vertical section through one of the turn-tables used in this system. Fig. 7 is another view of the turn-table, the left-hand half of the view showing the top plates of the turn-table and the right-hand half showing anti-friction ball-bearings. Fig. 8 is a view of a horizontal section of a turn-table at the end of a loop, showing the position of the turn-table and method of changing the trolley from one line to another. Fig. 9 is a view of a horizontal section showing the distal end of a switch with the rails thrown open automatically. Fig. 10 is a view showing the end of the main line thrown open to permit the car to pass onto the switch. Fig. 11 is a view of a vertical section through Fig. 10 on the dotted line $x\,x$, showing switch thrown open, as in Fig. 10. Fig. 12 is an isometrical view of the slotted continuous underground metal case, showing said case resting on wooden or metal beams or cross-ties over the drainage-conduit m, also showing metal braces $i\,i$, fastened to the metal case with the bolts U, and also bolted securely to the beams or cross-ties $k\,k$ for the purpose of holding said metal case rigidly in position to prevent displacement of any of the parts. This view also shows a portion of the plate R and the

brace S, the rail H and the shield I being removed for the purpose of showing the method of access to the working parts. *n* represents an opening in the pavement for the purpose of removing the bolt U, when necessary, to remove the plate R. *l l* represent paving-blocks.

Referring now to the illustrations, wherein like parts are designated by the same notations or references, in Figs. 1, 2, 3, and 4 A designates the trolley, which is made of copper, delta metal, or any other suitable conducting material. B designates the end of the pivot-bar. C C designate the journal-boxes for the pivet-bar, made of wood or other non-conducting material. D designates the inner plate of the trolley-carriage. E designates the outer plate of the trolley-carriage, the continuation of which turns up and forms the slot-bar O. In the downward continuation of said outer plate E is an opening or a slot cut through to allow the conductor P to pass into the groove rolled in the slot-bar O, as seen in Fig. 5. Said inner plate E is carried down far enough before it is turned up to form the slot-bar O to permit the shield I to extend down to or below the level of the upper surface of the rail G. From there it is bent outward sufficiently far to clear the shield I. Then it is extended upward to the upper edge of the shield I, and then it is bent inward until it comes directly under the slot, and then extends directly upward to the draft-irons V V, as shown in Fig. 5. At the upper end of the slot-bar a metal plate is screwed onto the inner surface to protect the conductor against wear. F F designate the trolley-carriage wheels made in the form of flanged wheels, with anti-friction bearings. The two larger wheels run on the lower rail G and carry the weight of the trolley-carriage and slot-bar. The two smaller wheels have sufficient bearing against the upper rail H to keep the trolley-carriage in place. I is a metallic shield to prevent the ingress of water, snow, sleet, ice, or débris of any kind, which might prevent the working of the trolley-carriage or interfere with the insulation of the trolley-wire. This shield is also so constructed that any débris or foreign matter falling through the slot will be deflected away from the working parts and dropped through into a conduit below. Said shield I at its upper edge is firmly riveted in the groove in the surface of the top track H, and extends down so that its lower edge is on or below a level of the upper surface of the lower rail G. J designates a continuous trolley-rail made of vegetable fiber, wood, or metal bolted to the angle-bars M M, from which it is insulated by a packing of rubber or other insulating material, the upper edge of said trolley-rail being grooved for the reception of a continuous strip of insulating material and the conductor K, said conductor being made of copper, delta metal, or any other suitable material. The upper part of said bar can be made in any desired shape; but the lower part is a projecting flange from the upper part, made to fit into the insulating material in the groove of the trolley-rail and held firmly in place by said groove and the solid-rubber pins *o o*. L designates a plate of rolled steel, iron, or other metal, forming the inner shell of the metal case, and is riveted to the angle-bars M M. Said angle-bars M M may be placed at such intervals as may be deemed expedient, and are firmly riveted to the inner plate L and to the top plate M. N designates a plate of rolled steel, iron, or other metal, having its inner surface bent at a right angle in such a manner as to form the outer edge of the slot in the upper surface of the continuous metal case. O designates the slot-bar, which is a continuation of the outer plate E of the trolley-carriage, and which extends upward through the slot to the draft-irons, as shown at V in Fig. 5. R designates the upper plate of the continuous underground metal case, with its inner edge bent down in such a manner as to form the inner edge of the slot, and also forms the top rail H. A groove is rolled in the outer surface of the top rail H to receive the upper edge or bearing-surface of the shield I. The outer edge of plate R is also bent down over plate L, to which it is secured by bolts or screws, so that it may be easily removed to give access to the working parts. S designates a continuous metallic brace, firmly riveted to the inner side of the track H, its lower edge resting in the stud T. T designates a metallic stud. These studs are to be placed at regular intervals and firmly riveted to the plate L. The object of these studs is to afford a firm support for the bottom of the brace S, and at the same time permit its easy removal whenever such removal becomes necessary. By the removal of the bolts U the top plate R, the top rail H, shield I, and brace S may be removed, thereby giving access to the lower rail G and the trolley-wire K.

In Figs. 4 and 5 P designates a strip of conducting metal sufficiently wrapped with insulating material, except at the slotted end, where it makes a contact with the pivot-bar B. This conductor lies in a groove rolled on the inner surface of the slot-bar O, thus permitting the current to pass from the trolley-wire K through the trolley A, to the pivot-bar B, and on up through the conductor P, said conductor P being connected at its upper end to an insulated wire that may be attached to the conducting-wires of the motors.

The pivot-bar designated B B, as shown in Figs. 4 and 5, is a cylindrical metal bar with insulated journals running in the wooden boxes C C. Said bar moves easily in the boxes, permitting sufficient play to permit the trolley-wheel to pass over any possible inequalities in the trolley-rail. From the center of said pivot-bar extends an arm at a right angle to form a journal for the trolley-wheel. V V are the draft-irons attached

to the top of the slot-bar O. Said draft-irons are attached to a car by suitable chains or cables, with suitable rings made to slide on the draft-irons to permit changing of the trolley-carriage from one track to another, as shown in Fig. 8, and more specifically described hereinafter.

In Figs. 6, 7, and 8, *a* designates a circular rim-plate of a turn-table bolted down to the plates R and N of Fig. 1. *b* designates the top plate of the turn-table and corresponds to the plates R and N on the main track. *c c* designate metal braces used to support the top plate *b*. *d d* designate a flange-plate with a circular groove for ball-bearings and is riveted or bolted to the plate L, the rails G and J, and to the flanges of the shell F, which is a curvilinear extension of the plate L. *e e* designate the inner shell of the turn-table, and is riveted to the top plate *b b* and to the flange M′. M′ designates a circular steel or metal plate resting on the ball-bearings *h h*. Across the plate M′ M′ are projected the rails G and J. The switches and turn-tables shown in the drawings are such as are necessary to be used in the operation of this system. The object of the representations of the turn-tables is to show the method of changing the trolley-carriage and the trolley-wheel from one track to another at the end of a loop at a junction, if necessary, and at right-angled crossings.

The draft-irons V V are placed one on each side of the slot-bar O, as shown in Fig. 5. It will be readily seen that the peculiar position in which these draft-irons are placed permits the rings connecting them with the attaching chains or cables to readily slide from one end of the draft-irons to the other end, permitting the turning of the trolley-carriage on the turn-table at the end of a loop or elsewhere, if required, to change the trolley and trolley-carriage from one track to another.

Fig. 9 shows the distal end of a switch, in which the ends of trolley-rail J, the lower rail G, and top rail H are hinged, as shown at J′ and G′, and are provided with a suitable coil or other spring, which throws them back in place and forms a continuation of the main track after being displaced by the passage of the slot-bar O.

Figs. 10 and 11 are views showing the end of the main line thrown open to permit the trolley-carriage to pass onto the switch. This is accomplished by a hand-lever switch, which permits the passage of the trolley-carriage from the main line onto the switch when open, as shown in said figures.

All breaks in the conductor by switches, turn-tables, or crossings are to be connected by a suitable insulated wire properly fastened to the conductor and carried out of the way of the working parts and attached to the conductor again, thus keeping a continuous live conductor.

A switch-hook of any ordinary kind will easily turn the trolley-carriage on the turn-table.

To secure perfect insulation of the necessary parts, I provide as follows: The inner plate of the trolley-carriage D is covered with a thin plate of rubber or other suitable insulating material. The bolts that fasten the journal-boxes C C to the plate D are covered with rubber tubing, and rubber disks are placed under the washers and nuts of said bolts. The journals of the pivot-bar B are also covered with rubber or other insulating material where they pass into the journal-boxes C C. The trolley-rail J has placed between it and the angle-bar M rubber or other insulating material, with the bolts insulated in the same manner as the bolts that hold the journal-boxes C C to the plate D. Furthermore, the groove of the trolley-rail J has a continuous packing of rubber or other insulating material, leaving just enough space to receive the flange on the lower edge of the conductor K. All insulation is shown on the drawings in solid black and designated *r*.

It will be readily seen that the perfect insulation of this system is such as to render unnecessary the use of lightning-arresters, and obviates all danger from lightning-stroke or other natural electrical disturbances, thus insuring greater safety to passengers and machinery.

The inside of the slotted continuous underground metal case comprising the brace S, the stud T, the lower part of plate L, the trolley-rail J, and the rails G and H are to be thoroughly coated with suitable paint or other covering material to prevent condensation of moisture and inducting currents.

The operation of this system is readily understood from the foregoing description. The electric current passes from the trolley-wire K through the trolley A to the pivot-bar B, and thence on up through the conductor P, said conductor P being connected at its upper end to an insulated wire attached to the conducting-wires of the motors, making thus a complete connection with the car, the draft-irons V V of the slot-bar of the trolley-carriage being also connected with the car, as previously described.

It will be readily seen that my system can be used on streets having solid road-beds, also on elevated railroads, and on such other railroads as are now commonly propelled by steam. On elevated railroads the drainage-conduit may be made of metal, with openings at regular intervals to let off the water, snow, or other débris that may be deflected into it by the deflecting-shield of the continuous metal case, said metal case lying above said conduit and resting on beams or cross-ties, as previously described. By this system all difficulties arising from smoke, ashes, and cinders are obviated.

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

1. In an electric-railway system, an underground conduit made of suitable material, in combination with a slotted continuous underground metal case containing the following, viz.: a conductor K, a metallic shield I, a trolley-carriage having an inner plate D, an outer plate E, which is extended to form the slot-bar O, carriage-wheels F F, a pivot-bar B, from which at a right angle is extended an arm carrying the trolley A, said pivot-bar running into the journal-boxes C C, the lower rail G and upper rail H, upon which run the wheels of the trolley-carriage, and the lower rail J, upon which runs the trolley, all substantially as described, and for the purpose specified.

2. In an electric-railway system, the combination of an underground conduit over which and resting upon metal beams or cross-ties lies a continuous metal case, also placed under ground, except its upper surface, which bears a longitudinal slot and is on a level with the surface of the ground, said metal case inclosing a conductor K, said conductor lying in a groove of the trolley-rail J and surrounded by continuous packing of insulating material, said trolley-rail J having insulating material placed between it and the angle-bar M, the bolts which pass between the angle-bar and said trolley-rail being covered with rubber tubing, and rubber disks being placed under the washers and nuts, and a trolley-carriage provided with flange-wheels made to run on the rails G and H, said trolley-carriage having an inner plate D, which is covered with a thin plate of insulating material, and a pivot-bar B, having its journals and the bolts that hold the journal-boxes C C to the plate D covered with insulating material, and from the center of which extends at a right angle an arm carrying a trolley A, said trolley-carriage also having an upwardly-extending arm forming a slot-bar O, provided with the draft-arms V V, the rails G and H, and the deflecting-shield I, substantially as described, and for the purpose specified.

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

MILTON SHOEMAKER.

Witnesses:

WILBER A. COLEMAN,

OLIN G. DEARDORFF.