To all whom it may concern:

Be it known that I, LOWELL MASON MAXHAM, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful System of Electric Traction, of which the following is a full, clear, and exact description.

This invention is in the line of electric third rails in which an exposed rail is put into circuit with a normally-insulated conductor by means of magnetically-actuated contacts raised by magnets carried by the car; and the object of my invention is the construction of such a third rail which shall be simple in its arrangement, effective in operation, and not liable to injury from sparking nor capable of being tampered with from the surface.

Referring to the drawings forming part of this specification, Figure 1 is a transverse section of my complete rail. Fig. 2 is a side view, partly in section, showing the contact-actuating magnets. Fig. 3 is a plan view of the insulating device in a modified form and of its carbon cap. Fig. 4 is a perspective view of one of the current-collecting brushes. Fig. 5 is a plan view of the third rail with its exposed rail removed. Fig. 6 is a perspective view of the mercury-cup-insulating device. Fig. 7 is a plan view, on a larger scale than Fig. 5, of the third rail with exposed rail removed.

As shown in Fig. 1, the electric conductor 3 is laid in the bottom of the channel 2 of the stringer 1 and wooden blocks 9 laid thereon. Said blocks fill said channel tightly with the exception of being shortened sufficiently to provide spaces between their terminals for the mercury-cups 10 and their insulating devices 7. Said devices 7 are preferably rectangular and fitted to the channel of said stringers. Secured over the top of said stringers and strips or blocks is the exposed rail 5, the central section of which is considerably thickened compared with the remainder to form the tread. The edges of said rail are bent sharply down to form the confining flanges 6, which extend over the corners of the stringers 1, and thereby secure the latter from spreading.

The electric conductor 3 is a somewhat thin bar of copper or aluminum, and my means for enabling the current to be shunted from said conductor to the exposed rail 5 comprises a series of aluminum cups 10, seated on said conductor, each partially filled with mercury and provided with the armature or magnetic contact 11. This armature consists of the iron head 11 and the stem 12, projecting rigidly therefrom nearly to the bottom of the mercury cup. Said stem is of aluminum and is secured to said head by forcing it into a central hole in the latter, the upper part of which is countersunk, and then upsetting such end of the aluminum stem. (See Fig. 1.)

The lower end of said stem is sharpened, as shown, to better enable the stem's vertical play within the mercury. My objects in having the stem 12 of aluminum are, first, because the surface of this metal, as I have discovered, is not eroded or eaten into by the mercury; second, because the aluminum is so good a conductor of electricity that the stem can be quite slender and yet be fully capable of transmitting the electric current from the mercury to the exposed rail. The stem being thus made slender is not buoyed up by the mercury to such an extent as would a more bulky body, and hence being less buoyed up the head 11 is enabled to instantly sink to its level after the magnet has passed, by which said head is drawn into contact with the exposed rail and the energizing-current thereby obtained. Any such buoyant effect would strongly tend toward ruining the system through a liability of one of the armatures or heads 11 remaining too near the exposed rail and creating an arc between such points and injuring people or animals crossing the tracks.

To further insure against arcing, I round off the upper surface of the head 11 and have the upset end of the aluminum stem the part which contacts with the exposed rail, or, rather, with the carbon shield, which I introduce between said parts, and the object of which shield is to still further reduce the danger of arcing and of the head being fused into permanent contact with the rail. Said shield consists of the carbon disk 8, placed within the seat 7 of the porcelain tube 7, which wholly surrounds the mercury-cup 10 and the armature or head, and being of carbon strongly compressed serves to transmit
the current from the armature 11 to the exposed rail, but cannot, of course, be fused into union with said armature. It also prevents evaporation of the mercury in the cup.

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The object of the porcelain tube 7 is, primarily, to prevent the possibility of igniting the wooden stringer 1 or the blocks 9 by any arc in any manner formed between an armature or head 11 and the exposed rail. Another advantage is derived from making said tube externally prismatic, as shown in Fig. 6, so that viewed from above, as in Fig. 5, it is substantially square and accurately fills the channel 2 in the stringer 1. The remainder of the space between the several tubes 7 is filled by means of the wooden blocks 9, which being sawed at right angles at the ends and of proper length require no further labor than to be laid in place with the mercury-cups and insulating-tubes.

In applying my form of rail I first lay the stringer 1 in place and then the conductor-bar 8 within the channel 2. Having placed a mercury-cup within each porcelain tube, several such tubes are introduced into the channel 2 of the stringer 1, placing between each pair of said tubes one of the blocks 9. As a matter of fact I apply first a tube, then a block, then another tube, then another block, &c. In this manner there is a minimum amount of labor in fitting and applying the tubes and blocks, much less than if the said tubes were made cylindrical and inserted through holes bored in a continuous strip. It is also a saving in material. I do not, however, restrict myself to having the tubes 7 prismatic, as they can be made cylindrical, as shown in Fig. 9; but I prefer the prismatic form for the reasons above given. After having applied the tubes 7 and blocks 9 as described the mercury-cups 10 are each nearly filled with mercury, and simultaneous with each filling an armature is dropped within it and a carbon disk 8 pressed into the flanged mouth of the tube. The exposed rail 5 is then laid upon the stringers, pressing it firmly home until the flanges 6 have clasped the edges of the stringers and the under face of the rail seated itself firmly upon both the stringers and the carbon disks. I always have the tubes 7 slightly shorter than the space between the conductor and exposed rail, but with the carbon disk and the mercury-cup adapted to slightly more than compensate therefor, in order that contact shall be insured between the cup and conductor and between the disk and rail.

Before the stringer 1 is laid I thoroughly creosote the same, and then as it and the blocks 9 are laid apply tar to the contacting surfaces in order to wholly prevent water from having access to the conducting-bar.

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My means for taking current from the exposed rail comprises a plurality of electro-magnets 20, the pole-piece of each of which is horizontally elongated and carried near to but out of contact with the rail 5. The ends of these pole-pieces 21 are bifurcated or split, and between these bifurcations are inserted the eyes 24 of the brushes 22, pins 23 being inserted through said eyes and openings made therefor in the pole-pieces in order to hold said brushes in place. These brushes serve to transmit the current from the exposed rail to the pole-pieces of the magnets and from 75 the magnets to the car-propelling motor. I usually have the pole-pieces 21 and the cores of the magnets made of steel in order that being permanently magnetized they shall aid in attracting the circuit-closers. The main dependence is, however, upon the energizing-current from the conductor passing through the windings of the magnets 20.

As shown in Fig. 2, the brushes 22 are made substantially bow shape, the central convex portion of each contacting with the exposed rail and the ends thereof being held by the poles of the magnets. If the brush is made of iron or steel, it is magnetized by induction from the magnet, and thereby drawn into stronger contact with the exposed rail, thus materially increasing the friction. To prevent this, I form the brushes of some metal which is incapable of magnetization, but a good conductor of electricity. The material which I prefer for this purpose is a hard wear-resistant metal or alloy like aluminum-bronze. I further prefer to make a longitudinal slot in each brush bar or sheet in order to pluralize it and also to remove all obstruction to the lines of magnet attraction between the magnet and the exposed rail directly over the circuit-closers.

I further improve the exposed rail 5 by materially lowering its thin lateral sections 4, as shown in Fig. 1. This lessens the vertical thickness required on the stringer and what is more important provides ample space for the asphalt 6, designed for filling the space between the exposed part of the rail and the paving-stones usually laid beside the same. A too-thin layer of asphalt is chipped out very easily, but the thicker one remains.

What I claim as my invention, and for which I desire Letters Patent, is as follows, to wit:

1. The combination of the longitudinally-continuous stringers formed of insulating material, and having the central longitudinal channel; the metal bar laid in said channel and constituting the electric conductor; the cylindrical mercury-cups terminally supported upon said metal bar; the magnetically-acted circuit-closers in said cups; and the exposed rail located upon said stringers, substantially as described.

2. The combination of the longitudinally-continuous stringers formed of insulating material and having the central longitudinal channel; the electric conductor laid within said channel; the insulating-blocks filling said channel but terminally separated for short distances; the exposed rail laid upon said stringers and blocks; and magnetically-
actuated circuit-closers located in said channel between said blocks and normally in circuit with said electric conductor, substantially as described.

3. The combination of the metal bar forming a continuous electric conductor, the mercury-cups seated on said bar, the circuit-closers located in said cups, the exposed rail supported above said cups and normally insulated from said conductor and cups, and the insulating-tubes exterior to said cups, said tubes being formed of some fire-resisting material, substantially as set forth.

4. The combination of the bar forming a continuous electric conductor, the mercury-cups seated thereon, the circuit-closers located in said cups, the exposed rail supported above the same and normally insulated therefrom, the porcelain insulating-tubes protecting said cups, and the insulating material about them, substantially as set forth.

5. The combination of the wooden stringers having the central longitudinal groove, the metal conductor-bar resting upon the bottom of said groove, the mercury-cups seated on said bar, the fire-resisting non-conducting tubes surrounding said cups and made rectangular externally, the wooden blocks filling the space between said tubes in said groove, and the exposed rail, substantially as set forth.

6. In a circuit-closer, the combination with the mercury-cup, of the circuit-closer comprising the magnetically-attracted head and the non-magnetic stem of greater conducting capacity in proportion to its weight than is said head, substantially as set forth.

7. In a circuit-closer, the combination with the mercury-cup, of the circuit-closer comprising the iron head and the aluminum stem, substantially as set forth.

8. In a circuit-closer, the magnetically-attracted head having the central vertical hole through it, in combination with the stem fixed at one end in said hole and formed of a metal excelling said head in conducting capacity, substantially as set forth.

9. In a circuit-closer, the combination of the magnetically-attracted head having the vertical hole through it, and the aluminum stem having its upper end riveted in said hole and rising slightly above the level of said head, substantially as set forth.

10. In a circuit-closer, the combination of the head formed of a magnetically-attracted metal, and the slender stem depending from said head and having its lower end sharply conical, substantially as set forth.

11. The combination of the bar forming an electric conductor, the wooden stringers supporting said bar, the exposed rail seated on said stringers, the mercury-cups seated on said bar, the porcelain tubes surrounding said cups and having the seats, the carbon disks supported in said seats and in contact with the under side of said exposed rail, and the circuit-closers located in said cups, substantially as set forth.

12. The combination with the exposed rail, of the electromagnet movable over said rail and having the horizontally-extended pole-piece carried near but out of contact with said rail, the ends of said pole-piece being bifurcated, the brush having its central portion adapted to contact with said rail and its ends formed with eyes, and the pins adapted to be inserted through openings in said bifurcated ends and through said eyes, substantially as set forth.

13. In a circuit-closer, the combination of the mercury-cup, the magnetically-attracted head rounded upon its upper surface and having the countersunk central hole, and the aluminim stem inserted in said hole and upset therein, substantially as set forth.

14. The combination with an exposed rail having an electric current communicated thereto, of the contact-brush consisting of a bar of metal bent into substantially a bow and thereby enabled to contact with said rail at its convex central portion and having its ends held by the electromagnet moving over said rail, substantially as set forth.

15. The combination with the exposed rail, a normally-insulated conductor and magnetically-attracted circuit-closers, of a magnet carried with one pole near to but out of contact with said rail, and a brush held by said pole in contact with said rail, said brush being centrally slotted, substantially as set forth.

In testimony that I claim the foregoing invention I have hereunto set my hand this 15th day of March, 1900.

LOWELL MASON MAXHAM.

Witnesses:

A. B. UPHAM,
GUY H. HOLLIDAY.