

(No Model.)

2 Sheets—Sheet 1.

B. R. SHOVER & W. C. DICKSON.
ELECTRIC RAILWAY.

No. 461,057.

Patented Oct. 13, 1891.

Fig. 2.

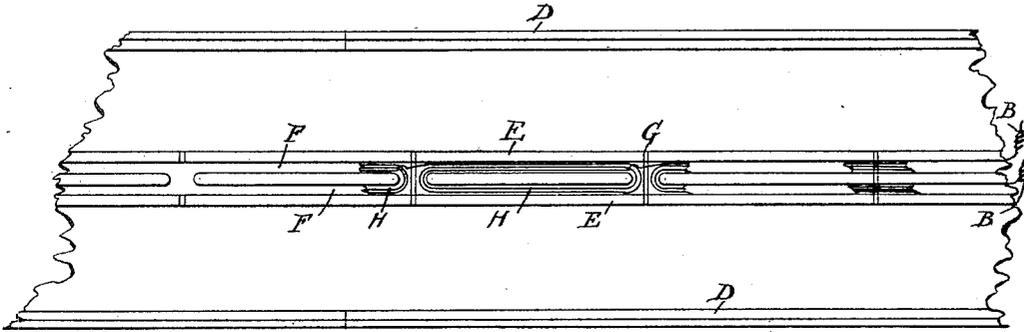
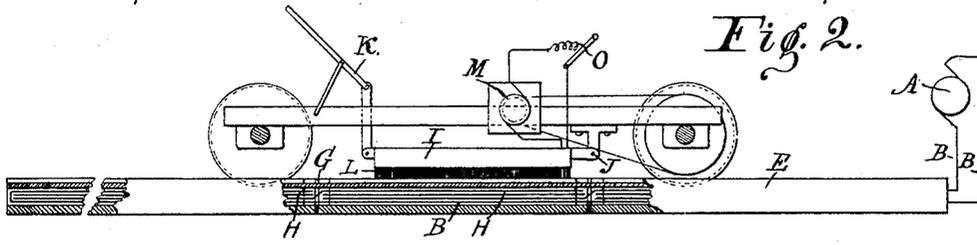


Fig. 1.

Fig. 3.

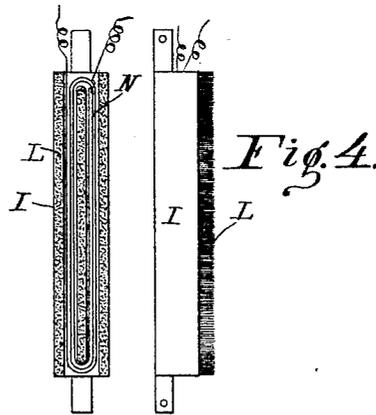
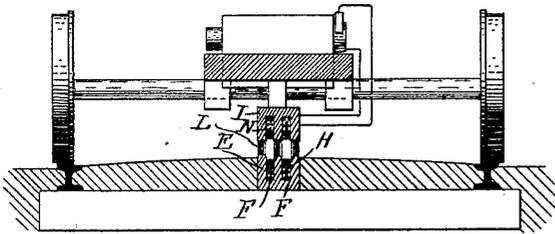


Fig. 4.

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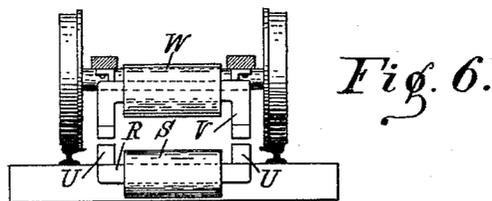
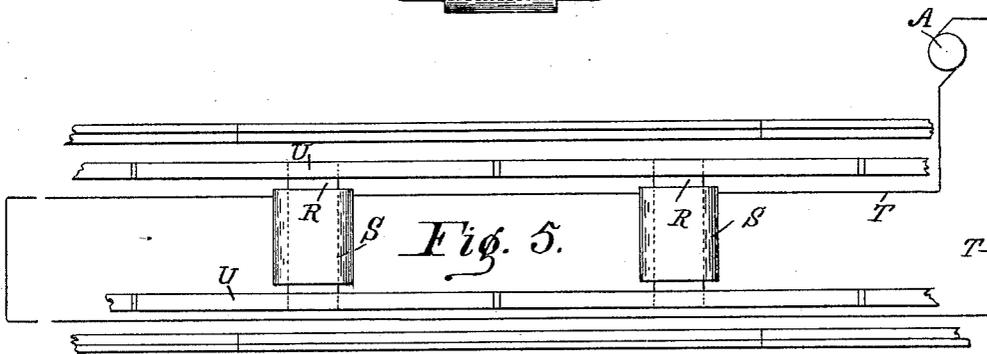
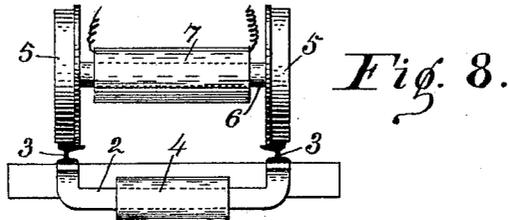
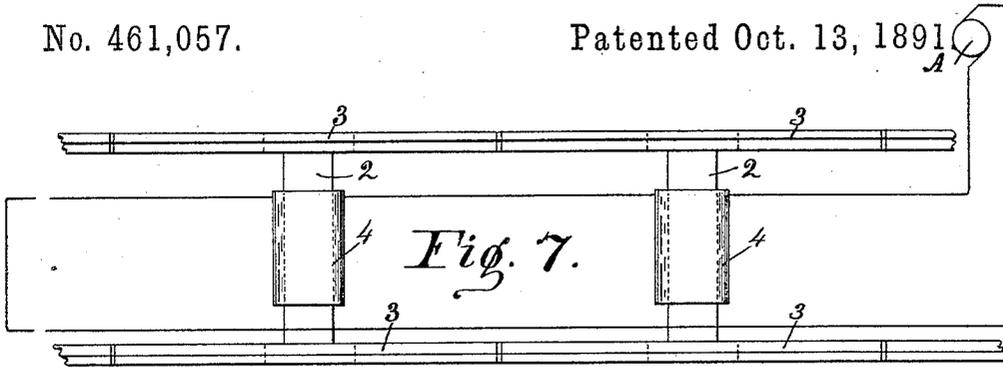
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BARTON R. SHOVER AND WILLIAM C. DICKSON, OF INDIANAPOLIS, INDIANA.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 461,057, dated October 13, 1891.

Application filed February 25, 1891. Serial No. 382,755. (No model.)

To all whom it may concern:

Be it known that we, BARTON R. SHOVER and WILLIAM C. DICKSON, both citizens of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Improvement in Electric Railways, of which the following is a specification.

Our invention relates to an improvement in electric railways and in the means for conducting the electric current therefrom to a motor mounted on a car arranged to traverse said railway.

The object of our improvement is to provide a new, better, and safer system of electric railways, which shall remedy some of the objections to the overhead and conduit systems heretofore in use. Heretofore in this class of railways the electric conductor extending along the line of the railway has been bare, and the electric current has been furnished to the driving mechanism of the car by means of an electric conductor mounted on the car and moving therewith in direct contact with the line working conductor. In such a system the exposed heavily-charged line working conductor is a constant source of danger. In our improved electric railway there is no direct connection between the line working conductor and the electric motor on the car. Consequently the line working conductor is not exposed, but is completely covered and insulated from outside contact, accidental or otherwise, and all danger from that source is therefore avoided.

The principle upon which our system is founded is that of "induction"—*i. e.*, the current used on the car to propel it is induced by but entirely separate from the current generated at the power-house and transmitted along the line of travel by the line working conductor. In applying this principle of induction use is made of the fact that the presence of a complete magnetic circuit in or around the primary and secondary electric circuits greatly increases the inductive effects of the primary current, as is shown in the "transformers" or "converters" now in use in alternating systems of electric lighting. The means which we make use of in carrying into operation the principle above mentioned consists in constructing the elements of a mag-

netic circuit in two parts, one of which is stationary, being preferably built into the roadway, and the other of which is carried by the motor-car, the stationary element being energized by an irregular or alternating electric current derived from any suitable source and traversing said stationary element, and the induced electric current being generated in a coil surrounding the movable element, and from thence transmitted to the motor which drives the car when the movable and stationary elements of the magnetic current are brought into magnetic connection.

Various mechanical constructions and electric appliances, some of which are illustrated in the accompanying drawings and are hereinafter described, may be used in carrying out our invention; but we do not wish to be understood as limiting our invention to the particular constructions shown and described.

The accompanying drawings illustrate our invention. Figure 1 represents a plan of the preferred form of our electric roadway. Figure 2 represents a side elevation, partly in section, of the roadway and a motor-car mounted thereon. Figure 3 represents a transverse section of the roadway and the motor-car on a larger scale. Figure 4 represents a side elevation and a plan of the under side of that portion of the magnetic circuit which is carried by the car. Figure 5 is a modified form of a roadway embodying our invention, and Figure 6 is a transverse section of the said roadway and a motor-car mounted thereon. Figure 7 is another form of roadway embodying our invention, and Figure 8 is a transverse section of said roadway and a motor-car mounted thereon.

In Figs. 1, 2, 3, and 4, A represents a source of an irregular or alternating electric current, and B is the line working conductor forming a circuit therewith. D D are the rails or track, of ordinary construction, on which the cars run. E is a bar of paramagnetic material, as iron, having longitudinal grooves F F in its upper surface and extending along the track between or near the rails. Said bar may be formed in long or short sections, set in the roadway and separated, or insulated magnetically from each other by diamagnetic strips G. The insulated line working conductor ex-

tends from the generator A along the grooves F of bar E and is wound several times around the central portion of the bar, thus forming a series of connected coils H, inclosing the central portion of each of the sections of the bar and returning along one of the grooves to the generator. The interstices between the several coils of the conductor are filled in the grooves with any suitable water-proof insulating material, and the grooves are then filled to protect the line conductor with broken stone, asphaltum, or any suitable diamagnetic substance, the upper surface of the bar E, however, being left exposed. The several sections of the bar E each form one half of a magnetic circuit, the other half or complement of which is carried by the motor-car and consists of a bar I, similar in form and material to the bar E, suspended from the car so as to be opposite to and above bar E and in magnetic connection therewith. The bar I is suspended from the car in such a manner that it can be raised out of connection with the bar E for the purpose of controlling or stopping the flow of current to the motor. One method of doing this is shown in Fig. 2, the bar I being hinged at one end, as at J, to the car and suspended at the other end from a lever K, mounted on the car. The connection between bars E and I may be by direct contact of their opposed surfaces, by a paramagnetic brush L, as shown in the drawings, or by any other suitable means. The electric motor M on the car is placed in circuit with a coil of insulated conducting-wire N, formed on the bar I, and the movement of the motor is controlled by a resistance coil and switch O, arranged in said circuit.

It will be observed that when the primary electric current is passed through the line working conductor B there are magnetic lines of force generated in the bar E at right angles to the direction of the conductor B, but there is no complete magnetic circuit. When the grooved bar I, carrying the coil N, is brought opposite to and in magnetic connection with the bar E, as is shown in Fig. 2, two complete magnetic circuits are formed, one around each of the sides of the coil N and the corresponding part of the line working conductor B. The effect of these magnetic circuits around the parts of the coil N is to generate in the coil N a secondary or induced current, which current energizes the motor, and thus propels the car.

In the figures thus far described the elements of the magnetic circuit have been shown and described as grooved bars having the conducting-wires wound longitudinally thereon. In Figs. 5 and 6 a modified form is shown, consisting in the fixed member of a

bar R, of paramagnetic material, laid transversely in the roadway, inclosed in a coil S, formed of the line working conductor T and having its ends extended to form bars U U, extending longitudinally along the roadway, while a like member V, having wound on its transverse bar a coil W, formed of the conductor connected with the motor, completes the magnetic circuit.

In the form shown in Figs. 7 and 8 the transverse bar 2 in the roadway is extended and is connected to the track-rails 3 3, thus forming, with the coil 4, the fixed element or member of the magnetic circuit, while the corresponding movable element is formed by a pair of car-wheels 5 5 and axle 6, on which the coil 7, formed of the conductor connected with the motor, is wound.

Having thus fully described our invention and the means for carrying it into operation, we claim as our invention—

1. In an electric railway, the combination, with the railway proper, of a bar of paramagnetic material, as iron, arranged longitudinally along the roadway between the rails and having in its upper exposed surfaces two or more grooves adapted to receive the line working electric conductor, and the line working electric conductor arranged in said grooves and forming one or more coils surrounding a portion of said bar between the grooves, substantially as and for the purpose set forth.

2. In an electric-railway system, the combination of the railway proper, a series of bars of paramagnetic material arranged longitudinally along the roadway between the rails and insulated magnetically from each other, said bars each having in its upper exposed surface two or more grooves adapted to receive the line working electric conductor, the line working electric conductor arranged in said grooves and forming a series of connected coils surrounding a portion of each of said bars between the grooves, the vehicle mounted on the railway and provided with the electric motor, the grooved bar corresponding substantially in form and material to the grooved bars in the roadway and arranged to form a complete magnetic circuit therewith, and the electric conductor connected with the said electric motor and arranged to form one or more coils surrounding a portion of the bar, which is mounted on the vehicle, all arranged to co-operate substantially as and for the purpose set forth.

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