No. 647,666. Patented Apr. 17, 1900.

J. McL. MURPHY.

ELECTRIC RAILWAY SYSTEM.

(Application filed Sept. 3, 1897. Renewed June 9, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

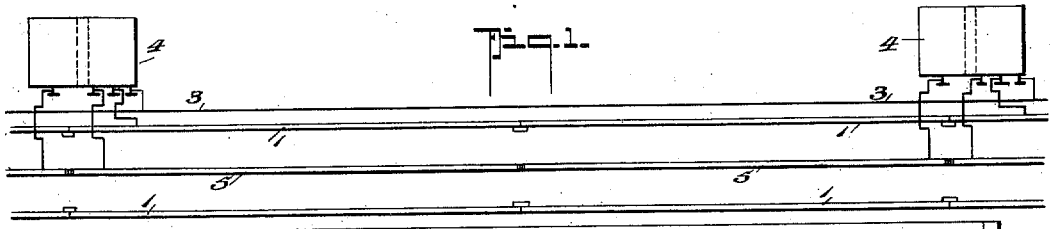


Fig. 2.

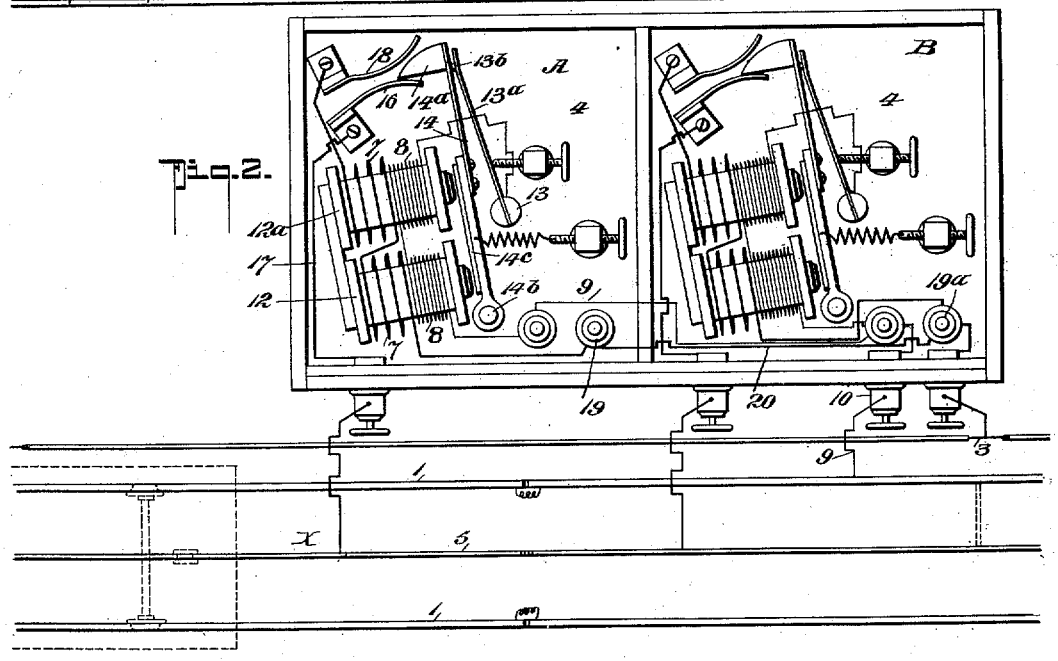


Fig. 4.

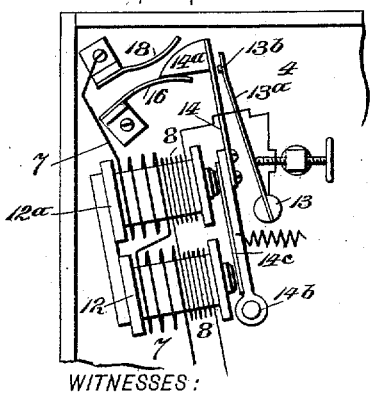
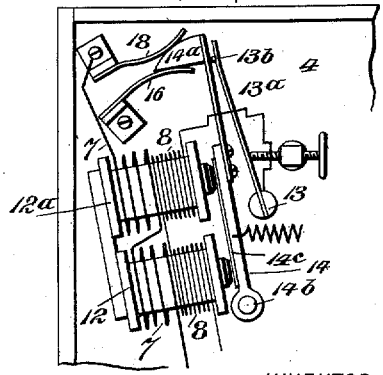


Fig. 5.



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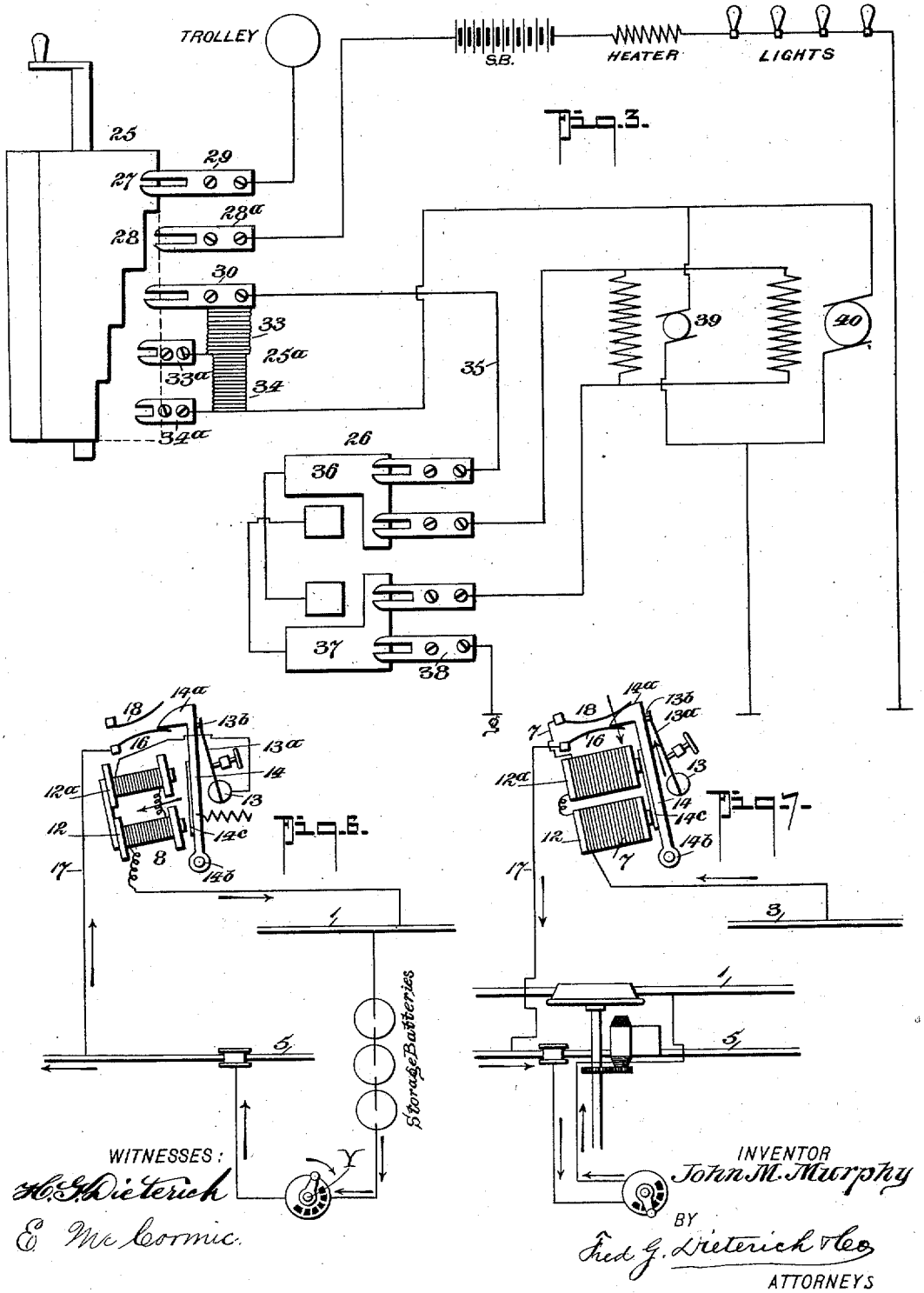

UNITED STATES PATENT OFFICE.

JOHN McLEOD MURPHY, OF TORRINGTON, CONNECTICUT, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE SAFETY THIRD RAIL ELECTRIC COMPANY, OF NEW JERSEY.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 647,666, dated April 17, 1900.

Application filed September 3, 1897. Renewed June 9, 1899. Serial No. 719,957. (No model.)

To all whom it may concern:

Be it known that I, JOHN McLEOD MURPHY, residing at Torrington, in the county of Litchfield and State of Connecticut, have invented a new and Improved Electric-Railway System, of which the following is a specification.

This invention relates to surface-contact electric-railway systems of that class in which the feeder supplies the current to laterals (secondary conductors) having switch mechanism automatically operated by a source of electric energy carried on the moving vehicle, whereby to successively shunt the current from one contact-section or conductor-rail to another.

In its general nature this invention comprehends a system of this character in which the local or energizing current is shunted through a line having its circuit through the controller, the trolley, the sectional conductor, and the main or feed lateral which joins the switch and a conductor and which also carries the main or feeder current thereto.

This invention also has for its object to provide a novel arrangement of the controller mechanism, the trolley, the local or switch-energizing circuit, a single contact or conductor rail, a switch mechanism adapted, as the controller-lever is properly shifted, to shunt the local circuit through the controller, the trolley, and the conductor or contact-section to the switch to set the same, which when set connects the feeder-line with the trolley and motor, the high-resistance or local current from the car-carried supply being turned into a low-resistance or feeder current without further manipulation of the controller-lever, and thereby maintain the car-carried electric source of energy charged to operate the light and heater devices and also the motor to drive the car to a limited extent in case of a break in the main or feeder line.

This invention also has for its purpose to provide a novel form of controller in connection with a special form of switch mechanism adapted to open up a connection to the local and the main or feeder current, whereby to charge the conductor-rail and local or storage battery and keep the said rail-battery charged during the ordinary stopping of the car, whereby the local circuit need be utilized only for energizing the switches when it is desired to start the car at the beginning of its route or at such points where it may be found necessary to cut out the sectional conductor from the main line.

With these objects in view this invention consists in the novel arrangement and peculiar combination of parts such as will be first described in detail, and specifically pointed out in the appended claims.

In the drawings, Figure 1 is a diagrammatic view illustrating the arrangement of the trackway, the feeder, the single line of surface conductors, and the switch-boxes. Fig. 2 is a diagrammatic plan view of one set of switch devices and a section of the trackway, the car being indicated in dotted lines. Fig. 3 is a diagram illustrating the correlation of the controller mechanism, the storage batteries, the motor, and the trolley. Fig. 4 is a detail view illustrating the position of the switch-head after it has left the supplemental or spring plate and before it engages the main-circuit-closing contact. Fig. 5 illustrates the position of the switch after it is moved to close the main line in circuit with the sectional conductor; and Figs. 6 and 7 are diagrammatic views of my improved system, which hereinafter will be particularly referred to.

In the practical arrangement of my improved system the tread-rails 1 are bonded in the usual manner.

3 indicates a main or feed wire disposed between or alongside the track-rails and preferably adjacent the switch-boxes 4.

The working conductor is in the nature of a tread-rail 5, formed of sections insulated from each other, the lengths of which vary in accordance with the surrounding conditions, they being long in suburban or sparsely-settled districts and very short in crowded thoroughfares, whereby to have but a minimum amount of the rail alive as the car passes over it.

In my present form of electric propulsion means one switch mechanism is employed for

each conductor, and to simplify the construction of the system the switches are arranged in pairs, as shown, or they may be in clusters held in suitably-located vaults along the road.

Each switch-box 4 is preferably of a duplex character and has two compartments, in each of which is held a switch mechanism, which mechanisms each comprise magnets having low-resistance windings 7 and high-resistance windings 8, and the high-resistance winding is connected with the local or energizing circuit carried on the car, as follows: The high-resistance winding has its ground or return section 9 connected with one of the track-rails, from whence it passes to a binding-post 10 about the core 12 of the magnet to form the winding portion 8, through and thence to the other core 12^a to form the other winding portion 8, and from there to the post 13. To the post 13 is connected a flexible and adjustable spring contact-plate 13^a, having a small impact-point 13^b, adapted to normally engage the head 14^a of the armature switch-lever 14, fulcrumed at 14^b, its armature-block 14^c opposing the magnet-core 12 12^a, as shown. The head 14^a of the lever 14 is normally held, through the medium of the spring 13^a, in touch with the contact-piece 16, which, through the wire-section 17, is in electrical connection with the working or conductor section, (indicated by X in Fig. 2.) This completes the circuit having the ground-rail as one terminal and passing through the high-resistance windings 8, the magnets, the lever 14 when the magnets are energized, the contact 16, the wire-section 17, and the conductor-rail section X.

19 indicates a binding-post of one of the switch mechanisms indicated by A which connects through the wire-section 20 with a similar post 19^a in the switch mechanism indicated by B, which post 19^a connects with the feeder or wire cable 3.

So far as described it will be readily observed that when the local or car circuit is shunted into the contact-rail section X in the manner presently more fully described it passes through the wire-section 17, the contact 16, lever-head 14, the plate 13^a, the post 13 of the winding 8, which energizes the magnets and attracts the lever 14, which as it is swung over first breaks connection with the plate 13^a, as shown in Fig. 4, and then engages with the section-contact 18, but during such movement keeping a contact with the member 16, thereby breaking the local circuit or initial source of energy which started the armature-lever and closing in the main or feeder line circuit with the conductor-rail section X, which then receives a current of high voltage, such main-line circuit with the contact X being established through the posts 19^a 19, the low-resistance windings 7, contact 18 in electric connection with the windings 7, the head 14^a of the lever 14, the contact 16, and the lead 17, which lead, it should be stated, alternately forms a transmitting member for the local and then for the main or feeder circuit.

While I have described the construction of parts constituting the switch devices in detail, it should be stated that in this application the general arrangement only of the electromagnetic switch mechanism, including the lever 14, a supplemental adjustable circuit-breaking switch, such as the plate 13^a, forms an essential feature of this invention in connection with the peculiarly operated and arranged controller and current-pick-up devices, as the exact detail construction of the parts comprising the said switch mechanism forms the subject-matter of another application filed by me September 3, 1897, Serial No. 650,481, allowed April 23, 1898.

Referring now more particularly to Fig. 3 in the arrangement of the storage batteries, the motor, the rheostat, or the contoller and the trolley devices are illustrated in detail.

25 indicates the controller; 25^a, the resistance-coils thereof; 26, the reversing-contacts, which may be connected with the motor-field windings in the usual manner.

The controller-shank in the present construction has two supplemental contacts 27 28, which form the first and second contact or notches and are arranged the one, 27, to engage the trolley-shunting-wire contact-plate 29, and the other, 28, the light and heater shunting wire plate 28^a.

30 indicates the first contact-plate for throwing the motor in circuit with the controller, said plate connecting with the motor feed-wire through the resistance-coils 33 34 and the plates 33^a and 34^a, which are adapted to engage with the second and third motor-notches of the controller by the proper shifting of the lever, said first motor-notch-closing plate 30 being grounded through the return 35, the reversing-spindle sections 36 37, and the lead 38.

39 and 40 indicate the motors, one for each end of the car, arranged in multiple in the motor-feeder circuit.

The manner in which my system is operated is best explained as follows: Assuming the car to be standing as indicated in dotted lines in Fig. 2, and the controller turned at an entirely-inoperative condition, as indicated in Fig. 3, all of the circuits between the main-line feed, the circuit, the conductor, (third rail,) and the local or storage battery and the third rail are broken, the storage batteries being, however, at this time in condition to operate the lighting and heating devices. To start the car, the motorman turns the controller-handle sufficiently to close the storage-battery-circuit contact with the controller, which closes a circuit from the storage battery through the controller and trolley-plate, through the trolley, the section conductor-rail X, and the lead 17 to energize the magnets and substantially simultaneously cut out the storage-battery circuit and close in the main-

line circuit with the sectional conductor and trolley, thereby bringing the feeder-current in condition to be picked up by the third movement of the controller and also bring the battery-circuit in line with the main or feeder circuit, whereby to keep the same charged up to its maximum degree. To now start the car, the motorman moves the lever to bring in the first and the successive contact-plates 28 28 and 30. At this point it should be stated the correlation of the plate 13^a, the switch 14, and the plate 18 is such that as the switch is pulled over by the initial energy in the magnet its head 14^a will be out of touch with plate 13^a before it closes on the plate 18, thereby reducing the danger of arcing to a minimum, as in its swinging movement it becomes electrically disengaged from the local or initial energy circuit before it completes the feed-line circuit, thereby positively cutting out the local or initial energized circuit from the switch in advance of the shunting of the main-line or feeder circuit therethrough.

By providing a switch mechanism of the character stated in connection with the peculiar arrangement of controller, trolley, and motor connections the motorman can cut out the entire working conductor or third rail, including the section directly under the car, or cut out the motor and keep the section under the car alive, as both the initial or local and the main-line circuit pass through a single trolley, a single transmission-wire section 17, and a single conductor-rail section, the local circuit being shunted through such parts in one direction and the main-line current shunted through the same parts in a reverse direction.

By arranging the local or motor circuits and controller in the manner shown and described it is manifest that by providing a suitable number of storage batteries sufficient power can be maintained at all times to propel the car for a limited time without the aid of the main-line circuit, such arrangement being especially advantageous, as it prevents stalling of cars on the line in case of breakage in the main line and also serves to propel the cars over the line without feed from the main line—as, for instance, in passing through a crowded street—which can be done by lifting the trolley by any suitable means from the contact or third rail and turning the controller-lever open to the circuit from the storage battery to the motor. Again, as the motorman can cut out all of the circuits it is obvious that the car can travel through the conductor or third rail without affecting the switch mechanism.

Another advantage of my improved system is that after starting the car at the beginning of the route it will not be necessary to charge the successive conductor-rails, especially so in case a divided trolley is used, as the advance conductor-rail section can be energized directly from the live section to the rear of it, energized from the main or feeder circuit.

To clearly illustrate the correlation of the several parts when the local circuit and the feed-circuit are on, I have diagrammatically illustrated the arrangement of the parts in Figs. 6 and 7. In Fig. 6 the parts are shown with a lever in position to be energized by the local or storage battery circuit as soon as the controller-lever is turned in the direction indicated by the arrow to the line marked Y, when the current will be from the storage battery in the direction indicated by the arrows.

In Fig. 7 the several parts are shown in the position they assume when the feed-wire circuit is on from the feed-wire, from the switches, through the trolley, and the controller to the motor, the current flowing in the direction indicated by the arrows.

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

1. An electric-railway system, comprising a feed-line or feed-wire, electromagnetic switch devices connected therewith, a series of working conductors, having laterals connected with the electromagnetic switch devices, said devices being normally out of circuit with the main-line wire and the working conductors, a car-trolley for engaging the conductors, a local or storage battery circuit connected with the trolley, a controller-switch in such circuit, said controller being electrically connected with the car-motor, all being arranged substantially as shown, whereby one manipulation of the controller will close a local circuit, thereby allowing a local current to flow through the trolley and working conductors to the magnets, to place them in closed circuit with the feed-wire and whereby to feed the line-circuit through the magnets in a reverse direction to the local path of the local circuit, back to the trolley the motor and the storage batteries.

2. In an electric-railway system, the combination, substantially as described, of the tread-rails and a single sectional conductor or third rail, a series of electromagnetic switches for connecting the same to the line, normally held open, a switch or controlling mechanism on the car, in the motor and trolley circuit and a local or storage battery on the car held in connection with the controller, and adapted when the controller is set in its initial position to close a local circuit through the trolley and the third rail to energize the electromagnets and close the switches to open up the main-line circuit to the controller, and motor, said local circuit being in connection with the motor-circuit when such circuit is closed by the proper movement of the controller, as set forth.

3. In an electric-railway system, the combination substantially as described, of a series of working conductors normally disconnected from the main line, a series of electromagnetically-operated switch devices, a storage battery on the car held in circuit with the motor-

circuit, for recharging during the application of the main-line power, a controller-switch for connecting such local circuit with the trolley, whereby to complete such circuit through the conductor-rails, the magnets, the switches to the tread-rail or ground, and thereby shift the switches, said switches being arranged to break the local circuit so far as it relates to its switch-operating energy before closing the circuit from the main line to the trolley, all being arranged substantially as shown and for the purpose described.

4. In an electric-railway system, the combination substantially as described, of the tread-rails, the single conductor-rail, the electromagnetically-operated switches for connecting the conductor-rail and main line, normally held open, a local circuit for energizing the magnets to shift the switches, a contacting means in the main circuit for holding the switches to their shifted position during power from main line, said local circuit having in one terminal the magnets, the conductor-rail and the trolley, and in the other terminal the tread or ground rail, and the switches, all being arranged substantially as shown, whereby the short-circuiting of the main or power current and the breaking of the switch-contact, will serve to energize the local circuit and maintain a current through the car-motor of the storage-battery capacity only, as shown and for the purposes described.

5. In an electric-railway system, the combination substantially as described, of the tread-rails, the sectional conductor-rail, the feed-line and the electromagnetic switches for connecting the sectional conductor and the feed-line, the storage-battery circuit held on the car, the controller mechanism held in circuit with the main or motor line, and the storage batteries, said controller having switch means whereby to shunt the local or storage battery circuit through the trolley, the sectional conductors and the magnets, and an independent ground or return circuit for the magnets, for completing the shunted local circuit when the controller is set to lead the storage-battery circuit to the magnets as set forth.

6. In an electric-railway system, the combination substantially as described, of the tread-rails, the magnets having inner and outer windings, vibrating switches, held normally in electrical connection with the inner magnet-windings, said inner windings being in electrical connection with the tread-rails, the conductor-rail sections normally held in electrical connection with the vibrating switches, the car-trolley and storage-battery circuit and a switch means on the car for bringing such circuit in the main-line circuit during the movement of the car, and an independent circuit, connecting the outer magnet-windings with the feed-wire and having a contact adapted to be engaged by the vibrating contacts when energized by the local circuit as specified.

7. A surface-contact electrical-railway system, comprising in combination with the moving vehicle having a source of electrical energy thereon; a controller having an initial contact for throwing the said electric energy in line with the trolley in advance of cutting in the motor; a contact or working rail section; an electric magnetic switch mechanism including a magnet having high and low resistance windings; a pair of separated contacts 16 and 18, one of which is in connection with the high-resistance winding and the working conductor, the other being in connection with the low-resistance winding, the high-resistance winding having the ground-terminal and the low-resistance winding a connection with the feeder-wire; an armature-lever normally in touch with the contact 16 and normally forming a part of the high-resistance-winding circuit, said armature-lever being adapted to bring the contact 18 in circuit with the contact 16 when swung over by the initial or local circuit and having a local-circuit breaker adapted to be drawn into an operative condition as the lever is being swung over, substantially as shown and described.

JOHN McLEOD MURPHY.

Witnesses:
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GEO. F. HILL.