No. 785,315. PATENTED MAR. 21, 1905.

T. MAHONEY.

ELECTRIC RAILWAY.

APPLICATION FILED DEC. 1, 1903.

Fig. 1.

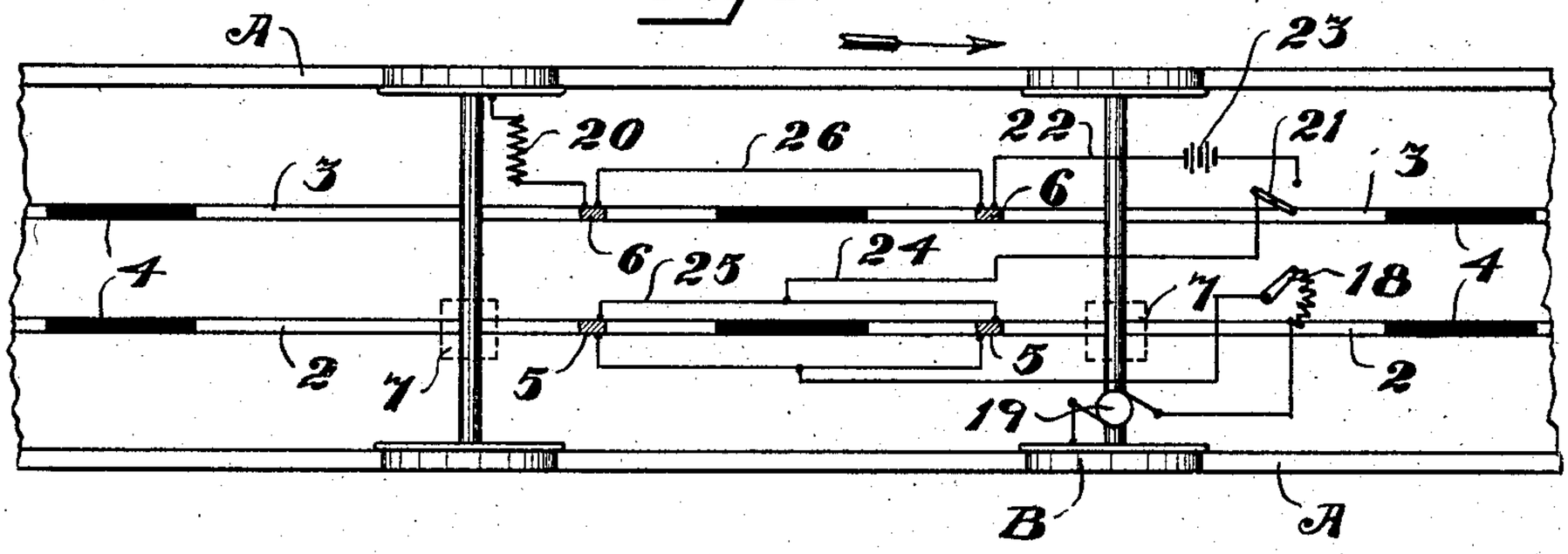
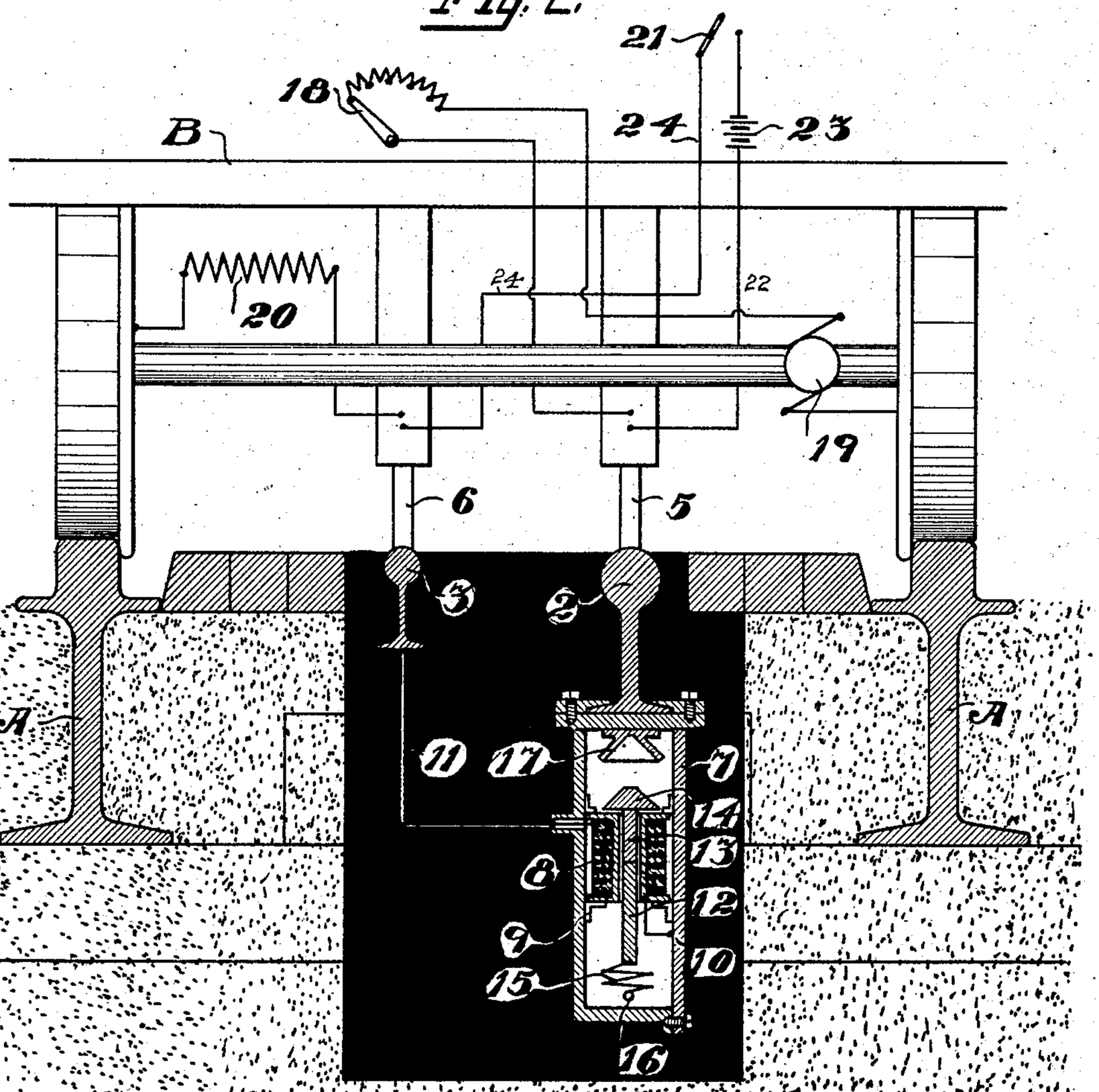


Fig. 2.



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No. 785,315. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

TIMOTHY MAHONEY, OF SAN FRANCISCO, CALIFORNIA.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 785,315, dated March 21, 1905.

Application filed December 1, 1903. Serial No. 183,332.

To all whom it may concern:

Be it known that I, TIMOTHY MAHONEY, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Electric Railways, of which the following is a specification.

My invention relates to improvements in railway systems of the third-rail type. Its object is to simplify construction, reduce cost, and render it as safe as possible to life by affording perfect insulation, and particularly to overcome the difficulty heretofore generally experienced in many of the electromagnetically-operated switch systems in cutting in the current when the car is traveling at a high rate of speed.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described, having reference to the accompanying drawings, in which—

Figure 1 is a plan view of track with diagrammatic car-truck and wiring. Fig. 2 is a cross-section of track with car-truck and diagrammatic wiring.

A A represent the track-rails of an ordinary street-railway, and B a motor-car or like body movable thereon.

Between the track-rails are the two sectional surface rails 2 3, the one being the trolley-rail and the other, 3, a conducting-rail adapted to operate the switch mechanism by which the current is cut into and out of the trolley and car. The rails 2 3 are disposed on each side of the center line between the track-rails, and the sections of each are separated a space slightly in excess of the distance between either of the said sectional rails and its adjacent track-rail. The space between the adjacent ends of rails 2 3 is occupied by suitable insulating material, as indicated at 4. In fact, the rails 2 and 3 are preferably embedded in asphaltum, and the distance between the adjacent ends of the sections would be in practice about half the width of the track-rails. The object of having space between the sectional rails and their adjacent track-rails less than the distance between two adjacent sections is that in case of any leak the current in seeking the path of least resistance will pass over to a track-rail as a return-conductor and not run back along either of the sectional rails to be a menace to life. As the sections are of the same length and are placed abreast of each other and being of approximately half the length of the car they will always be "dead" after the car has passed over them.

The car carries two sets of brushes or current-collectors 5 6, one set, 5, impinging on the trolley-rail 2 and gathering up the current therefrom to propel the car, the collectors 6 contacting with the rail 3 or the "fourth" rail as it may be termed. The function of this fourth rail will be described later. The front and rear brushes are separated a substantial distance to insure their not only spanning the interval between adjoining sections, but to have a sufficient lead onto the advance section and insure the energizing of that section before contact with the rear section is broken.

7 is a switch-box disposed beneath each section of trolley-rail 2 and bolted or clamped to and in electrical contact therewith. These boxes are spaced equidistant from each other and are insulated from everything but the trolley-rail.

The switch mechanism includes a solenoid-coil magnet 8, supported in guides 9 in the box, one terminal of the coil being connected to the box 7 at 10 and the other passing out through an insulating-plug and extending over to the rail 3, as shown by wiring at 11. A soft-iron core 12 is reciprocal within the coil and has a brass or other non-magnetizable conducting extension 13 with a contact-head 14. The lower end of the core 12 is secured to a flat conducting-spring 15, which is in constant electrical connection with the feed-wire 16. A contact-piece 17 is disposed in the path of the head 14 and is in electrical connection with the trolley-rail section and box. Normally the parts 14 and 17 are separated by the combined action of gravity and spring 15 to pull the core down. On the excitation of the coil the core is lifted to cut in the current from the feed-wire to the trolley-rail and the car. From the rail the current for the motor-circuit passes up through a brush 5 to the controller 18 and thence to the motor 19, whence it returns to the power-

house through the car-axle and wheels and one or other, or both, of the rails A. The fourth rail 3 forms a sectional conductor for the exciter or actuating-circuit by which the solenoid is energized to operate the switch.

Ordinarily with the core once elevated to bring the contacts 14 17 together, and thus put box 7 and the feed-wire 16 into electrical communication, a portion of the current will pass from 10 through the coil, wire 11 to rail 3, up through a brush 6, through the resistance 20 to the track and return. In other words, the coil and corresponding section of track 3 is in shunt-circuit with the motor-circuit. In case, however, the power in the main feed-wire should be temporarily cut off I provide an auxiliary circuit on the car by which the coil beneath the car may be excited to lift the core and hold it in contact with part 17, so that as soon as the current comes into the feed-wire again the car may be moved. This auxiliary circuit includes a switch 21, disposed in the conductor 24, leading from the battery 23 to brush 6. The other terminal, 22, of the battery connects with brush 5, one or the other of the brushes of each pair always being in contact with a rail-section and the brushes in each pair being connected in parallel. Usually switch 21 would be open. It is only closed when the main current fails. As soon as the current is felt in the main feed-wire again the motorman throws off switch 21.

It is to be noted that the resistance 20 instead of being carried by the solenoid-coil is separated therefrom, and therefore the coil requires but a small amount of wire, making a switch of this type very cheap.

In operation with the car standing over sections of rails 2 3 and the solenoid having been excited to lift the switch and bring the trolley-rail section and feed-conductor 16 into electrical connection the further excitation of the solenoid is maintained, as before described, by a portion of the main current passing in shunt-circuit through the coil, rail 3, brush 6, resistance 20 to the ground. The stopping and starting of the car does not affect in any way the action of the solenoid. The section or sections of the trolley-rail under the car, or those sections contacting with brushes 5, and those sections only, remain alive in whatever position the controller may be, since the latter affects only the current passing through the motor. As the car moves on from one section to another the solenoids beneath the several sections are successively and temporarily excited to lift the switches and cut in the current to the trolley-rail and car, the solenoids becoming inert as soon as the rear brushes leave their respective sections.

For clarity the circuits may be traced as follows, with the front and rear brushes standing on adjoining rail-sections, as in Fig. 1, assuming the car to be moving in the direction of the arrow and preliminary to the lifting of the forward switch. From rear brush 5 a portion of the current passes by wire 25 to forward brush 5, to its rail-section, box 7 therebeneath, through the solenoid in that box across to opposite section of rail 3, up through forward brush 6, back over wire 26 to rear brush 6, resistance 20, to ground. This is the actuating-circuit, which is closed the instant the forward brushes come upon a rail-section and causes the actuation of the switch which cuts in the current to the car before the rear brushes leave their sections.

Since the coils 8 are in shunt with the motor-circuit, they offer no resistance to the main or motor circuit to limit the amount of current that may be required for the motor. The actuating-circuit through the coils 8 and resistance 20 is always closed (through one coil or another) so long as the feed-wire remains alive and no matter what the position of the car is nor which way the car is going. Both shoes 6 are connected by wire 26, and it does not matter which shoe is taking current.

The function of the circuit through resistance 20, or the actuating-circuit, is to energize the successive magnets 8 to lift and to hold up the core and cut in the feeder to the rail-section 2 beneath the car. This function is the same whether the car travels in one direction or the other, since this actuating-circuit is normally uninterrupted.

As the distance between the front and rear brushes exceeds considerably the space between two adjoining sections of rails 2 or 3, this difference is the "lead" that the car has upon a section before the rear trolley leaves a live section, and the period necessary to traverse this lead distance is that period during which the switch has to act. Thus, for instance, with the brushes ten feet apart and the space between two sections two and a half feet the lead of the forward brush will be seven and a half feet, and the time that it takes a car to travel seven and a half feet will be the time in which the switch has to operate. With ordinary sectional third-rail systems the space in which the switch has to operate is scarcely as many inches. By this system it is possible to run cars at a very high rate of speed. Furthermore, it is to be noted that this system does not depend upon any magnets on the car to actuate the switch. When current is not being taken from one trolley-brush it is being taken from the other, and at times when both brushes are on a single section it is being taken from both. By this system the sections may be of any desired or practical length, though for ordinary traffic the live sections would not extend beyond the length of a car or train. The moment the rear brushes leave their sections the solenoid is cut out, the current from those sections to the car is cut off, and the switch in box 7 breaks dead. Whatever spark there is is at the brush-points prior to the opening of the

switch. There is no chance for leak from section to section to leave danger behind, because of so spacing the adjacent ends of the sections relative to the adjacent track-rails.

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

1. In an electric-railway system the combination of a motor-car, of a sectional trolley-rail, a sectional conductor, current-collectors on the car contacting with said trolley-rail and sectional conductor, uninterrupted electrical connections between each of the sectional-conductor collectors and the return, a feed-wire, an electromagnetic switch relative to each trolley-rail section for connecting the section to the feed-wire, a motor-circuit, the coils of said electromagnetic switches not being in series with the motor-circuit, an actuating-circuit with which said coils are in series, said actuating-circuit connecting with the advance switch-coil through the car, thence passing to the sectional conductor, thence up through a sectional-conductor collector to return.

2. In an electric-railway system, the combination with a motor-car of a sectional trolley-rail and a sectional conductor abreast of said trolley-rail, a switch-box disposed relative to each trolley-rail section, a solenoid in said box, a feeder, a core reciprocal in said solenoid and adapted to close the circuit between the feeder and trolley-rail and to carry the motor-circuit, current-collectors on the car contacting with the trolley-rail and sectional conductor, the sectional-conductor collectors in constant electrical connection with the return irrespective of the direction of travel, and an actuating-circuit shunted off from the motor-circuit and passing through a solenoid, thence across to a corresponding section of said sectional conductor up into the car through said sectional-conductor collectors to return.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

TIMOTHY MAHONEY.

Witnesses:
S. H. NOURSE,
JESSIE C. BRODIE.