H. F. PARSHALL.

ELECTRIC RAILWAY SYSTEM.

APPLICATION FILED AUG. 19, 1904.

**901,997.** Patented Oct. 27, 1908.

Fig. 1.

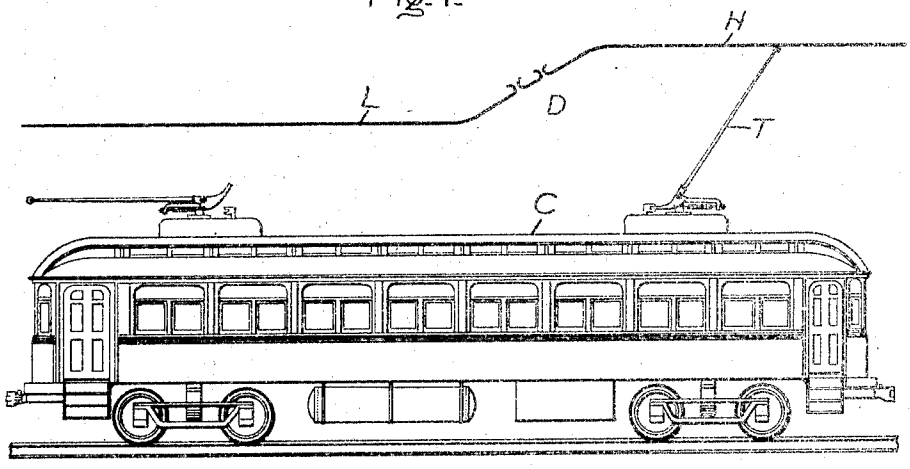
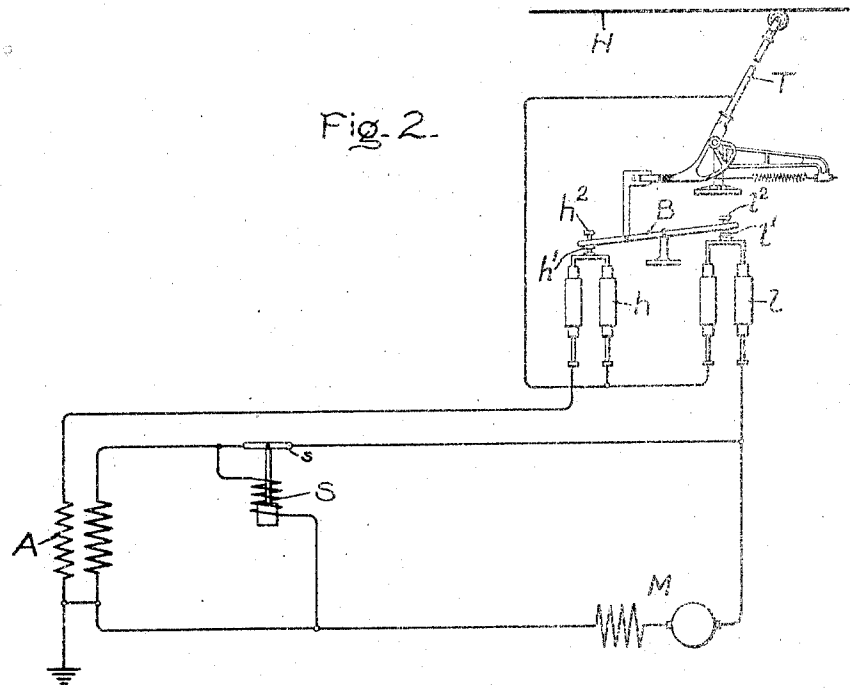



Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC-RAILWAY SYSTEM.

No. 901,997. Specification of Letters Patent. Patented Oct. 27, 1908.

Application filed August 19, 1904. Serial No. 221,324.

*To all whom it may concern:*

Be it known that I, HORACE F. PARSHALL, a citizen of the United States, residing at Salisbury House, London Wall, London, E. C., England, have invented certain new and useful Improvements in Electric-Railway Systems, of which the following is a specification.

My invention relates to electrical railway systems, employing a bare conductor for transmitting the power from the source to the locomotive or train. In such systems it may be necessary in certain cases for reasons of economy to charge the conductor to a high tension which may be inconvenient to use along certain portions of the railway, such as passenger stations, yards and under low bridges, where it becomes advisable to charge the conductor at a low tension. In such systems employing a conductor charged to a high tension and having sections which are charged to a low-tension it is necessary that the tension at the terminals of the motor or motors on the locomotive or train should be the same whether the train is taking current from the high tension or low-tension conductor except for the comparatively small changes due to the drop in the conductor. It is also desirable that the operation by which this is effected should be automatic and should involve no more than a momentary interruption of supply to the motors.

In one of its aspects, my invention consists in providing automatic means for changing the connections of a car circuit when passing from a low-tension to a high-tension section, or vice versa.

In a further aspect, my invention comprises a switch adapted to change the connections of the car circuits, a movable member operatively connected to the switch, and means stationed at a point along the roadway, between two sections energized by current differing in character, adapted to engage and move said member, and so to operate the switch when the car passes from one section to another.

More specifically considered, my invention consists in placing the sections of the working conductor, which are energized by currents differing in character, in different positions relative to track, so that the collecting device on the car is shifted in passing from one section to another, and in utilizing this shifting motion to operate a switch in the car circuit.

My invention will best be understood by reference to the accompanying drawings, in which

Figure 1 shows diagrammatically a transmission line comprising sections energized by currents differing in character and arranged in accordance with my invention; and Fig. 2 shows diagrammatically the car circuits and the automatic controlling means therefor.

In Fig. 1, C represents a car carrying a spring-pressed trolley-arm T, which is shown in engagement with the high-tension section H of a trolley-wire. L represents a low-tension section of a trolley-wire which is separated from a high-tension section by the short dead section D. The high-tension and low-tension sections are placed at different heights above the track, so that in passing from one to the other, the trolley-arm T will be lowered or raised. I take advantage of this movement of the trolley-arm to operate the devices for making the proper circuit changes on the car. Thus, in Fig. 2 I have shown the trolley-arm T operatively connected to a pivoted bar or lever B, the opposite ends of which are operatively connected to two oil switches $h$ and $l$. The switch $h$ is shown in its closed position and the switch $l$ in its open position, the trolley T being in engagement with the high-tension section H. With this position of the switches a circuit is closed from trolley-wire H through trolley-arm T, switch $h$, and primary of transformer A, to earth. The secondary of transformer A is connected to the motor M, and the transformer is designed to reduce the voltage to the proper amount for the motor. When the trolley-arm T reaches the point between high and low-tension sections, it is depressed so as to open the switch $h$ before leaving the high-tension section. The high-tension circuit is consequently broken by the switch $h$, instead of by trolley-arm T leaving the high-tension section. In this way arcing and depreciation of the trolley-wire and trolley-wheel are avoided. Switch $h$ is arranged to open before switch $l$ is closed. The latter switch is not closed until after the trolley-arm T has passed the dead section D, and has entered on the low-tension section. The opening of switch $h$ and the closing of switch $l$ opens the primary of transformer A and closes a circuit from trolley-arm T di-

rectly through motor M, to earth. The voltage of the low-tension section is thus impressed directly on the motor.

When the change is from high-tension alternating to low-tension direct-current, the solenoid S is provided, controlling a switch *s* arranged to open the circuit of the secondary of transformer A. When switch *h* is open, deënergizing transformer A, solenoid S is deënergized and opens the switch *s*. This prevents damage to the transformer, due to flow of direct-current through its secondary when switch *l* is closed. When changing from high-tension to low-tension alternating-current, it is not necessary to employ the automatic switch *s*.

In order to avoid a continual small movement of the switches *h* and *l*, due to the usual and unavoidable variation in the height of different portions of the same section of a trolley-wire, the bar B is connected to switches *h* and *l* through a lost-motion connection which gives sufficient play to the trolley-arm to enable it to follow the ordinary variations in height in the trolley-wire without moving the switches. This lost motion connection may take various forms as, for instance, the ends of the bar B may play between separated shoulders or stops $h^1$ and $h^2$ and $l^1$ and $l^2$ secured to the movable members of switches *h* and *l*, respectively. In the position illustrated in Fig. 2, the trolley is in its extreme high position, and one end of the arm B is in engagement with the lower shoulder or stop $h^1$ of the switch *h*. At points where the trolley wire is depressed slightly, the bar B is free to oscillate from the shoulder or stop $h^1$ to the shoulder or stop $h^2$ without affecting the switch. The distance between the shoulders or stops $h^1$ and $h^2$ and similarly between *l* and $l^2$ is such that ordinary irregularities in the height of the trolley wire do not affect the switches.

Although I have shown the switching devices on the car operated by a trolley-arm and over-head wire, it will be understood that my invention is not limited to this particular arrangement. The switching devices may obviously be operated from a collector-shoe traveling on a third rail which has its sections arranged at different heights above the ground, or at different distances from the car. Moreover, the means for operating the switches may be wholly independent of the current-collecting devices. Any suitable operative connection may be employed between the movable member and the switches in place of the direct mechanical connection shown. Consequently, I aim in the appended claims to cover any suitable means for operating a movable member on a car at the entrance to a section energized by current of a different character, together with means for utilizing the movement of said member for producing a change in the car circuits.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In an electric railway system, a conductor having sections energized by currents differing in character and arranged in different positions relative to the track, a car, circuits thereon, a collecting device carried by the car and adapted to engage said conductor, a switch on the car for changing the connections of the car circuits, and means between said collecting device and said switch for moving the switch from one position to another when the collecting device passes from one section of conductor to another.

2. In an electric railway system, a conductor having sections energized by currents differing in character, said sections being arranged at different heights above the track, a car, circuits thereon, a trolley carried by the car and adapted to engage said conductor, and means on the car operated by the trolley for changing the connections of the car circuits when the trolley passes from one section of conductor to another.

3. In an electric railway system, a conductor adapted to be engaged by a moving car and comprising sections energized by currents differing in character, a car, circuits thereon, a movable member carried by the car, means stationed at a point between said sections for engaging and moving said member, a switch on the car adapted to change the connections of the car circuits, and operative connections between said switch and said member.

4. In an electric railway system, a working conductor having sections energized by currents differing in character, a car, circuits thereon, a collecting device carried by the car and adapted to engage said conductor, the said sections being differently positioned relatively to the track so that said collecting device is shifted in passing from one section to another, and means operated by the shifting of said device for changing the circuit connections on the car.

5. In an electric railway system, a working conductor comprising sections energized by currents differing in character and differently positioned relatively to the track, a car, circuits thereon, a collecting device carried by the car and adapted to be shifted in passing from one section to another, a switch adapted to change the connections of the car circuits, and operative connections between said device and said switch.

6. In an electric railway system, a trolley-wire comprising sections energized by currents varying in character and suspended at different heights above the track, a car, circuits thereon, a spring-pressed trolley-arm carried by the car adapted to engage said conductor and to be raised and lowered in passing from one section to another, a switch adapted to change the connections of the car

circuits, and operative connections between said arm and said switch.

7. In an electric railway system, a conductor having sections energized by currents differing in character, a car, a motor-circuit thereon a collecting device carried by the car and adapted to engage said conductor, a transformer having its primary connected to said device and its secondary to the motor-circuit of the car, switches adapted to open the circuit of said transformer and to connect the motor-circuit directly to the collecting device, and means stationed at a point between said sections for operating said switches.

8. In an electric railway, a working conductor comprising sections energized by currents differing in character and differently positioned relatively to the track, a car, a motor-circuit thereon a collecting device carried by the car and adapted to engage said conductor and to be shifted in position in passing from one section to another, a transformer having its primary connected to said collecting device and its secondary connected to the motor circuit on the car, switches adapted to open the circuit of said transformer and to connect the motors directly to the collecting device, and operative connections between said switches and said device, whereby said switches are operated when said device is shifted in position.

9. In an electric railway system, a conductor adapted to be engaged by a moving car and comprising sections energized by currents differing in character, a car, circuits thereon, a movable member carried by the car, means stationed at a point between said sections for engaging and moving said member, switches on the car arranged to establish different connections of the car circuits, and operative connections between said switches and said member, the operating means for said member and the connections between said member and said switches being arranged to open one of said switches before the car leaves one of said sections and to close the second switch after the car reaches the second section.

10. In an electric railway system, a working conductor comprising sections energized by currents differing in character and differently positioned relatively to the track, a car, circuits thereon, a collecting device carried by the car and adapted to be shifted in passing from one section to another, a switch adapted to change the connections of the car circuits, and operative connections between said device and said switch, said connections comprising a lost-motion connection adapted to permit a certain amount of play of said collecting device without moving said switch.

In witness whereof I have hereunto set my hand this eighth day of August, 1904.

HORACE F. PARSHALL.

Witnesses:

R. WESTACOTT,

FREDK L. RAND.