(No Model.)

M. W. DEWEY.

ELECTRIC HEATING APPARATUS FOR RAILWAY SYSTEMS.

No. 406,890. Patented July 16, 1889.

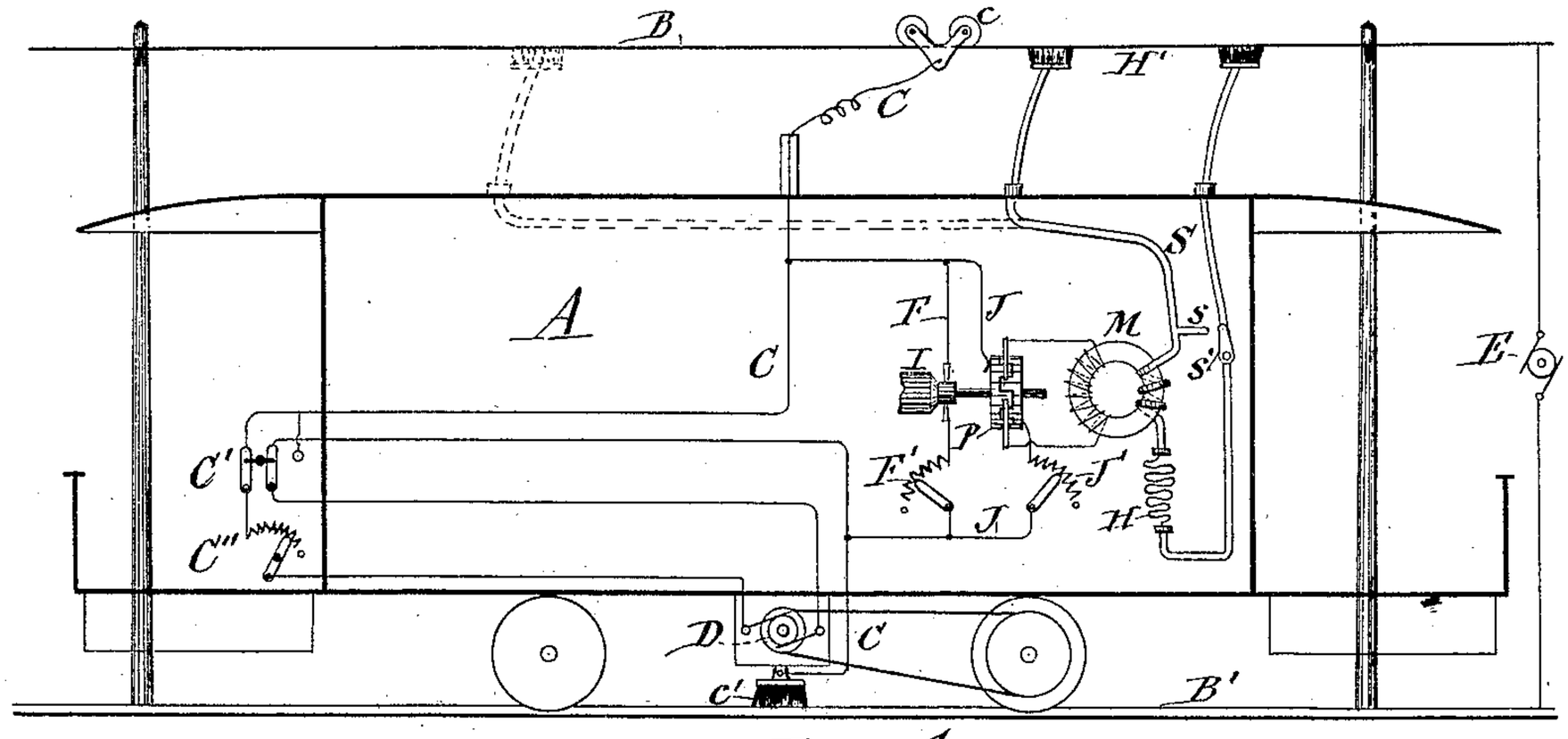

Fig. 1

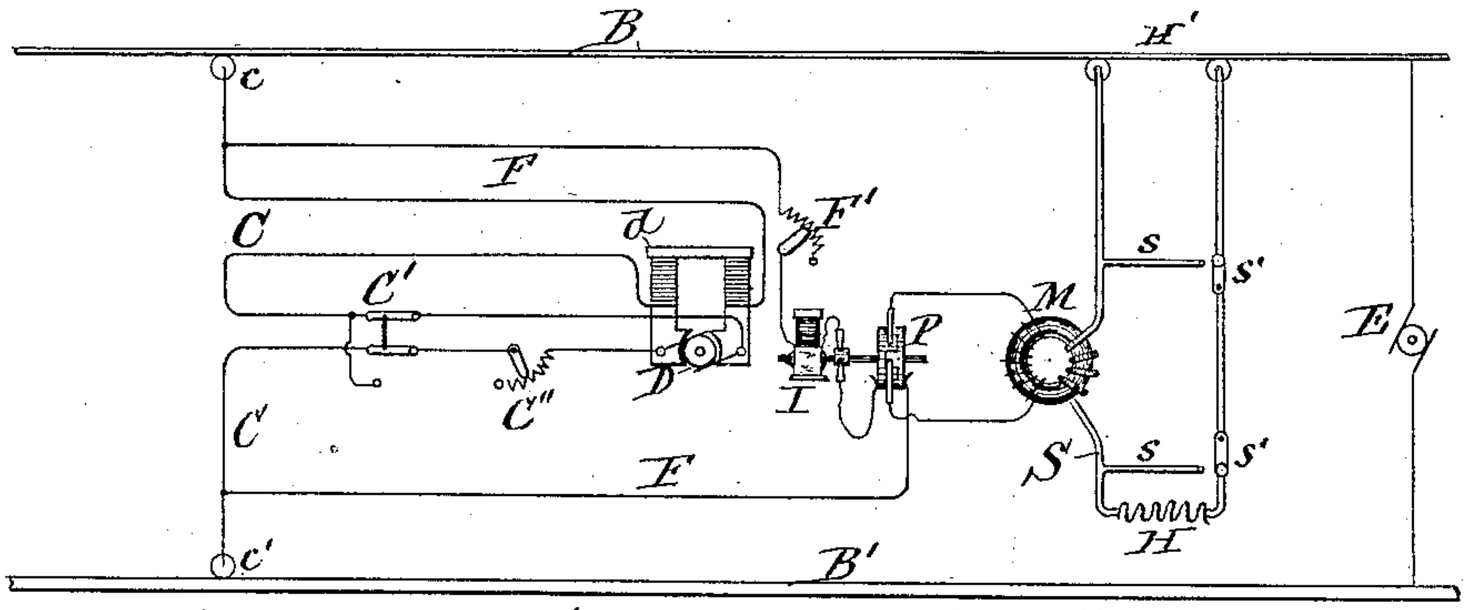

Fig. 2

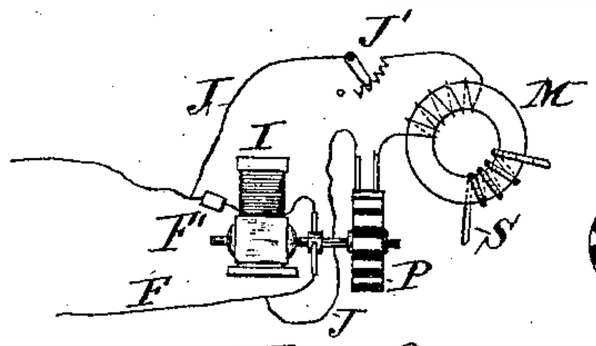

Fig. 3

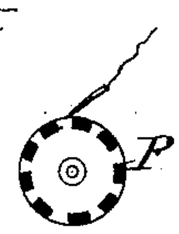

Fig. 4

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UNITED STATES PATENT OFFICE.

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ELECTRIC HEATING APPARATUS FOR RAILWAY SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 406,890, dated July 16, 1889.

Application filed April 16, 1889. Serial No. 307,396. (No model.)

To all whom it may concern:

Be it known that I, MARK W. DEWEY, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Electric Heating Apparatus for Railway Systems, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention has reference to electric railways; and it consists in certain improvements herein set forth, and shown in the accompanying drawings.

My invention relates to electric railways, with special reference to heating apparatus similar to that shown and described in my patent No. 401,482, dated April 16, 1889.

My invention consists in the following improvement over said application, viz: The heating apparatus is controlled independent of the motor for propelling the car and the condition of the circuit through said motor.

In order to convert the direct current at the vehicle for operating the propelling-motor into a heating-current for the heating device a suitable pulsator, preferably a pole-changer, must be operated. In the prior case referred to this was accomplished by continuously operating the motor for propelling the car, even when the car was at rest, which required suitable devices for coupling and uncoupling said motor with the axle of the car, so that while said car was at rest the motor was still in operation for operating the pole-changer. For the purpose of operating the pulsator or pole-changer independent of the mechanism for propelling the car, and at the same time utilizing the same current, a small electric motor is employed connected in a shunt-circuit around the propelling-motor and its controlling devices. A suitable current-regulator or adjustable resistance is also included in said shunt-circuit. The pulsator and primary coil of an inductional transformer may either be in the same shunt with the motor or in a separate shunt-circuit, with an adjustable resistance around both motors and their controlling devices, preferably the latter. The heating devices are included in a closed low-resistance secondary circuit of the transformer moved by the car. This secondary circuit is termed a "low-resistance" circuit, to distinguish it from the line working-circuit, which is of much higher resistance. By this arrangement of the apparatus cars not provided with the uncoupling devices hereinbefore referred to may be equipped more easily, energy saved, especially in cases where the cars are required to stand at the terminus of road for long time, and a variation of the strength of current flowing to the propelling-motor will not vary the supply of heat.

My invention also consists in forming a heating device of a portion of the line working-conductor in the vicinity of the car, in order to free said line conductor of ice, by simply including in the heating-circuit said portion of the line conductor by means of suitable movable contacts bearing upon the line conductor and located a distance apart or disposed one in advance of the other on the same and moved by the car while in motion.

In the accompanying drawings, Figure 1 represents a sectional elevation of an electric street-car, showing circuits thereon and receiving the current by a movable contact on an overhead-line working-conductor and a movable contact on the track, which in this case forms the return-conductor. A portion of the said line conductor is shown as included between terminals of the heating-circuit in contact with the line conductor. Fig. 2 is a diagram view of the electrical circuits shown in Fig. 1 slightly modified. Fig. 3 shows an ordinary intermittent pulsator that may be employed in place of the pole-changers shown in the other figures in connection with its motor and circuits, and Fig. 4 is a side view of the pulsator.

Referring specifically to the drawings, A represents the vehicle or car; B and B′, the supply or line working-conductors arranged along the path of the vehicle or roadway; C, the conductor or electrical connection with the line conductors B and B′, and E denotes the source of electricity.

I do not limit myself to the location of the said line conductors, as they may be contained in a suitable conduit beneath the road-bed, overhead, or alongside of the track. Neither do I limit myself to the form of contacts traveling on the said conductors. The motor D

is preferably designed to have the direction of rotation of its armature reversed by reversing the current through the armature, the direction of the current through the field-magnet *d* of the motor remaining the same. It will be obvious, however, that other well-known methods of reversing may be employed if desirable.

C′ represents the usual current-reverser for changing the direction of rotation of the motor D, and C″ an adjustable resistance in the conductor C for controlling the speed of said motor.

F is a shunt-circuit connected with the motor-circuit C in proximity to the traveling contacts *c* and *c′* or around the motor D and its controlling devices C′ and C″.

I is a small electric motor in said shunt-circuit for operating the pulsator.

F′ is an adjustable rheostat and circuit maker and breaker in said shunt-circuit for regulating the amount of current flowing therein.

The object of pulsating the current is to transform said current, when continuous and direct, by means of an inductional transformer and secondary circuit of low resistance, into an increased heating-current or a current of lower electro-motive force and greater volume.

P is a pulsator or continuity-preserving current pole-changer which is connected rigidly to the shaft of the small motor and rotated thereby. The pole-changer may be either connected in the shunt-circuit with said motor, as shown in Fig. 2, or in a separate shunt-circuit J, as shown in Figs. 1 and 3. It is preferably connected in a separate shunt from the motor I, and has an adjustable resistance and circuit-breaker J′ therein to control the current flowing through the pulsator and primary coil of the transformer M independent of the strength of the current in the shunt F. By the operation of the pole-changer the current in the portion of the shunt-circuit containing the primary coil of the transformer M is alternated.

S is the secondary circuit of the transformer, and is formed of large wire or cable. The heating devices H and H′ are included in said circuit in series.

s s indicate direct low-resistance shunt-paths for the current around the heating devices, that may be closed by suitable switches or circuit-closers *s′* when it is desired to cut out one of said heating devices independent of the other heating device in circuit, for the purpose of supplying the interior of the car only with heat when desired.

It will be obvious that when the current for propelling the car is of an alternating character the pulsator and motor I may be dispensed with.

The dotted portion of Fig. 1 shows the terminals of the secondary circuit a greater distance apart on the line conductor and with the movable contact *c* between said terminals. By this arrangement the line conductor is kept clear ahead or in advance of the contact *c*. If desirable, the said terminals may be placed in contact with the conductor, so that both will be in advance of the trolley or movable contact *c*.

What I claim as my invention is—

1. The combination, with an electrically-propelled vehicle, working-conductors supplied with direct current along the path of said vehicle, conductors on the vehicle in contact with the working-conductors and the electric motor for propelling the vehicle, and controlling devices connected with the vehicle-conductors, of a shunt-circuit of the vehicle-conductor around the said motor and its controlling devices, a second electric motor and controlling device in said shunt-circuit, a second shunt-circuit around both motors and their controlling devices, a pulsator operated by the second motor and primary coil of an inductional transformer in the second shunt-circuit, a secondary circuit of low resistance in circuit with the secondary coil of said transformer, one or more electric heating devices included in the secondary circuit, and means for cutting one or more of said heating devices out of circuit.

2. The combination, with an electrically-propelled vehicle, the supply-conductors on the vehicle and the electric motor for propelling the vehicle, and controlling devices connected with the said supply-conductors, of a shunt-circuit of the said supply-conductors, a second electric motor in said shunt-circuit, a pulsator operated by the second motor, and primary coil of a transformer in shunt-circuit, a secondary circuit including the secondary coil of said transformer, and one or more suitable electric heating devices in said secondary circuit.

3. The combination, with a vehicle, the conductors on the vehicle connected with a source of direct current, and a translating device and means for controlling the same connected in circuit with said conductors, of a shunt-circuit around both the said translating and controlling devices, an electric motor in the shunt-circuit, a pulsator operated by the motor and primary coil of a transformer in shunt-circuit, a secondary circuit including the secondary coil of the transformer, and one or more electric heating devices in said secondary circuit.

4. The combination, with a vehicle, the conductors on the vehicle connected with a source of direct current, and a translating device and means for controlling the same in circuit with said conductors, of a shunt-circuit around both the translating and controlling devices, an electric motor and adjustable resistance in the shunt-circuit, a second shunt-circuit around said motor and adjustable resistance, a pulsator operated by the motor and a primary coil of a transformer in the second shunt-circuit, a secondary circuit of low resistance, including the secondary coil of the

transformer, and one or more electric heating devices in said secondary circuit.

5. The combination, with a vehicle, the conductors on the vehicle connected with a source of direct current and a translating device and controlling devices therefor in circuit with said conductors, of a shunt-circuit around said devices, an electric motor and a rheostat in the shunt-circuit, a second shunt-circuit around said motor and rheostat, a pulsator operated by the motor and a primary coil of a transformer in the second shunt-circuit, means for regulating the current flowing through said primary coil, a secondary circuit of low resistance, including a secondary coil of the transformer, and one or more electric heating devices in said secondary circuit.

6. The combination, with an electrically-propelled vehicle, working-conductors supplied with direct current along the path of said vehicle, conductors on the vehicle in movable contact with the working-conductors, and the electric motor for propelling the vehicle and its controlling devices in circuit with the vehicle-conductors, of a shunt-circuit on said vehicle around the motor and its controlling devices, a second electric motor and adjustable resistance in said shunt-circuit, a second shunt-circuit around both motors and their controlling devices, a pulsator operated by the second motor, a primary coil of a transformer and regulating device in the second shunt-circuit, a secondary circuit, including the secondary coil of said transformer, and one or more electric heating devices on the vehicle in the secondary circuit.

7. The combination, with a vehicle, working-conductors supplied with direct current along the path of said vehicle, the conductors on the vehicle, and a translating device and controlling devices therefor in circuit with said vehicle-conductors, of a shunt-circuit around said devices, an electric motor and a rheostat in the shunt-circuit, a second shunt-circuit around said devices, motor, and rheostat, a pulsator operated by the motor and a primary coil of a transformer in the second shunt-circuit, means for regulating the current flowing through said primary coil, a secondary circuit of low resistance, including a secondary coil of the transformer, and one or more electric heating devices in said secondary circuit.

8. The combination, with a vehicle, and a line working-conductor arranged along the path of said vehicle, of a closed electric circuit to be moved with the vehicle, including a conductor of lower resistance than the line conductor, movable contacts connected with the terminals of said low-resistance conductor and in contact with the said line working-conductor, and a portion of the line working-conductor between the terminals and supplied with electric current from a suitable source, for the purpose set forth.

9. The combination, with a vehicle, and a line working-conductor arranged along the path of said vehicle, of a closed electric circuit to be moved with the vehicle, including a conductor on the vehicle, terminals of said conductor disposed one in advance of the other and in contact with the line working-conductor, and a portion of the line working-conductor between the terminals, and supplied with electric current from a suitable source, for the purpose set forth.

10. The combination, with a vehicle, and a continuous-line working-conductor arranged along the path of said vehicle, of a low-resistance conductor on the vehicle supplied with electric current, terminals of said vehicle-conductor disposed one in advance of the other in contact with the line working-conductor and the portion of the said line-conductor between the said terminals, for the purpose set forth.

11. The combination of an electrically-propelled vehicle, a continuous-line working-conductor arranged along the path of said vehicle, an electric motor propelling said vehicle, an electric connection between said motor and working-conductor, a shunt-circuit around the motor on the vehicle, a primary coil of a transformer in said shunt-circuit, means to regulate the current flowing through the shunt-circuit, a secondary circuit including the secondary coil of the transformer, terminals of the secondary circuit in contact with the line conductor, and a portion of the line working-conductor between the said terminals, for the purpose set forth.

12. The combination of an electrically-propelled vehicle, a continuous-line working-conductor arranged along the path of said vehicle, an electric motor propelling said vehicle, an electric connection between said motor and working-conductor, a shunt-circuit around the motor on the vehicle, a pulsator and a primary coil of a transformer in said shunt-circuit, means to regulate the current flowing through the shunt-circuit, a secondary circuit including the secondary coil of the transformer, terminals of the secondary circuit in contact with the line conductor, and a portion of the line working-conductor between the said terminals, for the purpose set forth.

13. The combination of an electrically-propelled vehicle, a continuous-line working-conductor arranged along the path of said vehicle, an electric motor propelling said vehicle, an electric connection between said motor and working-conductor, a shunt-circuit around the motor on the vehicle, a pulsator and a primary coil of a transformer in said shunt-circuit, means to regulate the current flowing through the shunt-circuit, an electric motor operating the pulsator, a secondary circuit including the secondary coil of the transformer, terminals of the secondary circuit in contact with the line-conductor, and a portion of the line working-conductor between the said terminals, for the purpose set forth.

14. The combination of an electrically-propelled vehicle, a continuous-line working-conductor arranged along the path of said vehicle, an electric motor to propel said vehicle, an electric connection between said motor and working-conductor, a shunt-circuit around the motor on the vehicle, a pulsator and a primary coil of a transformer in said shunt-circuit, means to regulate the current flowing through the shunt-circuit, an electric motor operating the pulsator, a secondary circuit including the secondary coil of the transformer and a plurality of heating devices, terminals of the secondary circuit in contact with the line conductor, a portion of the line working-conductor between the said terminals forming one of said heating devices, and means for cutting in or out of circuit one of the said heating devices independent of the other heating device in circuit, for the purpose set forth.

15. In an electric railway, a line working-conductor, a traveling vehicle, an electric motor to propel said vehicle, an electrical connection between said vehicle and working-conductor, an inductional transformer on the vehicle, a secondary circuit of low resistance, an electric heater to heat said vehicle in the secondary circuit, and means to control the current passing through the transformer independently of the motor.

16. In an electric railway, a line working-conductor, a traveling vehicle, an electric motor to propel said vehicle, an electrical connection between said motor and working-conductor, a current-transformer on the vehicle in electrical connection with the working-conductor, a secondary circuit of lower resistance than the working-conductor, an electric heater to heat said vehicle in the secondary circuit, and means to control the current passing to the transformer independently of the motor.

17. The combination of a vehicle, a line working-conductor arranged along the path of said vehicle, a translating device on the vehicle, an electrical connection between said translating device and working-conductor, a current-transformer on the vehicle in electric connection with the working-conductor, a secondary circuit of lower resistance than the working-conductor, an electric heater to heat said vehicle in the secondary circuit, and means to control the currents passing to the translating device and transformer independently of each other.

In testimony whereof I have hereunto signed my name this 15th day of April, 1889.

MARK W. DEWEY. [L. S.]

Witnesses:
C. H. DUELL,
A. F. WALZ.