(No Model.)

M. W. DEWEY.

ELECTRIC LIGHTING AND HEATING APPARATUS FOR ELECTRIC RAILWAYS.

No. 436,125. Patented Sept. 9, 1890.

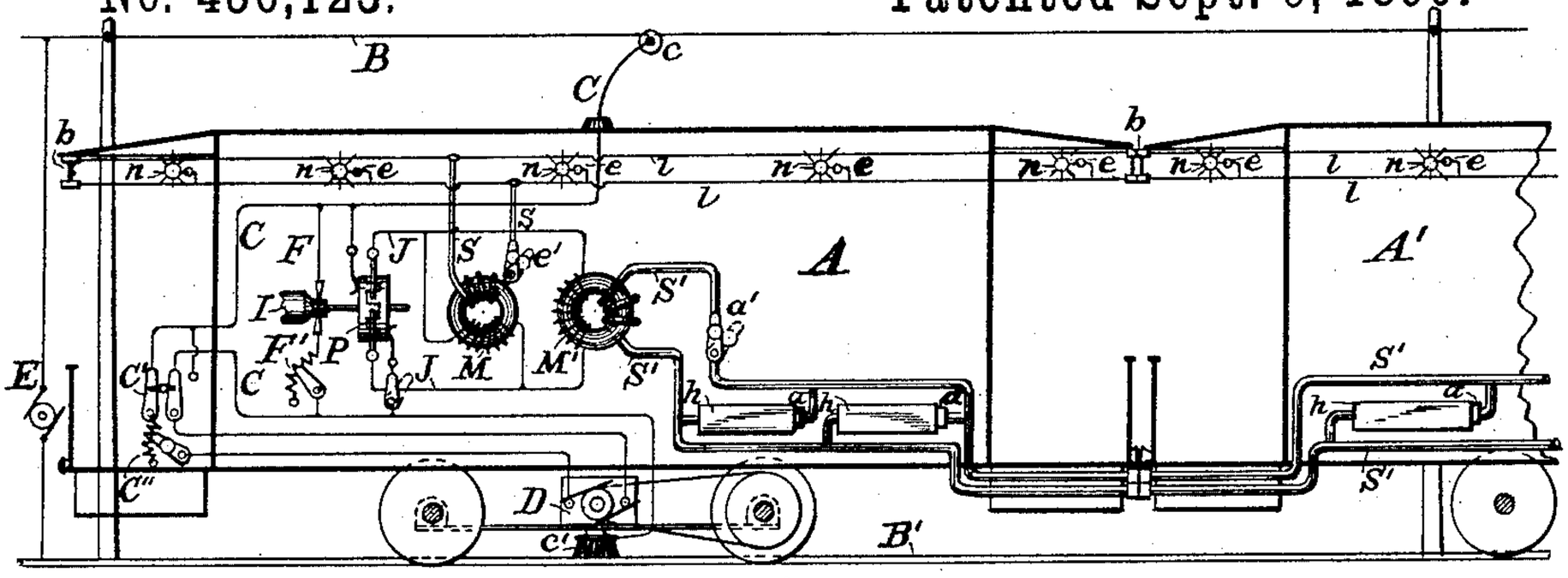

Fig. 1.

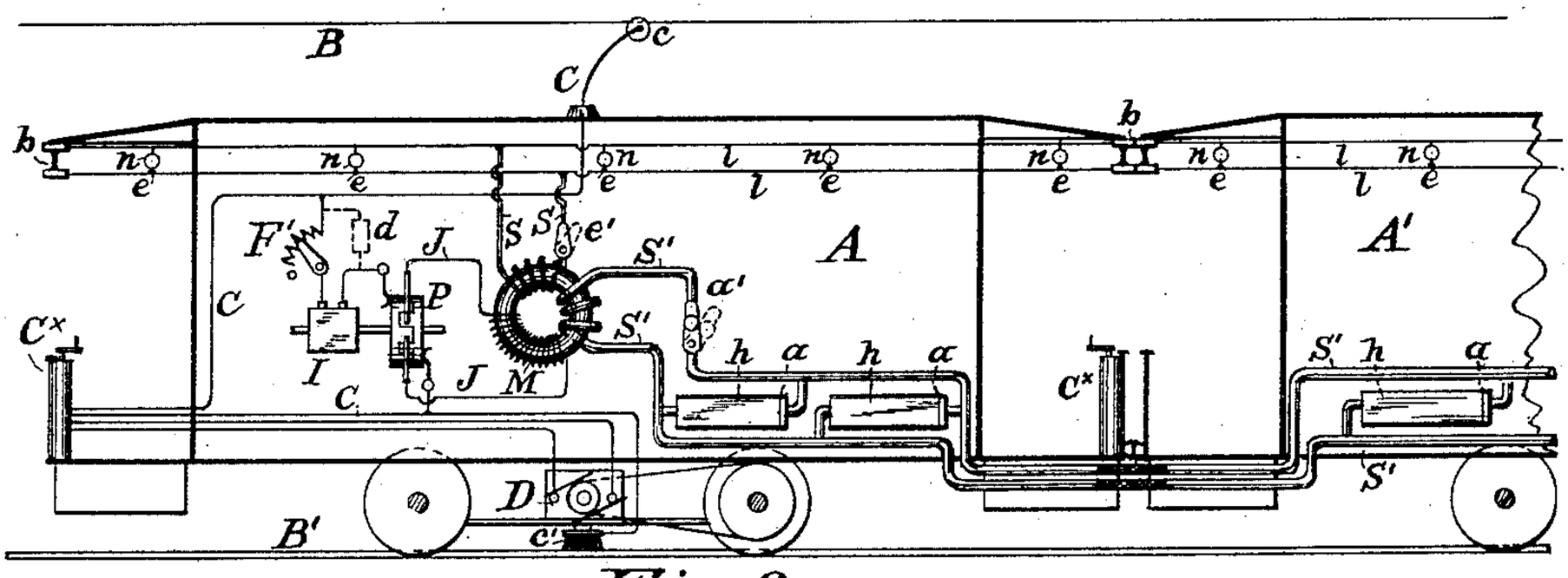

Fig. 2.

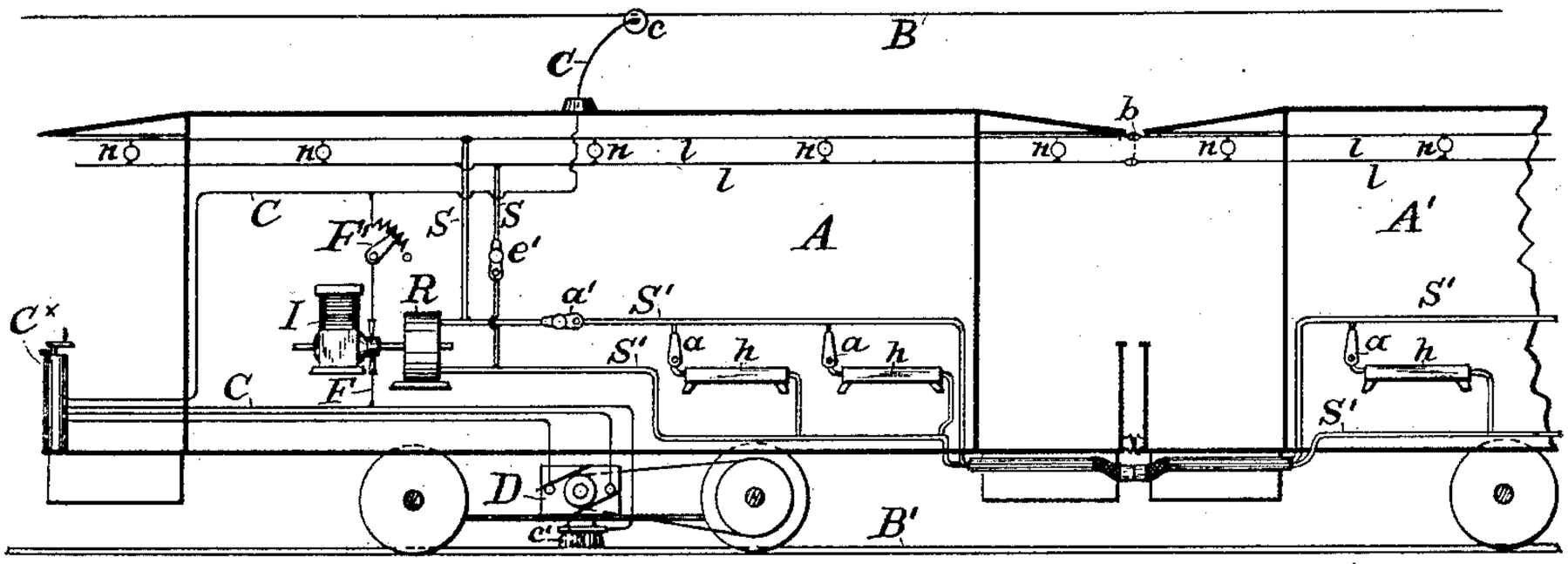

Fig. 3.

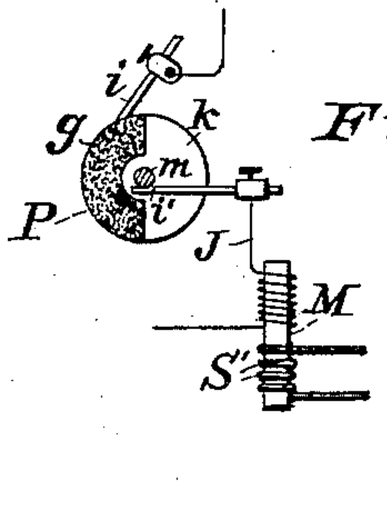

Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRIC LIGHTING AND HEATING APPARATUS FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 436,125, dated September 9, 1890.

Application filed March 14, 1890. Serial No. 343,855. (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 Lighting and Heating Apparatus for Electric Railways, (Case No. 52,) of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to electric railways, with special reference to lighting apparatus therefor, and heating apparatus similar to that shown and described in my patents, No. 401,482, dated April 16, 1889; No. 406,890, dated July 16, 1889, and No. 418,911, dated January 7, 1890.

As now commonly constructed, electric-railway cars receiving current from line working-conductors are lighted by means of incandescent lamps included in a shunt-circuit around the propelling-motor, and on account of the high voltage of the line and the low resistance of the lamps said lamps are connected in circuit in series. The filaments of said lamps often break when lighted, which is due, among other causes, to the vibration or jolting of the car. When one of the filaments of said lamps breaks, the shunt-circuit is entirely broken, all the lamps are extinguished, and the car is left in darkness. It is impossible then to distinguish which lamp is broken, and this necessitates often the completion of the trip without light. The lamps being connected in circuit in series, they must all be lighted, if one is lighted, for if one or more are shunted and the current is permitted to pass through the others their life will be shortened and considerable current wasted, if they are not instantly broken. Several (five) high-resistance lamps are simultaneously employed on each car, when in some cases one or two would be sufficient, simply to create the required resistance in the lamp-circuit. If at any time one or two more lamps are needed than usual, it is necessary to provide another shunt-circuit with five or six lamps, according to the voltage.

The object of my invention is to obviate these objectionable features of our present system of lighting electric-railway cars, and this I accomplish by providing suitable apparatus for transforming or converting the current or a portion of the current received on the car into a current of lower voltage and larger volume and by placing the lamps in multiple connection with a secondary circuit through which the transformed current flows, and, further, in providing switches for each of said lamps in circuit, so that one or more of the lamps may be lighted while one or more others are not lighted.

The object of my invention also is to provide apparatus whereby the current supplied will be varied with and in proportion to the number of lamps in circuit without waste. The above applies equally to the heating of electric cars as well as to the lighting of the same.

In my prior patents, hereinbefore referred to, the heaters or translating devices were placed in circuit in series and shunt-paths, for the current around each heater was provided to cut the latter out, allowing an increased current to flow through the other heaters in circuit, and the current flowing through the primary coil of the transformer was regulated by an adjustable resistance; but in my present invention it is regulated by changing the conductivity of the secondary circuit or, as before explained, said current is automatically varied with and in proportion to the number of heaters in circuit, and the number of heaters may be varied as desired, as they are adapted to be placed in circuit in parallel.

By combining the lighting and heating systems, which, in fact, should go together in an equipment for electric-railway cars or trains, both economy and simplicity of construction are derived, as but one pulsator is required for both systems, one motor to operate the pulsator, and in some cases but one transformer and one consumption circuit. Furthermore, this apparatus may be used for one or both purposes at a time, and does not remain idle as much of the time as when employed for but one purpose, besides affording a very convenient and efficient system.

In the accompanying drawings, Figure 1

represents a sectional elevation of an electrically-propelled car and a portion of another coupled to it, showing circuits and apparatus thereon in accordance with my invention and receiving the current by movable contacts on stationary line working-conductors arranged along the railway. Fig. 2 is a modification of Fig. 1, and shows a single transformer having two secondary circuits, one for the lamps and the other for the heaters. Fig. 3 is also a modification, and shows a dynamo operated by a motor for transforming the current and producing a current in a circuit having two branches, one containing the lamps and the other the heaters. Fig. 4 represents a simple form of pulsator and transformer that may be employed in my system.

Similar letters of reference indicate corresponding parts.

Referring specifically to the drawings, A represents the motor-car, A′ the car coupled to it, B and B′ the supply or line working-conductors arranged along the railway or path of the car or vehicle, C the vehicle-conductor or electrical connection on the car connected movably to the line-conductors, and E denotes the source of electricity.

I do not limit myself to the location of the said line-conductors, as they may be arranged in a conduit beneath the road-bed, overhead, or alongside of the track; neither do I limit myself to the form of the cars or the contacts *c* and *c′*, carried thereon in movable connection with the line-conductors.

The motor D is located, as usual, in the vehicle-conductor C, containing the current-controlling devices, preferably a pole-changing switch C′ and an adjustable resistance C″.

F in the figures is a shunt-circuit connected with the motor-circuit C and around the motor D and its controlling devices C′ and C″. I is a suitable electric motor in the shunt-circuit F, for operating a pulsator or dynamo. I preferably employ a second or separate motor for this purpose; but it will be obvious that the propelling-motor may be employed if desired, especially if it is adapted to run continuously, as shown and described in one of my prior patents before mentioned.

F′ is an adjustable rheostat and circuit maker and breaker in said shunt-circuit for regulating the current therein and thereby controlling the motor.

P is an alternator or a rotatable pole-changer in shunt-circuit, and is rigidly connected to the shaft of the motor. The pole-changer may be either connected in the shunt-circuit with said motor in series or in a derived circuit of said shunt, as indicated in dotted lines in Fig. 2 of the drawings, or in a separate shunt-circuit, as shown in Fig. 1. By the operation of the pole-changer the current in the portion of the shunt-circuit containing the primary coil of the transformer is alternated or changed into an alternating current.

The current is alternated for the purpose of inductionally transforming the direct current supplied to the car for the propelling-motor into a current of lower voltage and greater volume to be passed through the translating devices in circuit, as the lamps and heaters. If the current supplied to the car is of an alternating character, the pulsator and motor for operating the same may of course be dispensed with.

Referring particularly to Fig. 1, M and M′ represent two inductional transformers having preferably closed laminated magnetic circuits with their primary coils in parallel or multiple arc connection with the shunt-circuit J, containing the pole-changer P. The secondary circuits S and S′ of the transformers M and M′ are of larger wire than their primaries, and are wound a less number of times around the cores, in order to reduce the electro-motive force and increase the volume of the currents as, required. The secondary circuit S is connected with the leads *l l*, between which the incandescent lamps *n n n*, &c., are connected in multiple arc. The said leads may be arranged upon the car A only or may extend through suitable couplings *b* to one or more other cars coupled to it, as A′.

The secondary circuit S′ is of lower resistance than the other secondary circuit S and contains the heaters *h h h* in multiple-arc connection between the supply-conductors thereof. These transformers are preferably constructed so that the currents in the primaries will be varied with and in proportion to the conductivity of the secondaries or the number of translating or consumption devices in circuit.

The heaters *h h h* (shown in Fig. 1) may be the same or similar to the heaters described and shown in my prior patent, No. 423,223, dated March 11, 1890, *a a a* indicating the current regulators or switches on each heater, (represented more clearly in Fig. 3,) and *a′* is a switch located near the transformer for opening the supply-conductor to cut out all the heaters simultaneously. In the same figure, *e e e*, &c., indicate the switches or circuit makers and breakers at each lamp *n n n*, &c., to enable one or more to be lighted without lighting the others, or to allow any desired number of lamps to be placed in circuit, and *e′* is a switch for opening or closing the circuit to all the lamps simultaneously.

In Fig. 2 the motor I is shown connected in series with the alternator P, and a single inductional transformer M, having the two secondary circuits wound upon its core. The motor I may be placed in a derived circuit of the shunt J or have a shunt placed around it and its controlling device F′, as indicated in dotted lines at *d*. The current-regulating device F′ in Fig. 2 may be also used to regulate the current flowing through the primary coil of the transformer independently of the current flowing to the propelling-motor D.

$C^{\times}$ in Fig. 2 indicates the controlling devices of the motor D, and the same may be placed at both ends of the car, as usual.

In Fig. 3 the motor I operates a dynamo R, which generates a current of lower voltage and greater volume, when desired, and takes the place of or acts as a transformer. In this case the lamps *n n n*, &c., are arranged in multiple arc in a branch of the circuit leading to the heaters *h h h*, and the heaters in circuit may be the same or similar to those described in my prior application for Letters Patent, Serial No. 337,452, filed January 20, 1890.

The simple form of pulsator shown in Fig. 4 and designed to be used in place of the alternator, if desired, consists of a metallic wheel *k*, mounted on a shaft *m* and having a segment of non-conducting or semi-conducting material *g* in its periphery and forming preferably about one-half of the latter.

i is a stationary brush bearing upon the periphery of the wheel, and *i'* is a brush bearing upon the shaft. When the wheel is rotated, if the segment *g* is non-conducting the circuit will be made and broken; but if said segment is of semi-conducting material the circuit or current will not be broken, but simply pulsated, and will be maintained in a direct condition continually. The segment *g* may be made of carbon or a mixture of carbon and some other resisting material.

The inductional transformer M, shown in circuit with this pulsator, is a common straight-core transformer; but it will be obvious that any suitable form of transformer may be used with the same.

Having described my invention, what I claim 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 a 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, a plurality of lamps in multiple-arc connection with the secondary circuit, and means for switching each of said lamps out of circuit independently of the others.

2. 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 a 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, a plurality of lamps in multiple-arc connection with the secondary circuit, and means for cutting said lamps out of circuit.

3. 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 a 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, and a plurality of lamps connected in the secondary circuit in multiple arc.

4. 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 a primary coil of a transformer in shunt-circuit, a secondary circuit including the secondary coil of said transformer, and a plurality of lamps connected in the secondary circuit in multiple arc.

5. 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 a primary coil of a transformer in shunt-circuit, a secondary circuit including the secondary coil of said transformer, a plurality of lamps in multiple-arc connection with the secondary circuit, and means for cutting each of said lamps out of circuit.

6. The combination, with a vehicle, the conductors on the vehicle connected with a source of direct current, and a translating de-

vice 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 a primary coil of a transformer in shunt-circuit, a secondary circuit including the secondary coil of the transformer, and a plurality of lamps connected in the secondary circuit in multiple arc.

7. 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 resistance in the shunt-circuit, a second shunt-circuit around said motor and 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 a plurality of lamps connected in the secondary circuit in multiple arc.

8. 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, a secondary circuit of low resistance, including a secondary coil of the transformer, and a plurality of lamps connected in the secondary circuit in multiple arc.

9. 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 constructed to vary the current flowing through said primary coil in proportion to the number of lamps in circuit and in the second shunt-circuit, a secondary circuit of low resistance, including the secondary coil of the transformer, and a plurality of lamps connected in the secondary circuit in multiple arc.

10. 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 in the second shunt-circuit, a secondary circuit of said transformer, and a plurality of lamps connected in the secondary circuit in multiple arc.

11. 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 in the shunt-circuit, a second shunt-circuit around said devices, a pulsator operated by the motor, and a primary coil of a transformer in the second shunt-circuit, a secondary circuit of low resistance, and a plurality of lamps connected in the secondary circuit in multiple arc.

12. The combination, with an electrically-propelled vehicle, working-conductors supplied with direct current along the path of said vehicle, a conductor on the vehicle having its terminals in movable connection with the working-conductors, and an electric motor in the vehicle-conductor for propelling the vehicle, of a shunt-circuit around the motor, an electric pulsator in said shunt-circuit, an inductional transformer having its primary in the shunt-circuit, a secondary circuit, and translating devices connected in the secondary circuit in multiple arc.

13. The combination, with an electrically-propelled vehicle, working-conductors supplied with direct current along the path of said vehicle, a conductor on the vehicle having its terminals in movable connection with the working-conductors, and an electric motor in the vehicle-conductor for propelling the vehicle, of a shunt-circuit around the motor, means for inductionally transforming the current in the shunt-circuit, two secondary circuits of different conductivity, and translating devices connected in each of said secondary circuits in multiple arc.

14. The combination, with an electrically-propelled vehicle, working-conductors supplied with direct current along the path of said vehicle, a conductor on the vehicle having its terminals in movable connection with the working-conductors, and an electric motor in the vehicle-conductor for propelling the vehicle, of a shunt-circuit around the motor, an electric pulsator in said shunt-circuit, two inductional transformers having their primaries connected in the shunt-circuit in multiple-arc relation, secondary circuits of different conductivity for the transformers, and translating devices connected in each of said secondary circuits in multiple arc.

15. The combination, with an electrically-propelled vehicle, working-conductors supplied with direct current along the path of said vehicle, a conductor on the vehicle hav-

ing its terminals in movable connection with the working-conductors, and an electric motor in the vehicle-conductor for propelling the vehicle, of a shunt-circuit around the motor, an electric pulsator in said shunt-circuit, an inductional transformer having its primary in the shunt-circuit, a secondary circuit, translating devices connected in the secondary circuit in multiple arc, and means for cutting one or more of said translating devices out of circuit.

In testimony whereof I have hereunto signed my name this 12th day of March, 1890.

MARK W. DEWEY. [L. S.]

Witnesses:
C. L. BENDIXON,
H. M. SEAMANS.