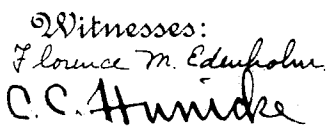
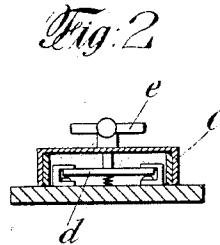


APPLICATION FILED DEC 4, 1911.

Patented Mar. 4, 1913.

2 SHEETS—SHEET 1.



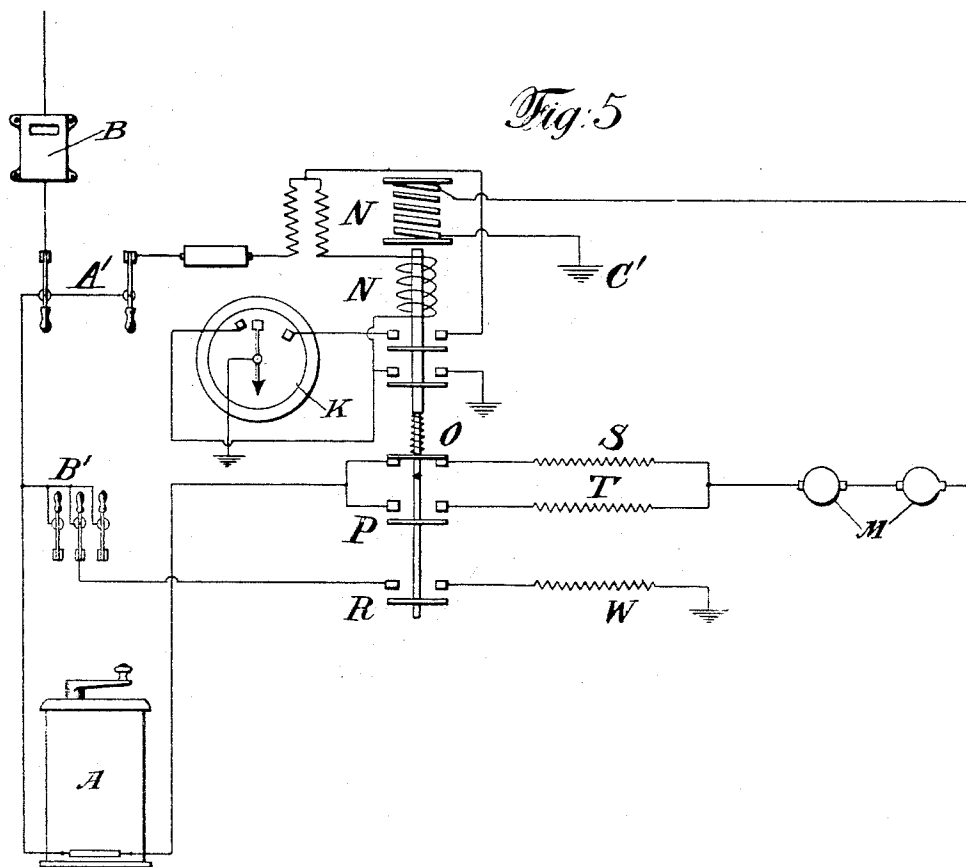
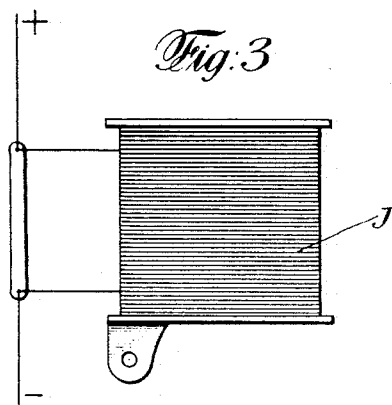
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F. HEDLEY & J. S. DOYLE.
ELECTRIC RAILWAY CAR HEATING SYSTEM.
APPLICATION FILED DEC. 4, 1911.

1,054,767.

Patented Mar. 4, 1913.

2 SHEETS-SHEET 2.



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UNITED STATES PATENT OFFICE.

FRANK HEDLEY, OF YONKERS, AND JAMES S. DOYLE, OF MOUNT VERNON, NEW YORK.

ELECTRIC-RAILWAY-CAR-HEATING SYSTEM.

1,054,767.

Specification of Letters Patent.

Patented Mar. 4, 1913.

Application filed December 4, 1911. Serial No. 663,792.

To all whom it may concern:

Be it known that we, FRANK HEDLEY and JAMES S. DOYLE, both citizens of the United States, and residents, respectively, of Yonkers and Mount Vernon, county of Westchester, and State of New York, have made a certain new and useful Invention in Electric-Railway-Car-Heating Systems, of which the following is a specification.

10 This invention relates to heating systems for electric railways, and particularly to such systems where current is supplied to the electric propelling motors, and also to the electric car heating system from the same source of power.

15 In the modern operation of electric cars, locomotives or the like, for street cars, trains or other purposes, it is usually customary and necessary to employ electric heaters for the cars, which, in addition to the car or locomotive propelling motors, are supplied by current from the same power house. The load imposed upon the current supply for heating purposes, added to that imposed by the propelling motors for the car locomotive or train, very greatly increases the work required of the power house generating plant, particularly when the current is supplied to the heaters, and to the propelling motors of the electric cars or locomotives, at the same time. This results in very great expense in initial cost of construction and equipment, as well as in the subsequent maintenance and operation of the power station. Frequently the electric heaters do not require to be constantly supplied with current. Thus the heating system on the cars is not required to run at full capacities on certain days, or at certain hours, but are required to run at full capacity at certain other hours, or on certain other days, depending upon traffic and atmospheric temperature conditions. And at some seasons of the year, the heating system is not required at all, as in the summer, while during the winter it is required, and frequently to its maximum capacity. By imposing the operation of electric heating system at irregular intervals on the current supply along with the operating motor, a very irregular load duty is imposed on the power plant for generating the required current supply, and since, as is the case with most street car systems, there are certain hours of the day when the traffic is at a maximum

and certain other hours, when the traffic is at a minimum the irregularity of the load duty, or load line of the power plant is increased, resulting in increased cost of maintenance and operation at the power plant, and extra installation of power house equipment.

It is among the special purposes of our present invention to provide means for reducing the irregularities of the load imposed upon the power plant, and to render the load line more uniform, and to reduce the power plant equipment, and the expense of initial cost of constructing and equipping the plant, and maintenance thereof, while at the same time delivering adequate supply of current not only to the car or locomotive propelling motors, but also to the heaters required to be supplied from such power plant.

In carrying out our invention we propose to provide means whereby the heaters, are supplied with current to operate them only when the current is cut off from the propelling motors, or only during the time the propelling motors are receiving only the normal amount of current from the power plant to operate them. By this method we avoid the necessity of imposing the additional load of the heating systems upon the supply circuit, at the same time with the propelling motors, thereby avoiding unduly increasing the load on the power plant. In this manner we secure greater uniformity in the load line of the feeding circuit, and hence of the power plant, and this is a condition which secures the most economical cost of operation and maintenance of the power plant.

It is obvious that in its broadest scope, our invention is not confined to any particular arrangement or specific form of means for securing the result of cutting out the heating system only while the propelling motors are receiving current, or while they are receiving their maximum current supply, or of cutting into the feeding circuit the car heaters only while the propelling motors are cut out of circuit, or are receiving their normal current supply, the broad invention being the provision of means for equalizing the load on the power plant or generating station, or cutting down the maximum load peak, by drawing the required current supply for operating the heating system only when current supply is

not required for the propelling motors, or when only a normal current supply is required therefor.

In one form of practical application of our invention we propose to provide means whereby the current is supplied for the heating system only during the periods or time intervals, in the operation of a street car or train, for instance, when the car or train is standing still, as at stations, or while passengers are being loaded or unloaded, or the car is laid up in the yards, and the current is shut off from the propelling motors. In case the periods of time intervals when the car or train is at rest is insufficient for the purpose, that is, if the heating system requires more current for its operation than is possible to secure in the time interval during which the car or train is at rest, then we may extend the time during which the current is supplied to the heaters by utilizing, in addition to the time intervals during which the car or train is at rest, the time intervals during which the brakes are supplied and current shut off from the propelling motors. Should it be desirable to still further increase the time intervals during which the heaters draw their current supply from the main feeding circuit, we may also utilize for that purpose the time intervals during which the car or train is "coasting", that is, the time during which the car or train moves with the brakes released and current shut off from the propelling motors, as for instance, while the car or train is approaching a stopping point and is running under its own momentum, or is running down a grade without current. It may sometimes be necessary to increase the "coasting" time of the car or train in order to increase the time of supply of current to the heaters. In the economical operation of street and electric railway systems we have heretofore devised means for accomplishing this increase of "coasting" time by providing means for making a record of the "coasting" travel of the car or train in order that the compensation of the motorman may be based on such record, taking into account other factors which are also recorded, as, for instance, the current consumption during the time the propelling motors are being supplied with current, the maintenance of time schedules, and the like. The means referred to are set forth described and claimed in Patent No. 940,810, granted to us November 23, 1909. Under the practical operation of such "coasting" recording devices it has been found that during a very large percentage of the total time required for a car or train to make a trip from any given point to another the car or train is "coasting". In the operation of the Interborough Rapid Transit Railway Company system in New York city, before the introduc-

tion of the "coasting" record method above referred to it was customary to roughly estimate the time of "coasting" travel of cars or trains at approximately 12% of the total trip time, and this, in practice proved to be approximately the average "coasting" time percentage. In like manner, and before the introduction of the "coasting" record method referred to, experience demonstrated that approximately 25% of the total trip time was consumed in brake application. That is the brakes were applied during approximately 25% of the total trip time between given points. This meant that for approximately 63% of the total trip time current was being supplied to the propelling motors in addition to that supplied to the heating system and other car equipment, from the power plant. By the installation and practical use of the "coasting" record method, above mentioned, experience has shown a reduction of the average brake time percentage from 25% to 17%, the increase of "coasting" time percentage from 12% to 38% and the decrease of current consumption time percentage for the motors from 63% to 45%. It is the utilization of the largely increased "coasting" time percentage that we propose to accomplish in the present invention as the time interval during which the heating system of the car or train is to be supplied with current. It will be observed from the percentage comparisons above given, which are based on actual practical experience in the operation of the street car system mentioned, that not only is the brake time percentage, which may be considered as a loss factor, in the general computation, reduced from 25% to 17% but this reduction serves to enable the "coasting" time percentage to increase from 12% to 38%. Experience has also demonstrated that the coasting time thus accomplished and gained is amply sufficient for adequately supplying current to the heating system. If, however, this "coasting" time interval is insufficient to supply the maximum requirements of the heating system and other auxiliary equipments, as, for instance, in the winter season, then the capacity or number of the heaters or heating elements may be increased so as to supply any deficiency in this respect. The cost of such additional heaters is very small, almost negligible, when compared with the enormous saving in investment, operation and maintenance at the power plant, which is secured by the use of our present invention. Should it be desirable to still further increase the capacity of the heating system, or, rather, the time of current supply thereto, either with or without increasing the number of individual heating elements, provision may be made in accordance with our invention to supply current to the heating

system not only during the coasting, braking and station wait periods but also during the time intervals when the motors are receiving only their normal current supply and after the load line has been reduced to its normal condition. If the maximum heating requirements should demand still longer time intervals or periods of current supply to the heating system, then we may employ the heating system or a controllable portion thereof, as starting resistance for the motors, thereby turning to useful account in the heating system the energy which would otherwise be consumed in the motor starting rheostats.

In order to show the vast saving effected by our invention attention is called to the fact that a power plant and its equipment is designed and planned to take care of the maximum requirement to be encountered, that is, the maximum output that such plant must at anytime be called on to supply. The cost of a plant and its equipment, so designed and planned, represents what may be called the investment which it represents. Experience has demonstrated that the maximum demands upon the power plant occur when the traffic is at its maximum. This is usually in the winter time at which time the demands for the heating system supply are also at a maximum. Consequently, heretofore, the maximum requirements of the plant, which form the basis for measuring the investment involved in designing, constructing and equipping the power plant is the maximum current supply for propelling the cars or trains of the street car system supplied from the plant at the time when the traffic is greatest, and added thereto, the maximum current supply for operating to its maximum capacity, the entire electric heating system employed on the cars and trains, as well as that for operating the other auxiliary apparatus employed. Practical experience in the operation of electric street railway systems has shown that approximately 30% of the entire current output of a power plant is required for operating at its maximum requirements the electric heating system of the cars and trains. If therefore, the current employed for the electric heating system of the cars is supplied only when current supply to the car or train propelling motors is shut off or is at its normal value, it will be readily seen that the maximum load peak on the power plant is cut down by the same percentage, and this results in cutting down the standard or basis for computing the cost of constructing and equipping the power plant in the same ratio, since in that case, the investment is figured on the basis of the maximum current supply for maximum traffic purposes only, that is, for maximum car propelling purposes. In other words the elimination of the element

of current supply for maximums electric heating and other auxiliary purposes from the basis of calculation of the investment which a power plant represents, reduces in the same proportion the amount of investment required to be made for designing constructing and initially equipping the plant. To take a specific example, suppose on the basis of a maximum load peak where current for car propelling and also for heating purposes are both necessary factors and the cost of constructing and equipping the necessary power plant to meet the requirements on such basis is \$1,000,000.00, then by eliminating the heating factor, that is, by removing this factor from the maximum load peak, as, in accordance with our invention, by supplying the current for heating purposes only when current is not required for car propelling purposes, or only when it is required at its normal value, the cost of plant and equipment is reduced by approximately 30% or to \$700,000 instead of \$1,000,000.00. But this does not represent all of the reduction achieved in the practical use and application of our invention. Not only is the investment reduced, as above explained, but the subsequent operation and maintenance of the plant is also very greatly reduced, though possibly not to the same proportional extent. If desired a still greater reduction of cost of operation and maintenance is accomplished in the practical use of our invention, by employing a suitable automatic mechanism for controlling the supply of current for heating purposes, so that when a desired temperature in a car is attained the current supply for that purpose is automatically shut off. The saving effected in this manner is a matter of material consequence.

The foregoing explanations will serve to indicate the practical advantage as well as the very great utility and value of our invention.

As above noted our invention in its broadest scope involves merely the provision of means whereby, when current is being supplied to the propelling motors the circuits for the heating system, and, if desired, also the circuits for other auxiliary devices, are opened. Of course, it is immaterial, in the broadest scope of our invention, whether the heating system circuits are closed when, or during the time when the propelling motor circuits are opened. The essential is that the heating circuits be and remain opened when, and during the time when the motor circuits are closed or are receiving current to meet normal running conditions.

As a refinement or further step of development and use of our invention we also propose to control and regulate the supply of current for heating purposes.

In carrying out our invention many

specifically different constructions and arrangements of devices, switches, circuit controllers and the like, may be employed, for securing the opening of the supply circuits for the heater during the time the circuits of the car propelling motors are closed.

Where we have referred particularly to the operation of the electric heating system as the translating devices on the cars or trains which are to be supplied with current under the conditions set forth, it is obvious that the principles of our invention are equally well adapted for application to other desired car or train equipment. Therefore, in referring to the heating system we wish it to be understood that we include as well other devices or equipment which are operated by current supply from the same feed or supply source.

In the accompanying drawings: Figure 1 is a view illustrating in diagram one simple arrangement for carrying our invention into practice, wherein the motor controller when in off position closes a circuit to a manually operated switch device through which the completion of the circuit to the heating system is controlled. Fig. 2 is a detail view of the manually operated switch device. Fig. 3 is a view similar to Fig. 1, showing an automatic circuit closing device operated by the current in the motor circuit for maintaining the circuits of the heating and other desired auxiliary devices open. Fig. 4 is a view similar to Fig. 1 showing an arrangement of devices for automatically controlling the circuits of the heating system. Fig. 5 is a view in diagram showing an arrangement of combined manual and automatic control where the heating system receives current only when the motors are operating under normal conditions of current supply, and also where the starting resistance is employed for heating purposes.

Referring to Fig. 1, A designates an ordinary motor controller and B a coasting recorder or other device by means of which the current time or distance may be recorded, indicated or read. The particular construction or type of this device is not of our present invention. The essential with reference thereto is that by means of it the coasting record of the train or car may be ascertained recorded or indicated. E, is a contact segment on the controller A, and with which cooperate the contacts F, G, these parts being so arranged that only when the controller is in off position will the circuit through these contacts be closed from the source of current supply, trolley, third rail, or the like. C, is a manually controlled switch device arranged in the circuit from the contact G. This switch is preferably a three way switch, though our invention is not to be limited in this respect. D, is a bus-bar for multiple or other suitable

connection to the circuits of the heater coils indicated at H. The switch device C includes the three sets of contacts, *a*, *b* and *c* and a cooperating bridge piece *d*, controlled by a handle *e*. The bridge *d*, cooperates with contacts *a*, for completing the heater circuit to the bus-bar, and with contacts *b*, to open the circuit to the bus-bar, and with contacts *c*, to close an auxiliary circuit *f*, from the current source around the controller to the bus-bar independently of the controller circuit. The motor is indicated at M.

The operation is simple. When the controller A, is moved toward "on" position the circuit through contacts F, E, G, is broken, so that during the time current is being supplied to the propelling motors, the circuit of the heating system is opened, and when the controller is in "off" position the propelling motors are cut out and the supply circuit is established and maintained completed through the contacts F, E, G. The closing of the circuit at contacts F, E, G need not necessarily mean that current will thereby be supplied to the heating devices since that would depend upon the position of the switch device C, in case such a device, or its equivalent, is employed. If this switch device is employed and its bridging member *d*, is in position to close circuit between contacts *a*, then upon closing the circuit through contacts F, E, G, current will be supplied to the bus-bar D, and to the heating or other devices connected up to the bus-bar. If, the bridging member *d*, of switch device C, is across the contacts *b*, then no current will be supplied to the bus-bar D, whether circuit is closed through contacts F, E, G, or not. This will be the relation when no current supply to the bus-bar is required, as, for instance during warm weather if the bus-bar is employed in the heating system circuit. If the bridging member *d*, is across contacts *c*, then current will be supplied from the current source to the bus-bar around the motor controller A, and independent of the contacts F, E, G. This will be a convenient arrangement and relation when the car is standing in the yards or barns, or on siding tracks, or the like. Of course, other relations might readily suggest themselves to persons skilled in the art.

Instead of employing contacts which are opened and closed by the controller A, an automatic device may be used, which may be operated by current in the propelling motor circuit to open the circuit from supply to the heating system or to the bus-bar D, or switch device C, or otherwise, when current is supplied to the propelling motors. Such a device is indicated at J, Fig. 3, wherein a magnet or solenoid is in a circuit in shunt to the propelling motors supply

circuit between the controller and the propelling motors and which automatically controls contacts in the supply circuit to the heating devices. It is obvious that many other constructions and arrangements of devices for accomplishing the object of cutting out or opening the circuits of the heater devices might readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of our invention as broadly defined in the claims.

Where it is desired to decrease the current consumption for heating purposes to the lowest practical point in connection with the use and application of our invention, as, for instance, by regulating such current supply in accordance with the temperature produced, thereby automatically maintaining the heating effect at a constant point, we may employ a suitable thermostatic device, indicated generally by reference letter K, in Fig. 4, for controlling the circuit of a magnet or solenoid L, the operation of which controls a switch device P, through which the current supply to the heating devices, or to the bus-bar D, is controlled. Thus after the car propelling motors are cut out and the circuit to the heating devices is completed, either by the operation of the motor controller A, or the automatic switch device J, or otherwise, as may be desired, to the switch device P, such circuit at said switch device, is completed by the action of the solenoid or magnet L, when energized and the circuit of said solenoid is controlled thermostatically and automatically by the thermostatic device K. It is obvious that other forms and arrangements of thermostatic or other automatic control might easily be supplied or employed, without departing from the broad scope of our invention as defined in the claims.

It is usually necessary to employ starting resistance in the motor circuits and for this purpose resistance coils are used, which, as the motors start up are cut out of the circuit. The current consumed in the resistance coils performs no useful work. It does, however, develop heat. This heat may be utilized in connection with the application of our invention by employing the electric car heaters as the starting resistance or at least as a part of the starting resistance for the motors, or the starting resistance coils themselves may be used as heaters and arranged in such relation as to furnish the heat developed therein to the interior of the car for heating the latter. Where the propelling motors are required to be started frequently, as is usual in the case of operation of electric cars in service, the resistance coils may supply sufficient heat for car heating purposes. A simple switch arrangement for accomplishing this result

may be employed and in that case we are enabled to increase the time of heat production beyond that which is afforded by supplying current to the heating system only when current is cut off from the motors, and without increasing the current supply. It may also be desirable to supply current to the heating system after the current supply to the motors has fallen to a normal value and before the motors are actually cut out of circuit, that is during the time the motors are running along under normal conditions. In Fig. 5 we have shown a simple arrangement for accomplishing these objects and purposes. In this arrangement the solenoid N, controls the switch devices O, P, R, which are respectively in the circuits of the car rheostat coils S, and the rheostat and main heating coils T, W. The coils S and T, are in parallel with each other. The solenoid N is equipped with a double winding, one in series with the motors M, and one in series with the thermostatic control device K, and the power source. A manual switch A¹ may be arranged in this circuit. Similarly the heating coils W are in the supply circuit around the controller A, and may also be controlled by a manual switch B¹ in addition to the solenoid switch R. The operation of this arrangement is simple. When the controller A, is operated toward "on" position to supply current to the motors the current will pass from the line through the controller, switch O, coils S, motors M, solenoids N, to ground at C¹. This energizes the solenoid causing switches P and R to close. Thereupon current will pass from the controller through switch P, rheostat heater T, motors M, and solenoid to ground. The closing of circuit through switch R will accomplish nothing unless switch B¹ is closed. When this switch is closed the main heater coil W will receive current. This switch B¹ may be similar in construction, function and operation to the switch device C, above referred to.

When the heat developed by the heating system exceeds a given limit the heating circuits are automatically opened by the thermostatic device K, completing a circuit from current source through the auxiliary coil or winding of solenoid N, thereby opening switches R and P.

From the foregoing description it will be seen that we provide a most valuable and important arrangement in connection with electric traction railway or similar operation wherein we greatly reduce the initial cost of construction and equipment as well as the cost of maintenance and operation of the power plant required to supply current for the requirements of the railway or other operations, and without decreasing the maximum current supply to meet maximum traf-

fic and heating requirements. It will also be seen that we accomplish these important results by removing the demands of the heating system upon the current supply from the current supply source during the time interval when the demands of the propelling motors for current supply are being met. In other words, during the time current is being supplied to operate the propelling motors, the load of the heating system is removed from the generating system. And in connection with this operation we employ means for reducing the time interval during which current is being supplied to the propelling motors, thereby increasing the time interval available, after the propelling motors are cut out for the operation of the heating system. We also in connection with this operation, as explained, provide means for automatically reducing the current consumption for heating purposes by regulating the current supply for this purpose according to the heating requirements, and we employ the starting rheostats or a portion of them for augmenting the heating system.

Having now set forth the object and nature of our invention, and various constructions and arrangements for carrying the same into practical operation, what we claim as new and useful, and of our own invention and desire to secure by Letters Patent, is,—

1. In an electric heating system control for cars employing electric propelling motors and electric heating devices supplied from the same source of current and in combination with such motors and heating devices, of a controller for the motor and means operating in conjunction therewith for cutting off the current supply to the heating devices during the time current is being supplied to the propelling motors.

2. In an electric heating system control for railway or other electric cars employing electric propelling motors and electric heating devices supplied from the same current source and in combination with said motors and heating devices, of a motor controller and means operating in conjunction therewith for automatically cutting off the current supply to the heating devices during the time current is being supplied to the propelling motors.

3. In an electric heating system control for railway or other cars employing electric propelling motors and electric heating devices supplied with current from the same source, and in combination with said motors and heating devices, of a controller for the motors, and means for opening the circuit of said heating devices through the controller and maintaining the same open during the time the controller is in "on" position.

4. In an electric heating system control for railway or other cars employing electric propelling motors and electric heating devices having the same source of current supply, and in combination with said motors and heating devices, and circuits therefor, of means for opening the circuits of the heating devices coincidently with the closing of the motor circuits, said means operating to maintain the heating circuit open during the time the motor circuit remains closed.

5. In an electric heating system control for railway or other cars employing electric propelling motors and electric heating devices having the same source of current supply, and in combination with said motors and heating devices, and circuits therefor, of means for closing the circuits of the heating devices coincidently with the opening of the motor circuits.

6. In an electric heating system control for railway or other cars employing electric propelling motors and heating devices having the same source of current supply, and in combination with said motors and heating devices, and circuits therefor, of a motor controller and means operating in conjunction therewith for closing the circuits of the heating devices coincidently with the opening of the motor circuits, and auxiliary means for independently controlling the circuits of the heating devices.

7. In an electric heating system control for railway or other cars employing electric propelling motors and heating devices having the same source of current supply, and in combination with said motors and heating devices and circuits therefor, of means for closing the circuits of the heating devices coincidently with the opening of the motor circuits, and automatic means for independently controlling the circuits of the heating devices.

8. In an electric heating system control for railway or other cars employing electric propelling motors and heating devices having the same source of current supply, and in combination with said motors and heating devices, and circuits therefor, of means for opening and closing the circuits of the heating devices coincidently with the closing and opening, respectively, of the circuits of the motors.

9. In an electric heating system control for railway or other cars employing electric propelling motors and heating devices having the same source of current supply, and in combination with said motors and heating devices, and circuits therefor, of means for closing the heater circuit and maintaining the same closed during the time the motor circuit is open, and means for indicating the running time interval during which the motor circuit is open.

10. In an electric heating system control for railway or other cars employing electric propelling motors and heating devices having the same source of current supply, and in combination with said motors and heating devices and circuits therefor, of means for closing the circuits of the heating devices during the "coasting" travel of the car, and means for indicating the "coasting" travel of the car.

11. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters and their circuits, of a motor controller, and means operating in conjunction therewith to permit the supply of current to the heaters at all times except when current is supplied to the propelling motors.

12. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters and their circuits, of means to permit the supply of current to the heaters at all times, except when current is supplied to the propelling motors, and means for independently controlling the supply of current to the heaters.

13. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters, and their circuits, of means to permit the supply of current to the heaters at all times except when current is supplied to the propelling motors, and means for automatically controlling the supply of current to the heaters.

14. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply and in combination with said motors and heaters, and their circuits, of means to permit the supply of current to the heaters at all times except when current is supplied to the propelling motors, and means for utilizing the heaters as starting resistance for the motors.

15. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters and their circuits, of a controller for the motor, auxiliary contacts operated thereby and arranged in to control the heater supply circuit, and an auxiliary heater supply circuit and a switch for controlling the same.

16. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the

same source of current supply, and in combination with said motors and heaters, of a controller for the motor circuit, auxiliary contacts operated by the motor controller to close the main circuit to the heaters only when the motor controller is in "off" position, an independent heater supply circuit, and a switch arranged to control both heater circuits.

17. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters, of means for initially including the heaters in the motor circuit, to serve as starting resistance for the motor and means for automatically cutting the heaters out of circuit.

18. In an electric heating system control for railway or other cars, employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters, of means for initially including the heaters in the motor circuit to serve as starting resistance, for the motors, and means operated by current supplied to the motors for automatically cutting the heaters out of circuit.

19. In an electric heating system control for railway or other cars employing electric propelling motors and heaters having the same source of current supply, and in combination with said motors and heaters, of independent heater circuits, a switch device for controlling both circuits, and means for opening one of said circuits while current is being supplied to the motors.

20. In an electric street railway system employing electric car propelling motors and heating system, supplied from the same source of current, and in combination with said motors and heating system, of means to prevent the heater current load from being imposed on the supply source during the time the motor current load is imposed thereon, whereby the maximum load peak on the power source is reduced.

21. In an electric street railway system employing electric propelling motors and auxiliary electric translating devices supplied from the same source of current, and in combination with said motors and auxiliary devices, of a motor controller, and means operating in conjunction therewith for maintaining the auxiliary devices in circuit with the source of current only during the time the motors are out of circuit, and automatically operating devices for controlling the circuit of the translating devices.

22. In an electric heating system for cars, the combination with the car propelling motor and heating devices supplied with current from the same source, a motor controller, means operating in conjunction with the

motor controller for closing and maintain-
ing closed the circuit of the heating devices
only when the motor circuit is open, an
auxiliary circuit around the controller for
5 the heating devices, and means for control-
ling said auxiliary circuit.

23. In an electric heating system for cars,
the combination with the car propelling
motor and heating devices, a common sup-
ply circuit therefor, a controller for the
10 motor, means operating in conjunction
therewith for closing circuit through the
heating devices only during the time cur-

rent is cut off from the motor, an auxiliary
circuit for the heating devices around the 15
controller and means for automatically con-
trolling said auxiliary circuit.

In testimony whereof we have hereunto
set our hands in the presence of the sub-
scribing witnesses, on this 27th day of No- 20
vember A. D., 1911.

FRANK HEDLEY.
JAMES S. DOYLE.

Witnesses:

CHARLES U. SMITH,
HENRY M. NORRIS.