

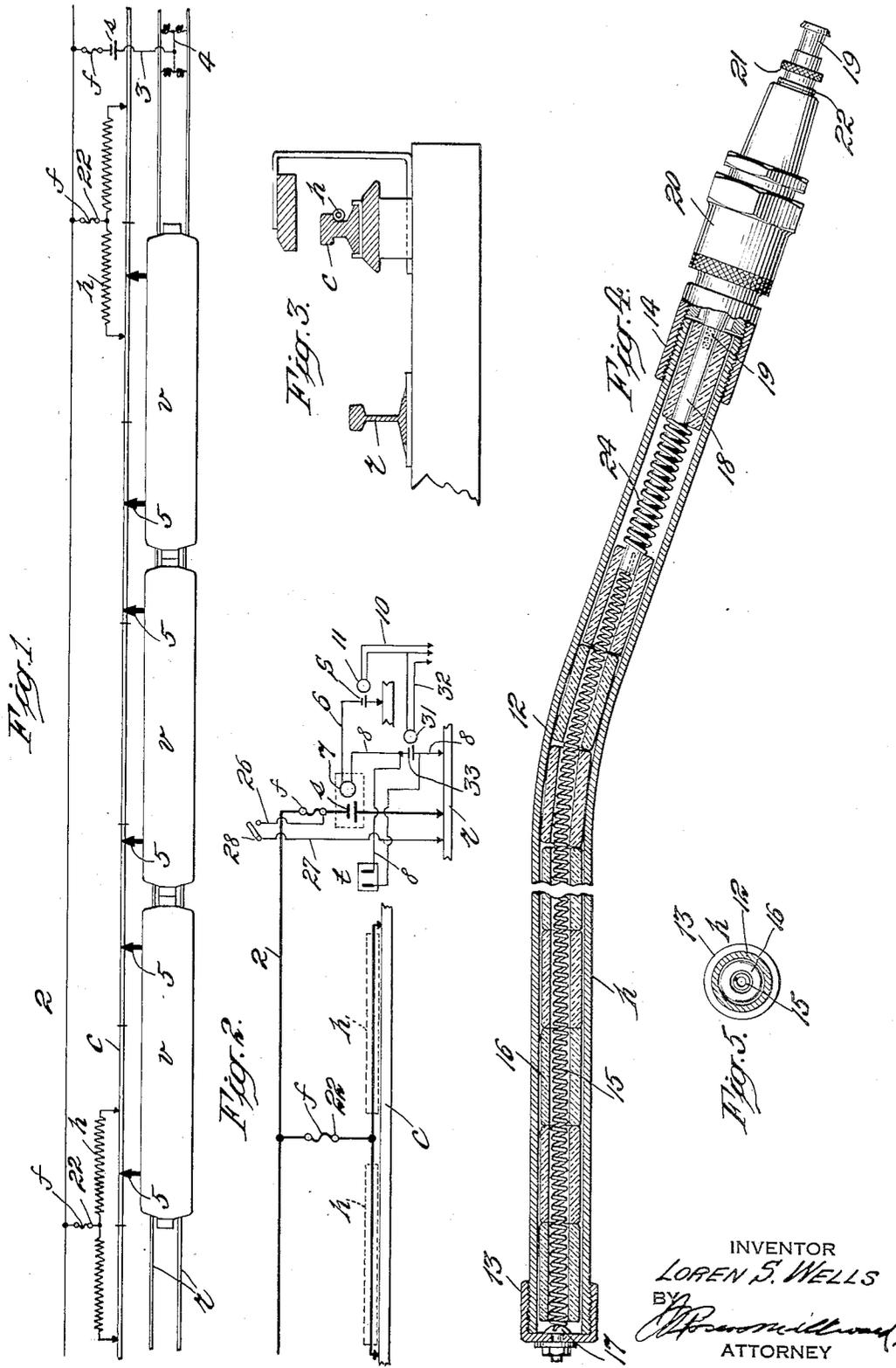
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L. S. WELLS

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PROTECTIVE HEATING MEANS FOR THIRD RAIL ELECTRIC RAILWAYS

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INVENTOR  
LOREN S. WELLS  
BY  
*L. S. Wells*  
ATTORNEY

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## PROTECTIVE HEATING MEANS FOR THIRD RAIL ELECTRIC RAILWAYS

Loren Stanford Wells, Great Neck, N. Y.

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7 Claims. (Cl. 191—27)

This invention relates to protective means for third rail operated electric railways and is designed to afford the greatest protection at the minimum of cost, both for installation and operation, in maintaining the road in operation during periods of severe blizzard or cold weather storm conditions.

As is well known, the operation to train schedules of third rail, open track railways is seriously interfered with under blizzard, drifting snow and sleet conditions by reason of the snow and ice accumulations on the third or contact rails. Such accumulations interrupt the transmission of the power current through the contact shoes and driving motors of the cars, in addition to causing destructive arcing at the shoe contacts resulting in hindrance to and at times complete tie-up of operation. Also, as will be appreciated, protection may be afforded by heating of the third or contact rail as disclosed in my prior Patent No. 1,524,223, dated January 27, 1925, but the cost of installation and current consumption for heating, on a system of considerable mileage, is excessive if not economically prohibitive, particularly as related to the rarity of its essential use for maintaining operation.

As an effective and practical solution of the problem, I have devised a heating means having a minimum heating requirement of the contact rail and wherein heated lengths of rail are spaced with relation to normal contact shoe spacing and standard car lengths in electrically coupled relation to produce an economic installation but sufficient for maintaining operating conditions during periods of heavy and drifting snows which otherwise might tie up traffic.

To further contribute in producing an operatively economic protective means for this purpose there is incorporated with the heating circuits, thermostatic controls for the heater operation to reduce the heating element current consumption to the minimum thereby allowing of extending the protection areas for a given amount of current consumption. There is further employed therewith an improved heater control circuit arrangement allowing of remote control operation of the protective heaters from a centralized control station permitting of automatic control under qualified supervision. Also for use with my improved protective means, I have designed an improved resistance heating element of simplified construction and which offers important advantages in installations for this purpose.

The foregoing and other important features and advantages of the present invention will be

more fully understood by reference to the accompanying drawing wherein like reference characters are applied to the corresponding parts in the several views.

In the drawing:

Fig. 1 is a diagrammatic view showing a portion of third rail electric railway embodying my improved protective heating means.

Fig. 2 is a detail diagrammatic view illustrating the improved control of the heating circuit.

Fig. 3 is a partial, vertical sectional view showing the location of the heating element for the third or contact rail.

Fig. 4 is a central, longitudinal sectional view of the improved resistance heating element.

Fig. 5 is a cross-sectional view thereof.

In the approved embodiment of my protective means for third rail operated railways as here illustrated, I employ electric resistance units for heating of the third or contact rail. As diagrammatically shown in Figs. 1 to 3, *r* indicates the running or track rails of an electrified railway installation having the usual insulated and electrically energized third or contact rail *c* in spaced and parallel relation thereto.

To successfully provide an effective contact rail heating protection as described, without prohibitive installation and operating cost, I have provided for the concentration of the heating at suitably spaced areas which in practice is determined as to area or length of heated section with relation to the standards of car contact shoe spacing and in the spacing between the heated areas or intervals with relation to a normal or operating minimum series coupling of the cars or rolling stock. Accordingly, as here illustrated, provision is made for the protective heating of the contact rail for areas limited with relation to the spacing of the car contact shoes and with the heated areas or lengths spaced to have an operating relation to a minimum train length of three cars *v* as shown.

In the diagrammatic illustration of Fig. 1 and as exemplifying a practical embodiment of my invention, the track or running rails are indicated at *r*, the electrified contact rail at *c* having spaced portions or areas thereof protectively heated by electrical resistance heating elements *h* which are energized from the contact rail and connected through fuses *f* to a negative or return circuit wire *2* and grounding connection *3* having a balanced or compensating ground connection *4* to the track rails. The connection *3* as shown is provided with a fuse *f* and a circuit breaker or control switch *s* for closing of the circuit through a multiple of the heating units as employed with

the circuit. In the train of three cars *v* shown, each car is provided with the usual contact shoes 5-5 having a standard distance between the shoes of a car of forty-three feet seven inches center to center spacing with, as will be understood, power bus line electric coupling between the cars whereby proper contact of any one shoe of the train with the contact rail will energize the driving motors of all cars. With a minimum train length for severe weather operation, as thus established, I space the heated contact rail areas with relation thereto to obtain a maximum spacing of the heated areas while providing at all times for shoe contact with a heated rail area. This spacing is substantially a distance slightly less than the distance between the forward shoe of the first car and the rearward shoe of the last car electrically connected by bus line therewith thereby insuring a closed operating circuit at all times. These spaced protected areas or heated lengths of the contact rail may desirably extend from a station location a distance sufficient in advance thereof to allow of obtaining requisite momentum of the train to carry through to the next protected section or area similarly heated.

The heaters *h* employed are of the type comprising an electric resistance heating coil within and insulated from a suitable tubular casing, the heating units being secured in engagement with the contact rail beneath the head portion thereof so that the heat therefrom is conducted directly to the rail. The energizing current is taken from the charged contact rail and at each heated area or length of the contact rail, as here shown, two resistance heating units are employed each having a length of about one-half the distance of the contact shoe spacing so as to give a total length heated area substantially equal to the employed car shoe spacing. In the installation as shown each resistance unit has a length of twenty-two and a half feet giving a protected area greater than the total length of forty-five feet by reason of the extended heat conduction.

To control the operation of the heater circuits, provision is made for remote control from a central point as shown in Fig. 2 comprising a control circuit 6 to coil 7 of a solenoid operating circuit breaker switch *s*, the coil having a ground connection 8 to a track rail *r*. The control circuit 6, 7, 8 is closed from the contact rail by a master switch *S* operated by a manually closed circuit 10 having operating coil 11 for the switch *S*.

For special or emergency use in the event of interruption to the control circuit, a shunting circuit is provided by the connections 26-27 having a manually operated switch 28 which allows of closing the heater circuit independent of the controlling circuit.

To effect a further substantial economy in current consumption there is associated with each circuit controlling the heaters of a given location a thermostatic control switch operative automatically to open the heating circuit when the contact rail attains a predetermined maximum heated condition and to again close the circuit responsive to drop in temperature. This is diagrammatically shown in Fig. 2 wherein *t* indicates a suitable thermostat or thermal switch in series with connection 8 and positioned to be influenced by the heat of the contact rail and operative at low temperatures to close the circuit from the contact rail, through connections 6, 7, 8 to the track rail. Accordingly, in operation, opening of the thermostat switch *t* responsive to high temperature, will open the control circuit

6, 7, 8 thereby releasing the circuit breaker switch to open under the normal action of its spring as customarily employed. Cooling of the contact rail will again allow the control circuit to function to close the circuit breakers and heater circuit thereby automatically effecting a substantial economy in current consumption while maintaining effective heating.

A shunting connection having switch 33 is provided to allow of cutting out of the thermal switch control which may be desired under very severe weather conditions. This switch 33, when closed, short circuits the thermal control and is operated by a coil 31 in remote control circuit 32 as indicated. While the remote control circuits 10 and 32 are shown of the three wire type, it will be understood that the coils 11 and 31 may be in a single circuit when the well known type of selective relay switch and supervising control circuit is employed.

As illustrated in Figs. 4 and 5, I have designed an improved electric resistance heating unit of simple, durable and economic construction particularly adapted for the present use. The heater unit comprises a tubular metal casing 12 having its ends closed by the threaded caps 13-14 and having positioned centrally and longitudinally extending thereof a resistance heating conductor or coil 15 having fitted thereon insulator collars or beads 16 insulating and spacing the coil from the casing. One end of the heater coil 15 is secured by terminal screw 17 to the cap 13 and the opposite end is secured to a terminal rod 18 having threaded connection to central conductor terminal 19 of spark plug type terminal member 20 having clamping nut 21 for the negative lead connection 22. The latter, or negative terminal portion of the heating unit is desirably angularly bent as shown to be offset from the contact rail when assembled therewith. The casing and its opposite cap end portion is secured to the charged contact rail in direct engagement therewith whereby the casing member is in effect the positive electric terminal and eliminates the use of other or special terminal connections with resulting economy and simplification. Fitted upon the rod 18 is a coil spring 24 interposed between insulator beads 16 to maintain them in close contact and abutting relation.

While there is shown and described an approved embodiment of the features of my invention, it will be understood that varied modifications may be made therein to meet specific requirements without departing from the invention as defined in the appended claims.

Having described my invention, I claim:

1. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, heaters positioned for heating of the contact rail at spaced areas, each area in length substantially equal to said contact shoe spacing and having the heated areas spaced relative to a determined minimum length of rolling stock to be operatively spanned thereby.

2. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, resistance heating units positioned for heating of the contact rail at spaced areas, each area in length substantially

equal to said contact shoe spacing and with the heated areas spaced relative to a determined minimum train length to be operatively spanned thereby and a circuit common to a multiple of the heated areas and connected for energizing the heaters thereof.

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3. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, resistance heating units positioned for heating of the contact rail at spaced areas, each area in length substantially equal to said contact shoe spacing and with the heated areas spaced relative to a determined train length to be operatively spanned thereby, an energizing circuit for the heaters and a thermal responsive switch connected automatically to open and close the heater circuit responsive to temperature changes.

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4. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, resistance heating units positioned for heating of the contact rail at spaced areas, each area in length substantially equal to said contact shoe spacing and with the heated areas spaced relative to a determined minimum train length to be operatively spanned thereby, a negative conductor common to a multiple of the heater areas and connected for closing a circuit through the heaters thereof, a control switch associated with said conductor and a control circuit for remote control operation of said switch.

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5. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, resistance heating units positioned for heating of the contact rail at spaced areas, each area in length substantially equal to said contact shoe spacing and with the heated areas spaced relative to a determined minimum train length to be operatively spanned thereby, a circuit connection common to a multi-

ple of the heated areas and connected for energizing the heaters thereof, a control switch in said connection, a control circuit for remote control of said switch and a thermal responsive switch positioned to be influenced by the heat of the contact rail and connected automatically to effect opening and closing of the heater circuit responsive to temperature changes.

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6. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, resistance heating units positioned for heating of the contact rail at spaced areas, each area in length substantially equal to said contact shoe spacing and with the heated areas spaced relative to a determined minimum length of rolling stock to be operatively spanned thereby, a circuit connection common to a multiple of the heated areas and connected for energizing the heaters thereof, a control switch in said connection, a control circuit for remote control of said switch, a thermal responsive switch positioned to be influenced by the heat of the contact rail and connected automatically to effect opening and closing of the heater circuit responsive to temperature changes and a shunt circuit having a switch adapted to close the heating circuit independent of the control circuit operation.

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7. A protective heating means for third rail electric railways comprising in combination with the track rails and contact rail parallel thereto, rolling stock adapted to be operated thereover having a plurality of contact shoes spaced substantial distances apart, resistance heating units positioned for heating of the contact rail at spaced areas, each area in length substantially equal to said contact shoe spacing and with the heated areas spaced relative to a determined train length to be operatively spanned thereby, an energizing circuit for the heaters and a thermal responsive switch positioned to be influenced by the heat of the contact rail and connected automatically to open and close the heater circuit responsive to temperature changes and a switch in the thermal switch circuit substantially as described.

LOREN STANFORD WELLS. 50