Aug. 17, 1937. W. P. SCHOLZ 2,090,156

ICE MELTER FOR THIRD RAILS

Filed Jan. 15, 1936 3 Sheets-Sheet 1

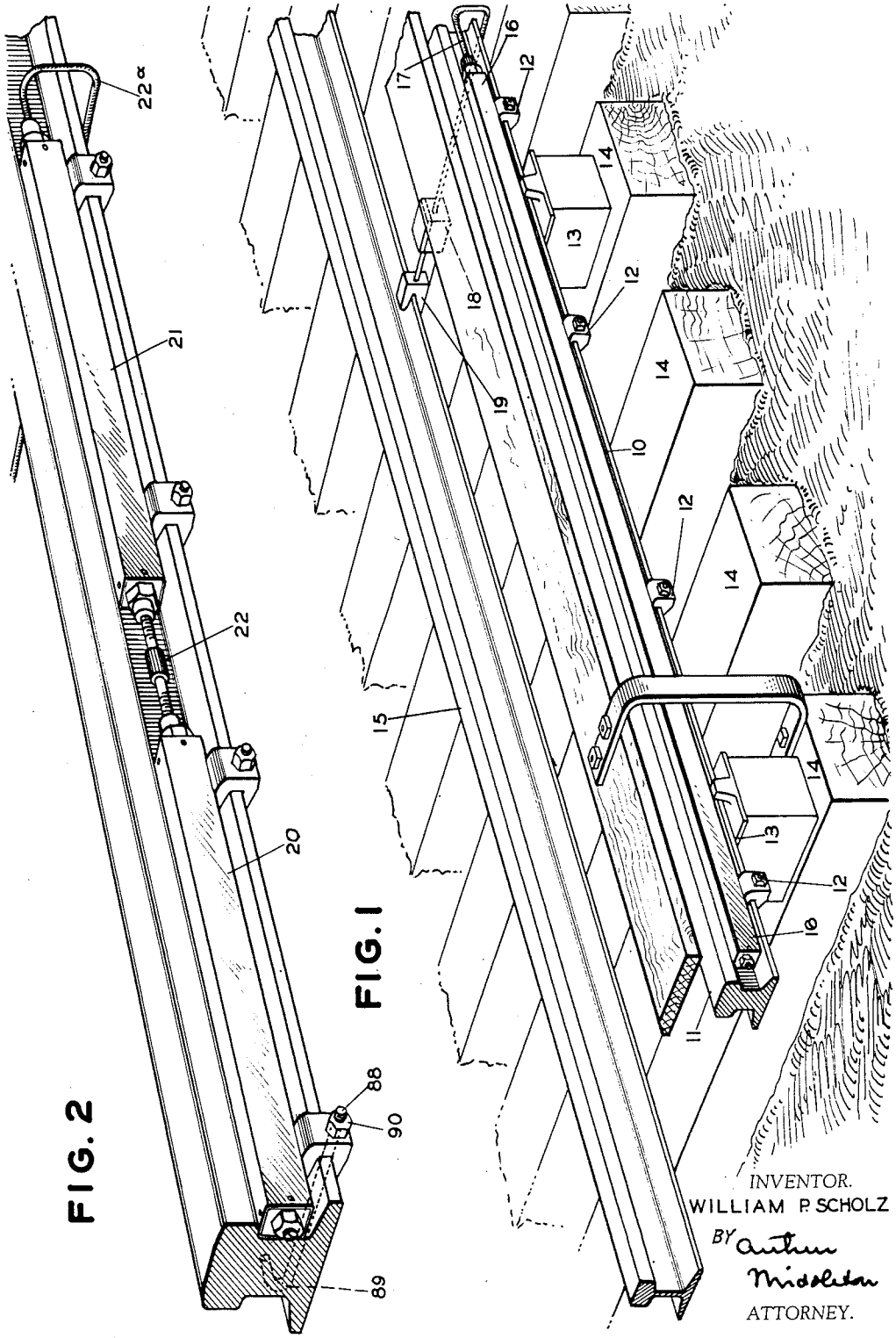


FIG. 2

FIG. 1

INVENTOR.
WILLIAM P. SCHOLZ
BY Arthur Middleton
ATTORNEY.

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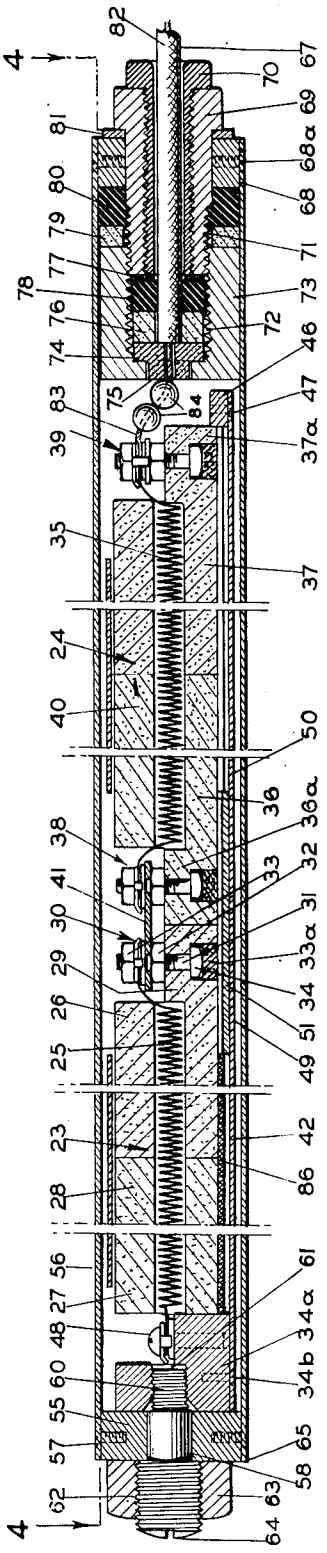


FIG. 3

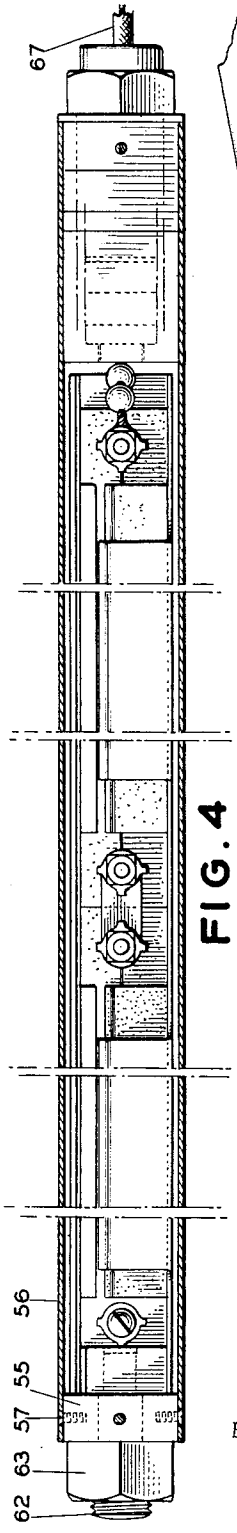


FIG. 4

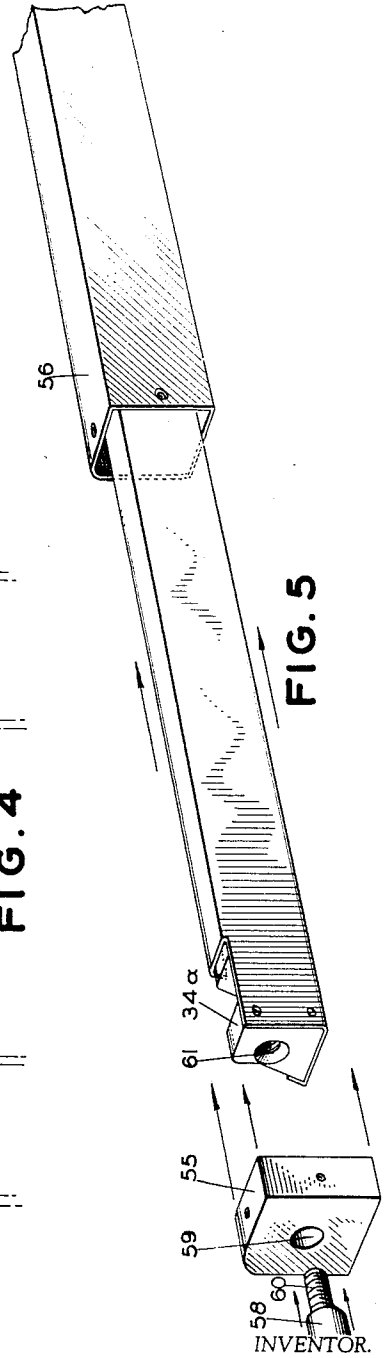


FIG. 5

INVENTOR.

WILLIAM P. SCHOLZ

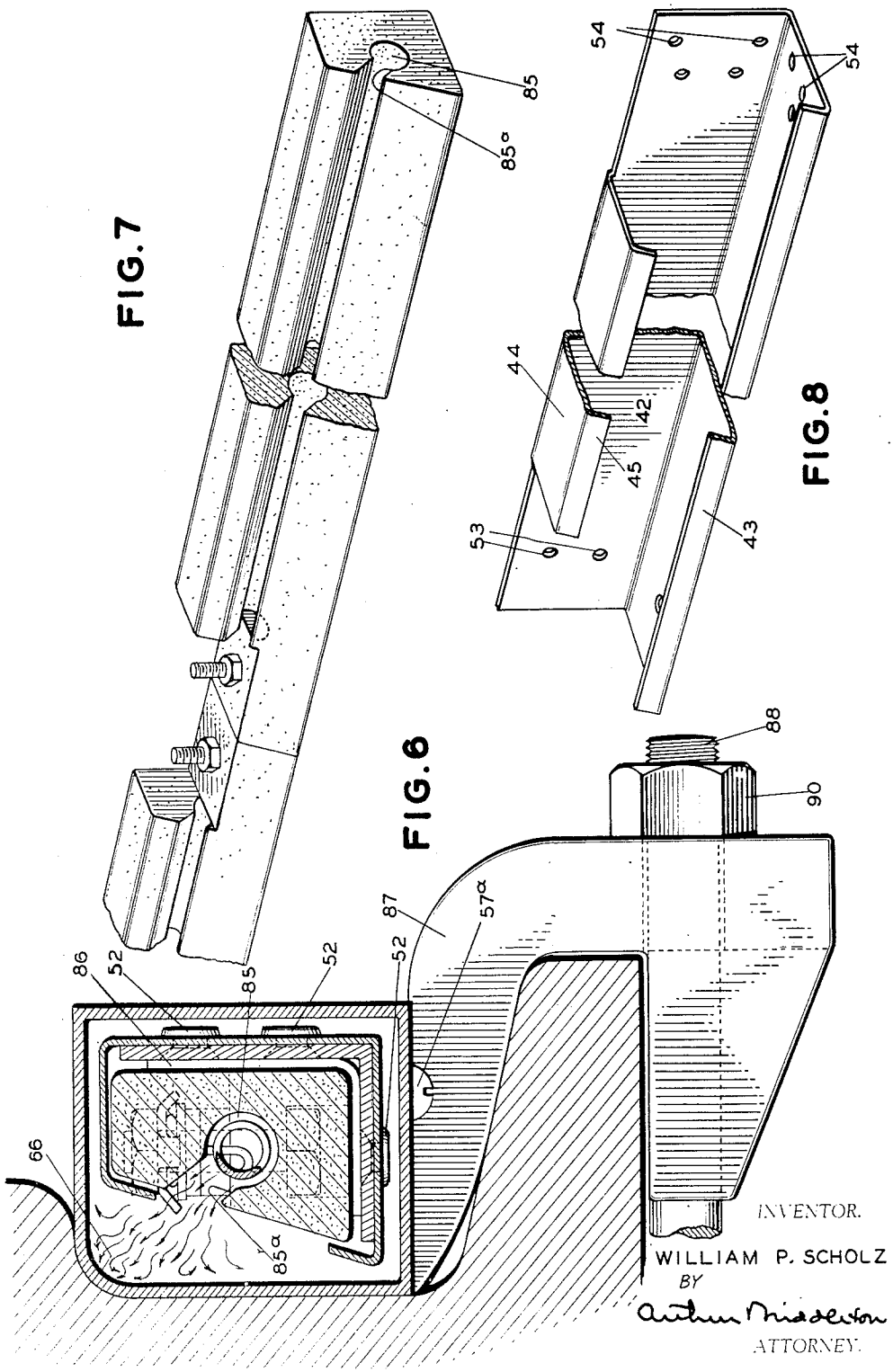
BY Arthur Middleton

ATTORNEY.

Aug. 17, 1937. W. P. SCHOLZ 2,090,156

ICE MELTER FOR THIRD RAILS

Filed Jan. 15, 1936 3 Sheets-Sheet 3



INVENTOR.
WILLIAM P. SCHOLZ
BY
Arthur Middleton
ATTORNEY.

Patented Aug. 17, 1937 2,090,156

UNITED STATES PATENT OFFICE

2,090,156

ICE MELTER FOR THIRD RAILS

William P. Scholz, Morristown, N. J.

Application January 15, 1936, Serial No. 59,179

15 Claims. (Cl. 219—19)

This invention relates to electrically heating the third-or power rails of electrically operated train systems, and more particularly it relates to means for preventing failure of the power transmitting contact between the power-collecting shoe of a motor equipped car and the current supply-or third rail usually extending along the train tracks.

Where climatic and atmospheric conditions, location and exposure, are conducive to the formation of a coating of snow, ice or sleet upon the contact face of the power rail, it has been found that even a minute covering or film of solidified moisture formed upon the rail, as through freezing thereof, may hamper or interfere with the proper starting and accelerating of the train, as a cause of insufficient, defective or improper metal-to-metal contact between the resilient contact shoe of the motor car and the power rail. Such an ice or frozen coating on the power rail may be the cause for jerks of a more or less violent character occurring during the starting period of the train, while under particularly severe conditions the starting of the train from the controller of the motor car may become altogether impossible.

Once the train has acquired momentum and assumed substantially a normal speed, the effect of an ice coating upon the power rail becomes inconsequential provided the ice be of a thickness such as normally encountered. Its momentum will carry the running train over and past ice coated stretches while the flow of current having the tendency to maintain itself, heat developing between contact shoe and the power rail, friction, and the sweeping of the contact shoe over the rail, will tend to sustain the flow of current through the contact faces sufficiently intense and uniform, and for practical purposes undisturbed.

As an indirect characterization of the contact problem underlying this invention, there might be compared the intensity of pressure between the control shoe and the power rail, with that which exists between the car wheels and the track rails of the train. It is clear that where the full weight of the train rests upon the rails the contact pressure is infinitely larger than the pressure which is permissible upon the power rail from the sliding contact shoe. This makes clear that the contact problem as evolved does not exist with respect to the track rails and the car wheels, although upon their proper contact also depends the maintenance of the operating circuit inasmuch as the electric current passing from the power rail to the motors of the control car must be closed through the track rails.

Consequently, there are found to exist along the extent of the power rail, well defined points or stretches essentially marked as by the stopping points of the train or by stretches of slow train-movement, at which under given conditions ice and sleet, if formed, will actually interfere with the unrestricted transfer of energy from the power rail to the motor of the driving car, and will therefore render uncertain or irregular the re-starting and accelerating of a train.

At any rate, with such conditions prevailing during the starting period, delays and inconveniences have been known to be caused to the passengers of crowded trains, aside from the strain, wear, and possible damage imposed upon the equipment such as rails, cars, motors, fuses, etc., due to the irregular energy impulses and spasmodic overload received during the starting period where the power contact is periodically defective. Moreover, the difficulties encountered under such temporarily abnormal operating conditions are of the kind over which the engineer handling the train has no absolute control.

Consequently, the object of the invention is to provide controllable rail heating devices to be associated with those points or stretches of the power rail which for the reasons pointed out are potentially troublesome for the operation of the trains stopping or slowing down at these crucial points.

The invention, therefore, contemplates the design of heating elements of an armored or encased type, which are adapted for attachment to, and which extend along, the side of the power rail for a suitable or desirable length thereof.

More specifically, the invention contemplates the design of an electrical heating device for this purpose, and to operate the device as by tapping some of the current therethrough from the power rail itself to complete the circuit across to the track rails.

The device herein contemplated is simple, compact, rugged, safe and of a construction which renders it substantially insusceptible to extraneous climatic and mechanical influences, or to vibrations set up in the power rail from the running train, and which also makes it readily attachable and adaptable to any suitable length of power rail. Also, the device as herein contemplated is efficient in that it directs concentrated heat conduction and radiation onto the power rail and onto a strip thereof where it is specifically desired.

According to one feature the rail heating device or attachment herein contemplated is in the nature of a self-contained encased or armored unit in which a length of heating coil is sealed to be moisture proof.

Another feature provides that the heating coils within the casing be surrounded by a heat confining body of refractory material formed into suitable shape for concentrating and directing heat radiating therefrom in the direction of a specific strip or section of the rail profile desired particularly to be heated. Another feature is a fixed assembly of a heating coil within the body of refractory material arranged to form a heating element which is ready for insertion into the casing in which it is to be hermetically sealed.

Other features relate to the sectionalizing of the essential parts or heating means within the casing; to means for expediting the assembly of the component parts into a unit; to heat insulating means; to shielding means; to shock absorbing means associated with the refractory body or bodies effective to cushion vibrations caused by the running train and prevent breakage of the refractory material; to means for sealing the heating elements in the surrounding casing in combination with the provision of necessary ground—and power rail connections; to an expansible type of sealing closure or gland device; to means for mounting and sustaining the heating-unit or attachment in suitable operating position relative to the power rail; and to a special and unique arrangement of terminal connections for an armored or encased heating unit operated as between the positive of the power rail on the one hand and the negative of the track rails or ground on the other hand.

In a preferred embodiment of this invention, the relationship of the heating elements and the surrounding casing or armor is such that the casing itself constitutes the one terminal, herein called the positive terminal, for the heating coils, while the other, or negative terminal, is in the nature of a cable connection leading out through one end of the casing by way of a novel double-acting sealing gland arrangement. The casing terminal makes bodily contact with the power rail by reason of being tightly clamped thereto, only one outward cable-lead thus being required to render the device operative once it is mounted in place, namely, a connection between it and one of the track rails, a switch or control means being provided in the connection to operate the heating device as desired.

The casing is tubular, and through one of its open ends there may be inserted one or more heating elements. A series of such heating elements can be used having their own intermediate terminals and electrical connecting means. They can be sustained and held together in unitary fashion by way of an auxiliary supporting means in the form of an embracing channel member or cage permitting the assembled heating elements to be manipulated as a unit prior to their insertion into the casing, as well as to establish their fixed relation to the walls of the outer casing when in place therein. More specifically, an open ended tubular casing may be slipped over an assembled series of heating elements, each end of which series has a suitable casing closure attached thereto, whereupon certain expansible sealing means embodied in such a closure may be rendered effective to form a hermetical seal relative to the inner tube wall or to an outleading cable connection respectively.

Preferably, the supporting channel although substantially rigid is sectionalized in any suitable manner into composite lengths, and so is the refractory body surrounding the heating coils, all in a manner to make possible the fabrication of units of varying total lengths from established components of short lengths or elements.

The casing is shaped to offer a contact face which is substantially conforming or complementary to the web and head portion of the rail profile. Also, the casing has associated therewith suitable rail clamping means adapted to embrace the bottom flange of the power rail, and to provide for and maintain the desired intimate contact for the flow of current through the corresponding contact faces of the casing and the power rail.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description. In the accompanying drawings, for the purpose of example, there has been illustrated the best embodiment of the invention now known to me, but such embodiment is to be regarded as typical only of many possible embodiments, and the invention is not to be limited thereto. Other features and advantages will hereinafter appear.

In the drawings:

Fig. 1 is a perspective view of the heating unit mounted upon the power rail and its connection with the adjacent track rail, and a control switch for the heating unit.

Fig. 2 is an enlarged detail perspective view of a length of power rail, to show a modified arrangement in the way of interconnected, otherwise self-contained armored heating units.

Fig. 3 is a longitudinal elevational section through a preferred form of the armored heating unit.

Fig. 4 is a plan view upon the heating unit according to Fig. 3, with the top portion of the casing broken away.

Fig. 5 is a perspective view of a heating unit with parts drawn apart to illustrate the method of assembling the heating elements in the casing.

Fig. 6 is an enlarged cross-section of the armored heating unit shown as being clamped to, and in contact with, the power rail.

Fig. 7 is a detail perspective view of the heat confining and heat directing refractory bodies, per se, which normally surround the heating coils.

Fig. 8 is a detail perspective of the auxiliary supporting means or channel for the heating elements.

An encased rail heating unit 10 is shown to be mounted (see Fig. 1) in place upon a power rail 11 by means of clamping devices 12 which are substantially unitary with the casing of the heating unit. The power rail is supported upon insulating members 13 which in turn are fixed upon the rail ties 14 which carry the track rails, one of which is indicated by the numeral 15. The one terminal of the heating unit is formed by the metal casing 16 itself contacting the power rail (as will be more clearly described), the other terminal being in the form of a cable lead 17 which extends from one end of the heating unit, then crosses underneath the power rail in order to reach by way of an interposed control switch 18 the track rail 15 to which it is fastened by means of a clamping device as indicated at 19. In Fig. 2 is shown a modified arrangement ac-

cording to which a number of smaller encased heating units are connected in series to supply a desired length of power rail with heat. There is shown one unit 20 coupled with another unit 21 as through a cable connection or coupling 22. Such array of smaller units may serve to adapt the device more readily to curved or otherwise irregular portions of power rail, and, again, of course, there must be a cable connection 22a leading from the end of the second unit 21 into contact with one of the track rails (not shown).

Figures 3 and 4 are longitudinal sections taken through the length of a heating unit substantially such as indicated in Fig. 1, and these views are to disclose the interior construction of the encased heating unit, that is to say, an assemblage of heating elements which mainly include sectional lengths of heating coils suitably interconnected, also sectional lengths of refractory heat confining bodies or shielding blocks, a common carrier or auxiliary channel or girder upon which the heating elements are assembled to expedite their manipulation, and also certain closure means or devices which are provided at each end of this assemblage. Practically this entire assemblage is insertable endwise into a tubular casing, and the closure means are adapted to form moisture-proof seals at the respective ends of the casing.

There may be combined in such a unit a plurality of heating elements. However, Fig. 2 discloses for example merely a pair of heating elements 23 and 24 connected in series. The heating element 23 comprises a heating coil 25, and a heat confining body which consists of a series of blocks of refractory material to surround or shield the heating coil 25, and which series comprises special end blocks 26 and 27 respectively as well as plain intermediate blocks 28. The special end block 26 has a longitudinally protruding portion 29 designed to have anchored therein a terminal 30 for the connection thereto of the adjacent end of the heating coil 25. This terminal 30 consists of a screwbolt 31 with nuts 32 and 33. The bolt has its head portion 34 embedded in the end block 26 and sealed and secured in place by suitable filler material indicated at 33a. The other end block 27 of this heating element 23 is shown to have a plain squared end portion, with no provision made for a terminal since the heating coil 25 at this end is to be connected to a separate terminal block or member 34a, which in turn is to be rigidly associated with the adjacent casing closure means at this end of the unit in a manner more clearly to be described.

The second heating element 24 is shown to be substantially symmetrical with respect to its sectional end portions, and it comprises a heating coil 35, a pair of symmetrically arranged refractory end blocks 36 and 37, which end blocks similar to the one already described have longitudinally protruding end portions 36a and 37a respectively provided with corresponding terminals 38 and 39 for connection with the respective ends of the heating coil 35, and which terminals are substantially similar to the one described in connection with the other heating element 23.

Again, confined between the end blocks 36 and 37 of the second heating element 24 there are provided intermediate plain refractory blocks 40. The subdivision or sectionalizing of the refractory bodies surrounding the respective heating coils, into a series of blocks has the dual advantage of reducing the hazard of breakage, as well as to make possible the composition of block elements into shielding bodies of varying lengths.

The inner adjoining end blocks of the two respective heating elements 23 and 24 meet buttwise. The respective terminals 30 and 38 of the heating coils 25 and 35 are interconnected through a busbar 41.

The two heating elements or sections 23 and 24 are held in cooperative relationship by being confined in a common carrier or support channel member or girder 42 a detail section or half of which is shown in Fig. 8. This channel member 42 is shaped or flanged so as to embrace more than half of the circumference of the series of refractory blocks, however, leaving uncovered a portion thereof through which heat radiation is directed in a certain direction towards the power rail, as shown in Fig. 6. Consequently, then the refractory blocks are confined against transverse displacement in the channel member 42 as by flange portions 43, 44 and 45, thereof, and against longitudinal displacement as by a metal block 46 at one end of the channel member and fixed thereto by screws or rivets 47 or the like, and at the other end by the aforementioned terminal block 34a by means of screws 34b. This terminal block then serves a dual purpose in that it also provides a terminal screw 48 to fix thereto the end of the heating coil 25.

The support channel or girder 42 is shown to be composed of two sections 49 and 50 (see Fig. 3) which are shown to be rigidly interconnected by means of a clip or channel splice plate 51 fixed by rivets 52. One such channel section 50 is the one shown in Fig. 8 and it has holes 53 shown to be provided at one end to indicate the connection with the splice plate 51, and holes 54 shown at the other end for connection with the respective confining end block. Otherwise the channel or girder sections 49 and 50 are identical and substantially exchangeable with each other.

The terminal block 34a is furthermore adapted for connection with a closure piece 55 hereinafter also to be called the positive end casing cap inasmuch as it serves to close the one open end of a tubular casing 56 which surrounds the entire assemblage of heating elements. The closure piece 55 is made to fit into the non-circular hollow of the tubular casing and it may be fixed in place as by means of counter-sunk screws 57 or screws having a semi-spherical head 57a (see Fig. 6).

A bolt 58 fits into a central hole 59 provided in the closure piece 55, which bolt is substantially co-extensive with the longitudinal extent of the casing 56 and has a reduced threaded portion 60 to be screwed into a corresponding tapped hole 61 provided in the terminal block 34a. The other end of the bolt 58 has an enlarged threaded head portion 62 upon which fits a nut 63, and which end portion is shown to have provided in the top face thereof a transverse groove 64. A hermetical or moisture-proof closure at this end of the casing 56 may then be effected by brazing the line of closure between the casing and the closure piece as at 65.

Through its current-conducting connection with the terminal block 34a the casing 56 virtually becomes the positive terminal of the heating unit and as such is formed to be adapted for form-fitting engagement with the profile of the power rail so as to enable an effective current transferring contact to be made between the casing and the power rail (see Fig. 6).

In speaking of a formed tubular casing 56,

this is preferably meant to convey that a casing of the desired form is produced by forming a length of tubing, such as seamless copper tubing, into the approximately square cross-sectional shape herein disclosed, this square shape being characterized by a rounded upper left-hand corner portion 66, which is to fit into a correspondingly curved or recessed portion of the power rail profile just below the head portin thereof.

The provision of a sealed closure for the opposite end opening of the casing offers a different problem in view of a cable lead 67 passing therethrough. In order to effect such a closure there is provided a special closure device of unique design, and which may be called a double-acting gland or packing device which is operable to effect a hermetical closure, and adapted to offer electrical insulation as well, between the cable lead 67 and the tubular casing 56.

This special gland device is described as follows: A closure piece 68, also to be called the cable end casing cap, is shaped to be inserted into the non-circular opening of the casing 56 and fitted substantially in the manner described in connection with the closure piece 55 at the opposite end of the casing, and it is shown to be fixed in place as by means of counter-sunk screws 68a.

Through a round central hole in the closure piece 68 extends the male member or bushing 69 of the gland device, and it may be of brass or similar suitable material, and it is shown to have threaded tightly into it a second bushing or lining 70 of suitable insulating material such as bakelite. The bushing 69 has provided thereon an exterior thread 71. The bushing by way of its exterior thread fits into a correspondingly tapped hollow 72 of a corresponding female member of the gland device, namely, a gland casing or packing ram 73, the circumferential contour of which again corresponds to the non-circular hollow of the formed tubing or casing 56 so that it appears to be secured therein against rotation.

An inner packing, including a series of packing elements, is placed within the gland casing 73 and it surrounds the cable lead 67. The packing elements are shown to include a bushing element 74 of substantially non-deformable insulating or refractory material for instance a material known under the name of Alsimag and which incidentally is of synthetic lava ground up with a binder and moulded, and herein being used as a refractory heat resisting non-conductor. This element 74 is seated and centered with respect to the bottom of the gland casing or with respect to the bottom opening 75 therein. Then follows a substantially non-compressible or non-deformable annulus or gasket member 76 also of a heat resisting non-conducting material or compound, for instance, such as known under the name of Durabla.

A gasket ring 77 as of brass is disposed next to the inner end of the male gland member or bushing 69, and between it and the aforementioned non-deformable gasket member 76 there is confined a packing ring 78 of deformable rubber which is pressure responsive so as to furnish a seal between the packing casing 73 and the cable lead 67.

A second or outer packing, also including a series of packing elements is placed around the bushing 69 and into the space between the bushing and the casing 56. The function and the component elements of this outer packing are substantially similar to the inner packing just described, and it includes a gasket member 79 of heat resisting non-conductive material such as Durabla, and again a deformable annular packing member 80 of rubber which is confined between the gasket member 79 on the one hand and the closure piece 68 on the other hand. There is also provided a metal gasket ring 81 between the fixed closure piece 68 and the rotatable bushing 69.

Consequently, there is obtained in this gland device a double sealing effect, as the tightening of the bushing 69 by the rotation thereof presses the inner as well as the outer packing into sealing engagement.

The cable lead 67 has an insulating covering 82 which is shown to extend along where it lodges within the gland device, leaving an inner bared end portion 83 to be connected with the adjacent outer terminal 39 of the heating coil 35. Glass beads 84 cover the end portion 83 for insulation.

Since the refractory bodies for the heating coils are of importance for the proper functioning and efficiency of the heating elements, a separate detail of these bodies is shown in Fig. 7, and their special heat shielding and heat directing function is illustrated in the cross-sectional showing of Fig. 6. It then appears that substantially centrally in the refractory bodies or blocks and to extend along the longitudinal axis thereof there is provided a cylindrical hollow 85 in which the respective heating coil is to lodge, which hollow 85 has a slightly constricted or neck-like extension 85a (see Fig. 6) disposed in an upwardly inclined direction so that a concentration of radiating heat may be thrown therethrough against the upper left hand rounded corner portion 66 of the casing 56 which then conducts the heat to the adjoining top portion of the power rail where the ice or sleet is to be melted.

It is also desired to have the refractory blocks of the respective heating elements somewhat yieldingly seated or cushioned upon the supporting channel member or girder 42. For this purpose there is provided a backing strip 86 of suitable material which is in the nature of a non-conducting heat resisting padding which may be so-called Nigrate tape made essentially of asbestos and without any metal ingredients or components, to act as a shock absorber in deadening vibrations.

From Fig. 6 there furthermore appears that the casing 56 of the heating device is substantially unitary with supporting brackets 87. Each bracket 87 in turn constitutes a jaw of a clamping device attachable to the lower base flange of the power rail, the corresponding other jaw being formed in the way of a bolt 88 having a hooked portion 89 (see Fig. 2) to engage the rail flange and a nut 90 for tightening the same.

Operation

Inasmuch as the heating operation proper of an installed unit of the device described is intrinsically simple and substantially self-evident, any comment as to function may be directed more specifically to the manner of assembling the unit; to the ways and means through which the durability and safe continuity of function is insured, a desired heat transfer most effectively attained under otherwise adverse operating conditions; and to the adaptability of the present design in general to a variety of local conditions, and a variety of size and other requirements.

The procedure of assembling the heating unit relies mainly upon the use of the auxiliary support or channel member or girder 42. This chan-

nel member, although composed of sections may be assumed to be available in its predetermined total length. A series of pre-assembled and interconnected heating elements **23** and **24**, including heating coils **25** and **35**, refractory blocks **26**, **27**, **28** of the one heating element and those marked **36**, **37**, **40** of the other heating element, corresponding terminals **30**, **34***a*, **38**, **39** and the inter-connecting bus bar **41**, are then lengthwise inserted into the supporting channel member **42**, not without having interposed between the refractory blocks and the channel member the strip of padding **86**. There are recesses or cut-outs provided in the top flange portions of the channel member (see Fig. 3) to permit access to be had to the respective terminals of the heating coils in case the same are to be manipulated after the assembly of the blocks in the channel member.

Thereafter, the terminal block **34***a* is attached to the supporting channel or girder by means of screws **34***b* (see lefthand end of Fig. 3) and to it is connected the corresponding adjacent end of the heating coil **25** by means of the terminal screw **48**.

Also if desired the positive casing end cap or closure piece **55** may now be attached and fixed to the terminal block **34***a* through the medium of the bolt **58** and the nut **63**, care being taken that the rotational relationship of the associated parts is correct with respect to their unobstructed insertion into the non-circular and substantially square shaped opening of the casing **56**.

The assembly up to this point of the heating elements and accessories upon the channel member is now ready for endwise insertion into the casing **56**, it being noted that there is no part in evidence which by its protrusion would not permit the entire assembly to pass unobstructed from end to end through the entire casing, while relative rotary displacement of the parts is checked by the non-circular cross-section of the casing and of corresponding inserted parts.

Consequently, it is possible to introduce the assemblage so far described through one end opening into and through the casing **56** far enough to have the opposite outer terminal **39** of the assembly exposed and protruding from the opposite end of the casing, whereupon the entire sealing gland device, essentially including the bushing **69**, the gland casing **73**, inner and outer packings, and the cable lead **67**, pre-assembled as it were, may be added to the assemblage by connecting the blank portion **83** of the cable lead **67** to the then exposed terminal **39** of heating coil **35**.

Thereafter, the entire assemblage, including the gland device, may be retracted into the casing **56** in order to bring both casing closure pieces **55** and **68** respectively into their proper position relative to the end portions of the casing, whereupon they may be secured in place by the fixing screws **57** and **68***a* respectively.

It is to be understood that prior to inserting the sealing gland device into the casing **56**, the bushing **69** therein should be retracted as far as necessary to release the respective inner and outer packing elements. After the device is fixed in place, the gland member or bushing **69** is to be tightened by rotating the same, in order to render effective the inner and outer packings to establish a dual hermetical closure as between the cable lead **67** and the gland device on the one hand, and between the gland device and the casing **56** on the other hand. In fact the rotation of bushing **69** will cause the gland casing **73** to move axially over the bushing thereby compressing the enclosed packings.

The opposite end of the casing **56** may be sealed as by brazing the crevice along the line of closure as at **65** or in other suitable ways. The interior of the casing is now fully sealed and moisture-proof, the presence of moisture within the casing being condemnable in view of the potential formation of steam pressure therein upon heating and the attendant hazard of bulging or deformation of the casing or other damages. The casing is preferably made of seamless tubing, such as copper tubing, to exclude the danger of seams to open under heat tension, and the tube may be shaped into the desired cross-sectional form by way of extrusion.

It is noted that the unit thus assembled is extremely compact and of smooth outer contour, having no parts protruding beyond the surface of the casing **56**, with all component parts being designed to be capable of passing straight through the entire hollow of the casing **56**.

The assembled heating unit is then clamped to the power rail by means of the clamping elements **87**, **88**, and **90**, unitary therewith, whereby the casing **56** is brought into close form-fitting contact with the corresponding intermediate or web portion of the power rail. According to the preferred construction described, this contact must be at once effective to transmit power from the power rail to the heating device, as well as heat from the heating device to the power rail. To complete the circuit the cable lead **67** operating by way of the control switch **18** is clamped or connected to the bottom flange of the track rail **15**. The operation of the switch device, which may be distance controlled, will bring the heating device into or out of play.

It is noted with respect to the use of a single complete heating unit, and which may be constructed to be for instance approximately 15 feet long, that only one out-leading cable connection is required. The refractory bodies within the casing are disposed, subdivided, mounted and cushioned in such a manner that the possibility of breakage thereof is substantially eliminated. The casing and its closure devices safeguard the vital parts within against the effects of atmospheric or other deteriorating or destructive influences, although the unit can be readily dismounted, the parts dismantled and inspected.

The sectional organization of the interior parts, such as heating coils and refractory bodies, is conducive to adapting the design to a multitude of desired lengths of the unit to suit local conditions.

But where, for reasons of fabrication or in view of local requirements, the installation of a sequence of shorter individually encased units is desired, such condition can be met by employing the modified arrangement illustrated in Fig. 2. The first heating unit **20** shown therein may be assumed to be internally substantially similar to, although shorter in total length than the unit described in connection with Fig. 1. The additional heating unit **21**, although equally composed of standard working parts, such as herein established, is modified in that each end thereof is provided with a cable outlet or lead and consequently each end also with a double acting sealing gland device such as previously described in Fig. 3.

In this way two or more such shorter but in themselves complete and encased heating units

may be connected in series as through the cable coupling 22. This makes it possible to utilize available standard component working parts of these devices, as well as to give additional flexibility or adaptability to the rail heating arrangement with regard to possible curvatures, deviations or inequalities of the power rail.

I claim:

1. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and forming an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of the rail, electric resistance heating means extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, means for sustaining said casing substantially in the hollow of said undercut portion and in a position favorable for heat transfer substantially to the upper portion of the rail, heat-directing and shielding means within the casing and disposed relative to said heating means in such a manner as to partly surround the same for realizing heating effects from said heating means in an upwardly inclined direction and toward the top portion of the rail.

2. An electric rail heating device substantially adapted for use in connection with rails having a profile including an overhanging top portion, a base portion, and a web portion inter-connecting said top and said base portions, and forming an undercut portion with said top portion, which comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of rail, said casing being prefabricated so as to have a wall profile substantially corresponding to the contour of said undercut portions and thus being adapted to have substantially form-fitting contact relationship with said undercut portion when being applied thereto in operating position, for heat transfer between the casing and substantially the upper portion of the rail, electric resistance heating means extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, means for sustaining said casing substantially in the hollow of said undercut portion of the rail, and heat-directing and shielding means disposed relative to said heating means in order to transmit heating effects from said heating means toward said top rail portion, said casing thus being supported in a position for realizing said heating effects in an upwardly inclined direction in the upper portion of the rail.

3. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and constituting an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of the rail, electric heating resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, heat-confining shielding means provided and normally located within said casing and formed and positionable therein so as to surround said wire coil except for a portion thereof from which heat is to be thrown in an upwardly inclined substantially predetermined direction toward a desired upper portion of the rail profile, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the means within said casing, and means for sustaining said casing substantially within the hollow of said undercut portion and in a position favorable for realizing heating effects from said wire coil substantially in the above mentioned direction of said upper portion of the rail.

4. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and constituting an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmtting association with a corresponding length of the rail, electric heating resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, heat-confining shielding means of refractory material provided and normally located within said casing and formed and positionable so as to surround the wire coil, except for a portion thereof from which heat is to be drawn in an upwardly inclined substantially predetermined direction toward a desired upper portion of the rail profile, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and means for sustaining said casing substantially within the hollow of said undercut portion and in a position favorable for realizing heating effects from said wire coil substantially in the above mentioned direction of the upper portion of the rail.

5. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and forming an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of rail, electric heating resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, a heat-shielding and heat-directing body including a series of blocks of refractory material provided and normally located within said casing and formed and positionable so as to surround a portion of the circumference of said wire coil in a manner to enable the same to throw heat in a substantially predetermined direction toward the upper portion of the rail, a channel member formed and adapted to have assembled therein said series of refractory blocks and for positioning the same within and relative to the surrounding casing to realize heat effects in said predetermined direction, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and means for sustaining said casing in heat-transmitting

relationship with the rail and substantially within the hollow of said undercut portion and in a position favorable for realizing heat effects substantially in the direction of said top portion of the rail.

6. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and constituting an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of rail, electric heating resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, a heat-shielding and heat-directing body, including a series of blocks of refractory material provided and normally located within said casing and formed and positionable so as to surround a portion of the circumference of said wire coil in a manner to enable the same to throw heat in a substantially predetermined direction toward the upper portion of the rail profile, a channel member shaped corresponding to said refractory blocks and substantially surrounding the same while adapted to have said blocks secured therein against transverse displacement and leaving the heat free to radiate in said predetermined direction, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and means for sustaining said casing in heat-transmitting relationship with the rail and substantially within the hollow of said undercut portion and in a position favorable for realizing heating effects substantially in said direction of the upper portion of the rail.

7. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and forming an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of rail, electric heating resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, a heat-shielding and heat-directing body, including a series of blocks of refractory material provided and normally located within said casing and formed so as to surround a portion of the circumference of said wire coil in a manner to enable the same to throw heat in a substantially predetermined direction toward the upper portion of the rail profile, a channel member shaped substantially corresponding to said blocks and substantially surrounding same and adapted to have secured therein said blocks against transverse displacement while leaving the heat free to radiate in said predetermined direction, detachable end blocking members unitary with said channel member for securing thereon the assembled position of said refractory blocks; said channel member, said coil, said refractory blocks and said end blocking members constituting a unitary assembly insertable as such into said tubular casing, said assembly after insertion being adapted to realize heat effects in the desired direction, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and means for sustaining said casing in heat transmitting relationship with the rail and substantially within the hollow of said undercut portion and in a position favorable for realizing heat effects from said wire coil substantially in the direction of the upper portion of the rail.

8. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a base portion, and a web portion inter-connecting said top and said base portions and forming an undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat-transmitting association with a corresponding length of rail, electric heating resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said rail, a heat-shielding and heat-directing body including a series of suitably-profiled blocks of refractory material provided and normally located within said casing and formed so as to surround a portion of the circumference of said wire coil in a manner to enable the same to throw heat in a substantially predetermined direction toward the upper portion of the rail profile, a channel member shaped substantially corresponding to said refractory blocks and substantially surrounding same and adapted to have secured therein said blocks against transverse displacement while leaving the heat free to radiate unimpeded in said predetermined direction, detachable end blocking members unitary with said supporting member for securing thereon the assembled position of said refractory blocks in a longitudinal direction; said channel member, said coil, said refractory blocks and said end blocking members constituting a unitary assembly insertable as such into said tubular casing, said assembly after insertion being adapted to realize heat effects in the said desired direction, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, which means comprise a closure member for one end of the casing, which closure member is unitary with one of said end block members and thereby fixedly attached to said channel member when assembled, and means for sustaining said casing in heat transmitting relationship with said rail and substantially within the hollow of said undercut portion of the rail and in a position favorable for realizing heat effects from said wire coil substantially in the direction of the upper portion of the rail.

9. In an electric rail heating device in combination a length of tubular casing adapted for heat transmitting association with a corresponding length of the rail, which tubular casing has an open end portion electric resistance heating means extending within said casing along a length thereof and arranged and adapted to effect the transfer of heat through the casing wall to said rail, power supply and return connections for said heating means comprising a cable lead passing through and from the open end portion of said tubular casing, means for effecting a moisture-proof sealing of the heating means within said casing, which means comprise a bodily removable gland device which gland device includes as one main element a gland casing insertable into the said open end portion of the tubular casing, and including as a corresponding second main element

a gland bushing adapted for telescopic screw engagement with said gland casing, packing means enclosed by said gland casing and effective under pressure from said bushing to seal the elements of the gland device against the cable lead passing therethrough, and other packing means adapted to be effective to seal said gland casing against the surrounding wall of said tubular casing, said gland device in conjunction with both said packings thus adapted and operable to seal the substantially annular space between said cable lead and the adjacent wall portion of the tubular casing.

10. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a horizontally and bi-laterally extending base flange, and a web portion inter-connecting said top portion and said base flange and constituting with said top portion an undercut portion, which device comprises a length of tubular casing adapted for heat transmitting association with a corresponding length of rail, said casing being prefabricated so as to have a wall profile substantially corresponding to the contour of said undercut portion and thus adapted to have a substantially form-fitting contact with said undercut portion when being applied thereto in operating position for heat transfer between the casing and substantially the upper portion of the rail, electric resistance heating means extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said power rail, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and a pair of clamping devices for sustaining said casing substantially in the hollow of said undercut portion, each clamping device comprising a pair of clamping jaws designed to grip around said base flange of the rail profile and effective when in gripping position thereon to place said casing into said heat-transmitting contact relationship with the power rail.

11. An electric rail heating device substantially adapted for use in connection with rails having a profile including a top portion, a horizontally and bi-laterally extending base flange, and a web portion inter-connecting said top portion and said base flange and constituting with said top portion an undercut portion, which device comprises a length of tubular casing adapted for heat transmitting association with a corresponding length of rail, said casing being prefabricated so as to have a wall profile substantially corresponding to the contour of said undercut portion and thus adapted to have a substantially form-fitting contact with said undercut portion when being applied thereto in operating position for heat transfer between the casing and substantially the upper portion of the rail, electric resistance heating means extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said power rail, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and a pair of clamping devices for sustaining said casing substantially in the hollow of said undercut portion, each clamping device including a bolt member adapted to extend across and underneath the base flange and having a hooked head portion adapted to serve as a jaw to grip around one side portion of the base flange, a separate jaw member adapted to grip around the opposite side portion of the base flange and also adapted to fit over the free end of said bolt member, means for tightening said body portion and said separate jaw member relative to each other and relative to said bottom flange by way of said bolt member, said casing being rigidly supported by said respective separate jaw members of the clamping device with respect to the intended heat transferring contact with the rail, said jaw tightening means consequently being effective to place said casing into said heat transmitting relationship with the corresponding contour of the power rail.

12. An electric rail heating device substantially adapted for use in connection with rails having a profile including an overhanging top portion, a base portion, and a web portion inter-connecting said top and said base portions and constituting a partly rounded and undercut portion with said top portion, which device comprises a length of tubular casing adapted for heat transmitting association with the corresponding length of rail, said casing being of substantially rectangular cross-section and having a rounded corner portion substantially corresponding to a similar contour of said rounded undercut portion of the rail and thus adapted to have substantially form-fitting association with the contour of said undercut portion when placed in operating position relative to the rail, for heat transfer between the casing and substantially the upper portion of the rail, electric heat resistance wire coil extending within said casing along a length thereof and arranged and adapted for effecting the transfer of heat through the casing wall to said power rail, a series of heat shielding and heat directing blocks of refractory material provided and normally located within said casing and formed and positionable so as to surround a portion of the circumference of said wire coil in a manner to enable the same to throw heat in a substantially predetermined direction toward the upper portion of the rail profile, said blocks having upright trapezoidal cross-section, the trapezoid involved being substantially defined by horizontally extended top and bottom limitations, by a vertical rear limitation at the far side from the rail, and by a limitation extending under a slope from the near side of the rail, a channel member substantially shaped corresponding to said refractory blocks and substantially surrounding the same and adapted to have secured therein said blocks while leaving the heat free to radiate in said predetermined direction, said channel member also being shaped to correspond in general to the interior of said casing, power supply and return connections for said heating means, means for effecting a moisture-proof sealing of the heating means within said casing, and means for sustaining said casing substantially within the hollow of said undercut portion and in a position substantially favorable for realizing heating effects from said wire coil in the direction of the upper portion of the rail.

13. In an electric rail heating device in combination a length of tubular casing adapted for heat transmitting association with a corresponding length of the rail, which tubular casing has an open end portion, electric resistance heating means extending within said casing along a length thereof and arranged and adapted to effect the transfer of heat through the casing wall to said rail, power supply and return connections for said heating means comprising a cable lead passing through and from the open end portion

of said tubular casing, means for effecting a moisture-proof sealing of the heating means within said casing, which means comprise a bodily removable gland device adapted and operable to seal the substantially annular space between said cable lead and the adjacent surrounding wall portion of the tubular casing, which gland device in turn comprises as one main member a gland casing insertable into said tubular casing and positionable in the open end portion thereof, and as another main member a gland bushing cooperatively associated with and operable in telescopic screw engagement with the gland casing, means effective to prevent the rotation of the one main gland member relative to the surrounding tubular casing when the other main gland member is rotated in rendering effective certain sealing means hereinafter mentioned, a first and internal packing surrounding the cable lead and confined within the gland casing and adapted to be exposed to pressure from said screw engaged bushing to be effective as a seal between the insertable gland device and the cable lead passing therethrough, and a second and external packing adapted to surround an exposed portion of the screw-engaged gland bushing and which packing is confined between the bushing and the surrounding wall of the tubular casing and further adapted under pressure from said bushing to seal said insertable gland device against said surrounding wall along with the sealing as effected by said first-mentioned internal packing.

14. An electric heating device according to claim 13, in which the gland bushing is rotatably mounted in the end portion of the tubular casing although restrained in its axial movement, and the gland casing is bodily and axially movable relative to the bushing according to the rotation thereof and thus also movable relative to the tubular casing.

15. An electric heating device according to claim 13, in which the gland bushing is rotatably mounted in the end portion of the tubular casing although restrained in its axial movement and the gland casing is bodily and axially movable relative to the bushing according to the rotation thereof and thus also movable relative to the tubular casing, and in which the tubular casing is of non-circular cross-section, and in which the gland casing is shaped according to said non-circular cross-section thereby preventing its rotation relative to the surrounding tubular casing when the gland bushing is rotated.

WILLIAM P. SCHOLZ.