



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.02.2013 Bulletin 2013/07

(51) Int Cl.:
E01B 7/24 (2006.01)

(21) Application number: **12179937.3**

(22) Date of filing: **09.08.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventor: **Cenci, Enzo**
43039 Salsomaggiore Terme (PR) (IT)

(74) Representative: **Banfi, Paolo**
Bianchetti Bracco Minoja S.r.l.
Via Plinio, 63
20129 Milano (IT)

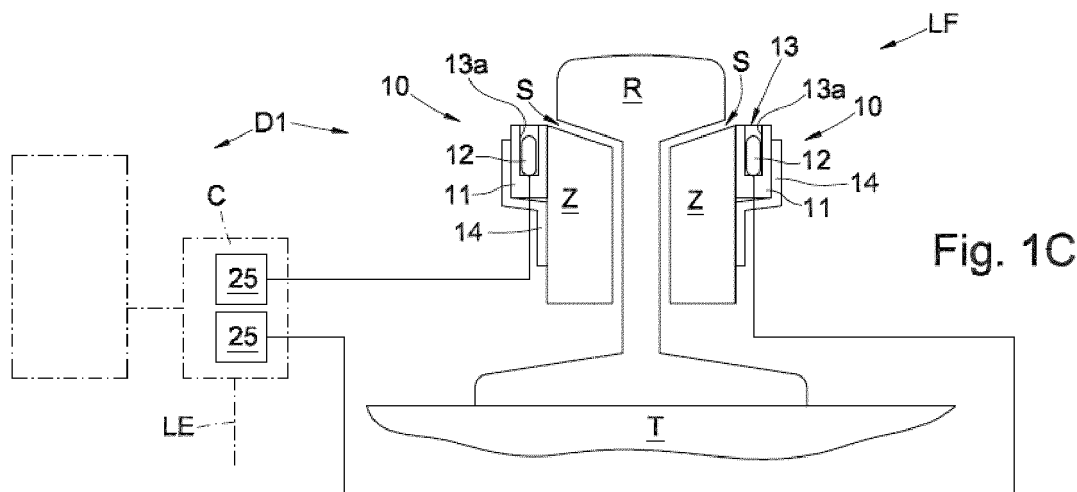
(30) Priority: **11.08.2011 IT MI20111531**

(71) Applicant: **Accomandita Tecnologie Speciali Energia SPA in Breve Accomandita T.S.E. SPA**
43039 Salsomaggiore Terme (PR) (IT)

(54) **Heating device for rails**

(57) A heating system (10; 20; 30; 40) for protecting against climatic events, such as cold, frost or condensation, comprising: a diffuser body (11; 21; 31; 41) made of a heat-conductive metal, in particular brass, which is to be fixed along a railway track in the vicinity of a corresponding control and/or safety device (D1; D2; D3; D4) to be protected against climatic events; the system further comprises at least one heating electric cable (12; 22; 32; 42) housed in a respective seat (13; 23; 33; 43) formed in said diffuser body, wherein said electric heating

cable is provided for being powered by using the same electrical equipment that supplies the control and/or safety device to be protected against climatic and environmental events, wherein the diffuser body (11; 21; 31; 41) is suitable for transmitting and diffusing the heat generated by the heating electric cable (12; 22; 32; 42) in the area of the control and/or safety device to be protected and wherein fastening means are provided for fastening and firmly fixing the diffuser body of the heating system along the railroad tracks, in the area of the corresponding control and/or safety device.



Description

Field of the invention

[0001] The present invention relates in general to the sector of control and/or safety devices and systems which are used within the sphere of railway transport systems, and relates more particularly to a series of new heating systems suitable for protecting against climatic events, such as cold, frost and condensation, and therefore avoiding the relative disadvantages, a series of control and/or safety devices which are installed along railway tracks, such as control and release pedals, shunting switches, key transmitter devices and similar devices

Prior art

[0002] As is known, railway handling and transport systems provide a multiplicity of control and safety devices which are installed in various points along the railway tracks, both to guarantee a correct and safe traffic of the trains and to allow operation on the railway lines, for example for the purpose of performing maintenance works in conditions of absolute safety.

[0003] These control and safety devices include in particular control pedals, shunting switches and key transmitter devices.

[0004] The pedals are devices suitable for controlling and signalling the transit of a train, for example in order to actuate, following this transit, the closure of a level crossing positioned after the pedal in the direction of forward movement of the train, or in order to release, after the train has transited, a level crossing positioned before the pedal in the direction of forward movement of the train.

[0005] Shunting switches, in turn, are devices which are used for controlling and commanding automatically and from a remote position certain operations along the railway lines and tracks, for example in order to perform a switch between tracks.

[0006] Finally key transmitter boxes or devices are devices which have especially the function of guaranteeing the safety of a certain area, normally not manned, of the railway line, preventing the traffic of trains there, so as to allow for example operations of maintenance in this area to be performed in absolute safety.

[0007] These key transmitter devices are associated with a key which is inserted in the device and is recognised by the remote control system of the railway system.

[0008] Therefore without this key and consequent release signal given by the remote control system it is not possible to restore the status of normal functioning along the railway line, so that the operations of maintenance can be performed safely.

[0009] Obviously these devices, being installed in the open air along railway tracks, are subject to environmental and climatic events and variations, such as cold, frost, snow, jumps in temperature, humidity and others, and

therefore must be adequately and effectively protected against these climatic variables and factors in order to ensure their correct and reliable functioning in time and in every environmental and/or climatic condition, in particular intense cold and frost, and abundant snowfalls.

[0010] Naturally various solutions have been prepared and are currently adopted in order to protect these important control and safety devices against the aforementioned climatic events.

[0011] For example these solutions provide for the use of heaters or similar heating devices which are integrated inside these devices, or positioned adjacent thereto, in order to keep them warm and at such a temperature as to prevent the cold and frost from jeopardising regular functioning thereof.

[0012] It is noted however, in general, that the known systems and solutions currently provided for protecting these control and safety devices against the disadvantages caused by the climatic and environmental variables, and in particular those based on the use of heaters, may display critical factors, even if at times only in extreme conditions, so that they could be found to be insufficiently effective.

[0013] It is also noted how, among the control and safety devices currently installed along the tracks of railway lines, and in particular of the RFI (Rete Ferroviaria Italiana - Italian Rail Network) national network, specific models and types, such as for example the P70 type pedals produced by the company Westinghouse, are not in fact equipped with any device intended to protect them against environmental variables.

[0014] Finally it has also been found that specific models and types of these control and/or safety devices, widely applied along the lines of the RFI, such as SILEC Cauter type pedals with one arm, SILEC Forfex type pedals with two arms, and the FS64 LC boxes (with LC from Level Crossing), although being associated with heating systems and with heaters of various kinds, are not wholly immune from the disadvantages caused by the cold and by the frost, so as to require more secure solutions for protecting them against these events.

[0015] In any case, all these problems being in some way linked to the general safety of railway systems, it is clear that every solution and improvement aimed at increasing further the current level of safety must inevitably come up against needs that are constantly present and felt in the technical sector of railway systems.

Summary of the invention

[0016] Therefore a first, more general, object which the present invention sets out to achieve is that of providing a heating system which can be applied along railway lines, which is able to protect, in a safe and effective manner, against environmental and climatic variables and events, such as cold, frost and condensation, a series of control and/or safety devices, such as for example control pedals, shunting switches and others, which are

usually installed along railway tracks, so as to avoid the disadvantages and the malfunctioning of these devices caused, in fact, by these environmental and climatic variables, and therefore respond to the increasingly urgent needs of greater safety and reliability within the sphere of rail transport systems.

[0017] A second, more particular, object of the present invention is that of providing a series of heating systems which are specifically aimed and designed to protect against climatic events, such as typically cold, frost and condensation, certain models and types of these control and/or safety devices, currently in use and installed along the RFI (Rete Ferroviaria Italiana - Italian Rail Network) railway lines.

[0018] The above objects can be considered achieved in full by the heating system which can be applied along the tracks of a railway line, having the features disclosed by the first independent main claim.

[0019] Particular embodiments of the heating system of the invention are also defined by the dependent claims.

[0020] Numerous advantages are associated with the new heating system proposed by the present invention, such as those listed herein below, purely by way of an example:

- rapidity and ease of installation of the heating system in the area of the corresponding control and/or safety device to be kept warm and to be protected;
- easy and rapid replacement of the conventional heaters, currently adopted, with the new heating system;
- use, for the connections and electrical supply of the new heating system, of the electrical boxes and cables, already present, which serve the device to be protected;
- a reduced consumption of electrical energy;
- capacity for functioning, i.e. of keeping the device to be protected warm, even when the point of electrical supply of the heating system is very distant, for example a few kilometres, from this device to be protected.

Brief description of the drawings

[0021] These and other objects, features and advantages of the present invention will be made clear and evident from the following description of some of its preferred embodiments, given purely by way of example with reference to the accompanying drawings, in which:

Figs. 1A and 1B are photographic views of a first embodiment of a heating system, in accordance with the present invention, in the effective use for protecting from the cold and from the frost a P70 railway pedal manufactured by the company Westinghouse; Fig. 1C is a diagram relating to the application of the first embodiment, of Figs. 1A and 1B, heating system of the invention, on the Westinghouse P70 type ped-

al;

Figs. 1D, 1E, 1F are plan views, sectioned and from a lateral observation point, of a diffuser body of the first embodiment, of Fig. 1A and 1B, of the heating system of the invention, with the relevant dimensions indicated;

Fig. 2A is a photographic view of a second embodiment of the heating system of the invention, provided in order to protect a SILEC Cautor model pedal with one arm;

Fig. 2B is a photographic view of the heating system of Fig. 2A, in the effective use for protecting the SILEC Cautor model pedal with one arm;

Fig. 2C is a photographic view of a diffuser body of the heating system of Figs. 2A and 2B with a protection profile applied;

Figs. 2D, 2E, 2F are plan views, sectioned and from a lateral observation point, of a diffuser body of the second embodiment of Figs. 2A and 2B, of the heating system of the invention, with the relevant dimensions indicated;

Fig. 3A is a photographic view of a third embodiment of the heating system of the invention for protecting a SILEC Forfex model pedal with two arms;

Fig. 3B is a photographic view of the heating system of Fig. 3A, in the effective use for protecting the SILEC Cautor model pedal with two arms;

Figs. 3C, 3D, 3E are plan views, sectioned and from a lateral observation point, of a diffuser body of the third embodiment, of Figs. 3A and 3B, of the heating system of the invention, with the relevant dimensions indicated;

Fig. 4A is a photographic view of a fourth embodiment of the heating system of the invention, installed inside an FS64 type LC box for protecting it against environmental variables, and in particular against phenomena of condensation; and

Figs. 4B, 4C, 4D are plan views, sectioned and from a lateral observation point, of a diffuser body of the fourth embodiment of Fig. 4A of the heating system of the invention, with the relevant dimensions indicated;

Description of some preferred embodiments of the heating system of the invention

[0022] Referring to the drawings a description will now be given of some preferred embodiments of the heating system, in accordance with the present invention, in which, as will be seen, these embodiments have in common some essential features and are applicable on railway lines, and in particular the RFI national lines, in order to heat and protect against environmental and climatic events certain control and/or safety devices installed along these railway lines.

Heating system for Westinghouse P70 pedal

[0023] Figs. 1A and 1B show a first embodiment, denoted overall by 10, of a heating system, in accordance with the present invention, specifically intended to heat a P70 type railway pedal manufactured by the company Westinghouse.

[0024] According to what has already been anticipated, illustrating the context of the prior art, the Westinghouse P70 pedal is a device, denoted herein below in brief by D1, which is installed along a railway line LF in order to signal the transit of a train.

[0025] More particularly, as schematised in Fig. 1C, this pedal D1 comprises a sensor, which is integral with a pair of beams Z positioned on opposite sides with respect to a rail R and is suitable for detecting the bending, generally of a few hundredths of a millimetre, caused by the transit of the train, of a section of this rail R, defined by two adjacent cross members T, with respect to the beams Z.

[0026] The pedal D1 also integrates a system, based on a fluid dynamic principle, which amplifies this bending in order to generate a signal indicating the transit of the train.

[0027] In situations of snow and frost, and/or in conjunction with critical climatic conditions, it may occur that the pedal D1 is no longer able to function correctly in order to signal the transit of the train, due to the ice which forms in the space S between the upper splice plate of the rail R and the beams Z.

[0028] In fact the ice formed in this space S means that the beams Z become practically integral with the rail R and therefore follow the bending thereof, so that in fact the relative rail-beams motion is prevented, and as a result the pedal D1 stops functioning correctly for signalling the transit of the train and for example releasing a level crossing.

[0029] The heating system 10 tends in fact to avoid these disadvantages, due especially to ice, which may affect the pedal D1, and comprises in particular:

- a diffuser body 11, made of heat-conductive metal material, in particular brass; and
- a heating electric cable 12, housed in a respective seat 13 formed in the diffuser body 11.

[0030] Fastening means are also provided, denoted by 14, for fastening and firmly fixing the diffuser body 11 of the heating system 10 along the railway tracks, in the area of the pedal D1.

[0031] The diffuser body 11, in brass, has an elongated parallelepiped shape, and a rectangular profile in cross section, as shown in Figs. 1D, 1E, 1F.

[0032] The seat 13, which houses the heating cable 12, is in turn defined by a longitudinal groove 13a, which is formed on one side of the diffuser body 11, in particular corresponding to a short side of the rectangular cross section of the same diffuser body 11, and extends along

the entire length of the latter.

[0033] The heating electric cable 12 is of a known type and is preferably made up of a Raychem TLT cable, self-regulating, i.e. including in its structure a special plastic material which has an electrical resistance which varies as a function of the temperature present in the same material, so as to regulate automatically the electrical power absorbed, i.e. the amount of heat produced, and therefore maintain the cable 12 at a substantially constant temperature, along its length, despite the varying of the external conditions.

[0034] This heating cable 22, of the Raychem TLT type, is provided to be supplied with a supply voltage for example of 24 Volts, by means of its own transformer 25, for example of 65 VA, as schematised in Fig. 1C.

[0035] Or, according to circumstances, the heating cable 22 can also be supplied with 50, 110, 240 and 750 Volts.

[0036] Referring to Figs. 1D, 1E, 1F, herein below some preferred values are indicated of the main dimensions which define the diffuser body 11, with parallelepiped shape, and the relative seat 13:

$$a1 = 450 \text{ mm}; b1 = 10 \text{ mm}; c1 = 20 \text{ mm}; d1 = 15; e1 = 4 \text{ mm}.$$

[0037] In the specific case, described here, wherein the heating system of the invention is intended to protect the pedal D1, two heating systems 10 are provided, as described previously, each one comprising a diffuser body 11, in turn housing a heating cable 22, Raychem, wherein these two heating systems 10 are fixed, at the two opposite sides of the rail R, each one on a corresponding beam Z, as shown in Fig. 1C.

[0038] More particularly each of the two diffuser bodies 11 is fixed, on the corresponding beam Z, by means of a pair of small plates 14, with the short side, of the rectangular cross section of the diffuser body 11, turned upwards, and with the wide side facing and in contact with the beam Z.

[0039] Moreover the two transformers 25 which supply the corresponding heating cables 22, Raychem, self-regulating, of the two heating systems 10 associated with the two beams Z, are housed in the same electrical box C which serves the pedal D1 and is supplied by the external electricity line LE, as schematised in Fig. 1C.

[0040] The two sides of the diffuser body 11 which do not have a function of irradiation and transmission, towards the respective beam Z, of the heat produced by the heating cable 22, can be protected with an L-shaped angular profile of insulating material, for example of plastic, so as to avoid unnecessary heat dispersions.

[0041] In effective use the Raychem cable 22 of each heating system 10 is supplied electrically and has initially at its terminals a low voltage, in turn dependent on the distance of the pedal D1 from the source of supply, which grows during an initial pick-up phase which triggers the heating.

[0042] Therefore, at the end of this initial phase, the two cables 22 reach at the respective terminals a normalised and stable voltage, so as to generate in continuation heat, in the normal functioning of the two heating systems 10 positioned at the sides of the rail R.

[0043] Therefore each diffuser body 11 transmits and diffuses the heat generated by the heating electric cable 12, in order to keep warm and therefore protect against environmental and climatic events the area of the pedal D1, and in particular the area of the two beams Z integral with the bending sensor of the pedal D1.

[0044] It should be noted that each heating system 10 is able to function correctly in order to keep the pedal D1 warm even when the point of electrical supply, i.e. in particular the box C already present, of the same heating system 10, is very distant, for example 2 km, from the pedal D1.

Heating system for SILEC Cautor pedal with one arm

[0045] Referring to Figs. 2A and 2B, a heating system for a SILEC Cautor type railway pedal with one arm is denoted overall by 20.

[0046] This SILEC Cautor pedal, with a single arm, herein below denoted in brief by D2, is a device which, similar to the pedal D1, is provided to detect the passage of a train and for this purpose comprises an arm D2' suitable for bending, in contrast to the action of an internal spring, at the contact with the wheels of the train, so as to generate a signal indicating this passage.

[0047] In critical environmental situations it may occur that the snow which accumulates on this pedal D2, above all in the period of closure of the railway line, is energetically compressed at the transit of the first train and therefore hardens and freezes, so as to imprison and block the arm D2' which therefore no longer succeeds in returning into the upper rest position.

[0048] In other words, in this situation, the action of the internal spring no longer succeeds in overcoming the force which restrains and blocks the arm D2', so that the pedal D2 stops functioning and no longer detects the passage of the train.

[0049] This phenomenon is very similar to that which occurs when a stainless steel rod, covered by a veil of frost, is placed in contact with the wall of a cold store, covered by an identical veil of frost, and which means that these two parts in contact remain glued one to the other.

[0050] The heating system 20 has the purpose of preventing and eliminating this blockage making the arm D2' of the pedal D2 operate constantly in a warm area, wherein the accumulation of snow is therefore prevented also in extreme conditions, and in detail comprises:

- a diffuser body 21, made of heat-conductive metal material, in particular brass; and
- a heating electric cable 22, housed in a respective seat 23 formed in the diffuser body 21.

[0051] Fastening means are also provided, denoted by 24, for fastening and firmly fixing the diffuser body 21, along the railway tracks, in the area of the pedal D2.

5 [0052] The diffuser body 21, in brass, has an elongated parallelepiped shape, and a rectangular external profile in cross section, as clearly shown in Figs. 2D, 2E, 2F.

[0053] The heating electric cable 22 is, similarly to the cable 12 of the heating system 10, preferably made up of a Raychem TLT cable, self-regulating, i.e. suitable for maintaining a substantially constant temperature, along its length, despite the variation in external conditions, with supply at 24 Volts and possibility of also being supplied with 50, 110, 240 and 750 Volts.

10 [0054] The seat 23 is made up of a plurality of grooves 23a, parallel one to the other, which are formed in the direction of the length and on one side of the diffuser body 21, corresponding to the wide side of the respective rectangular section, and which lead at the ends into cavities 23b, also formed in the thickness of the diffuser body 21 along the same side of the grooves 23a.

[0055] The heating cable 22, in turn, is housed in these grooves 23a according to a serpentine configuration.

[0056] Referring to Figs. 2D, 2E, 2F, herein below some preferred values are indicated of the main dimensions which define the diffuser body 21 and the relative seat 23:

$$a2 = 200 \text{ mm}; b2 = 40 \text{ mm}; c2 = 20 \text{ mm}.$$

20 [0057] A plastic protection profile, denoted by 27, exhibiting an L-shaped section, is provided for protecting the diffuser body 21, installed in the area of the pedal D2, as shown in Fig. 2C.

30 [0058] The assembly of the heating system 20 on the rail, in the area of the pedal D2 to be protected, is carried out by inserting a pair of bands 24 in respective slots 26, formed through the thickness of the diffuser body 21, and then tightening these bands 24 in such a way as to fix integrally the diffuser body 21 to the rail R.

35 [0059] Moreover the transformer, which is connected to and which supplies the heating cable 22, Raychem TLT, is housed in the same electrical box, already installed, which serves the pedal D2 to be kept warm and to be protected.

40 [0060] In the effective use of the heating system 20, the diffuser body 21 transmits and diffuses the heat generated by the heating electric cable 22, housed in the seat 23, in order to keep warm and therefore protect against environmental and climatic events the area of the pedal D2.

Heating system for SILEC Forflex pedal with two arms

[0061] Referring to Figs. 3A and 3B, a heating system for a SILEC Cautor type railway pedal with two arms is denoted overall by 30.

[0062] This SILEC Cautor pedal, with two arms, herein below denoted in brief by D3, is a device which, similarly

to the pedal D2, is provided to detect the passage of a train.

[0063] Unlike however the pedal D2 which is provided with a single arm D2', the pedal D3 is provided with two arms, denoted by D3', both suitable for bending at the contact with the wheels of the train in transit.

[0064] Therefore the pedal D3 is also directional, being suitable for detecting, as well as the passage of the train, the respective direction of forward movement, taking account of which of the two arms D3' bends first during this passage.

[0065] In critical environmental situations, this pedal D3 can also be affected by the same disadvantages, already described previously, which affect the pedal D2, with one single arm, so that the arms D3' can be blocked and therefore prevent the pedal D3 from functioning correctly.

[0066] The heating system 30 has the purpose of preventing and eliminating this blockage, making the arms D3' of the pedal D3 operate constantly in a warm area, wherein the accumulation of snow is therefore prevented also in extreme conditions, and in detail comprises:

- a diffuser body 31, made of heat-conductive metal material, in particular brass; and
- a heating electric cable 32, housed in a respective seat 33 formed in said diffuser body 31.

[0067] Fastening means are also provided, denoted by 34, for fastening and firmly fixing the diffuser body 31, along the railway tracks, in the area of the pedal D3.

[0068] The diffuser body 31, in brass, has, similarly to the diffuser body 21 of the heating system 20, an elongated parallelepiped shape, as shown in Figs. 3C, 3D, 3E, and in cross section a rectangular external profile.

[0069] The heating electric cable 32 is, similarly to the cable 22 of the heating system 20, preferably made up of a Raychem TLT cable, self-regulating, i.e. suitable for maintaining a substantially constant temperature, along its length, despite the variation in external conditions, with supply at 24 Volts and possibility of also being supplied with 50, 110, 240 and 750 Volts.

[0070] The seat 33, which houses the heating cable 32, in turn comprises a plurality of grooves 33a, parallel one to the other and similar to those of the seat 23 of the diffuser body 21, wherein these grooves 33a are formed on one side of the diffuser body 31, corresponding to the wide side of the rectangular section of the same diffuser body 31, which lead at the ends into cavities 33b, formed in the thickness of the diffuser body 31, and house the heating cable 32 according to a serpentine configuration.

[0071] Referring to Figs. 3C, 3D, 3E, herein below some preferred values are indicated of the main dimensions which define the diffuser body 31 and the relative seat 33:

$$a3 = 330 \text{ mm}; b3 = 40 \text{ mm}; c3 = 20 \text{ mm}.$$

[0072] Also in the case of the heating system 30, a plastic protection profile, exhibiting an L-shaped section, is provided for protecting the diffuser body 31, installed along the tracks.

[0073] The assembly of the heating system 30 on the rail, in the area of the pedal D3 to be protected, is carried out by inserting a pair of bands 34 in respective slots 36, formed through the thickness of the diffuser body 31, and then tightening these bands 34 in such a way as to fix integrally the diffuser body 31 to the rail R.

[0074] In the effective use of the heating system 30, the heating electric cable 22 is supplied electrically, so that the diffuser body 31 transmits and diffuses the heat generated by the heating electric cable 32, housed in the serpentine seat 33, in order to keep warm and therefore protect against environmental and climatic events the area of the pedal D3.

[0075] It should be noted that the heating system 30 is able to function correctly in order to keep the pedal D3 warm even when the point or source of electrical supply of the same heating system 10 is very distant, for example 4 km, from the pedal D3.

Heating system for FS64 type LC box

[0076] Referring to Fig. 4A, a heating system for an LC box, i.e. for level crossing, type FS64, is denoted overall by 40.

[0077] This FS64 type LC box, denoted herein below in brief by D4, is part of those key transmitter devices which, as already anticipated, are associated with the use of a key which, when it is inserted in the box, is recognised by a distance remote control system, in order to inhibit traffic of the trains in a certain area of the railway line, for example to allow operations of maintenance to be performed in absolute safety in this area.

[0078] In critical situations and despite the fact a conventional heater can be housed inside the box D4, it may occur that the action by this heater is ineffective, even at times counterproductive.

[0079] In fact the current of rising hot air generated by the heater, rising towards the control and shunt combiner of the box D4, moistens to then condense on the electrical contacts, on the springs and on the copper segments of the same combiner.

[0080] Moreover the condensation which is deposited on the metal of the electrical contacts, in addition to generating a slight sulphating of the copper, can form, in the case of very low temperatures, frost with negative consequences and risks for the proper operational status of the box.

[0081] Again the electrical resistance which constitutes the type of heater, usually adopted in these D4 boxes, can easily be interrupted, as if it were a usual incandescent bulb, without giving any indication of this interruption which allows replacement of the heater to be activated.

[0082] Finally, as a further disadvantage, the surface

of the heater reaches such a high temperature as to cause minor burns if coming accidentally into contact with it.

[0083] The heating system 40 of the invention has the purpose of preventing and eliminating all these disadvantages and problems, not solved by the traditional heaters and due mainly to phenomena of condensation, and in detail comprises:

- a diffuser body 41, made of heat-conductive metal material, in particular brass; and
- a heating electric cable 42, housed in a respective seat 43 formed in the diffuser body 41.

[0084] Fastening means are also provided, denoted by 44, for fastening and firmly fixing the diffuser body 41, along the railway tracks, in the area of the box D4.

[0085] The diffuser body 41, in brass, has an elongated parallelepiped shape, and a rectangular or square external profile in cross section, as clearly shown in Figs. 4B, 4C, 4D.

[0086] The heating electric cable 42 is, similarly to the cable 12, 22, 32 of the previous embodiments 10, 20, 30 of the heating system of the invention, preferably made up of a Raychem TLT cable, self-regulating, i.e. suitable for maintaining a substantially constant temperature, along its length, despite the variation in external conditions, with supply at 24 Volts and possibility of also being supplied with 50, 110, 240 and 750 Volts.

[0087] The seat 43, for the heating cable 42, is in turn constituted by a plurality of grooves 43a, parallel one to the other, which are formed on one side of the diffuser body 41 in the direction of its length, and which lead at the ends into cavities 43b, open on the same side of the grooves 43a, wherein the heating cable 42 is housed in these grooves 43a according to a serpentine configuration.

[0088] Referring to Figs. 4B, 4C, 4D, herein below some preferred values are indicated of the main dimensions which define the diffuser body 41 and the relative seat 43:

$$a4 = 140 \text{ mm}; b4 = 20 \text{ mm}; c4 = 20 \text{ mm}.$$

[0089] Also in the case of the heating system 40, a plastic protection profile, denoted by 47 and exhibiting an L-shaped section, is provided for protecting the diffuser body 41, installed along the tracks, as shown in Fig. 4A.

[0090] The heating system 40 is assembled and fixed stably inside the box D4, to be protected against climatic events and in particular against condensation, screwing a bolt 44 inserted in a slot 46 formed in a lateral tongue 48 of the diffuser body 41, and also housing the supply transformer of the heating cable 42 in the electrical box, already installed, which serves the same box D4 to be kept warm and protected.

[0091] In the effective use of the heating system 40,

the diffuser body 41 transmits and diffuses the heat generated by the heating electric cable 42, housed in the seat 43, in order to keep warm and therefore protect against environmental and climatic events the area of the FS64 type LC box.

[0092] In particular the heating performed with the self-regulating Raychem cable, positioned in fact inside the D4 shunt box, emanates a diffused heat at low temperature, so as to maintain dry, without any condensation, the relative functioning mechanisms, and also preventing the formation of sulphated patinas, such as also possible ice, so as to preserve them from wear and from the stresses due to the variations of the microclimate.

[0093] It is therefore clear, from the description given, that the present invention fully achieves the objects that had been set, and more specifically proposes both, in general, a new heating system, and, more particularly, a series of specific embodiments of the same system, which are advantageously applicable in order to protect against environmental and climatic variables important control and/or safety devices installed along railway lines, wherein these new heating systems innovate considerably with respect to the heaters and heating systems currently adopted and in use, so as to guarantee a regular and correct functioning in every climatic situation of these devices.

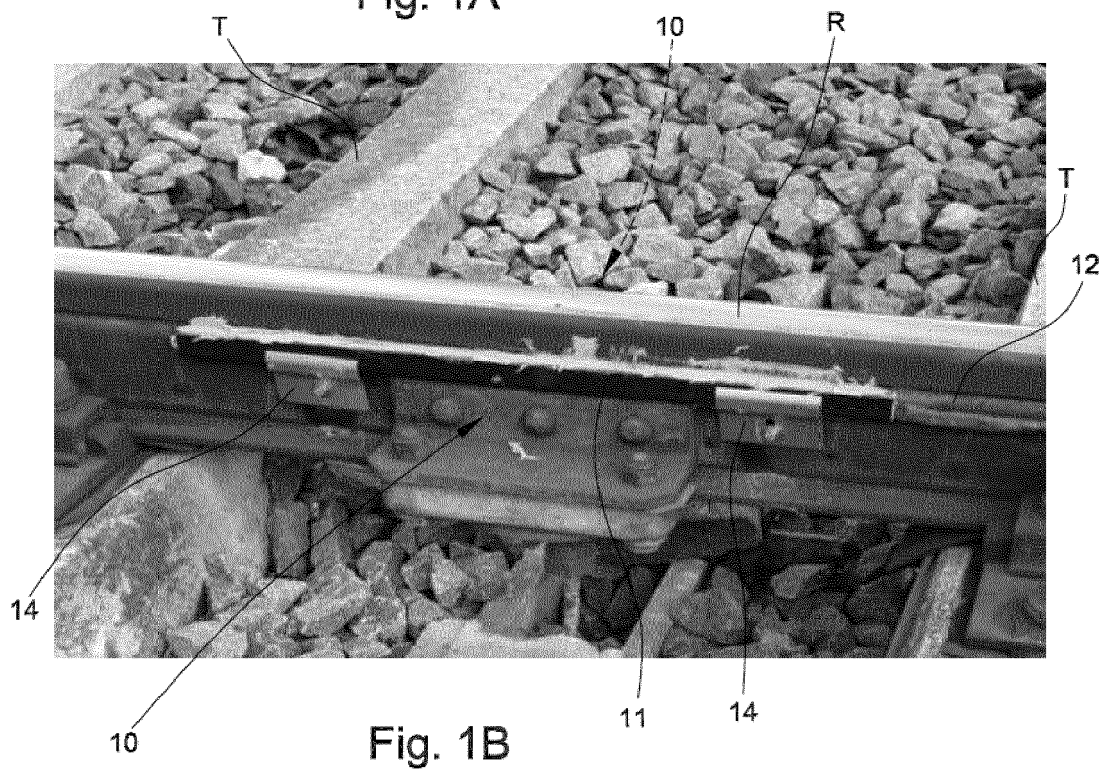
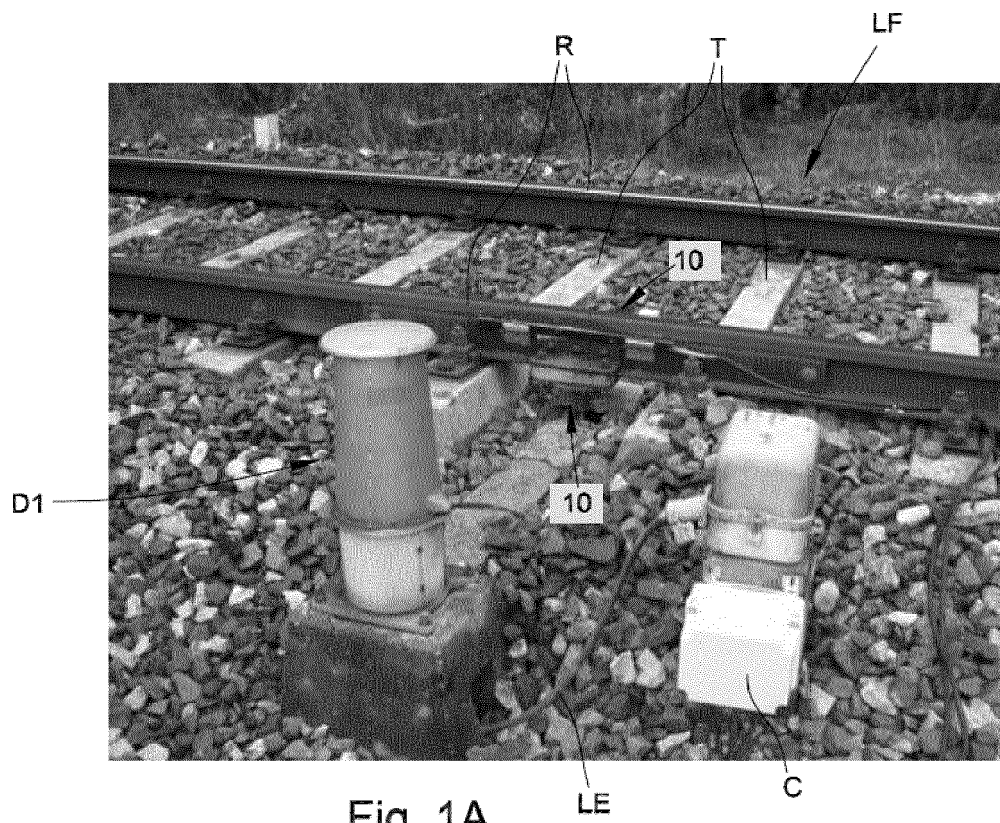
[0094] Naturally, without detriment to the basic concepts and principle of the present invention, the embodiments and the details of manufacture of the heating system, and of the relative embodiments, proposed here, may be widely varied with respect to what has been described hitherto and illustrated, without thereby departing from the scope of the same invention.

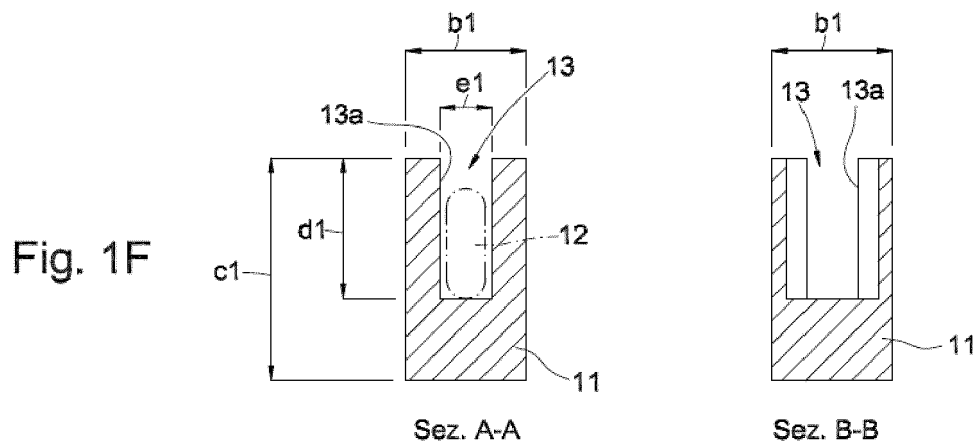
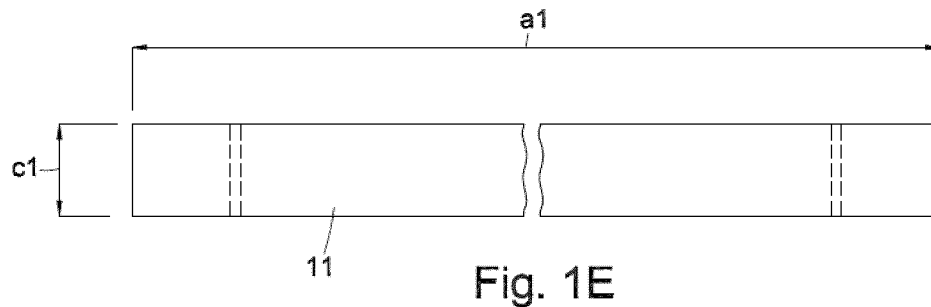
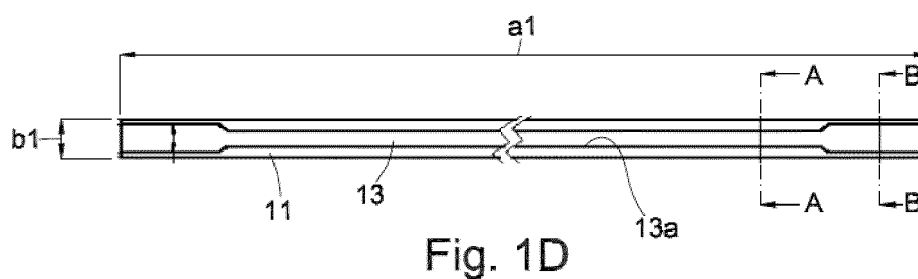
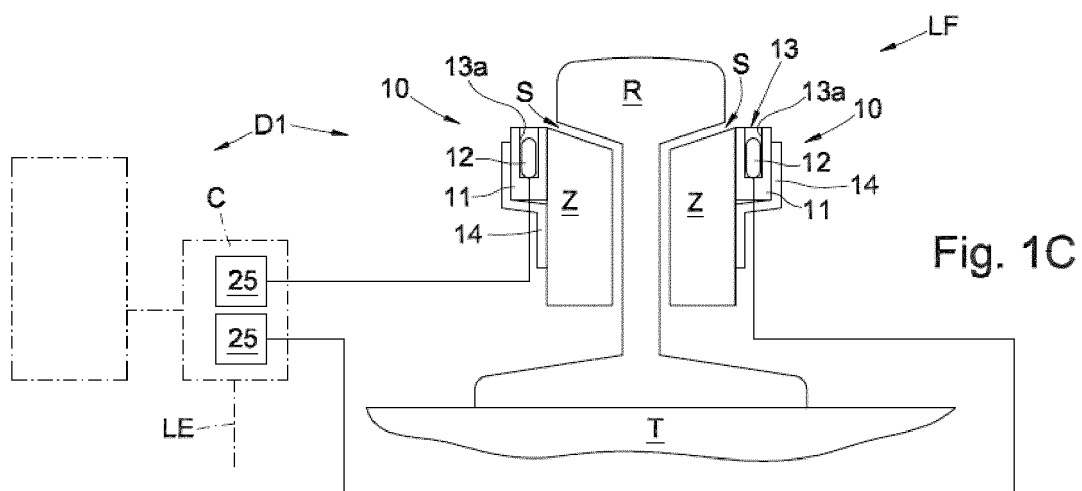
Claims

1. Heating system (10; 20; 30; 40) for protecting against climatic and environmental events, such as cold, frost and condensation, a series of control and/or safety devices installed along railway tracks, such as in particular control and release pedals, shunting switches, key transmitter devices and other similar devices, **characterised in that** it comprises:

- a diffuser body (11; 21; 31; 41), made of heat-conductive metal material, in particular brass; and
- at least one heating electric cable (12; 22; 32; 42), housed in a respective seat (13; 23; 33; 43) formed in said diffuser body (11; 21; 31; 41); wherein said heating electric cable (12; 22; 32; 42) is provided in order to be powered using the same equipment or the same electrical box that supplies the control and/or safety device (D1; D2; D3; D4) to be protected by means of said heating system (10; 20; 30; 40), and wherein said diffuser body (11; 21; 31; 41) is

- suitable for transmitting and diffusing the heat generated by said heating electric cable (12; 22; 32; 42), in order to keep warm and thereby protect against climatic and environmental events said corresponding control and/or safety device (D1; D2; D3; D4),
there being provided fastening means (14; 24; 34; 44) for fastening and firmly fixing the diffuser body (12; 22; 32; 42) of the heating system (10; 20; 30; 40), along the railway tracks, in the area of the corresponding control and/or safety device (D1; D2; D3; D4) to be heated and protected against climatic and environmental events.
2. Heating system (10; 20; 30; 40) according to claim 1, wherein said diffuser body (11; 21; 31; 41) has an elongated parallelepiped shape, with a substantially rectangular cross section, and said seat (13; 23; 33; 43) comprises at least one groove (13a; 23a; 33a; 43a) formed along one side and extending in the direction of the length of said elongated parallelepiped diffuser body (11; 21; 31; 41).
 3. Heating system (20; 30; 40) according to claim 2, wherein said seat (23; 33; 43) comprises a plurality of grooves (23a; 33a, 43a), substantially parallel, formed along one side and extending in the direction of the length of said diffuser body (21; 31; 41), wherein said heating electric cable is housed in said grooves (23a; 33a; 43a) according to a serpentine configuration.
 4. Heating system (10; 20; 30; 40) according to any one of the preceding claims, wherein said heating electric cable (12; 22; 32; 42) is of the Raychem type, self-regulating.
 5. Heating system specifically designed to protect against the problems related to environmental variables a P70 model pedal (D1), manufactured by the company Westinghouse,
characterised in that it comprises at least two heating systems (10) according to any one of claims 1 to 4, wherein the diffuser bodies (11) of the two heating systems (10) are each fixed, at opposite sides with respect to the rail (R) of the railway line, on a respective beam (Z) of the two beams that are associated with the bending sensor of said P70 model pedal (D1).
 6. Heating system according to claim 5, in that dependent on claim 2, wherein the diffuser body (11) of each of said two heating systems (10) is fixed on the respective beam (Z), with the side of the diffuser body (11), exhibiting said seat (13) and said groove (13a), facing and in contact with the beam (Z), and wherein said fastening means include one or more small plates (14) for fixing said diffuser body (11) on the beam (Z).
 7. Heating system (20; 30) according to claim 1, provided for protecting a SILEC Cautor model pedal with one arm (D2) or a SILEC Forflex model pedal with two arms (D3),
wherein said diffuser body (21; 31) has an elongated parallelepiped shape, with a substantially rectangular cross section,
wherein said seat (23; 33) is defined by a plurality of grooves (23a; 33a) which are formed on one side and extend in the direction of the length of the diffuser body (21; 31), and house one or more turns of said heating electric cable (22; 32) according to a serpentine configuration, and
wherein said fastening means comprise one or more bands (24; 34) suitable for being inserted in corresponding slots (26; 36), formed across the thickness of said diffuser body (21; 31), and for being tightened in order to fix said diffuser body (21; 31) on the rail (R) of the railway line.
 8. Heating system (40) according to claim 1, provided for protecting specifically an FS64 type LC box,
wherein said diffuser body (41) has an elongated parallelepiped shape,
wherein said seat (43) is defined by a plurality of grooves (43a) which are formed on one side and extend in the direction of the length of the diffuser body (21; 31), and house one or more turns of said heating electric cable (42) according to a serpentine configuration, and
wherein said fastening means comprise at least one screw (44) suitable for being inserted in a slot (46), formed in a lateral tongue (48) of the diffuser body (41), and for being tightened to fix said diffuser body (41) inside said FS64 type LC box.
 9. Heating system (20; 30; 40) according to any one of claims 5 to 8, wherein a profile (27; 47) of thermally insulating material, more particularly plastic, is provided for protecting the areas of the outer surface of the diffuser body (21; 31; 41) which do not have a function of irradiation and transmission of heat towards the device to be protected, so as to prevent unnecessary heat dispersions.
 10. Railway line (LF) comprising one or more control and/or safety devices (D1; D2; D3; D4) installed along the respective rail tracks, **characterised in that** it comprises one or more heating systems (10; 20; 30; 40), according to any one of the preceding claims, in order to heat and protect against climatic and environmental variables said one or more control and/or safety devices.





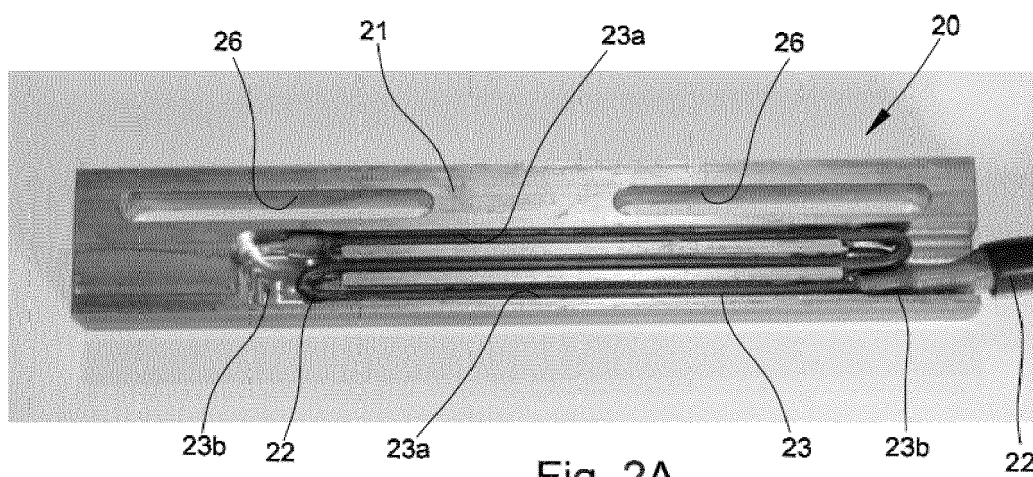


Fig. 2A

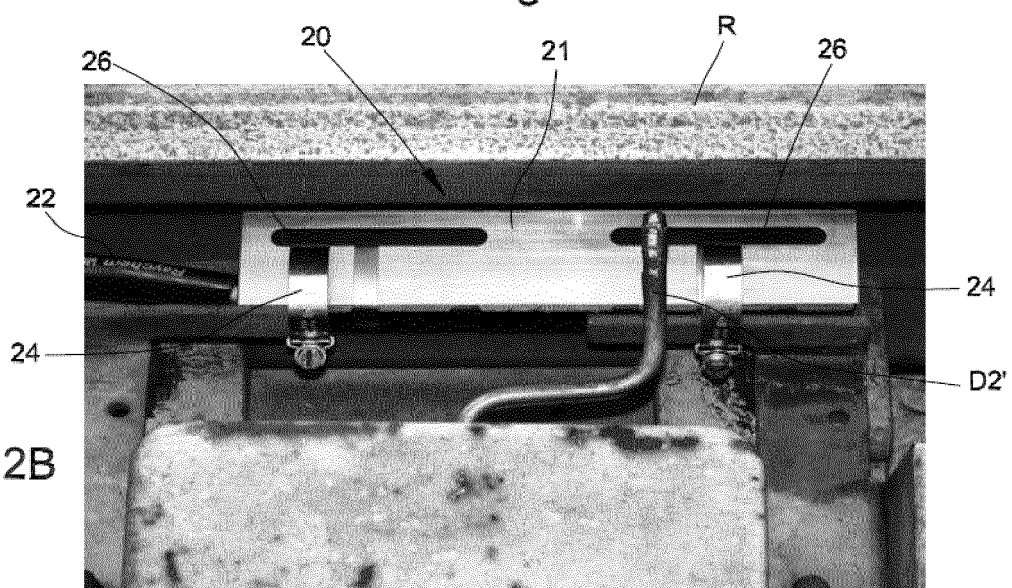


Fig. 2B

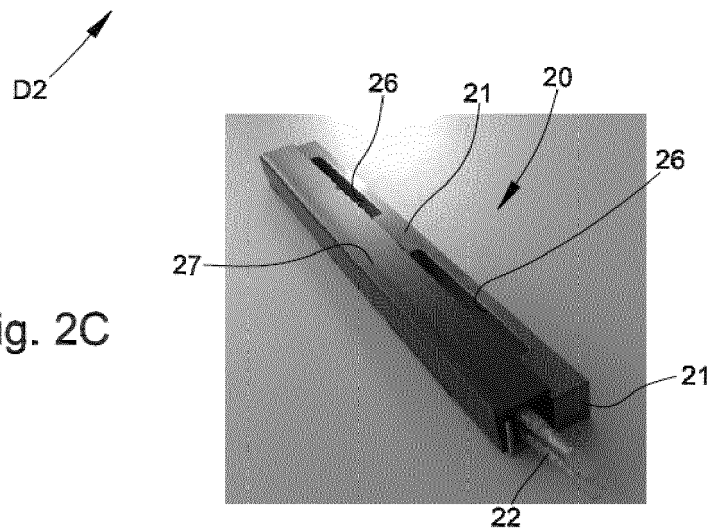


Fig. 2C

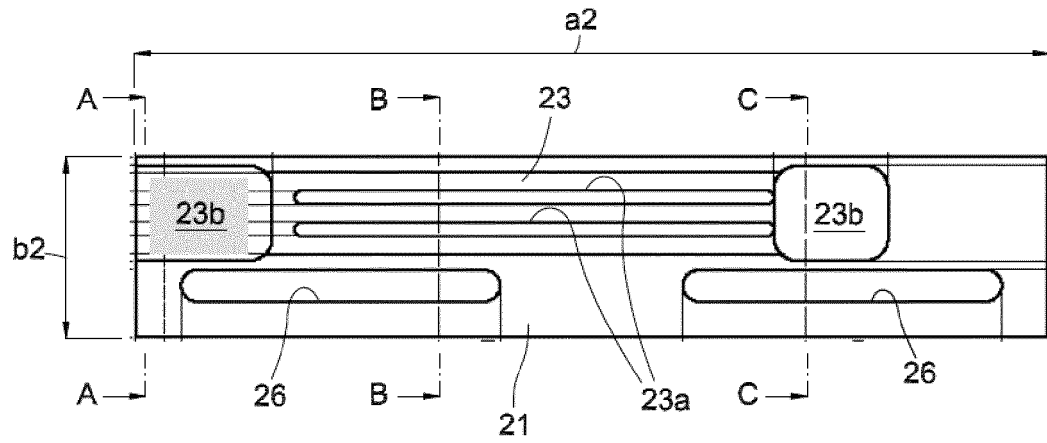


Fig. 2D

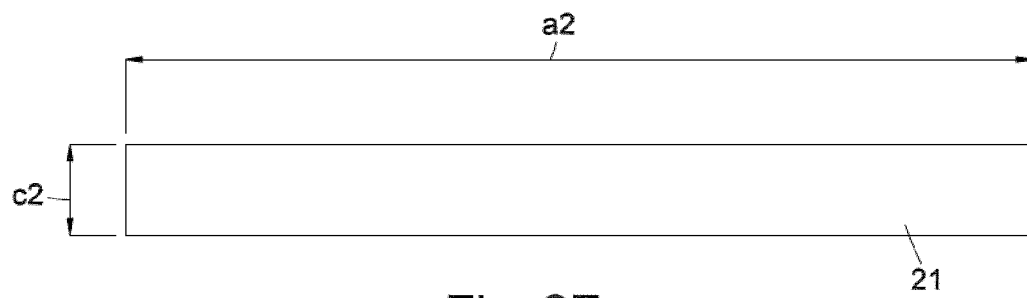


Fig. 2E

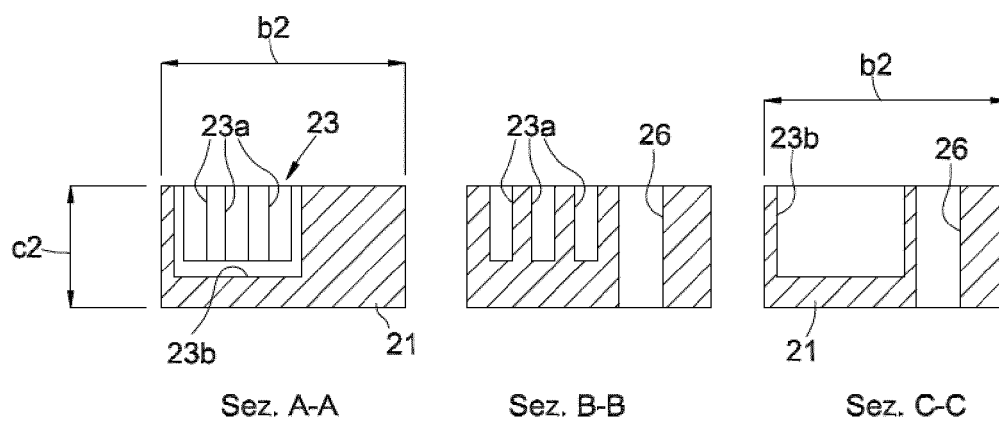


Fig. 2F

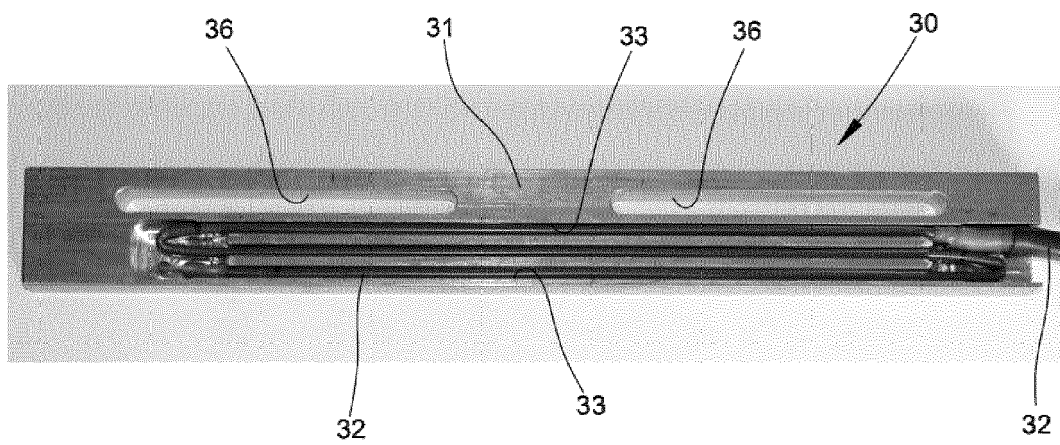


Fig. 3A

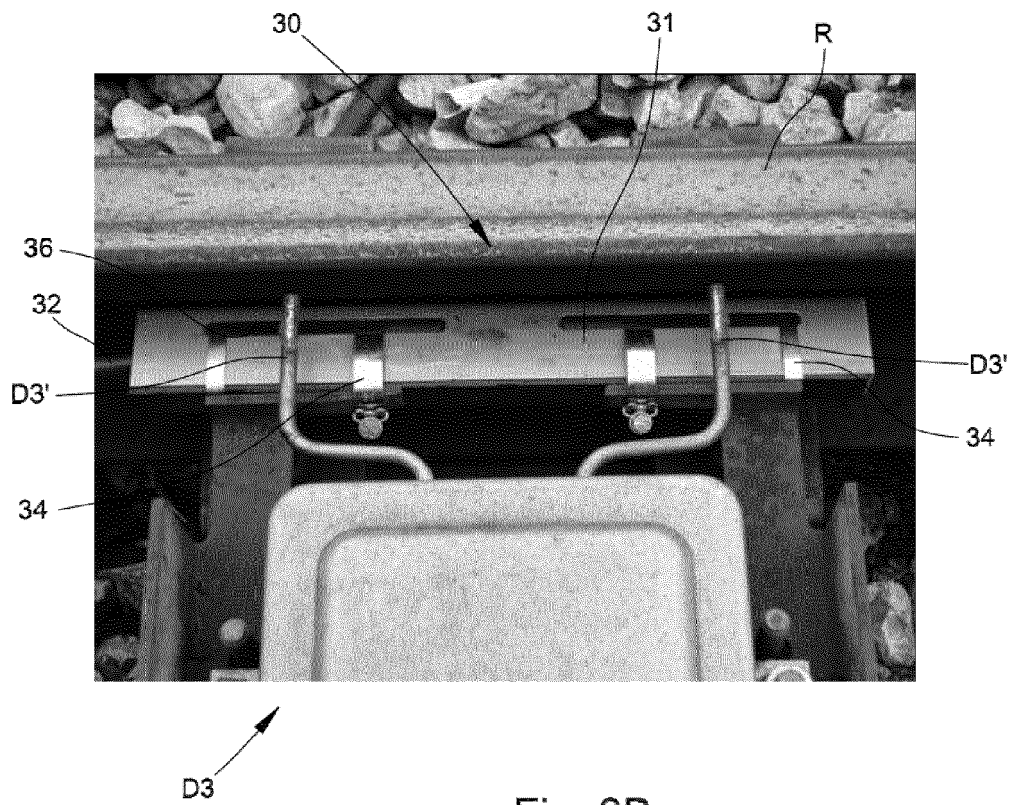


Fig. 3B

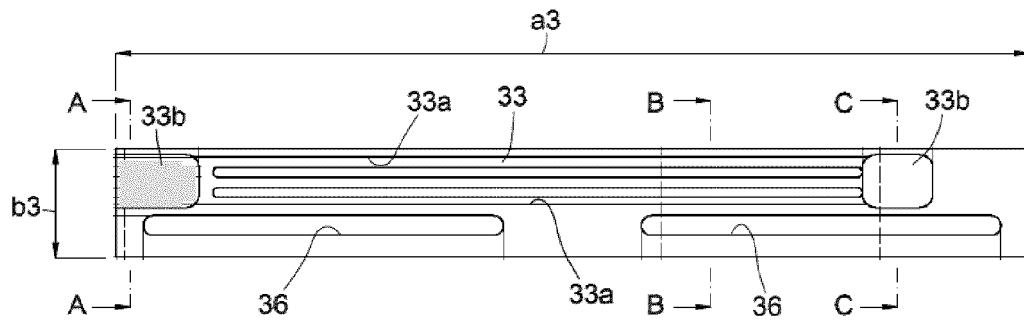


Fig. 3C

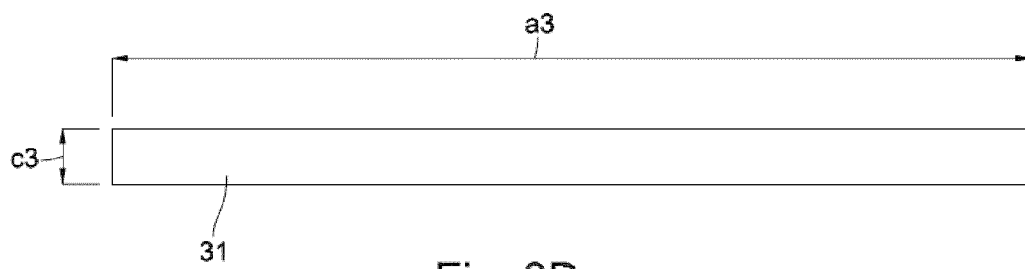


Fig. 3D

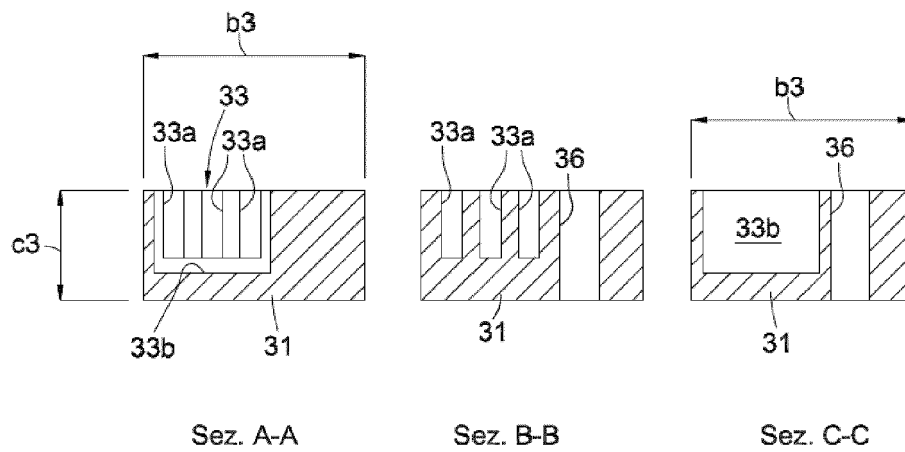


Fig. 3E

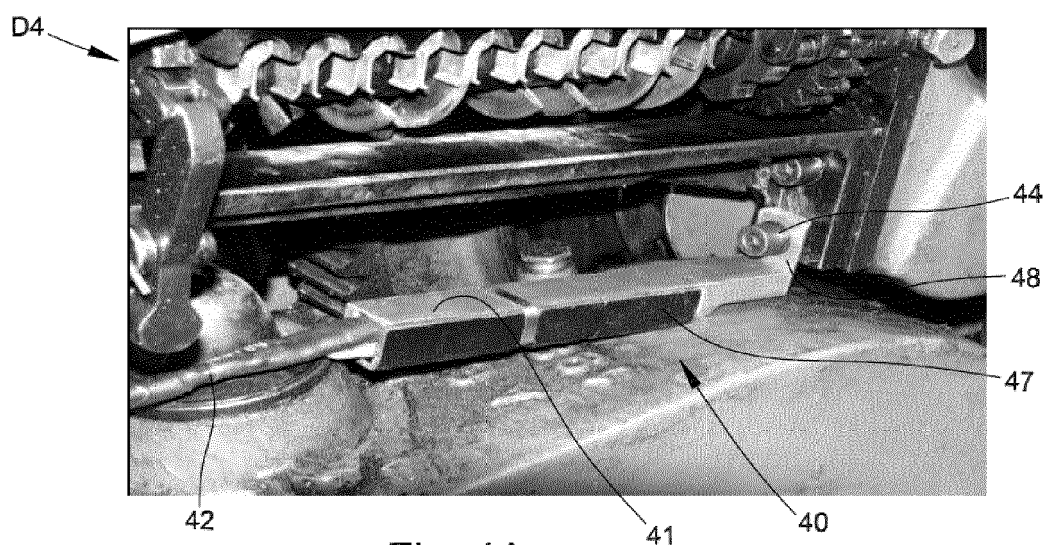


Fig. 4A

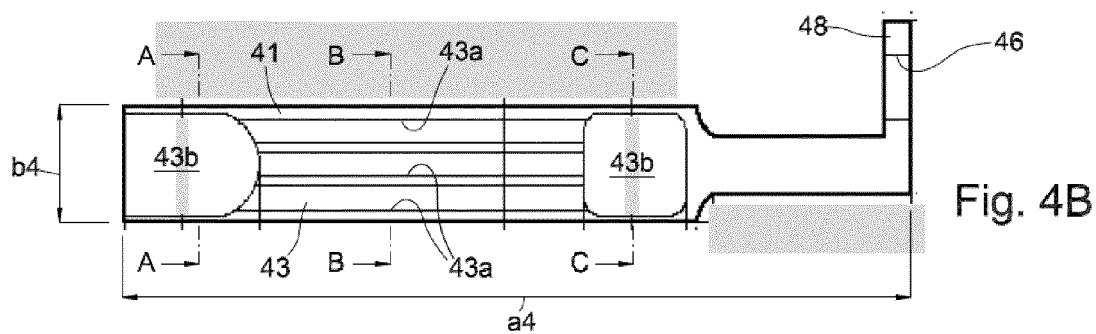


Fig. 4B

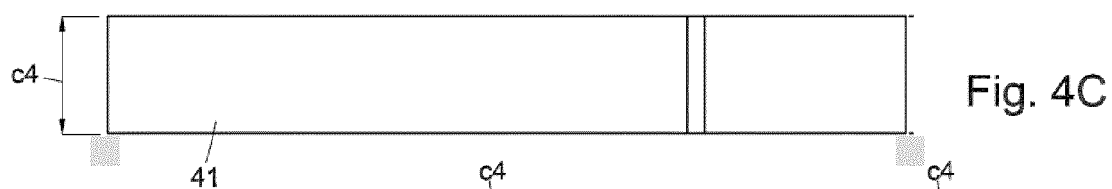


Fig. 4C

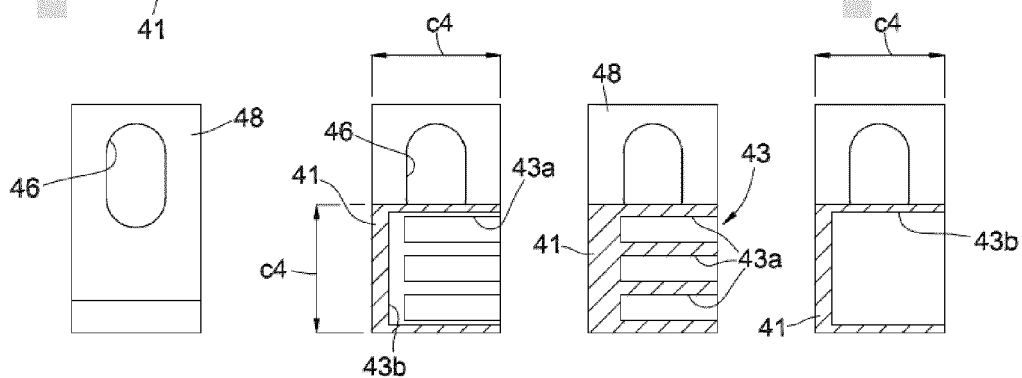


Fig. 4D

Sez. A-A

Sez. B-B

Sez. C-C



EUROPEAN SEARCH REPORT

Application Number
EP 12 17 9937

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 2001 295203 A (SHINYOSHA KK; ASAHI ELECTRIC WORKS LTD) 26 October 2001 (2001-10-26) * abstract; figures 1-5 *	1,2,10	INV. E01B7/24
A	DE 20 2006 013822 U1 (SCHARRENBROICH EUGEN [AT]) 9 November 2006 (2006-11-09) * page 2, paragraph 7-11; figure 1 *	1,2	
A	FR 2 231 176 A1 (AURAY DIDIER [FR]) 20 December 1974 (1974-12-20) * page 2, lines 12-18; figure 2 *	1,2	
A	WO 2010/142720 A1 (BALFOUR BEATTY PLC [GB]; MOHRICH JOERG [DE]; ZEISE WOLFRAM [DE]) 16 December 2010 (2010-12-16) * abstract; figures 1-3 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E01B
Place of search		Date of completion of the search	Examiner
Munich		8 November 2012	Fernandez, Eva
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 17 9937

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-11-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001295203 A	26-10-2001	JP 4226757 B2 JP 2001295203 A	18-02-2009 26-10-2001
-----	-----	-----	-----
DE 202006013822 U1	09-11-2006	AT 8836 U1 DE 202006013822 U1	25-01-2007 09-11-2006
-----	-----	-----	-----
FR 2231176 A1	20-12-1974	NONE	
-----	-----	-----	-----
WO 2010142720 A1	16-12-2010	DE 102010029854 A1 EP 2440706 A1 WO 2010142720 A1	16-12-2010 18-04-2012 16-12-2010
-----	-----	-----	-----