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(54) **METHOD FOR INSTALLATION OF AN EMBEDDED RAIL SYSTEM**

VERFAHREN ZUR INSTALLATION EINES EINGEBETTETEN SCHIENENSYSTEMS

PROCEDE D'INSTALLATION D'UN SYSTEME DE RAIL INTEGRE

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(73) Proprietor: **edilon)(sedra B.V.**
2031 CN Haarlem (NL)

(72) Inventors:
- **VAN DER HOUWEN, Gerrit, Marinus**
  NL-2023 EL Haarlem (NL)
- **SCHRAM, Willem, Paul**
  NL-2151 AC Nieuw-Vennep (NL)

(74) Representative: **Brookhuis, Hendrik Jan Arnold**
Exter Polak & Charlouis B.V. (EP&C)
P.O. Box 3241
2280 GE Rijswijk (NL)

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Description

[0001] The present invention relates to a method for installation of an embedded rail system, wherein a railway track support structure has an elongated open-topped channel and wherein a steel rail of a railway track is positioned in the channel. The method comprises the step of pouring a pourable resilient compound which cures over time in the channel with the rail and remains elastic when cured, the compound then bonding to the rail and in cured state providing continuous vertical and horizontal support to the rail.

[0002] Such embedded rail systems (ERS) are generally known in the field of railway tracks for e.g. train, tram, metro, crane and other railbound vehicle applications. Often polyurethane based elastomeric compounds are used to obtain the required resilient behaviour as well as provide a reliable connection of the rail to the railway track support structure in the absence of other connection members. The embedded rail system is for instance found in level crossings and (steel) bridges.

[0003] In the prior art approach the installation of such an embedded rail system often involved the preparation of the outer surface of the steel rail that were to be bonded to the compound by application of a primer on the steel surface. The purpose of the primer is to establish a chemical bond with the curing compound, based on polymerisation. When done properly a very strong and reliable bond is obtained in this manner.

[0004] In situ installation of such an embedded rail system could however give rise to practical problems, often compounded by the fact that installation has to be done in a short time, e.g. during the night when work is done on an existing track. Problems are e.g. encountered when working in wet, moist and/or dust/dirt-laden conditions. Such conditions are bound to have a detrimental effect on the primer, with the result that no bond or an insufficient bond with the compound is obtained. Protocol may even prohibit that the compound is actually poured under certain conditions thus causing undesirable problems such as the availability of the track for railway services. A delay in pouring the compound may then result in the primer become inactive over time, requiring that a new layer of primer is applied.

[0005] EP 1400 628 shows an elastomer sheath embeded in a concrete bed. There is no binding between the sheath and the bed in the sense of the present invention.

[0006] It is an object of the present invention to overcome or at least alleviate the above-mentioned installation problems.

[0007] The present invention achieves this aim by providing a method according to the preamble of claim 1, wherein- prior to the pouring of the resilient compound - an anchoring sheet is attached directly to the rail, the anchoring sheet having a multitude of anchoring formations, so that upon curing of the compound a mechanical interlock is obtained with the cured compound.

[0008] The attachment of an anchoring sheet to the rail can be done in situ, but it is preferred to attach the anchoring sheet at a remote location (preferably indoors in a controlled environment) e.g. in a tent close to the railway track or a remote specialized factory.

[0009] Attaching such an anchoring sheet can e.g. be done with an adhesive applied between the anchoring sheet and the steel surface of the rail and is generally less critical then the application of the primer as in the prior art method.

[0010] In fact, if moisture or water is present on the anchoring sheet, the compound is likely to expel most of the moist/water in upward direction as the level of the compound in the channel rises during the pouring step. Of course it is advisable to remove dirt and dust from the anchoring sheet prior to the pouring, e.g. by a high-pressure spraying with a water and/or air pistol. Any water left in the anchoring sheet, possibly due to the high-pressure treatment, is preferably removed from the installation site prior to the pouring, e.g. using a blower.

[0011] Preferably anchoring sheets are at least attached to opposed side surfaces of the rail. This ensures adequate bonding to resist vertical rail motion, also including uplift of the rail.

[0012] Preferably the rail has a rail head, a vertical web, and a foot broader than the vertical web, and anchoring sheets are attached to at least the opposed side surfaces of the vertical web, preferably also to at least the upper surface of the foot.

[0013] It is also possible that anchoring sheets are attached so as to extend over the side surfaces of the rail head, or such that these sheets only extend over the side surfaces of the rail head. In the latter embodiment it can be envisaged that void forming members, also known as filling members, such as relatively lightweight (e.g. cellular foam) members are placed against the side faces of the rails below the rail head.

[0014] In general the provision of the anchoring sheets on the rail will serve to avoid release of the compound from the rail, and thus avoid problems associated with the ingress of water.

[0015] It is envisaged that the anchoring sheet can be attached to the rail with an adhesive. Suitable adhesives, e.g. epoxy, are less sensitive to conditions during application than the primer used in the prior art approach.

[0016] The adhesive for attachment of the anchoring sheet could be an adhesive tape, possibly the adhesive tape having two opposed adhesive sides. Such a tape could be attached to the anchoring sheet prior to attachment of the sheet to the rail (or support structure as will be explained below). The adhesive side could be covered by a removable liner sheet, so that the adhesive is only exposed shortly before attachment of the anchoring sheet.

[0017] As will be explained with reference to a possible embodiment the step of attaching the anchoring sheet to the rail could well be performed at a location remote from the railway track, preferably indoors. Also the attachment

could be performed more than 24 hours before pouring of the compound.

[0018] The anchoring sheet could be so flexible that it is supplied from a roll, thereby facilitating installation of the system.

[0019] The anchoring sheet could be a multilayer sheet, e.g. having multiple layers (woven and/or non-woven) with openings therein allowing the compound to penetrate into and between the layers thus effecting the mechanical interlock. Geotextiles are available with such a structure.

[0020] In a possible embodiment the anchoring sheet is a sheet with hooks and/or loops similar to a hook-and-loop fastener system. In fact it is envisaged that sheet nowadays marketed as hook-and-loop fasteners for e.g. clothing are suitable for use in the present method. A well known alternative is the hook-and-mushroom fastener system, wherein a sheet is provided with hooks and the other sheet with mushroom members, that may also be applied in the present invention.

[0021] Preference is given to an anchoring sheet provided with looped anchoring formations, e.g. plastic loops. The loops may be small, e.g. extending between 1 and 5 millimetres from a backing layer.

[0022] In a possible embodiment the anchoring sheet comprises a backing layer (e.g. of a plastic material) that is provided with a multitude of protruding anchoring members at the side facing away from the rail.

[0023] It is possible that the entirety of the anchoring sheet is of suitable plastic, e.g. PA, PE, PP, EVA.

[0024] In another possible embodiment the anchoring sheet is a metallic sheet.

[0025] It can be envisaged that an elastic mat is placed under the rail prior to the pouring of the compound, but in another configuration there is an open space below the rail which is then filled with the compound.

[0026] In a practical embodiment, e.g. seen at level crossings, one or more void forming members are positioned in the channel. Such member can e.g. be tubes that allow the passage of an (electric) cable there through, which tubes are preferably positioned in the channel spaced a distance from the rail with the anchoring sheet prior to the pouring of the compound. When arranged spaced from the rail the void forming members do not interfere with the bonding of the compound to the anchoring sheet.

[0027] As is known in the art the railway track support structure could be a concrete slab, e.g. a level crossing slab.

[0028] In another embodiment the railway track support structure is a bridge, e.g. a steel bridge.

[0029] In a preferred embodiment the compound is a polyurethane based compound.

[0030] In a highly preferred embodiment one or more further anchoring sheets with a multitude of anchoring formations have been attached on the surface of the channel in the railway track structure prior to the pouring of the compound. This is done to establish a mechanical bond between the cured compound and the channel surface(s) of the track structure.

[0031] In a possible embodiment the channel is made of metal, e.g. by a metal channel member supported by a concrete structure (such as a slab), or by the entire support structure being made of metal, e.g. a steel bridge. An anchoring sheet could be attached to the channel in the manner described with respect to the attachment of an anchoring sheet to the rail, e.g. using an epoxy adhesive.

[0032] In another practical embodiment the support structure or a channel member of said support structure is made of concrete, so that the surface of the channel is of concrete. An anchoring sheet can be attached to the concrete by suitable attachment means, e.g. using an adhesive such as epoxy.

[0033] In a highly preferred embodiment the railway track support structure is a concrete support structure that has been cast using a suitable formwork or mould, wherein a double-sided anchoring sheet is used which is to be attached to the concrete, which anchoring sheet has a central layer that is substantially impenetrable for the liquid concrete and on opposed sides thereof is provided with a multitude of anchoring formations.

[0034] The double-sided anchoring sheet is then mounted to the surface of the formwork or mould defining the channel, so that upon casting of the concrete, the anchoring formations on the side facing away from the formwork or mould establish a mechanical bond with the concrete. Upon removal of the formwork or mould the side with anchoring formations facing away from the concrete is exposed, so that upon pouring the resilient compound into the channel with the rail a mechanical interlock of the compound with the concrete is obtained via said double-sided anchoring sheet.

[0035] The present invention also relates to an embedded rail system, wherein a railway track support structure has an elongated open-topped channel and wherein a steel rail of a railway track is positioned in the channel, and wherein a pourable resilient compound which cures over time in the channel with the rail is bonded to the rail and provides continuous vertical and horizontal support to the rail, which is characterised in that an anchoring sheet is attached directly to the rail, the anchoring sheet having a multitude of anchoring formations, so that a mechanical interlock is obtained with the cured compound.

[0036] The present invention also relates to a steel rail for use in an embedded rail system, wherein a railway track support structure has an elongated open-topped channel and wherein the steel rail is to be positioned in the channel, and wherein a pourable resilient compound which cures over time is to be poured in the channel with the rail so that the compound is bonded to the rail and provides continuous vertical and horizontal support to the rail, characterized in that an anchoring sheet is attached directly to the rail, the anchoring sheet having a multitude of anchoring formations, so that a mechanical interlock is obtained with the cured compound.

[0037] The present invention also relates to a level crossing of a railway track system comprising one or more concrete slabs provided with parallel elongated open-topped channels and wherein a steel rail is positioned in each channel, and wherein a pourable resilient compound which cures over time is poured in each channel with the rail so that the compound is bonded to the rail and provides continuous vertical and horizontal support to the rail, characterized in that an anchoring sheet is attached directly to the rail, the anchoring sheet having a multitude of anchoring formations, so that a mechanical interlock is obtained with the cured compound.

[0038] The invention also relates to a method for installation of an embedded rail system as in claim 23, wherein a railway track support structure has an elongated open-topped channel and wherein a steel rail of a railway track is positioned in the channel, and wherein the method comprises the step of pouring a pourable resilient compound which cures over time in the channel with the rail, the compound then bonding to the rail and in cured state providing continuous vertical and horizontal support to the rail, characterised in that - prior to the pouring of the resilient compound - an anchoring sheet is attached directly to one or more surfaces of the channel in the railway track support structure, the anchoring sheet having a multitude of anchoring formations, so that upon curing of the compound a mechanical interlock is obtained with the cured compound.

[0039] The present invention also relates to a railway track support structure having an elongated open-topped channel to receive therein a steel rail of a railway track to form an embedded rail system, wherein a pourable resilient compound which cures over time will be poured in the channel with the rail, the compound then bonding to the rail and in cured state providing continuous vertical and horizontal support to the rail, which railway track support structure is characterised in that - prior to the pouring of the resilient compound - an anchoring sheet is attached directly to one or more surfaces of the channel in the railway track support structure, the anchoring sheet having a multitude of anchoring formations, so that upon curing of the compound a mechanical interlock is obtained with the cured compound.

[0040] It will be appreciated that the installation of the embedded rail system can also involve the use of one or more temporary mould members to form the channel or part of the channel into which the compound is poured. After curing of the compound the one or more temporary mould members are removed and the permanent railway track support structure is compteted.

[0041] Further preferred embodiments of the method and other aspects of the invention are disclosed in the appended claims and in the description with reference to the drawings. In the drawings:

Figures 1 a, 1 b shows schematically in cross-section an example of a railway track support structure and a rail to form an embedded rail system prior to and after the pouring of the compound,

Figure 2 an enlarged exemplary detail of figure 1,

Figure 3 an enlarged exemplary detail of figure 1,

Figure 4 in a view corresponding to figure 1 a further example of an embedded rail system according to the invention,

Figures 4a-f possible embodiments of the anchoring sheet on a larger scale,

Figure 5 in a view corresponding to figure 1 a yet another example of an embedded rail system according to the invention, wherein the channel is made of steel,

Figure 6 in a view corresponding to figure 1 a yet another example of an embedded rail system according to the invention, wherein the channel is made of steel,

Figures 7, 8 illustrate a method for attachment of an anchoring sheet to a concrete railway support structure according to the invention,

Figure 9 in a view corresponding to figure 1 a yet another example of an embedded rail system according to the invention, wherein the channel is made of concrete.

[0042] Figures 1 a and 1 b show an example of a portion of a railway track support structure 1 which has an elongated open-topped channel 2, here a concrete slab, such as a level-crossing concrete slab. Often a slab is provided with two or more parallel channels 2.

[0043] Also shown is a steel rail 10 of a railway track which is positioned in the channel 2 so as to be spaced from the side faces of the channel 2 and here also from the bottom face of the channel 2.

[0044] The rail shown as an example here has a rail head 10a, a vertical web 10b, and a foot 10c that is broader than the vertical web 10b.

[0045] Anchoring sheets 20 have been attached to opposed surfaces of the rail 10, here so as to extent over all or at least the major part of the vertical web 20, and as is preferred also over at least the upper surfaces of the foot 10c. The anchoring sheets 20 each have a multitude of anchoring formations of which examples will be elucidated in more detail below.

[0046] In order to arrive at the embedded rail system a pourable resilient compound which cures over time is then poured into the channel 2 with the rail 10 therein. As the compound cures a mechanical interlock is obtained between the anchoring sheets 20 and the cured compound 30. In general, the anchoring sheets 20 transmit forces from the rail 10 via the cured compound to the railway track support structure 2. Such forces may be horizontal, vertical and/ or longitudinal forces.

[0047] The compound remains elastic when cured and provides continuous vertical and horizontal resilient support to the rail.

[0048] The anchoring sheet 20 is shown by way of example in figure 3 and here includes a backing layer 21 that is provided with a multitude of protruding anchoring

members 22 at the side facing away from the rail 10. The backing layer 21 can be a plastic material, or alternatively a textile layer. The anchoring members 22 could also be of plastic material.

[0049] The entirety of the anchoring sheet 20 could be of suitable plastic, e.g. PA,PE,PP,EVA,etc. It can also be envisaged that high-strength fibres are included in the sheet 20.

[0050] The anchoring sheet 20 could be a sheet with hooks and/or loops similar to a hook-and-loop fastener system.

[0051] Preferably the anchoring sheet is attached to the rail with an adhesive.

[0052] The step of attaching the anchoring sheet to the rail is preferably performed at a location remote from the railway track, preferably indoors. One could envisage that a railway level-crossing is made or renovated by preparing (remote from the site of the level-crossing) a new section of rail to which the anchoring sheet(s) are attached. Said new section is then brought to the site and placed in the channel (from which an old rail section may have been removed), after which the compound is poured in the channel and allowed to cure.

[0053] The anchoring sheet can be rather thin and flexible, allowing the anchoring sheet to be supplied in a roll.

[0054] Although not preferred it can be envisaged that the anchoring sheet is a metallic sheet.

[0055] In a preferred embodiment the compound is a polyurethane based compound.

[0056] As can be seen in figures 1 a, 1 b and 2 one or more further anchoring sheets 40 have been attached on the surface of the channel 2 in the railway track structure 1 prior to the pouring of the compound.

[0057] As in this example the structure 1 is made of concrete one could envisage that the sheets 40 are attached with a suitable adhesive to the concrete. The same is possible if the channel was made of metal.

[0058] Figure 4 show another example of a portion of a railway track support structure 101 which has an elongated open-topped channel 102, here a concrete slab similar to the slab shown in fig. 1.

[0059] Also shown is a steel rail 110 of a railway track which is positioned in the channel 102 so as to be spaced from the side faces of the channel 102 and here also from the bottom face of the channel 102. In the shown embodiment a pourable resilient compound which cures over time has already been poured into the channel 102 with the rail 110 therein. The cured compound is indicated with reference number 130.

[0060] The rail 110 shown as an example here is a so-called grooved rail having a groove 100d in a rail head 110a, and further comprising a vertical web 110b and a foot 110c, substantially broader than the vertical web 110b.

[0061] As is known in the art an elastic mat 150 is in this embodiment placed under the rail 110 in the channel 102 of concrete 101 prior to the pouring of the compound 130.

[0062] Anchoring sheets 120 have been attached to opposed surfaces of the rail head 110a, extending over the side surfaces of the rail head 110a. The anchoring sheets 120 have a multitude of possible anchoring formations, examples of which are shown in figures 4a, 4b and 4c. Resilient members 135 are placed against the side faces of the vertical web 100b of the rail.

[0063] Further anchoring sheets 140 are attached with a suitable adhesive to the upper region of elongated open-topped channel 102 of the concrete railway track support structure 101. The anchoring sheets 140 have a multitude of possible anchoring formations, examples of which are shown in figures 4d, 4e and 4f.

[0064] The anchoring sheets 120 and 140 hereby in particular prevent the intrusion of water or the like between the rail 110 and the cured compound 130 and between the concrete 101 and the cured compound. This contributes to the life time of the embedded rail system as it prevents corrosion of the rail by preventing moisture to contact the steel rail 110. It also prevents the built up of large water pressures which may result in damage of the concrete. Such water pressures may occur when trains cross a water inclusion between the cured compound 130 and the concrete 101.

[0065] Figures 4a, 4b, 4c, 4d show possible embodiments of the anchoring sheet 120 attached to the rail head 110a on a larger scale. All figures show a portion of the rail 110 to which a backing layer 121 of an anchoring sheet 120 is attached with a multitude of protruding anchoring members at the side facing away from the rail 110. Figure 4a shows protruding anchoring members 122 in a mushroom shape, figure 4b shows hook-shaped protruding anchoring members 123, figure 4c shows loop-shaped protruding anchoring members 124 and figure 4d shows a textile mat 125 forming protruding anchoring members.

[0066] Analogously, figures 4e, 4f, 4g, 4h show possible embodiments of the anchoring sheet 1-40 attached to the concrete 101 on a larger scale. All figures show a portion of the concrete 101 to which a backing layer 141 of an anchoring sheet 140 is attached with a multitude of protruding anchoring members at the side facing away from the concrete 101. Figure 4e shows protruding anchoring members 142 in a mushroom shape, figure 4f shows hook-shaped protruding anchoring members 143, figure 4g shows loop-shaped protruding anchoring members 144, and figure 4h shows a textile mat 145 forming protruding anchoring members.

[0067] In figure 5 yet another example of an embedded rail system 201 according to the invention is shown, which has an elongated open-topped channel 202 formed by a channel member, here a channel member made of steel. Also shown is a steel rail 210 of a railway track which is positioned in the channel 202 so as to be spaced from the side faces of the channel 202 and here also from the bottom face of the channel 202. As is known in the art an elastic mat 250 is in this embodiment placed under the rail 210 in the channel 202 of steel 201 prior to the

pouring of a compound 130. In the shown embodiment a pourable resilient compound which cures over time has already been poured into the channel 202 with the rail 210 therein. The cured compound is indicated with reference number 230.

[0068] The rail 210 shown as an example here has rail head 210a, and further comprising a vertical web 210b and a foot 210c, substantially broader than the vertical web 210b. Void forming members 235 are positioned in the channel spaced a distance from the side faces of the vertical web 210b of the rail prior to the pouring of the compound 230. Such void forming members are known in the art and are formed e.g. by tubes that allow the passage of an (electric) cable there through.

[0069] In the embodiment of the embedded rail system of fig. 5 anchoring sheets 240 are attached with a suitable adhesive to the upper regions of the elongated open-topped channel 202 of the steel concrete railway track support structure 201. The anchoring sheets 240 may have any possible anchoring formations, e.g. one of the formations shown in figs. 4d, 4e and 4f. Due to the anchoring formations upon curing of the compound a mechanical interlock is obtained with the cured compound 230. In this embodiment, no further anchoring sheets attached to the rail are provided.

[0070] In figure 6 in a view corresponding to figure 1 a yet another example of an embedded rail system 301 according to the invention is shown, which has an elongated open-topped channel 302 formed by a channel member made of steel. Also shown is a steel rail 310 of a railway track which is positioned in the channel 302 so as to be spaced from the side faces of the channel 302 and here also from the bottom face of the channel 302. As is known in the art an elastic mat 350 is in this embodiment placed under the rail 310 in the channel 302 of steel 301 prior to the pouring of a pourable resilient compound (not shown).

[0071] The rail 310 shown as an example here has rail head 310a, and further comprising a vertical web 310b and a foot 310c, substantially broader than the vertical web 310b. Void forming members 335 are placed at a distance from the side faces of the vertical web 310b of the rail prior to the pouring of the compound.

[0072] In the embodiment of the embedded rail system of fig. 6 anchoring sheets 340 are attached with a suitable adhesive to the upper regions of the elongated open-topped channel 302 of the steel concrete railway track support structure 301. The anchoring sheets 340 may have any possible anchoring formations, e.g. one of the formations shown in figs. 4d, 4e and 4f.

[0073] Figures 7, 8 illustrate a method for attachment of an anchoring sheet to a concrete railway support structure 401 according to the invention. The railway track support structure 401 is a concrete support structure that has been cast using a suitable formwork or mould 402.

[0074] A double-sided anchoring sheet 403 is used which is to be attached to the concrete 401. The double-sided anchoring sheet 403, as shown in detail in fig. 8, has a central layer 410 that is substantially impenetrable for the liquid concrete. On opposed sides thereof a multitude of anchoring formations, in this embodiment loops 411, 412 are provided. The double-sided anchoring sheet 403 is mounted to the surface of the mould defining the channel 402. In the embodiment shown the mould 402 is provided with anchoring hooks 404, to which the loops 412 of the double-sided anchoring sheet 403 are attached via a conventional hook-loop connection.

[0075] Upon casting of the concrete 401, the anchoring formations 411 on the side facing away from the mould 402 establish a mechanical bond with the concrete 401.

[0076] Upon removal of the mould 402, in this embodiment by releasing the hooks 404 on the mould 402 from the loops 412 of the double-sided anchoring sheet 403, the side with anchoring formations 412 facing away from the concrete 401 is exposed.

[0077] Upon subsequent pouring of a pourable resilient compound which cures over time in the channel created by removal of the mould 402, in which channel a rail is to be positioned, a mechanical interlock of the loops 412 with the compound (not shown) is obtained, and thus a mechanical interlock of the compound (not shown) with the concrete 401 is obtained via said double-sided anchoring sheet 403.

[0078] In fig. 9 in a view corresponding to figure 1 a yet another example of an embedded rail system 500 according to the invention is shown. A dedicated track support structure 502 has an elongated open-topped concrete channel 503 wherein a steel rail 501 suitable for guiding buses is positioned. For bus guidance systems frequently only a single rail 501 and channel 502 is provided, positioned in the middle of the road (not shown).

[0079] The steel rail shown in fig. 9 has a rail head 501 a, a vertical web 501 b and a foot 501 c, which foot 501 c is much broader than the vertical web 501 b.

[0080] Anchoring sheets 520 have been attached to opposed surfaces of the rail 501, here so as to extent over all or at least the major part of the upper surface of the foot 501 c, and over the bottom surface of the foot 501 c, and also over part of the vertical web 501 b. The anchoring sheets 520 each have a multitude of anchoring formations of which examples are elucidated above.

[0081] In order to arrive at an embedded rail system a pourable resilient compound which cures over time is poured into the channel 503 with the rail 501 therein. As the compound cures a mechanical interlock is obtained between the anchoring sheets 520 and the cured compound 504. The compound 504 remains elastic when cured and provides continuous vertical, horizontal and longitudinal support to the rail 501.

[0082] Further anchoring sheets 540 have been attached on the surface of the channel 503 in the dedicated track support structure 502 prior to the pouring of the compound. The anchoring sheets 540 each have a multitude of anchoring formations of which examples are elucidated above.

Claims

1. Method for installation of an embedded rail system, wherein a railway track support structure has an elongated open-topped channel and wherein a steel rail of a railway track is positioned in the channel, and wherein the method comprises the step of pouring a pourable resilient compound which cures over time in the channel with the rail, the compound then bonding to the rail and remaining elastic when cured and in cured state providing continuous vertical and horizontal support to the rail,
characterised in that - prior to the pouring of the resilient compound - an anchoring sheet is attached directly to the rail, the anchoring sheet having a multitude of anchoring formations, so that upon curing of the compound a mechanical interlock is obtained with the cured compound.

2. Method according to claim 1, wherein the rail has vertical surfaces, and wherein anchoring sheets are attached to said vertical surfaces.

3. Method according to claim 2, wherein the rail has a rail head, a vertical web, and a foot broader than the vertical web, and wherein anchoring sheets are attached to at least the opposed surfaces of the vertical web, preferably also to at least the upper surface of the foot.

4. Method according to one or more of the preceding claims, wherein an anchoring sheet is attached to the rail with an adhesive.

5. Method according to one or more of the preceding claims, wherein the step of attaching the anchoring sheet to the rail is performed at a location remote from the railway track, preferably indoors.

6. Method according to one or more of the preceding claims, wherein the anchoring sheet is supplied from a roll.

7. Method according to one or more of the preceding claims, wherein the anchoring sheet is a sheet with hooks and/or loops similar to a hook-and-loop fastener system.

8. Method according to one or more of the preceding claims, wherein the anchoring sheet comprises a backing layer that is provided with a multitude of protruding anchoring members at the side facing away from the rail.

9. Method according to one or more of the preceding claims, wherein the anchoring sheet is a plastic sheet (PA,PE,PP,EVA,etc).

10. Method according to one or more of the preceding claims, wherein an elastic mat is placed under the rail prior to the pouring of the compound.

11. Method according to one or more of the preceding claims, wherein the railway track support structure is a concrete slab, e.g. a level crossing slab, preferably a monolithic level crossing slab.

12. Method according to one or more of the preceding claims, wherein one or more further anchoring sheets are attached on the surface of the channel in the railway track support structure prior to the pouring of the compound.

13. Method according to one or more of the preceding claims, wherein the railway track support structure includes a channel member delimiting the channel.

14. Method according to one or more of the preceding claims 1-12, wherein the railway track support structure is a concrete support structure that is cast using a suitable formwork or mould, and wherein a double-sided anchoring sheet is used which is to be attached to the concrete, which has a central layer that is substantially impenetrable for the liquid concrete and on opposed sides thereof is provided with a multitude of anchoring formations, and wherein said double-sided anchoring sheet is mounted to the surface of the formwork or mould defining the channel, so that upon casting of the concrete, the anchoring formations on the side facing away from the formwork or mould establish a mechanical bond with the concrete, and so that upon removal of the formwork or mould the side with anchoring formations facing away from the concrete is exposed, so that upon pouring the compound into the channel with the rail a mechanical interlock of the compound with the concrete is obtained via said double-sided anchoring sheet.

15. An embedded rail system, wherein a railway track support structure has an elongated open-topped channel and wherein a steel rail of a railway track is positioned in the channel, and wherein a pourable resilient compound which cures over time has been poured in the channel with the rail and has bonded to the rail and remain elastic when cured and provides continuous vertical and horizontal support to the rail,
characterised in that an anchoring sheet is attached directly to the rail, the anchoring sheet having a multitude of anchoring formations, so that a mechanical interlock is obtained with the cured compound.

16. Method for installation of an embedded rail system, wherein a railway track support structure has an

elongated open-topped channel and wherein a steel rail of a railway track is positioned in the channel, and wherein the method comprises the step of pouring a pourable resilient compound which cures over time in the channel with the rail, the compound then bonding to the rail and remaining elastic when cured and in cured state providing continuous vertical and horizontal support to the rail,
characterised in that - prior to the pouring of the resilient compound - an anchoring sheet is attached directly to one or more surfaces of the channel in the railway track support structure, the anchoring sheet having a multitude of anchoring formations, so that upon curing of the compound a mechanical interlock is obtained with the cured compound.

Patentansprüche

1. Verfahren zur Installierung eines eingebetteten Schienensystems, wobei ein Gleisanlagen-Tragwerk einen länglichen, nach oben offenen Kanal hat, und wobei eine Stahlschiene einer Gleisanlage in dem Kanal positioniert ist, und wobei das Verfahren den Schritt des Schüttens einer schüttbaren elastischen Verbindung enthält, die im Laufe der Zeit im Kanal mit der Schiene aushärtet, wobei die Verbindung dann an der Schiene haftet und elastisch bleibt, wenn sie ausgehärtet ist, und im ausgehärteten Zustand der Schiene einen durchgehenden senkrechten und waagrechten Halt liefert,
dadurch gekennzeichnet, dass - vor dem Schütten der elastischen Verbindung - eine Verankerungsfolie direkt an der Schiene befestigt wird, wobei die Verankerungsfolie eine Vielzahl von Verankerungsausbildungen hat, so dass nach dem Aushärten der Verbindung eine mechanische Verriegelung mit der ausgehärteten Verbindung erhalten wird.

2. Verfahren nach Anspruch 1, wobei die Schiene senkrechte Flächen hat, und wobei Verankerungsfolien an den senkrechten Flächen befestigt sind.

3. Verfahren nach Anspruch 2, wobei die Schiene einen Schienenkopf, einen senkrechten Steg und einen Fuß breiter als der senkrechte Steg hat, und wobei Verankerungsfolien an mindestens den gegenüberliegenden Flächen des senkrechten Stegs, vorzugsweise auch an mindestens der Oberfläche des Fußes, befestigt sind.

4. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei eine Verankerungsfolie mit einem Klebstoff an der Schiene befestigt ist.

5. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Schritt der Befestigung der Verankerungsfolie an der Schiene an einer von der Gleisanlage entfernten Stelle ausgeführt wird, vorzugsweise in einem geschlossenen Raum.

6. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Verankerungsfolie von einer Rolle geliefert wird.

7. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Verankerungsfolie eine Folie mit Haken und/oder Schlaufen ähnlichen einem Klettverschlusssystem ist.

8. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Verankerungsfolie eine Trägerschicht aufweist, die an der von der Schiene abgewandten Seite mit einer Vielzahl von vorstehenden Verankerungselementen versehen ist.

9. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Verankerungsfolie eine Kunststofffolie ist (PA, PE, PP, EVA, etc.).

10. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei vor dem Schütten der Verbindung eine elastische Matte unter der Schiene angeordnet wird.

11. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei das Gleisanlagen-Tragwerk eine Betonplatte ist, z.B. eine Bahnübergangsplatte, vorzugsweise eine monolithische Bahnübergangsplatte.

12. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei eine oder mehrere weitere Verankerungsfolien vor dem Schütten der Verbindung an der Fläche des Kanals im Gleisanlagen-Tragwerk befestigt werden.

13. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, wobei das Gleisanlagen-Tragwerk ein den Kanal begrenzendes Kanalelement enthält.

14. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche 1-12, wobei das Gleisanlagen-Tragwerk ein Betontragwerk ist, das unter Verwendung einer geeigneten Verschalung oder Form gegossen wird, und wobei eine doppelseitige, am Beton zu befestigende Verankerungsfolie verwendet wird, die eine mittlere Schicht hat, welche im Wesentlichen für den Flüssigbeton undurchdringlich ist, und auf gegenüberliegenden Seiten von der eine Vielzahl von Verankerungsausbildungen vorgesehen sind, und wobei die doppelseitige Verankerungsfolie so auf die Fläche der den Kanal definierenden Verschalung oder Form montiert ist, dass beim Gießen des Betons die Verankerungsformen

auf der von der Verschalung oder Form abgewandten Seite eine mechanische Verbindung mit dem Beton aufbauen, und dass beim Entfernen der Verschalung oder Form die Seite mit vom Beton abgewandten Verankerungsausbildungen freigelegt wird, so dass beim Schütten der Verbindung in den Kanal mit der Schiene über die doppelseitige Verankerungsfolie eine mechanische Verriegelung der Verbindung mit dem Beton erhalten wird.

15. Eingebettetes Schienensystem, wobei ein Gleisanlagen-Tragwerk einen länglichen, nach oben offenen Kanal hat, und wobei eine Stahlschiene einer Gleisanlage in dem Kanal positioniert ist, und wobei eine schüttbare elastische Verbindung, die im Laufe der Zeit aushärtet, in den Kanal mit der Schiene geschüttet wurde und sich mit der Schiene verbunden hat und elastisch bleibt, wenn sie aushärtet, und der Schiene einen durchgehenden senkrechten und waagrechten Halt liefert,
dadurch gekennzeichnet, dass eine Verankerungsfolie direkt an der Schiene befestigt ist, wobei die Verankerungsfolie eine Vielzahl von Verankerungsausbildungen hat, so dass eine mechanische Verriegelung mit der ausgehärteten Verbindung erhalten wird.

16. Verfahren zur Installierung eines eingebetteten Schienensystems, wobei ein Gleisanlagen-Tragwerk einen länglichen, nach oben offenen Kanal hat, und wobei eine Stahlschiene einer Gleisanlage im Kanal positioniert ist, und wobei das Verfahren den Schritt des Schüttens einer schüttbaren elastischen Verbindung enthält, die im Laufe der Zeit im Kanal mit der Schiene aushärtet, wobei die Verbindung sich dann mit der Schiene verbindet und elastisch bleibt, wenn sie ausgehärtet ist, und im ausgehärteten Zustand der Schiene einen durchgehenden senkrechten und waagrechten Halt liefert,
dadurch gekennzeichnet, dass - vor dem Schütten der elastischen Verbindung - eine Verankerungsfolie direkt an einer oder mehreren Flächen des Kanals im Gleisanlagen-Tragwerk befestigt wird, wobei die Verankerungsfolie eine Vielzahl von Verankerungsausbildungen hat, so dass nach dem Aushärten der Verbindung eine mechanische Verriegelung mit der ausgehärteten Verbindung erhalten wird.

Revendications

1. Procédé d'installation d'un système de rail encastré, dans lequel une structure de support de voie de chemin de fer comporte un canal allongé dont le haut est ouvert, et dans lequel un rail en acier d'une voie de chemin de fer est positionné dans le canal, et dans lequel le procédé comprend l'étape de déversement d'un composé élastique pouvant être déversé qui durcit avec le temps dans le canal avec le rail, le composé se liant ensuite au rail et restant élastique lorsqu'il a durci et, dans l'état durci, fournissant un support vertical et horizontal continu au rail,
caractérisé en ce que - avant le déversement du composé élastique - une feuille d'ancrage est attachée directement au rail, la feuille d'ancrage comportant une multitude de formations d'ancrage, de sorte que, lors du durcissement du composé, un verrouillage mécanique est obtenu avec le composé durci.

2. Procédé selon la revendication 1, dans lequel le rail comporte des surfaces verticales, et dans lequel des feuilles d'ancrage sont attachées aux dites surfaces verticales.

3. Procédé selon la revendication 2, dans lequel le rail comporte un champignon de rail, une âme verticale et un patin plus large que l'âme verticale, et dans lequel des feuilles d'ancrage sont attachées au moins aux surfaces opposées de l'âme verticale, de préférence également au moins à la surface supérieure du patin.

4. Procédé selon une ou plusieurs des revendications précédentes, dans lequel une feuille d'ancrage est attachée au rail par un adhésif.

5. Procédé selon une ou plusieurs des revendications précédentes, dans lequel l'étape de fixation de la feuille d'ancrage au rail est effectuée à un emplacement à distance de la voie de chemin de fer, de préférence à l'intérieur.

6. Procédé selon une ou plusieurs des revendications précédentes, dans lequel la feuille d'ancrage est fournie à partir d'un rouleau.

7. Procédé selon une ou plusieurs des revendications précédentes, dans lequel la feuille d'ancrage est une feuille avec des crochets et/ou des boucles similaire à un système de fixation de type velcro.

8. Procédé selon une ou plusieurs des revendications précédentes, dans lequel la feuille d'ancrage comprend une couche d'appui qui est pourvue d'une multitude d'éléments d'ancrage saillants du côté orienté à l'opposé du rail.

9. Procédé selon une ou plusieurs des revendications précédentes, dans lequel la feuille d'ancrage est une feuille en plastique (PA, PE, PP, EVA, etc.).

10. Procédé selon une ou plusieurs des revendications précédentes, dans lequel un mat élastique est placé sous le rail avant le déversement du composé.

11. Procédé selon une ou plusieurs des revendications précédentes, dans lequel la structure de support de voie de chemin de fer est une dalle en béton, par exemple, une dalle de passage à niveau, de préférence une dalle de passage à niveau monolithique.

12. Procédé selon une ou plusieurs des revendications précédentes, dans lequel une ou plusieurs feuilles d'ancrage supplémentaires sont attachées sur la surface du canal dans la structure de support de voie de chemin de fer avant le déversement du composé.

13. Procédé selon une ou plusieurs des revendications précédentes, dans lequel la structure de support de voie de chemin de fer comprend un élément de canal délimitant le canal.

14. Procédé selon une ou plusieurs des revendications 1 à 12 précédentes, dans lequel la structure de support de voie de chemin de fer est une structure de support en béton qui est coulée en utilisant un coffrage ou un moule approprié, et dans lequel une feuille d'ancrage double face est utilisée, laquelle est destinée à être attachée au béton, qui comporte une couche centrale qui est sensiblement impénétrable pour le béton liquide et sur les côtés opposés de laquelle une multitude de formations d'ancrage sont prévues, et dans lequel ladite feuille d'ancrage double face est montée sur la surface du coffrage ou du moule définissant le canal, de sorte que, lors de la coulée du béton, les formations d'ancrage sur le côté orienté à l'opposé du coffrage ou du moule établissent une liaison mécanique avec le béton, et de sorte que, lors du retrait du coffrage ou du moule, le côté avec des formations d'ancrage orienté à l'opposé du béton est exposé, de sorte que, lors du déversement du composé dans le canal avec le rail, un verrouillage mécanique du composé avec le béton est obtenu par l'intermédiaire de ladite feuille d'ancrage double face.

15. Système de rail encastré, dans lequel une structure de support de voie de chemin de fer comporte un canal allongé dont le haut est ouvert, et dans lequel un rail en acier d'une voie de chemin de fer est positionné dans le canal, et dans lequel un composé élastique pouvant être déversé qui durcit avec le temps a été déversé dans le canal avec le rail et s'est lié avec le rail et reste élastique lorsqu'il a durci et fournit un support vertical et horizontal continu au rail,
caractérisé en ce qu'une feuille d'ancrage est attachée directement au rail, la feuille d'ancrage comportant une multitude de formations d'ancrage, de sorte qu'un verrouillage mécanique est obtenu avec le composé durci.

16. Procédé d'installation d'un système de rail encastré, dans lequel une structure de support de voie de chemin de fer comporte un canal allongé dont le haut est ouvert, et dans lequel un rail en acier d'une voie de chemin de fer est positionné dans le canal, et dans lequel le procédé comprend l'étape de déversement d'un composé élastique pouvant être déversé qui durcit avec le temps dans le canal avec le rail, le composé se liant ensuite au rail et restant élastique lorsqu'il a durci et, dans un état durci, fournissant un support vertical et horizontal continu au rail,
caractérisé en ce que - avant le déversement du composé élastique - une feuille d'ancrage est attachée directement à une ou plusieurs surfaces du canal dans la structure de support de voie de chemin de fer, la feuille d'ancrage comportant une multitude de formations d'ancrage, de sorte que, lors du durcissement du composé, un verrouillage mécanique est obtenu avec le composé durci.

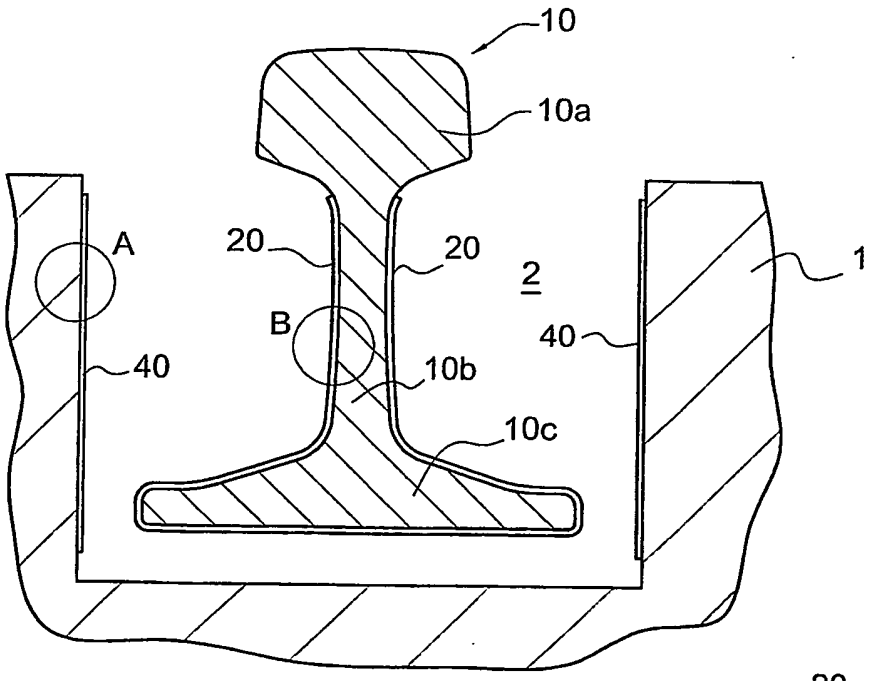


Fig. 1a

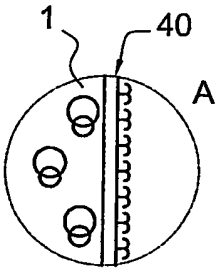


Fig. 2

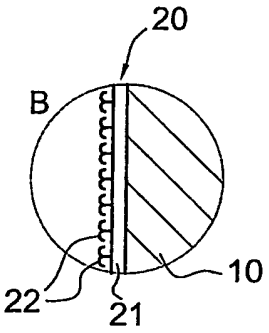


Fig. 3

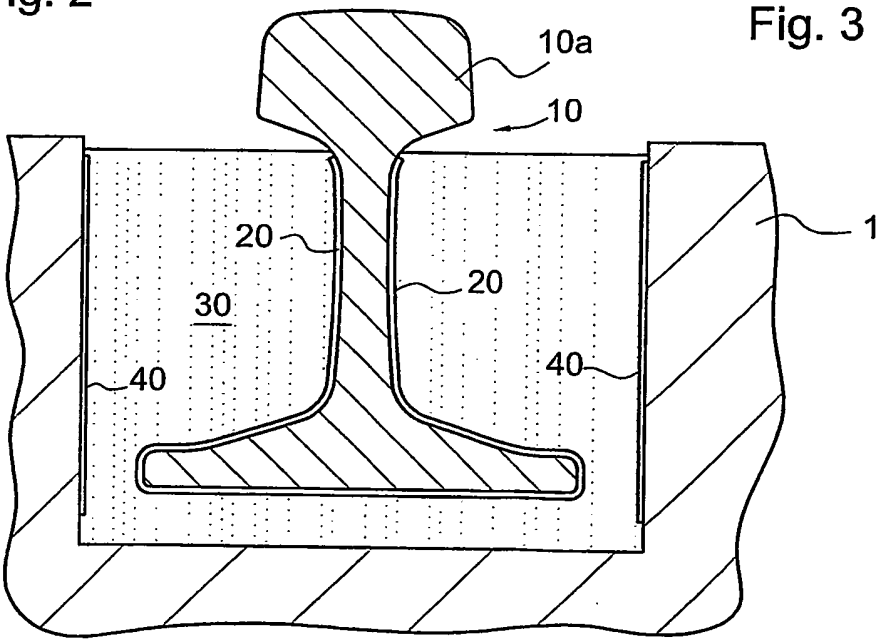


Fig. 1b

Fig.4a

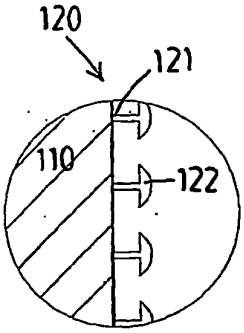


Fig.4b

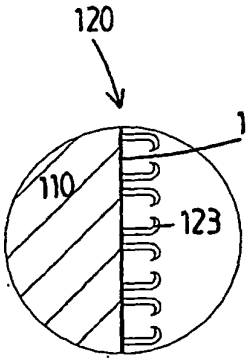


Fig.4c

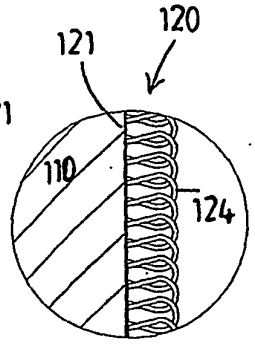
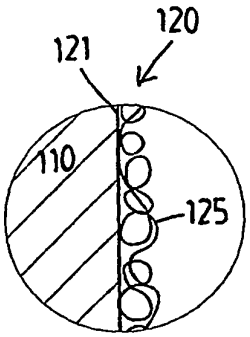


Fig.4d



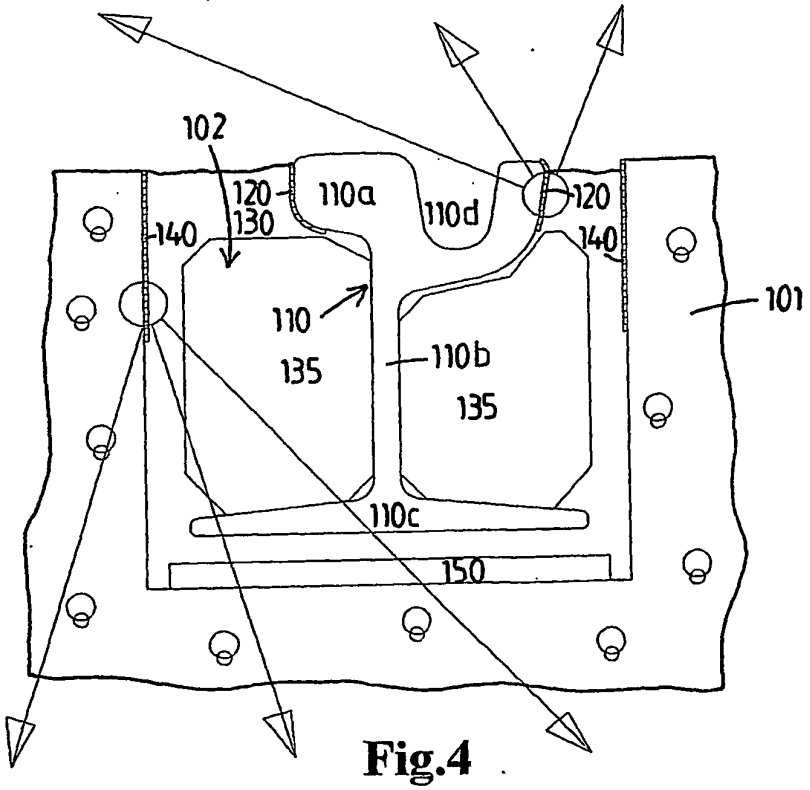


Fig.4

Fig.4e

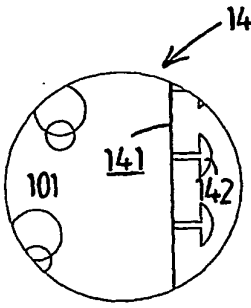


Fig.4f

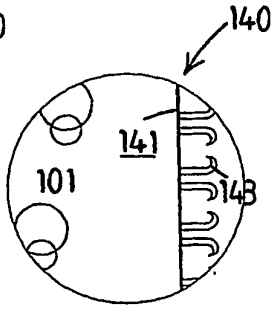


Fig.4g

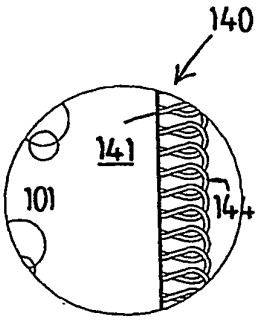
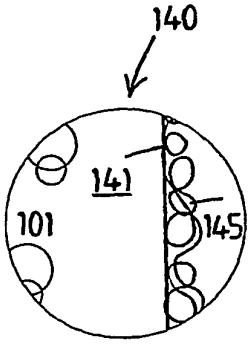


Fig.4h



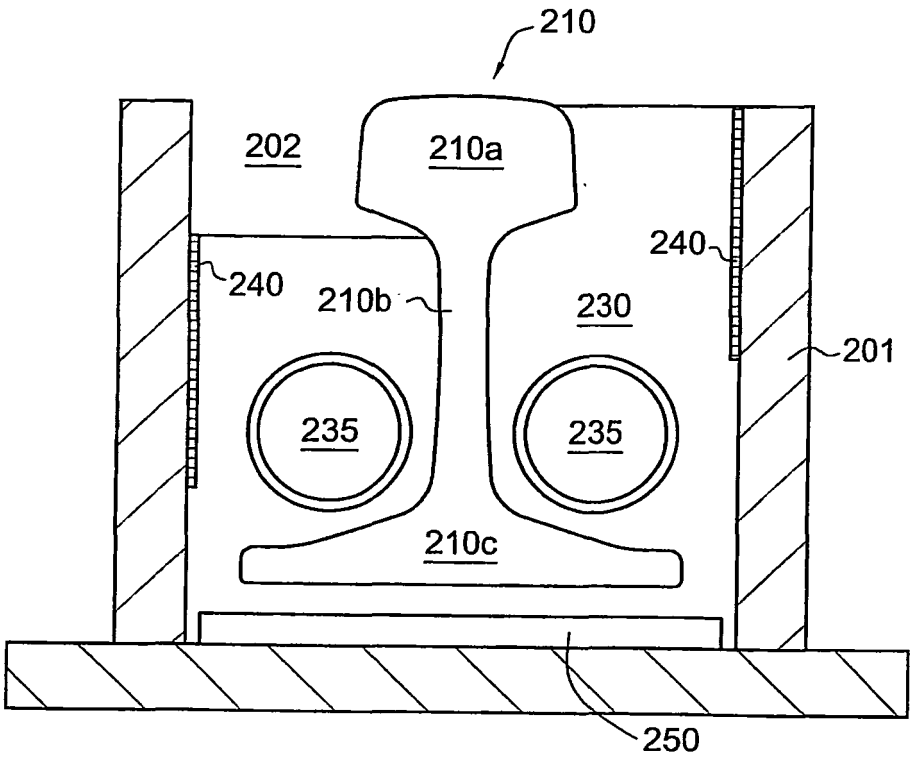


Fig. 5

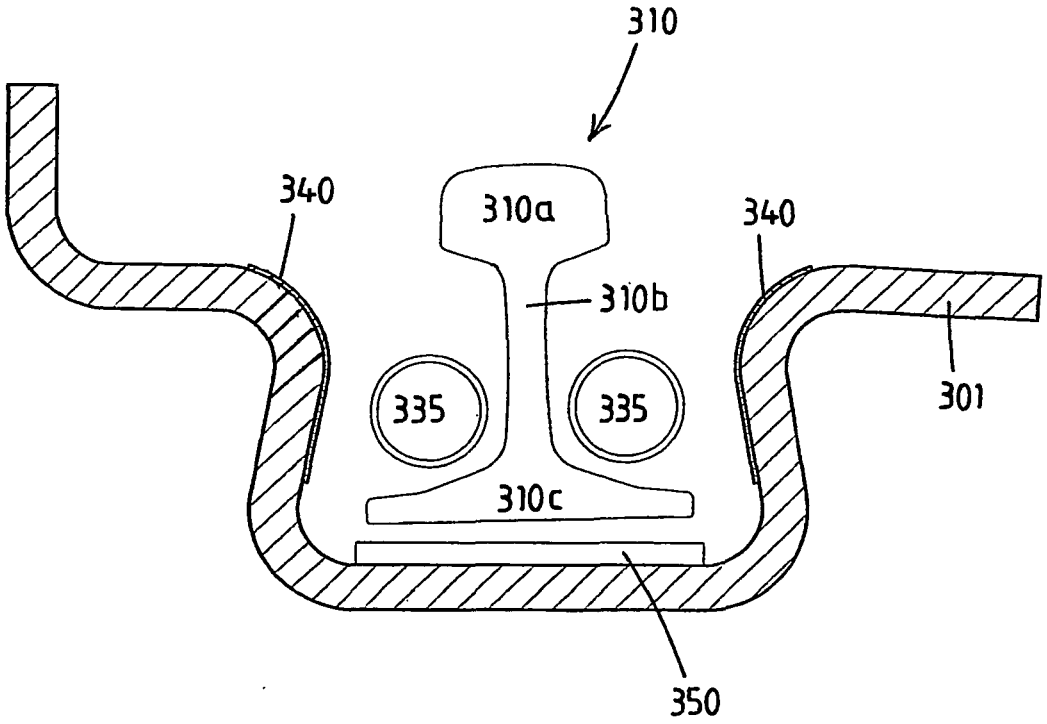


Fig.6

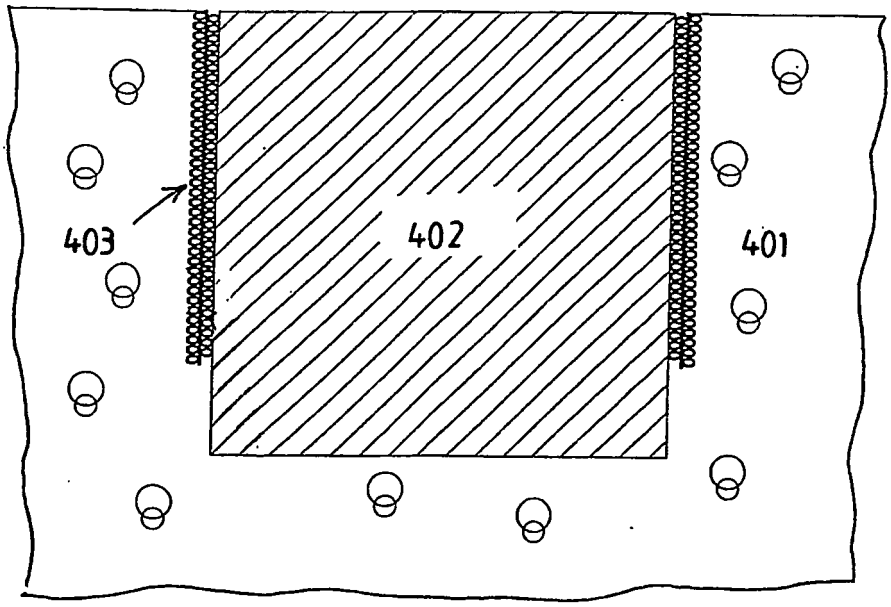


Fig.7

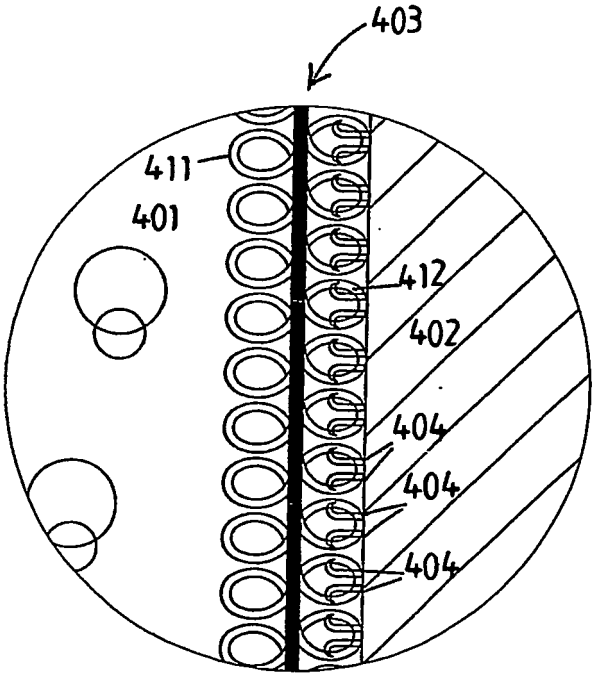


Fig.8

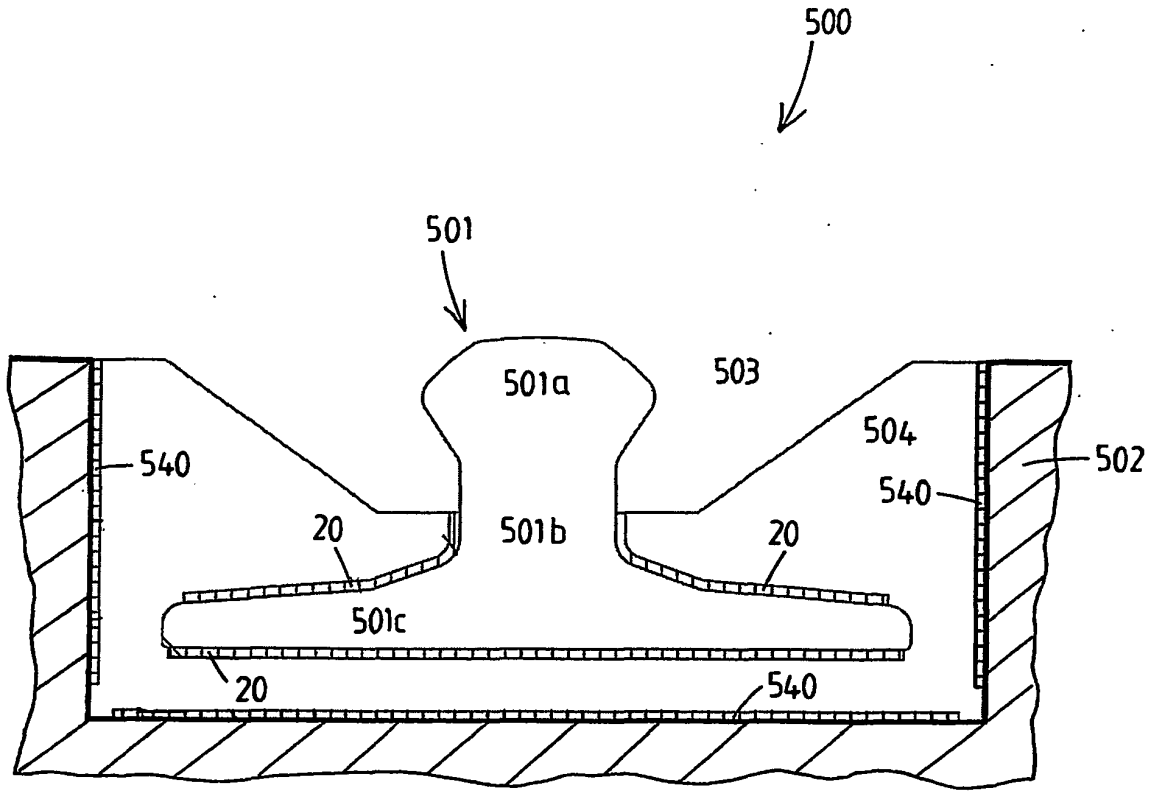


Fig.9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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