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(72) Inventor: **Puckey, Barry  
 Bodmin, Cornwall PL30 3EA (GB)**

(74) Representative: **Thielmann, Andreas et al  
 Cohausz & Florack,  
 Patentanwälte,  
 Kanzlerstrasse 8a  
 40472 Düsseldorf (DE)**

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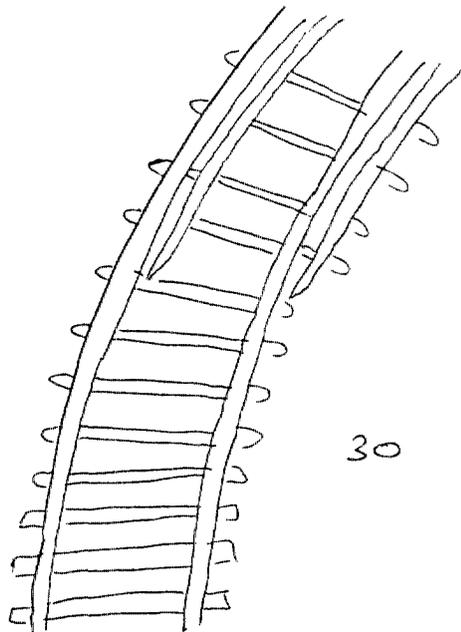
(71) Applicant: **DaimlerChrysler Rail Systems GmbH  
 13627 Berlin (DE)**

(54) **Load bearing structure for a railway**

(57) A load bearing structure for railways comprising ballast and a coagulant adapted to bind the ballast, wherein the coagulant is an elastomeric dispersion,

such as polyurethane foam, which dispersion is added to the ballast in situ, such that the ballast and coagulant form a cohesive mass.

Fig 4



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## Description

**[0001]** The invention relates to a load bearing structure for railways comprising ballast and a coagulant for binding the ballast to form a cohesive mass.

**[0002]** As is generally well known, rail systems typically comprise a track supported on a ballast bed together with various trackside equipment such as signals, location boxes, trackside buildings and the like. Typically various communication cables will run buried underground adjacent to the tracks. As such communication cables are vital to running the railway, before any digging can be carried out a CAT scan is required to see if there is a cable present which might be damaged. The industry standard requires that a fresh CAT scan be made every 15cm of depth, so that several separate scans are required at each location.

**[0003]** The most commonly used system for installing signals and other trackside equipment involves building solid foundations using pre-cast concrete, which is sectionalised and assembled on site and then pouring concrete prepared on site onto this pre-cast concrete. Whilst this approach has proved satisfactory over many decades, it is slow as it requires a great deal of manpower and expensive as it can also cause disruption to railway operations. A return visit must be made to complete the installation once the concrete has cured after 7 to 14 days.

**[0004]** Various alternative proposals have been made involving the use of special preformed substructures but these are impractical for most existing rail systems on cost grounds alone and only really suitable for new routes.

**[0005]** The present invention seeks to provide a load bearing structure and a method for making this, which is quicker and cheaper to install than the presently used methods.

**[0006]** According to the invention there is provided a load bearing structure for railways comprising ballast and a coagulant adapted to bind the ballast, wherein the coagulant is an elastomeric dispersion, which dispersion is added to the ballast in situ, such that the ballast and coagulant form a cohesive mass.

**[0007]** In a preferred embodiment, the coagulant is added to ballast adjacent to a railway track. In an alternative embodiment, the coagulant is added to the ballast in the region of a set of points. The cohesive mass preferably has a load bearing capacity of 0.5 tons per square foot or more. Preferably the coagulant is a polyurethane foam.

**[0008]** The invention provides the advantage over the known solutions that it is quick and easy to install as the coagulant can cure typically in less than 30 minutes. As the ballast can be poured over the existing trackside, if it is not already present, the need to dig foundations and hence carry out CAT scans is obviated. By overcoming the requirement to dig conventional foundations, it also becomes possible to install new signals in places where

previously land owners permission would have been required.

**[0009]** Exemplary embodiments of the invention will now be described in greater detail with reference to the drawings in which:

Figure 1 shows a typical layout for trackside equipment;

Figure 2a shows a schematic longitudinal cross-section through a part of a railway track bed for jointed track;

Figure 2b shows a schematic longitudinal cross-section through a part of a railway track bed for a continuous rail track;

Figure 3 shows a schematic plan view of a part of railway track;

Figure 4 shows a schematic plan view of a set of points;

**[0010]** Figure 1 shows a pair of rails 1,2 supported on a sleeper 2 on a ballast bed 3. Adjacent to the track at a typical distance of 2 m are a plurality of handrails separating the trackside equipment from the rails. Adjacent to the rails on the side remote from the track is shown by way of example some cable routing 4, location case 5 on a firm standage 6 and a signal 7. In general the standage will be made from a combination of pre-cast concrete and site poured concrete as outlined above.

**[0011]** Figure 2a and 2b show a schematic longitudinal cross-section through a track bed for a jointed rail and a continuous rail respective. The standard ballast 10 arrangement for each type of bed is shown in solid profile. According to an aspect of the invention, additional ballast 11 is the spread adjacent to the conventional ballast 10, which is protected by shutters 12 and 13. In figure 2a this is shown as having a level which is substantially parallel to the conventional track bed, whereas in figure 2b, it is slightly below the raised edge of the ballast. The amount of additional ballast used is dependent on the requirements of the trackside equipment to be supported but in general no excavations will be necessary.

**[0012]** A coagulant, such as polyurethane foam, is then poured over the additional ballast 11 in the area to form the load bearing structure. In an exemplary embodiment, about 25kg of polyurethane is poured over an area of 4 square feet, to a depth of 2 feet such as would be used to support a signal. The polyurethane has a curing time of about one hour, so that the signal can be installed shortly after the load bearing structure has been prepared and formed. Although polyurethane has shown to be suitable, any coagulating foam, which when combined with the ballast achieves a load bearing capacity of in the region of ½ ton per square foot would be suitable. Once the load bearing structure has cured the shutters 12 and 13 can be removed for re-use if necessary.

**[0013]** Although it is possible to have the load bearing structure separate from the conventional ballast 10, it is

preferable to have the structure linked to the original ballast track 10. In its simplest form this can be achieved simply by pouring the coagulant foam over the original ballast 10 as well as the additional ballast 11.

**[0014]** Figure 3 shows a particularly preferred embodiment of the load bearing structure for supporting a signal in which first and second cantilevers 20, 21 are fixed to sleepers 22,23. The first and second cantilevers 20, 21 meet a point remote from the original track bed. The space between and around the cantilevers is covered with additional ballast and then coagulant is poured over the additional ballast to form the load bearing structure. The signal is then installed at the point where the cantilevers meet. In an alternative embodiment, a single cantilever extending parallel from a sleeper could be used. This particular embodiment has the additional advantage that the track will be stabilised by the load bearing structure.

**[0015]** Figure 4 shows a schematic plan view of a set of points 30 on a bed of ballast. A particular problem with points on curved section of track is that the momentum of the train will tend to try to bend the track straight leading to slight warping of the rails. Over time this leads to a points failure as the points are gradually shifted out of position with respect to the other rails. Coagulant foam is poured over the ballast in the region of points and allowed to cure. Due to the elasticity provided by the elastomeric polyurethane coagulant, the track will be stabilised and the load bearing structure will provide a damping effect on vibrations and any rail movements. To minimise the drainage problems that the coagulant will cause, a small channel can be left in the centre of the ballast bed so that water can drain away.

**[0016]** Suitable polyurethane foams include foams formed from a mixture of polyether polyols and polyether/polyester polyols using amine catalysts, such as those sold under the Eviromould and Envirofoam trade marks. Other possible foams include diphenylmethane diisocyanate based foams.

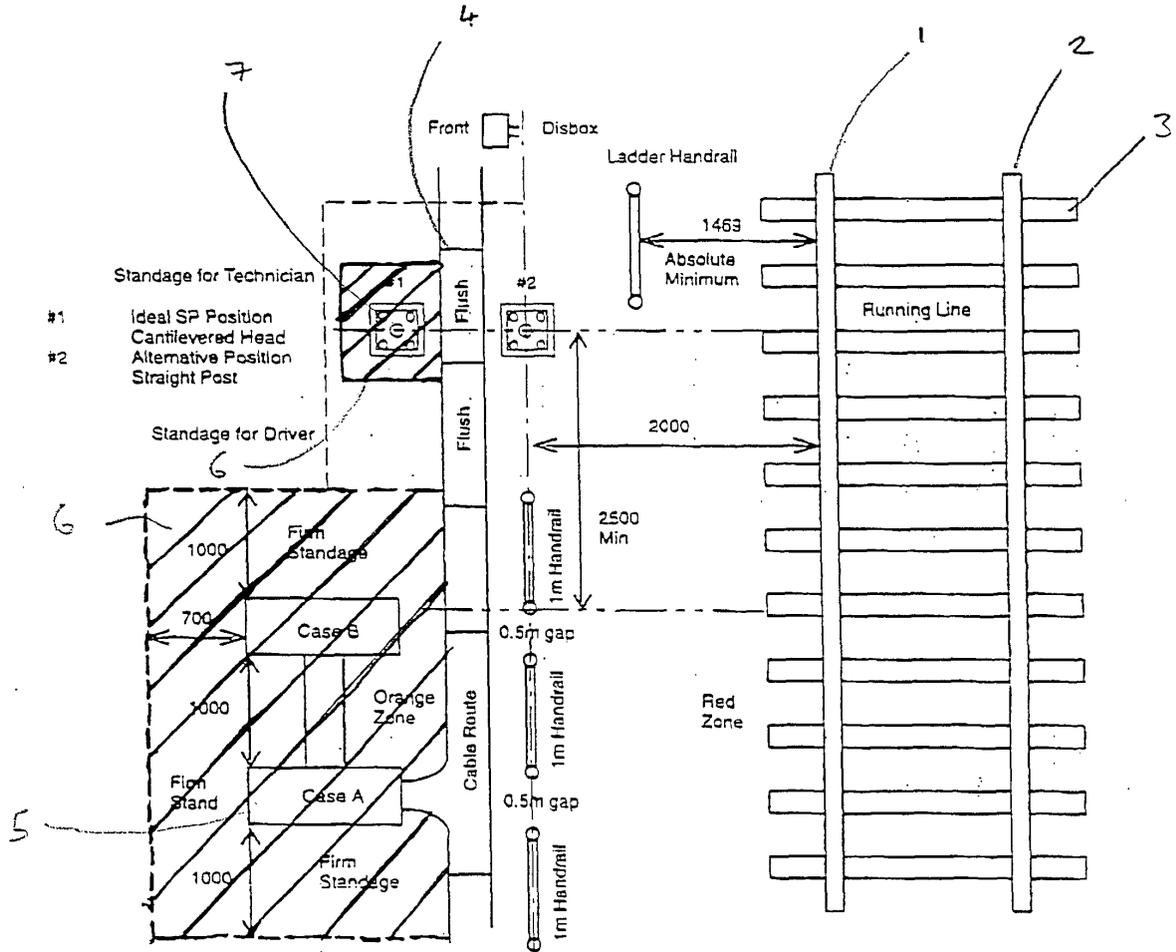
**[0017]** Although the structure has been described as suitable for providing support for railway trackside equipment, it is envisaged that the structure could also be used for certain conventional building foundations. In a further application the structure can act as a vibration dampener for certain bridge and gantry foundation systems, in particular for metal beam type structures.

## Claims

1. A load bearing structure for railways comprising ballast and a coagulant adapted to bind the ballast, wherein the coagulant is an elastomeric dispersion, which dispersion is added to the ballast in situ, such that the ballast and coagulant form a cohesive mass.
2. A load bearing structure according to Claim 1,

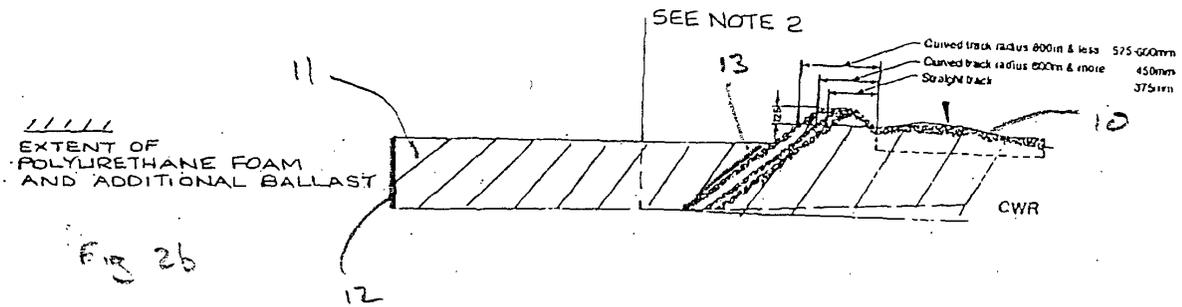
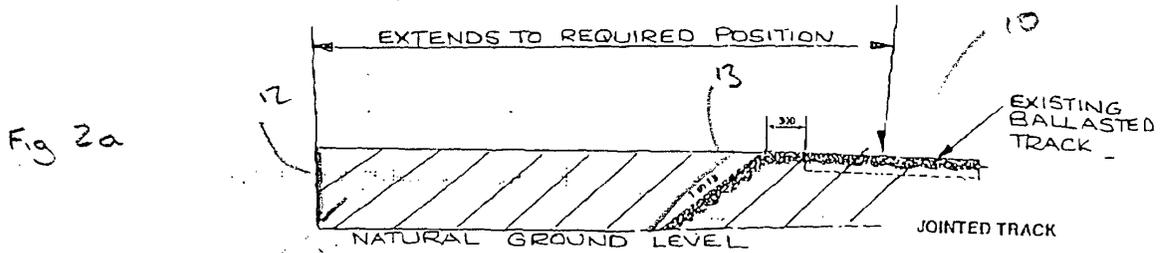
wherein the coagulant is added to ballast adjacent to a railway track.

3. A load bearing structure according to Claim 1, wherein the coagulant is added to the ballast in the region of a set of points.
4. A load bearing structure according to any one of Claims 1 to 3, wherein the cohesive mass has a load bearing capacity of 0.5 tons per square foot or more.
5. A load bearing structure according to any one of Claims 1 to 4, wherein the coagulant is a polyurethane foam.



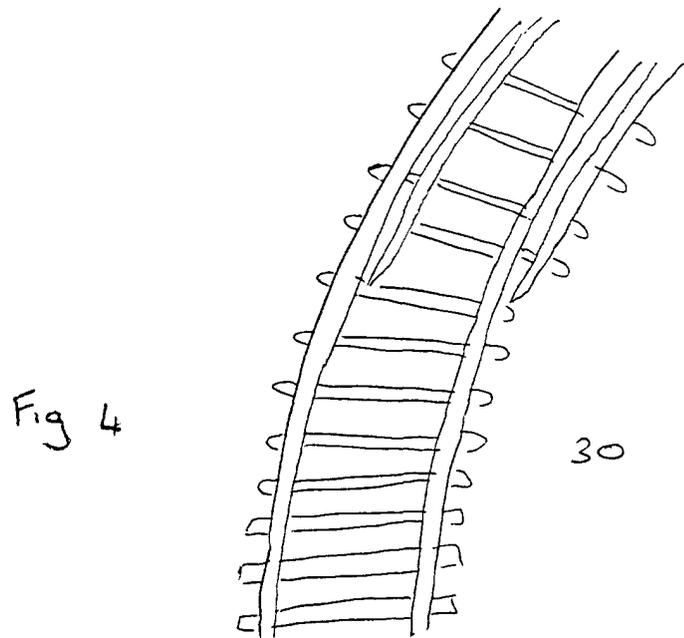
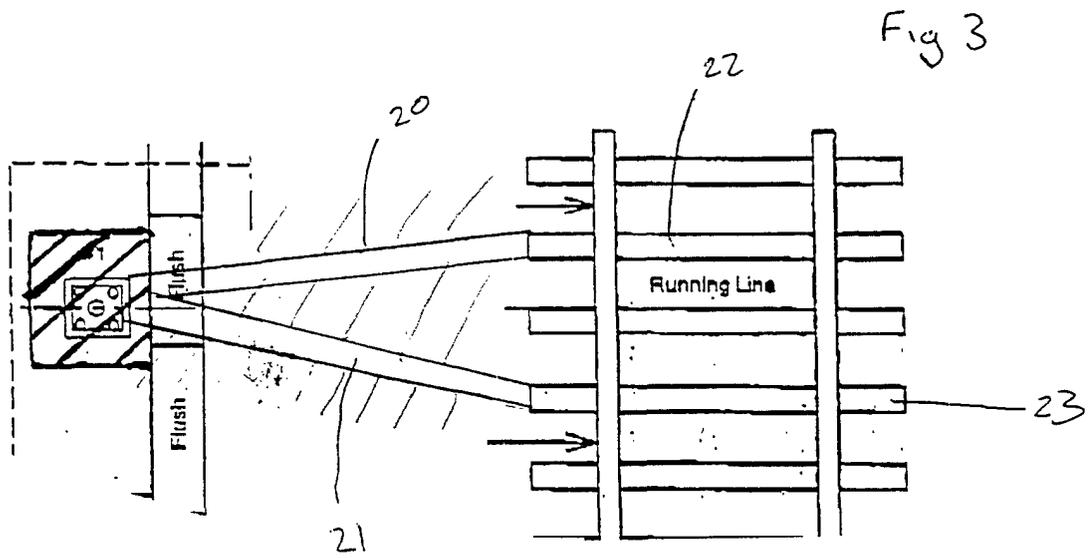
NOTE CABLE ROUTE CAN BE ALLOWED FOR IN TEMPLATE TO PRODUCE FOUNDATION OF BALLAST & POLYURETHANE FOAM

FIG. 1



NOTE

1. EXTENDED PLATFORM CAN EXTEND ALONG TRACK TO SUIT EQUIPMENT REQUIREMENT SEE ATTACHED DRAWINGS
2. DEPENDANT ON EQUIPMENT REQUIREMENT THE LINK TO THE BALLASTED TRACK NEED NOT BE MADE





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EUROPEAN SEARCH REPORT

Application Number  
EP 01 10 9706

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A	* page 4, line 32 - page 7, line 14; figure 1 *	2	
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A	--- EP 0 969 148 A (MÜLLER) 5 January 2000 (2000-01-05) -----		
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>18 July 2001</b>	Examiner <b>Kergueno, J</b>
CATEGORY OF CITED DOCUMENTS		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	
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EPC FORM 1505 09 92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 01 10 9706

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