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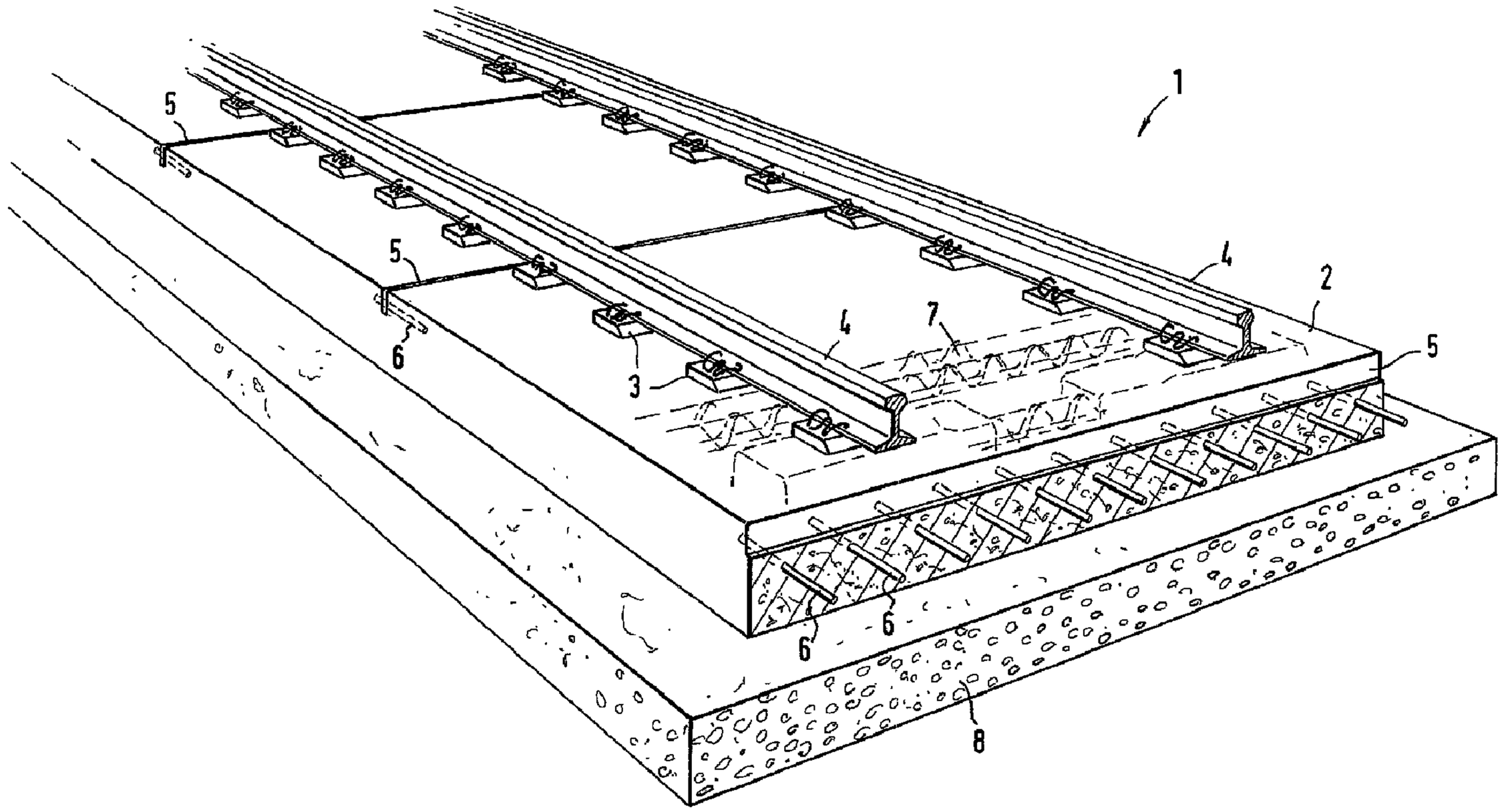


(57) Abrégé/Abstract:
The invention relates to a concrete track for rail vehicles comprising single or multi-block sleepers that are embedded in the track flagstone. The invention is characterised in that the track flagstone comprises cross-sectional weaknesses that run transversally to the direction of travel, in order to create cracks and at least one respective body that overlaps the region of the weakened cross-section on both sides, transmitting transversal forces.

Abstract

The invention relates to a concrete track for rail vehicles comprising single or multi-block sleepers that are embedded in the track flagstone. The invention is characterised in that the track flagstone comprises cross-sectional weaknesses that run transversally to the direction of travel, in order to create cracks and at least one respective body that overlaps the region of the weakened cross-section on both sides, transmitting transversal forces.

## Concrete track for rail vehicles

The invention relates to a concrete carriageway for rail vehicles having single- or multiple-block sleepers embedded in a carriageway panel.

Concrete carriageways are usually used in sections of rail which are set up for high-speed and very high-speed trains. Instead of the conventional gravel ballast bed, in concrete carriageways a carriageway panel is provided into which the single- or multiple-block sleepers are embedded.

In conventional concrete carriageways, stray uncontrolled cracks may occur which are caused by longitudinal stresses. The occurrence of stray cracks is unwanted, as their position and continuation cannot be controlled.

It is therefore desirable to create an improved concrete carriageway in which the occurrence of stray cracks is prevented.

## Summary of the Invention

According to an aspect of the invention, there is provided a concrete carriageway for rail vehicles, having single- or multiple-block sleepers embedded in a carriageway panel defining a direction of travel, characterised in that the carriageway panel has areas of thinned cross-section for generating cracks, each of the areas extending between two sides transverse to the direction of travel, and the carriageway panel comprises a body overlapping said two sides of the each area for transmitting transverse forces.

Due to the areas of thinned cross-section provided in the carriageway panel, controlled cracking can be achieved, and accordingly the occurrence of stray cracks may be prevented. Due to the areas of thinned cross-section, the location of the crack can be fixed in a controlled manner. In order to meet the statutory requirements in spite of the areas of thinned cross-section disposed transverse to the direction of travel, the transmission of transverse forces from one segment of

the carriageway panel to the adjacent one can be effected by bodies for transmitting the transverse forces, which bodies may be embedded during manufacture of the carriageway panel.

The areas of thinned cross-section may be formed as grooves or joints or notches in the carriageway panel. These regions with a thinner cross-section may for example be produced by culling or milling, the grooves and the like being applied to the carriageway panel subsequently.

In order to provide a longer service life of the concrete carriageway, the areas of thinned cross-section may be sealed against environmental effects, in particular against penetrating damp. Thus, damage due to penetrating water can be effectively prevented.

The concrete carriageway may be laid in such a manner that the formation of cracks may be triggered due to temperature fluctuations or temperature gradients in different regions of the concrete carriageway or due to shrinkage of the concrete. In a concrete carriageway laid in this manner, the cracks automatically form due to physical effects, so that it is not necessary to cause the cracks retrospectively by manual or mechanical means.

It can be provided that the areas of thinned cross-section are formed as bodies embedded in the carriageway panel. These bodies can be concreted in during manufacture of the carriageway panel. The embedded body or bodies can have the property of interrupting the transmission of force between the sections of carriageway panel abutting the bodies and act as pre-formed break points, which cause crack formation due to a temperature difference or other trigger for example. Alternatively, it can also be provided that a body embedded in the carriageway panel is removable after the thinned cross-sectional area has been produced. This variant may be considered if the embedded body is located at the surface of the carriageway panel.

The embedded body may be rod-shaped and have a rectangular or wedge-shaped or sword-shaped profile. Alternatively, the embedded body may be formed two-dimensionally, e.g. as a foil, plate or slab or as a textile. The embedded body or bodies is/are advantageously embedded transverse to the carriageway and to the direction of travel and interrupt the concrete carriageway as a whole or in part in the transverse direction.

Particularly advantageously the following materials are used for manufacturing the embedded body: steel, concrete, wood, plastics material.

It is particularly preferred that the bodies of the carriageway which transmit the transverse forces are formed as a rods or bars or as horizontal dowels. A particularly efficient transmission of transverse forces is achieved if the bodies for transmitting transverse forces are aligned in the direction of travel, i.e. in the longitudinal direction of the concrete carriageway.

In order to simplify the manufacture of the concrete carriageway, plural bodies for transmitting the transverse forces can be used pre-assembled and spaced apart. Preferably, the bodies for transmitting the transverse forces may be inserted into a holding device, e.g. consisting of wire, before the carriageway panel is manufactured or may be connected together, spaced apart, in order to fix their position.

A particularly advantageous fixing option for the bodies for transmitting the transverse forces is achieved if the bodies penetrate the grid reinforcement of the sleepers or are fixable laterally and/or below to projecting sections of the grid reinforcement of the sleepers or to another suitable section of the sleepers.

In the concrete carriageway the length of a body for transmitting the transverse forces may be 400 to 600 mm, preferably 500 mm. The diameter of a body for transmitting the transverse forces may be 20 to

35 mm, preferably 25 mm. The distance between two bodies for transmitting transverse forces may be 200 to 500 mm, preferably 250 to 300 mm.

A body for transmitting transverse forces may consist of steel, plastics or concrete or a combination of these materials, preferably the body may be produced from reinforced concrete or plastics fibres. It is also possible for a body for transmitting transverse forces to have a coating, in particular a corrosion protection coating or a plastics casing.

A further advantage of the concrete carriageway according to the invention is that the carriageway panel has no or at least no continuous longitudinal reinforcement.

The substructure of the carriageway panel of the concrete carriageway according to the invention may comprise a bonded or non-bonded support layer, e.g. a hydraulic bonded support layer, a layer of ballast, a frost protection layer, a foil or a geotextile. A hydraulically bonded support layer may have at its surface projecting anchoring elements acting as supports for the bodies for transmitting transverse forces. The concrete carriageway may also be mounted on a smooth base. Further, separating, sliding, elastomer or drainage layers can be laid between the concrete carriageway and the substructure.

The support layer of the concrete carriageway, in particular a hydraulically bonded support layer, may have areas of thinned cross-section disposed transverse to the direction of travel, in particular grooves or joints or notches. Optionally, the concrete carriageway and the substructure can be connectable or connected together via friction, cams, elements for transmitting transverse force, in particular dowels, or via a connecting reinforcement.

Further advantages and details of the invention will appear from the following description of embodiments and from the figures, comprising diagrams which show:

Fig. 1, a first embodiment of a concrete carriageway according to the invention; and

Fig. 2, a second embodiment of a concrete carriageway according to the invention.

Fig. 1 is a perspective diagram of a concrete carriageway formed as a fixed carriageway 1. The fixed carriageway 1 comprises a carriageway panel 2, which in the example shown has a height of about 350 mm. Grooves 5 of predetermined depth and width are cut in the carriageway panel 2 at regular intervals to form areas of thinned cross-section extending transverse to the direction of travel. If temperature fluctuations, temperature gradients and/or shrinkage of the concrete occur, these grooves effect controlled crack formation, so that the grooves 5 formed at the surface of the carriageway panel 2 break right through. Thus the formation of stray cracks on the carriageway panel 2 is avoided. As can be seen from Fig. 1, in the region of the grooves 5 plural horizontal dowels 6 extending transverse to the grooves and parallel to the direction of travel are embedded in the carriageway panel 2 as bodies for transmitting transverse forces. The horizontal dowels 6 are disposed approximately symmetrically to the respective groove 5, so that approximately half the length of a horizontal dowel 6 is located in one section of the carriageway panel 2 and the other half in the adjacent section of the carriageway panel 2. The horizontal dowels 6 ensure transmission of the transverse forces between the individual sections of the carriageway panel 2 separated from one another by the groove 5 which is split through.

In the embodiment shown, one horizontal dowel has a length of 500 mm, the diameter is 25 mm, and the dowels 6 are fitted at a distance of 250 mm. As corrosion protection, each horizontal dowel 6 has a plastics coating. However, it is possible to deviate from these size details according to the respective requirements.

In order to simplify the fitting and positioning of the horizontal dowels 6, these are inserted respectively into the grid structure 7 of a dual-block sleeper 3. Due to the presence of grid structures 7, additional reinforcement of the fixed carriageway 1 in the transverse direction can be dispensed with. Further, due to the presence of horizontal dowels, an additional or separate longitudinal reinforcement of the fixed carriageway 1 can be dispensed with or can be considerably reduced. However, in special applications it may be practical to provide a longitudinal reinforcement at least in sections of the fixed carriageway 1 in addition to the horizontal dowels 6. By using the horizontal dowels 6, the further advantage is gained that no earthing of the horizontal dowels 6 acting as longitudinal reinforcement is required, or that this can be much simplified.

In the embodiment shown in Fig. 1, the carriageway panel 2 is constructed on a ballast support layer 8. Similarly, the carriageway panel can also be constructed on a frost protection layer, a foil, a geotextile, a hydraulically bonded support layer on a concrete slab or another bonded support layer.

Fig. 2 shows a second embodiment of the fixed carriageway according to the invention, the same components being provided with the same references as in Fig. 1.

As in Fig. 1, dual-block sleepers 3 are embedded in the carriageway panel 2, which are for the mounting of rails 4. The carriageway panel 2 has transverse grooves 5, which are filled with a casting compound. In the region of the grooves 5, horizontal dowels 6 extending in the direction of travel are disposed, which connect sections of the carriageway panel 2 separated by the grooves 5.

Unlike in the first embodiment, below the carriageway panel 2 is a hydraulically bonded support layer 9, which has a height of about 300 mm. In the hydraulically bonded support layer 9, the mineral aggregate mix is bonded by hydraulic bonding means.

As can be seen from Fig. 2, the hydraulically bonded support layer 9 also has grooves 10 extending in the transverse direction, which are located under the grooves 5 of the carriageway panel 2. In the case of temperature fluctuations, therefore, controlled crack formation occurs not only in the carriageway panel 2, but also in the hydraulically bonded support layer 9. Below the hydraulically bonded support layer 9 is a frost protection layer 11.

Claims

1. Concrete carriageway for rail vehicles, having single- or multiple-block sleepers embedded in a carriageway panel defining a direction of travel, characterised in that the carriageway panel has areas of thinned cross-section for generating cracks, each of said areas extending between two sides transverse to the direction of travel, and the carriageway panel comprises a body overlapping said two sides of said each area for transmitting transverse forces.

2. Concrete carriageway according to claim 1, characterised in that the areas of thinned cross-section are formed as at least one of (i) grooves, (ii) joints and (iii) notches formed in the carriageway panel.

3. Concrete carriageway according to claim 2, characterised in that the areas of thinned cross-section are producible by one of (i) a cutting process and (ii) a milling process.

4. Concrete carriageway according to any one of claims 1 to 3, characterised in that the areas of thinned cross-section are sealed against environmental effects.

5. Concrete carriageway according to any one of claims 1 to 4, characterised in that the areas of thinned cross-section are sealable against penetrating dampness.

6. Concrete carriageway according to any one of claims 1 to 5, characterised in that the generating of said cracks may be triggered by at least one of (i) temperature fluctuation, (ii) temperature gradient and (iii) shrinkage of the concrete.

7. Concrete carriageway according to any one of claims 1 to 6, characterised in that the areas of thinned cross-section are formed as bodies embedded in the carriageway panel.

8. Concrete carriageway according to claim 7, characterised in that at least one of the bodies embedded in the carriageway panel is removable after the area of thinned cross-section has been generated.

9. Concrete carriageway according to claim 7 or claim 8, characterised in that at least one of the bodies embedded in the carriageway panel is rod-shaped and has a profile in the shape of one of (i) a rectangle, (ii) a wedge and (iii) a sword.

10. Concrete carriageway according to claim 7 or claim 8, characterised in that at least one of the bodies embedded in the carriageway panel is formed two-dimensionally.

11. Concrete carriageway according to claim 10, characterised in that at least one of the bodies embedded in the carriageway panel is formed as one of (i) a foil, (ii) a plate, (iii) a slab, and (iv) a textile.

12. Concrete carriageway according to any one of claims 7 to 10, characterised in that the bodies embedded in the carriageway panelconsist of at least one of the following materials: steel, concrete, wood, and plastic.

13. Concrete carriageway according to any one of claims 1 to 12, characterised in that at least one said body for transmitting transverse forces is formed as a horizontal dowel.

14. Concrete carriageway according to any one of claims 1 to 13, characterised in that at least one said body for transmitting transverse forces is aligned transverse to the areas of thinned cross-section in the direction of travel.

15. Concrete carriageway according to any one of claims 1 to 14, characterised in that the carriageway panel comprises a plurality of bodies for transmitting transverse forces which are pre-assembled spaced apart.

16. Concrete carriageway according to claim 15, characterised in that the plurality of bodies for transmitting transverse forces are used before the carriageway panel is manufactured in order to fix their position in a holding device.

17. Concrete carriageway according to claim 16, characterised in that the holding device comprises wire.

18. Concrete carriageway according to any one of claims 1 to 17, characterised in that at least one said body for transmitting transverse forces penetrates a grid reinforcement of the sleepers and is fixed to the grid reinforcement projecting at one of (i) the sides, (ii) below and (iii) another section of the sleepers.

19. Concrete carriageway according to any one of claims 1 to 18, characterised in that at least one said body for transmitting transverse forces has a length of 400 to 600 mm.

20. Concrete carriageway according to claim 19, characterised in that the length of at least one said body for transmitting transverse forces is about 500 mm.

21. Concrete carriageway according to any one of claims 1 to 20, characterised in that at least one said body for transmitting transverse forces has a diameter of about 20 to 35 mm.

22. Concrete carriageway according to claim 21, characterised in that the diameter of at least one said body for transmitting transverse forces is about 25 mm.

23. Concrete carriageway according to any one of claims 1 to 22, characterised in that the carriageway panel comprises at least two bodies for transmitting transverse forces that are spaced by a distance of about 200 to 500 mm.

24. Concrete carriageway according to claim 23, characterised in that the distance between said at least two bodies for transmitting transverse forces is about 250 to 300 mm.

25. Concrete carriageway according to any one of claims 1 to 24, characterised in that at least one said body for transmitting transverse forces consists of at least one of (i) steel, (ii) plastics and (iii) concrete.

26. Concrete carriageway according to any one of claims 1 to 25, characterised in that at least one said body for transmitting transverse forces comprises one of (i) reinforced concrete and (ii) plastics fibres.

27. Concrete carriageway according to any one of claims 1 to 26, characterised in that at least one said body for transmitting transverse forces has a coating.

28. Concrete carriageway according to claim 27, characterised in that the coating is one of (i) a corrosion protection coating and (ii) a plastics casing.

29. Concrete carriageway according to any one of claims 1 to 28, characterised in that the carriageway panel is free of any continuous longitudinal reinforcement.

30. Concrete carriageway according to claim 29, characterised in that the carriageway panel is free of any longitudinal reinforcement.

31. Concrete carriageway according to any one of claims 1 to 30, characterised in that the carriageway panel comprises a substructure, wherein the substructure comprises one of (i) a hydraulically bonded support layer, (ii) a ballast support layer, (iii) a frost protection layer, (iv) a foil, (v) a geotextile, and (vi) a bonded support layer.

32. Concrete carriageway according to claim 31, characterised in that the substructure comprises a hydraulically bonded support layer, and the hydraulically bonded support layer has anchoring elements projecting at its upper face and acting as supports for the body for transmitting transverse forces.

33. Concrete carriageway according to claim 31 or claim 32, characterised in that the areas of thinned cross-section are disposed on the support layer.

34. Concrete carriageway according to any one of claims 31 to 33, characterised in that the concrete carriageway and the substructure are connected together via one of (i) friction, (ii) cams, (iii) dowels, viand (iv) a connecting reinforcement.

35. Concrete carriageway according to any one of claims 1 to 34, characterised in that the concrete carriageway is fitted in a region of a set of points.

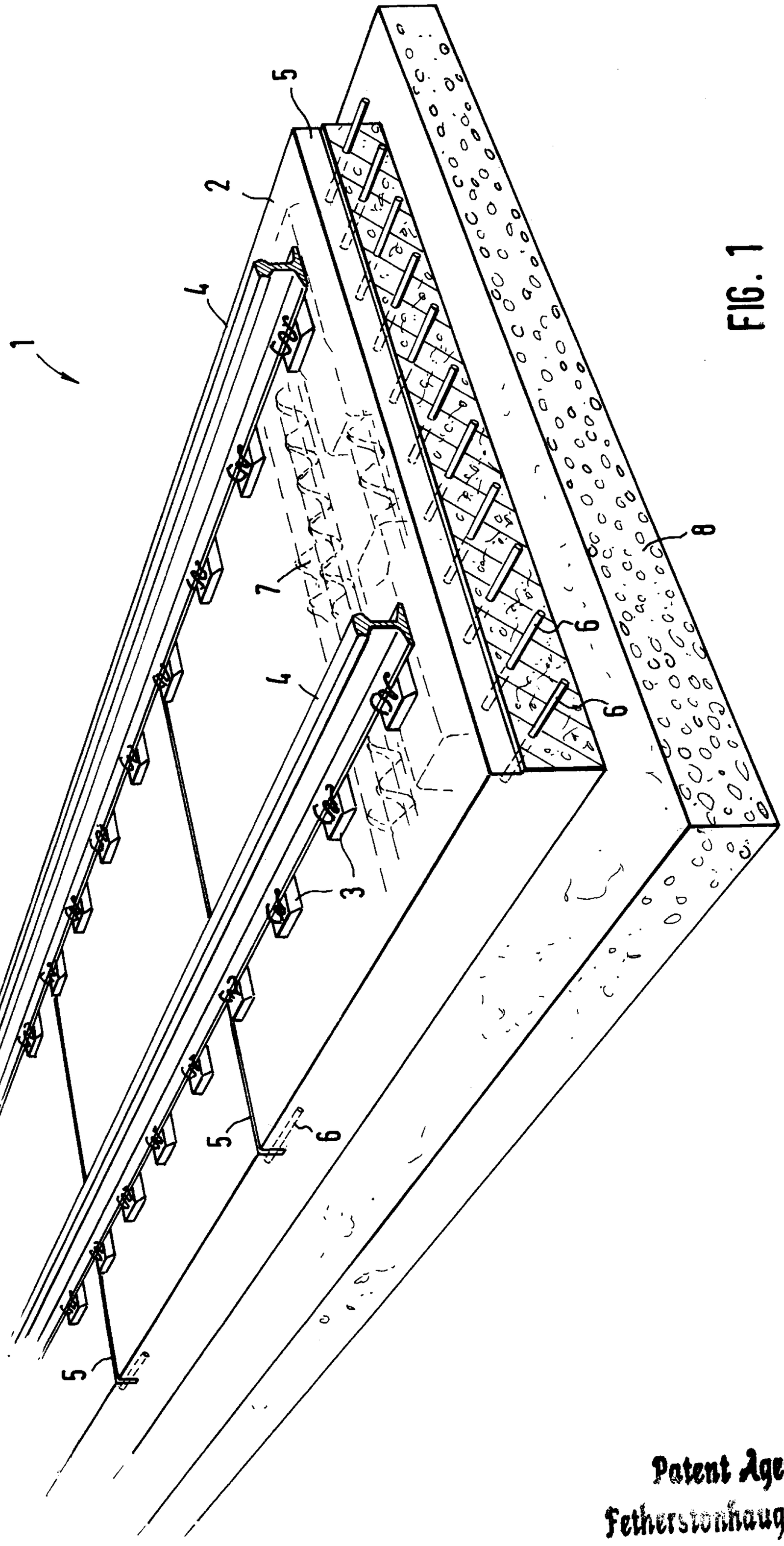


FIG. 1

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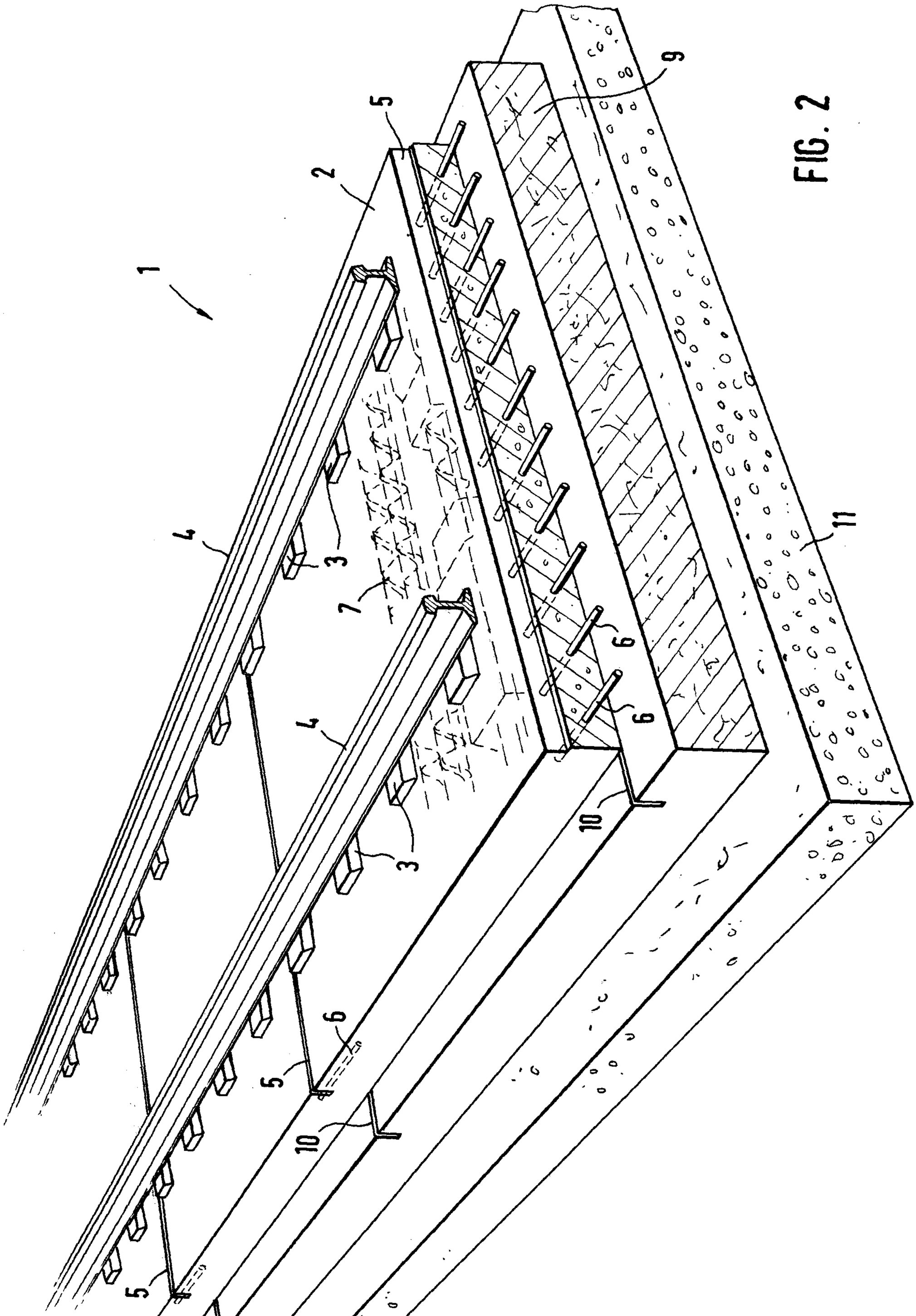


FIG. 2

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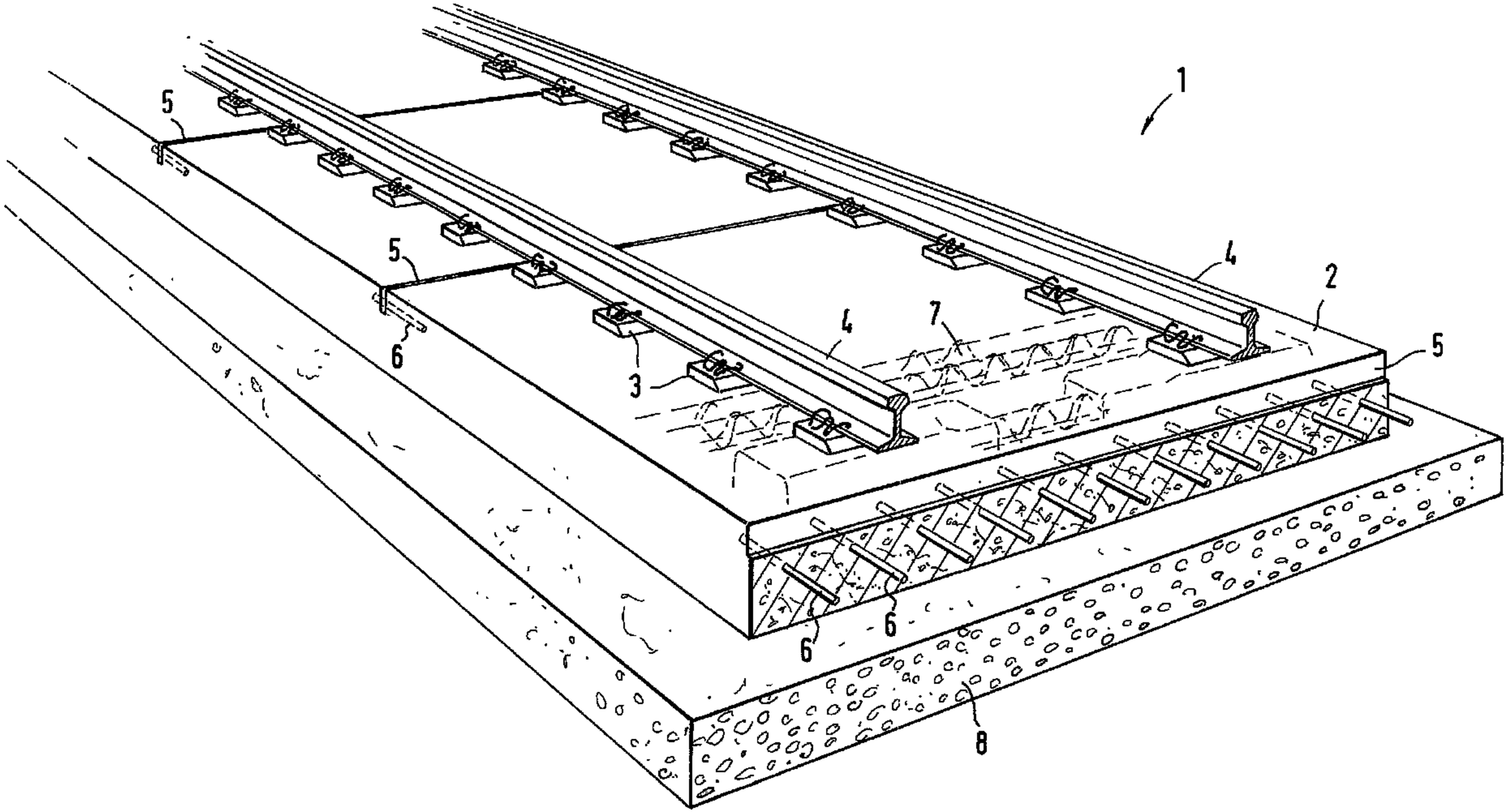
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