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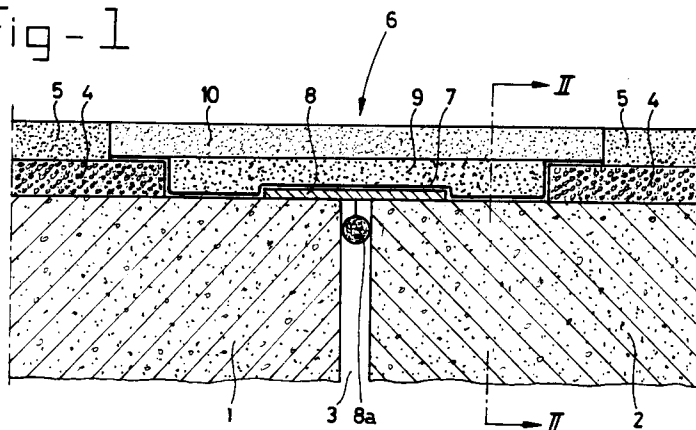
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(54) **Method for sealing the join between two road parts which are movable relative to each other and are provided with an asphalt road surface, in particular the join between two bridge roadway parts or between a bridge roadway part and a land-abutment part.**

(57) For sealing the join (3) between two road parts (1,2) which are movable relative to each other and are to be provided with, or have already been provided with, an asphalt road surface (4,5), in particular the join between two bridge roadway parts or between a bridge roadway part and a land-abutment part, a recess (6) is made at the site of the join in at least the hot-rolled asphalt covering said parts, and a material with elastic properties is placed in the recess. In order to provide a water-permeable or water-draining and low-noise filling of the recess at

the position of the join, without adversely affecting the elasticity and flexibility of said filling, which is necessary to avoid cracks forming, at least the bottom of the recess is covered with an elastic sealing membrane layer (7), a hard strip (8), for example of metal, is placed in said layer above the join, the membrane layer extending over the strip, and the recess above the membrane layer is filled with elastic hot-rolled asphalt (9,10) of which at least the top layer is made of very open elastic hot-rolled asphalt (10).

fig - 1

**EP 0 506 196 A1**

The invention relates to a method for sealing the join between two road parts which are movable relative to each other and are provided with an asphalt road surface, in particular the join between two bridge roadway parts or between a bridge roadway part and a land-abutment part, comprising:

- making a recess at the site of the join in at least the hot-rolled asphalt covering said parts, and
- placing a material with elastic properties in the recess.

Such a method is known from EP-B-000642.

In order to prevent the road surface from cracking at the site of the join, it is proposed in this publication that the recess should be filled with an aggregate of stone chippings in a rubber-type binder essentially composed of bitumen, pitch, pitch-tar, or tar. The volume percentage of stone chippings lies between 40 and 70%. This solution is not suitable for road surfaces in which the top layer is made of a very open-textured hot-rolled asphalt. Such a water-permeable, sound-deadening material is being used increasingly to promote safety when it rains, and to reduce noise nuisance. Use of the filling of the recess known from the above-mentioned European patent in water-permeable road surfaces would lead to an unsafe situation in which, when it rained, the motorist could suddenly be faced with a pool of water on the road surface before, after and above the join. There would also be greatly increased tyre noise when passing over the join.

The object of the invention is to solve this problem and provide a water-permeable or water-draining and low-noise filling of the recess at the site of the join, without the elasticity and flexibility of said filling, which is necessary in order to avoid cracks forming, being adversely affected.

According to the invention, the method is to this end characterised in that at least the bottom of the recess is covered with an elastic sealing membrane layer and a hard strip, for example of metal, is placed in said layer above the join, the membrane layer extending over the strip, and in that the recess above the membrane layer is filled with elastic hot-rolled asphalt of which at least the top layer is made of very open-textured elastic hot-rolled asphalt.

The metal strip prevents material from sinking in the join. The elastic sealing membrane provides the water seal and ensures the spread of the movement in the join, with the result that stress concentrations in the layers lying above are prevented. The elastic hot-rolled asphalt can absorb movements in the ground below, without giving way. This elastic material is preferably composed of a bottom layer of dense hot-rolled asphalt and a top layer of very open-textured hot-rolled asphalt. The

elastic very open-textured hot-rolled asphalt of the join seal abuts the very open-textured hot-rolled asphalt of the connecting road, so that there is no difference in sound production, and the horizontal water conveyance through the open-textured layer, viewed in the lengthwise direction of the road, is not interrupted. The elastic dense hot-rolled asphalt ensures that water is retained and can be drained through the elastic very open-textured hot-rolled asphalt.

If the vertical distance between the top surface of the road and the top surface of the bridge roadway part corresponds to the thickness of the very open-textured hot-rolled asphalt, the recess can be made right into the material of the road parts which are movable relative to each other. Space is then produced for a layer of elastic dense hot-rolled asphalt. If movements are very small, such a layer of dense hot-rolled asphalt is not necessary.

Securing means projecting into the join are used to prevent shifting of the hard strip, without said strip being fixed.

The elastic sealing membrane can be made of a 3 to 30 mm thick layer of a bitumen emulsion or a plastic modified bitumen emulsion mixed with fine stone grit. Another possibility is for the elastic sealing membrane to be made up of a 3 to 30 mm thick layer of an emulsion based on polyurethane alone or mixed with a fine stone grit.

It is also possible for the elastic sealing membrane to be composed of several layers, in which case little or none of said emulsion is applied in the stone grit between the layers. This produces a very low shear strength between the two layers, with the result that the stresses in the elastic very open-textured hot-rolled asphalt lying above will be minimal.

Another embodiment is to apply a one to five millimetre thick emulsion layer between the above-mentioned two layers, which also achieves a low shear strength.

There are practical advantages if the recess narrows stepwise from top to bottom. This step form is not necessary.

The elastic, very open-textured hot-rolled asphalt can have the following composition:

stone chippings: 65-90 mass per cent, particle size 8-16 mm

sand: 0-20 mass per cent, granule size 0-3 mm

filler: 0-10 mass per cent, size < 63 μ m

binder: 4-25 mass per cent

additions: 0-1 mass per cent,

the binder being composed of a mixture of bitumen and a natural rubber or elastomer, or a thermoplastic.

The admixture to the bitumen can be styrene butadiene styrene polymer (SBS), styrene butadi-

ene rubber (SBR) or ethyl vinyl acetate (EVA), or ethylene propylene dimonomer (EPDM).

The above-mentioned additions (0-1 mass per cent) can contain glass fibres, mineral fibres, rubber particles, adhesion improvers, latex emulsions and bitumen emulsions.

The invention will now be explained in greater detail with reference to the figures.

Figure 1 shows a longitudinal section through two bridge roadway parts which are movable relative to each other.

Figure 2 shows a cross-section along the line II - II in Figure 1.

Figure 3 shows a longitudinal section through two bridge roadway parts which are movable relative to each other, in which the join seal is of a different type.

The figures show two bridge roadway parts 1, 2 which are separated from each other by a join 3. The normal road surface on the bridge roadway parts in Figure 1 comprises a bottom layer 4 of dense hot-rolled asphalt and a top layer 5 of very open-textured hot-rolled asphalt. The layer 4 is not present in Figure 3. In both cases the road surface on the bridge roadway parts abuts the ordinary road surface composed of a bottom layer of dense hot-rolled asphalt and a top layer of very open-textured hot-rolled asphalt. In Figure 3 the dense hot-rolled asphalt of the ordinary road surface is not continued on the bridge roadway parts, but lies with the end face against the vertical boundary of a bridge roadway part.

In Figure 1 a recess 6 is made in the asphalt above the join 3. In Figure 2 this recess 6 continues over the hot-rolled asphalt of the bridge roadway parts.

An elastic sealing membrane layer 7 covers the bottom of the recess, and a metal strip 8 is placed in said membrane layer above the join 3, which strip is connected to securing means such as a cord 8a, which prevents shifting of the strip. The membrane extends over the top surface of the strip.

The recess 6 is also filled with a bottom layer 9 of elastic dense hot-rolled asphalt and a top layer 10 of elastic very open-textured hot-rolled asphalt.

The open-textured layers 5 and 10 are the same thickness and abut each other accurately, so that the water seeping through said layers can flow away in the lengthwise direction of the road. It can be seen from the cross-section of Figure 2 that water which has collected on the top surface of the elastic dense hot-rolled asphalt layer can flow away in the crosswise direction through the elastic very open-textured hot-rolled asphalt to a channel 11 formed through the layer 10 not running through to the side boundary of said bridge roadway part 2.

Depending on the circumstances, it is also

possible for layer 5 to have the composition of layer 10, and for these layers 5 and 10 to be applied in one go over the whole or part of the bridge roadway.

The membrane layer 7 runs through at the ends to the transition between the elastic dense hot-rolled asphalt and the elastic very open-textured hot-rolled asphalt.

It is possible in the absence of the dense hot-rolled asphalt on the bridge for the layer of elastic very open-textured hot-rolled asphalt to be placed directly on the membrane layer 7. In other words, in certain circumstances (very small changes in the width of the join) the layer 9 in Figure 3 can be omitted.

The watertight membrane layer 7 can be a stress-absorbing membrane interlayer (SAMI) which is characterised not only by its watertightness, but also by a great elasticity, even at low temperatures.

The membrane is composed of at least one layer of a bitumen emulsion mixed with fine stone grit, in order to create a layer thickness. The layer thickness varies between 3 and 30 mm. If the membrane is made of at least two of these layers, a very low shear strength can be created between the two layers by applying the stone grit in a suitable manner, with the result that lower stresses in the very open-textured hot-rolled asphalt lying above this will be produced. In the zone of low shear strength hardly any bitumen emulsion is present between the stone grit, or an emulsion layer one to five millimetres thick is applied. The bitumen emulsion can be composed of a mixture of bitumen with SBS or bitumen with EVA, SBR or EPDM.

Another possibility is to replace the bitumen emulsion by polyurethane-based mixtures.

The elastic very open-textured hot-rolled asphalt has the following composition:

stone chippings: 65-90 mass per cent, particle size 8-16 mm

sand: 5-20 mass per cent, granule size 0-3 mm

filler: 4-10 mass per cent, size < 63 μm

binder: 4-10 mass per cent

additions: 0-1 mass per cent.

The binder can be composed of a mixture of bitumen with natural rubber or elastomer, or a thermoplastic, in particular with styrene butadiene styrene polymer (SBS) or with styrene butadiene rubber (SBR) or with ethyl vinyl acetate (EVA), or with ethylene propylene dimonomer (EPDM). The additions can contain glass fibres, mineral fibres, rubber particles, adhesion improvers, latex emulsions and bitumen emulsions. What is essential is that the mixture after compacting should have hollow spaces between 15 and 35 volume per cent.

The elastic dense hot-rolled asphalt differs

from the elastic very open-textured hot-rolled asphalt in that the spaces between the larger pieces of chippings are filled with smaller pieces and sand. The mixture will therefore contain more sand and more smaller stone chipping parts than is the case with the elastic very open-textured hot-rolled asphalt.

The main advantage of the join seal described is that the very open hot-rolled asphalt runs over the join in such a way that the water drainage through this open-textured hot-rolled asphalt layer in the lengthwise direction of the road is uninterrupted and no noise peak is produced on passing over the join. This advantage is obtained without detriment to the resistance to crack formation at the site of the join.

Claims

1. Method for sealing the join between two road parts which are movable relative to each other and are provided with, or are to be provided with, an asphalt road surface, in particular the join between two bridge roadway parts or between a bridge roadway part and a land-abutment part, comprising:
 - making a recess at the site of the join in at least the hot-rolled asphalt covering said parts, and
 - placing a material with elastic properties in the recess, characterised in that at least the bottom of the recess is covered with an elastic sealing membrane layer and a hard strip, for example of metal, is placed in said layer above the join, the membrane layer extending over the strip, and in that the recess above the membrane layer is filled with elastic hot-rolled asphalt of which at least the top layer is made of very open-textured elastic hot-rolled asphalt.
2. Method according to Claim 1, characterised in that the elastic hot-rolled asphalt in the recess has a bottom layer of dense hot-rolled asphalt or a dense join structure.
3. Method according to Claim 1 or 2, characterised in that the recess is made right into the material of the road parts which are movable relative to each other.
4. Method according to one of the preceding claims, characterised by securing means projecting into the join to prevent shifting of the hard strip without fixing the strip.
5. Method according to one of the preceding

claims, characterised in that the elastic sealing membrane is composed of a one to thirty millimetre thick layer of a bitumen emulsion or modified bitumen emulsion mixed with stone.

6. Method according to Claims 1 to 4, characterised in that the elastic sealing membrane is composed of a one to thirty millimetre thick layer of an emulsion based on polyurethane mixed with a stone.
7. Method according to Claim 5 or 6, characterised in that the elastic sealing membrane is composed of several layers, and little or none of said emulsion is applied in the stones between the layers.
8. Method according to Claim 7, characterised in that a one to five millimetre thick layer of said emulsion is applied between the layers.
9. Method according to one of the preceding claims, characterised in that the recess is narrowed stepwise from top to bottom.
10. Method according to one of the preceding claims, characterised in that the elastic very open-textured hot-rolled asphalt has the following composition:
 - stone chippings: 65-90 mass per cent, particle size 8-16 mm
 - sand: 0-20 mass per cent, granule size 0-3 mm
 - filler: 0-10 mass per cent, size < 63 μ m
 - binder: 4-25 mass per cent
 - additions: 0-1 mass per cent, the binder being composed of a mixture of bitumen and a natural rubber or elastomer, or a thermoplastic material.
11. Method according to Claim 9, characterised in that the binder is composed of a mixture of bitumen and styrene butadiene styrene polymer (SBS).
12. Method according to Claim 9, characterised in that the binder is composed of a mixture of bitumen and styrene butadiene rubber (SBR).
13. Method according to Claim 9, characterised in that the binder is composed of a mixture of bitumen with ethyl vinyl acetate (EVA).
14. Method according to one of Claims 9 - 12, characterised in that the additions are composed of glass fibres and/or mineral fibres and/or rubber particles and/or adhesion improvers and/or latex emulsions and/or bitumen

emulsions.

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fig-1

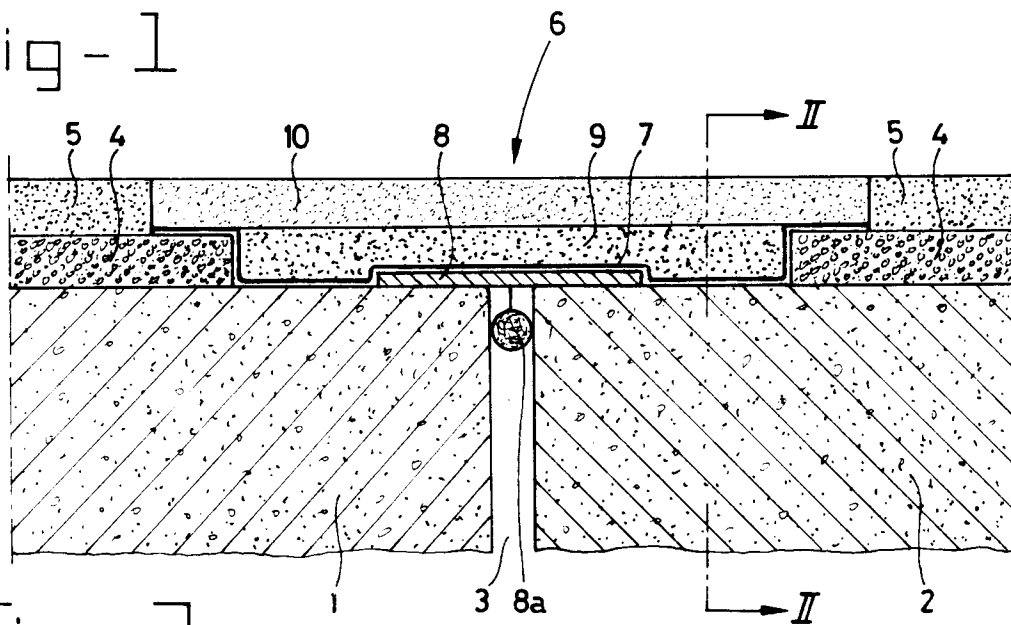


fig-2

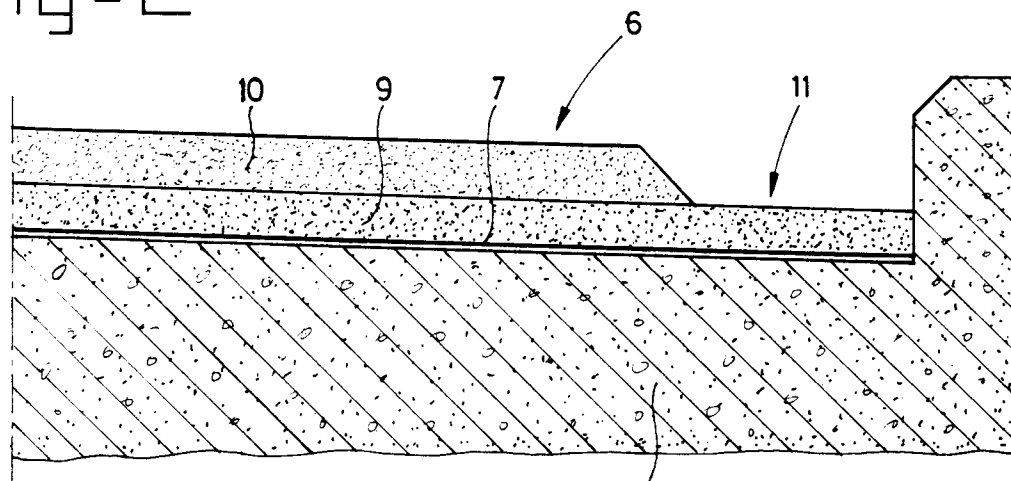
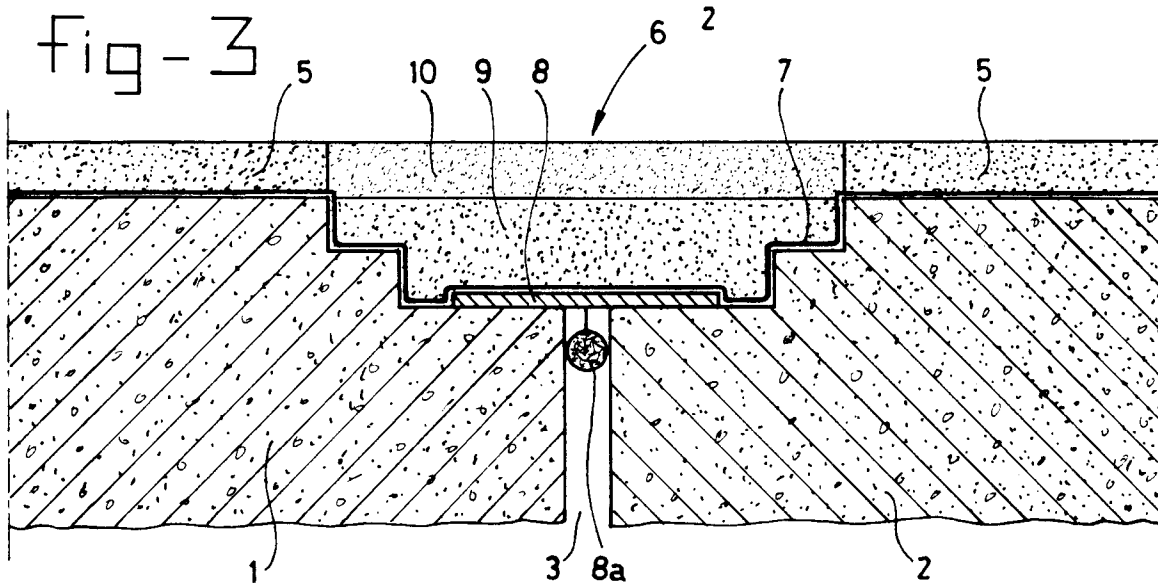


fig-3





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EUROPEAN SEARCH REPORT

Application Number

EP 92 20 0837

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 296 377 (H. LAFRENTZ GMBH & CO.) * column 2, line 12 - line 42; figure 1 *	1, 2, 4	E01D19/06 E01C11/22
A	---	5, 6	
Y	WEGEN vol. 64, no. 6, June 1990, EDE pages 30 - 31; VAN BOCHOVE: 'Nieuw concept voor zeer open asfaltbeton' * the whole document *	1, 2, 4	
A	---	10, 14	
Y	GB-A-2 218 437 (SHO-BOND CONSTRUCTION CO. LTD) * page 3, paragraph 3 - page 5, paragraph 3; figure 1 *	1, 2, 4	
Y	DE-A-3 611 199 (DEUTAG-MISCHWERKE GMBH) * the whole document *	1, 2, 4	
A	---	5, 10, 14	
A	PT/CIVIELE TECHNIEK vol. 42, no. 2, June 1987, RIJSWIJK pages 28 - 30; RIEMENS: 'Elastische voegovergangen' * page 28, right column, paragraph 6 - page 29, left column, paragraph 3; figure 2 *	1, 2, 4	TECHNICAL FIELDS SEARCHED (Int. Cl.5) E01D E01C
A	GB-A-1 318 805 (INVERNIZZI) * page 2, line 3 - line 66; figure 2 *	1-3, 9	
A	HIGHWAYS vol. 54, no. 1917, September 1986, CROYDON page 26; 'Flexible buried joints resists deformation' * the whole document *	1, 2, 4, 11, 14	
A	DE-A-3 712 461 (GEBR. LUGINBÜHL AG) * column 1, line 39 - line 66; claim 1 *	5	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 JUNE 1992	Examiner DE COENE P. J. S.
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			