(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 396 579 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.03.2004 Bulletin 2004/11

(51) Int Cl.[7]: **E01C 7/18**, E01C 7/35, E01C 19/46

(21) Application number: **03077779.1**

(22) Date of filing: **03.09.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(30) Priority: **05.09.2002 NL 1021404**

(71) Applicant: **Janssen de Jong Infra B.V.**
5981 PT Horst (NL)

(72) Inventor: **Van Hoof, Matheus Franciscus Antonius Maria**
4133 GA Vianen (NL)

(74) Representative: **'t Jong, Bastiaan Jacob et al**
Arnold & Siedsma,
Advocaten en Octrooigemachtigden,
Sweelinckplein 1
2517 GK Den Haag (NL)

(54) Method for strengthening a road surface, strengthened road surface and an asphalt concrete therefor

(57) The invention relates to a method for strengthening a road surface with an open surface structure, such as very open asphalt concrete (ZOAB), comprising of arranging a layer of asphalt concrete on the road surface, wherein the road surface respectively the asphalt concrete has a grain size distribution around an average such that an open surface structure is formed. The average grain size in the road surface is at least four times greater than that in the layer. Use is made of a layer with an excess of bituminous binder. According to the invention a road surface is obtained in which a layer of asphalt concrete is substantially taken up into an upper layer of the road surface, and the average grain size in the road surface is substantially a factor of four greater than that in the layer, wherein the bitumen of the applied layer has penetrated into the existing road surface.

EP 1 396 579 A2

Description

[0001] The invention relates to a method for strengthening a road surface with an open surface structure, such as very open asphalt concrete (ZOAB), comprising of applying a layer of asphalt concrete to the road surface, wherein the road surface respectively the asphalt concrete has a grain size distribution around an average such that an open surface structure is formed, wherein the average of the grain size distribution in the road surface is at least substantially a factor of four greater compared to the layer.

[0002] It is known to arrange a second, finer layer of ZOAB in hot state on a ZOAB road surface. This method can be applied in new laying of 2-layer ZOAB, wherein a second layer of asphalt concrete has an open surface structure which is little finer than the underlying first ZOAB layer. It is also possible to arrange on the road surface a second layer of asphalt concrete which has a property differing from the road surface, for instance an upper layer which is more sound-damping. The second layer is arranged on the first layer.

[0003] From NL 1016026 is known a method wherein a road surface is strengthened with an aggregate of fine-grained material and binder. The d50 (median of the grain size distribution) for the fine-grained material lies between 0.65 and 3.5 mm and is a factor of five smaller than the median of the road surface. The grain size distribution of the aggregate to be applied is narrow, 90% of the grains having a grain diameter lying between 0.8 x d50 and 1.2 x d50. The plastic binder forms 2 to 8% of the total filling material. The combination of this aggregate and an existing road surface does not fulfil standard requirements.

[0004] The object of the invention is to provide a method which improves the known method.

[0005] This object is achieved according to the invention by including in the layer to be arranged a bitumen binder and by applying an excess of bitumen in the arranged layer. Surprisingly, it has been found that, despite the fact that use is being made of a thin, extra layer of asphalt concrete, bitumen functions better than plastic binders. According to the prior art the skilled person will automatically use a plastic binder with enhanced adhesive properties, this to keep down the percentage of binder in the layer of asphalt concrete to be applied and to be able to guarantee the open structure of the mix after curing. According to the invention however, bitumen can be used as binder. The use of bitumen also results in a considerable cost-saving.

[0006] Surprisingly, it has further been found that during application of the layer a part of the bitumen from the applied layer penetrates into the open surface structure of the underlying road surface. The excess of bitumen is used to make new regenerating connections between the contact surfaces of the grains in the road surface with the open surface structure in the lower parts of the top layer, i.e. up to a few centimetres below the upper surface. The applied bitumen forms a fresh layer or binder film on the exposed stones in the existing road surface.

[0007] It is known in the prior art that the amount of bitumen in an asphalt is very precise. An excess of bitumen will according to prior art result in poorer performance of the road surface. The prior art teaches that parts of the excess of bitumen will be situated close to the upper surface of the road surface, whereby the road surface becomes very slippery. In addition, it is known that an excess of bitumen results in a less open structure of the asphalt concrete. The amount of hollow space is reduced when more bitumen is applied.

[0008] It is known to calculate the amount of bitumen required for an aggregate, such as a combination of different broken stones or road metals in an asphalt concrete. The amount of bitumen will depend on the composition (road metal, grain size distribution) of the aggregate. According to the invention however, the aggregate contains more bitumen than strictly necessary, for instance at least 1.2 x, for instance more than 1.3 x, and in the preferred embodiment 1.4 x as much as the calculated value. Very surprisingly, it has been found that very good results are obtained with a layer with double the calculated value for the bitumen.

[0009] The material of the layer of asphalt concrete will be substantially taken up into the open surface structure of the road surface. The new layer of asphalt concrete has an average grain size which is at least four times finer than the average of the underlying road surface, and is therefore taken up into the upper surface of the underlying road surface. The invention differs here from the prior art, wherein a layer is arranged on the existing road surface. The difference in grain size is such that the second layer can be taken up into the old road surface, also for instance partially into the hollow space of the road surface.

[0010] The upper layer in particular of an existing road surface is strengthened, consolidated or preserved using the invention. Owing to the layer of asphalt concrete many more contact surfaces will occur in the uppermost layer of the road surface, whereby the upper layer becomes stronger and can better withstand textural damage or plucking. In addition, particularly the noise reduction in the road surface with an open surface structure is improved compared to prior art. The term road surface is understood to mean the whole of the first ZOAB layer. The upper layer hereof constitutes the uppermost centimetres.

[0011] The invention is particularly suitable for, but not limited to, repairing or strengthening an older road surface. The invention is a maintenance or preservation technique for a road surface with an open surface structure or texture.

[0012] The open surface structure of the new layer of asphalt concrete is less open than the open surface structure of the old road surface. The total water-transmitting capacity of the aggregate of road surface and layer will logically

decrease to a limited extent relative to the capacity of a non-strengthened road surface. The layer of asphalt concrete is arranged in the upper layer of the road surface, close to the upper surface, whereby for water drainage through the road surface use can also be made of the pumping effect of the wheels travelling over the road surface. Water will be pressed through the aggregate of road surface and layer, so that it can be drained through the lower layers of the road surface.

[0013] The sound-damping properties of the older ZOAB road surface are however improved considerably by arranging the layer of asphalt concrete according to the invention. The sound produced by traffic travelling over the road surface is greatly reduced by arranging the layer. This is particularly the result of filling the plucked-out parts in the road surface with the layer.

[0014] The average grain size of the road surface is preferably at least six times larger than the average grain size of the second layer. The grains are hereby taken up better in a road surface. In the preferred embodiment the average grain size of the road surface is at least eight times larger than the average grain size of the layer. There is hereby deeper penetration into the underlying new road surface with an open surface structure, and more contact surfaces are made in the upper layer of the road surface. Penetration into the upper layer takes up 0.5 - 2 centimetres.

[0015] In the preferred embodiment the layer is arranged substantially in the road surface. The road surface is hereby strengthened and the sound-damping properties are further regenerated or retained. Remnants of the applied layer protruding above the existing road surface are removed and swept away after application.

[0016] In another embodiment a layer of 0 - 0.8 centimetre is arranged on the road surface. The road surface with an open surface structure can hereby be repaired with very little asphalt concrete.

[0017] The road surface is preferably filled with the asphalt concrete substantially up to an upper surface of the road surface. The upper surface of a road surface is the top surface of that road surface. The spaces in the open surface structure at the upper surface of the road surface, or the plucked-out parts formed for instance by a part of the upper surface of the road surface coming loose and being removed, are hereby filled and strengthened. It is hereby possible to postpone for at least a number of years the complete replacement of the road surface with an open surface structure. It is less expensive to apply the method according to the invention than to completely replace the road surface with the open surface structure.

[0018] Filling of the road surface with the asphalt concrete can be carried out actively, for instance by making use of a roller which presses the layer of asphalt concrete into the road surface. In addition, the asphalt concrete can be taken up into the road surface by being driven therein by traffic during normal road use.

[0019] A layer of asphalt concrete is preferably applied cold to the road surface, wherein bituminous emulsion is included in the layer. The method according to the invention can hereby be performed rapidly and the road surface can be quickly reopened to traffic.

[0020] A bituminous emulsion is a substantially homogeneous mixture of water and bitumen. The bitumen floats like small globules in the water. During processing, for instance after arranging of the layer on/in the underlying road surface, the stability of the emulsion is broken down. Bitumen and water separate out again into the two original liquids, wherein the water eventually evaporates.

[0021] The ratio of the percentage of water and bitumen can vary and lies between 40 and 80%, preferably 50-70%, and in a further preferred embodiment between 63-65%. The speed of the breakdown process can be adapted to the application. Preferably chosen is a stable bituminous emulsion which breaks down slowly. Breakdown of the bituminous emulsion occurs on contact with mineral aggregate. The aggregate ends the equilibrium. Bitumen is deposited onto the aggregate, thereby creating a bitumen film. The stones are adhered to each other on the contact surfaces.

[0022] A layer of asphalt concrete substantially of less than 0.8 centimetre, and preferably 0.7 centimetre in thickness, is preferably arranged temporarily on the road surface and then sinks into the upper layer of the existing road surface. Such a layer cannot be seen as an extra layer (double-layered) on the existing road surface. The road surface is hereby strengthened using a very small quantity of asphalt concrete.

[0023] Use is preferably made of asphalt concrete comprising bitumen (emulsion), cement and a road metal such that an open surface structure is formed. Cement is added as catalyst for the emulsion when the layer is applied. Cement breaks down emulsifier after the application, so that bitumen can flow together again.

[0024] The invention also relates to asphalt concrete for strengthening a road surface with an open surface structure, such as very open asphalt concrete (ZOAB), comprising binder, cement and a road metal such that an open surface structure is formed, wherein the road metal of the asphalt concrete has substantially a grain size distribution of 0/3 mm or 1/3 mm. Such asphalt concrete is known and is used to arrange a layer with an open surface structure on a substrate which optionally also defines an open surface structure.

[0025] According to the invention the binder comprises an excess of bitumen. A layer of asphalt concrete made up in such a way has surprisingly been found to be very suitable for strengthening the upper layer of a road surface with an open surface structure. Even more surprising is that this strengthening has no adverse consequences for the most important properties of the road surface. The smaller road metal of the asphalt concrete according to the invention is taken up into the upper layer of the existing road surface. The excess of bitumen will penetrate into the road surface

and connections will herein be formed between the applied layer and the underlying road surface. In addition, the road surface on which the asphalt concrete is arranged is itself strengthened in that the excess of bitumen forms connections in the upper layer of the road surface. Adhesive in the upper layer can disappear through age, but is now replaced by the newly applied bitumen.

[0026] The bitumen is preferably a bituminous emulsion. The asphalt concrete can hereby be applied cold to a road surface. Such bituminous emulsion comprises globules of bitumen in water. After the breakdown process of the emulsion the bitumen will bind with the road metal. The globules herein disintegrate and bitumen films are formed around the grains of the road surface or the layer.

[0027] The asphalt concrete preferably comprises a modified bituminous emulsion provided with a polymer-modified bitumen. Improved properties are hereby obtained, for instance for adhesion, elasticity, flexibility, flow and increased lifespan. The original bitumen can be mixed with SBS or EVA, whereafter the polymer-modified binder is emulsified. In another embodiment a quantity of polymer emulsion (latex) is added to a standard emulsion and then mixed to form an homogeneous whole. The emulsion can be modified such that after drying there occurs no adhesion of the bitumen to tyres in traffic.

[0028] The invention also relates to a road surface for roads an open surface structure, such as very open asphalt concrete (ZOAB), provided with a layer of asphalt concrete, wherein the road surface respectively the layer has a grain size distribution around an average, wherein the distribution is such that an open surface structure is formed, wherein the layer of asphalt concrete is substantially taken up into an upper layer of the road surface, and wherein the average of the grain size in the road surface is substantially a factor of four greater than the average in the layer. According to the invention the applied layer of asphalt concrete comprises an excess of bitumen. The bitumen serves as binder for the layer to itself and to the underlying road surface, and also as binder for the road surface per se. A road surface is hereby obtained wherein the upper layer of the road surface has an open surface structure which is the combination of two types of open surface structure. The excess of bitumen is found, surprisingly, not only to provide connections between the minerals in the applied layer of asphalt concrete and between the applied asphalt concrete and the underlying road surface, but also to repair connections in the underlying road surface. The open surface structures mix together in the upper 0-2 centimetres of the upper layer of the road surface. In addition, the open surface structure of the lower layer is retained.

[0029] When the open surface structure of the existing road surface is still intact, the layer of asphalt concrete will partially fill this open surface structure, thereby forming additional strengthening connections which counter wear, for instance plucking, of the road surface. When the open surface structure of the road surface is already damaged, for instance in that a number of stones have become detached from the upper layer of the road surface, this hole is filled with the layer of asphalt concrete which will itself form an open surface structure. This open surface structure is almost as porous as the open surface structure of the road surface. According to the invention however, the water-draining capacity of the aggregate of the road surface plus new layer will not decrease, or hardly so. The water-draining capacity of the road surface is determined to a large extent by the open surface structure in the lower part of the road surface, and this is not affected according to the method of the invention. The water-draining capacity is not reduced because, according to the invention, use is made of the pumping power of traffic travelling over the road surface and the layer. The upper layer is consolidated in that the stone skeleton is strengthened. The sound-damping properties of the road surface are improved.

[0030] Such a road surface can withstand traffic better and will last longer, thereby postponing replacement. Considerable costs are hereby saved.

[0031] It is noted that the median of the grain size can be taken instead of the average grain size. According to the invention the median of the road surface and that of the layer to be applied also differ by at least a factor of four.

[0032] The invention will be further described with reference to the annexed drawings, wherein:

Figure 1 shows a side view of a production train for applying the method according to the invention,
Figure 2 shows a detail view of the application device according to arrow II in figure 1,
Figure 3 shows a cross-section of a road surface according to an embodiment of the invention,
Figure 4 shows a detail of figure 3,
Figure 5 shows a cross-section of a road surface according to a second embodiment,
Figure 6 shows a detail of the cross-section according to figure 5,
Figure 7 shows a cross-section of a third embodiment of the road surface according to the invention.

[0033] Figure 1 shows a train 1 in the form of a truck 2 and a trailer 3 provided with three compartments 4-6 in which the supplies for the layer of asphalt concrete are arranged. Compartment 4 comprises different types of bituminous emulsion, compartment 5 comprises different road metals. Compartment 6 comprises cement. Train 1 can advance as according to arrow 7 over a road surface 8. Road surface 8 is a road surface with an open surface structure, for instance ZOAB. This ZOAB is for instance new, old or even damaged. According to the method of the invention this

ZOAB can be strengthened so as to counter plucking.

[0034] Train 1 is provided for this purpose on the rear with an application device 9 which, at least without the specific modifications according to the invention, is per se known for emulsion asphalt concrete.

[0035] Compartments 4,5,6 comprise cement, minerals, water and/or bituminous emulsion. There can be different compartments with minerals, for instance pre-sorted road metals. These can be mixed during use, whereby the grain size distribution can be adjusted. These substances from the compartments are mixed when fed to the dispensing device 9 arranged on train 1. Dispensing device 9 is controlled in each case such that a layer of asphalt concrete is dispensed which has an open surface structure.

[0036] Dispensing device 9 applies a determined pressure to the dispensed layer. The pressure is adjustable and depends on the precise composition of the product to be applied. Determining factors are the stability of the bituminous emulsion and the average grain size.

[0037] The mixing of the at least three components of the layer to be applied takes place in the dispensing device. The components of the asphalt concrete are optionally mixed even further between two rollers 10, 11 so as to form an homogenous mass. This takes place under hood 12. The layer is then applied to the underlying road surface 8.

[0038] The contact surface of the layer of asphalt concrete to be applied in the composition according to the invention is shorter than the contact surface that is usual for other repair techniques, such as in the case of emulsion asphalt. The known application device 9 is provided for this purpose with a beam 14 which is mounted on hood 12 for sliding as according to arrow 13 and which can vary, and particularly reduce, the size of the contact surface with road surface 8. The contact surface is preferably halved.

[0039] With a layer thickness control 15 the height of the layer being applied can be adjusted during application. Use is made of a bituminous emulsion of water and bitumen mixture which also includes a polymerized modified additive. The use of bituminous emulsion is per se known and is used for cold application of a layer of normal asphalt.

[0040] Use is made of an excess of bitumen. The ideal quantity of bitumen for a mineral aggregate can be calculated when a sieve analysis is known. Taken instead of this ideal quantity however is an excess, preferably of more than 1.8 x the calculated quantity.

[0041] The amount of filler in the layer of asphalt concrete to be applied is small. Fillers are the minerals of the smallest screen size, for instance smaller than 0.063 mm. The percentage of filler in the layer of asphalt concrete according to the invention is preferably less than 8% of the total mixture of minerals. In a preferred embodiment less than 6.5% is made up by filler, and more particularly less than 5.1%.

[0042] Since use is made of a low percentage of filler, the required quantity of bitumen in the total mixture for the layer of asphalt concrete to be applied will decrease. The calculated bitumen percentage for a road metal mixture according to the invention is for instance 3%. Instead of this 3%, use is made of more bitumen, for instance a mass percentage of 3.5% to 6.5%.

[0043] The composition of the layer to be applied will depend on the underlying road surface. In a known road surface of ZOAB 0/16 the composition below is preferably used for the layer to be applied. The table below gives the grading curve distribution for the grain size. The average grain size is ± 1.8 mm. The ZOAB 0/16 road surface has an average grain size of 11 mm.

The embodiments below are examples.

Cumulative grain distribution with road metal 1/3	
Road metal on sieve	Cumulative percentage
4 mm	0
2.8 mm	5.3 %
2 mm	36.2 %
0.063 mm	95.3 %

Cumulative grain distribution with basalt 1/3	
Road metal on sieve	Cumulative percentage
4 mm	0.1 %
2.8 mm	15.1 %
2 mm	61.1 %
0.063 mm	95.0 %

The composition of the layer is:

Basic composition	
Dutch road metal Portland cement	98 % 2 %
to 100% minerals is added: Bituminous emulsion	 10 %
of the composition of minerals and emulsion Emulsifier is: Bitumen is:	 0.2 % 6.0 %

Respectively	
Basalt 1/3 Portland cement	98 % 2 %
to 100% minerals is added: Bituminous emulsion	 10 %
of the composition of minerals and emulsion Emulsifier is: Bitumen (corrected for density) is:	 0.2 % 5.7 %

[0044] Figure 3 shows a cross-section of a road surface with an open surface structure. Figure 3 is a schematic representation thereof. Twelve stone granules 20 are shown. The shown cross-section is very schematic and does not correspond to reality. A choice has however been made to give a cross-sectional view which provides a better insight. Shown is that the road surface has a very regular structure, wherein the road surface comprises grains of a reasonably uniform size. Each of the grains 20 is at least partially enclosed by a bitumen film 21 which has hardened in the usual situation. The bitumen adheres in particular around the grain 20. The bitumen also provides bindings between the respective grains. Stones 20 and bitumen 21 form the existing road surface.

[0045] It is also apparent that the upper layer of the (old) road surface with the open surface structure is rather less firmly connected to the other grains. This is a known given in a road surface with an open surface structure such as ZOAB, wherein plucking of the upper surface can occur. Owing to the traffic travelling over the upper layer of the road surface, the bitumen film which encloses grains 20 in the first instance has practically disappeared from the grains in the upper layer of the road surface.

[0046] The upper surface 22 of the road surface formed by grains 20 and bitumen 21 is shown with dashed line 22. A layer of asphalt concrete according to the invention is arranged a little above and substantially below the upper surface 22, wherein the average of the grain size distribution of this asphalt concrete is a factor of 10 smaller than the average of the grain size distribution of the road surface. Grains 23 can hereby penetrate even into the open surface structure of the road surface. The bitumen of the asphalt concrete layer once again forms a film around grains 23, whereby an open surface structure is created in the layer of asphalt concrete. There is in fact created a layer-within-layer structure of a larger open surface structure and a smaller open surface structure formed by respectively the road surface and the layer of asphalt concrete.

[0047] Close to 25 and 26 can be seen that the bitumen of the layer of asphalt concrete has penetrated into the road surface and that the open surface structure of the road surface has been partly filled. The bitumen of the layer will form contact surfaces with the grains 20 already present. The upper layer of the road surface is hereby strengthened/consolidated/preserved, and the upper layer will display less plucking.

[0048] Use is made of a layer of asphalt concrete comprising bituminous emulsion globules 27. These latter comprise inter alia water which, during the breakdown process, will be released under the influence of pressure from traffic or from a roller, or due to UV radiation, and wherein the bitumen forms a film around the grains. The greater part of the bituminous emulsion according to figure 3 has already been broken up. A number of separate grains 28 are still lying loosely above the layer of asphalt concrete. By driving with a roller over the road surface or as a result of the traffic travelling over the road surface, these loose grains 28 are pressed down and the bituminous emulsion globules will burst, whereby grains 28 are provided with a bituminous layer. In addition, the upper layer of the road surface will be further filled with the layer of asphalt concrete with the smaller average grain size, and the cavities of the open surface structure of the road surface will be further filled. This is shown in figure 5. The cavities between grains 30 and 31 of

the road surface are further filled close to 32. The upper layer A of the road surface, which according to figure 5 is for instance 1 centimetre, is filled with the smaller open surface structure of the applied layer of asphalt concrete. This layer is arranged in the upper layer of the road surface. The upper grains of the road surface will now come loose less quickly. Grain 31 still forms the top of the road surface. The other grains 30 of the road surface are almost fully covered with the new layer. Figure 6 shows the detail according to arrow VI.

[0049] The drawing of figure 5 once again shows the situation very schematically, wherein a non-realistic cross-section of the road surface and the layer is shown. In reality a cross-section will give a much more varied picture of the size of a stone, despite the fact that the grain size distribution in both the road surface and the layer varies little.

[0050] The upper layer 34 is filled to a depth A. The strengthening of the upper layer is considerable since the upper grains of the road surface form a large number of connections with the bitumen 35 of the layer of asphalt concrete.

[0051] Figure 7 shows a schematic cross-section of a road surface in which the layer-within-layer composition of two open surface structures can be recognized. The surface of the road has herein been affected considerably since one of the large grains of the road surface which lay on the surface has come loose. Following the method according to the invention, this hole at 40 has been filled with a layer of asphalt concrete with an open surface structure and an average grain size which is a factor of 10 smaller than the average grain size of the road surface. The layer-within-layer structure can once again be identified. The aggregate of the open surface structures is water-permeable, not only because of the open surface structure but also because of the pumping action of traffic travelling over the upper surface 41 of the road surface according to the invention.

[0052] The layer according to the invention can also protrude considerably above the existing road surface.

Claims

1. Method for strengthening a.road surface with an open surface structure, such as very open asphalt concrete (ZO-AB), comprising of arranging a layer of asphalt concrete on the road surface, wherein the road surface respectively the asphalt concrete has a grain size distribution around an average such that an open surface structure is formed, wherein the average of the grain size distribution in the road surface is at least substantially a factor of four greater compared to the layer, **characterized by** applying a layer of asphalt concrete which includes a bituminous binder and in which the bitumen is present in an excess.

2. Method as claimed in claim 1, **characterized in that** the average grain size of the road surface is at least eight times larger than the average grain size of the layer.

3. Method as claimed in claim 1 or 2, **characterized by** substantially arranging the layer in the road surface.

4. Method as claimed in any of the claims 1-3, **characterized by** filling the road surface with the layer of asphalt concrete substantially up to an upper surface of the road surface.

5. Method as claimed in any of the claims 1-4, **characterized in that** the bitumen in the layer is a bituminous emulsion.

6. Method as claimed in any of the claims 1-5, **characterized by** applying the layer to the road surface, wherein components of the layer are mixed prior to application.

7. Method as claimed in any of the claims 1-6, **characterized by** applying a layer of asphalt concrete substantially of less than 0.8 cm thickness.

8. Method as claimed in any of the foregoing claims, **characterized by** rolling the layer into the road surface.

9. Asphalt concrete for strengthening a road surface with an open surface structure, such as very open asphalt concrete (ZOAB), comprising binder, cement and a road metal with a composition such that an open surface structure is formed, wherein the road metal has substantially a 0.1/3 mm grain size distribution, **characterized in that** the asphalt concrete has an excess of bituminous binder.

10. Asphalt concrete as claimed in claim 9, **characterized in that** the asphalt concrete is an emulsion asphalt concrete comprising bituminous emulsion.

11. Asphalt concrete as claimed in either of the claims 9 or 10, **characterized in that** the asphalt concrete comprises a modified bituminous emulsion provided with a rubber or plastic additive.

12. Road surface for traffic roads with an open surface structure, such as very open asphalt concrete (ZOAB), provided with a layer of asphalt concrete, wherein the road surface respectively the layer has a grain size distribution around an average such that an open surface structure is formed, wherein the layer of asphalt concrete is substantially taken up into an upper layer of the road surface, and the average of the grain size in the road surface is substantially a factor of four greater than the average in the layer, **characterized in that** the applied layer comprises bitumen which has penetrated into the road surface.

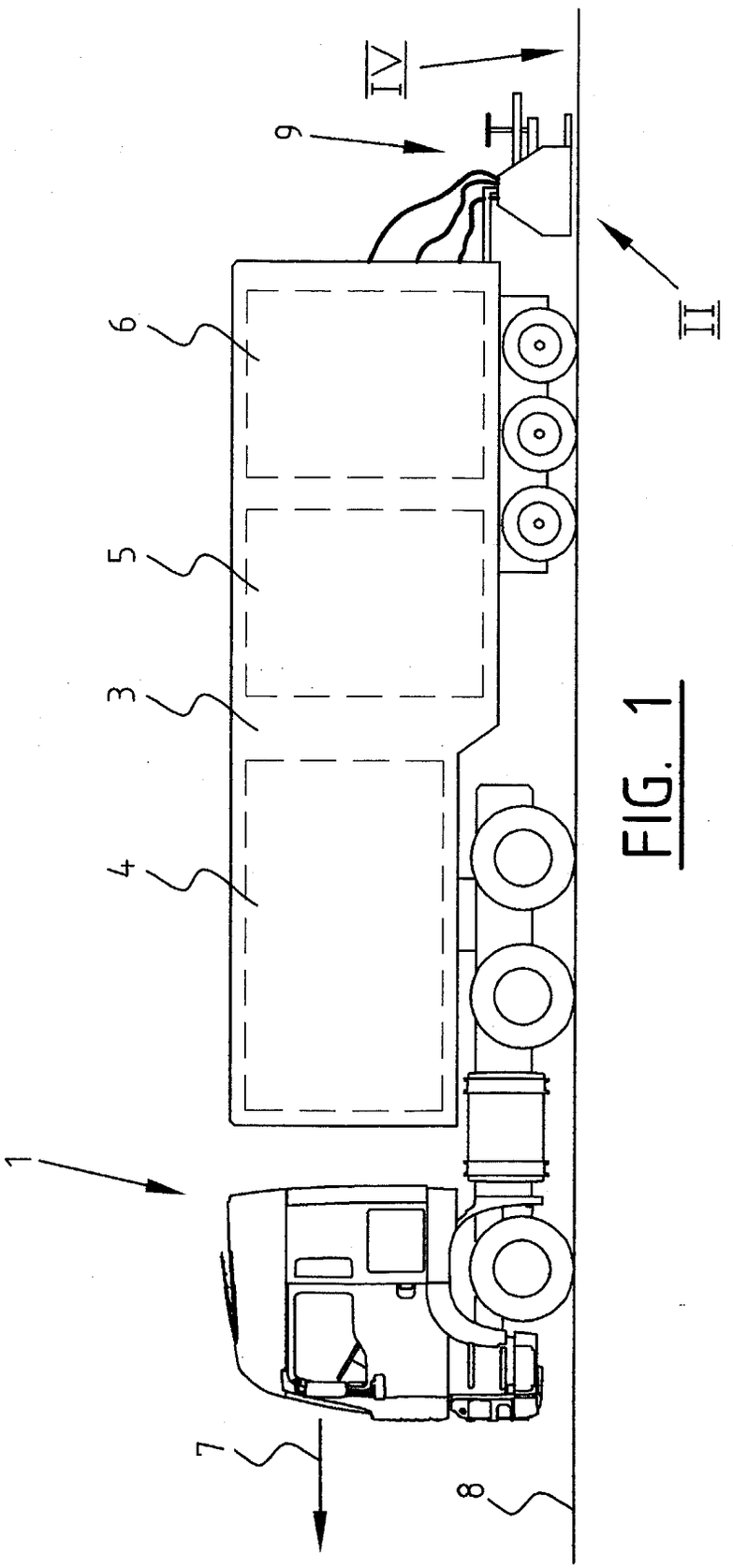


FIG. 1

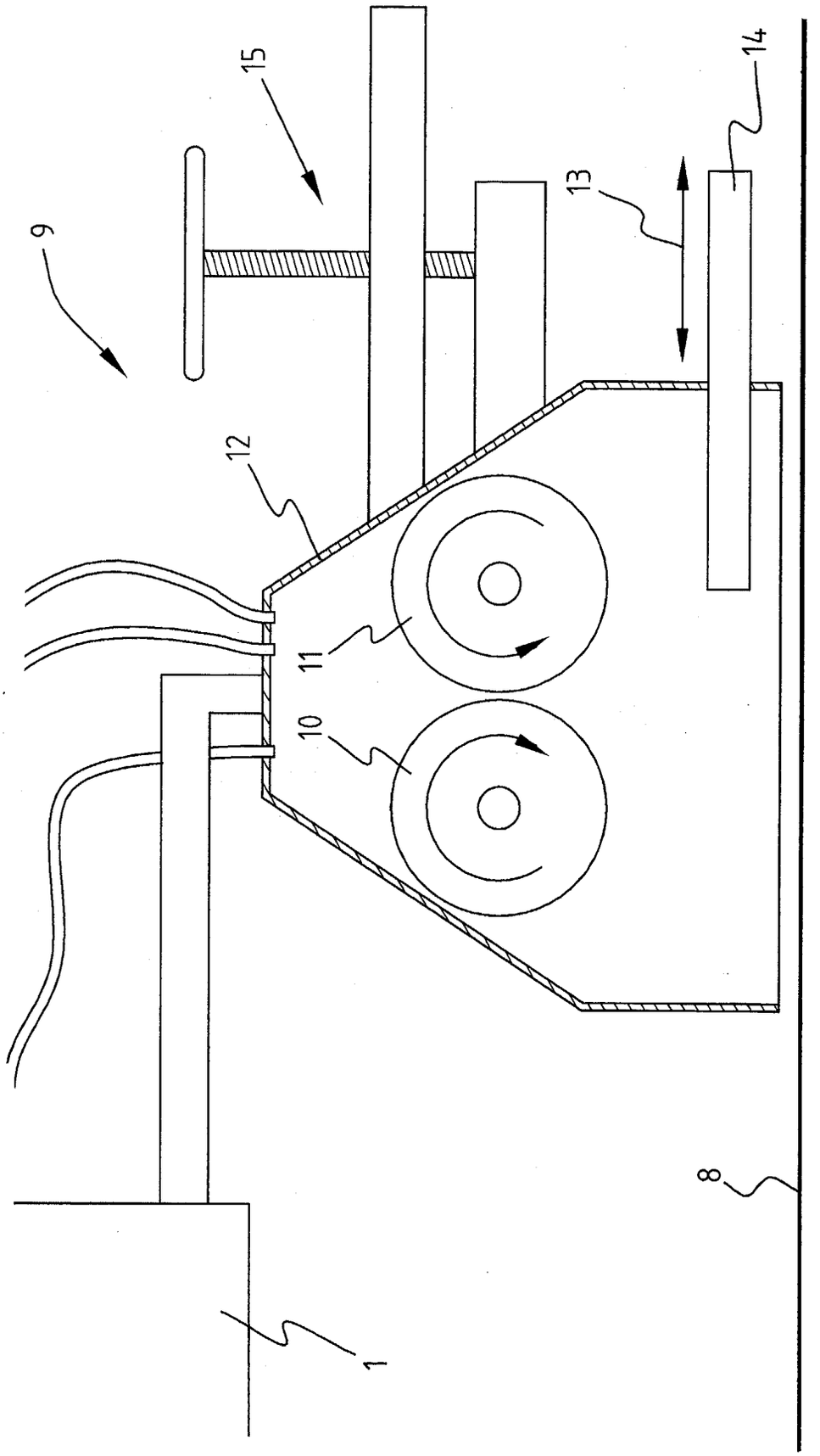


FIG. 2

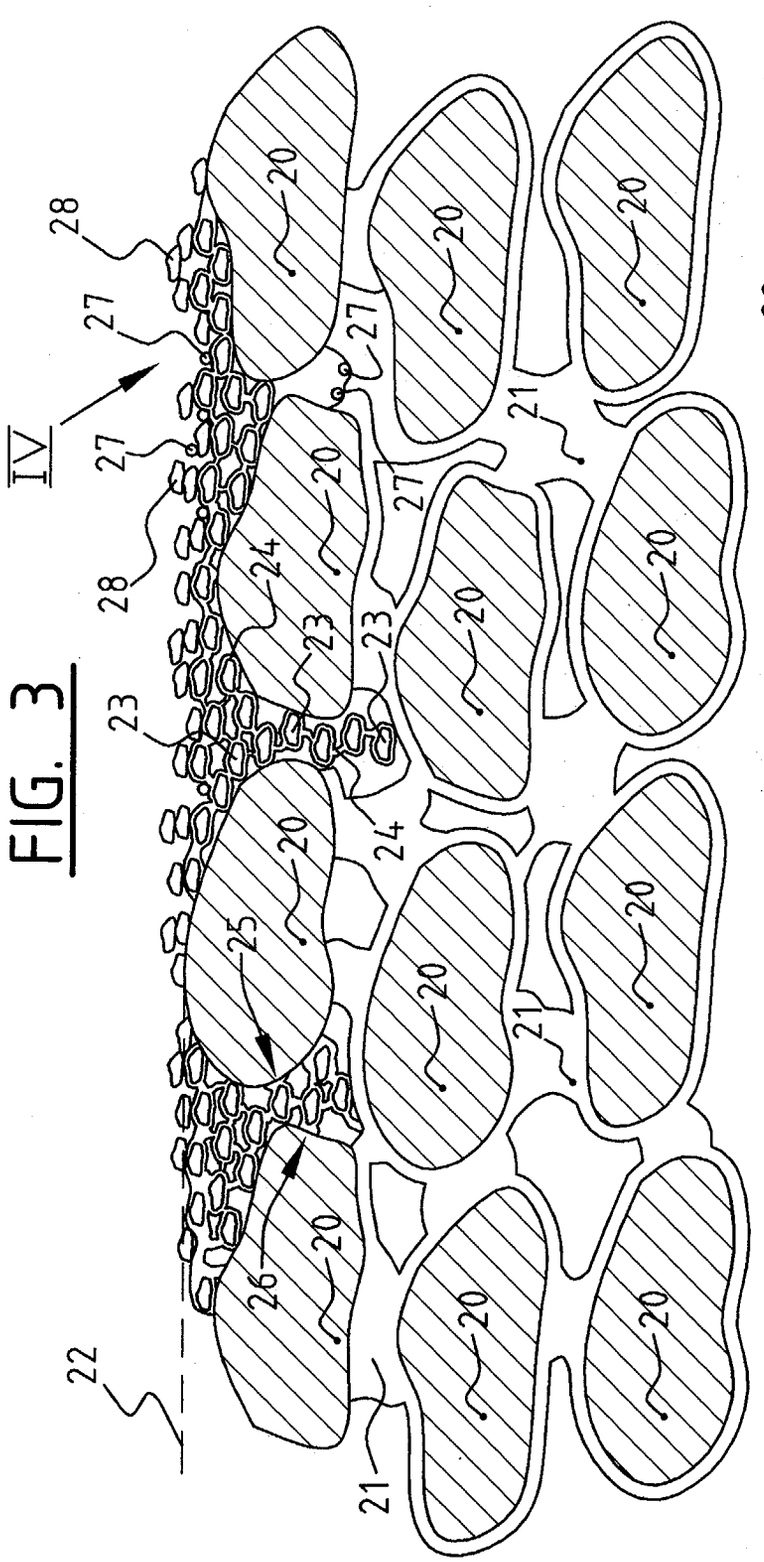


FIG. 3

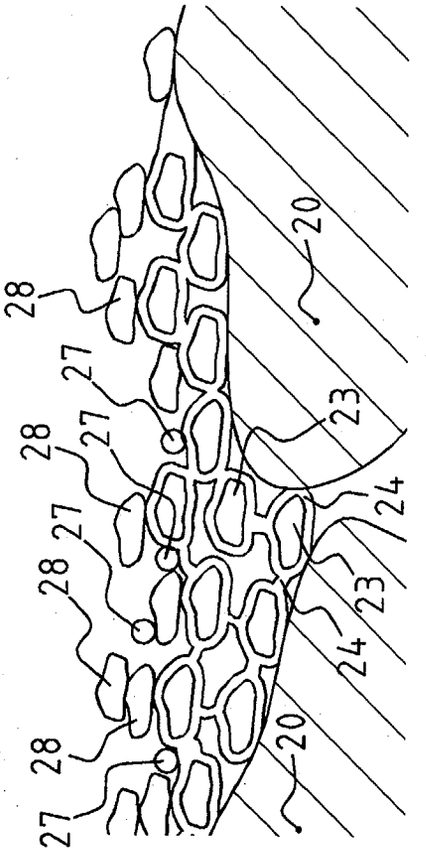
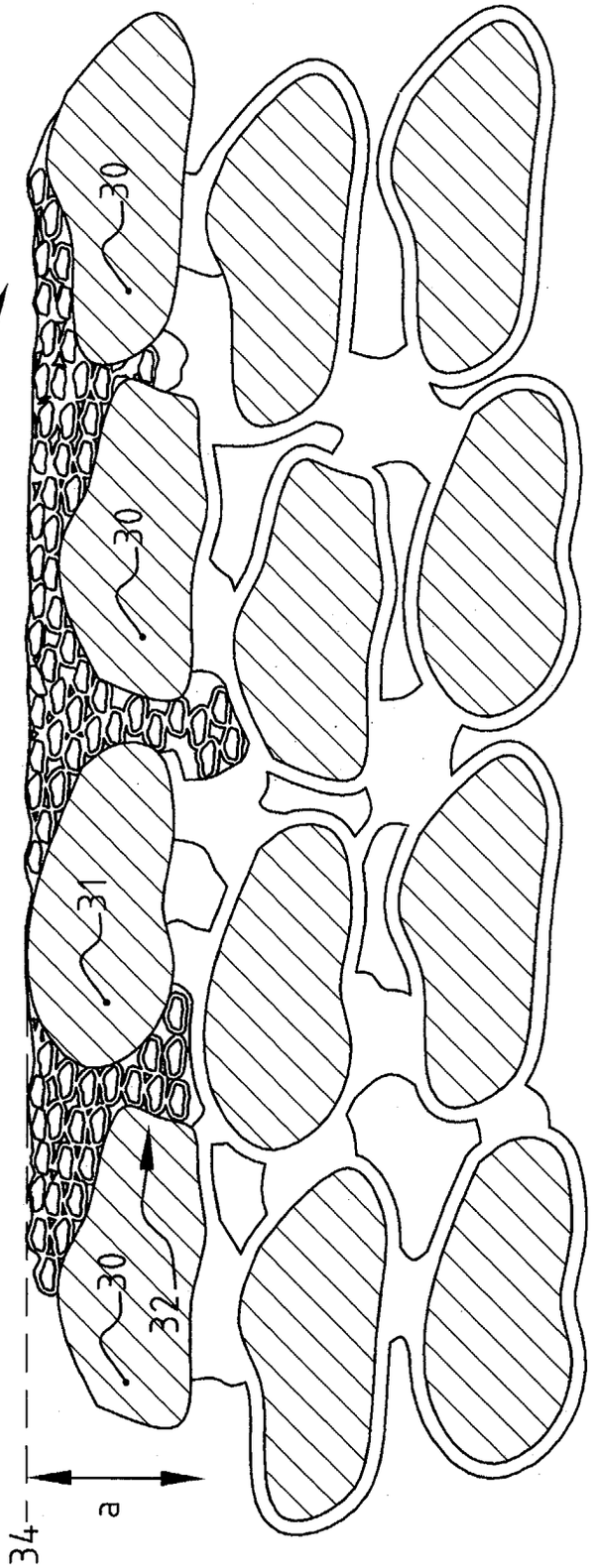


FIG. 4

FIG. 5



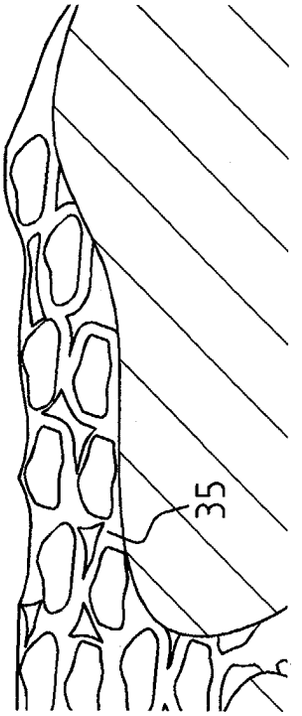


FIG. 6

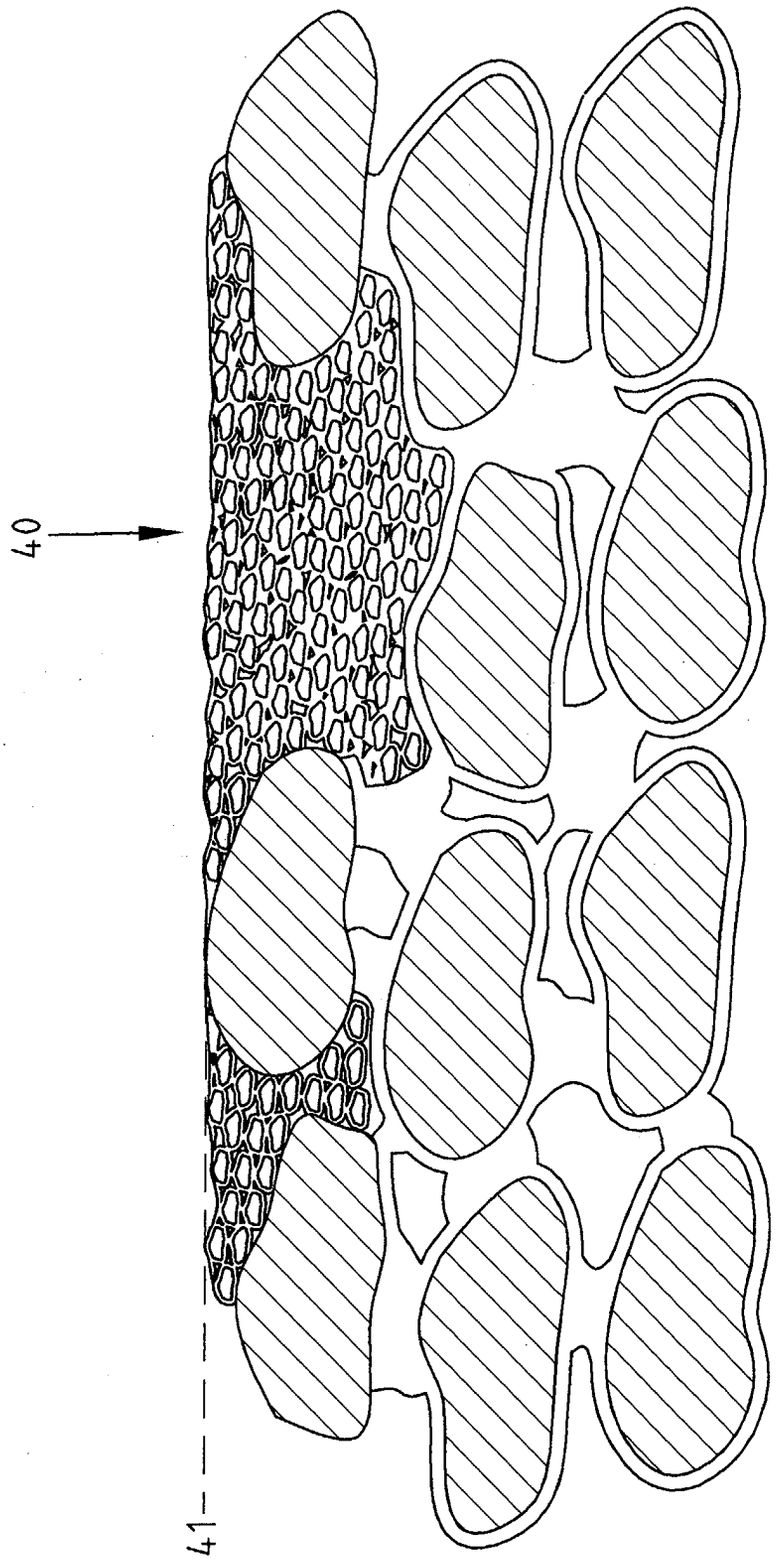


FIG. 7