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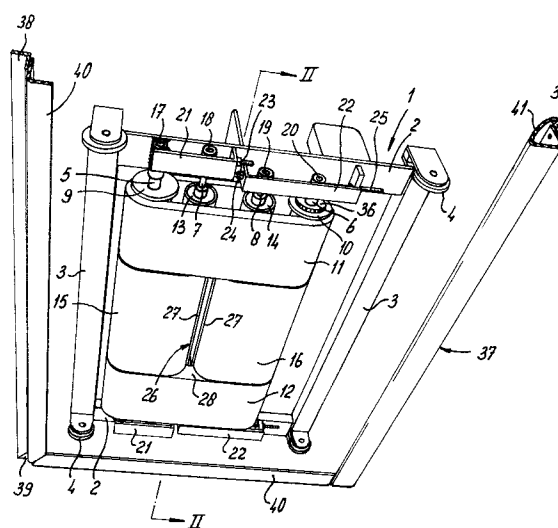
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NL-2502 LS Den Haag (NL)(54) **Method and device for cleaning a road surface of very open asphalt concrete.**

(57) For the purpose of removing dirt such as sand, mud, rubber particles and the like from the open spaces in a road surface of very open asphalt concrete, a flushing liquid is applied to the road surface and subsequently removed with the entrained dirt (32). The parts deeper down (31) can also be cleaned well if the road surface is covered locally in an essentially liquid-tight way (14), and in at least two road surface areas at a distance from each other and adjacent to the covered surface a pressure difference is generated in such a way that a liquid flow (31) forms in the covered road surface area.

A device for carrying out this method comprises a covering element (1) for covering a road surface part, means for feeding the flushing liquid to the very open asphalt concrete in a first road surface area along a first peripheral edge of the covering element (1), and also means (26) for discharging the flushing liquid from the very open asphalt concrete in a second road surface area along a second peripheral edge of the covering element (1).

fig-1



The invention relates to a method for removing dirt such as sand, mud and possibly rubber particles and the like from the open spaces in a road surface of very open asphalt concrete. In this connection a method is known in which a flushing liquid is applied to the road surface and subsequently removed with the entrained dirt. The flushing liquid is sprayed on in thin jets at a very high pressure, the object of which is also to flush away the dirt present in the cavities deeper down.

The sprayed flushing liquid is then sucked up by means of a strong air stream and discharged to a separating device, where the dirt is removed. The cleaned flushing liquid is subsequently re-used for cleaning the road surface.

In practice, such a method is found to be only partially satisfactory. Although the top layer of the road surface is adequately cleaned, the cleaning is much less satisfactory in the cavities deeper down. Despite the very high pressure at which they are sprayed, it is found that the jets of flushing liquid very soon lose their penetrating action. This means that hardly any flushing out takes place in the cavities lying lower down, so that the dirt present there is not removed.

The object of the invention is therefore to provide a method by which the layer of very open asphalt concrete can be cleaned reliably over its entire thickness. This is achieved through the fact that the road surface is covered locally in an essentially liquid-tight way, and that in at least two road surface areas at a distance from each other and adjacent to the covered surface a pressure difference is generated in such a way that a liquid flow forms in the covered road surface area.

Through the pressure difference, combined with the covering which is impermeable to the liquid applied to the road surface, said liquid is forced to take a flow path running through the open spaces in the very open asphalt concrete. By selecting the dimensions of the covering in a suitable way, it can be ensured that the liquid flow thus produced also actually spreads over the whole thickness of the layer of asphalt concrete, and does not merely select the shortest route through the top layer.

The pressure difference can be obtained through the flushing liquid being fed in at excess pressure in one of the road surface areas, or through the flushing liquid being removed by vacuum in one of the road surface areas. A combination of the two variants is also possible.

A layer of liquid is preferably applied beforehand to the road surface to be cleaned, following which a vacuum is created through an opening in the covered road surface area, in such a way that a liquid flow running from the edge of the covered road surface area to the passage forms. A layer of

liquid which is sufficient to prevent ambient air from being sucked up must be present here.

In order also to remove obstinate dirt, it can be beneficial to vary the vacuum. The vacuum can be interrupted, for example intermittently, with the result that a shock effect occurs in the liquid flow, which loosens the dirt.

The invention also relates to a device for carrying out the method described above. This device comprises a covering element for covering a road surface part, means for feeding a flushing liquid to the very open asphalt concrete in a first road surface area along a first peripheral edge of the covering element, and also means for discharging the flushing liquid from the very open asphalt concrete in a second road surface area along a second peripheral edge of the covering element.

The supply or discharge of the flushing liquid can be carried out by, for example, pressure means or suction means which can be placed on the road surface. The covering passage of the device preferably comprises an essentially central passage which is connected in a liquid-tight manner to a feed or a discharge pipe. If a central discharge pipe is provided, the flushing liquid with dirt can be sucked away, and the flushing liquid can flow in uniformly from all sides.

In order to ensure that no "leakage" can take place here, the covering element comprises a relatively soft material, the surface of which can adapt to the irregular surface shape of the asphalt concrete.

Good results can be obtained if the covering element is an approximately constant width measured from the passage. As already discussed above, said width must be such that the flushing liquid spreads over the whole thickness of the layer of very open asphalt concrete, and can thus entrain all dirt.

According to a first embodiment, the covering element has a circular periphery. The passage is situated centrally here, in such a way that the distance from the periphery is the same everywhere.

According to a second embodiment, the covering element has a rectangular periphery, and the passage is slit-shaped. In the case of these two embodiments it is conceivable to take a single piece of material for the covering element. In a device designed in this way the covering element must be moved stepwise over the road surface to be cleaned.

For proper functioning of the device it is not just important to select the width of the covering element ensuring that it is not too small. If the width is selected too large, the flushing liquid must cover such a long distance through the open spaces in the very open asphalt concrete that the

pressure difference required for producing the desired liquid flow is hardly attainable any longer. Of course, several of such covering elements with relatively small dimensions, and each with its own central passage, could also be used side by side. At each stage a number of road parts can then be cleaned simultaneously, thus increasing the working speed of the device.

Another possibility, which is preferred, for increasing the working speed is the embodiment in which the slit-shaped passage is bounded by four endless belts, each of which is guided over corresponding pairs of rollers, of which the shafts are suspended in a frame and are parallel to two slit edges lying opposite each other. Such a device can travel over the road surface, cleaning as it goes, and thus produces a continuous action.

Two of these belts lie next to each other in each case near the corners of the slit-shaped passage. Since all belts move at the same peripheral speed, it is no problem at all if the edges of the belts touch each other. A good sealing can be obtained in this way, and it can be further improved if the device is placed on the road surface, and the fairly soft material of the belts is compressed a little here under the influence of the vacuum and the weight of the device itself, and thus bulges outwards.

In the case of this embodiment, provision is made for a slit-shaped nozzle extending in a close-fitting manner in the slit present between the belts in the direction of the bottom parts of the belts to be placed on the road surface. The walls of the nozzle adjoining the inner belts preferably extend to the level of the shafts, while the other two walls extend further to near the surface of the belts and in that direction flare out to shut off the opening between the inner belts and the outer belt concerned.

In this case the nozzle opens out at the side facing away from the bottom parts into a pipe which is connected to a source of vacuum for sucking up the flushing liquid.

An auxiliary frame is also provided according to the invention, the internal dimensions of which frame are greater than the corresponding external dimensions of the frame, which auxiliary frame has on its periphery rubber strips, in such a way that the auxiliary frame can form a basin which can be dragged along with the frame and is essentially watertight relative to the road surface.

The invention will be explained further below with reference to an example of an embodiment shown in the figures.

Figure 1 shows a view in perspective of the underside of the device according to the invention.

Figure 2 shows a view along section II-II of Figure 1.

The device shown in Figure 1 comprises a rectangular frame 1, composed of sections 2, 3. An auxiliary wheel 4 is provided at the four corner points of frame 1, by means of which wheel the frame can be supported on a road surface. These auxiliary wheels 4 also limit the compression of the belts 11, 12, 15, 16.

Four shafts are suspended in frame 1, i.e. the outer shafts 5, 6 and the inner shafts 7, 8. Fitted on the outer shafts are rollers 9, 10, over which the outer endless belts 11, 12 are guided.

Rollers 13, 14 are provided on the inner shafts 7, 8. The inner belts 15, 16 are now guided in each case over rollers 9, 13 and rollers 10, 14 respectively. The rollers 13, 14 also provide an additional support for the central region of the outer belts 11, 12. As shown, the inner belts 15, 16 lie with their edges against the outer edges 11, 12, thus ensuring the seal at that point.

The inner belts can be a substantial width, for example several metres, so that a road surface part the width of a road lane or a part thereof can be cleaned in each case. The shafts must, however, be so rigid that even in the central part of these belts sufficiently great pressure on the road surface remains ensured.

Shaft 9 is suspended in a fixed support 17 on frame 1. The shafts 10, 13 and 14 are each suspended in a suspension in the form of a slide block 18, 19, 20. These slide blocks 18 - 20 are supported between section 2 of frame 1 and parallel auxiliary sections 21, 22 welded thereto. The shafts 10, 13 and 14 can be displaced in a suitable manner by means of partially visible tensioning elements 23, 24 and 25, for tensioning the belts 11, 12, 15 and 16.

A nozzle, indicated in its entirety by 26, is situated in the gap formed between the belts 11, 12, 15 and 16. This nozzle is rectangular and comprises two straight plates 27 and two flared plates 28. The plates 27 rest against the belts 15, 16 and extend no further than to the centre between the top and bottom parts of said belts 15, 16.

The plates 28 are welded to the plates 27 to form a closed channel. However, plates 28 extend further than the plates 27, to a little before the surface of the belts. This can be seen in Figure 2. The plates 28 also extend over a short distance between the edges of the belts 11, 15, 16 and 12, 15, 16 facing each other. In operation, the belts are in friction contact with the plates 27, 28, but in this case the flushing liquid acts as a lubricant, so that hardly any wear occurs.

The plates 27, 28 are covered at the top side by partition 29, in which a channel 30 which is connected to a source of vacuum (not shown) opens out. If the device is of greater width, several

channels can, of course, also be used next to one another.

In operation, a liquid flow, shown by arrows 31, 32 in Figure 2, is created by the vacuum. The flow 31 through the very open asphalt concrete ensures that the dirt present in that asphalt concrete is entrained. Owing to the very soft material layer 33 of the belts, such a sealing of the surface of the asphalt concrete is obtained that no leakage over that surface can occur. The compression of the soft material layer 33 on the road surface is ensured by, on the one hand, the rollers 9, 10, 13 and 14 and, on the other, the pre-tension in the belts. This pre-tension is absorbed by the material layer 34 of high tensile strength, which is guided over the rollers in question. However, the vacuum also makes a contribution to the compression of the belts on the road surface.

Motor 35 drives the shaft 6 by means of chain transmission 36.

The framework 37, comprising sections 38, 39, is also shown in Figure 1. The sections 38 are shown in cross-section; one of the sections 39 is omitted. This framework 37 is dragged along when the device is travelling over the road surface.

The framework rests on the road surface by means of the rubber strips 40, 41. They form a seal relative to the road surface, in such a way that a layer of water of a level which is great enough to ensure proper functioning of the device can be applied within the framework. The framework shown is capable of being dragged along to the left in the figure. Strip 41 is therefore turned back and fixed by both edges to the corresponding section 38. Strip 41 cannot, therefore, flip over underneath the section 38 when the framework is being dragged along.

Claims

1. Method for removing dirt such as sand, mud and possibly rubber particles and the like from the open spaces in a road surface of very open asphalt concrete, in which a flushing liquid is applied to the road surface and is then removed with entrained dirt, characterised in that the road surface is covered locally in an essentially liquid-tight way, and that in at least two road surface areas at a distance from each other and adjacent to the covered surface a pressure difference is generated in such a way that a liquid flow forms in the covered road surface area.
2. Method according to Claim 1, in which in one of the road surface areas the flushing liquid is fed in at excess pressure.
3. Method according to Claim 1 or 2, in which in one of the road surface areas the flushing liquid is discharged by vacuum.
4. Method according to Claim 3, in which a layer of liquid is applied to the road surface part to be cleaned, following which a vacuum is created through a passage in the covered road surface area, in such a way that a liquid flow running from the edge of the covered road surface area to the passage forms.
5. Device for carrying out the method according to Claim 1, 2, 3 or 4, comprising a covering element for covering a road surface part, means for feeding the flushing liquid to the very open asphalt concrete in a first road surface part along a first peripheral edge of the covering element, and also means for discharging the flushing liquid from the very open asphalt concrete in a second road surface area along a second peripheral edge of the covering element.
6. Device according to Claim 5, in which pressure means which can be placed on a road surface part, for feeding in the flushing liquid by excess pressure, are provided.
7. Device according to Claim 5, or 6, in which suction means which can be placed on a road surface part, for discharging the flushing liquid by vacuum, are provided.
8. Device according to Claim 6 or 7, in which the covering element has an essentially central passage which is connected in a liquid-tight manner to a feed or a discharge pipe.
9. Device according to Claim 8, in which the covering element comprises a relatively soft material, the surface of which can adapt to the irregular surface shape of the asphalt concrete.
10. Device according to Claim 8 or 9, in which the covering element is a constant width going from the passage in the peripheral direction.
11. Device according to Claim 10, in which the covering element has a circular periphery.
12. Device according to Claim 10, in which the covering element has a rectangular periphery, and the passage is slit-shaped.
13. Device according to Claim 12, in which the slit-shaped passage is bounded by four endless belts, each of which is guided over corre-

sponding pairs of rollers, of which the shafts are suspended in a frame and run parallel to two slit edges lying opposite each other.

14. Device according to Claim 13, in which in the direction parallel to the shafts the parts of the conveyor belts lying next to each other touch each other.

15. Device according to Claim 13 or 14, in which in the direction at right angles to the shafts in total four shafts are provided, and the outer belts, viewed in the shaft direction, are guided over rollers on the outer shafts, while the inner belts are each guided over a roller on an outer shaft and a roller on an inner shaft lying on the same side of the slit as the outer shaft concerned.

16. Device according to one of Claims 12 - 15, in which a slit-shaped nozzle is provided, extending in a tight fit in the slit present between the belts, in the direction of the bottom parts of the belts to be placed on the road surface.

17. Device according to Claim 16, in which the walls of the nozzle adjoining the inner belts extend to the level of the shafts, while the other two walls extend further to near the surface of the belts and in that direction flare out to shut off the opening between the inner belts and the outer belt concerned.

18. Device according to Claim 16 or 17, in which the nozzle opens out at the side facing away from the bottom parts into a pipe which is connected to a source of vacuum for sucking up the flushing liquid.

19. Device according to Claim 15, 16, 17 or 18, in which one shaft is fixed, and the other shafts are adjustable, for tensioning the belts.

20. Device according to Claim 15, 16, 17, 18 or 19, in which at the level of the outer belts the central shafts are also provided with rollers, in order to support said belts.

21. Device according to one of Claims 13 - 20, in which the frame is provided with auxiliary wheels, for supporting it in such a way that the belts are compressed to a predetermined extent under the influence of the weight and the vacuum.

22. Device according to one of Claims 13 - 21, in which a drive motor which is connected to one or more shafts is provided.

23. Device according to one of Claims 13 - 22, in which each belt has a supporting layer of high strength which is in contact with the rollers.

24. Device according to one of Claims 13 - 23, in which an auxiliary frame of which the internal dimensions are greater than the corresponding outer dimensions of the frame is provided, which auxiliary frame can form a basin which can be dragged along with the frame and is essentially watertight relative to the road surface.

25. Device according to Claim 24, in which the auxiliary frame is provided on its periphery with rubber strips by means of which the auxiliary frame can be supported on the road surface.

26. Device according to Claim 24, in which the auxiliary frame is provided on its periphery with four mutually sealing, endless belts which connect to each other and are guided over corresponding pairs of rollers of which the shafts are suspended in an auxiliary frame and are parallel to the shafts of the frame.

27. Device according to Claim 19, in which the auxiliary frame is provided at its longitudinal sides in each case with an endless belt, and at its transverse sides in each case with a sealing roller having a surface of essentially the same material as the belts, which sealing rollers rest with their end faces against the parts of the belts guided around over the rollers.

28. Device according to Claim 24, 25, 26 or 27, in which at the front side of the auxiliary frame, viewed in the direction of movement, a brush is provided, for removing or loosening dirt present on the road surface.

29. Device according to one of Claims 13 - 28, in which the belts are provided at their outer surface with a supple layer of wear-resistant material.

30. Device according to one of Claims 5 - 29, in which the covering element comprises closed-cell foam rubber.

fig-1

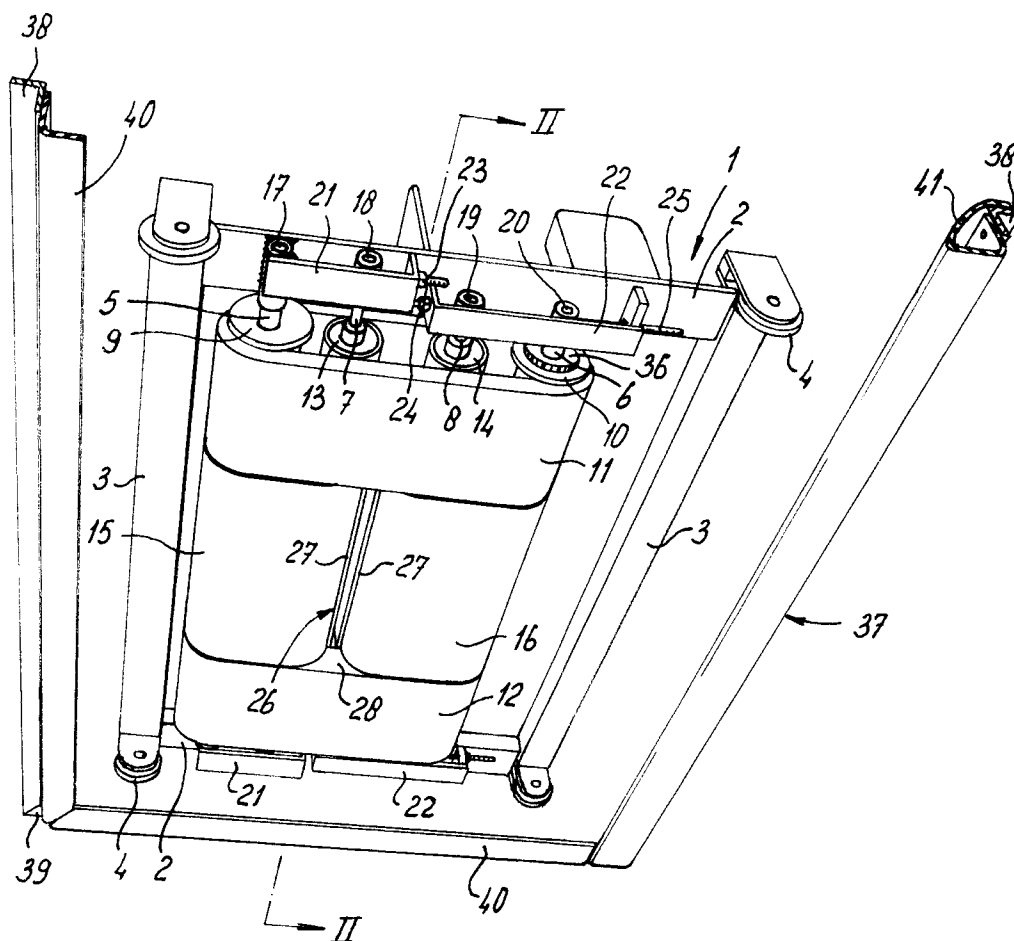
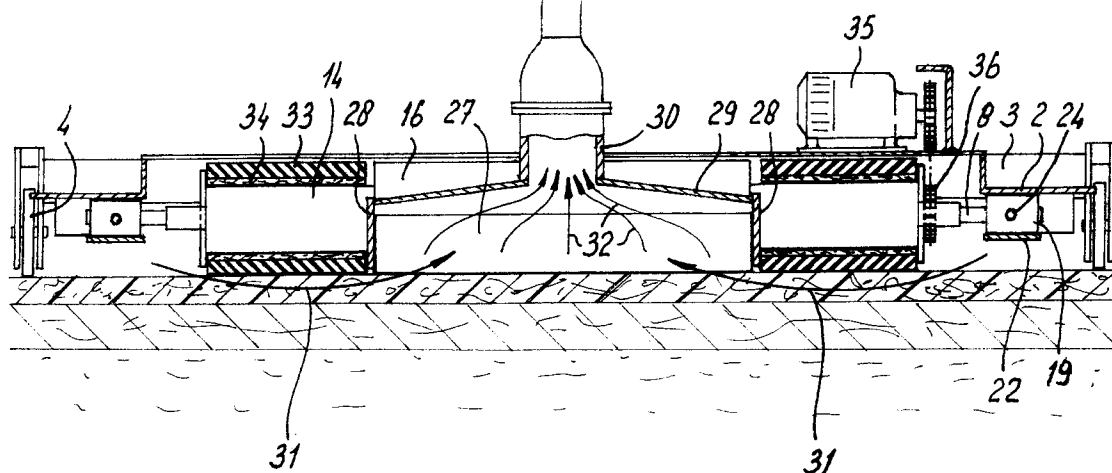


fig-2





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EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0448

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)
X Y A	DE-U-9 017 025 (WALTER) * the whole document *	1-10, 12 11 18, 21	E01H1/10
Y	DE-A-4 023 964 (GOLDSTAR) * abstract; figures *	11	
A	EP-A-0 279 729 (COMM. A L'ENERGIE ATOMIQUE) * the whole document *	1, 16, 18	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E01H E01C A47L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 MAY 1993	Examiner DIJKSTRA G.
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			