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(54) **ROOFTOP PAVING ASSEMBLY FOR CARS**

(57) A rooftop paving assembly for cars comprises a number of tiles 2, a coupling element 20 arranged between at least two adjacent tiles, a positioning element 40 arranged under the coupling element, and a support element 60 arranged under the positioning element 40 and on a rooftop. The positioning element 40 comprises a plate and at least one upright wall. The plate comprises a placing side 52 and a bottom 54. The support element 60 has an upper support side with a wide recess which

receives the positioning element flush. The positioning element comprises a protrusion extending from the bottom. The support element comprises a small recess extending from the wide recess. The small recess receives the protrusion. The rooftop paving assembly comprises connecting means which are at least partly embedded in the protrusion of the positioning element, and which attach the positioning element to the coupling element.

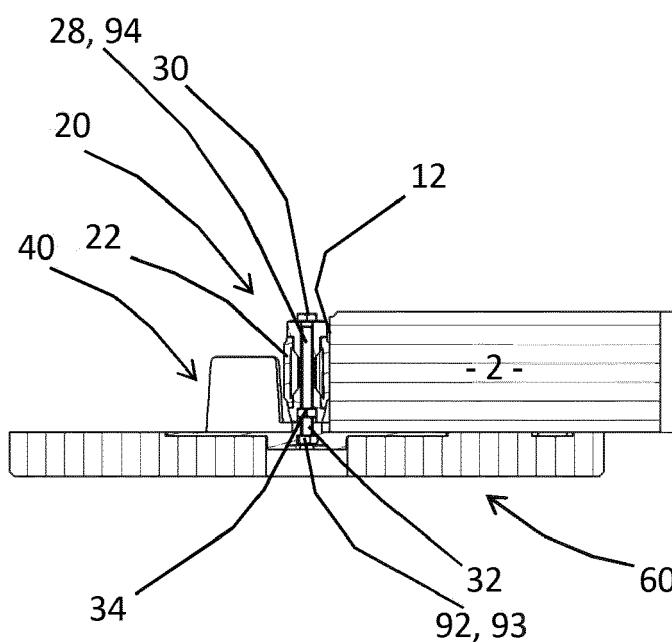


Fig. 6

Description

[0001] The invention relates to a rooftop paving assembly for cars, according to the preamble of claim 1.

[0002] A rooftop paving assembly of this type is used to enable cars to ride and/or park on rooftops without damaging the rooftop while offering a safe and stable surface for the cars. Depending on the structural properties of the rooftop itself, and the dimensioning of the rooftop assembly itself, the rooftop paving assembly may just carry cars of the passenger car type, or even trucks.

[0003] A rooftop paving assembly of this type is known from EP-1.897.994. Figures 5 and 6 of EP-1.897.994 disclose an assembly with concrete tiles, coupling elements, positioning elements, and support elements. The tiles have a chamfered part at their corners. A concave recess is arranged roughly in the centre of the chamfered parts. This concave recess is produced by grinding into the chamfered part of the concrete tile, or by providing a separate adjusting element with an upright strip which the concave recess, which adjusting element is glued to the tile. The coupling elements are provided at the corners of the tiles. They are adjustable by means of a cotter bolt which is tightened so as to compress and expand its middle part. While expanded, they engage the relevant concave recess at the chamfered part. The positioning elements are formed by a disc-shaped plate which is provided on the top side with four upright walls. The upright walls position the tiles in the correct manner and the thickness of the upright walls provides for a desired mutual spacing between the tiles. The plate of the positioning element is arranged in a circular recess in a top side of the support element. The circular recess is arranged such that the top side of plate is roughly flush with the top side of support element. The support elements are arranged on a rooftop, while the corners sections of the bottoms of the tiles are supported by the positioning and support elements.

[0004] A disadvantage of the known rooftop paving assembly is that it cannot use standard tiles, and that it is expensive to provide concrete tiles with a concave recess at its chamfered corners. This is due to the required grinding into the concrete, which is an extra manufacturing step, or to the adjusting element which already adds costs as being an extra element and which further needs to be glued to the concrete tile.

[0005] The invention aims to solve at least one of these problems, or at least to provide an alternative. In particular, the invention aims to provide a rooftop paving assembly with standard tiles, or at least tiles which are less expensive than the tile of EP-1.897.994.

[0006] This aim is achieved by a rooftop paving assembly according to claim 1.

[0007] A rooftop paving assembly for cars comprises a number of tiles, a coupling element, a positioning element, and a support element. The number of tiles are arranged substantially in a substantially horizontal plane. Each tile has a top, a bottom, side surfaces, and at least

one engaging surface. The tiles are suitable for supporting cars. The coupling element is arranged between at least two adjacent tiles of the number of tiles, wherein the coupling element engages on a respective engaging surface at the side surface of each adjacent tile. The positioning element is arranged under the coupling element and supports the at least two adjacent tiles. The positioning element comprises a plate and at least one upright wall. The plate extends parallel to the substantially horizontal plane, and comprises a placing side, and a bottom. The at least one upright wall extends from the placing side of the plate between the at least two adjacent tiles. The support element is arranged under the positioning element and on a rooftop. The support element has an upper support side with a wide recess which receives the positioning element such that the upper support side of the support element is flush with the placing side of the plate for jointly receiving the bottom of the at least two tiles. The support element further has an underside which rests on the rooftop. The positioning element comprises a protrusion extending from the bottom of the plate of the positioning element. The support element comprises a small recess extending from the wide recess wherein the small recess is smaller than the wide recess in a horizontal direction. The small recess receives the protrusion. The rooftop paving assembly comprises connecting means which are at least partly embedded in the protrusion of the positioning element. The connecting means attach the positioning element to the coupling element.

[0008] By attaching the coupling element to the positioning element via connecting means, it is ensured that the coupling element remains in a desired predetermined vertical position, and does not slip upwards or downwards due to the vertical movement of the tiles when cars are passing over them. Therefore, the concave recess in the chamfered corners of the prior art tiles is not necessary anymore. The protrusion of the positioning element accommodates the connecting means. By providing the protrusion at the bottom of the plate and by providing a small recess in the support element, it is achieved that the support sides of the support element and the placing side of the plate remain flush. Therefore, no recess in the bottom of the concrete tiles is necessary.

[0009] It is noted that figure 7 of EP-1.897.994 discloses connecting means in the form of a protruding part of a cotter bolt which is arranged in a threaded hole of a tensioning element. The tensioning element has upright walls, and is provided on a support element and inside a matching cavity formed in the tiles. The cavity is defined by quarter-circular recesses of four adjacent tiles, which are arranged on the underside of each tile at the corners of the tiles. The tensioning element has a diameter which can be increased by about 4 mm.

[0010] Within the context of this document, the expression 'a number of tiles, which are arranged substantially in a substantially horizontal plane' is to be interpreted as follows. The tiles being substantially in a plane means

that said plane is not to be considered as a mathematical plane, but a practical plane. In other words, due to irregularities at the surface of the rooftop and/or irregularities in the support elements and tiles itself, deviations between one tile and the other may occur within the limits as are considered normal by a skilled person considering the size of the individual tiles and of the total assembly, as well as the intended use of the assembly. In some cases, such deviations may be up to a few millimetres. The plane being substantially horizontal means that the assembly of tiles may be angled with respect to the horizontal, e.g. to follow the contour of the respective rooftop. However, the respective angle is small enough for cars to be able to drive and/or park on the tiles. The expression that 'the upper support side of the support element is flush with the placing side of the plate for jointly receiving the bottom of the at least two tiles' should be interpreted practically, rather than mathematically too, in that slight differences between the level of the upper support side and the placing side may occur, as long as these differences do not prevent the tile from being supported by both surfaces. In practice, such slight differences will be smaller than 1 mm.

[0011] Preferred embodiments are defined in the dependent claims.

[0012] In an embodiment, the connecting means comprises a female connector, fixedly connected to one of the positioning element and the coupling element, and a male connector, fixedly connected to the other of the positioning element and the coupling element. This offers a simple and strong connection.

[0013] In particular, the female connector comprises an inner screw-thread and the male connector comprises a bolt with outer screw-thread. This enables not only connecting the coupling element and the positioning element, but also disconnecting these elements when needed in practice.

[0014] In an embodiment, the small recess and/or the wide recess are cylindrically shaped. This allows for easy placement and angular adjustment of the positioning element with respect to the support element. In particular, the small recess and the wide recess are both cylindrically shaped and have a common axis.

[0015] In an embodiment, the small recess extends through the support element to the underside of support element. This results in a minimum joint thickness of the support element and positioning element and/or a margin for the protrusion to move downwards without touching the rooftop while the support element is compressed and/or a margin for a part of the connecting means to extend beyond the protrusion.

[0016] In an embodiment, the corners of the tiles are provided with a chamfered part, or the corners are rounded off, for forming the engaging surface. A chamfered part provides an extra large engaging surface. A rounded off corner is more usual for tiles, so that standard tiles may be used.

[0017] In an embodiment, the coupling element is at

least partially elastic, and/or has a dimension which is adjustable in a direction parallel to the substantially horizontal plane. A partial elastic coupling element adjusts to the shape and irregularities of the engaging surface. Moreover, or alternatively, it absorbs movements and/or damps vibrations of the tiles which may be caused by passing cars.

[0018] In an embodiment, the support element is at least partially elastic. An elastic support element adjusts itself to irregularities in the rooftop and/or absorbs vibrations of the tiles.

[0019] In an embodiment, the tiles are at least partially made of concrete. Concrete is a relative cheap yet strong material for tiles.

[0020] In an embodiment, the tiles are rectangular, in particular square. This results in a support element receiving four corners, unless in cases where a support element is provided at an edge of the paving assembly. In particular, the positioning element is provided with four upright walls.

[0021] In an embodiment, the bottom of the tiles is flat.

[0022] In an embodiment, the wide recess has a depth which is smaller than a thickness of the support element. In an embodiment, the wide recess has a bottom, in particular a flat bottom, more in particular a round flat bottom. The small recess extends downwards from the flat bottom.

[0023] In an embodiment, the wide recess has a depth which corresponds to a thickness of the plate of the positioning element.

[0024] The invention, its effects, and advantages will be explained in more detail on the basis of the schematic drawing, in which:

Fig. 1 shows an assembly according to the invention, in top view;

Fig. 2 shows the assembly of fig. 1 in side view;

Fig. 3 shows detail III of the assembly of fig. 1, with a coupling element in a loose state;

Fig. 4 shows section IV-IV from fig. 3;

Fig. 5 shows the detail III of the assembly of fig. 1, with the coupling element in a tightened state;

Fig. 6 shows section IV-IV from fig. 5;

Fig. 7 shows a positioning element according to the invention;

Fig. 8 shows section VIII-VIII from fig. 7;

Fig. 9 shows a support element according to the invention; and

Fig. 10 shows section X-X from fig. 9.

[0025] The figures show a rooftop paving assembly for cars according to the invention, which is denoted in its entirety by reference number 1. The rooftop paving assembly 1 comprises a number of square tiles 2, which are arranged substantially in a substantially horizontal plane 4. Each tile 2 has a flat top 6, a flat bottom 8, and side surfaces 10. The tiles 2 have rounded corners 11 where the side surfaces 10 meet. These corners function

as engaging surfaces 12 (see below). The tiles 2 are made of concrete and are suitable for supporting cars (not shown).

[0026] The rooftop paving assembly 1 further comprises multiple coupling elements 20 which are arranged to connect to engaging surfaces 12 of four tiles. As shown more clearly in fig. 4 and 6, each coupling element 20 comprises an elastic beam-like middle part 22 which is enclosed between two harder clamping parts 24, 26. A bolt 28 is arranged through an elongate, continuous opening through coupling element 20. The bolt 28 has outer screw-thread, and a screw head 30, which can be reached above clamping part 24, and a protruding part 32 opposite of the screw head 30. The difference between figs. 4 and 6 is that in fig. 6 the middle part 22 of coupling element 20 has been compressed by means of the bolt 28 and a nut 34, which is embedded in the clamping part 26, opposite of the screw head 30. The middle part 22 has expanded correspondingly in a direction which is parallel to the substantially horizontal plane, such that side walls of the middle part 22 connect to the engaging surfaces 12.

[0027] The elastic middle part 22 is made of a suitable material, such as rubber or plastic. Elastomers of polyurethane PU will for instance suffice as plastic. The clamping parts 24, 26 have pointed ends, which pointed ends are directed towards each other for facilitating the expansion of the middle part 22. Further details and variants of coupling elements are disclosed in EP-1.897.994.

[0028] Referring for details to figs. 6 and 7, the rooftop paving assembly 1 comprises multiple positioning elements 40 arranged each time under the coupling element 20 and each supporting four tiles 2. The positioning element 40 comprising a plate 42, four upright walls 43, 44, 45, 46, and a cylindrical protrusion 47. The cylindrical protrusion 47 has a depth 48, measured from the bottom of the plate 42, and a diameter 49. The plate 42 comprises a placing side 52 and a bottom 54, as well as a plate thickness 56 and a diameter 58. Each of the four upright walls 43, 44, 45, 46 extends upwards from the placing side 52 of the plate 42 between two adjacent tiles 2.

[0029] Referring to figs. 2, 9, and 10, the rooftop paving assembly 1 further comprises an elastic and flexible support element 60 arranged under the positioning element 40 and on a rooftop 62. The support element 60 has an upper support side 64, an underside 66 which rests on the rooftop 62, and a thickness 67. The upper support side 64 a wide cylindrically shaped recess 68. The wide recess 68 has a depth 70 which corresponds to the plate thickness 56, and a diameter 72 which corresponds to the diameter 58 of the plate 42. The support element 60 further comprises a small cylindrically shaped recess 74 which extends downwards from the wide recess 68. The small cylindrical recess 74 has a diameter 76, which corresponds to the diameter 49 of the protrusion 47, and is smaller than the diameter 72 of the wide recess 68. The small cylindrical recess 74 has a depth 77, measure from

the lower plane of the wide recess 68. The small recess extends through the support element 60 to the underside 66 of support element 60. In other words: the depth 70 of the wide recess plus the depth 77 of the small recess 74 equals the thickness 67 of the support element 60. The cylindrical wide recess 68 and the cylindrical small recess 74 have a common axis 78.

[0030] The wide cylindrically shaped recess 68 receives the plate 42 of the positioning element 40 such that the upper support side 64 of the support element 60 is flush with the placing side 52 of the plate 42 for jointly receiving the bottom 8 of, in this embodiment, four tiles 2. The small cylindrical recess 74 receives the protrusion 47. The depth 48 of the protrusion 47 is smaller than the depth 77 of the small recess 74. This allows the support element 60 to be compressed by the weight of the tiles 2 and cars, without the protrusion touching the rooftop 62, and for the bolt 28 to extend.

[0031] The rooftop paving assembly 1 further comprises connecting means 90 that attach the positioning element 40 to the coupling element 20 (see fig. 4). The connecting means 90 comprise a female connector 92, fixedly connected to the positioning element 40. The female connector is a nut 93 which comprises an inner screw-thread. The nut 93 is partly embedded in the protrusion 47 of the positioning element 40, while a top part of the nut 93 is embedded in the plate 42. The connecting means 90 further comprise a male connector 94, fixedly connected to the coupling element 20. The male connector 94 is in this embodiment formed by the bolt 28, and in particular by the protruding part 32 with outer screw-thread.

[0032] In use, support elements 60 are provided on a rooftop 62 at the planned locations of the corners of the tiles 20. Positioning elements 40 have been, or are, positioned in the wide recess 68 and small recess 74 of each support element 60. Coupling elements 20 have been, or are, connected to the positioning elements 40. The protruding part 32 of the bolt 28 is inserted into the positioning element 40 and into the nut 93. By rotating the coupling element with respect to the positioning element, the bolt 28 is fastened in the nut 32. Tiles are positioned on the respective upper support side 64 of the support elements 60 and the respective placing side 52 of the positioning elements 40 such, that the four upright walls 43, 44, 45, 46 extend between the tiles. This enables easy positioning of the tiles 2 and results in a constant and regular distance between the tiles which allows rainwater to drain to the rooftop 62. The screw head 30 is then rotated for the purpose of compressing and expanding middle part 22. The screw head 30 is tightened until the outer wall of middle part 22 strongly abuts the four relevant engaging surfaces 12 of the tiles. This fixates the tile 12 with respect to each other and - thanks to the connecting means 90 - with respect to the positioning element 40.

[0033] A part of a floor formed in this way is shown in top view in fig. 1. At the outermost edges such a floor

connects with for instance an intermediate space to walls or an outer wall of a building (not shown). The floor formed according to the present invention is provided for this purpose with a so-called edge enclosure. An example of an edge enclosure is a mixture which is arranged in the intermediate space between the outermost edges of the floor and the walls of the building. The mixture comprises for instance rubber granulate, alumina silicate and/or a binder. The alumina silicate is black and comprises for instance 1/3 part grains. The binder is for instance polyurethane glue (PU). The mixture is prepared in situ when laying the floor, and arranged in the intermediate space which is in the order of 4 to 6 cm wide. Another example of an edge enclosure is an adapted positioning element.

[0034] In a practical embodiment the tiles of the different embodiments have for instance a length and width of 90 cm x 90 cm, with a weight in the order of 150 kg. In another embodiment the tiles have a length and a width in the order of 110 cm x 110 cm, with a weight in the order of 250 kg.

[0035] Several variants are possible within the scope of the attached claims. The features of the above described preferred embodiment(s) may be replaced by any other feature within the scope of the attached claims, such as the features described in other embodiments, and in the following paragraphs.

[0036] In an embodiment, the tiles are polygonal, in particular rectangular, triangular, or hexagonal. In an embodiment with triangular tiles, the positioning elements and coupling elements are adapted to receive up to six corners. In an embodiment with hexagonal tiles, the positioning elements and coupling elements are adapted to receive up to three corners.

[0037] In an embodiment, the tiles are at least partly made of natural stone and/or composite materials.

[0038] In an embodiment, a positioning element and a coupling element is provided at a side of a tile between two corners.

[0039] In an embodiment, the wide recess has an irregular and/or slanting bottom. A thickness of the plate of the positioning element is at each corresponding position equal to, or smaller than, the local depth of the wide recess.

[0040] In an embodiment, the wide recess and/or the small recess have one of the following shapes in plan view: oval, polygonal, or irregular.

[0041] In an embodiment, the small recess has a bottom, i.e. the small recess does not extend through the full thickness of the support element.

[0042] In an embodiment, the walls of the wide and/or small recess are converging.

[0043] In an embodiment, the protrusion has one of the following shapes in plan view: oval, polygonal, or irregular.

[0044] In an embodiment, the protrusion and the small recess have different shapes, as long as the dimensions of the protrusion are such that the protrusion is received in the small recess. In particular, the dimensions of the

protrusion are smaller than the corresponding dimensions of the small recess.

[0045] In an embodiment, the middle part of the coupling element is tubular, cylindrical or beam-like. In an embodiment, the coupling element is rigid, i.e. it does not comprise an elastic part which deforms under the action of adjacent tiles. In an embodiment, the coupling element has fixed dimensions, i.e. it is not adjustable.

[0046] In the shown embodiment, the substantially horizontal plane of the tiles is parallel to the rooftop. In another embodiment, these planes are not parallel, e.g. in case the rooftop is slanting to discharge rain water, or the rooftop has an irregular surface. The tile plane is made more horizontal by using support elements with different thicknesses, or by providing extra supports, such as adjustable pedestals or disks with different thicknesses under the support elements.

[0047] In an embodiment, the male connector is fixedly connected to the positioning element and the female connector is connected to the coupling element.

[0048] In an embodiment, the connecting means comprise a friction fitting, or a snap fitting. In another embodiment, the connection between the coupling element and the positioning element is permanent, or semi-permanent.

Claims

1. Rooftop paving assembly (1) for cars, comprising a number of tiles (2), which are arranged substantially in a substantially horizontal plane (4) and are suitable for supporting cars, wherein each tile (2) has a top (6), a bottom (8), side surfaces (10), and at least one engaging surface (12), a coupling element (20) arranged between at least two adjacent tiles (2) of the number of tiles (2), wherein the coupling element (20) engages on a respective engaging surface (12) at the side surface (10) of each adjacent tile (2), a positioning element (40) arranged under the coupling element (20) and supporting the at least two adjacent tiles (2), the positioning element (40) comprising a plate (42) and at least one upright wall (43, 44, 45, 46), wherein the plate (42) extends parallel to the substantially horizontal plane, and comprises a placing side (52) and a bottom (54), and wherein the at least one upright wall extends upwards from the placing side (52) of the plate (42) between the at least two adjacent tiles (2), and a support element (60) arranged under the positioning element (40) and on a rooftop (62), the support element (60) having an upper support side (64) with a wide recess (68) which receives the positioning element (40) such that the upper support side (64) of the support element (60) is flush with the placing side (52) of the plate (42) for jointly receiving the bottom (8) of the at least two tiles (2), and an under-

side (66) which rests on the rooftop (62), **characterised, in that**

the positioning element (40) comprises a protrusion (47) extending from the bottom (54) of the plate (42) of the positioning element (40),

the support element (60) comprises a small recess (74) extending from the wide recess (68),

the small recess (74) is smaller than the wide recess (68) in a horizontal direction,

the small recess (74) receives the protrusion (47),

the rooftop paving assembly comprises connecting means (90) which are at least partly embedded in the protrusion (47) of the positioning element (40), and

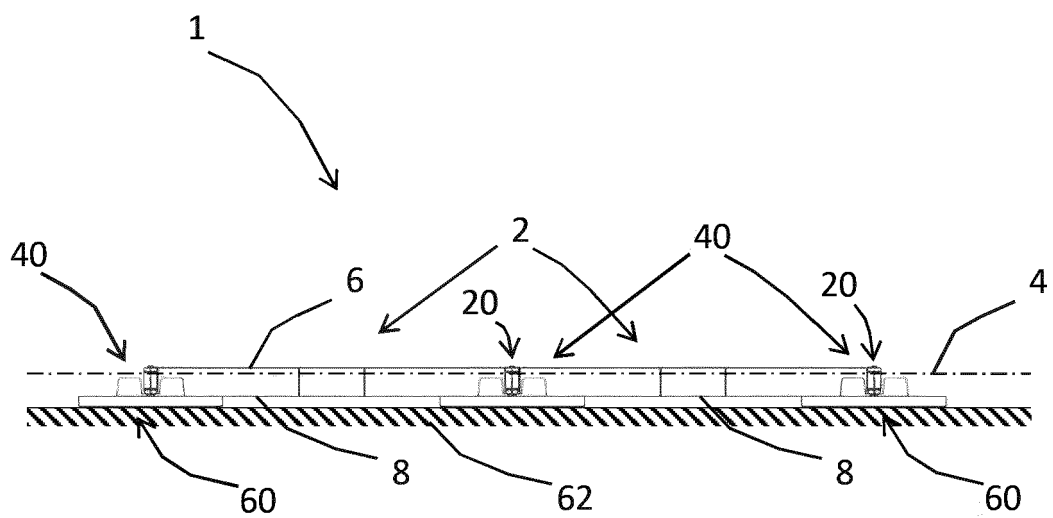
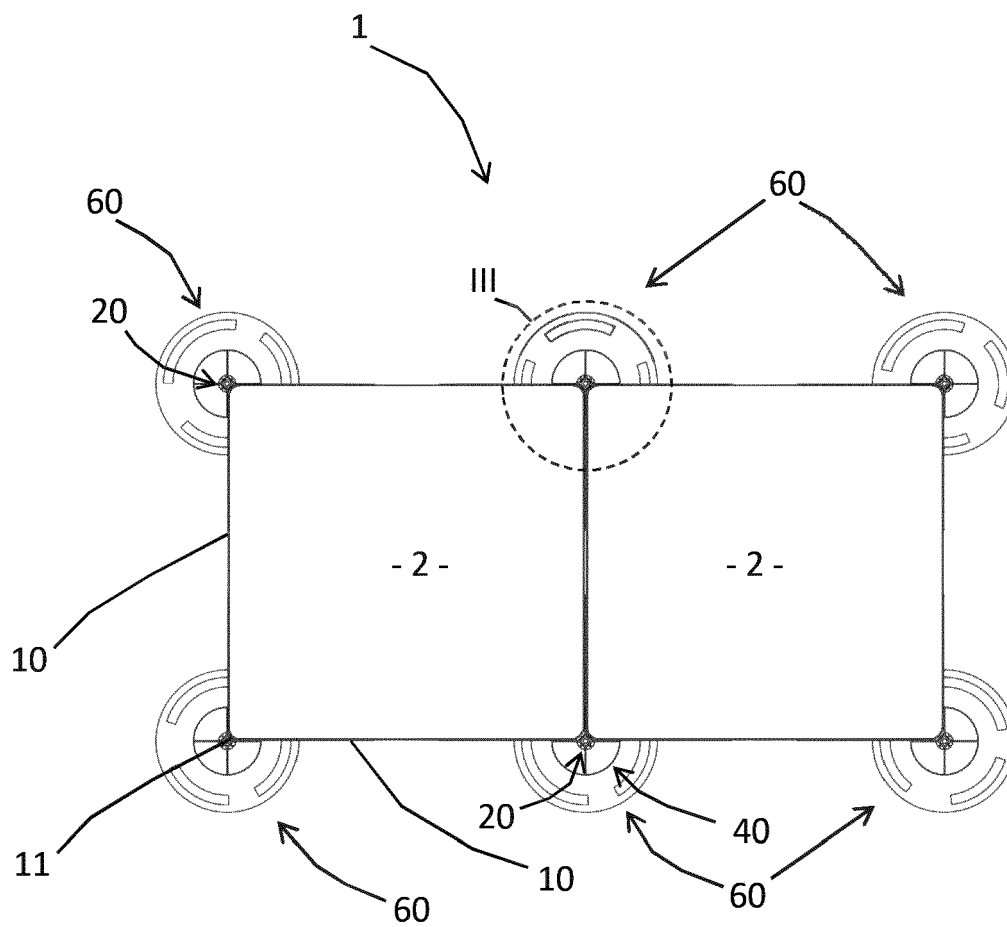
the connecting means (90) attach the positioning element (40) to the coupling element (20).

2. Rooftop paving assembly according to claim 1, wherein the connecting means (90) comprises a female connector (92), fixedly connected to one of the positioning element (40) and the coupling element (20), and a male connector (94), fixedly connected to other of the positioning element (40) and the coupling element (20).
3. Rooftop paving assembly according to claim 2, wherein the male connector (94) comprises a bolt (28) with outer screw-thread and the female connector (92) comprises an inner screw-thread, in particular the female connector is a nut (93)
4. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the small recess (74) and/or the wide recess (68) are cylindrically shaped.
5. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the small recess (74) extends through the support element (60) to the underside (66) of support element (60).
6. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the tiles (2) comprise corners (11), which corners are provided with a chamfered part, or the corners are rounded off, for forming the engaging surface (12).
7. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the coupling element (20) is at least partially elastic.
8. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the coupling element (20) has a dimension which is adjustable in a direction parallel to the substantially horizontal plane (64).
9. Rooftop paving assembly according to any one, or

more, of the preceding claims, wherein the support element (60) is at least partially elastic.

10. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the tiles (2) are at least partially made of concrete.

11. Rooftop paving assembly according to any one, or more, of the preceding claims, wherein the tiles (2) are rectangular, in particular square.



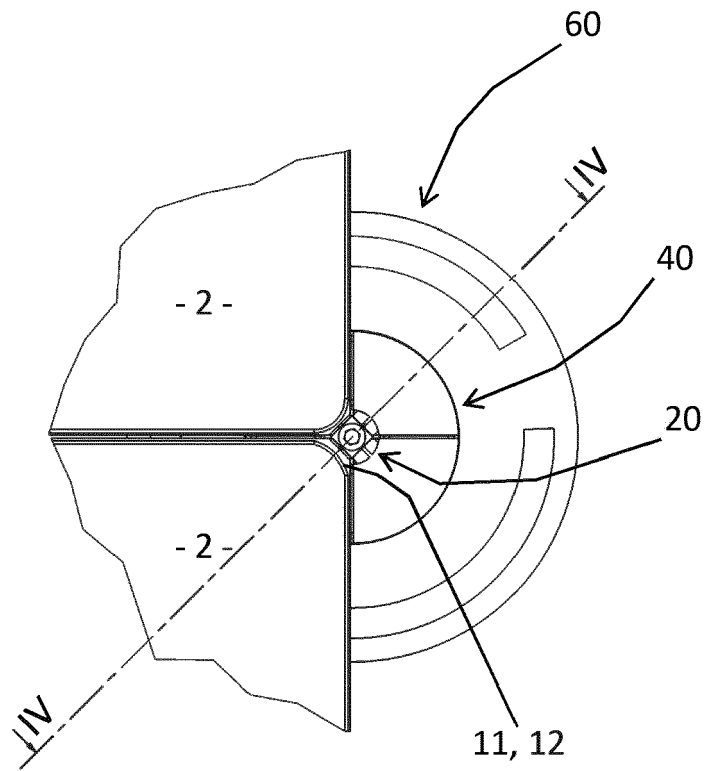


Fig. 3

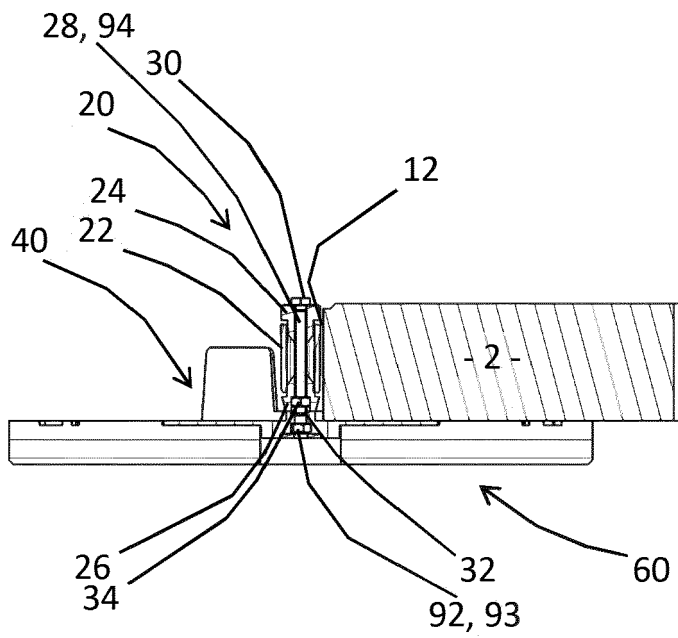


Fig. 4

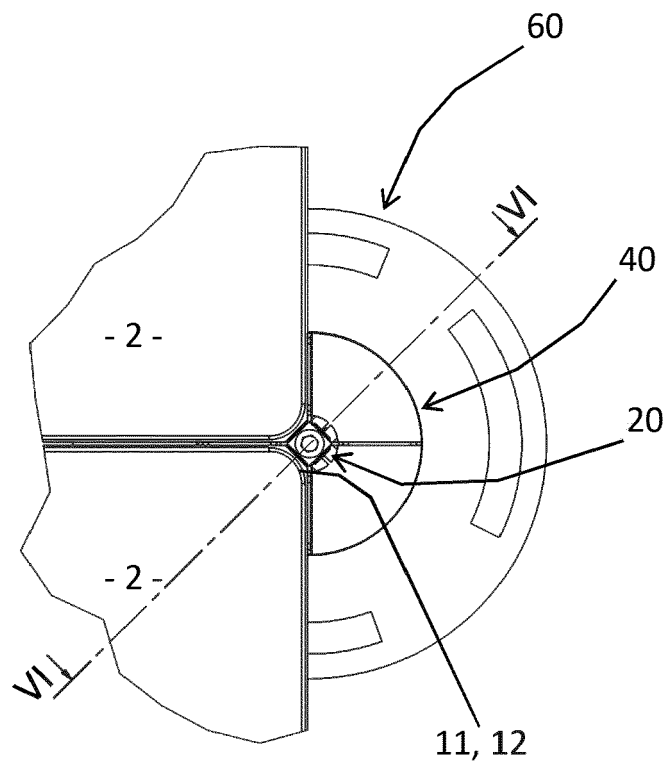


Fig. 5

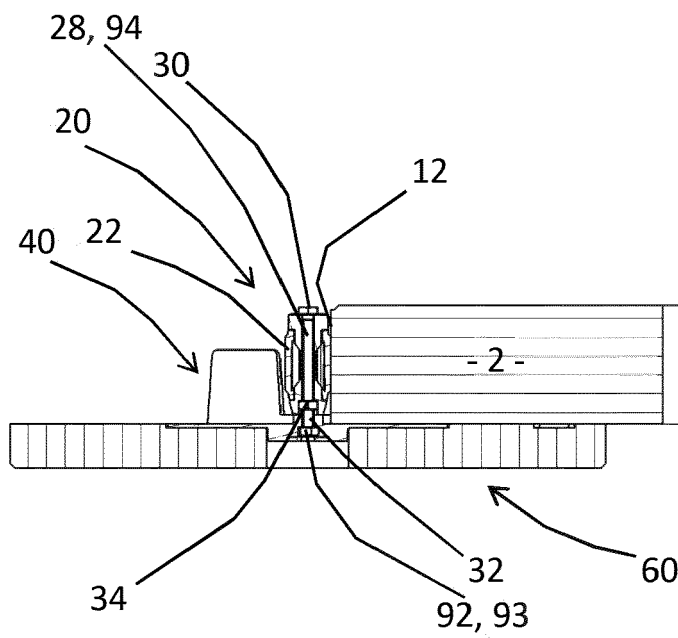


Fig. 6

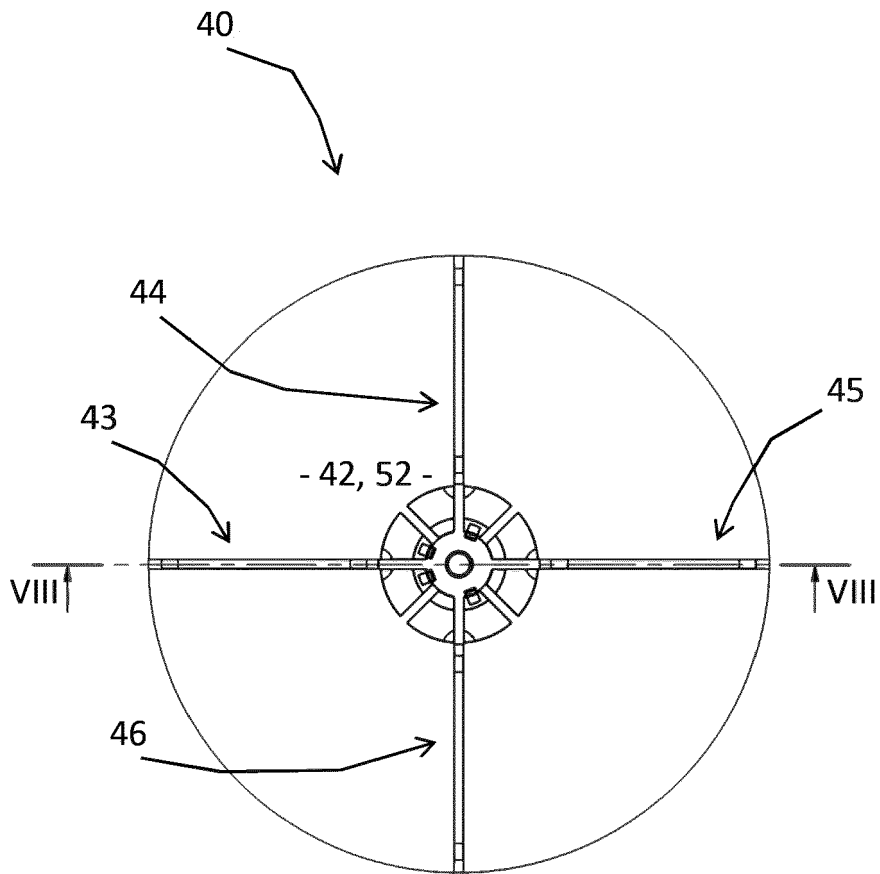


Fig. 7

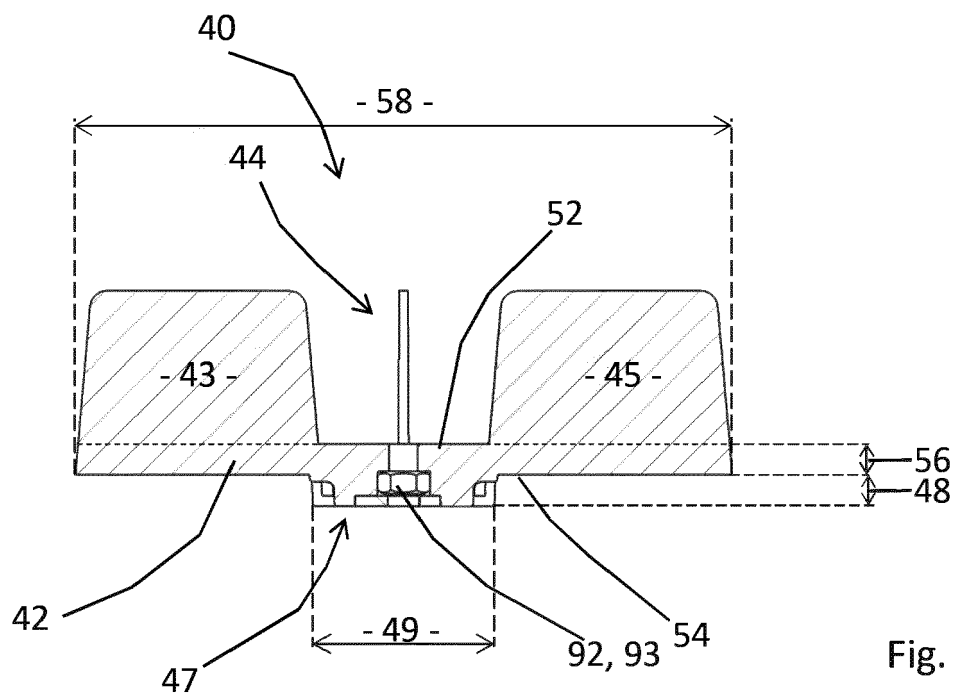


Fig. 8

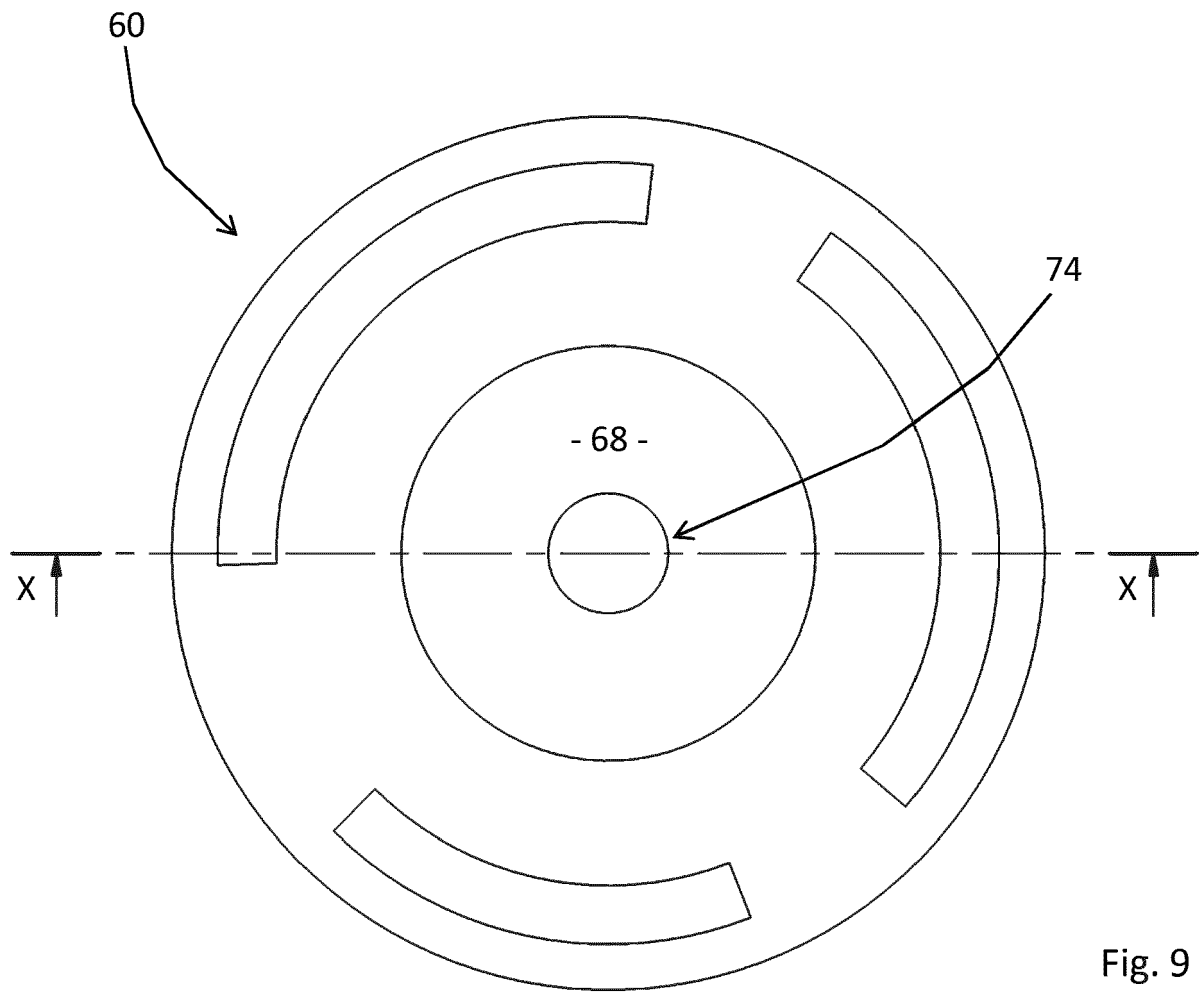


Fig. 9

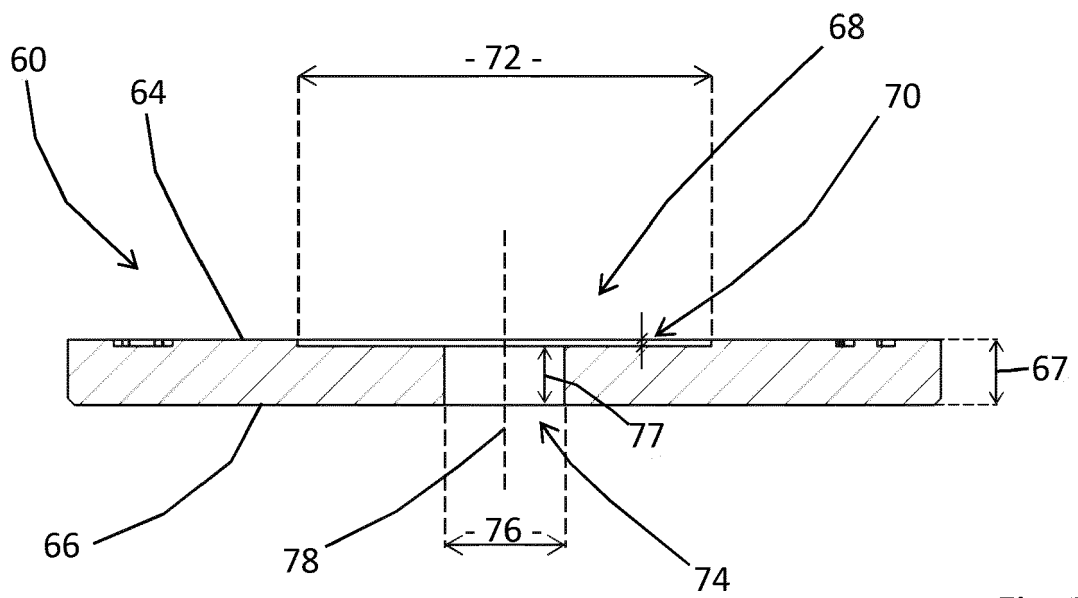


Fig. 10



EUROPEAN SEARCH REPORT

Application Number
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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 507 420 A1 (ZOONTJENS BETON B V [NL]) 10 July 2019 (2019-07-10) * pages 6-8; figures * -----	1-11	INV. E01C5/00 E04D11/00
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			TECHNICAL FIELDS SEARCHED (IPC)
			E01C E04D E04F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 May 2021	Examiner Movadat, Robin
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