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(54) Dome device with multiple dome-like shells

(57) Dome device comprising at least a first and a second dome-like shell formed by thermoforming, wherein the first dome-like shell and the second dome-like shell are formed with respectively a first and second dome element and with respectively a first and second peripheral flange connecting thereto, wherein the first peripheral

flange of the first dome-like shell is formed with protruding first studs, wherein the first studs of the first peripheral flange form a spacer between the first and the second dome-like shells, wherein the first studs make contact with the second peripheral flange while the first dome element is located at a distance from the second dome element.

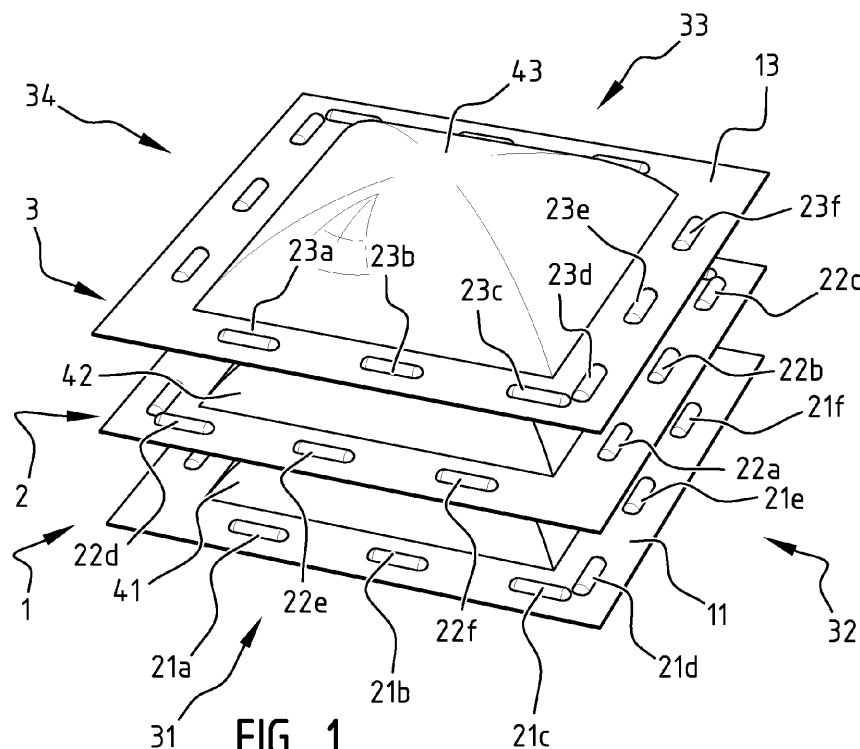


FIG. 1

EP 2 679 742 A1

Description

[0001] The present invention relates to a dome device with at least a first and a second dome-like shell formed by thermoforming, to an assembly particularly for use in such a device and to a method for mounting a dome device with at least a first and a second dome-like shell.

[0002] Dome assemblies with multiple dome-like shells mounted at a distance from each other to form a multi-wall dome are known. A currently known technique consists of thermoforming the different dome-like shells and adhering them to each other by means of for instance a foam or adhesive of a variable thickness (normally between 5 and 10 mm). The foam thickness provides for a suitable distance between adjacent dome-like shells and prevents them lying against each other. The drawback of such a foam is that arranging thereof is time-consuming and expensive and requires manual labour and precision.

[0003] The present invention has for its object to provide a dome device of the type stated in the preamble with which two, three or more dome-like shells can be mounted at a distance from each other in a simpler and improved manner.

[0004] The dome device according to the invention is distinguished for this purpose in that the first dome-like shell and the second dome-like shell are formed with respectively a first and second dome element and with respectively a first and second peripheral flange connecting thereto. The first peripheral flange of the first dome-like shell is formed with protruding first studs, wherein the first studs of the first peripheral flange form a spacer between the first and the second dome-like shells, wherein the first studs make contact with the second peripheral flange while the first dome element is located at a distance from the second dome element.

[0005] Thermoforming the peripheral flange of a first dome-like shell such that studs protrude from the first peripheral flange thereof creates in simple manner spacers against which a peripheral flange of a second dome-like shell can support. Note that the studs can protrude downward or upward. In the case the studs protrude upward, the second dome-like shell is placed on the first dome-like shell. In the case the studs protrude downward, the second dome-like shell is placed under the first dome-like shell.

[0006] The skilled person will appreciate that this concept can be extended to more than two dome-like shells, wherein a dome-like shell in higher position is placed in each case via studs at a distance relative to a dome-like shell lying thereunder.

[0007] According to an advantageous embodiment of the dome device, the second peripheral flange is also formed with protruding second studs, wherein the first and second studs are arranged such that, as seen in top view, the first and the second studs do not overlap. The first and second studs are as it were a deformation of respectively the first and second peripheral flanges, and

are therefore hollow.

[0008] According to a preferred embodiment of the dome device, the form of the first dome-like shell, including a pattern of the first studs, is the same as the form of the second dome-like shell, including a pattern of the second studs, such that in a stacking position the second dome-like shell can fit onto the first dome-like shell. The pattern is further such that in the mounted position in the dome device the second dome-like shell is rotated relative to the first dome-like shell when compared to the stacking position, wherein the first and the second studs, as seen in top view, do not overlap each other and the second peripheral flange supports on the first studs. The skilled person will appreciate that this concept can be extended to assemblies with three or more dome-like shells, wherein in the mounted position a higher placed dome-like shell is rotated in each case relative to the dome-like shell lying immediately thereunder.

[0009] According to a possible embodiment, the first and second peripheral flange are each formed as a framework with four sides, wherein the first and second peripheral flange are provided on each side with a plurality of studs. The studs on two of the four sides can then be arranged in a first pattern, and on the other two of the four sides in a second pattern which does not overlap with the first pattern. In the mounted position the second dome-like shell is then placed in a position rotated through 90 or 180 degrees relative to the first dome-like shell such that for each side a first pattern lies opposite a second pattern.

[0010] According to a possible embodiment, the first dome-like shell and the second dome-like shell are secured with nut and bolt as in conventional dome assemblies. According to an alternative, the first and the second dome-like shell are secured in a frame, for instance with snap battens. According to yet another alternative, the studs of the first peripheral flange are glued to the second peripheral flange lying thereabove.

[0011] The invention also relates to an assembly of at least a first and a second dome-like shell formed by thermoforming, wherein the first dome-like shell and the second dome-like shell are formed with respectively a first and second dome element and respectively a first and second peripheral flange. The first peripheral flange of the first dome-like shell is formed with protruding first studs which are arranged such that in a mounted position the second dome-like shell is placeable on or under the first dome-like shell, wherein the first studs of the first peripheral flange form a spacer between the first and second dome-like shell and the first studs support on the second peripheral flange while the first dome element is located at a distance from the second dome element.

[0012] According to an aspect of the invention, the second dome-like shell is formed with protruding second studs which are arranged such that, as seen in top view, the first and the second studs do not overlap in the mounted position.

[0013] According to an aspect of the invention, the form

of the first dome-like shell, including the pattern of the first studs, is the same as the form of the second dome-like shell, including the pattern of the second studs, such that in a stacking position the second dome-like shell can fit onto the first dome-like shell, wherein the pattern is such that the second dome-like shell, in the mounted position in which the second dome-like shell is rotated relative to the first dome-like shell, can support with the second peripheral flange on the first studs.

[0014] According to an aspect of the invention, the first and second peripheral flange are each formed as a framework with four sides, wherein the first and second peripheral flange are provided on each side with a plurality of studs.

[0015] According to an aspect of the invention, the studs on two of the four sides are arranged in the first pattern, and on the other two of the four sides in a second pattern which does not overlap with the first pattern such that the second dome-like shell is placeable in a position rotated through 90 or 180 degrees on a first dome-like shell, wherein for each side a first pattern lies opposite a second pattern.

[0016] According to an aspect of the invention, the first and the second dome-like shell are manufactured in the same mould by thermoforming.

[0017] The invention finally relates to a method which is distinguished in that a first dome-like shell and a second dome-like shell are thermoformed with respectively a first and a second dome element and a first and second peripheral flange connecting thereto, wherein the first dome-like shell is formed with first studs which protrude from the first peripheral flange. In a mounted position the second dome-like shell is then placed on or under the first dome-like shell such that the second peripheral flange supports against the first studs and the first and second dome element lie at a distance from each other.

[0018] According to an advantageous embodiment of the method, the second dome-like shell is formed with second studs which protrude from the second peripheral flange, wherein the second dome-like shell is placed on or under the first dome-like shell such that, as seen in top view, the first and the second studs do not overlap.

[0019] The first dome-like shell is preferably thermoformed in the same mould as the second dome-like shell such that the second dome-like shell has the same form as the first dome-like shell and in a stacking position can fit onto the first dome-like shell, wherein the studs are formed in a pattern such that the second dome-like shell, in a mounted position in which the second dome-like shell is rotated relative to the first dome-like shell, can support with the second peripheral flange on the first studs.

[0020] For the purpose of forming the studs suitable cavities can be provided in the clamping mould used during the process for thermoforming the dome-like shell such that during blowing or vacuum-forming of the dome-like shell the studs are also pressed into the peripheral flange.

[0021] According to a preferred embodiment of the

method, the first and second peripheral flange are each formed as a framework with four sides, wherein at least two studs are formed on each side. The studs on two of the four sides can then be formed in a first pattern, and on the other two of the four sides in a second pattern which does not overlap with the first pattern. The second dome-like shell is then placed in a position rotated through 90 or 180 degrees relative to the first dome-like shell such that, for each pair of opposite sides of the first and the second peripheral flange, a first pattern lies opposite a second pattern.

[0022] The first dome-like shell and the second dome-like shell can for instance be secured with nut and bolt, or secured in a frame, for instance with snap battens.

[0023] According to a typical embodiment of the dome device or of the method, the studs protrude over a distance of 3 to 15 mm (preferably 5 to 10 mm) relative to the peripheral flange such that the first dome element is mounted at a distance of 3 to 15 mm from the second dome element.

[0024] The invention will be further elucidated on the basis of a number of by no means limitative exemplary embodiments of a dome assembly and method according to the invention with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a first embodiment of a dome assembly according to the invention;

Figure 2A shows a partial section of the dome assembly of figure 1 in the mounted position;

Figure 2B shows a partial section of the dome assembly of figure 1 in a stacking position;

Figure 3 is a top view of a second dome-like shell placed in a mounted position on an identical first dome-like shell, wherein the second dome-like shell is rotated through 90 degrees relative to the first dome-like shell;

Figure 4 is a schematic top view of a second dome-like shell placed in a position rotated through 90 degrees on an identical first dome-like shell as according to a second embodiment of the invention; and

Figure 5 is a schematic top view of a second dome-like shell placed in a position rotated through 180 degrees on an identical first dome-like shell as according to a third embodiment of the present invention.

[0025] The embodiment of the dome assembly of figures 1, 2A and 2B comprises a first dome-like shell 1, a second dome-like shell 2 and a third dome-like shell 3. These first, second and third dome-like shells are substantially identical, i.e. identical save for tolerances, and are typically thermoformed in the same mould. Figure 1 illustrates an exploded mounted position in which the second dome-like shell is rotated through 90 degrees relative to the first dome-like shell, and the third dome-like shell is in turn rotated through 90 degrees relative to

the second dome-like shell. It is noted that as reference for the rotation a position is used in which the adjacent identical dome-like shells fit together as in the stacking position of figure 2B. Figure 2A illustrates a cross-section of the mounted position in which the third dome-like shell 3 is supported on the second dome-like shell 2 and the second dome-like shell 2 is supported on the first dome-like shell 1.

[0026] Each dome-like shell 1, 2, 3 is provided with a dome element 41, 42, 43 and a peripheral flange 11, 12, 13 connecting thereto and taking the form here of a framework. Note that other shapes can also be envisaged in accordance with the form of the dome. The invention is thus also applicable to dome-like shells with a round peripheral flange or to dome-like shells with a polygonal peripheral flange. Each peripheral flange 11, 12, 13 is provided with a plurality of studs 21a-f, 22a-f, 23a-f. A plurality of studs 21a-c, 22a-c, 23a-c; 21d-f, 22d-f, 23d-f; 21a-c, 22a-c, 23a-c; 21d-f, 22d-f, 23d-f are typically provided on each side 31, 32, 33, 34 of each peripheral flange 11, 12, 13. The studs are preferably arranged at a pitch distance from each other and in regular distribution over the periphery. The studs are arranged such that, when a second dome-like shell is rotated through a determined angle relative to a first identical dome-like shell lying thereunder, the studs are localized such that the studs of the second dome-like shell which has been rotated relative to the first dome-like shell do not overlap. In the embodiment of figure 1 the second dome-like shell is rotated through 90 degrees relative to the first dome-like shell, and in this position the studs 22d-f do not overlap with studs 21a-c and studs 22a-c do not overlap with studs 21d-f. Note that it is for instance also possible to provide the pattern such that it is not a rotation through 90 degrees but a rotation through 180 degrees which produces the desired result of non-overlapping studs, see figure 5 and the discussion thereof below. The skilled person will further appreciate that other rotations are also possible in the case of peripheral flanges of different shape.

[0027] For the purpose of forming the first and second studs cavities are typically provided in a clamping mould used to clamp the peripheral flange fixedly during the process of thermoforming the dome-like shells. During the thermoforming process the first and second dome-like shells are formed by blowing or vacuum-forming and the first and second studs are pressed into the peripheral flange.

[0028] As best seen in figure 3, which shows a top view of a second dome-like shell which is placed in the mounted position on the first dome-like shell, i.e. in a position rotated through 90 degrees on the first dome-like shell, the first peripheral flange 11 is provided along its periphery with a pattern of first studs 21a-21f. The first dome-like shell 1 is more particularly provided on a first side 31 with three first studs 21a-21c, on a second side 32 with three first studs 21d-21f, on a third side 33 once again with first studs 21a-21c and on a fourth side 34 once

again with first studs 21d-21f. The stud pattern on third side 33 thus corresponds to the stud pattern on first side 31 which has been rotated through 180 degrees. In similar manner the stud pattern on fourth side 34 corresponds to the stud pattern on second side 32, but rotated through 180 degrees. Such a peripheral pattern makes it possible to make identical dome-like shells 1, 2, 3 which on the one hand are placeable on each other in a stacking position, see figure 2B, and which on the other are mountable at a distance from each other in a mounted position in which adjacent dome-like shells are rotated in each case through 90 degrees relative to each other, this without spacers being necessary between adjacent dome-like shells.

[0029] The assembly of dome-like shells 1, 2, 3 of figure 1 can be secured in the mounted position, for instance in classical manner using nut and bolt. According to another alternative, the assembly of dome-like shells of figure 1 can be secured in the mounted position thereof in a frame, for instance using snap battens.

[0030] Figures 4 and 5 illustrate two other possible patterns for the studs which can be used for application of the present invention. In the variant of figure 4 first studs 21a'-21c' are arranged on a first side 31' and first studs 21d'-21e' on a second side 32'. First studs 21d'-21e' are arranged such that they fit between second studs 22a'-22c' of a second dome-like shell 2' placed above the first dome-like shell 1', wherein the second dome-like shell 2' is rotated through 90 degrees relative to first dome-like shell 1'. Figure 5 illustrates yet another variant in which the first side 31" and the fourth side 34" are provided with the same first pattern which are rotated through 90 degrees relative to each other, while second side 32" and third side 33" are provided with a complementary second pattern. According to such an embodiment, the second dome-like shell will thus have to be rotated through 180 degrees relative to the first dome-like shell in order to ensure that the studs of the first dome-like shell do not overlap with the studs of the second dome-like shell.

[0031] The skilled person will appreciate that numerous other patterns are also possible, wherein all that is important is that a second dome-like shell is placeable in a rotated position on the first dome-like shell such that second peripheral flange 12 is supported on first studs 11.

[0032] In the illustrated embodiments the studs protrude upward from a peripheral flange in the same direction as the dome element itself. The skilled person will appreciate that it is also possible to have the studs protrude downward. A combination of upward and downward protruding studs is also possible.

[0033] The invention is not limited to the above described exemplary embodiments and the skilled person will appreciate that many variants and modifications can be envisaged without departing from the scope of the invention, which is defined solely by the following claims.

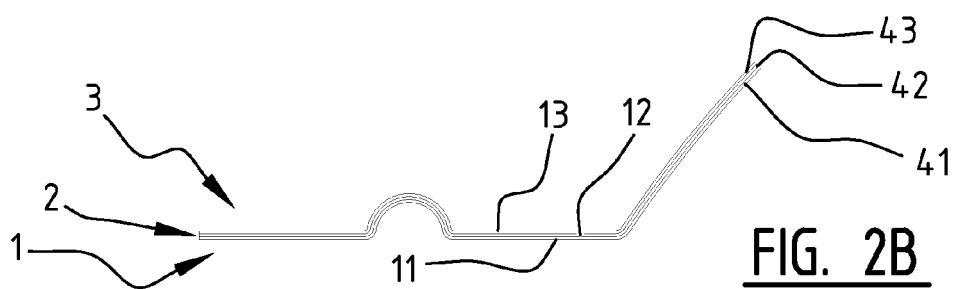
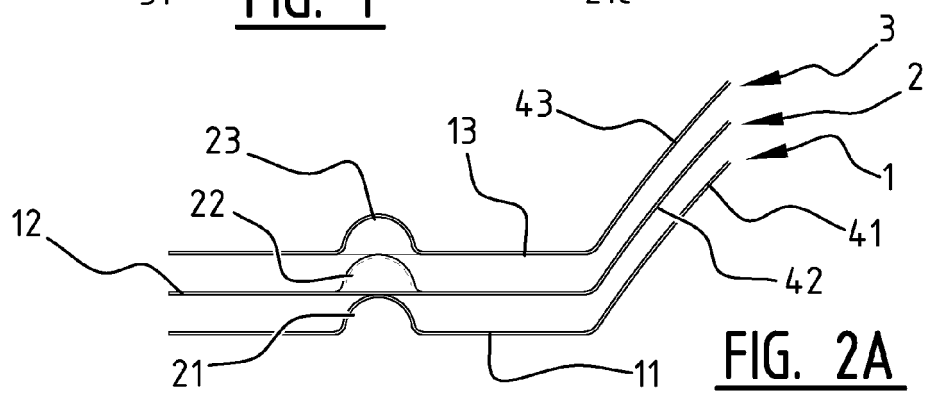
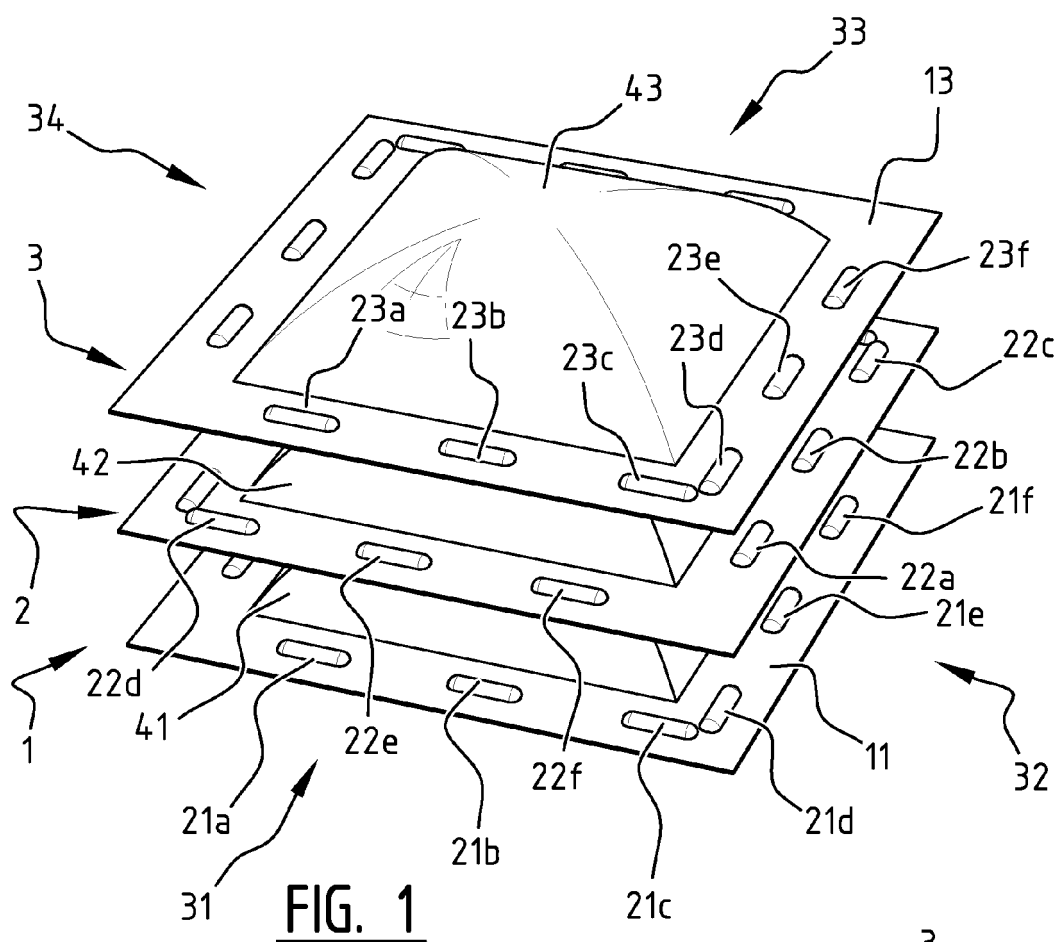
Claims

1. Dome device comprising at least a first and a second dome-like shell (1, 2, 3) formed by thermoforming, wherein the first dome-like shell and the second dome-like shell are formed with respectively a first and second dome element (41, 42) and with respectively a first and second peripheral flange (11, 12) connecting thereto, **characterized in that** the first peripheral flange of the first dome-like shell is formed with protruding first studs (21), wherein the first studs of the first peripheral flange form a spacer between the first and the second dome-like shells, wherein the first studs make contact with the second peripheral flange while the first dome element is located at a distance from the second dome element.
2. Dome device as claimed in claim 1, **characterized in that** the second peripheral flange (12) is formed with protruding second studs (22), wherein the first and second studs are a deformation of respectively the first and second peripheral flanges, and the first and second studs are arranged such that, as seen in top view, the first and the second studs do not overlap.
3. Dome device as claimed in any of the foregoing claims, **characterized in that** the form of the first dome-like shell (1), including the pattern of the first studs (21a-21f), is the same as the form of the second dome-like shell (2), including the pattern of the second studs (22a-22f), such that in a stacking position the second dome-like shell can fit onto the first dome-like shell, while in a mounted position the second dome-like shell is rotated relative to the first dome-like shell when compared to the stacking position, and the pattern is such that in the mounted position the second peripheral flange supports on the first studs.
4. Dome device as claimed in any of the foregoing claims, **characterized in that** the first dome-like shell is identical to the second dome-like shell.
5. Dome device as claimed in claim 4, further comprising a third dome-like shell with a third peripheral flange, which third dome-like shell is identical to the second dome-like shell, **characterized in that** the third dome-like shell is rotated relative to the second dome-like shell and the third peripheral flange supports on the second studs.
6. Dome device as claimed in any of the foregoing claims, **characterized in that** the first and second peripheral flange are each formed as a framework with four sides (31, 32, 33, 34), wherein the first and second peripheral flange are provided on each side with a plurality of studs.
7. Dome device as claimed in claim 6, **characterized in that** the studs on two of the four sides are arranged in a first pattern (21a-21c; 22a-22c), and on the other two of the four sides in a second pattern (21d-21f; 22d-22f) which does not overlap with the first pattern, wherein the second dome-like shell is placed in a position rotated through 90 or 180 degrees on the first dome-like shell such that for each side a first pattern lies opposite a second pattern.
8. Dome device as claimed in any of the foregoing claims, **characterized in that** the first dome-like shell and the second dome-like shell are secured with nut and bolt.
9. Dome device as claimed in any of the foregoing claims, **characterized in that** the first and the second dome-like shell are secured in a frame, for instance with snap battens.
10. Dome device as claimed in any of the foregoing claims, **characterized in that** the studs of the first peripheral flange are glued to the second peripheral flange.
11. Method for mounting a dome device with a first and a second dome-like shell, comprising of:

thermoforming the first dome-like shell and the second dome-like shell with respectively a first and a second dome element and a first and second peripheral flange connecting thereto, wherein the first dome-like shell is formed with first studs which protrude from the first peripheral flange, placing the second dome-like shell on or under the first dome-like shell such that the second peripheral flange supports against the first studs and the first and second dome element lie at a distance from each other.
12. Method as claimed in claim 11, **characterized in that** the second dome-like shell is formed with second studs which protrude from the second peripheral flange, wherein the second dome-like shell is placed on or under the first dome-like shell such that, as seen in top view, the first and the second studs do not overlap.
13. Method as claimed in claim 11 or 12, **characterized in that** the first dome-like shell is thermoformed in the same mould as the second dome-like shell such that in a stacking position the second dome-like shell can fit onto the first dome-like shell, wherein the studs are formed in a pattern such that the second dome-like shell, in a mounted position in which the second dome-like shell is rotated relative to the first dome-

like shell, can support with the second peripheral flange on the first studs.

14. Method as claimed in any of the claims 11-13, **characterized in that** the first and second peripheral flange are each formed as a framework with four sides, wherein at least two studs are formed on each side. 5
15. Method as claimed in claim 14, **characterized in that** the studs on two of the four sides are formed in a first pattern, and on the other two of the four sides in a second pattern which does not overlap with the first pattern, wherein the second dome-like shell is placed in a position rotated through 90 or 180 degrees relative to the first dome-like shell such that for each pair of opposite sides of the first and the second peripheral flange a first pattern lies opposite a second pattern. 10 15 20 25 30 35 40 45 50 55



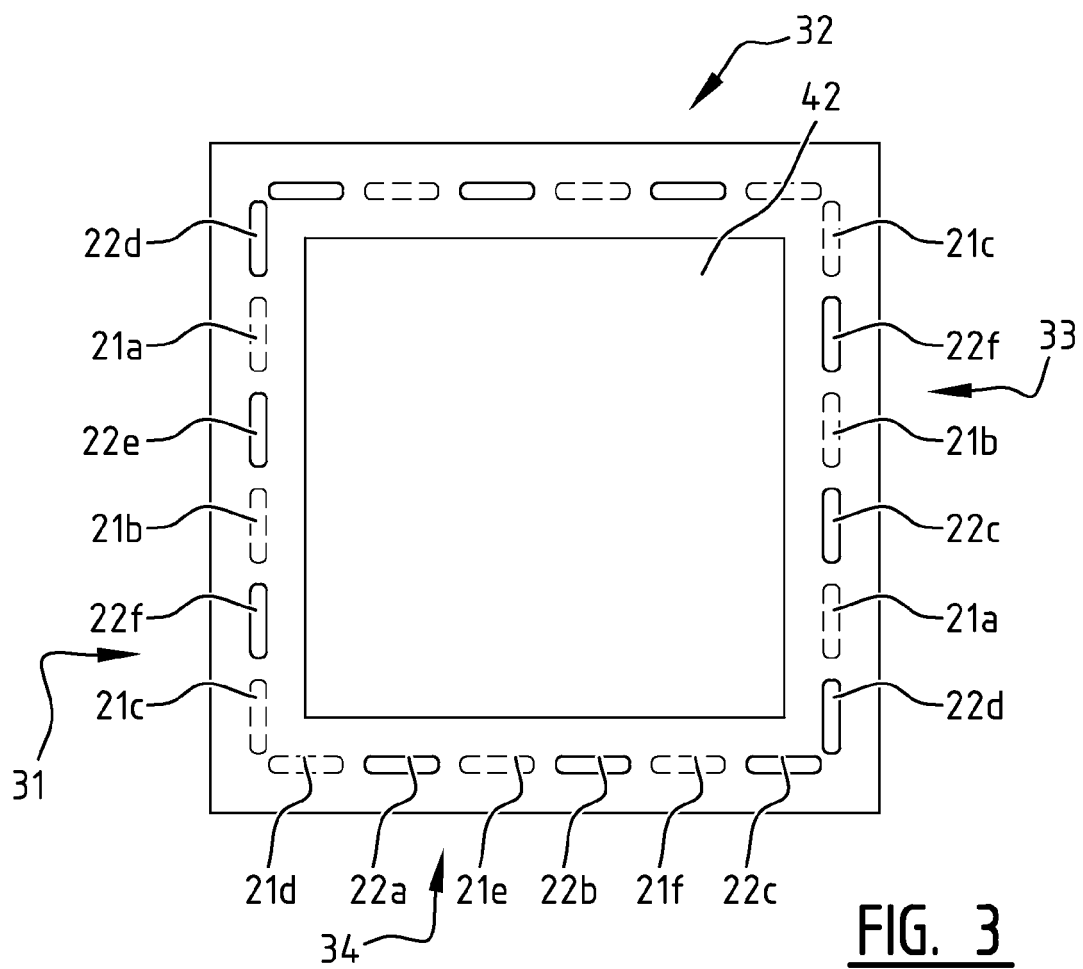
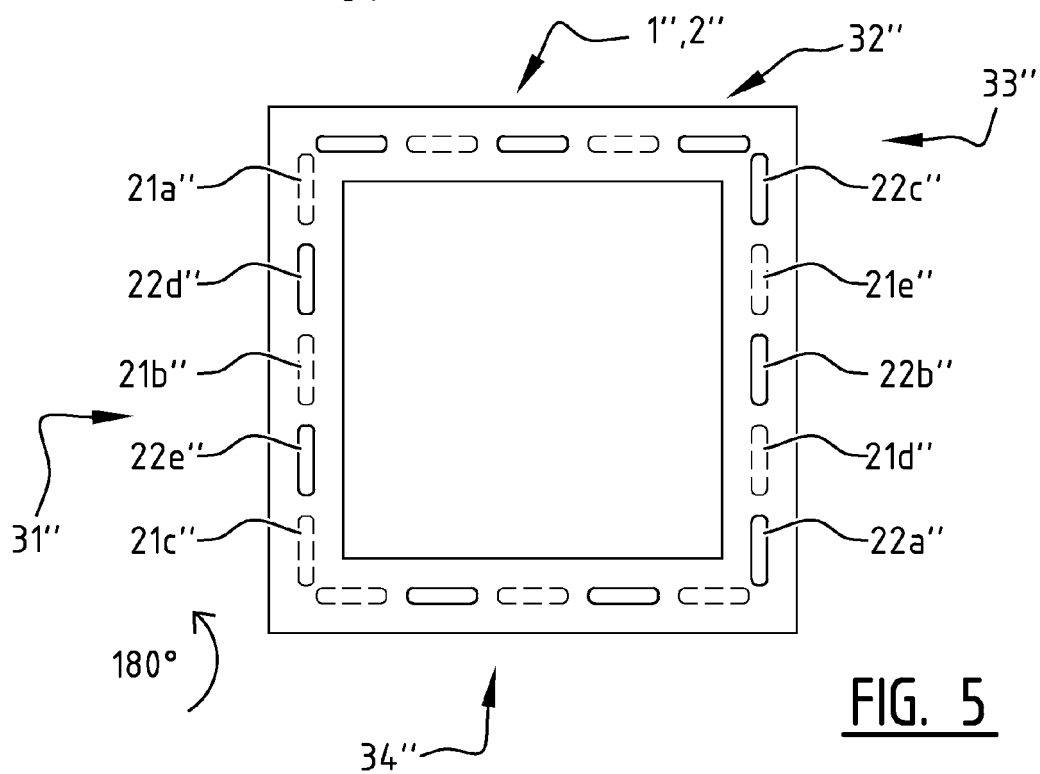
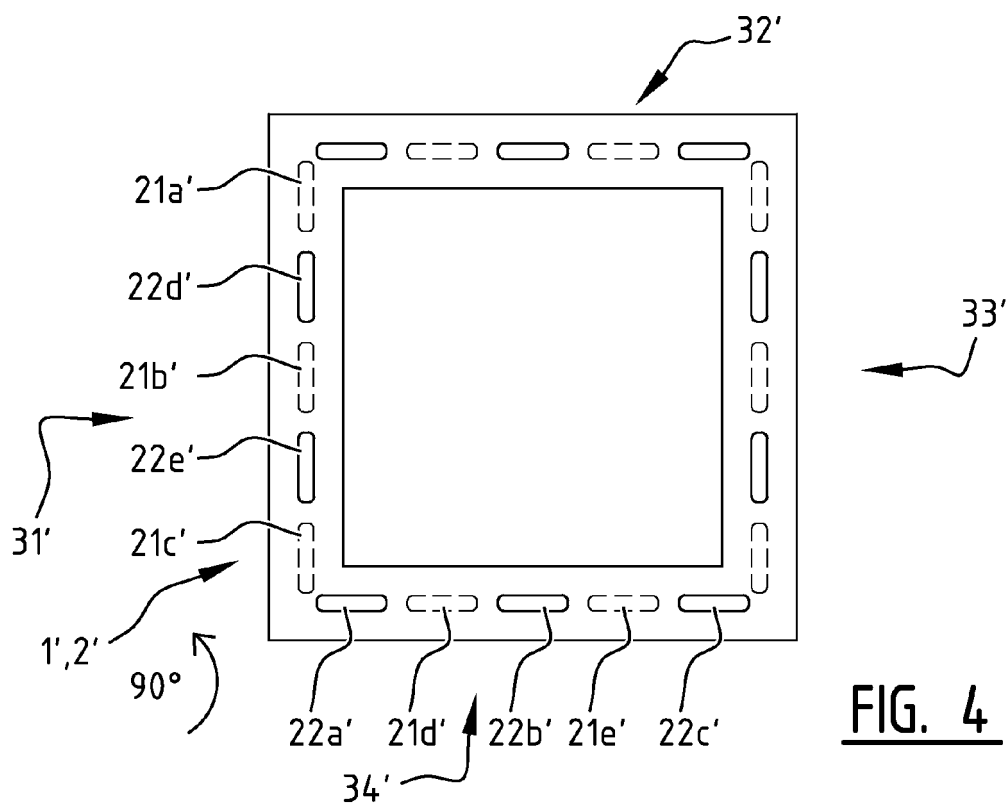


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 13 17 3696

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 3 October 2013	Examiner Demeester, Jan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 13 17 3696

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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