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(54) **Lid for a manhole**

(57) The lid (50) comprises a cover plate (61) delimited by an outer edge (51) and configured to cover a passage opening of a frame fixed to a manhole, and a number of protrusions (55) projecting radially from said outer edge (51). In an inner face of the cover plate (61) there are peripheral ribs (57) extending along the protrusions (55) parallel to the outer edge (51), one or more inner

ribs (58) forming a closed outline in a central region spaced from the outer edge (51), and a number of pairs of intermediate ribs (59) equal to the number of protrusions (55). The two intermediate ribs (59) of each pair have inner ends connected to said inner ribs (58) and outer ends connected to opposite ends of one of said peripheral ribs (57) in one of the protrusions (55).

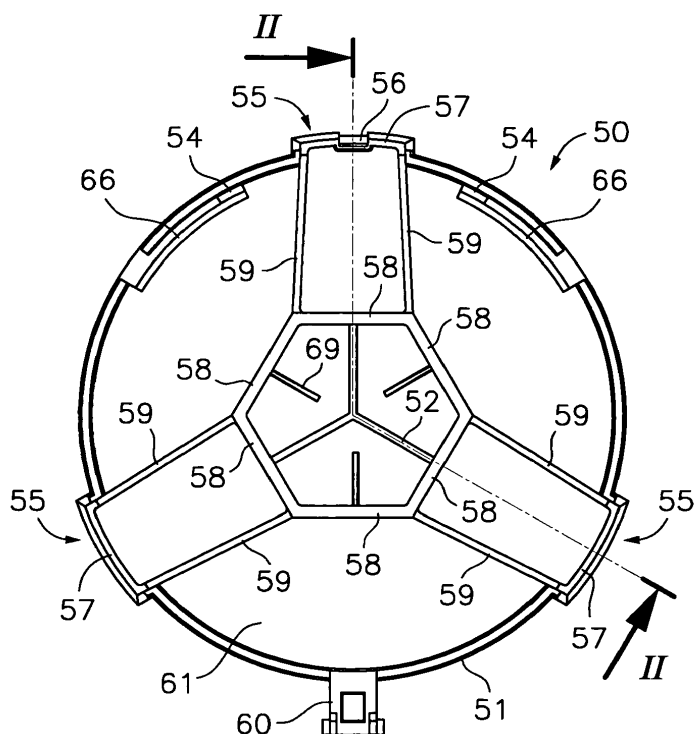


Fig. 1

Description

Field of the Art

[0001] The present invention generally relates to a lid for a manhole cover of an underground structure, and more particularly to a lid provided with a new arrangement of ribs in its lower face.

Background of the invention

[0002] Manhole covers for underground structures, of the type comprising a frame and a lid, are well known in the state of the art. The frame is suitable for being fixed to the ground in relation to said manhole and comprises a passage opening to provide access therethrough, and the lid is configured to be coupled to the frame covering said passage opening.

[0003] Patent EP-A-1769125 describes a lid for a manhole cover of an underground structure comprising a relatively thin cover plate provided with a structure of ribs projecting from a lower surface of the plate. The structure of ribs comprises inner ribs connected at their ends forming a regular hexagon and radial ribs extending from the vertexes of said hexagon to the periphery of the plate. The inner ribs have a determined height, and the height of the radial ribs progressively decreases from the inner ribs to the periphery

[0004] Patent US-A-4840514 discloses a cover of the type described above in which the lid and the frame comprise respective hinge elements cooperating to allow rotating the lid with respect to the frame about a horizontal axis between a closed position, in which the lid is coupled to the frame covering the passage opening, and an open position, in which the lid is inclined backwards at a certain angle in relation to a vertical position, thus leaving the passage opening clear. As a result of the aforementioned inclination the lid is stable in said open position. Furthermore, when the lid is in the aforementioned vertical position, the hinge elements allow the lid to be separated from the frame by moving it vertically upwards.

Description of the Invention

[0005] The present invention provides a lid for a manhole cover of an underground structure comprising a cover plate delimited by an outer edge and configured to cover a passage opening of a frame fixed to said manhole. The lid of the present invention is characterized in that said cover plate further comprises a number of protrusions projecting radially from said outer edge, peripheral ribs projecting from an inner face of said protrusions and extend therealong parallel to the outer edge, one or more inner ribs projecting from an inner face of the cover plate and forming a closed outline in a central region spaced from the outer edge, and a number of pairs of intermediate ribs equal to the number of protrusions, where said intermediate ribs also protrude from said inner

face of the cover plate. The two intermediate ribs of each pair have respective inner ends connected to said inner ribs and respective outer ends connected to opposite ends of one of said peripheral ribs of one of the protrusions.

[0006] The protrusions are configured such that they fit in box-shaped elements formed in the frame and located adjacent to and above an inner edge of said passage opening of the frame, and the aforementioned peripheral ribs are supported in seats formed at the bottom of said box-shaped elements when the lid is in a closed position with respect to the frame. Thus, the intermediate ribs transmit the loads applied on the lid, for example due to the rolling transit, to the peripheral ribs and to the seats of the frame. This arrangement of reinforcement ribs has proven to provide the lid with greater strength against forces perpendicular to the cover plate compared to lids of an equivalent weight with ribs arranged in radial directions and distributed at equal angular intervals around it.

[0007] Preferably, the inner ribs have a determined height, the peripheral ribs have a height less than the height of the inner ribs, and the height of the intermediate ribs progressively decreases from a height substantially equal to the height of the inner ribs in said inner ends to a height substantially equal to the height of the peripheral ribs in said outer ends.

[0008] In one embodiment, the aforementioned closed outline formed by the inner ribs is a polygon having a number of sides equal to twice the number of protrusions and of pairs of intermediate ribs, and preferably the inner ends of the intermediate ribs are connected to vertexes of the polygon formed by the inner ribs. In a preferred embodiment, the polygon is a hexagon and the cover plate has three protrusions in combination with three pairs of intermediate ribs. The three protrusions and the three pairs of intermediate ribs are distributed at regular angular intervals around the outer edge, i.e., at angular intervals of 120°. Thus, the support of the three peripheral ribs of the lid on the three corresponding seats of the frame provides an isostatic equilibrium that would not be attained with a different number of peripheral ribs and seats.

[0009] However, it must be pointed out that the inner ribs forming a closed outline in the form of a circle or a polygon with a number of sides different from twice the number of protrusions and of pairs of intermediate ribs, and the inner ends of the intermediate ribs not being connected to the vertexes of the polygon formed by the inner ribs are also within the scope of the present invention.

[0010] In one embodiment, the two intermediate ribs of each pair are substantially parallel to one another. In another embodiment, the two intermediate ribs of each pair are arranged in slightly converging directions from the inside towards the periphery. In yet another embodiment, the two intermediate ribs of each pair are arranged in slightly diverging directions from the inside towards the periphery.

[0011] The lid of the present invention can be coupled

to the frame without any type of hinge device, though in a preferred embodiment the lid comprises a hinge element cooperating with a corresponding hinge element of the frame to provide a rotation of the lid about a horizontal axis with respect to the frame between open and closed positions according to a conventional hinge device. In such case, one of the protrusions formed in the cover plate, which is located in a position diametrically opposed to said hinge element, includes a recess configured to receive an end of a crowbar when the lid is in a closed position. This crowbar serves to start opening the lid.

[0012] The outer edge of the cover plate can have different shapes which will generally be conjugated with the shape of the frame. In one embodiment, the outer edge of the cover plate has the form of a circle to be coupled to a frame having a circular passage opening. In another embodiment, the outer edge of the cover plate has the form of a non-circular curve of constant width geometrically similar to a non-circular curve of constant width defined by the inner edge of the passage opening of the frame. A curve of constant width is defined as a closed curve in which a distance between two parallel geometric lines tangent to opposite points of said outer edge is constant, no matter what the direction of said two parallel lines.

Brief Description of the Drawings

[0013] The foregoing and other features and advantages will be more fully understood from the following detailed description of embodiments with reference to the attached drawings, in which:

Fig. 1 is a bottom plan view of a lid for a manhole cover of an underground structure according to a first embodiment of the present invention;

Fig. 2 is a cross-section view taken along broken plane II-II of Fig. 1;

Fig. 3 is a top plan view of a cover which includes the lid of the first embodiment shown in Figs. 1 and 2 and a matching frame;

Fig. 4 is a cross-section view taken along broken plane IV-IV of Fig. 3;

Fig. 5 is a bottom plan view of a lid for a manhole cover of an underground structure according to a second embodiment of the present invention;

Fig. 6 is a cross-section view taken along broken plane VI-VI of Fig. 1;

Fig. 7 is a top plan view of a cover which includes the lid of the first embodiment shown in Figs. 5 and 6 and a matching frame; and

Fig. 8 is a cross-section view taken along broken plane VIII-VIII of Fig. 7.

Detailed Description of Exemplary Embodiments

[0014] First in reference to Figs. 1 to 4, a lid 50 according to a first embodiment of the present invention is

shown. The lid 50 comprises a relatively thin cover plate 61 delimited by an outer edge 51 and configured to cover a passage opening of a frame 10 (Figs. 3 and 4) fixed to a manhole of an underground structure, such as a sewer or the like (not shown).

[0015] The aforementioned outer edge 51 of the cover plate 61 has the form of a circle, and the lid 50 has three protrusions 55 radially projecting outwards from the outer edge 51 of the cover plate 61. In each of said protrusions 55 there is a peripheral rib 57 projecting from an inner face of the cover plate 61 and extending along the protrusion 55 parallel to the outer edge 51. Therefore, there are three of said peripheral ribs 57 in the lid 50.

[0016] The lid 50 further comprises six inner ribs 58 projecting from the inner face of the cover plate 61 which are connected to one another at their ends forming a closed outline in the form of a regular hexagon in a central region spaced from the outer edge 51 of the cover plate, and three pairs of intermediate ribs 59 also projecting from said inner face of the cover plate 61. The two intermediate ribs 59 of each pair have respective inner ends connected to two contiguous vertexes of the aforementioned hexagon formed by said inner ribs 58 and respective outer ends connected to opposite ends of one of the peripheral ribs 57 in one of the protrusions 55.

[0017] Thus, the two intermediate ribs 59 of each pair together with one of the peripheral ribs 57 and one of the inner ribs 58 form a closed outline in the form of a quadrangle. In this first embodiment, the two intermediate ribs 59 of each pair are arranged in slightly converging directions from their inner ends to their outer ends. The inner ribs 58 have a height greater than the height of the peripheral ribs 57 (Fig. 2), and the intermediate ribs 59 have a height which progressively decreases from a height substantially equal to the height of the inner ribs 58 at their inner ends to a height substantially equal to the height of the peripheral ribs 57 at their outer ends.

[0018] The three protrusions 55 and their corresponding peripheral ribs 57 and pairs of intermediate ribs 59 are distributed at regular angular intervals around the outer edge 51. A central region of the lid 50 delimited by the inner ribs 58 is reinforced by several auxiliary ribs 52 and gussets 69 of little height projecting from the inner face of the cover plate 61 and connecting with the inner ribs 58.

[0019] Figs. 3 and 4 show the lid 50 of the first embodiment described in relation to Figs. 1 and 2 coupled to a conjugated frame 10 configured to be fixed to the underground structure in relation to said manhole. The frame 10 comprises a perimetral tubular wall 19 defining a passage opening and a perimetral fixing flange 20 extending outwards from a lower end of said perimetral tubular wall 19. The perimetral fixing flange 20 has openings for reducing weight and fixing holes 13 for installing screws or the like by means of which the frame 10 is fixed to the underground structure.

[0020] When the frame 10 is fixed in the operating position, the perimetral fixing flange 20 is underground and

an upper edge of the perimetral tubular wall 19 is substantially flush with the surface of the ground. When the lid 50 is coupled to the frame 10 in a closed position, an upper surface of the cover plate 61 is substantially flush with an upper edge of the perimetral tubular wall 19. In the upper surface of the cover plate 61 of the lid 50 there is a pattern of non-slip projections 62 (Fig. 3). Optionally said pattern of non-slip projections 62 includes one or more clearings to place one or more embossed inscriptions (not shown).

[0021] The passage opening of the frame 10, which is generally sized to allow the passage of a person there-through, has an inner edge 14 in the form of a circle having a diameter slightly greater than the outer edge 51 of the cover plate 61 of the lid 50. The perimetral tubular wall 19 of the frame 10 has box-shaped elements 15 located adjacent to and above said inner edge 14 of the passage opening, such that these box-shaped elements 15 define seats 12 in a bottom wall thereof.

[0022] The protrusions 55 of the lid 50 are configured such that they fit in the box-shaped elements 15 of the frame 10, and the peripheral ribs 57 of the lid 50 are supported on the aforementioned seats 12 formed at the bottom of the box-shaped elements 15 of the frame 10 when the lid 50 is in a closed position with respect to the frame 10. The loads applied on the cover plate 61, due for example to rolling transit when the lid 50 is installed in a road, are thus transmitted by the intermediate ribs 59 and the peripheral ribs 57 to the frame 10.

[0023] The lid 50 includes a conventional type hinge element 60 cooperating with a corresponding conventional type hinge element 17 formed in the frame 10. When the hinge elements 17, 60 are mutually coupled, they allow rotating the lid 50 with respect to the frame 10 about a horizontal axis between a closed position (Figs. 3 and 4), in which the lid 50 is coupled to the frame 10 covering the passage opening, and an open position (not shown), in which the lid 50 is inclined backwards at a certain angle in relation to a vertical position, thus leaving the passage opening clear. As a result of the aforementioned inclination, the lid 50 is stable in said open position. Furthermore, when the lid is in the aforementioned vertical position, the hinge elements 17, 60 allow the lid to be separated from the frame by moving it vertically upwards.

[0024] The aforementioned hinge element 60 of the lid 50 is located in a position diametrically opposed to one of the protrusions 56, which, together with its corresponding peripheral rib 57, has a recess 56 configured to receive an end of a crowbar (not shown) when the lid 50 is in the closed position. This crowbar is used to start opening the lid 50 as is conventional.

[0025] As shown in Fig. 1, the lid 50 of the first embodiment further comprises a pair of elastic arms 66 connected at one of their ends to the inner face of the cover plate 61. These elastic arms have at their free ends upper pressure closure members 54 locking with corresponding lower pressure closure members (not shown) formed

in the frame 10 when the lid 50 is in the closed position.

[0026] Now in reference to Figs. 5 to 8, a lid 50 according to a second embodiment of the present invention is shown, which is essentially identical to the first embodiment described above in relation to Figs. 1 to 4 except in the form of the outer outline 51 of the cover plate 61. In this second embodiment, the outer edge 51 of the cover plate 61 has the form of a non-circular curve of constant width (Fig. 5), in which a distance D between two parallel geometric lines L1, L2 tangent to opposite points of said outer edge 51 is constant, no matter what the direction of said two parallel lines L1, L2.

[0027] Thus, the aforementioned distance D is equivalent to a diameter of the outer edge 51 of the cover plate 61, although the perimeter and the area of the curve of constant width are less than that of a circle of equivalent diameter. Therefore, the weight of the lid 50 of this second embodiment and the amount of material necessary for producing it are less than those of a circular lid of equivalent diameter.

[0028] As shown in Fig. 5, the lid 50 of the second embodiment has protrusions 55 and an arrangement of peripheral ribs 57, inner ribs 58 and intermediate ribs 59 analogous to the arrangement of ribs of the first embodiment. However, another difference of the lid 50 of the second embodiment compared to the first embodiment is that the two intermediate ribs 59 of each pair are substantially parallel to one another, and it does not have the auxiliary ribs 52 and gussets 69 shown in Fig. 1. In the lid 50 of the second embodiment, the hinge element 60 and the recess 56 are functionally equivalent to the hinge element 60 and the recess 56 of the lid 50 of the first embodiment even though their design is different.

[0029] Figs. 7 and 8 show the lid 50 of the second embodiment described in relation to Figs. 5 and 6 coupled to a conjugated frame 10 which, analogously to the first embodiment, comprises a perimetral tubular wall 19 defining a passage opening and a perimetral fixing flange 20 extending outwards from a lower end of said perimetral tubular wall 19. In this second embodiment, the passage opening of the frame 10 has an inner edge 14 in the form of a curve of constant width geometrically equivalent to the curve of constant width defined by the outer edge 51 of the lid 50, and of a slightly greater equivalent diameter. Therefore, the frame 10 conjugated with the lid 50 of the second embodiment has a weight less than that of a circular frame of equivalent diameter.

[0030] The frame 10 conjugated with the lid 50 of the second embodiment has, analogously to the first embodiment, box-shaped elements 15 with bottom walls defining seats 12 in which the peripheral ribs 57 of the lid 50 are supported in the closed position (Fig. 8). Unlike the first embodiment, here the bottom walls of the box-shaped elements 15 are reinforced in the lower portion by gussets 21 (Fig. 8). The lid 50 is articulated to the frame 10 by respective conventional type hinge elements 60, 17 functionally equivalent to the hinge elements 60, 17 of the first embodiment, and the protrusion 55 which

is located diametrically opposed to the hinge element 60 has a recess 56 configured to receive the end of a crow-bar (not shown).

[0031] Alternatively, the lid 50 of the present invention can have other embodiments different from the first and second embodiments shown and described in relation to Figs. 1 to 8. For example, in an alternative embodiment, the inner ribs 58 could form a closed outline different from a polygon, for example a circle. In another alternative embodiment, the polygon formed by the inner ribs 58 could have a number of sides different from twice the number of protrusions 55, peripheral ribs 57 and pairs of intermediate ribs 59. In yet another alternative embodiment, the inner ends of the intermediate ribs 59 could be connected to points of the polygon formed by the inner ribs 58 different from the vertexes thereof. In an additional alternative embodiment, the two intermediate ribs 59 of each pair could be arranged in diverging directions from their inner ends to their outer ends.

[0032] A person skilled in the art will conceive of other modifications, variations and combinations from the embodiments shown and described without departing from the scope of the present invention as it is defined in the attached claims.

Claims

1. A lid for a manhole cover of an underground structure, of the type comprising a cover plate (61) delimited by an outer edge (51) and configured to cover a passage opening of a frame (10) fixed to said manhole, **characterized in that** said lid (50) further comprises;
a number of protrusions (55) projecting radially from said outer edge (51) of said cover plate (61);
peripheral ribs (57) projecting from an inner face of said protrusions (55) and extending therealong parallel to the outer edge (51);
one or more inner ribs (58) projecting from an inner face of the cover plate (61) and forming a closed outline in a central region spaced from the outer edge (51); and
a number of pairs of intermediate ribs (59) equal to the number of protrusions (55), where the two intermediate ribs (59) of each pair protrude from said inner face of the cover plate (61) and have respective inner ends connected to said inner ribs (58) and respective outer ends connected to opposite ends of one of said peripheral ribs (57) of one of the protrusions (55).
2. The lid for a manhole cover according to claim 1, **characterized in that** said protrusions (55) are configured such that they fit in box-shaped elements (15) located adjacent to and above an inner edge (14) of said passage opening of the frame (10), and said peripheral ribs (57) are supported in seats (12)

formed at the bottom of said box-shaped elements (15) when the lid (50) is in a closed position with respect to the frame (10).

3. The lid for a manhole cover according to claim 2, **characterized in that** the inner ribs (58) have a first height, the peripheral ribs (57) have a second height less than said first height, and the intermediate ribs (59) have a height which progressively decreases from a height substantially equal to the first height in said inner ends to a height substantially equal to said second height in said outer ends.
4. The lid for a manhole cover according to claim 1, 2 or 3, **characterized in that** said closed outline formed by the inner ribs (58) is a polygon.
5. The lid for a manhole cover according to claim 4, **characterized in that** said polygon has a number of sides equal to twice the number of protrusions (55) and of pairs of intermediate ribs (59).
6. The lid for a manhole cover according to claim 5, **characterized in that** the inner ends of the intermediate ribs (59) are connected to vertexes of the polygon formed by the inner ribs (58).
7. The lid for a manhole cover according to any one of the preceding claims, **characterized in that** the two intermediate ribs (59) of each pair are substantially parallel to one another.
8. The lid for a manhole cover according to any one of claims 1 to 6, **characterized in that** the two intermediate ribs (59) of each pair are arranged in converging directions from their inner ends to their outer ends.
9. The lid for a manhole cover according to any one of claims 1 to 6, **characterized in that** the two intermediate ribs (59) of each pair are arranged in diverging directions from their inner ends to their outer ends.
10. The lid for a manhole cover according to any one of claims 4 to 9, **characterized in that** said polygon is a hexagon and said number of protrusions (55) and of pairs of intermediate ribs (59) is three.
11. The lid for a manhole cover according to claim 10, **characterized in that** said three protrusions (55) and pairs of intermediate ribs (59) are distributed at regular angular intervals around the outer edge (51).
12. The lid for a manhole cover according to any one of the preceding claims, **characterized in that** the lid (50) comprises a hinge element (60) cooperating with a hinge element (17) of the frame (10) to provide

a rotation of the lid (50) about a horizontal axis with respect to the frame (10) between open and closed positions.

13. The lid for a manhole cover according to claim 12, **characterized in that** one of the protrusions (55), which is located in a position diametrically opposed to said hinge element (60), includes a recess (56) configured to receive an end of a crowbar when the lid is in a closed position. 5 10
14. The lid for a manhole cover according to any one of the preceding claims, **characterized in that** the outer edge (51) of the cover plate (61) has the form of a circle. 15
15. The lid for a manhole cover according to any one of claims 1 to 13, **characterized in that** the outer edge (51) of the cover plate (61) has the form of a non-circular curve of constant width, in which a distance (D) between two parallel geometric lines (L1, L2) tangent to opposite points of said outer edge (51) is constant no matter what the direction of said two parallel lines (L1, L2). 20 25

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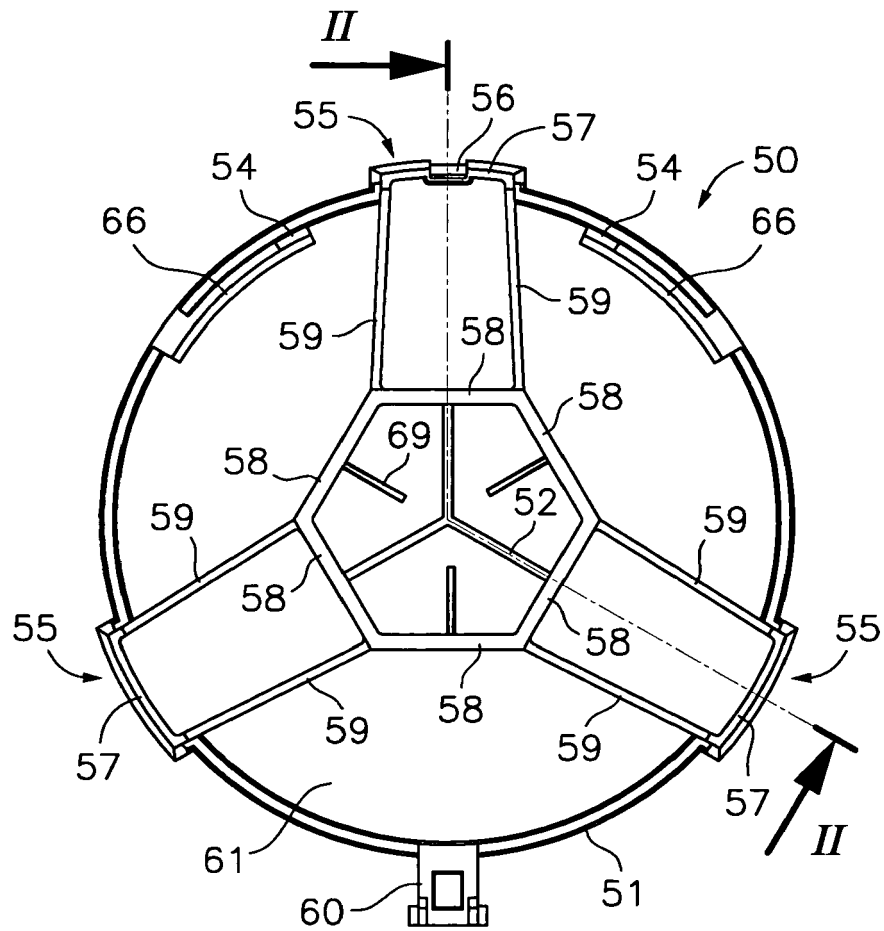


Fig. 1

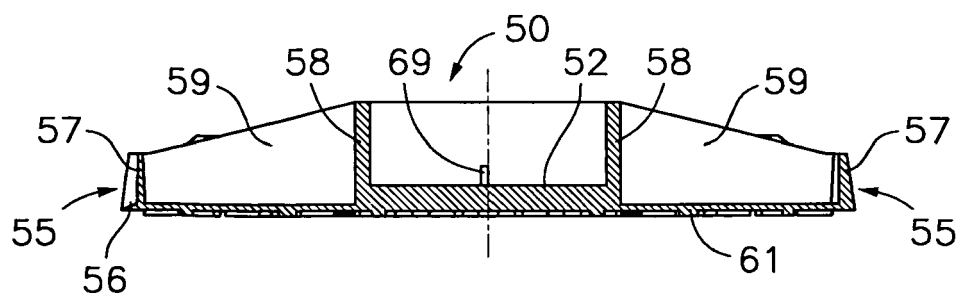


Fig. 2

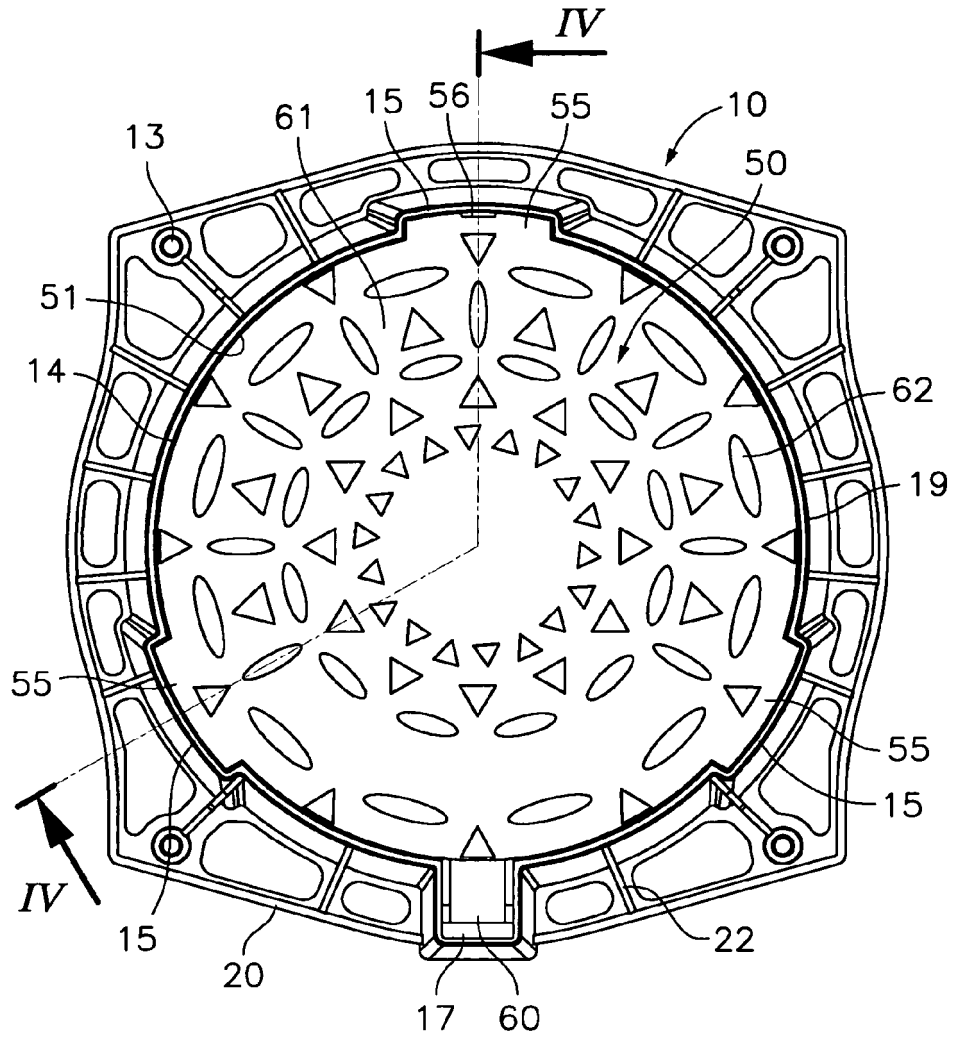


Fig. 3

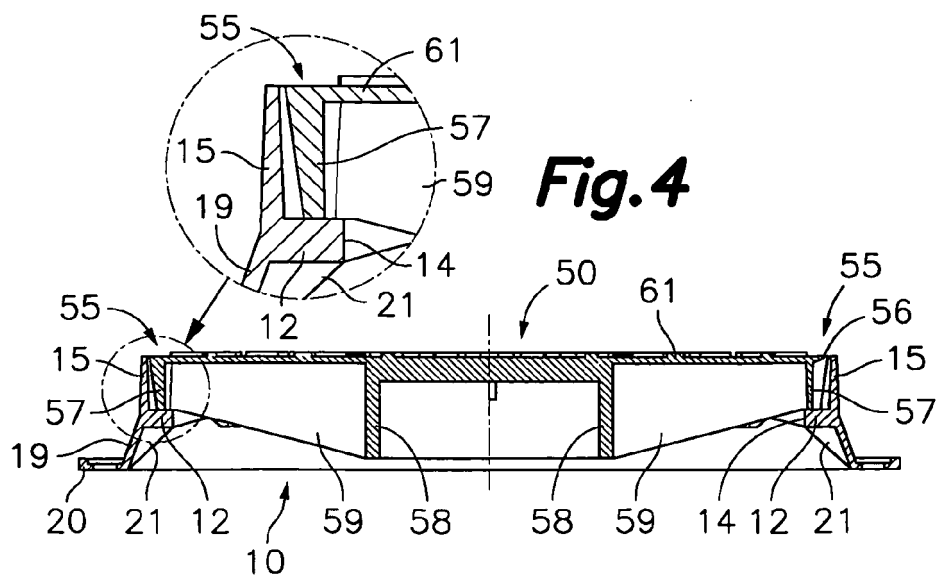
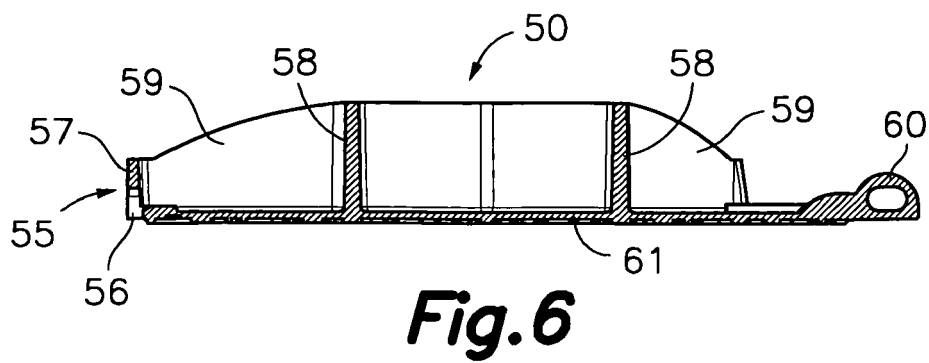
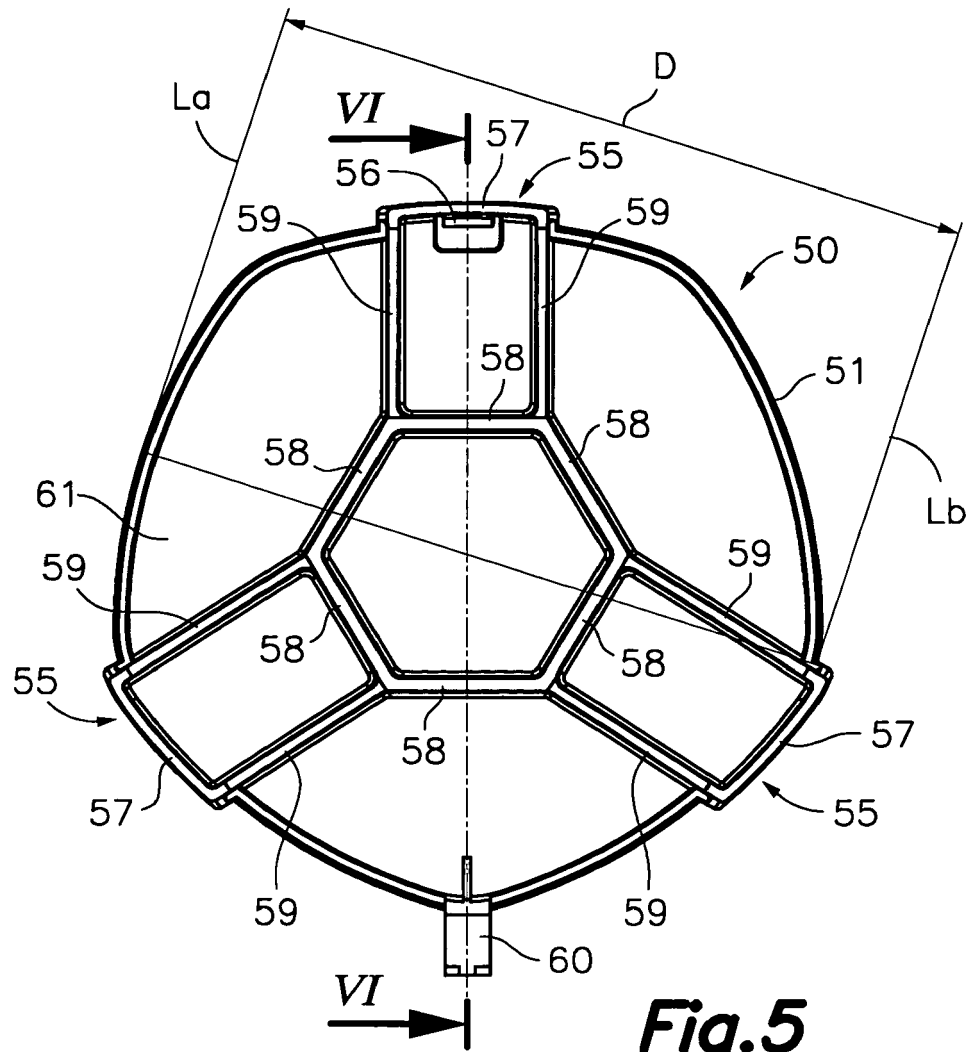
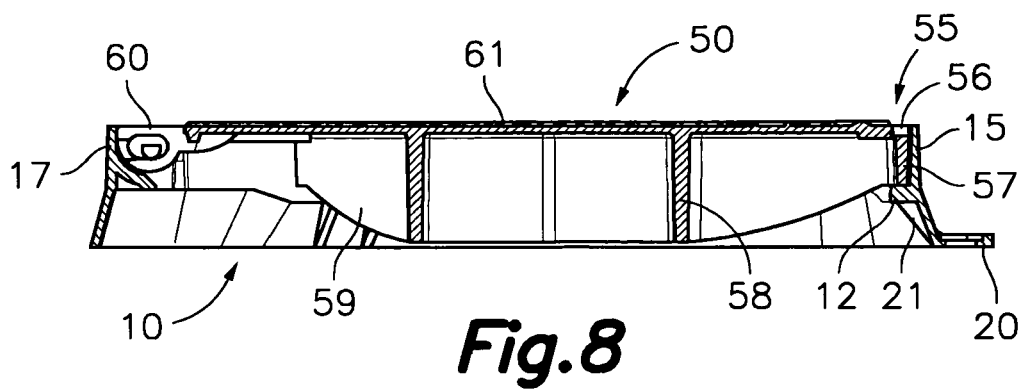
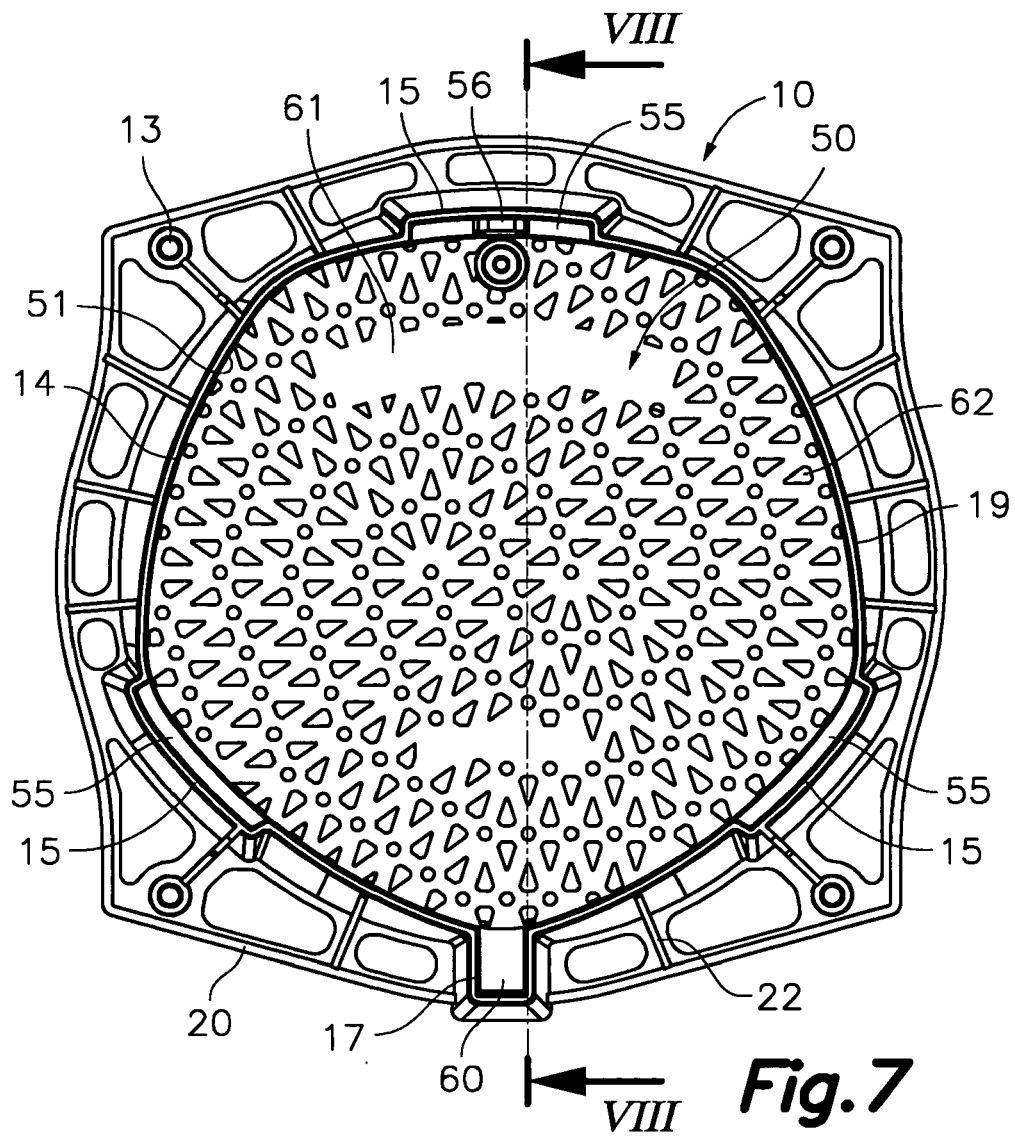


Fig. 4







EUROPEAN SEARCH REPORT

Application Number
EP 11 38 0029

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 October 2011	Examiner Geiger, Harald
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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