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(71) Applicant: **S.A. OMNIFORM**
1301 Waver (BE)

(72) Inventors:
- **Van Zele, Peter**
  3090 OVERIJSE (BE)
- **Wambeke, Alain**
  3440 ZOUTLEEUW (BE)
- **Van Zele, Eric**
  1560 HOEILAART (BE)

(74) Representative: **Quintelier, Claude et al**
Gevers & Vander Haeghen,
Intellectual Property House,
Brussels Airport Business Park
Holidaystraat 5
1831 Diegem (BE)

(54) **Self regulating vent for a paint supply vessel.**

(57) A vessel having an air inlet, said vessel being applicable on a liquid application tool, said air inlet comprising a plurality of openings, each opening having a surface area of at the most 15 mm^2, said air inlet being provided with a closure valve (15,16) made of flexible elastomer material, said valve (15,16) being resiliently mounted on said air inlet in such a manner as to cover said plurality of openings and to open upon a predetermined pressure difference between a first pressure inside said vessel and a second pressure outside said vessel.

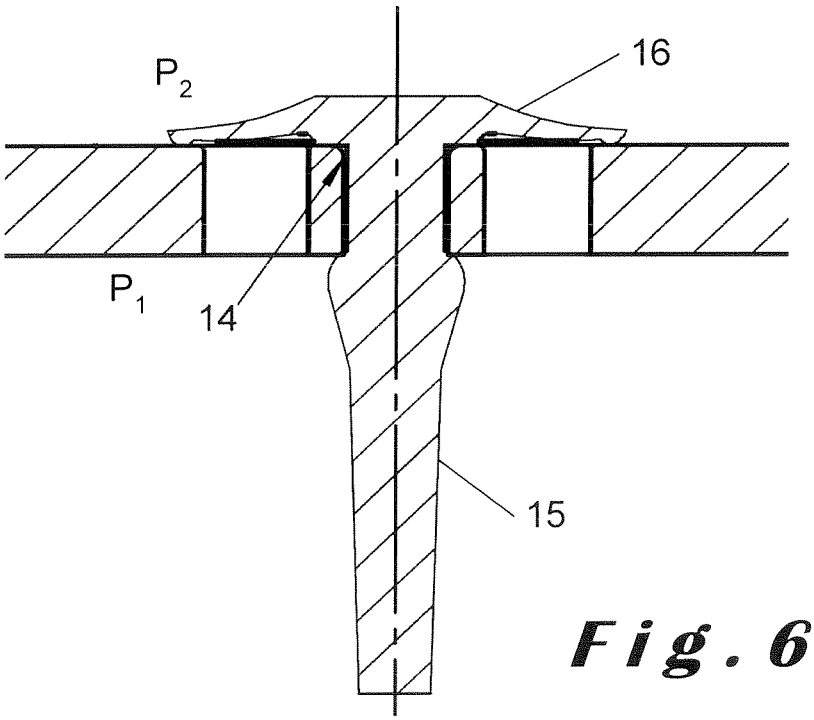

Fig. 6

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Description

[0001] The present invention relates to a vessel used for storing a liquid or viscous material to be supplied to a liquid application tool, said vessel having an air inlet.

[0002] Such a vessel is known and commonly used for various applications. For example, it can be used for storing paint or another liquid product or viscous material. The vessel is mounted onto a pneumatic or otherwise powered liquid application tool, such as for example a spray gun. The vessel is sealed with a closure lid, which typically clicks onto an upper rim of the vessel or can be held on by a screw-type thread or other various mounting and sealing means. The vessel, and in particular the closure lid, is punctured or otherwise opened before or after mounting the vessel onto the liquid application tool. In such a manner an air inlet is provided for equalizing the pressure difference that builds up in the vessel as the liquid is applied. In such a manner air can flow to the interior of the vessel thereby facilitating a supply of the liquid..

[0003] A drawback of the known vessels is that the vessel needs to be punctured or otherwise opened in order to provide the air inlet. Once punctured or opened, the vessel is no longer integral and can serve only to supply the material to the application tool in a relatively upright orientation. Once opened, it becomes difficult to leave unused product in the vessel as air continues to enter the vessel. Moreover the product will leak out of the vessel when the latter is removed from the application tool and turned upside down. With the known vessels it is therefore necessary to remove the punctured lid and replace it with a non-punctured one, or transfer the contents entirely by pouring the material into a new, genuine vessel for temporary storage away from the application tool.

[0004] The objective of the invention is to provide a vessel where it is no longer necessary to puncture the latter for the purpose of providing an air inlet.

[0005] For this purpose, a vessel according to the present invention is characterised in that said air inlet comprises a plurality of openings, each opening having a surface area of at the most 15 mm^2, said air inlet being provided with a closure valve made of flexible elastomer material, said valve being resiliently mounted on said air inlet in such a manner as to cover said plurality of openings and to open upon a predetermined pressure difference between a first pressure inside said vessel and a second pressure outside said vessel. The use of the closure valve applied on the air inlet provides for air supply regulation by means of the pressure difference present over the valve. For example, if the vessel is mounted onto a spray gun, the spraying will cause the liquid amount present inside the vessel to diminish, thereby creating a lower pressure in the interior of the vessel compared to the exterior thereof. The pressure difference will cause the valve to open and let air flow into the interior of the vessel. When the spraying stops, the pressure difference will no longer be present thereby closing the valve. In this manner, the valve is automatically regulated.

[0006] Preferably said vessel comprises a closure lid having a seat on which said air inlet is applied. In such a manner care is taken that the air inlet is applied on the closure lid.

[0007] A first preferred embodiment of a vessel according to the present invention is characterised in that said openings are applied along a circumference of a circle and wherein said valve has a circularly shaped member covering said openings. The circular distribution of the openings stimulates a well distributed air flow.

[0008] A second preferred embodiment of a vessel according to the present invention is characterised in that a further opening is applied in the centre of said circle, said valve having a stem extending from said member and penetrating into said further opening. In such a manner the stem is surrounded by the air flow openings.

[0009] Preferably said closure lid comprises a conically shaped part on which said seat is applied in such a manner as to form a flat surface, said plurality of openings being applied through said seat. In such a manner, a screen can be applied to filter the material as it leaves the vessel. Depending on the application, the filtering screen may cover the seat or may bypass it.

[0010] A third preferred embodiment of a vessel according to the present invention is characterised in that said seat is formed by a protrusion extending inside said vessel. In such a manner and even with a conically shaped closure lid, the valve acts on flat surface.

[0011] The invention also relates to a closure lid as part of a vessel according to the present invention.

[0012] The invention will now be described in more details with reference to the drawings showing a preferred embodiment of a vessel according to the invention. In the drawings:

figure 1 shows an overall view of the vessel mounted on a spray gun.;
figure 2 shows a top view of the closure lid;
figure 3 shows the inner side of the closure lid;
figure 4 shows a cross section along the line IV-IV';
figure 5 shows a detailed view of the plurality of holes; and
figure 6 shows a cross section through the closure valve.

[0013] In the drawings a same reference sign has been allocated to a same or analogous element.

[0014] The vessel 1 illustrated in figure 1, is mounted on a spray gun 4 provided with a handle 5 for controlling the spray volume. In this particular example a spray gun is used as a liquid application tool. It will however be clear that other application tools than a spray gun can be used. The vessel is provided for storing and conveying paint to the spray gun. It will however be clear that the present invention is not limited to vessels for storing paint and

that the vessels may contain any other liquid or viscous material to be supplied to the application tool. The vessel also comprises a reservoir 2, which is closed by means of a closure lid 3. The closure lid is preferably clicked on a rim of the reservoir with a pressure fit interlocking design. The vessel can also comprise a mixing cup which is removably mounted thereto. The mixing cup is used for preparing a mixture, in particular paint, prior to pouring it into the vessel, which is subsequently mounted onto the application tool. The removably mounted mixing cup enables to incorporate the mixing cup as part of the vessel, thereby avoiding the need to transfer the liquid to another vessel prior to the application thereof. This extends the utility of a mixing cup, reduces waste, and reduces the cost and the number of steps in the liquid (paint) preparation process.

[0015] As illustrated in figure 2, which shows a top view of the closure lid 3, the latter comprises a closure rim 6 for fixing the closure lid on the reservoir 2. The closure rim is upright with respect to the closure lid surface 11 extending from the closure rim towards a central opening 7 applied on a protrusion and provided for mounting the vessel 1 on the spray gun 4. Triangularly shaped reinforcement elements 8 extend as from the closure rim's upright part towards the central opening over a short section of the closure lid surface 11. The reinforcement elements reinforce the connection between the closure rim 6 and the closure lid surface 11 and also the whole closure lid, in such a manner as to firmly sustain the weight of the liquid when the vessel is applied on the application tool.

[0016] The closure lid further comprises an air inlet 9. As illustrated in the figures 2 and 3, the air inlet crosses the closure lid surface 11 and comprises a plurality of openings 10. The air inlet is applied approximately half way between the closure rim 6 and the central opening 7. The openings are applied along a circumference of a circle. As illustrated in figure 4, the air inlet is preferably applied on a seat 12. Especially when the closure lid comprises a conically shaped part, which is favourable when a filtering screen is mounted, the seat 12 forms a triangularly shaped protrusion (as seen in the sectioned view of figure 4) inside the vessel and with respect to the cover lid surface 11. The air inlet location may be adjusted for various reasons, such as to incorporate the aforementioned filtering screen. In the illustrated embodiment the air inlet is applied on the closure lid. Alternatively the air inlet could also be applied on the reservoir 2, preferably in the upper part thereof.

[0017] The openings 10 are applied in the flat surface part of the seat which extend substantially parallel with respect to line 13. In such a manner, the air penetrates perpendicularly through the openings 10 and turbulences are avoided which would be generated in case that the openings would be applied in the conical surface. When seen from the outer side of the closure lid (figure 2), the air inlet 9 is as if to say applied in a cavity, applied on the closure lid's surface 11.

[0018] As is illustrated in figure 5, which shows a detailed view of the openings, the latter are rather small and have preferably a diameter d1 = 1,6 mm. The dimension of the diameter d1 is determined in function of the liquid to be applied and the amount of air flow needed into the interior of the vessel. The diameter of each opening can vary between 0.2 mm to 4 mm. At the most each of the plurality of openings have a surface of 15 mm^2. Preferably the plurality of holes 10 are situated inside a circle C having a diameter d2 = 6 mm. However, diameter d2 may also vary according to the liquid to be applied and air flow needed into the vessel interior.

[0019] The air inlet is further provided with a closure valve 14 made of a flexible elastomer material such as silicone rubber, fluorosilicone, fluoroelastomers or perfluoroelastomers. The choice of the elastomer material of which the valve is made, is in function of the liquid that will be present in the vessel. Indeed, care has to be taken that the latter material is chemically resistant to this liquid. Nor is the location of the valve assembly limited to placement in the closure lid, the valve assembly may also be mounted in the reservoir if the air inlet is applied there.

[0020] In order to apply the closure valve, the air inlet is preferably provided with a further opening 14 as illustrated in figures 5 and 6. This further opening 14 is applied in a centre of the circle C within which the openings 10 are applied. The valve comprises preferably a stem 15 on which a circularly shaped member 16 is mounted as illustrated in figure 6. The circularly shaped member is dimensioned in such a manner that it covers the plurality of openings. Such a type of valve is also called an umbrella valve. The circularly shaped member 16 extends on the inner side of the closure lid, whereas the stem 15 penetrates through the further opening 14 in order to reach the outer side of the closure lid 3. The stem 15 is somewhat compressed inside the further opening 14 so that it bulges out at the outer side, thereby firmly fixing the valve to the air inlet. The valve thus covers the openings and opens upon a pressure difference between a first pressure P1 inside the vessel and a second pressure P2 outside the vessel.

[0021] When the user activates the handle 5 of the spray gun, the gun will open thereby causing a pressure drop inside the vessel. As the pressure P1, inside the vessel is then lower than the pressure P2 outside the vessel, a pressure difference will be established over the air inlet, causing the valve to open and thus allowing air from the outside to flow via the plurality of openings 10 inside the vessel. As soon as the handle is released, the pressure difference becomes negligible, thereby causing the valve to close. The valve is thus self regulating and as the valve closes after release of the handle, the vessel is closed and there is no need to change the closure lid, even if the liquid remains stored in the vessel.

[0022] The closure lid and the reservoir are preferably made of plastic disposable material so as to provide a low cost product. Moreover, there is also no need to clean the reservoir. It has to be noted that a silicone valve may

swell upon exposure to certain solvents which may be present in the liquid. However this will not affect the operation of the valve as the member 16 does not cross the boundaries of the seat.

[0023] The valve can be designed in such a manner that it opens at predetermined pressure differential between the interior and exterior of the vessel. The valve design can be optimized to open at as low as 5 millibar of pressure or as high as 100 millibar, depending on needs of the application. The valve has also a self sealing feature, as even without pressure difference the stem holds the valve closed due to the pretension in the stem. The self regulating properties of the valve cause the air volume passing through the plurality of openings to be directly dependent on the amount of liquid sprayed. To increase the flow of air into the vessel, the size of the valve and seat openings can be increased or multiple valve mountings could be used.

Claims

1. A vessel, in particular for containing paint, said vessel having an air inlet, said vessel being applicable on a liquid application tool, **characterised in that** said air inlet comprises a plurality of openings, each opening having a surface area of at the most 15 mm^2, said air inlet being provided with a closure valve made of flexible elastomer material, said valve being resiliently mounted on said air inlet in such a manner as to cover said plurality of openings and to open upon a predetermined pressure difference between a first pressure inside said vessel and a second pressure outside said vessel.

2. The vessel as claimed in claim 1, **characterised in that** said vessel comprises a closure lid having a seat on which said air inlet is applied.

3. The vessel as claimed in claim 1 or 2, **characterised in that** said openings are applied along a circumference of a circle and wherein said valve has a circularly shaped member covering said openings.

4. The vessel as claimed in claim 3, **characterised in that** a further opening is applied in a centre of said circle, said valve having a stem extending from said member and penetrating into said further opening.

5. The vessel as claimed in any one of the claims 2 to 4, **characterised in that** said closure lid comprises a conically shaped part on which said seat is applied in such a manner as to form a flat surface, said plurality of openings being applied on said seat.

6. The vessel as claimed in claim2, **characterised in that** said seat is formed by a protrusion extending inside said vessel.

7. The vessel as claimed in claim 2 or 6, **characterised in that** said seat is applied approximately half way between a rim and a centre of said lid.

8. The vessel as claimed in any one of the claims 1 to 7, **characterised in that** the vessel comprises a mixing cup removably mounted therein.

9. A closure lid as part of a vessel according to any one of the claims 1 to 8.

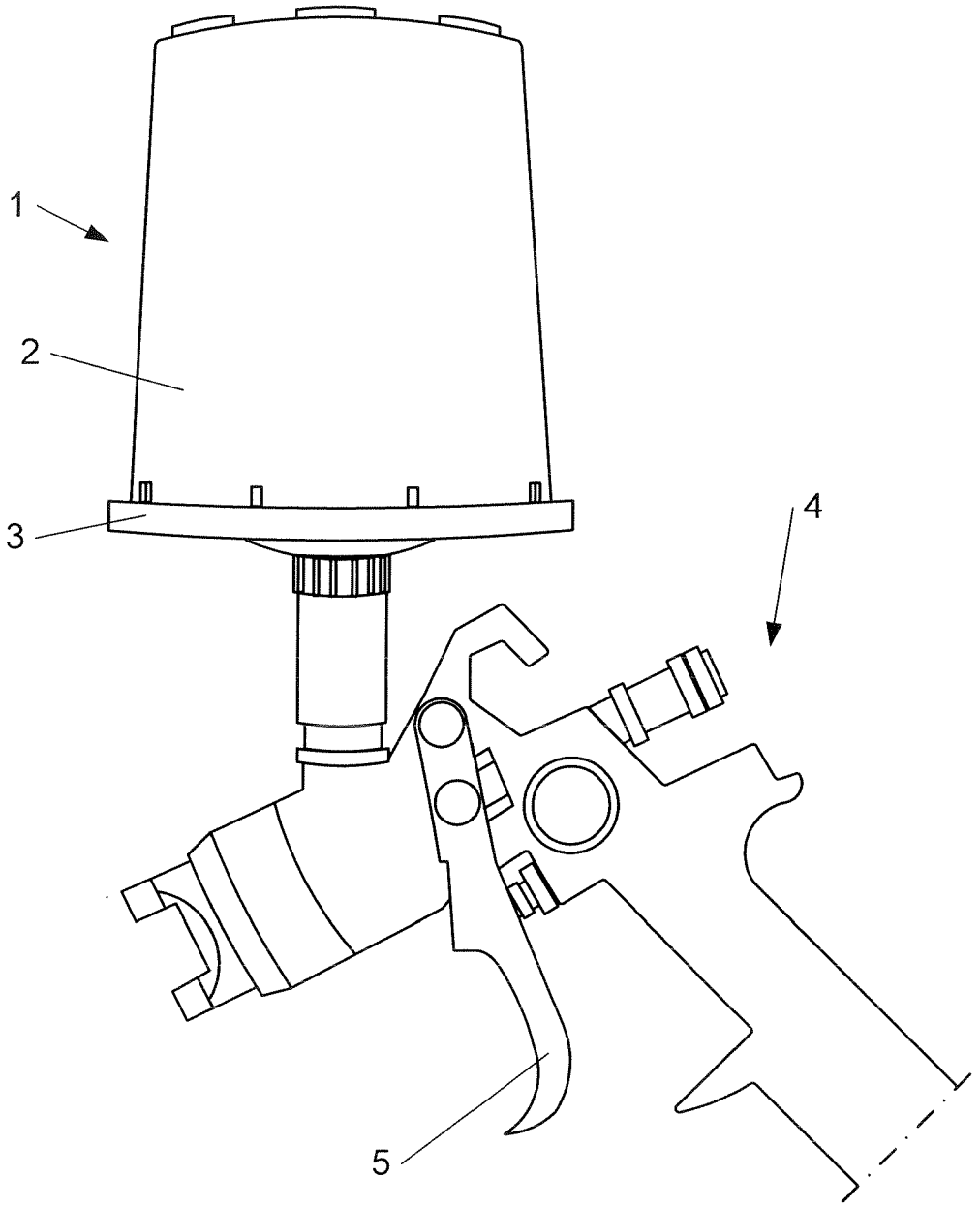

Fig. 1

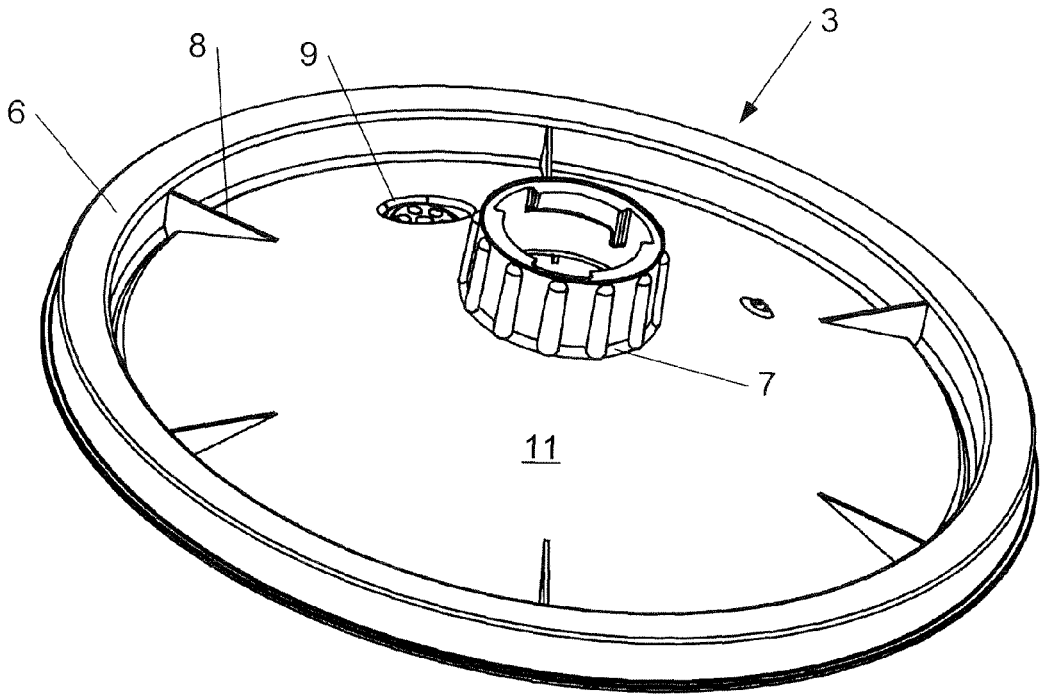

Fig. 2

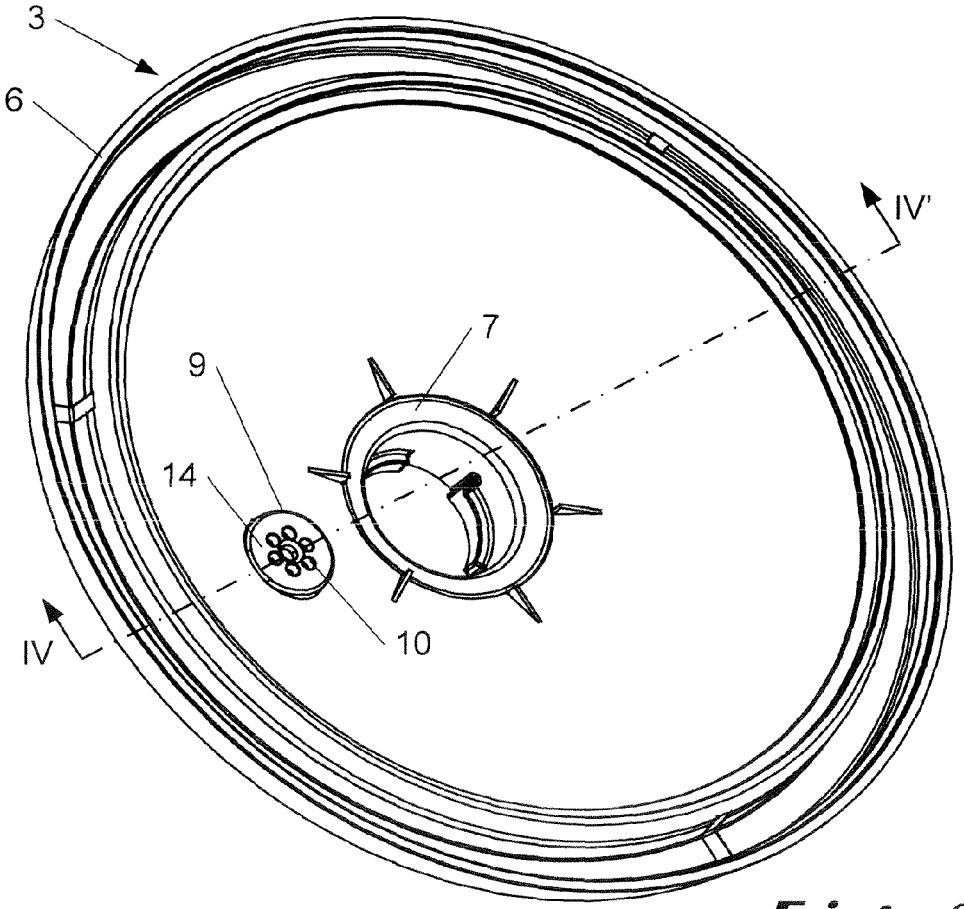

Fig. 3

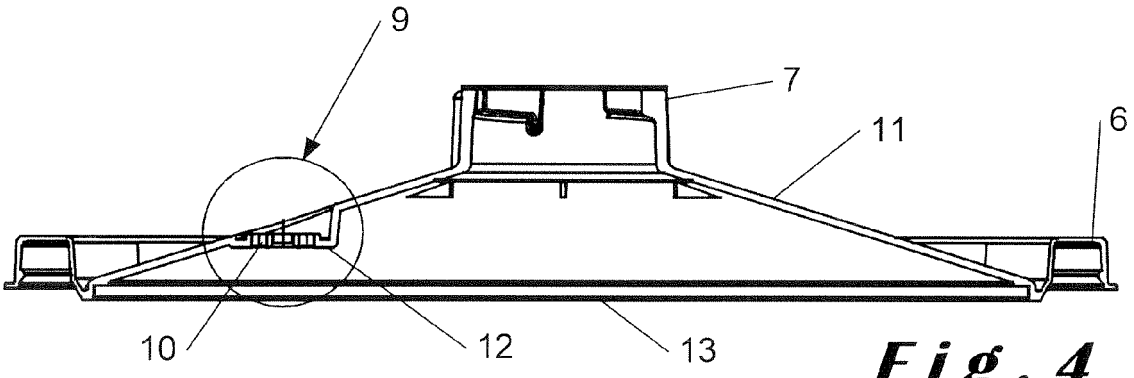

Fig. 4

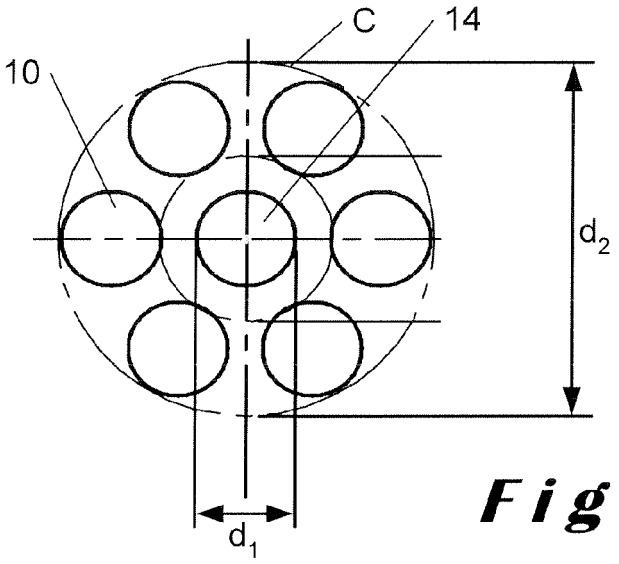

Fig. 5

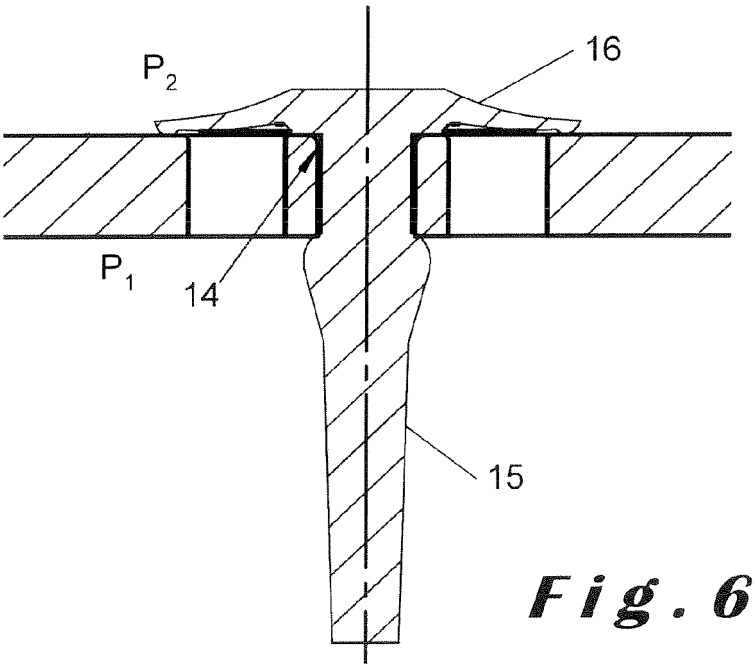

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 September 2007	Innecken, Axel

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X : particularly relevant if taken alone
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