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(54) **SELF REGULATING VENT FOR A PAINT SUPPLY VESSEL**

SELBSTREGULIERENDE ENTLÜFTUNG FÜR EIN FARBZUFUHRGEFÄSS

ÉVENT AUTORÉGULATEUR POUR CUVE D'ALIMENTATION EN PEINTURE

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**WO-A-03/006170**
**DE-U1-202004 003 376**
**US-A- 3 858 810**
**US-A- 4 388 997**

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## Description

**[0001]** The present invention relates to a vessel, in particular for containing paint, comprising a reservoir and a closure lid which reservoir is provided for being closed by said closure lid, which closure lid is applicable on top of a liquid application tool, said vessel having an air inlet comprising a plurality of openings, said closure lid comprises a conically shaped part.

**[0002]** Such a vessel is known from the International Patent application WO 03/006170. The latter application relates to a vessel being mounted on top of a liquid application tool. In such a vessel gravity helps feeding the liquid into the application tool. The vessel also comprises a conically shaped part, which allows to easily apply a filter between the reservoir and the application tool, which keeps the latter from clogging up. The conically shaped part further allows feeding the liquid into the liquid application tool even if the latter is used in a non-horizontal position. Openings are provided on the reservoir to provide vacuum relief for the liquid application tool. This implies that the reservoir is not liquid-tight any more. The above mentioned patents therefore describe the use of a flexible liner within the cavity of the reservoir, which liner holds the liquid. The advantage is that the reservoir can be used multiple times.

**[0003]** A drawback of the known vessel is that it requires an extra element, namely the liner. It also requires at least one extra step using such a vessel, namely placing the flexible liner into the reservoir.

**[0004]** It is an object of the present invention to provide a vessel which allows using a reservoir multiple times, and which vessel is easier to use than prior art vessels.

**[0005]** For this purpose, a vessel according to the present invention is characterised in that said air inlet is 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, of which each opening having a surface area of at the most 15 $mm^2$, and as to open upon a predetermined pressure difference between a first pressure inside said vessel and a second pressure outside said vessel, said closure lid (3) being provided with a protrusion applied on said conically shaped part and forming a flat contact face for said valve. Despite the openings, the vessel is capable of holding a liquid because a valve is used to cover the openings. Because the vessel is capable of holding a liquid, there is no need any more for a flexible liner, and the liquid can be applied directly into the reservoir. Because there is no flexible liner, in using the vessel, there is no need to apply such a liner, which makes the use of the vessel easier. No openings are to be provided in the reservoir so as to keep the latter intact and consequently suitable for using multiple times.

**[0006]** It should be noted that a combination of WO 03/006170 and US Patent 4388997 would not lead to the present invention. A person skilled in the art starting from WO 03/006170, and confronted with the current technical problem of the requirement of an extra element, namely the liner, and of at least one extra step using such a vessel, namely placing the flexible liner into the reservoir, could perhaps apply the teaching of US Patent 4388997, as the latter discloses a valve suitable for being used in the present invention. However in WO 03/006170, openings are provided on the top part of the vessel in a mounted position. So when using the application tool, the openings are provided above the liquid surface. Also in the US Patent 4388997, the valve is applied above the liquid surface. In combining those documents, a person skilled in the art would come up with the solution to apply the valve on the top part of the vessel in a mounted position.

**[0007]** However the solution provided by the present invention is different from the solution the skilled person could come up with. In the present invention, the valve is not applied on the reservoir which forms the top part of the vessel in a mounted position, but the valve is applied on the closure lid. No particular measures are to be applied on the reservoir for vacuum relief, which makes any cup which fits to the closure lid suitable for being used as reservoir. Moreover the valve is applied on the closure lid, which forms the lower part of the vessel in a mounted position, when air enters the vessel through the valve, the air enters below the liquid surface. This results in bubbles rising to the liquid surface, thereby creating turbulences inside the liquid. These turbulences induce a mixing effect to the liquid, which is especially advantageous in multi component liquids.

**[0008]** To ensure a duly closing of the valve to the closure lid comprising a conically shaped part, adaptation has to be made. By creating a protrusion on the conically shaped part of the closure lid, a flat surface is obtained on the closure lid. Due to the valve being applied to the flat surface, openings can be duly closed by the valve.

**[0009]** 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.

**[0010]** 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.

**[0011]** The invention also relates to a closure lid for a vessel according to the present invention. The closure lid having a central opening, being applicable on top of a liquid application tool and comprising a conically shaped part. The closure lid according to the invention is characterised by the closure lid having an air inlet comprising a plurality of openings wherein the air inlet is 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, of which each opening has a surface area of 15

$mm^2$ at the most and as to open upon a predetermined pressure difference between a first pressure inside a vessel closed by the lid and a second pressure outside a vessel closed by the lid, said closure lid being provided with a protrusion applied on said conically shaped part, the protrusion forming a flat contact face for said valve.

**[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. By this protrusion, a flat surface is created on which the air inlet can be provided. 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 17 as illustrated in figures 5 and 6. This further opening 17 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 17 in order to reach the outer side of the closure lid 3. The stem 15 is somewhat compressed inside the further opening 17 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 10 KPa, 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 pre-tension 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 (1), in particular for containing paint, comprising a reservoir (2) and a closure lid (3) which reservoir (2) is provided for being closed by said closure lid (3), which closure lid (3) is applicable on top of a liquid application tool (4), said vessel (1) having an air inlet (9) comprising a plurality of openings (10), said closure lid (3) comprises a conically shaped part, **characterised in that** said air inlet is provided with a closure valve (14) 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, of which each opening having a surface area of at the most 15 $mm^2$, and as to open upon a predetermined pressure difference between a first pressure inside said vessel and a second pressure outside said vessel, said closure lid (3) being provided with a protrusion (12) applied on said conically shaped part and forming a flat contact face for said valve.

2. The vessel as claimed in claim 1, **characterised in that** said openings (10) are applied along a circumference of a circle and wherein said valve has a circularly shaped member (16) covering said openings.

3. The vessel as claimed in claim 2, **characterised in that** a further opening (17) is applied in a centre of said circle, said valve having a stem (15) extending from said member (18) and penetrating into said further opening.

4. The vessel as claimed in anyone of the claims 1 to 3, **characterised in that** said air inlet is applied on a seat formed by a protrusion extending inside said vessel.

5. The vessel as claimed in anyone of the claims 1 to 4, characterise in that said air inlet is applied on a seat applied approximately half way between a rim (6) and a centre of said lid.

6. The vessel as claimed in anyone of the claims 1 to 5, **characterised in that** said closure lid (3) is provided for receiving a filtering screen.

7. The vessel as claimed in any one of the claims 1 to 6, **characterised in that** the vessel comprises a mixing cup removably mounted therein.

8. A closure lid (3) for a vessel (1) according to any of claims 1 to 7, the closure lid (3) having a central opening (7), being applicable on top of a liquid application tool (4), and comprising a conically shaped part, **characterised by** the closure lid (3) having an air inlet (9) comprising a plurality of openings (10) wherein the air inlet (9) is provided with a closure valve (14) made of flexible elastomer material, said valve (14) being resiliently mounted on said air inlet (9) in such a manner as to cover said plurality of openings, of which each opening has a surface area of 15 $mm^2$ at the most and as to open upon a predetermined pressure difference between a first pres-

sure inside a vessel closed by the lid (3) and a second pressure outside a vessel closed by the lid (3), said closure lid (3) being provided with a protrusion applied on said conically shaped part, the protrusion forming a flat contact face for said valve (14).

**Patentansprüche**

1. Gefäß (1), insbesondere zur Aufnahme von Farbe, das einen Sammelbehälter (2) und einen Verschlussdeckel (3) umfasst, wobei der Sammelbehälter (2) zum Verschluss durch den Verschlussdeckel (3) vorgesehen ist, wobei der Verschlussdeckel (3) auf einem Flüssigkeitsauftragewerkzeug (4) angebracht werden kann, wobei das Gefäß (1) einen Lufteinlass (9) aufweist, der mehrere Öffnungen (10) umfasst, wobei der Verschlussdeckel (3) einen konisch geformten Teil umfasst, **dadurch gekennzeichnet, dass** der Lufteinlass (9) mit einem Verschlussventil (14) versehen ist, das aus einem biegsamen Elastomermaterial besteht, wobei das Ventil auf eine solche Weise elastisch an dem Lufteinlass angebracht ist, dass es die mehreren Öffnungen, wovon jede Öffnung eine Flächenausdehnung von höchstens 15 $mm^2$ aufweist, abdeckt und sich bei einem vorherbestimmten Druckunterschied zwischen einem ersten Druck im Inneren des Gefäßes und einem zweiten Druck außerhalb des Gefäßes öffnet, wobei der Verschlussdeckel (3) mit einem Vorsprung (12) versehen ist der an dem konisch geformten Teil angebracht ist und eine flache Kontaktfläche für das Ventil bildet.

2. Gefäß nach Anspruch 1, **dadurch gekennzeichnet, dass** die Öffnungen (10) entlang eines Umfangs eines Kreises angeordnet sind, und wobei das Ventil ein kreisförmig geformtes Element (16) aufweist, das diese Öffnungen abdeckt.

3. Gefäß nach Anspruch 2, **dadurch gekennzeichnet, dass** eine weitere Öffnung (17) in einer Mitte des Kreises angeordnet ist, wobei das Ventil einen Schaft (15) aufweist, der sich von dem Element (16) erstreckt und in die weitere Öffnung eindringt.

4. Gefäß nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** genannter Lufteinlass an einem Sitz angebracht ist welche durch einen Vorsprung gebildet ist, der in das Innere des Gefäßes vorspringt.

5. Gefäß nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** genannter Lufteinlass an einem Sitz angebracht ist welcher ungefähr in der Hälfte zwischen einem Rand (6) und einer Mitte des Dekkels angeordnet ist.

6. Gefäß nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der Verschlussdeckel (3) zur Aufnahme eines Filtersiebs vorgesehen ist.

7. Gefäß nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Gefäß einen darin abnehmbar angebrachten Mischbecher umfasst.

8. Verschlussdeckel (3) für ein Gefäß (1) nach einem der Ansprüche 1 bis 7, wobei der Verschlussdeckel (3) eine mittlere Öffnung (7) aufweist, auf einem Flüssigkeitsauftragewerkzeug (4) angebracht werden kann und einen konisch geformten Teil umfasst, **dadurch gekennzeichnet, dass** der Verschlussdeckel (3) einen Lufteinlass (9) aufweist, der mehrere Öffnungen (10) umfasst, wobei der Lufteinlass (9) mit einem Verschlussventil (14) versehen ist, das aus einem biegsamen Elastomermaterial besteht, wobei das Ventil (14) auf eine solche Weise elastisch an dem Lufteinlass (9) angebracht ist, dass es die mehreren Öffnungen, wovon jede Öffnung eine Flächenausdehnung von höchstens 15 $mm^2$ aufweist, abdeckt und sich bei einem vorherbestimmten Druckunterschied zwischen einem ersten Druck im Inneren eines Gefäßes, das durch den Deckel (3) verschlossen ist, und einem zweiten Druck außerhalb eines Gefäßes, das durch den Deckel (3) verschlossen ist, öffnet, wobei der Verschlussdeckel (3) mit einem Vorsprung versehen ist, der an dem konisch geformten Teil angebracht ist, wobei der Vorsprung eine flache Kontaktfläche für das Ventil (14) bildet.

**Revendications**

1. Cuve (1), en particulier pour contenir de la peinture, comprenant un réservoir (2) et un couvercle de fermeture (3) dont est pourvu le réservoir (2) pour être fermé par ledit couvercle de fermeture (3), lequel couvercle de fermeture (3) est applicable sur le dessus d'un outil d'application de liquide (4), ladite cuve (1) ayant une entrée d'air (9) comprenant une pluralité d'ouvertures (10), ledit couvercle de couverture (3) comprenant une partie de forme conique, **caractérisée en ce que** ladite entrée d'air est pourvue d'une soupape de fermeture (14) réalisée en matière élastomère flexible, ladite soupape étant montée de manière élastique sur ladite entrée d'air de façon à couvrir ladite pluralité d'ouvertures, chacune d'elles ayant une aire d'au maximum 15 $mm^2$, et de façon à s'ouvrir en présence d'une différence de pression prédéterminée entre une première pression à l'intérieur de ladite cuve et une deuxième pression à l'extérieure de ladite cuve, ledit couvercle de fermeture (3) étant pourvu d'une protubérance (12) appliquée sur ladite partie de forme conique et formant une face de contact plate pour ladite soupape.

2. Cuve telle que revendiquée dans la revendication 1, **caractérisée en ce que** lesdites ouvertures (10) sont appliquées le long d'une circonférence d'un cercle et dans laquelle ladite soupape a un élément (16) de forme circulaire couvrant lesdites ouvertures.

3. Cuve telle que revendiquée dans la revendication 2, **caractérisée en ce qu'**une autre ouverture (17) est appliquée dans un centre dudit cercle, ladite soupape ayant une tige (15) s'étendant à partir dudit élément (16) et pénétrant dans ladite autre ouverture.

4. Cuve telle que revendiquée dans l'une quelconque des revendications 1 à 3, **caractérisée en ce que** ladite entrée d'air est appliquée sur un siège (12) formé par une protubérance s'étendant à l'intérieur de ladite cuve.

5. Cuve telle que revendiquée dans l'une quelconque des revendications 1 à 4, **caractérisée en ce que** ladite entrée d'air est appliquée sur ledit siège (12) situé approximativement à mi-parcours entre un bord (6) et un centre du couvercle.

6. Cuve telle que revendiquée dans l'une quelconque des revendications 1 à 5, **caractérisée en ce que** ledit couvercle de fermeture (3) est prévu pour recevoir un tamis filtrant.

7. Cuve telle que revendiquée dans l'une quelconque des revendications 1 à 6, **caractérisée en ce que** la cuve comprend une coupelle montée de manière amovible dans celle-ci.

8. Couvercle de fermeture (3) pour une cuve (1) selon l'une quelconque des revendications 1 à 7, le couvercle de fermeture (3) ayant une ouverture centrale (7), étant applicable sur le dessus d'un outil d'application de liquide (4) et comprenant une partie de forme conique, **caractérisé en ce que** le couvercle de fermeture (3) a une entrée d'air (9) comprenant une pluralité d'ouvertures (10), dans lequel l'entrée d'air (9) est pourvue d'une soupape de fermeture (14) réalisée en matière élastomère flexible, ladite soupape (14) étant montée de manière élastique sur ladite entrée d'air (9) de façon à couvrir ladite pluralité d'ouvertures, chacune d'elles ayant une aire de 15 $mm^2$ au maximum, et de façon à s'ouvrir en présence d'une différence de pression prédéterminée entre une première pression à l'intérieur de la cuve fermée par ledit couvercle (3) et une deuxième pression à l'extérieur de la cuve fermée par ledit couvercle (3), ledit couvercle de fermeture (3) étant pourvu d'une protubérance appliquée sur ladite partie de forme conique, la protubérance formant une face de contact plate pour ladite soupape (14).

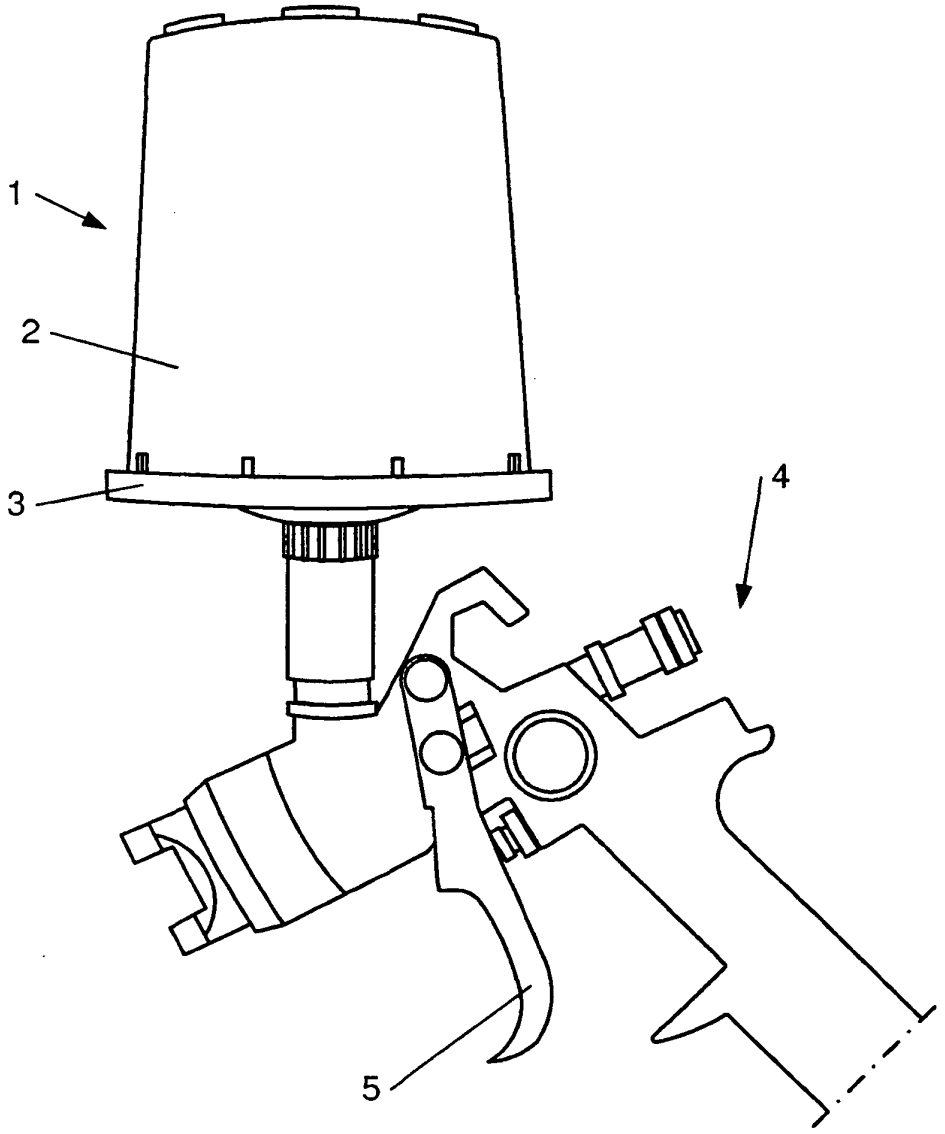



*Fig. 1*

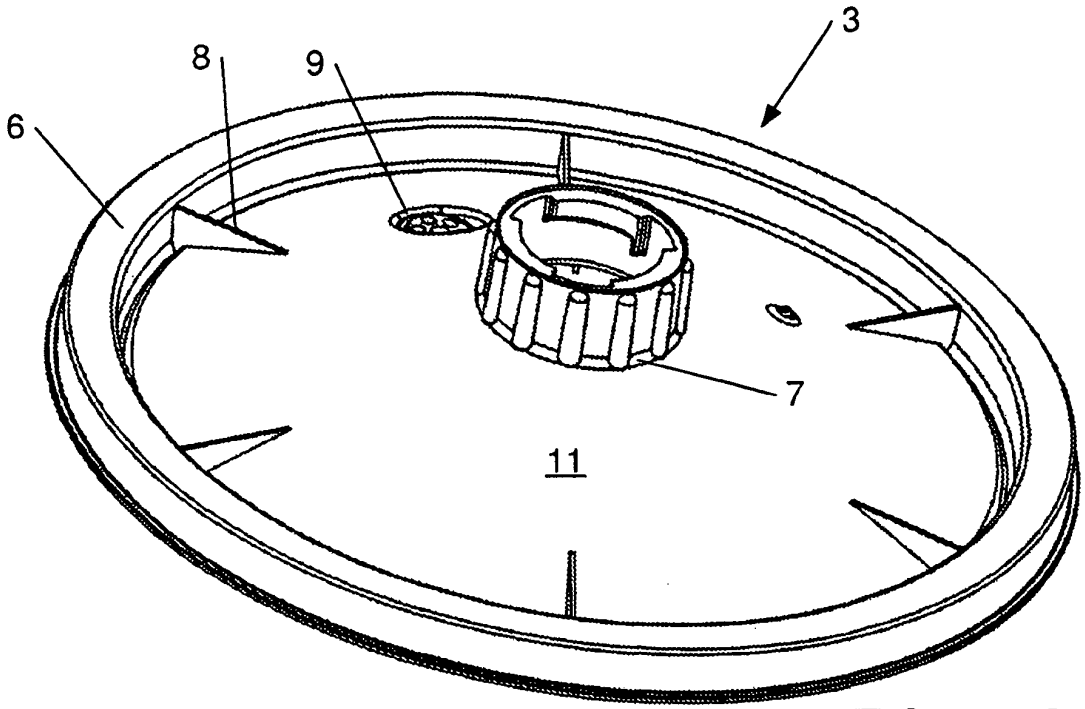



Fig. 2

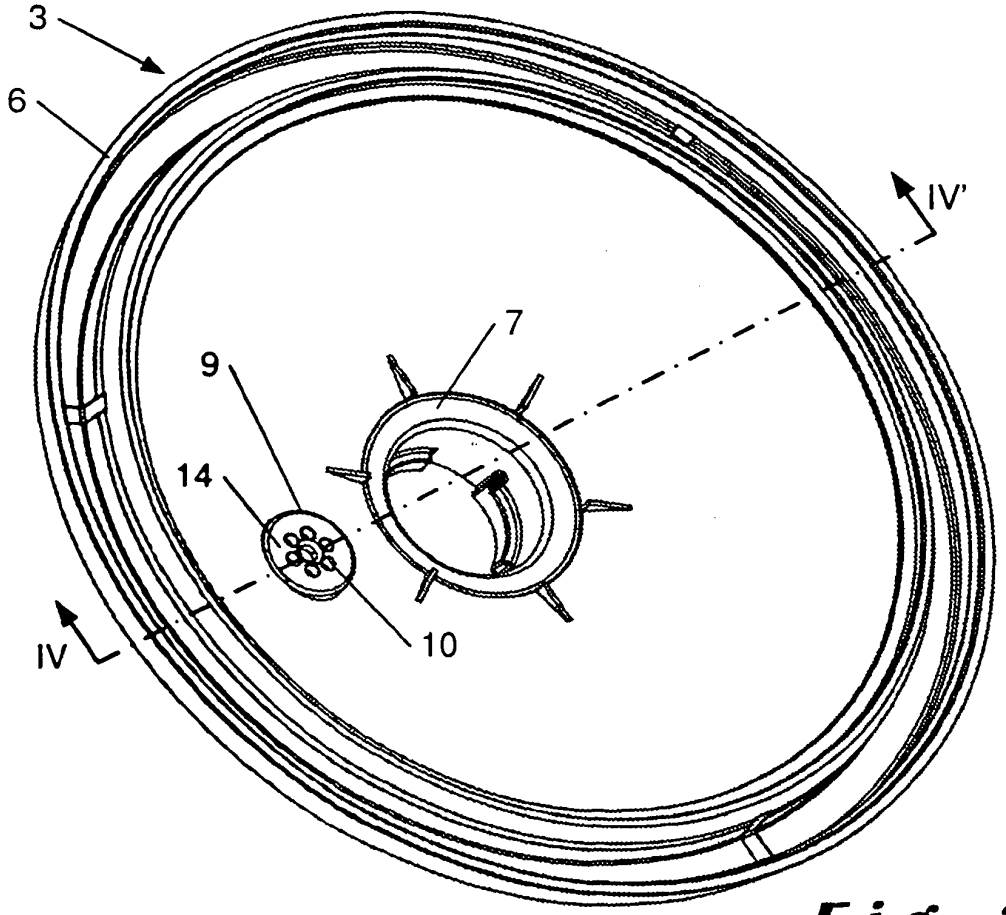



Fig. 3

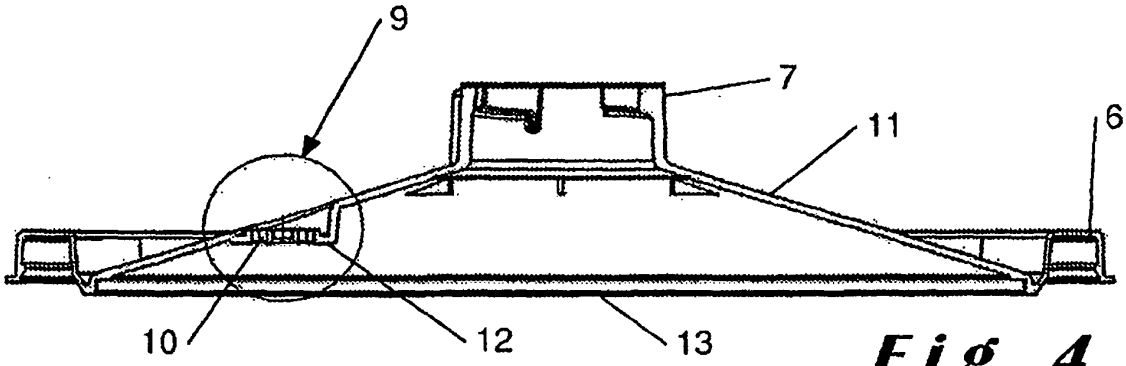



Fig. 4

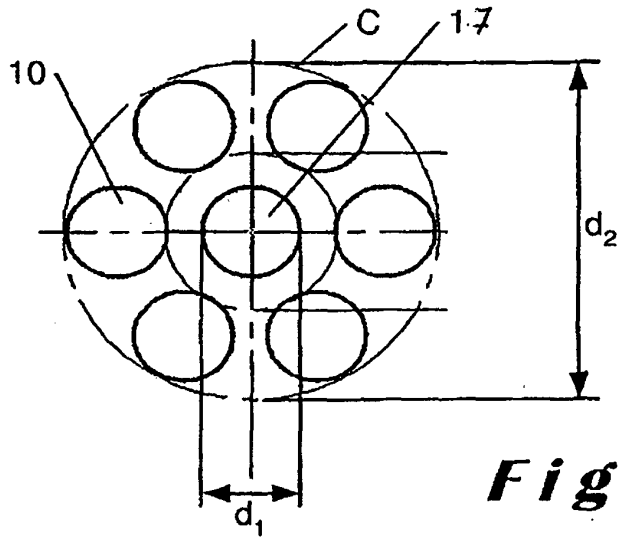



Fig. 5

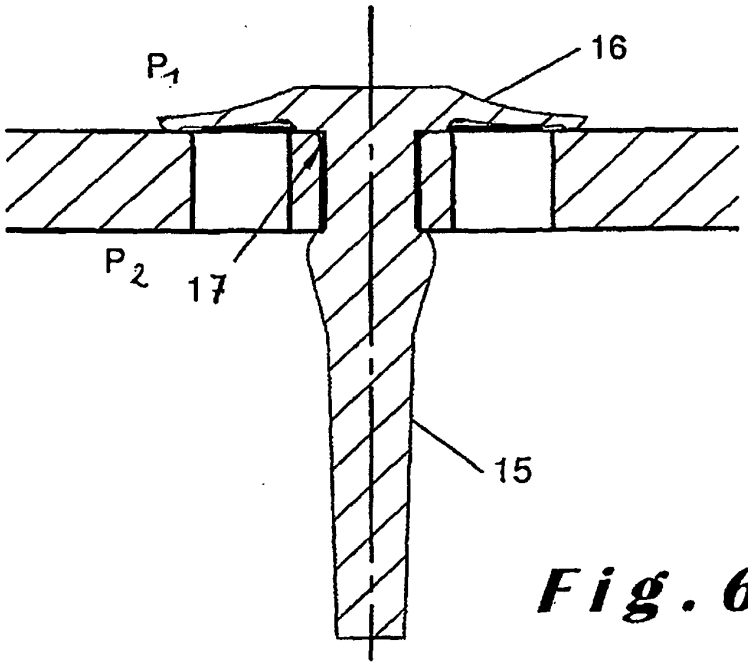



Fig. 6

## REFERENCES CITED IN THE DESCRIPTION

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- US 4388997 A **[0006]**