(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 August 2016 (04.08.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/120404 A1

(51) International Patent Classification:
*B65D 83/66* (2006.01)

(21) International Application Number:
PCT/EP2016/051837

(22) International Filing Date:
28 January 2016 (28.01.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
EP15152846.0 28 January 2015 (28.01.2015) EP

(71) Applicant: **AIROPACK TECHNOLOGY GROUP B.V.** [NL/NL]; Van Schijndelstraat 7, 5145 RE Waalwijk (NL).

(72) Inventors: **BROUWER, Mark**; Airopack Technology Group B.V., Van Schijndelstraat 7, 5145 RE Waalwijk (NL). **DIERICKX, William**; Airopack Technology Group B.V., Van Schijndelstraat 7, 5145 RE Waalwijk (NL). **ANTHIERENS, Tom**; Airopack Technology Group B.V., Van Schijndelstraat 7, 5145 RE Waalwijk (NL).

(74) Agent: **SPIERENBURG, Pieter**; Mellingerstrasse 12, Aargau, 5443 Niederrohrdorf (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17**:

— *of inventorship (Rule 4.17(iv))*

*[Continued on next page]*

(54) Title: PRESSURE CONTROL SYSTEM

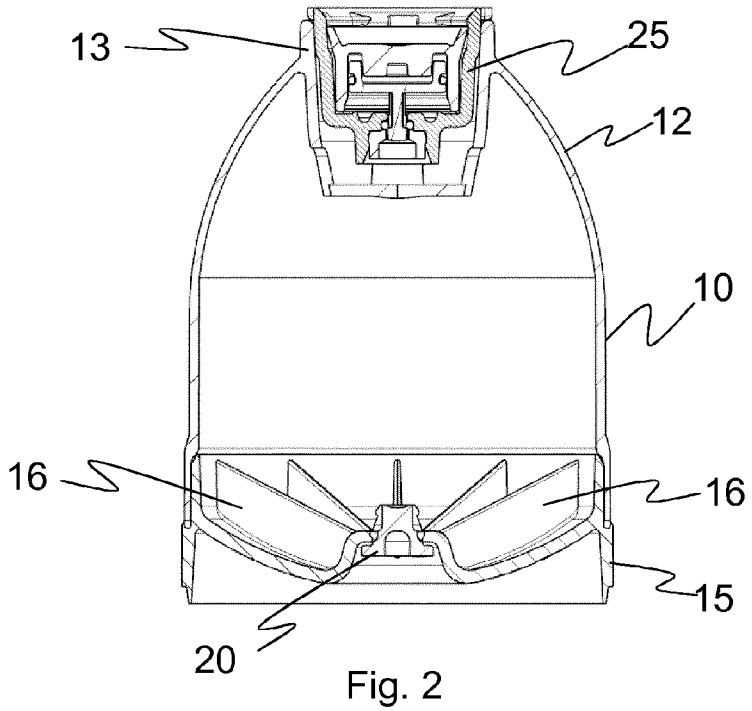


Fig. 2

(57) Abstract: A novel pressure control system (1) which is provided for maintaining a constant predetermined excess pressure in a fluid dispensing container is described, which comprises a high-pressure plastic vessel (10) having an inner chamber and an upper open end, and a pressure control device (25) with a valve, which pressure control device is mounted on the upper open end of the high-pressure vessel (10), whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve, wherein the vessel (10) is substantially cylindrical. The upper part of the vessel (10) has a spherical dome (12) with a cylindrical insert (13) provided for receiving the pressure control device (25) and the lower end of the vessel (10) has an open end, which is closed by a ring-shaped closure (15).

WO 2016/120404 A1

**Published**:

— *with international search report (Art. 21(3))*

# Pressure control system

## FIELD OF THE INVENTION

The invention pertains to a pressure control system provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprising a high-pressure plastic vessel having an inner chamber and a closed end and an open end, and a pressure control device with a valve, which pressure control device is mounted on the open end of the high-pressure vessel, whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve.

## BACKGROUND OF THE INVENTION

Such a pressure control system is described in WO-A-2005/082744, wherein the high-pressure vessel is substantially cylindrical with a tapered neck portion and a flange, on which a ring-shaped insert or closure with a step-like funnel is mounted. The pressure control device of this document is provided within the ring-shaped closure by a cup-like cylinder having a closed end and an open end, in which a piston with a downward protruding stem and a broader cylindrical end portion is movable mounted. At the open end of the step-like funnel an O-ring is pinched by a ring-cylinder, whereas the broader cylindrical portion of the stem and the O-ring provide a valve which is moved reciprocated by the pressure of the air in the chamber formed by the piston and the cup-like cylinder with its closed end. The high-pressure vessel must stand an overpressure of 8 bar so that the construction should be very stable. For this reason the high-pressure vessel is widened gradually towards its lower end with a broader end portion and an inwardly projecting rim, on which the end of a plastic fluid dispensing container rests. The bottom part of the high-pressure vessel has a ring-shaped depression which is reinforced with a central opening, in which a so-called Nicholson plug of rubber is pressed.

The high-pressure vessel of this document is manufactured by an injection stretch blow moulding process, in which the used polymer is melted and moulded onto a

core pin. Then the core pin is rotated to a blow moulding station to be inflated and cooled. The injection blow moulding machine is based on an extruder barrel and screw assembly which melts the polymer. The molten polymer is fed into a hot runner manifold where it is injected through nozzles into a heated cavity and core pin. The cavity mould forms the external shape and is clamped around a core rod which forms the internal shape of the preform. The preform consists of a fully formed bottle/jar neck with a thick tube of polymer attached, which will form the body. The preform mould opens and the core rod is rotated and clamped into the hollow, chillled blow mould. The end of the core rod opens and allows compressed air into the preform, which inflates it to the finished article shape. After a cooling period the blow mould opens and the core rod is rotated to the ejection position. The finished article is stripped off the core rod and as an option can be leak-tested prior to packing. The preform and blow mould can have many cavities, typically three to sixteen depending on the article size and the required output. There are three sets of core rods, which allow concurrent preform injection, blow moulding and ejection.

In the present construction the high-pressure vessel is further closed by a moulded bottom plate. With today's plastic material not all conditions as strength, creep, air permeability, resistance to heat and cold, chemical resistance against known chemicals, etc. can be fulfilled. If the vessel has to be enlarged, forces on the bottom plate will become much larger, so that the maximum volume of the present vessel is restricted.

The volume of the high-pressure vessel is further restricted by the production process of stretch blow moulding, i.e. in order to obtain a reinforced opening at both ends of the high-pressure vessel the process of stretching the heated plastic depends on the thickness of the preform before stretching. In practice the preform can be expanded only to a predefined width and length to obtain the prescribed stability.

## OBJECT OF THE INVENTION

It is an object of the present invention to provide a pressure control system with a high-pressure vessel which may have a larger volume as the known high-pressure vessel. This object of the invention is accomplished by a pressure control system with the features of claim 1.

According to embodiments of the invention, the pressure control system provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprises a high-pressure plastic vessel having an inner chamber and an upper open end, and a pressure control device with a valve, which pressure control device is mounted on the upper open end of the high-pressure vessel. A passageway is provided from the inner chamber to the outside, which is controlled by the valve, wherein the vessel is substantially cylindrical. The upper part of the vessel has a spherical dome with a cylindrical insert provided for receiving the pressure control device and the lower end of the vessel has an open end, which is closed by a ring-shaped closure.

The present invention has the main advantage, that the vessel is spherical which can withstand larger forces so that the diameter of the high-pressure vessel can be enlarged with less restrictions and the vessel can be provided for higher pressures.

A further advantage of the present invention is that the production of the high-pressure vessel is more cost effective.

Further advantages of the invention can be derived from the dependent claims and from the description below.

According to an embodiment of the pressure control system, the ring-shaped closure has internal reinforcing fins which are uniformly distributed over the inner surface of the closure. The fins strengthen the closure such that a gas with a higher pressure may be held in the high-pressure vessel.

According to another embodiment of the pressure control system the vessel is made by injection molding from PET. Injection moulding from PET is an economical method for production of vessels. PET is suitable for high-pressure applications.

According to a further embodiment of the pressure control system, the closure is connected to the lower open end of the vessel by laser welding. Through laser welding a gas-tight connection will be obtained between the closure and the vessel.

## BRIEF DESCRIPTION OF THE FIGURES

In the following, the invention is described in greater detail, by way of example, with reference to the accompanying drawings. It shows:

Fig. 1 a high-pressure vessel with a ring-shaped closure,

Fig. 2 the high-pressure vessel of Fig. 1 with a pressure control device on top,

Fig. 3 the high-pressure vessel of Fig. 2 in perspective and cross-sectional view, whereas the vessel is shown in an exploded view,

Fig. 4 a perspective view on the closure with the reinforcing fins, and

Fig. 5 a perspective view on the closure 15 from the lower side.

## DETAILED DESCRIPTION

In Figure 1 a high-pressure plastic vessel 10 is depicted, which is substantially cylindrical and has in the upper part a spherical dome 12 with a cylindrical insert 13. The vessel 10 with the dome 12 and the insert 13 is made of one piece from a suitable plastic material as PET by injection moulding. The lower end 14 of the ves-

sel 10 is open and is closed by a ring-shaped closure 15, which has internal reinforcing fins 16, which are uniformly distributed over the surface of the closure 15. In the closure 15 a reinforced retracted ring 17 with a central bore 18 is provided, in which a Nicholson plug 20 is clamped. The closure 15 is connected to the vessel 10 by laser welding.

The advantage of injection moulding of the high-pressure vessel 10 is that the vessel 15 has its final form and does not have to cut as in the injection stretch blow moulding process previously mentioned. The melt polymer will be injected centrally in order to obtain a uniform material distribution. The wall thickness is chosen between 1.0 and 2.0 mm, preferably 1.4 mm, so that the high-pressure vessel 10 can withstand high gas pressures of 10 bar and higher temperatures up to 50 °C.

In Figure 2 an assembled pressure control system 1 is shown, which comprises the vessel 10 and a pressure control device 25 which is fixedly received in the cylindrical insert 13. The construction of the pressure control device 25 is in principle the same as described in full details in WO-A-2005/082744.

Figure 3 shows the pressure control system 1 in exploded view. As can be seen in the figure the lower end 14 of the vessel 10 and the upper end 21 of the closure 15 have each a reduced thickness, such that the the thickness of the joint between the lower end 14 of the vessel 10 and the upper end 21 of the closure 15 is equal to the overall wall thickness of the vessel 10. The pressure control device 25 has a cup-like insert or upper closure 26 having a step-like funnel 27. Within the upper closure 26 an integral cylindrical insert 28 is pinched which has an upper widened crown 29 which is press-fit with the inner wall of the upper closure 26. Further the cylindrical insert 28 has an inner protruding ring 30. A piston 32 with a piston cup 33 and a stem 34 with a thickened end part 35 is provided within the cylindrical insert 28 and is guided by the protruding ring 30. Further the piston 32 is provided with an outer O-ring 36 which seals the piston 32 to the inner wall of the cylindrical insert 28. The step-like funnel 27 has downwardly a cylindrical clamping portion 37 with a

ringshaped barb 38 which clamps a ring cylinder 40. The upper end of the ring cylinder 40 pinches a sealing O-ring 41, which functions together with the thickened end part 35 of the stem as a valve.

In Figure 3 the closure 15 with the uniformly distributed fins 16 and the reinforced retracted ring 17 is shown in perspective view from the upper side.

In Figure 4 the closure 15 is shown in perspective view from the lower side.

## Claims

1. Pressure control system (1) provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprising a high-pressure plastic vessel (10) having an inner chamber and an upper open end, and a pressure control device (25) with a valve, which pressure control device is mounted on the upper open end of the high-pressure vessel (10), whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve, wherein the vessel (10) is substantially cylindrical characterized in that the upper part of the vessel (10) has a spherical dome (12) with a cylindrical insert (13) provided for receiving the pressure control device (25) and the lower end of the vessel (10) has an open end, which is closed by a ring-shaped closure (15).

2. Pressure control system according to claim 1, characterized in that the vessel (10) and the cylindrical insert (13) is made of one piece from a suitable plastic material.

3. Pressure control system according to claim 2, characterized in that the vessel (10) with the cylindrical insert (13) is made by injection moulding from PET.

4. Pressure control system according to one of claims 1 to 3, characterized in that the ring-shaped closure (15) has internal reinforcing fins (16) which are uniformly distributed over the inner surface of the closure (15).

5. Pressure control system according to claim 4, characterized in that the closure (15) is connected to the lower open end of the vessel (10) by laser welding.

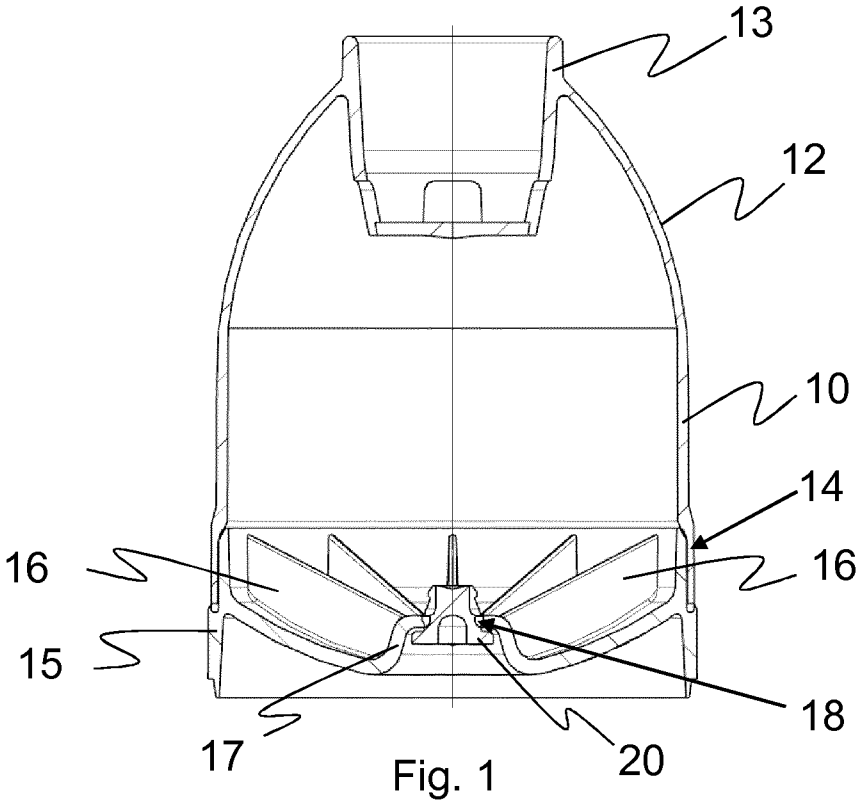


Fig. 1

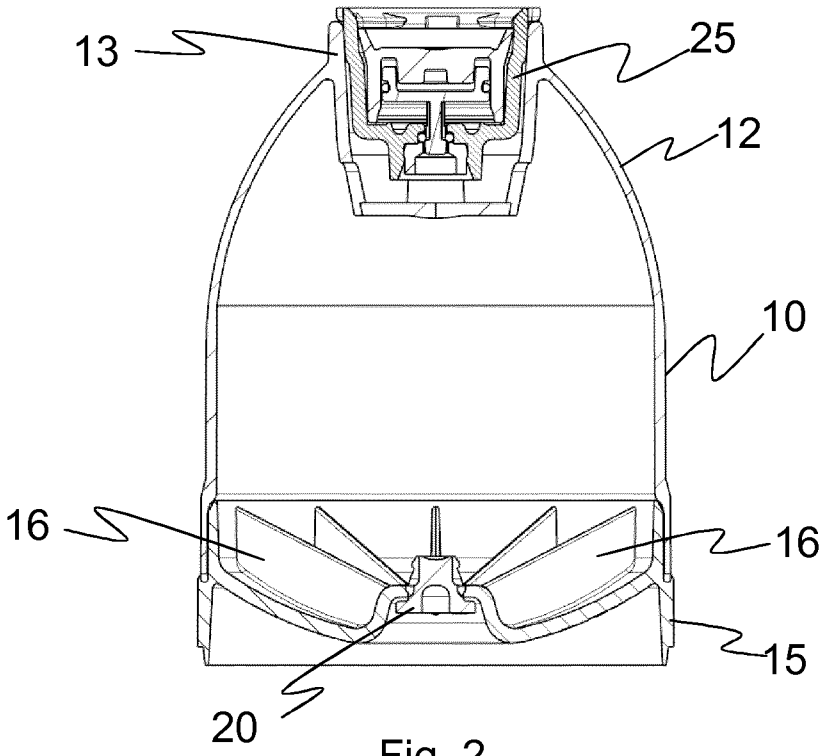


Fig. 2

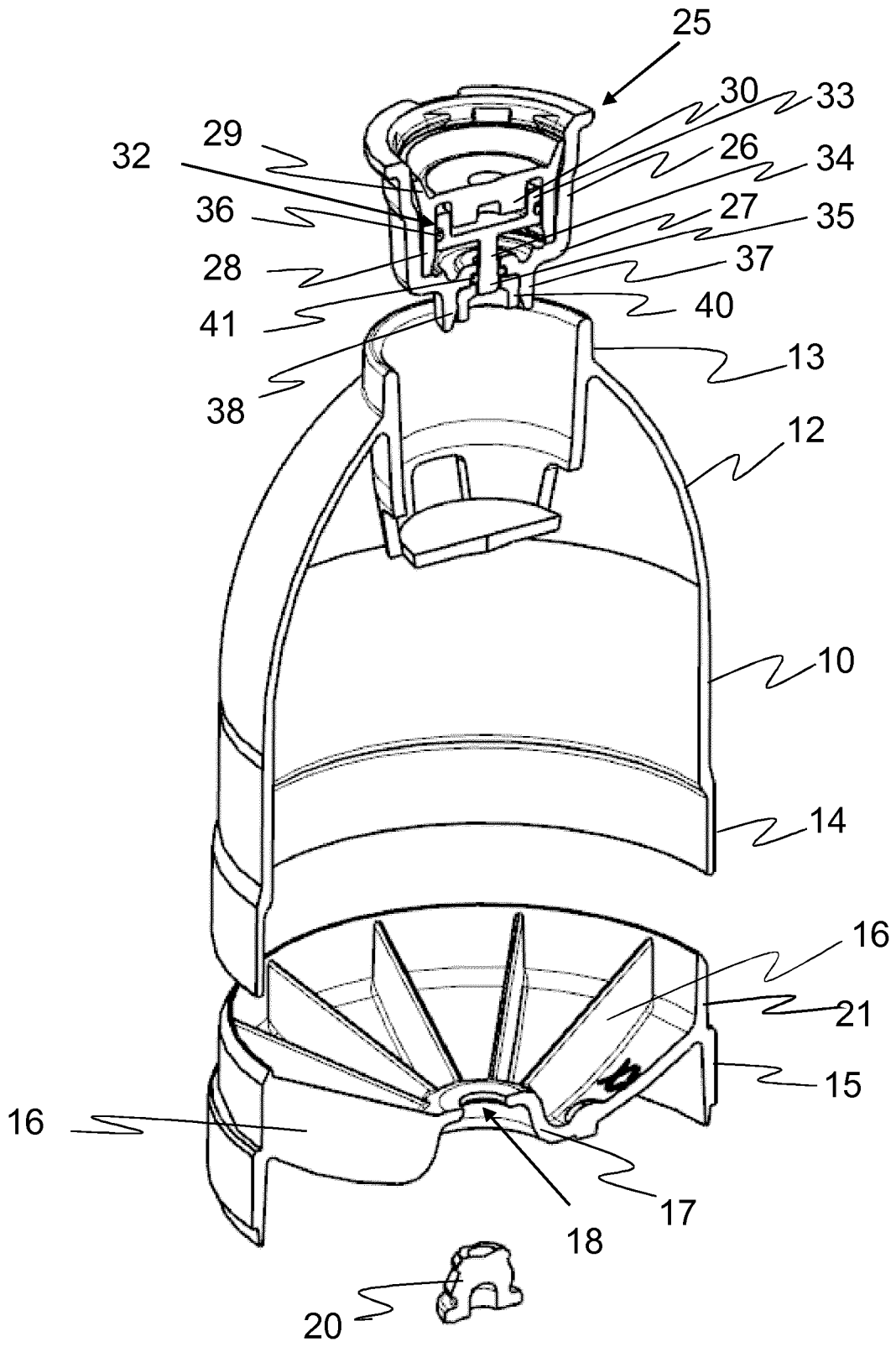
25
30
33
29
32
26
34
36
27
35
28
37
40
41
13
38
12
10
14
16
21
15
16
17
18
20

Fig. 3

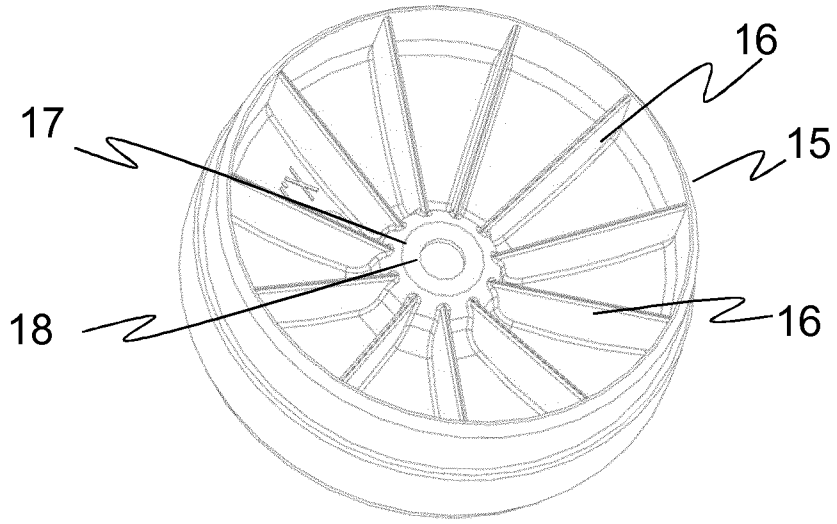


Fig. 4

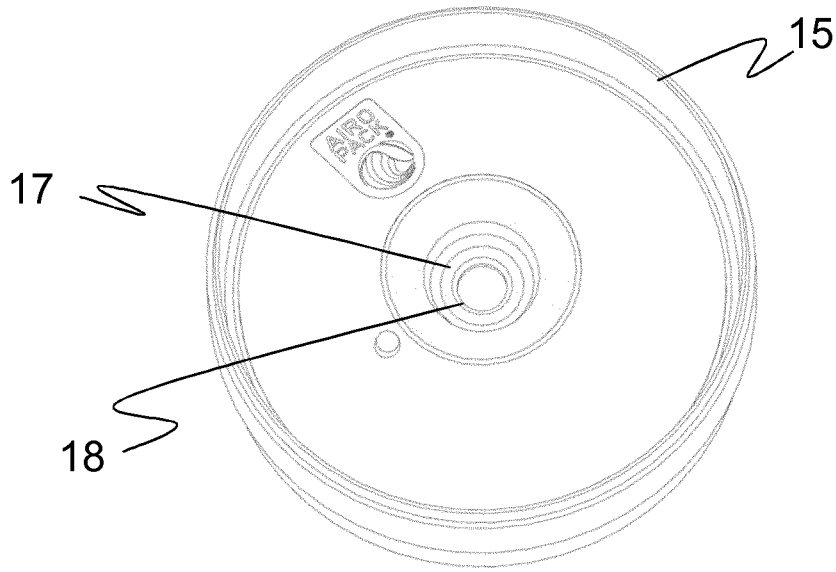


Fig. 5

# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/051837

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D83/66
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 2014/083531 A2 (I P S RES AND DEV B V [NL]) 5 June 2014 (2014-06-05) page 2, line 30 - page 4, line 16; figures 1,2 | 1-5 |
| A | WO 2005/082744 A1 (KELTUB B V [NL]; REGAN PHIL [NL]; VAN SWIETEN ROY [NL]) 9 September 2005 (2005-09-09) cited in the application the whole document | 1-5 |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 29 April 2016 | 11/05/2016 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Krysta, Dieter |

1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/051837

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 2014083531 A2 | 05-06-2014 | CN 104955742 A | 30-09-2015 |
| | | EP 2925635 A2 | 07-10-2015 |
| | | US 2015300568 A1 | 22-10-2015 |
| | | WO 2014083531 A2 | 05-06-2014 |
| WO 2005082744 A1 | 09-09-2005 | AT 376967 T | 15-11-2007 |
| | | AU 2004316447 A1 | 09-09-2005 |
| | | CA 2559019 A1 | 09-09-2005 |
| | | CN 1906097 A | 31-01-2007 |
| | | DE 602004009836 T2 | 28-08-2008 |
| | | DK 1725476 T3 | 03-03-2008 |
| | | EP 1725476 A1 | 29-11-2006 |
| | | ES 2295888 T3 | 16-04-2008 |
| | | JP 4364907 B2 | 18-11-2009 |
| | | JP 2007519578 A | 19-07-2007 |
| | | PT 1725476 E | 18-03-2008 |
| | | RU 2329188 C2 | 20-07-2008 |
| | | US 2007125809 A1 | 07-06-2007 |
| | | WO 2005082744 A1 | 09-09-2005 |