

(19)



(11)

EP 3 093 548 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.11.2016 Bulletin 2016/46

(51) Int Cl.:
F17C 1/04 (2006.01)

(21) Application number: **15382559.1**

(22) Date of filing: **11.11.2015**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Carbotainer, S.L.**
50197 Zaragoza (ES)

(72) Inventor: **GARCÍA ANDREU, GUILLERMO**
50197 ZARAGOZA (ES)

(74) Representative: **Carpintero Lopez, Francisco**
Herrero & Asociados, S.L.
Alcalá 35
28014 Madrid (ES)

(30) Priority: **04.05.2015 ES 201530603**

(54) **PROTECTIVE CASING FOR CYLINDER FOR PRESSURIZED GASES**

(57) Lightweight container for containing and transporting gases under high pressure, comprising an inner metal sleeve (6), a composite casing (12) around said sleeve (6) and a protective sheath of thermoplastic material formed by two parts (13-13') that can be coupled to each other by interposing clips (16-17), comprising on the bottom a stand (21) attached by rivets to the lateral

surface of the bottom part (13'), the assembly defining a lightweight and strong container that is suitable and ideal for transporting pressurized gases, while also having the feature that the outer surface includes hexagonal segments that allow a completely compact packaging, preventing the displacement or rotation of the containers.

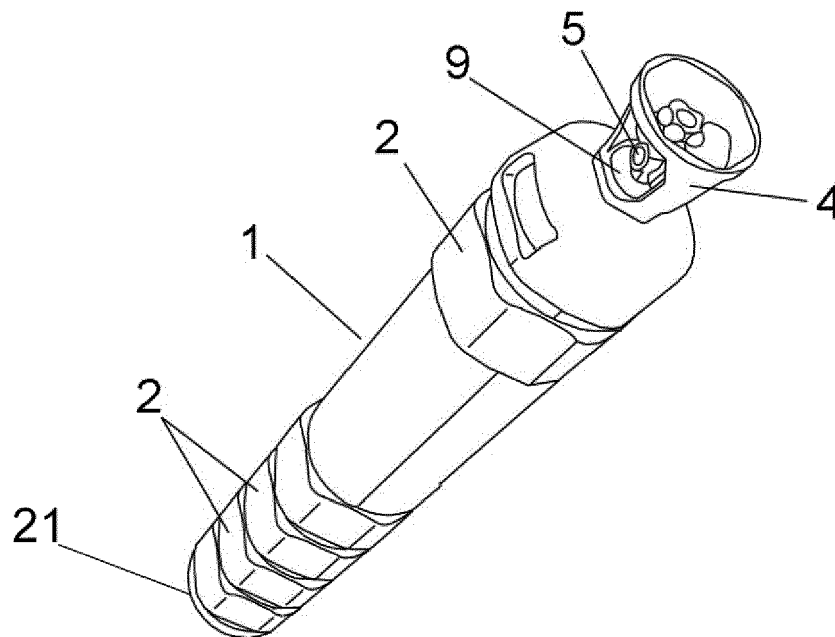


FIG. 1

EP 3 093 548 A1

Description**OBJECT OF THE INVENTION**

[0001] The present invention relates to a container for pressurized gases, and more specifically to a vessel or container meant to contain and transport gases under high or low pressure.

[0002] The object of the invention is to provide the market of the sector with a container for pressurized gases that can be transported in conventional pallets, allowing a fully compact packaging on the pallet and preventing the displacement of the containers with respect to each other.

[0003] A further object of the invention is to provide a container that is considerably lighter than conventional containers used for the same purpose.

BACKGROUND OF THE INVENTION

[0004] Containers or vessels currently used to transport pressurized gases have a series of drawbacks and disadvantages, among which are the following:

- They are heavy, as they are made entirely of steel or other metals.
- They have a cylindrical external shape such that if packaged vertically on conventional pallets, their movement during transport will make the containers slide against each other and the strap joining them will lose tension, eventually causing them to fall, with the ensuing risks.
- Transportation is performed on suspension crates since due to the above reasons the use of pallets is not appropriate as it is unsafe.
- Current containers lack any protection, and are consequently exposed to dents or damage of any other type due to knocks against each other or against the floor.
- Conventional containers usually have welded parts, such that they do not allow transporting medicinal or foodstuff gases, for example.
- Conventional valve guards included to protect the valves have a frustoconical shape, and therefore a circular cross-section, such that they are not very resistant to sudden impacts; to increase their strength it is obviously necessary to increase their thickness, resulting in a greater weight and cost.
- In addition, metal containers or vessels commonly used to transport pressurized gases do not allow the use of RFID technology for labelling and traceability thereof, as the metal interferes with the signal and,

regardless of the methods used to separate the TAG for the metal, it is not possible to achieve a 100% reliability in readings with antennas.

DESCRIPTION OF THE INVENTION

[0005] The container for pressurized gases disclosed has been conceived to solve the aforementioned drawbacks and provide additional advantages and features that will be described in the present description.

[0006] More specifically, the container of the invention is characterized in that it consists of a metal inner sleeve consisting of a hollow cylinder with a small thickness, made of a light alloy (such as an aluminium alloy) with the ends thereof finished by a planishing process with a geodesic shape, on one of which ends is provided an opening for fitting the corresponding valve. This inner sleeve, in addition to enclosing the gas within it, can be considered to define a support for a casing made of a composite material of strands of carbon fiber, glass fiber or the like and a bi-component epoxy or vinyl-ester resin based on resin proper and a catalyst that acts as a hardener of the mixture after applying heat.

[0007] The process consists in the following:

The fiber strands, which are electronically stressed, are passed through a bath in which the two components of the resin have been mixed, such that they are impregnated, and then wound about the metal sleeve at previously calculated directions and angles until there are enough layers to withstand the internal pressure, thereby forming the composite casing.

[0008] Then the composite and inner sleeve assembly is introduced in an oven where two processes take place simultaneously: on one hand the resin is cured, with the difference that the time and temperature conditions employed are substantially greater than those necessary for this purpose in order to attain the artificial curing conditions for the metal of the inner sleeve, thereby allowing to recover or even improve the mechanical properties thereof which were altered during the planishing process used to shape the ends, without this representing any drawback for the correct curing of the resin.

[0009] The assembly formed by the matured metal sleeve and the cured composite casing is complemented by a protective sheath of a thermoplastic material with a certain elastomer grade, comprising segments with a circular section alternating with segments with a hexagonal section such that the segments with a circular section contact and hold on their inside the container formed by the inner sleeve and the composite casing, while externally the circular segment or segments provide a housing for a universal strap that bundles a set of containers on a pallet.

[0010] As for the hexagonal sections of the sheath, internally these sections do not touch the composite, allowing a deformation after a fall or an external load, that

is, absorbing said load such that it is not transmitted to the composite damaging the same.

[0011] The upper end of the aforementioned protective sheath includes two tabs that engage a metal ring fitted on the end of the valve of the inner sleeve, thereby preventing the rotation of one element with respect to the other, while the bottom end of said protective sheath of a thermoplastic material includes a cross-shaped groove that prevents the rotation of this part with respect to a lower metal body that completes the protective sheath itself.

[0012] The body of the sheath is obtained by extrusion-blowing technology, the mold incorporating mobile blades that make a slit during the blowing process such that these parts are obtained as two separate pieces, the aforementioned top part made from alternating segments with a circular section and segments with a hexagonal section, and another part with a circular section that is assembled on the top part after inserting the container by means of complementary inner and outer clips that lock and attach to one other, such that the clips are arranged in correspondence with each of the edges of the hexagonal section of the sheath itself.

[0013] The container constructed in this way is complemented by the corresponding stand for support on the floor, this stand having a cup shape and being made of metal, preferably aluminium, obtained by cold stamping, the main function of which is to protect the assembly from any external loads resulting from transport.

[0014] Said stand includes in the base thereof and internally a cross-shaped groove complementary to that provided on the bottom part of the sheath body, the two grooves engaging one another to prevent the rotation of one body about the other, said stand being secured by rivets in correspondence with each of the clips of the upper body, these rivets crossing both parts of the plastic such that, in addition to holding the stand, they prevent the clips from being released accidentally.

[0015] In addition, the corresponding valve guard provided to protect the valve from the protector described above has a hexagonal cross section throughout its entire length, and is preferably made of a plastic material as it is cheaper than metal, using less material as the thickness thereof can be reduced since the hexagonal outline configuration provides a greater strength to the valve guard itself.

[0016] Finally, the container includes a passive RFID tag for radio frequency identification, allowing to view, control and record in real time the traceability of the containers both during the manufacturing process thereof and subsequently during their use in filling, restamping and other lines.

[0017] Currently available metal containers do not allow using RFID technology for tagging the same since the metal interferes with the radio signal and does not allow reliable readings, such that only barcodes can be used for this purpose.

[0018] In this case, as the container is completely coat-

ed with a composite material it is possible to use RFID tags, such that the antenna readings will be 100% reliable, resulting in significant time savings and elimination of errors during container handling in the manufacturing, filling and distribution chain.

[0019] The latter advantage or feature results from the fact that these tags are read by antennas with a considerable range, such that when a moving pallet passes an arch the containers included therein can be read and identified, while with the barcode system the pallet must be stopped and the operator must approach each container separately with the reading device in order to identify it.

[0020] Using RFID technology in this container provides safety at the time of filling and allows an unmanned checking of up-to-date periodic inspections or that the working pressure conforms to the filling set-point, thereby reducing administrative and container control tasks and allowing automation of hitherto manual processes such as issuing delivery notes, work and/or production reports, etc., while making it possible to handle a much greater volume of containers in a work shift compared to the current barcode system.

DESCRIPTION OF THE DRAWINGS

[0021] To complement the description made below and aid a better understanding of the features of the invention, according to a preferred embodiment thereof, a set of drawings is accompanied which form an integral part of said description where, for purposes of illustration only and in a non-limiting sense the following is shown:

Figure 1 shows a general perspective view of a container according to the purpose of the invention.

Figure 2 shows a perspective view of the inner metal sleeve that is part of the container of the previous figure.

Figure 3 shows a perspective view of the ring incorporated in the end of the sleeve for fitting the corresponding valve guard.

Figure 4 shows a side elevation view of the set of elements included in the protective sheath of the invention.

Figure 5 shows a perspective view of the top end of the sheath shown in the previous figure, revealing the engagement of the two tabs in the corresponding metal ring of the inner sleeve.

Figure 6 shows the opposite end of the same protective sheath revealing the cross-shaped groove incorporated in the same.

Figure 7 shows a perspective enlarged view of an

exploded representation of the bottom part of the components included in the container for pressurized gases of the invention.

Figure 8 shows a perspective view of the metal stand provided to be mounted in correspondence with the bottom end of the assembly shown in the previous figure.

Figure 9 shows a perspective and cross-sectional view of the bottom part of the container with all the components included in it.

Figure 10 shows a perspective view of the bottom part of the container with the stand attached by rivets.

Figure 11 shows a perspective view of the valve guard included in the container of the previous figures.

PREFERRED EMBODIMENT OF THE INVENTION

[0022] As can be seen in the above-described figures, the container of the invention, labelled in general by the numeral (1) in figure 1, has a body with hexagonal polygonal sections (2), ending at the top at a valve guard (4), while the numeral (5) references the valve itself.

[0023] The container (1) consists in an inner sleeve (6) made of metal and with a cylindrical shape, with ends having a geodesic shape (7) and one end provided with an opening (8) by which gas is introduced through the corresponding commercially-available valve (5).

[0024] This sleeve (6) incorporates in correspondence with the opening thereof a ring (9) of the same metal, inserted by heating such that it expands, the ring (9) having a pair of grooves (10) the function of which will be described below, and is also provided with an outer thread (11) for screwing on the valve guard. (4).

[0025] On said hollow cylinder or inner metal sleeve (6) is applied a composite based on strands of glass, kevlar, basalt, carbon fibers or the like, and epoxy-type polyester or vinyl-ester bi-component resin, such that the resin is cured at the optimum artificial curing conditions for the metal of the inner sleeve (for example, in the case of aluminium, a 1-hour ramp to 185 °C, maintaining for 6 additional hours), thereby attaining optimum mechanical properties of the metal without altering those of the resin.

[0026] On the assembly formed by the inner metal sleeve (6) and the composite casing (12) is placed a protective sheath (13) of a thermoplastic material that includes a bottom part (13') of the same material, completing said protective outer sheath, the sheath (13) being provided on the bottom thereof with an external clip (16) that complements an internal clip (17) provided on the bottom body (13'), the two bodies being coupled to each other by a plug connection, wherein the clips (16-17) complement one another to establish an optimum attach-

ment.

[0027] On the bottom part (13') of the sheath are four silent-blocks (18), one on each arm of the cross-shaped groove (19) provided on the bottom part (13') of the sheath (13), as shown in figure 6. Figure 5 shows the upper part of said sheath (13) with the ring (9) mounted on the corresponding inner sleeve, the ring of which already incorporates the aforementioned grooves (10) in which are inserted the corresponding tabs (20) to prevent the two parts from rotating about each other.

[0028] The protective sheath (13-13') is complemented by a stand (21) defined in the bottom body (13'), with a cup-shaped configuration and a cross-shaped groove (22) at the base thereof that complements the groove (19) and locks one in the other to prevent the rotation of the elements about each other, and it is also secured by rivets (23) that pass through orifices (24) provided on the lateral surfaces of the upper (13) and lower (13') parts of the sheath.

[0029] Lastly, the valve guard (25) shown in figure 11 has the special characteristic of having a hexagonal perimeter, defining internal edges (26) that stiffen said body, which consequently can be made of lighter materials than those normally used, reducing the weight and cost thereof.

[0030] Said valve guard (25) comprises corresponding openings (27) for actuating the corresponding valve (5) and a thread (28) for assembly thereof on the upper part of the described container.

Claims

1. Container for pressurized gases, conceived to contain and transport gases under high pressure, **characterized in that** it consists of an inner metal sleeve (6) formed by a hollow cylinder with ends finishing in a geodesic shape (7), on the end of one of which is an opening (8) in which to install the corresponding valve (5), such that said inner sleeve (6) constitutes a support for a composite sheath (12) made of strands of carbon fiber, glass fiber or the like, and epoxy polyester or vinyl-ester resin, the inner sleeve (6) and composite casing (12) being complemented by a protective sheath (13) of thermoplastic material with a certain elastomer grade; said sheath has circular sections (14) alternating with hexagonal sections (15), the upper end of the sheath incorporating a pair of tabs (20) that engage the grooves (10) provided for this purpose in a metal ring (9) inserted in the inner sleeve (6); the sheath (13) is complemented by a bottom part (13') coupled by a plug connection, with interposing inner and outer securing clips (16-17); said bottom part (13') includes a cross-shaped groove (19) in which the corresponding silent-blocks (18) of rubber material or the like are placed to establish a shock-absorbing means on the bottom part of the container assembly, such that in

addition the coupling between the two parts (13-13') of the sheath involves segments with clips (16 and 17) in correspondence with each edge of the hexagonal section of the sheath itself; the assembly is complemented by a metal stand (21) for support on the floor, which includes internally in the base thereof a cross-shaped groove (22) that engages the complementary cross-shaped groove (19) of the bottom part (13') of the sheath (13), preventing the two parts from rotating about each other.

2. Container for pressurized gases, according to claim 1, **characterized in that** the inner metal sleeve (6) with the composite casing (12) undergoes an oven curing treatment at the optimum conditions for artificial ageing or curing of the metal of the inner sleeve.
3. Container for pressurized gases, according to claim 1, **characterized in that** the metal stand (21) has a cup shape for receiving the bottom part (13') of the sheath (13), and is laterally provided with orifices (24) allowing passage of corresponding attachment rivets (23) between the stand and the bottom part of the sheath.
4. Container for pressurized gases, according to claim 1, **characterized in that** the valve guard (25) that protects the valve (5) has a hexagonal section along its entire length.
5. Container for pressurized gases, according to claim 1, **characterized in that** it incorporates a passive radiofrequency identification tag placed under the resin that impregnates the glass fiber or carbon fiber of the composite (12).

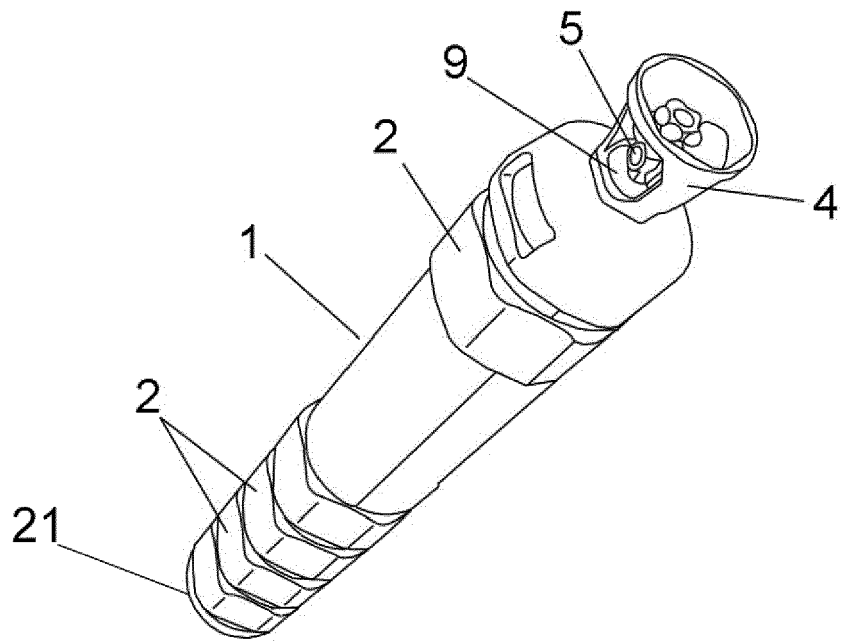


FIG. 1

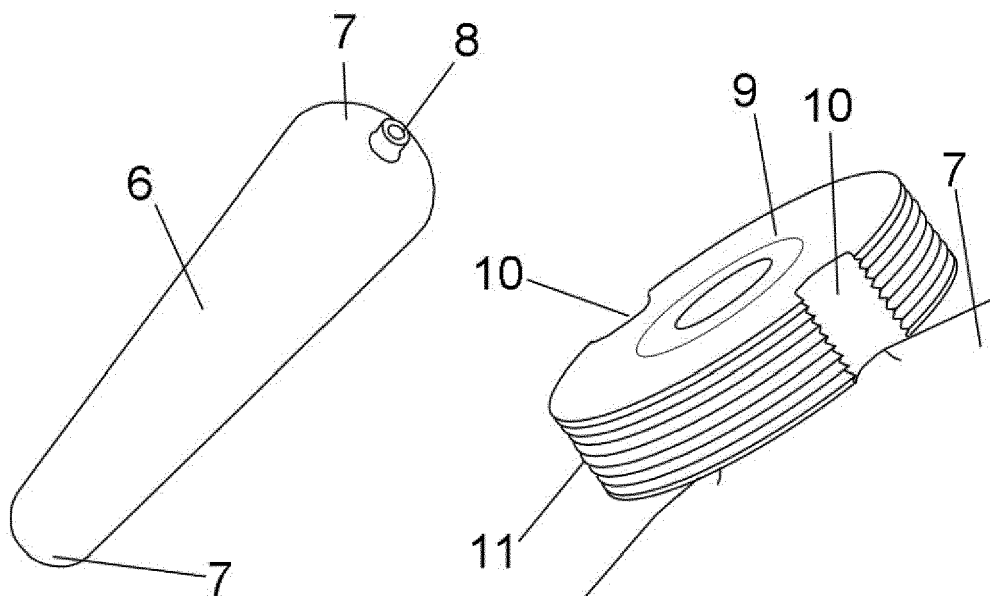


FIG. 2

FIG. 3

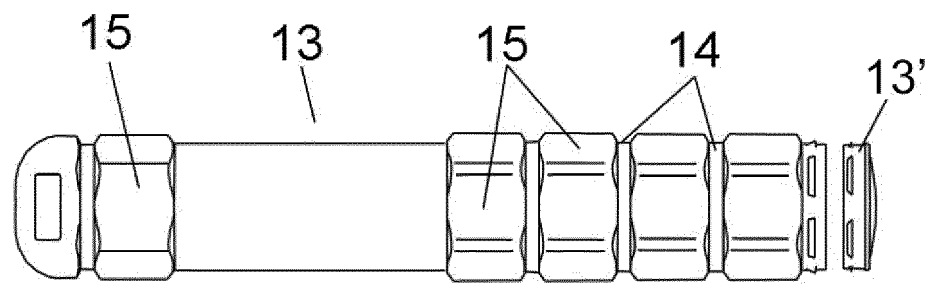


FIG. 4

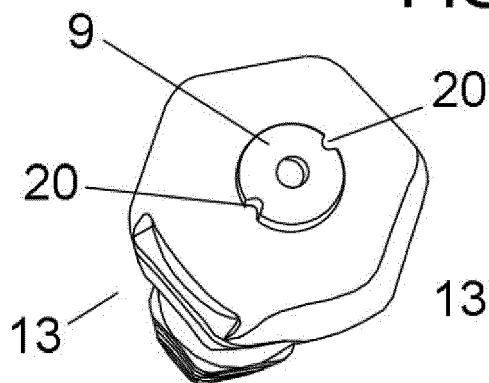


FIG. 5

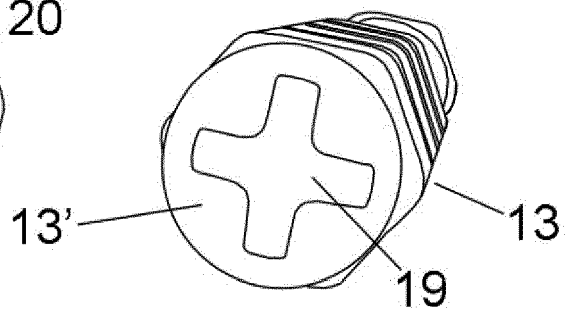


FIG. 6

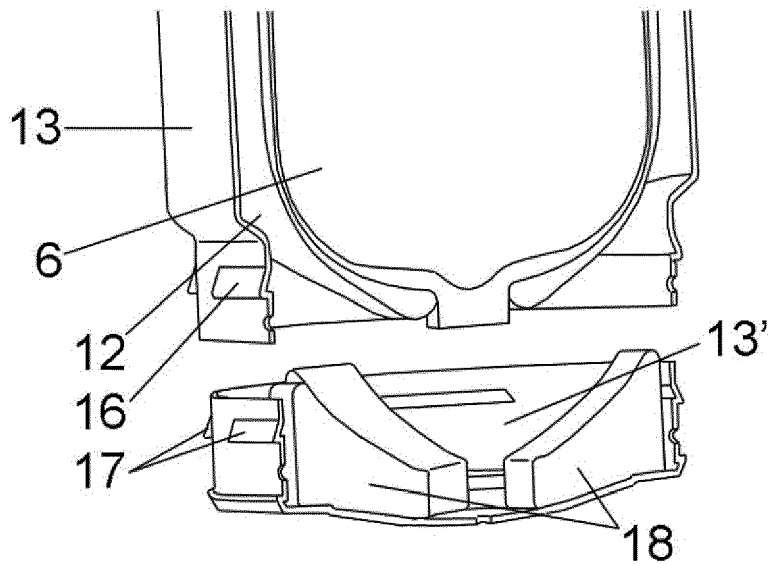


FIG. 7

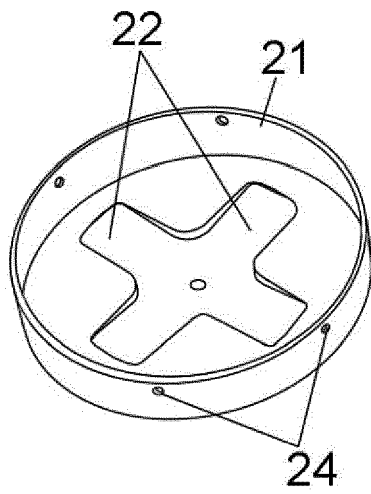


FIG. 8

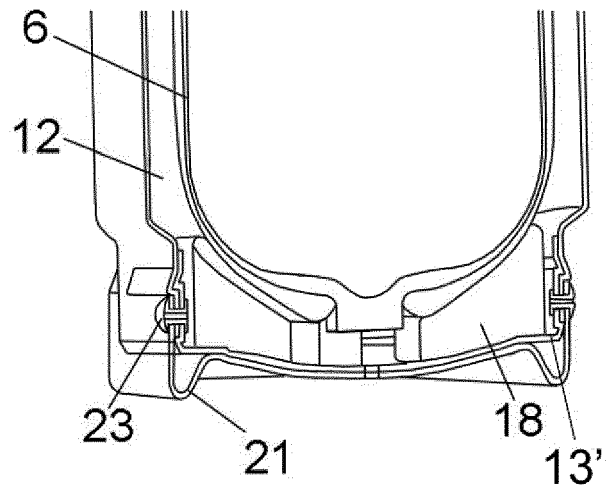


FIG. 9

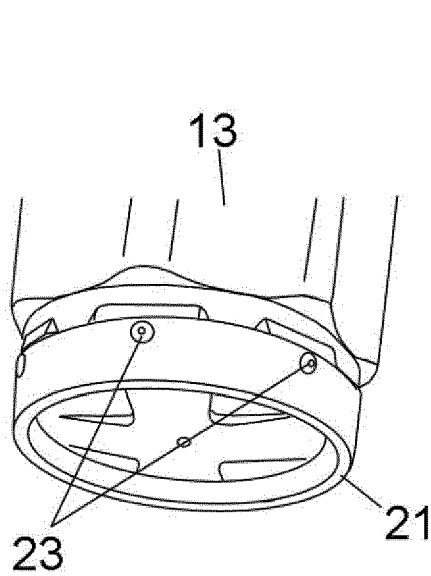


FIG. 10

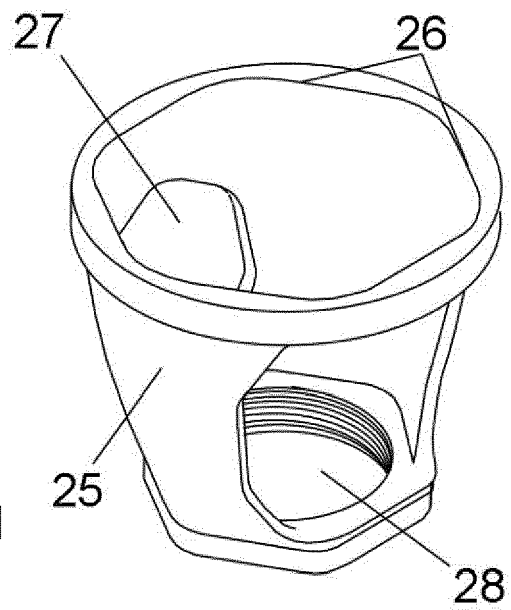


FIG. 11



EUROPEAN SEARCH REPORT

Application Number
EP 15 38 2559

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2011 208720 A (YACHIYO IND CO LTD) 20 October 2011 (2011-10-20) * fig.1a,b, fig.2a,b, (2), (5), (3), (7), (8), (11), (12); [0006], [0014]-[0020] *	1-5	INV. F17C1/04
A	US 4 022 343 A (RICHARDSON JOHN ERIC) 10 May 1977 (1977-05-10) * fig.1, (10), (c); fig.4, (45)-(53) *	1-5	
A	WO 2014/152505 A1 (WORTHINGTON CYLINDERS CORP [US]; AMES GREG CHURCHILL [US]; GETTER JAME) 25 September 2014 (2014-09-25) * fig.1, (10), (20), (22), (30) *	1-5	
A	WO 2012/131724 A2 (GENEX SCIENCE AND TECHNOLOGIES PVT LTD [IN]; KUMAR JAIN NAVEEN [IN]) 4 October 2012 (2012-10-04) * fig.1, (3), (4), (6); fig.4, (7), (9), (10); fig.7, (4) *	1-5	
A	DE 87 10 872 U1 (HOECHST AG) 24 September 1987 (1987-09-24) * fig.1, (1)-(5); page 4, lines 7-15 *	1-5	TECHNICAL FIELDS SEARCHED (IPC) F17C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 September 2016	Examiner Todor, H
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 38 2559

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-09-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2011208720 A	20-10-2011	JP 5314629 B2 JP 2011208720 A	16-10-2013 20-10-2011
US 4022343 A	10-05-1977	NONE	
WO 2014152505 A1	25-09-2014	US 2015013350 A1 WO 2014152505 A1	15-01-2015 25-09-2014
WO 2012131724 A2	04-10-2012	TW 201248048 A WO 2012131724 A2	01-12-2012 04-10-2012
DE 8710872 U1	24-09-1987	NONE	