



(51) International Patent Classification:
F17C 1/14 (2006.01)

(21) International Application Number:
PCT/EP2016/069911

(22) International Filing Date:
23 August 2016 (23.08.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1515300.0 28 August 2015 (28.08.2015) GB

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(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).

Published:

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

(54) Title: A GAS CYLINDER FABRICATED OF TWO PARTS WITH AN INTEGRATED VALVE

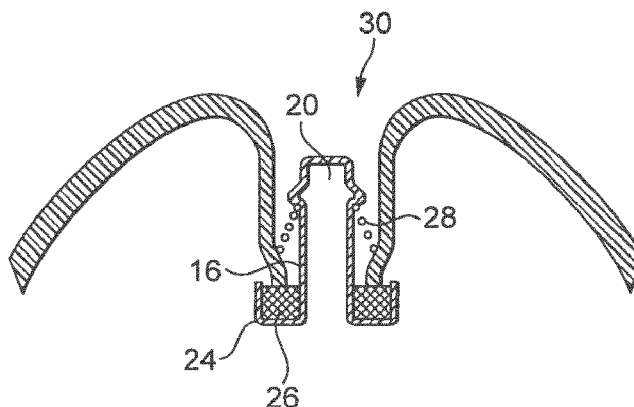


FIG. 1C

(57) Abstract: A pressurised gas cylinder defined by a wall, closed at one end, and having an access valve at the opposite end. The access valve comprises a valve stem which is biased closed onto a seat. The access end has an inturned portion which surrounds the valve stem. A biasing member is connected to the inturned part of the cylinder, and at least one resilient prong engages against the valve stem to bias it on to the seat.



A GAS CYLINDER FABRICATED OF TWO PARTS WITH AN INTEGRATED VALVE

BACKGROUND OF THE INVENTION

5 The present invention relates to gas cylinders,
modifications, and improvements thereto.

Gas cylinders are well known and are widely used in a
variety of different applications. The present application
10 is directed to making such cylinders safer to store and use.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention
15 there is provided a cylinder for pressurised gas, the
cylinder being defined by a wall and being closed at one end
and having an access valve at the opposite end, the access
valve comprising a valve stem which is biased closed onto a
seat by a biasing member and is openable by being displaced
20 against the biasing member; wherein the cylinder at the
opposite end has an inturned portion surrounding the valve
stem; a biasing member connected to the inturned portion of
the cylinder; and at least one resilient prong which engages
against the valve stem to bias it on to the seat.

25

The biasing member may be a deep drawn component.

The inturned portion may be integral with the cylinder
wall.

30

The cylinder wall may be formed as a cylindrical main
body closed at one end by an end cap including the access

valve. However, preferably the cylinder wall is formed from first and second shells, which may be deep drawn, the first shell comprising the one end and one part of a cylindrical side wall which terminates at an open end, and the second
5 shell receiving the access valve, and forming the opposite end and the second part of the cylindrical side wall which terminates at an open end; wherein the first and second shells are joined at their open ends to form the complete cylinder.

10

According to a second aspect of the present invention there is provided a cylinder for pressurised gas, the cylinder being defined by a wall and being closed at one end and having an access valve at the opposite end, the access
15 valve comprising a valve stem which is biased closed onto a seat by a biasing member and is openable by being displaced against the biasing member; wherein the cylinder wall is formed from first and second shells, the first shell comprising the one end and one part of a cylindrical side
20 wall which terminates at an open end, and the second shell receiving the access valve, and forming the opposite end and the second part of the cylindrical side wall which terminates at an open end; wherein the first and second shells are joined at their open ends to form the complete
25 cylinder; wherein the biasing member, the valve stem, the first shell and the second shell are each a deep drawn component. By having components from the cylinder formed by deep drawing, the cylinder is cheaper to manufacture.

30 The wall of the cylinder at the opposite end may have an inturned portion defining a recess surrounding the valve

stem. In this case, the biasing member may be connected to the inturned portion of the wall of the cylinder.

The biasing member may comprise at least one resilient
5 prong which engages against the valve stem.

The at least one resilient prong may comprise a plurality of resilient prongs.

10 The at least one resilient prong may extend radially inwardly.

Preferably, the valve stem never projects outwardly beyond the recess. In this way, the valve stem is protected
15 by the cylinder from knocks, accidental actuation, and/or damage.

The cylinder wall may be formed as a cylindrical main body closed at one end by an end cap including the access
20 valve. However, preferably the cylinder wall is formed from first and second shells,

the first shell comprising the one end and one part of a cylindrical side wall which terminates at an open end,
and the second shell receiving the access valve, and
25 forming the opposite end and a second part of the cylindrical side wall which terminates at an open end;

wherein the open end of one of the shells has a folded wall portion that is folded back on itself to create a double wall thickness in the vicinity of the open end, the
30 open end of the other shell overlapping with the folded wall portion and the two shells being welded in the region of the folded wall portion to create a triple wall thickness in

this region. The triple thickness portion provides the portion of the shells that are welded with improved structural rigidity and mitigates the effects of any stress concentrations occurring at the interface of the two shells.

5

The wall may define an opening to receive a valve stem, and the valve stem seats directly onto the part of the cylinder wall which surrounds the access valve. By seating the access valve directly on the cylinder wall, rather than
10 on an intermediary component located on the cylinder, this reduces the number of components needed in the valve, making the cylinder cheaper to manufacture.

The first and second shells may be joined at their open
15 ends by welding, or particularly laser welding. By laser welding the two shells together, the size of the heat affected zone around the area of the weld is reduced.

Preferably, the cylinder can contain a gas at a pressure
20 of up to 300 bar.

The cylinder may have a water capacity less than or equal to 500ml, or more preferably less than or equal to 200ml, or even more preferably less than or equal to 100ml.

25

The valve stem may be arranged to be open in a direction which is outward of the cylinder, but is preferably openable by being depressed into the cylinder. This makes it easier to access. Also, by opening it in an inwards direction, the
30 pressurised gas in the cylinder will tend to close the valve when the external force to open the valve is withdrawn, thereby providing a "fail safe" closure.

BRIEF DESCRIPTION OF THE FIGURES

The invention will now be described with reference to
5 the accompanying Figures in which:

Figure 1A shows a side view of a cylinder formed of
first and second shells;

Figure 1B shows a section view of the cylinder taken
10 about the section A-A from Figure 1A; and

Figure 1C shows an enlarged section view of the valve
portion of the cylinder shown in Figure 1B.

Figure 2A shows a side view of the first shell from the
15 cylinder shown in Figure 1A; and

Figure 2B shows a section view of the first shell taken
about the section D-D from Figure 2A.

Figure 3A shows a side view of the second shell from the
20 cylinder shown in Figure 1A; and

Figure 3B shows a section view of the second shell taken
about the section C-C from Figure 3A.

Figure 4A shows a side view of the valve assembly used
25 in the cylinder shown in Figure 1A; and

Figure 4B shows a section view of the valve assembly
taken about the section E-E from Figure 4A.

Figures 5A-5C show various view of a first embodiment
30 biasing member used in the cylinder shown in the Figures.

Figures 6A and 6B show an alternative biasing member for use in the cylinder.

Figures 7A and 7B show another alternative biasing
5 member for use in the cylinder.

DETAILED DESCRIPTION

Shown in Figure 1A is a container in the form of a
10 cylinder 10 for storing a pressurised gas. The cylinder is formed of a first shell 12 and a second shell 14. Each of the first and second shells 12;14 has a generally cylindrical side wall 12C;14C comprising a first hemispherical end 12A;14B and a second open end 12B;14B. The
15 cylindrical side wall of each shell is approximately 1mm thick.

The size, and thus the water capacity, of the cylinder
10 can be varied depending on the intended application of
20 the cylinder. In this example, the cylinder therein shown has a water capacity of approximately 50ml.

To join the first and second shells 12;14, the portion of the cylindrical side wall towards the open end 12B of the
25 first shell 12 is folded back on itself to create a double wall thickness 18 in the vicinity of the open end 12B. The portion of the cylindrical wall at the open end 14B of the second shell 14 is then overlapped with the folded wall portion 18 and the two shells 12;14 are then welded in the
30 region of the folded wall portion 18 to create a triple wall thickness in this region. The triple thickness portion 19 provides the welded area with improved structural rigidity

and mitigates the effects of any stress concentrations occurring at the interface of the two shells 12;14.

Preferably, the weld is a laser weld to reduce the size of the heat affected zone around the area of the weld. The
5 folded portion could equally be provided on the second shell 14 with the first shell 12 having the overlapping portion.

With reference to Figure 1C, 3A-3B and 4A-4B, an access valve 16 for controlling the amount of pressurised gas
10 inside the cylinder 10 is located within an opening 19 in the hemispherical end 14A of the second shell 14. The access valve 16 is a deep drawn component formed generally of a cylindrical valve stem 20 which has a bulbous head 22 at its first end and a radially outwardly extending annular skirt
15 24 at its other end which extends back towards the head 22. The radially extending skirt contains an annular seal 26 that acts as a valve seat which is engageable against the second shell 14 to plug the opening 19 in the second shell 14. The access valve 16 is biased into sealing engagement
20 with the second shell 14 by a biasing member 28 in the form of a conical compression spring as shown in Figures 5A-5C which acts between the bulbous head 22 of the valve 16 and the wall of the shell 14. From this closed position, the valve 16 is openable by exerting an inward force on the
25 valve stem 20 which overcomes the opposing biasing force from the biasing member 28.

Although the biasing member 28 shown in Figures 1C, 3A-3B and 4A-4B is located outside of the first and second
30 shells 12;14, the biasing member 28 could alternatively be located within the space defined by the first and second shells 12;14, as shown in Figures 6A and 6B. In this

arrangement the biasing member 28, shown as a conical compression spring, is supported at one end on the inturned portion 18 of the cylindrical wall of the first shell 12. The other end of the spring is connected to the underside of the valve stem 20 to force the seal 26 into engagement with the second shell 14.

To prevent accidental damage or actuation of the valve 16, and to minimise the overall length of the cylinder 10, the hemispherical end 14A of the second shell 14 has an inturned portion 30 defining a recess within which the access valve 16 is located. Particularly, the recess is narrow enough and deep enough such that the valve stem 20 is only actuatable by a correspondingly narrow actuator (not shown), and such that the valve stem never projects outwardly beyond the recess.

Figures 7A and 7B show another variant of biasing member 28' located within the space defined by the first and second shells 12;14. The biasing member 28' is made up of a series of resilient prongs 50 which are each connected to, and inwardly protrude from, a cylindrical sleeve 52 which is located inside the cylinder 10. The sleeve 52 is connected to the interior surface of the inturned portion 30 of the second shell 14.

A number of holes 54 extend through the thickness of the sleeve 52. Each of these holes 54 is located at the portion of the sleeve 52 adjacent to the interface of the seal 26 and the second shell 14. In this way, the holes 54 allow gas to escape the cylinder 10 when the valve 16 is open.

When the cylinder 10 is not in use, the resilient prongs 50 each engage the underside of the valve stem 20 and bias the seal 26 into engagement with the second shell 14.

5 From a closed position, the valve 16 is openable by exerting an inward force on the valve stem 20 which causes the prongs 50 to resiliently deflect inwardly, thus removing the biasing force allowing the valve 16 to open and gas to pass through the holes 54.

10

As gas passes through each of the holes 54, the gas travels in a direction which is substantially perpendicular to the movement of the valve stem 20 and the resilient prongs 50. By redirecting the flow of gas in this
15 perpendicular direction, in situations when the cylinder 10 is being filled with gas, the thrust force applied to the prongs 50 from the incoming gas is reduced, which reduces the likelihood of the prongs 50 being accidentally deflected beyond their yield point.

20

The sleeve 52 and the resilient prongs 50 form a single deep drawn component which is easy to manufacture.

It will be appreciated that the cylinder 10 can be made
25 of any suitable material capable of withstanding the pressures from the gas contained within the cylinder 10. Preferably the cylinder 10 should be able to support gases contained at a pressure of up to 300 bar. Possible materials for the cylinder 10 include, but are not limited to,
30 aluminium and steel (preferably stainless steel).

It will also be appreciated that the access valve could be located on the first shell 12, rather than the second shell 14.

- 5 Whilst the two shells 12;14 have been described as cylindrical, the shape of each shell 12;14 could be modified depending on the intended overall shape of the cylinder 10.

CLAIMS

1. A cylinder for pressurised gas, the cylinder being defined by a wall and being closed at one end and having an access valve at the opposite end, the access valve comprising a valve stem which is biased closed onto a seat; wherein the cylinder at the opposite end has an inturned portion surrounding the valve stem; a biasing member connected to the inturned portion of the cylinder; and at least one resilient prong which engages against the valve stem to bias it on to the seat.

2. A cylinder as claimed in any preceding claim wherein the biasing member is a deep drawn component.

3. A cylinder as claimed in any preceding claim wherein the inturned portion is integral with the cylinder wall.

4. A cylinder as claimed in any preceding claim wherein the cylinder wall is formed from first and second deep drawn shells,

the first shell comprising the one end and one part of a cylindrical side wall which terminates at an open end,

and the second shell receiving the access valve, and forming the opposite end and the second part of the cylindrical side wall which terminates at an open end;

wherein the first and second shells are joined at their open ends to form the complete cylinder.

5. A cylinder for pressurised gas, the cylinder being defined by a wall and being closed at one end and having an

access valve at the opposite end, the access valve comprising a valve stem which is biased closed onto a seat by a biasing member and is openable by being displaced against the biasing member;

5 wherein the cylinder wall is formed from first and second shells,

 the first shell comprising the one end and one part of a cylindrical side wall which terminates at an open end,

 and the second shell receiving the access valve, and
10 forming the opposite end and the second part of the cylindrical side wall which terminates at an open end;

 wherein the first and second shells are joined at their open ends to form the complete cylinder;

 wherein the biasing member, the valve stem, the first
15 shell and the second shell are each a deep drawn component.

6. A cylinder according to claim 5 wherein the wall of the cylinder at the opposite end has an inturned portion defining a recess surrounding the valve stem.

20

7. A cylinder according to claim 6 wherein the biasing member is connected to the inturned portion of the wall of the cylinder.

25 8. A cylinder according to claims 5-7 wherein the biasing member comprises at least one resilient prong which engages against the valve stem.

9. A cylinder according to claims 1-4 or 8 wherein the at
30 least one resilient prong comprises a plurality of resilient prongs.

10. A cylinder according to claims 1-4 or 8-9 wherein the
at least one resilient prong extends radially inwardly.

11. A cylinder according to claims 1-4 or 6-7 wherein the
5 valve stem never projects outwardly beyond the recess.

12. A cylinder as claimed in any preceding claim wherein
the cylinder wall is formed from first and second shells,
the first shell comprising the one end and one part of
10 a cylindrical side wall which terminates at an open end,
and the second shell receiving the access valve, and
forming the opposite end and a second part of the
cylindrical side wall which terminates at an open end;
wherein the open end of one of the shells has a folded
15 wall portion that is folded back on itself to create a
double wall thickness in the vicinity of the open end, the
open end of the other shell overlapping with the folded wall
portion and the two shells being welded in the region of the
folded wall portion to create a triple wall thickness in
20 this region.

13. A cylinder as claimed in any preceding claim wherein
the wall defines an opening to receive a valve stem, and the
valve stem seats directly onto the part of the cylinder wall
25 which surrounds the access valve.

14. A cylinder as claimed in claim 4, 5 or 12 wherein the
first and second shells are joined at their open ends by
laser welding.

30

15. A cylinder as claimed in any preceding claim for
containing gas at a pressure of up to 300 bar.

16. A cylinder as claimed in any preceding claim wherein the cylinder has a water capacity less than or equal to 500ml.

5

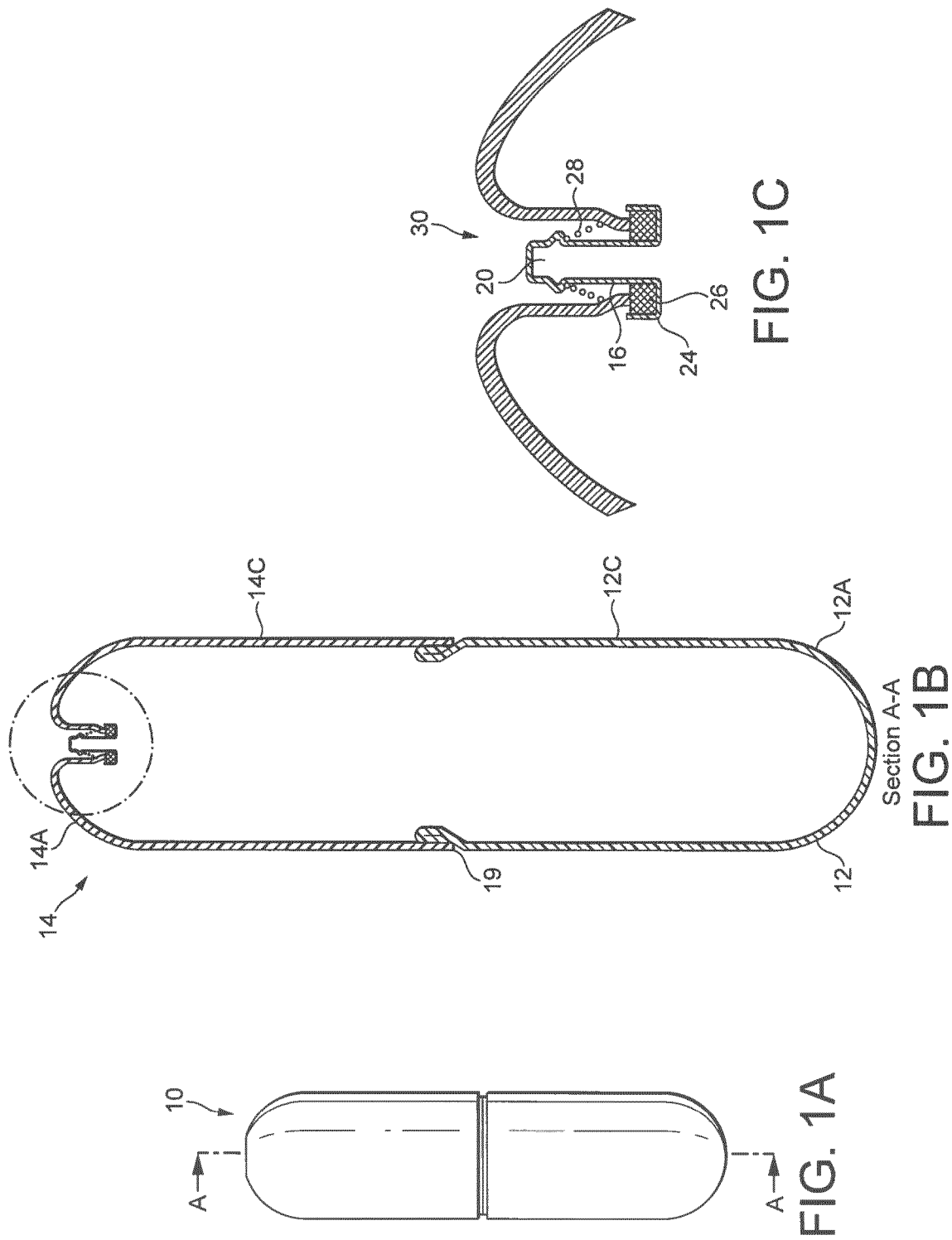
17. A cylinder as claimed in any preceding claim wherein the cylinder has a water capacity less than or equal to 200ml.

10 18. A cylinder as claimed in any preceding claim wherein the cylinder has a water capacity less than or equal to 100ml.

15 19. A cylinder as claimed in any preceding claim wherein the access valve is openable by being depressed into the cylinder.

20. A cylinder as substantially hereinbefore described with reference to the accompanying drawings.

20



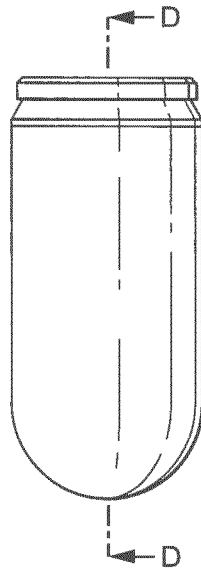
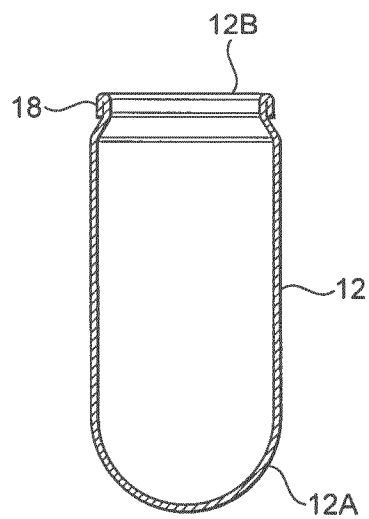


FIG. 2A



Section D-D

FIG. 2B

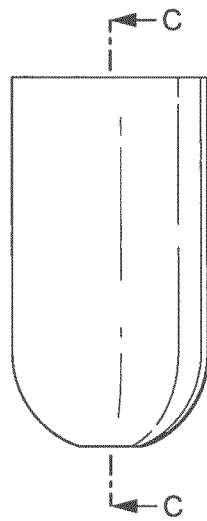
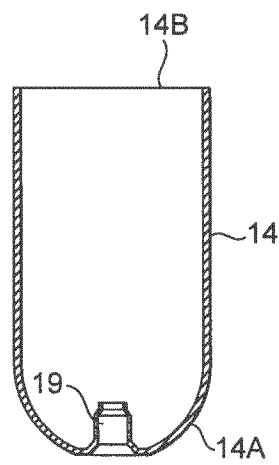


FIG. 3A



Section C-C

FIG. 3B

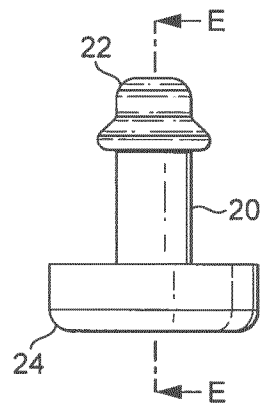


FIG. 4A

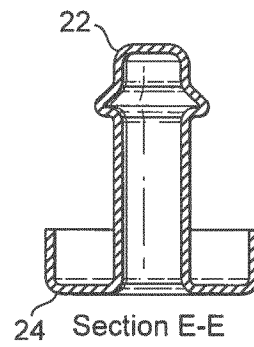


FIG. 4B

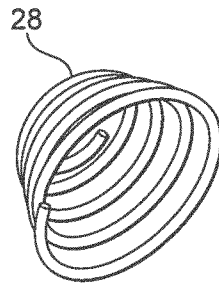


FIG. 5A

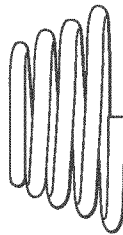


FIG. 5B

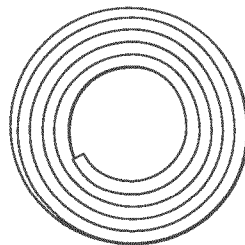


FIG. 5C

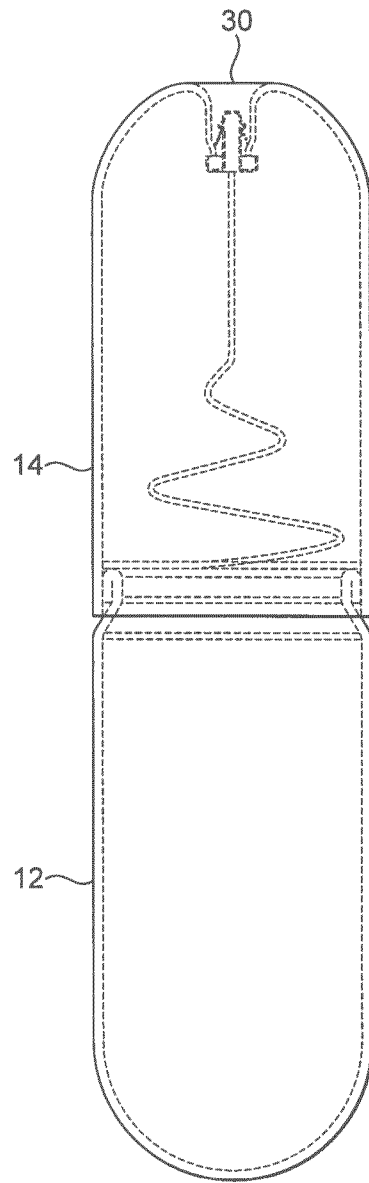


FIG. 6A

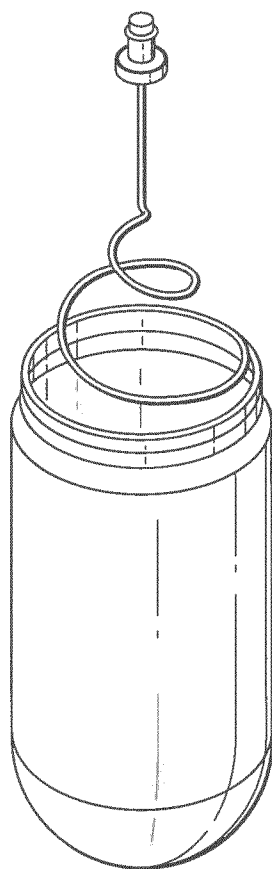


FIG. 6B

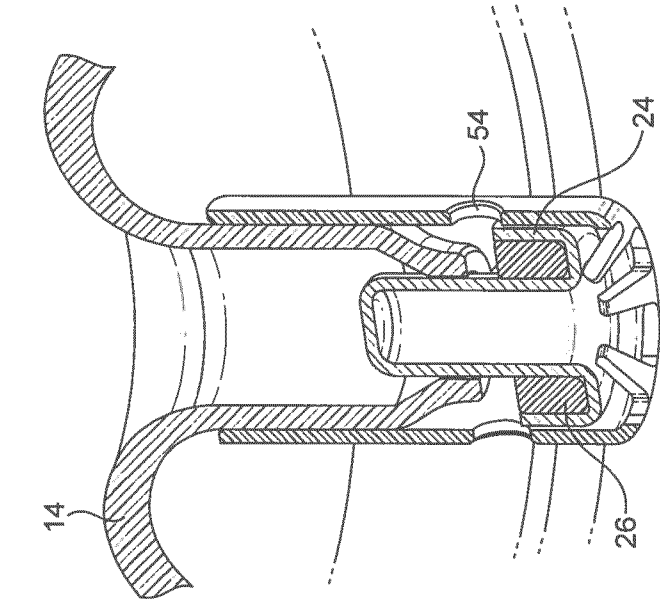


FIG. 7B

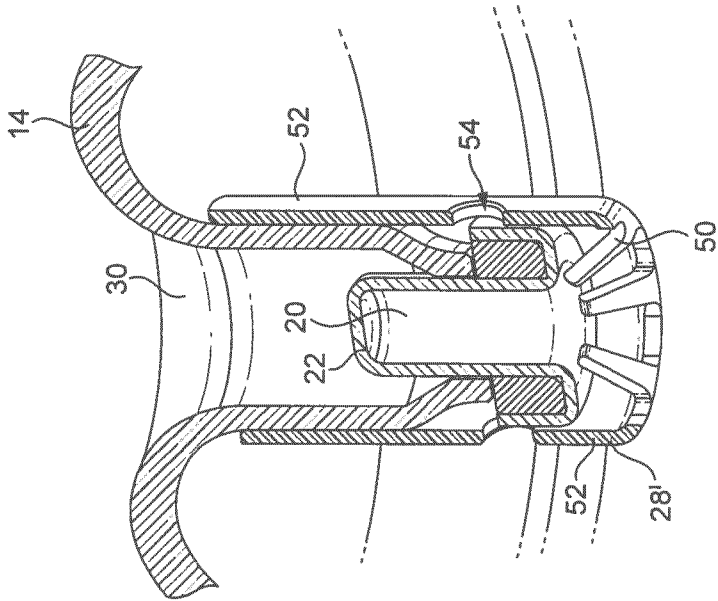


FIG. 7A

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/069911

A. CLASSIFICATION OF SUBJECT MATTER
INV. F17C1/14
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)
F17C

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

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X	FR 1 256 366 A (OTTO BERNZ CO INC) 17 March 1961 (1961-03-17) fig.1, (1), (9), (13), (14), (11), (12); p.2, last paragraph - page 3, first paragraph ----- -/--	1-20



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

13 October 2016

Date of mailing of the international search report

08/11/2016

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/069911

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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