



- (51) **International Patent Classification:**
B29C 45/34 (2006.01) *B29C 45/14* (2006.01)
- (21) **International Application Number:**
PCT/CA2012/050318
- (22) **International Filing Date:**
15 May 2012 (15.05.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/496,726 14 June 2011 (14.06.2011) US
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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, 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, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, 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, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- of inventorship (Rule 4.17(iv))

Published:

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



WO 2012/171118 A1

(54) **Title:** SPLIT INSERT HALF

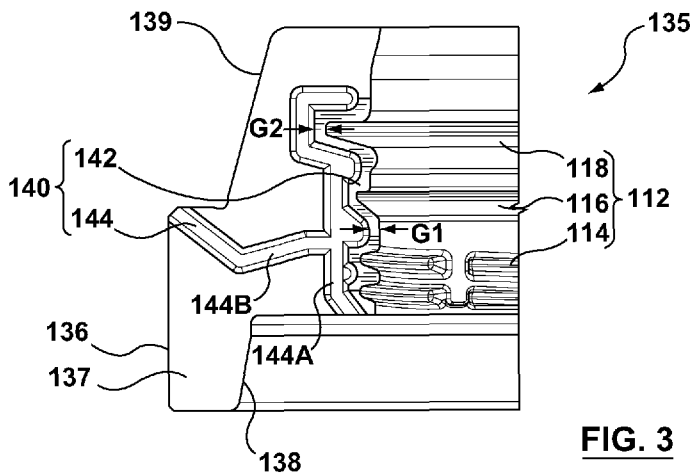


FIG. 3

(57) **Abstract:** Disclosed herein, amongst other things is a split insert half (135) of a split insert pair. The split insert half (135) has a body (136) defining a molding region (112), a mating interface (137) and a vent (140). The mating interface (137) is configured for mating, in use, with a complementary mating interface of a complementary split insert half. The vent (140) is defined, in use, between the mating interface (137) and the complementary mating interface. A portion of the vent (140) is defined on the mating interface (137) and the complementary mating interface. The slot vent (142) spans between the molding region (112) and the collector groove (144), the slot vent (142) being configured to provide a substantially uniform pressure drop therealong.

SPLIT INSERT HALF**TECHNICAL FIELD**

5 Non-Limiting embodiments disclosed herein generally relate to a molding insert for an injection mold, and more particularly to a split insert half for molding an encapsulated portion of a preform.

BACKGROUND OF THE INVENTION

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Molding is a process by virtue of which a molded article can be formed from molding material by using a molding system. Various molded articles can be formed by using the molding process, such as an injection molding process. One example of a molded article that can be formed, for example, from polyethylene terephthalate (PET) material is a preform that is capable of being subsequently blown into a beverage container, such as, a bottle and the like.

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A known mold stack 8 is depicted in FIG. 1 that is suitable to implement a process that includes heating the molding material to a homogeneous molten state and injecting, under pressure, the so-melted molding material into a molding cavity 10 defined, at least in part, by a first stack portion 20 and a second stack portion 30 that are associated, in use, with respective mold shoes (not shown) of an injection mold. The first stack portion broadly includes a cavity insert 22 and a gate insert 24 (through which the molding material is directed into the molding cavity). The second stack portion 30 broadly includes a core insert 32 and a split insert pair 34. During molding, the first stack portion 20 and the second stack portion 30 are urged together and are held together by clamp force against the pressure of the injected molding material. The so-injected molding material is then cooled to a temperature sufficient to enable ejection of the so-formed preform from the molding cavity 10.

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When molding a preform that is capable of being subsequently blown into a beverage container, one consideration that needs to be addressed is molding a so-called neck region 6 thereof. The neck region typically includes, without limitation, (i) a thread region (or other suitable structure) for accepting and retaining a closure assembly (e.g. a bottle cap – not shown), and (ii) an anti-pilferage member with which to cooperate, for example, with the closure assembly to indicate whether the end product (i.e. the beverage container that has been filled with a beverage and shipped to a store) has been tampered with in any way. The neck

region may comprise other additional elements used for various purposes, for example, to cooperate with parts of the molding system (e.g. a support ledge, etc.). The split insert pair 34 (FIG. 1) includes a pair of bodies that cooperate together to define a molding region. These “split insert halves” are moved apart (i.e. opened) when it comes time to release the encapsulated features of the threads, anti-pilferage member and support ledge of the neck region 6.

With reference to FIG. 2, there is depicted one such split insert half 35 of the split insert pair 34. From this view it may be appreciated that a body 36 defines a molding region 12 that includes a thread molding region 14, an anti-pilferage molding region 16 and a support ledge molding region 18 for molding the threads, the anti-pilferage member and the support ledge of the neck region respectively.

It is common practice in the art to provide shallow vents at one or more interfaces that exist between the various mold stack inserts. The vents provide a means through which air can escape the molding cavity 10 with the injection of the molding material therein. Over time the vents can become clogged with dust and molding by-products (i.e. molding detritus). Once venting has become impaired molding defects can ensue (e.g. incomplete molding of the preform).

As an example, a vent is typically provided between mating interfaces of the split insert halves 35. More particularly, the vent 40 is defined between portions of the mating interfaces that include on one mating interface 36 a shallow surface depression (about 0.03 millimeters) that spans between the molding region 12 and a narrow (about 2.0 millimeters), but relatively deep (about 1.0 millimeters), collector groove 44. The collector groove 44 includes a series of straight line segments that only partially follow a contour of the molding region 12 in close proximity thereto. When the mating interfaces of the split insert halves 35 of the split insert pair 34 are brought into contact with one another (i.e. a molding configuration), by a stripper assembly (not shown) of the injection mold (not shown), the vent 40 is fully defined. In operation, the air being displaced from the molding cavity 10, along with molding detritus entrained therewith, is forced through the shallow relief vent 42 and into the collector groove 44 whereupon it travels along the collector groove 44 before being discharged into the ambient environment. As previously mentioned, over time the shallow relief vent 42 may become clogged with the accumulation of the molding material dust and other molding material by-products whereupon the venting action becomes impaired enough that neck region

related defects may ensue (e.g. incomplete molding of threads, anti-pilfer band, support ledge and the like).

5 The foregoing problem has been recognized previously, and has been met with various strategies (i.e. devices and processes) for cleaning of the vent 40 either preventatively or once they have become clogged. Examples of such devices and processes may be found with reference to the following publications in which:

10 US Patent 4,575,443 to Bruce A. Moen, et al., published on March 11, 1986 discloses a device and method for flash suppression in a molding with rotation system having a non-rotating mating surface capable of venting gases during the molding process while simultaneously suppressing flash. Flash is directed inwardly and away from the mating surface and contained between a mandrel and mandrel housing in a low pressure reservoir which is completely separate from the mating surface. A cooling fluid is utilized to carry away flash
15 particles from the low pressure reservoir and thereby further prevent contamination of the mating surface.

US Patent Application Publication 2003/0070693 to Scott Stratford, published on April 17, 2003 discloses a method and apparatus of using a dry ice blasting system to clean injection
20 molds in and out of an injection molding machines characterized in that it is easy to use and is particularly well suited to cleaning small mold features such as the vents on molding inserts.

SUMMARY OF THE INVENTION

25 The invention is set forth and characterized in the main claim(s), while the dependent claims describe other characteristics of the invention.

A first general aspect of the invention is to provide a split insert half of a split insert pair. The split insert half has a body defining a molding region, a mating interface and a vent. The
30 mating interface is configured for mating, in use, with a complementary mating interface of a complementary split insert half. The vent is defined, in use, between the mating interface and the complementary mating interface. A portion of the vent is defined on the mating interface having a slot vent and a collector groove, the slot vent spans between the molding region and the collector groove, the slot vent being configured to provide a substantially uniform pressure
35 drop therealong.

A second general aspect of the invention is to provide a split insert half of a split insert pair. The split insert half has a body defining a molding region, a mating interface and a vent. The mating interface is configured for mating, in use, with a complementary mating interface of a complementary split insert half. The vent is defined, in use, between the mating interface and the complementary mating interface. A portion of the vent is defined on the mating interface having a slot vent and a collector groove, the slot vent spans between the molding region and the collector groove. The collector groove is contoured with a profile of the molding region.

These and other aspects and features of non-limiting embodiments will now become apparent to those skilled in the art upon review of the following description of specific non-limiting embodiments of the invention in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The non-limiting embodiments will be more fully appreciated by reference to the accompanying drawings, in which:

FIG. 1 depicts a mold stack according to the prior art.

FIG. 2 depicts a split insert half of a split insert pair shown in the mold stack of FIG. 1.

FIG. 3 depicts a split insert half of a split insert pair according to a first non-limiting embodiment for use in the mold stack of FIG. 1.

The drawings are not necessarily to scale and may be illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details that are not necessary for an understanding of the embodiments or that render other details difficult to perceive may have been omitted.

DETAILED DESCRIPTION OF THE EMBODIMENT(S)

Whereas efforts to date have seemingly focused on post-remediation of a clogged vent by removing of the molding detritus by various means, the solution presented hereafter focuses

instead on preventing the clogging of the vent in the first place or at least slowing down a rate at which the molding detritus accumulates therein.

5 Reference will now be made in detail to various non-limiting embodiment(s) of a split molding insert for use in a mold stack on an injection mold. It should be understood that other non-limiting embodiment(s), modifications and equivalents will be evident to one of ordinary skill in the art in view of the foregoing non-limiting embodiment(s) disclosed herein and that these variants are should be considered to be within scope of the appended claims.

10 Furthermore, it will be recognized by one of ordinary skill in the art that certain structural and operational details of the non-limiting embodiment(s) discussed hereafter may be modified or omitted (i.e. non-essential) altogether. In other instances, well known methods, procedures, and components have not been described in detail.

15 In an example non-limiting embodiment shown in FIG. 3, there is depicted a portion of a split insert half 135 of a split insert pair (not shown) that may be used in the mold stack 8 of FIG. 1 in place of the split insert pair 34 for molding the neck region 6 (FIG. 1) of a preform when used. As such, the split insert half 135 is similar to the split insert half 34 described previously.

20 More specifically, the split insert half 135 includes a body 136 that defines a molding region 112 that is structured for molding, without specific limitation, a neck region (i.e. thread molding region 114, anti-pilferage molding region 116, and support ledge molding region 118) of the preform (not shown).

25 In addition, the body 136 further defines a core interface 138 and a cavity interface 139 that are cooperable, in use, with complementary interfaces on the core insert 32 (FIG. 1) and the cavity insert 22 (FIG. 1) to ensure alignment of the molding surfaces disposed thereon and to keep the split insert pair from opening during injection of molding material into the molding
30 cavity 10. Without specific limitation, the core interface 138 and a cavity interface 139 may be formed as a female frusto-conical taper and as a male frusto-conical taper, respectively.

Also, like the split insert half 34, the body 136 also defines a mating interface 137 that is configured for mating, in use, with a complementary mating interface of a complementary
35 split insert half. The mating interface 137 is provided across a planar face of the body 136.

The vent 140 is defined, in use, with the split insert pair being in registration (i.e. in a molding configuration) and is located/formed between the mating interface 137 and the complementary mating interface thereof. Much like the portion of the vent 40 that is defined on the split insert half 35, the portion of the vent 140 that is defined on the mating interface 137 includes a slot vent 142 and a collector groove 144, the slot vent 142 spans between the molding region 112 and the collector groove 144. More specifically, the collector groove 144 is formed on the mating face 137 in close proximity but spaced apart from the molding region. The collector groove is generally narrow (e.g. width of about 2 mm – without specific limitation) and shallow (e.g. width of about 1 mm – without specific limitation) and has a first portion 144A that generally follows the profile of molding region 112, more about this later, and a second portion 144B for connecting, in use, the first portion 144A with the ambient environment. The slot vent 142 is a shallow depression having a planar surface that is inset (e.g. depth of about 0.03 to 0.04 mm – without specific limitation) from the mating interface 137 and that spans between the molding region 112 and the collector groove 144.

As described previously, in operation, the air being displaced from the molding cavity 10, along with molding material dust and other molding material by-products, is forced through the shallow relief vent 142 and into the collector groove 144 whereupon it travels along the collector groove 144 before being discharged into the ambient environment.

That being said, one may appreciate that vent 140 has a distinct appearance in comparison to the vent 40 (FIG. 2) by virtue of having a far more uniform width of the slot vent 142. The foregoing is the result of contouring the vent groove 144 to more closely follow the profile of the molding region 112. Referring back momentarily to FIG. 2, it can be readily seen that the width of the slot vent 42 adjacent to the support ledge molding region 18 is about 1 mm (D1), whereas at a location just beneath the anti-pilferage molding region 18 it is nearly 3 mm (D2) for a difference of 300%. In sharp contrast, and with reference back to the non-limiting embodiment of FIG. 3, it may be appreciated that the width of the slot vent 42 remains at a nearly uniform width of about 1 mm including at the support ledge molding region 18 (G1) and beneath the anti-pilferage molding region 18 (G2). Moreover, the slot vent 142 is generally narrower than the slot vent 42 (FIG. 1). As a result of the foregoing, the slot vent 142 has, in use, a relatively uniform and lower pressure drop along the slot vent 42 over a majority of its length. A technical effect of the foregoing may include an increase in the average velocity of air that passes through the vent along its length, with injection, so that the

molding detritus entrained therewith is much less likely to find a low velocity region along the slot vent 142 within which to stagnate and deposit.

5 In more specific terms, it has been determined that to maintain a substantially uniform pressure drop along the vent 142 that the slot vent 142 ideally has, without specific limitation, a width-to-depth ratio in the range of about 30 to 40 along the length thereof. Depending on the molding material being used, and the intrinsic viscosity thereof, the depth of the slot vent 142 will vary. For typical resins used in the manufacture of preforms, such as polyethylene terephthalate (PET) the slot vent 142 usually has a depth of less than 0.04 mm to avoid
10 flashing of the molding material into the slot vent 142.

Thus, as a first non-limiting example (not shown) wherein the depth of the slot vent 142 is about 0.04 mm, the width of the slot vent 142 should ideally be kept within a range of between 1.2 and 1.6 mm. To maintain the appropriate width of the slot vent 142 one would
15 need to provide an appropriate profile to the vent groove 144. In another non-limiting example, as shown in FIG. 3, the depth of the slot vent 142 is about 0.03 mm, this being the most commonly used depth for preform molds in the industry, and the width of the slot vent 142 should be kept within a range of between 0.9 and 1.2 mm. In the example illustrated, the vent 140 has been configured to have a width-to-depth ratio of about 33.3 along a majority of
20 its length.

It is noted that the foregoing has outlined some of the more pertinent non-limiting embodiments. It will be clear to those skilled in the art that modifications to the disclosed non-embodiment(s) can be effected without departing from the spirit and scope thereof. As
25 such, the described non-limiting embodiment(s) ought to be considered to be merely illustrative of some of the more prominent features and applications. Other beneficial results can be realized by applying the non-limiting embodiments in a different manner or modifying the invention in ways known to those familiar with the art. This includes the mixing and matching of features, elements and/or functions between various non-limiting embodiment(s)
30 is expressly contemplated herein so that one of ordinary skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as appropriate, unless described otherwise, above. Although the description is

made for particular arrangements and methods, the intent and concept thereof may be suitable and applicable to other arrangements and applications.

WHAT IS CLAIMED IS:

1. A split insert half of a split insert pair, comprising:
a body defining:
 - a molding region;
 - a mating interface that is configured for mating, in use, with a complementary mating interface of a complementary split insert half;
 - a vent that is defined, in use, between the mating interface and the complementary mating interface;
 - wherein a portion of the vent is defined on the mating interface having a slot vent and a collector groove, the slot vent spans between the molding region and the collector groove, the slot vent being configured to provide a substantially uniform pressure drop therealong.
2. The split insert half of claim 1, wherein:
the slot vent has a width that is substantially uniform along a length thereof,
3. The split insert half of claim 2, wherein:
the slot vent has a width-to-depth ratio in a range of 30 to 40 along the length thereof.
4. The split insert half of claim 3, wherein:
the slot vent has a depth of less than about 0.04 mm.
5. The split insert half of claim 4, wherein:
the depth of the slot vent is about 0.04 mm and wherein the width of the slot vent is in the range of 1.2 and 1.6 mm.
6. The split insert half of claim 4, wherein:
the depth of the slot vent is about 0.03 mm, and wherein the width of the slot vent is in the range of 0.9 and 1.2 mm.
7. The split insert half of claim 6, wherein:
the width-to-depth ratio is about 33.3.
8. A split insert half, the split insert half comprising:

a body defining:

a molding region;

a mating interface that is configured for mating, in use, with a complementary mating interface of a complementary split insert half; and

a vent that is defined on the mating interface having a slot vent and a collector groove, the slot vent spans between the molding region and the collector groove, wherein the collector groove is contoured with a profile of the molding region.

9. The split insert half of claim 8, wherein:
the slot vent has a width-to-depth ratio in a range of 30 to 40 along a length thereof.
10. The split insert half of claim 9, wherein:
the slot vent has a depth of less than about 0.04 mm.
11. The split insert half of claim 10, wherein:
the depth of the slot vent is about 0.04 mm and wherein a width of the slot vent is in the range of 1.2 and 1.6 mm.
12. The split insert half of claim 10, wherein:
the depth of the slot vent is about 0.03 mm, and wherein a width of the slot vent is in the range of 0.9 and 1.2 mm.
13. The split insert half of claim 12, wherein:
the width-to-depth ratio is about 33.3.

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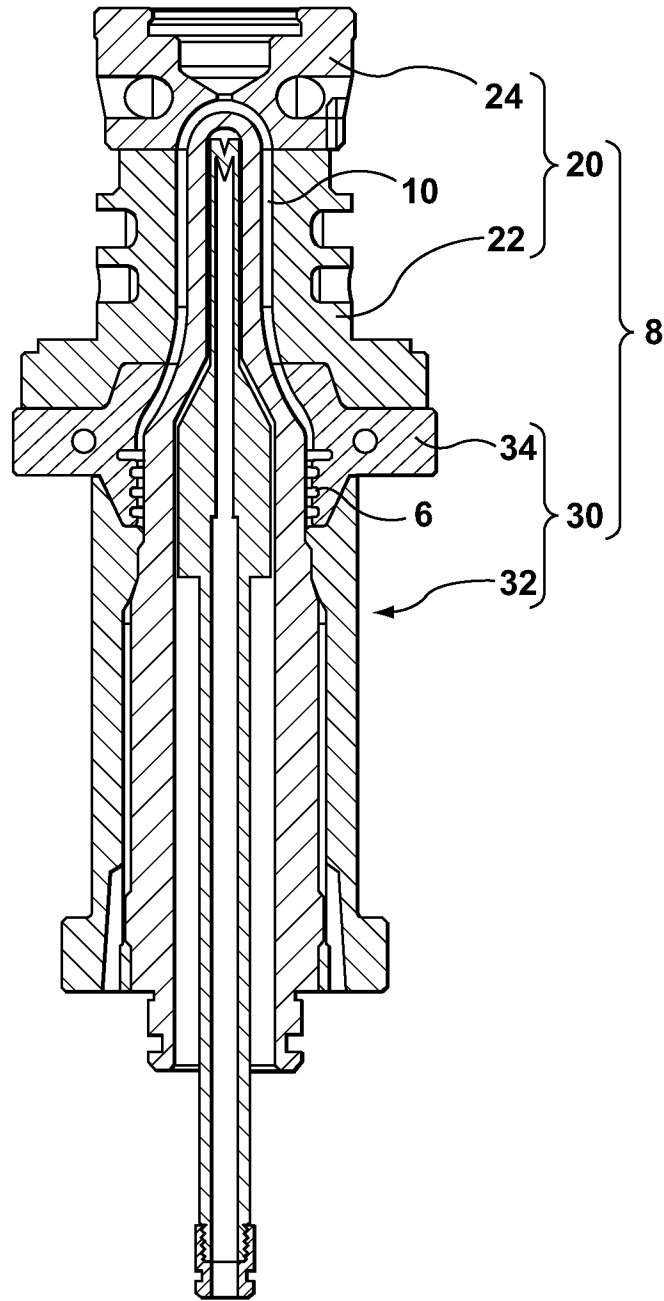


FIG. 1 (PRIOR ART)

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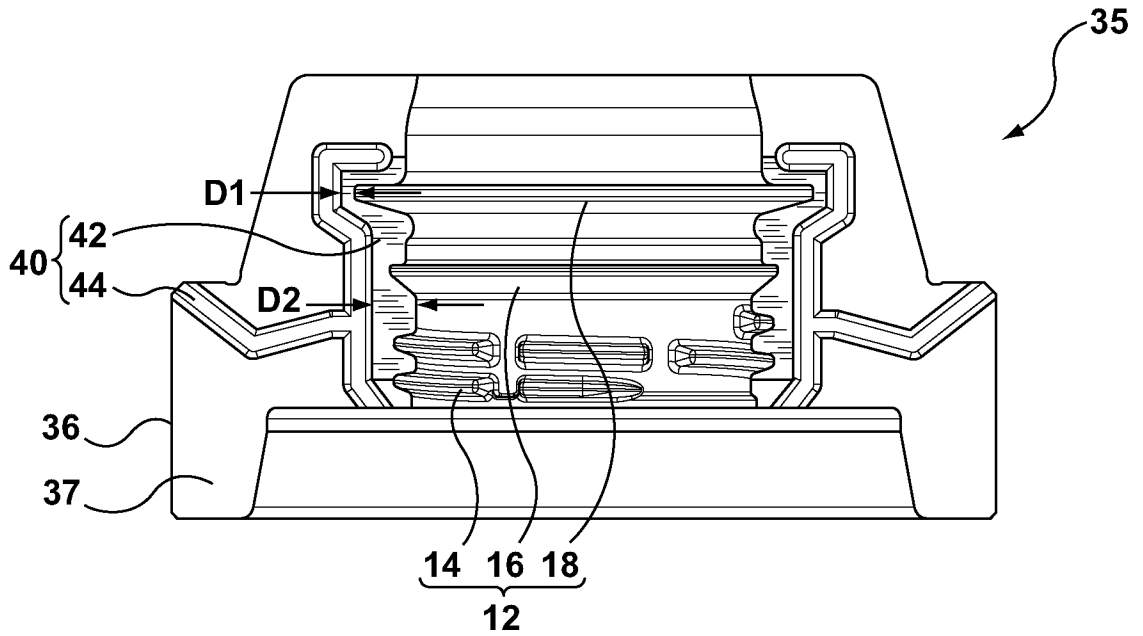


FIG. 2 (PRIOR ART)

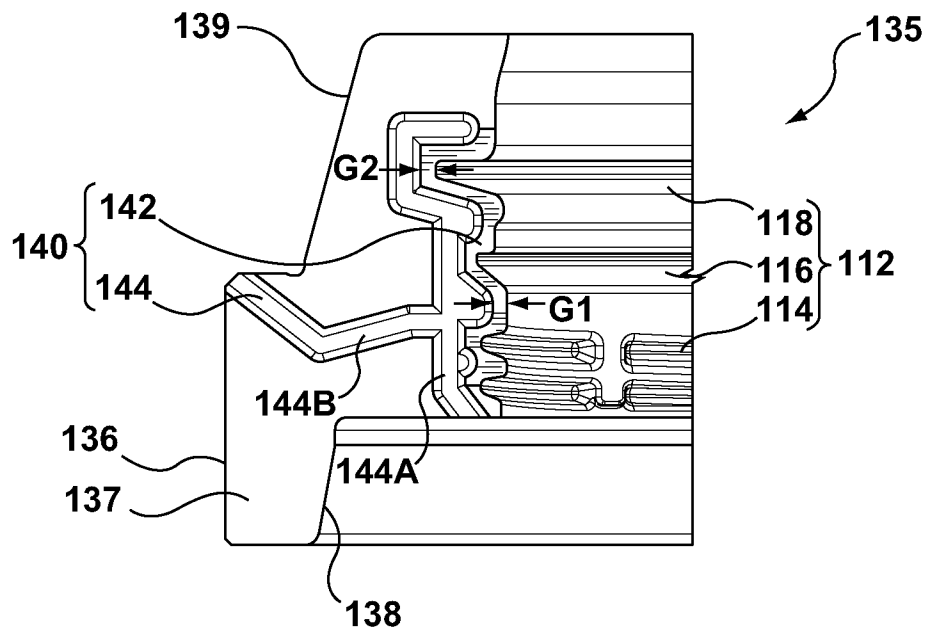


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2012/050318

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC: B29C 45/34 (2006.01) , B29C 45/14 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC</p>		
<p>B. FIELDS SEARCHED</p>		
<p>Minimum documentation searched (classification system followed by classification symbols) IPC: B29C 45/* (2006.01)</p>		
<p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p>		
<p>Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used) EPOQUE (EPODOC and X-FULL), CPD with key words, such as: mold, mould, preform*, core/cavity/split/gate insert*, vent* and gas.</p>		
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	WO 2012/019304 A1 (PAPA, R. et al.) 16 February 2012 (16-02-2012) *whole document*	1-13
A	WO 2010/096892 A1 (MAI, A. et al.) 2 September 2010 (02-09-2010) *whole document*	1-13
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.</p>		
*	Special categories of cited documents :	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	
<p>Date of the actual completion of the international search 14 June 2012 (14-06-2012)</p>		<p>Date of mailing of the international search report 20 June 2012 (20-06-2012)</p>
<p>Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476</p>		<p>Authorized officer Pengfei Zhang (819) 953-0654</p>

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2012/050318

Patent Document Cited in Search Report	Publication Date	Patent Family	Publication Member(s)	Date
WO 2012019304 A1	16 February 2012 (16-02-2012)		None	
WO 2010096892 A1	02 September 2010 (02-09-2010)		None	