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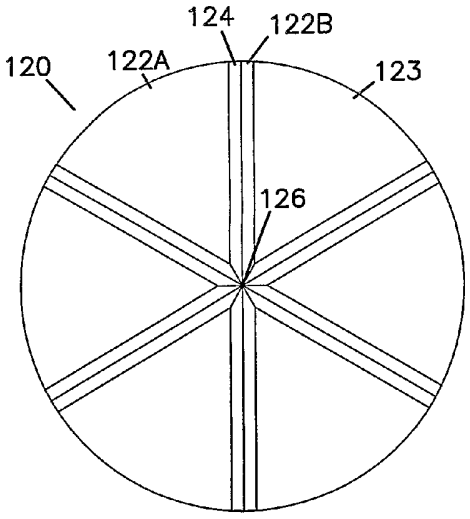
(54) **Title:** PENETRABLE MEMBRANE STRUCTURE AND COUPLER INCORPORATING THE SAME IN A FLUID PATH



(57) **Abstract:** A penetrable membrane structure (120) for incorporation in a flow path of a coupling includes a body having a first face and an opposite second face (123), one of the first and second faces including at least one major portion (122A) and at least one minor portion (122B). The major portion includes a major thickness between the first and second faces that is greater than a minor thickness of the minor portion, and the minor portion forms a channel transversely extending into one of the first or second faces, the channel of the minor portion including sidewalls (124) each adjacent to the major portion. The sidewalls of the channel extend toward each other in a converging configuration.

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PENETRABLE MEMBRANE STRUCTURE AND COUPLER INCORPORATING THE SAME IN A FLUID PATH

This application is being filed as a PCT International Patent application on 09 September 2005, in the name of Colder Products Company, a U.S. national corporation, applicant for the designation of all countries except the U.S., and Charles Peter deCler, a U.S. citizen, applicant for the designation of the U.S. only, and claims priority to U.S. Patent Application Serial No. 60/608,792 filed on September 09, 2004.

TECHNICAL FIELD

Embodiments of the invention relate to penetrable membrane structures for sealing a fluid path in a coupling before use and being puncture ready for enabling flow through the fluid path during use. More particularly, embodiments of the present invention relate to couplers having a penetrable membrane in a fluid path with the principles described.

BACKGROUND

The use of a penetrable membrane as applied to various products is well known. In particular, penetrable membranes have been used in various disposable food product packages such as, for example, juice containers and the like. Typically, such penetrable membranes are disposed over a container opening to seal the same. The penetrable membrane may be broken by using another instrument to puncture through the penetrable membrane, thereby allowing access to contents in the container.

U.S. Patent No. 4,436,125 to Blenkush, commonly assigned with the instant application herein and incorporated by reference, discloses a coupling having an insert that includes a penetrable membrane seal 28. Figures 2A through 2E and Figures 3A through 3E illustrate the penetrable membrane 28 being disposed at one end of the insert and being connectable to a quick connect/disconnect coupling device. The quick connect/disconnect coupling device includes an edge for puncturing the penetrable membrane 28 when connecting the same to the insert, so

as to break a seal provided by the penetrable membrane seal 28. Such a membrane has a thickness of 0.010 to 0.012 inches.

Another configuration of an insert 10 with a penetrable membrane incorporated therein is provided in the penetrable membrane structure 20 of Figure 1A through Figure 4 of the present application. As shown in Figures 1A through 1D, an insert 10 includes ends 12, 14 defining a flow passage 18 therethrough. One end 12 includes the penetrable membrane structure 20 proximately disposed, and the other end 14 includes a fitment structure 16. As illustrated in Figures 2A through 2E, a penetrable membrane 20 includes a body defining first and second sides 21, 23. The penetrable membrane 20 typically is used to seal a flow path such as shown in Figures 1A through 1D and Figures 3A through 3D. The penetrable membrane 20 typically is disposed proximate one end 12 for puncture access thereof. This insert 10 and penetrable membrane 20 also may be used in connection with a quick connect/disconnect coupling device, as disclosed in U.S. Patent 4,436,125. The penetrable membrane 20 usually is formed of an injection molded plastic material, for instance, a low-density polyethylene ("LDPE") material. The body is formed with main portions 22A and minor portions 22B. Six main portions 22A are formed as a symmetrical pie shape radially surrounding a central depression 26 that includes a circumference radially disposed about a central portion. The minor portions 22A are formed as channels converging toward the central depression 26.

As shown in Figures 2B and 2E, the channels extend substantially along a radius of the body toward the central depression 26, and transversely extend into the second side 23, so as to form the minor portions 22B having a thickness less than the thickness of the major portions 22A. The minor portions 22B define channels that each have a planar surface formed by vertical sidewalls that extend transversely toward the first side 21. The minor portions 22B each include bridge portions 24 typically formed during the molding process, so as to connect molded product formed in the channels. As conventionally manufactured, the channels of the minor portions 22B are formed, whereby the molded product converges toward a center of the planar surface in each channel to form bridge portions 24 and toward the central depression 26 to form a center portion 28. While the central depression 26 may have a thickness similar to the minor portions 22B, the bridge portions 24 and center portion 28 each have a greater thickness than the minor portions 22B and may have a greater thickness than the major portions 22A.

Dimensionally, the major portions 22A each may include sections being spaced about 60 degrees apart, and a molded thickness of 0.010 ± 0.001 or 0.002 inches. The minor portions 22B may include a molded thickness of 0.006 ± 0.001 inches. The bridge portions 24 each typically form a 30 degree wedge extending outward from the second side 23. The bridge portions 24 each may include a width of about 0.009 inches and a height of about 0.019 inches. The center portion 28 may include a diameter of about 0.056 inches and a thickness of about 0.034 inches. The central depression 26 may include a diameter of about 0.080 inches and a thickness being substantially similar to the thickness of the minor portions 22B. The penetrable membrane diameter 20 may include a total diameter of about 0.257 inches.

In the injection molding process forming the penetrable membrane 20, a mold tool 30 illustrated in Figure 4 typically is employed. The mold tool 30 includes various molding sections on a molding body 32. The major mold section 32A and minor mold sections 32 respectively form the major and minor portions 22A, 22B. The bridge portions 24 may be formed as receding wedge shaped portions through bridging sections 34 of the mold tool 30. The bridge part 34 molds a connection seam for the converging molded planar channel surface of each minor portion 22B. The bridges 24 thus form a wedge or thick seam of converged molded product within the channels of the minor portions 22B. Mold section 36 enables mold product to form toward the center of the tool 30, so as to form the central depression 26. In order to close up the penetrable membrane 20, mold section 38 is employed for connecting the centrally converging channels of the minor portions 22B at the central portion 28. The central portion 28 thus is a collection of converged or "balled up" molded product, thereby forming a thick center.

The above penetrable membrane arrangements, however, have several limitations. Such limitations in these previous designs include manufacturing shortcomings that also have resulted in performance problems when such penetrable membranes are in use.

For example, membrane thickness through the thinnest areas (the pie shaped cuts designed to tear) has been limited to 0.007 inches, when using the LDPE material. The force required for rupturing the membrane with, for example, a mating coupler body, has exceeded 20 lbs. In such bag-in-box product applications, such a required force can be considered excessive.

Such previous designs, as described above, have encountered problems during the injection molding process, wherein the minor portions 22B and central depression 26 included excessive distances for the injection molding to form the thinner wall portions. The LDPE material has had a tendency to cool and solidify as it flowed under pressure into the thin wall areas of the membrane, such as the minor portions 22B and the central depression. Such a membrane structure has caused incomplete molding and pinhole leaks in the membrane at the thin wall areas when using typical molding techniques. In order to promote flow of the LDPE material during the molding process and compensate for these larger distances, excessively high temperatures for the LDPE material (370 degrees F) and mold tool temperatures (120 degrees F) were required. Likewise, injecting, packing and holding pressures have become excessive.

As a result, such high temperatures and pressures can have the effect of burning the LDPE material, degrading the material, and may cause excessive flash on the finished part. Additionally, high pressures and temperatures cause unanticipated thermal and mechanical distortion of the mold tool, and can result in dimensional non-conformance of the finished part. Finally, the requirement of higher temperatures and pressures have required longer molding cycle times, which results lower production rates and increased costs of the molded article.

SUMMARY

Embodiments of the invention relate to penetrable membrane structures for sealing a fluid path in a coupling before use and being puncture ready for enabling flow through the fluid path during use. More particularly, embodiments of the present invention relate to couplers having a penetrable membrane in a fluid path with the principles described.

According to one aspect, a penetrable membrane structure for incorporation in a flow path of a coupling includes a body having a first face and an opposite second face, one of the first and second faces including at least one major portion and at least one minor portion, the major portion including a major thickness, defined between the first and second faces, that is greater than a minor thickness of the minor portion, and the minor portion forming a channel transversely extending into one of the first or second faces, the channel of the minor portion

including sidewalls each adjacent to the major portion. The sidewalls of the channel extend toward each other in a converging configuration.

According to another aspect, an insert configured to be coupled to a coupling device includes an insert body including a first end and a second end and defining a flow passage therethrough, the first end including a fitment structure. The insert further includes a penetrable membrane coupled at an opening defined at the second end of the insert body, the penetrable membrane being configured to seal the opening and to be punctured by the coupling device to allow flow through a fluid path between the insert and the coupling device. The penetrable membrane includes a body having a first face and an opposite second face, one of the first and second faces including at least one major portion and at least one minor portion, the major portion including a major thickness, defined between the first and second faces, that is greater than a minor thickness of the minor portion, and the minor portion forming a channel transversely extending into one of the first or second faces, the channel of the minor portion including sidewalls each adjacent to the major portion. The sidewalls extend toward each other in a converging configuration.

According to another aspect, a method of forming a penetrable membrane structure includes: providing a mold tool, the mold tool comprising a plurality of major mold sections each separated by a minor mold section, wherein each of the minor mold sections extends to a single central junction, and wherein each of the minor mold sections includes first and second surfaces converging at an angle with respect to one another; and injecting plastic material to form the penetrable membrane structure using the mold tool.

These and other various advantages and features of novelty are pointed out in the following detailed description. Reference should also be made to the drawings, which form a further part hereof, and to accompanying descriptive matter, in which there are illustrated and described specific example embodiments.

DESCRIPTION OF THE DRAWINGS

Like reference numbers generally indicate corresponding elements in the Figures.

Figure 1A represents a perspective view of an insert having a penetrable membrane seal of the prior art.

Figure 1B represents an elevational side view of the insert having a penetrable membrane seal illustrated in Figure 1A.

Figure 1C represents another elevational side view of the insert having a penetrable membrane seal illustrated in Figure 1A.

Figure 1D represents a rear end view of the insert having a penetrable membrane seal illustrated in Figure 1A.

Figure 2A represents a rear face view of the penetrable membrane of Figures 1A-1D.

Figure 2B represents a front face view of the penetrable membrane of Figures 1A-1D.

Figure 2C represents a sectional view of the penetrable membrane of Figures 1A-1D taken from line A-A from Figure 2B.

Figure 2D represents a sectional view of the penetrable membrane seal of Figures 1A-1D taken from line B-B from Figure 2B.

Figure 2E represents a sectional view of the penetrable membrane seal of Figures 1A-1D taken from line C-C from Figure 2B.

Figure 3A represents an elevational side view of the insert having a penetrable membrane seal illustrated in Figures 1A-1D.

Figure 3B represents a front end view of the insert having a penetrable membrane seal as illustrated in Figures 1A-1D.

Figure 3C represents a partial sectional view of the insert having a penetrable membrane seal taken from line B-B from Figure 3A.

Figure 3D represents a partial sectional view of the insert having penetrable membrane seal taken from line C-C from Figure 3C.

Figure 3E represents a partial sectional view of the penetrable membrane taken from line D-D from Figure 3C.

Figure 4 represents a molding tool for a penetrable membrane of the prior art.

Figure 5A represents a perspective view of one embodiment of an insert having a penetrable membrane seal in accordance with principles of the present invention.

Figure 5B represents an elevational side view of the insert having a penetrable membrane seal illustrated in Figure 5A.

Figure 5C represents another elevational side view of the insert having a penetrable membrane seal illustrated in Figure 5A.

Figure 5D represents a rear end view of the insert having a penetrable membrane seal illustrated in Figure 5A.

Figure 6A represents a rear face view of one embodiment of the penetrable membrane shown in Figures 5A-5D.

Figure 6B represents a front face view of the penetrable membrane of Figures 5A-5D.

Figure 6C represents a sectional view of the penetrable membrane of Figures 5A-5D taken from line A-A from Figure 6B.

Figure 6D represents a sectional view of the penetrable membrane seal of Figures 5A-5D taken from line B-B from Figure 6B.

Figure 6E represents a sectional view of the penetrable membrane seal of Figures 5A-5D taken from line C-C from Figure 6B.

Figure 7A represents an elevational side view of the insert having a penetrable membrane seal illustrated in Figures 5A-5D.

Figure 7B represents a front end view of the insert having a penetrable membrane seal as illustrated in Figures 5A-5D.

Figure 7C represents a partial sectional view of the insert having a penetrable membrane seal taken from line B-B from Figure 7A.

Figure 7D represents a partial sectional view of the insert having penetrable membrane seal taken from line D-D from Figure 7C.

Figure 8 represents a perspective view of one embodiment of a molding tool for a penetrable membrane in accordance with principles of the present invention.

DETAILED DESCRIPTION

One example embodiment of a penetrable membrane structure 120 is provided in Figures 5A through Figure 7D. The penetrable membrane structure may be incorporated within an insert 110, such as an insert as provided in Figures 1A through 1D. As shown in Figures 5A through 5D, insert 110 includes ends 112, 114 defining a flow passage 118 therethrough. One end 112 may be shown illustrated having the penetrable membrane structure 120 proximately disposed, and the other end 114 may be formed of a fitment structure 116. As one example configuration

only, the fitment 116 may be a flanged portion at end 114. It will be appreciated the fitment may be other suitable configurations such as but not limited to a welded flange, barbed or threaded end. Inserts are well known and are not further detailed.

In Figures 6A through 6E, a penetrable membrane structure 120 includes a body defining first and second sides 121, 123. The penetrable membrane 120 typically is used to seal a flow path in an insert 110, such as shown in Figures 5A through 5D and Figures 7A through 7C. The penetrable membrane structure typically is disposed proximate one end 112 for puncture access thereof. In the example shown, the penetrable membrane structure 120 is formed of an injection molded plastic material, such as but not limited to a low-density polyethylene LDPE material. The body is formed with main portions 122A and minor portions 122B. The penetrable membrane structure is illustrated with six main portions 122A and six minor portions 122B formed as a symmetrical pie shape, and radially surrounding a central junction 126. The minor portions 122A are formed as channels converging toward the central junction 126. While six of each major portion and minor portion are illustrated, it will be appreciated that such configuration is merely provided as an example, as other configurations may be suitable. Other configurations may include, but are not limited to, more or less major and/or minor portions, which may or may not be arranged and constructed in a symmetrical fashion.

As shown in Figures 6A, 6B and 6E, the channels extend substantially along a radius of the body toward the central junction 126, and transversely extend into the second side 123 so as to form the minor portions 122B. The minor portions 122B include a thickness that is less than the thickness of the major portions 122A. It will be appreciated that the major and minor portions 122A, 122B, may be as suitably formed on the first side 121, and that the major and minor portions are illustrated on the second side 123 as an example embodiment only. The minor portions 122B define channels having opposing sidewalls 124 that, in the example shown, are adjacent the major portions 122A. The sidewalls 124 extend from the second side 123 toward the first side 121, and are formed such that molded product may fill an area defined by each channel toward end points where the sidewalls 124 end. The sidewalls 124 are arranged in a converging configuration so to minimize a distance that a molding material needs to fill between the sidewalls 124. As shown in an example embodiment, the sidewalls 124 converge or are

beveled to meet at a single point, so as to form a wedge shaped channel, such that there is little or no distance between the sidewalls 124. It will be appreciated that other configurations for minimizing the distance between the sidewall portions may be employed, and may or may not include eliminating any distance therebetween. For example, the sidewalls 124 may be, but are not limited to an arrangement having a trapezoidal or arcuate configuration (not shown), such that sidewalls may be converging, however, the sidewalls may or may not come to a single point.

In the illustrated embodiments, the major portions 122A each may include sections spaced about 60 degrees apart, and a molded thickness of 0.020 ± 0.002 inches. The minor portions 122B may include a molded thickness of 0.003 ± 0.001 inches. The thickness of the minor portions 122B is defined from an endpoint of the converging sidewalls 124 to the other of the first or second face. The channels of the minor portions 122A may include wedge portions formed at a 90 degree angle. The penetrable membrane structure may include a total diameter of about 0.257 inches. In another example, the penetrable membrane structure may include a total diameter of about between 1.22 and 1.26 inches.

In the injection molding process forming the penetrable membrane 120, a mold tool 230 illustrated in Figure 8 may be employed. The mold tool 230 includes various molding sections on molding body 232. The major mold section 232A and minor mold sections 232 respectively form the major and minor portions 122A, 122B. Mold section 236 enables mold product to form toward the center of the tool 230, so as to form the central junction 126. In order to close up the penetrable membrane 20, mold sections 232A, 232B and 236 provide a mold tool 230 having minimized distances between wall sections, particularly between the sidewalls of the minor portion channels and at the central junction. The central junction 126 is structured such that the channels meet towards a single point to minimize an area occupied by the central junction 126. In this configuration, optimum mold pressures and temperatures can be readily used for injection molding of the penetrable membrane structure 120.

The penetrable membrane structure 120 provides a membrane thickness through the thinnest walls that can be achieved as low as 0.002 inches, while using molding process parameters that generally fall within a material manufacturer's recommendations. Achieving a thinner wall of 0.003 ± 0.001 inches compared to 0.007 inches in previous designs is desirable since it reduces the force

required to rupture the membrane. A reduced force is desirable since it makes it easier for a user to interconnect a mating coupler or connector body. In one example, the force required to rupture the redesigned membrane is approximately 14 lbs., providing for at least a 30 % reduction in force as compared to previous designs. Material and tool temperatures may average 50 degrees F lower than that required in previous designs.

The penetrable membrane structure 120 further avoids pinhole leaks, and the risk of burning the material during injection molding is substantially reduced. Additionally, the cycle time can be reduced by 1/3 (as much as from 30 seconds to 20 seconds), thereby reducing the cost of manufacturing the membrane structure. The penetrable membrane structure provides improved quality due to the greater consistency of the molded parts that are not subjected to the stresses of higher temperatures and pressures. Since the mold tool runs within temperatures contemplated for the mold tool, the penetrable membrane structure can conform to desired dimensional specifications.

It is noted that, although the penetrable membrane as described herein is suited for use in an insert for a coupling device, penetrable membrane structures in accordance with the principles of the present invention may be suitable for incorporation into larger assemblies, including but not limited to a fluid dispensing system, such as but not limited to bag-in-box dispensing applications. Further, the penetrable membrane structure is also suitable for incorporation as a puncture seal in couplings providing part-free sealing surfaces.

The above specification provides a complete description of the composition, manufacture and use of the improved penetrable membrane in accordance with the principles of the present invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

What is claimed is:

1. A penetrable membrane structure for incorporation in a flow path of a coupling, the penetrable membrane structure comprising:

a body having a first face and an opposite second face, one of the first and second faces including at least one major portion and at least one minor portion, the major portion including a major thickness, defined between the first and second faces, that is greater than a minor thickness of the minor portion, and the minor portion forming a channel transversely extending into one of the first or second faces, the channel of the minor portion including sidewalls each adjacent to the major portion;

wherein the sidewalls of the channel extend toward each other in a converging configuration.

2. The penetrable membrane structure of claim 1, further comprising a plurality of major portions.

3. The penetrable membrane structure of claim 1, further comprising a plurality of minor portions, wherein each of the minor portions extends to a central junction of the body of the penetrable membrane structure.

4. The penetrable membrane structure of claim 1, wherein the major thickness of the major portion is 0.012 ± 0.002 inches.

5. The penetrable membrane structure of claim 1, wherein the minor thickness of the minor portion is 0.003 ± 0.001 inches.

6. The penetrable membrane structure of claim 1, wherein the minor thickness of the minor portion is defined from an end point of the converging sidewalls extending into one of the first or second face to the other one of the first and second faces.

7. The penetrable membrane structure of claim 1, wherein the sidewalls of the channel are formed as converging beveled wall portions.

8. The penetrable membrane structure of claim 1, wherein the sidewalls of the channel converge to a single point in a wedge shape.

9. The penetrable membrane structure of claim 8, wherein one of the sidewalls of the wedge shape extends at a ninety degree angle with respect to another of the sidewalls.

10. An insert configured to be coupled to a coupling device, the insert comprising:

an insert body including a first end and a second end and defining a flow passage therethrough, the first end including a fitment structure; and

a penetrable membrane coupled at an opening defined at the second end of the insert body, the penetrable membrane being configured to seal the opening and to be punctured by the coupling device to allow flow through a fluid path between the insert and the coupling device, wherein the penetrable membrane includes:

a body having a first face and an opposite second face, one of the first and second faces including at least one major portion and at least one minor portion, the major portion including a major thickness, defined between the first and second faces, that is greater than a minor thickness of the minor portion, and the minor portion forming a channel transversely extending into one of the first or second faces, the channel of the minor portion including sidewalls each adjacent to the major portion;

wherein the sidewalls extend toward each other in a converging configuration.

11. The insert of claim 10, wherein the penetrable membrane structure further comprises:

a plurality of major portions; and

a plurality of minor portions, wherein each of the minor portions extends to a central junction of the body of the penetrable membrane structure.

12. The insert of claim 10, wherein the major thickness of the major portion is 0.012 ± 0.002 inches.

13. The insert of claim 10, wherein the minor thickness of the minor portion is 0.003 ± 0.001 inches.

14. The insert of claim 13, wherein the sidewalls of the channel of the penetrable membrane structure converge to a single point in a wedge shape, wherein one of the sidewalls of the wedge shape extends at a ninety degree angle with respect to another of the sidewalls.

15. The insert of claim 10, wherein the sidewalls of the channel of the penetrable membrane structure converge to a single point in a wedge shape, wherein one of the sidewalls of the wedge shape extends at a ninety degree angle with respect to another of the sidewalls.

16. A method of forming a penetrable membrane structure, the method comprising:

providing a mold tool, the mold tool comprising a plurality of major mold sections each separated by a minor mold section, wherein each of the minor mold sections extends to a single central junction, and wherein each of the minor mold sections includes first and second surfaces converging at an angle with respect to one another; and

injecting plastic material to form the penetrable membrane structure using the mold tool.

17. The method of claim 16, wherein providing further comprises forming each of the minor mold sections of the mold tool so that a minor thickness of the penetrable membrane structure is 0.003 ± 0.001 inches.

18. The method of claim 17, wherein providing further comprises forming each of the minor mold sections so that the first surface converges at a ninety degree angle with respect to the second surface.

19. The method of claim 16, wherein providing further comprises forming each of the minor mold sections so that the first surface converges at a ninety degree angle with respect to the second surface.

20. The method of claim 16, wherein injecting further comprises injecting a low-density polyethylene to form the penetrable membrane structure using the mold tool.

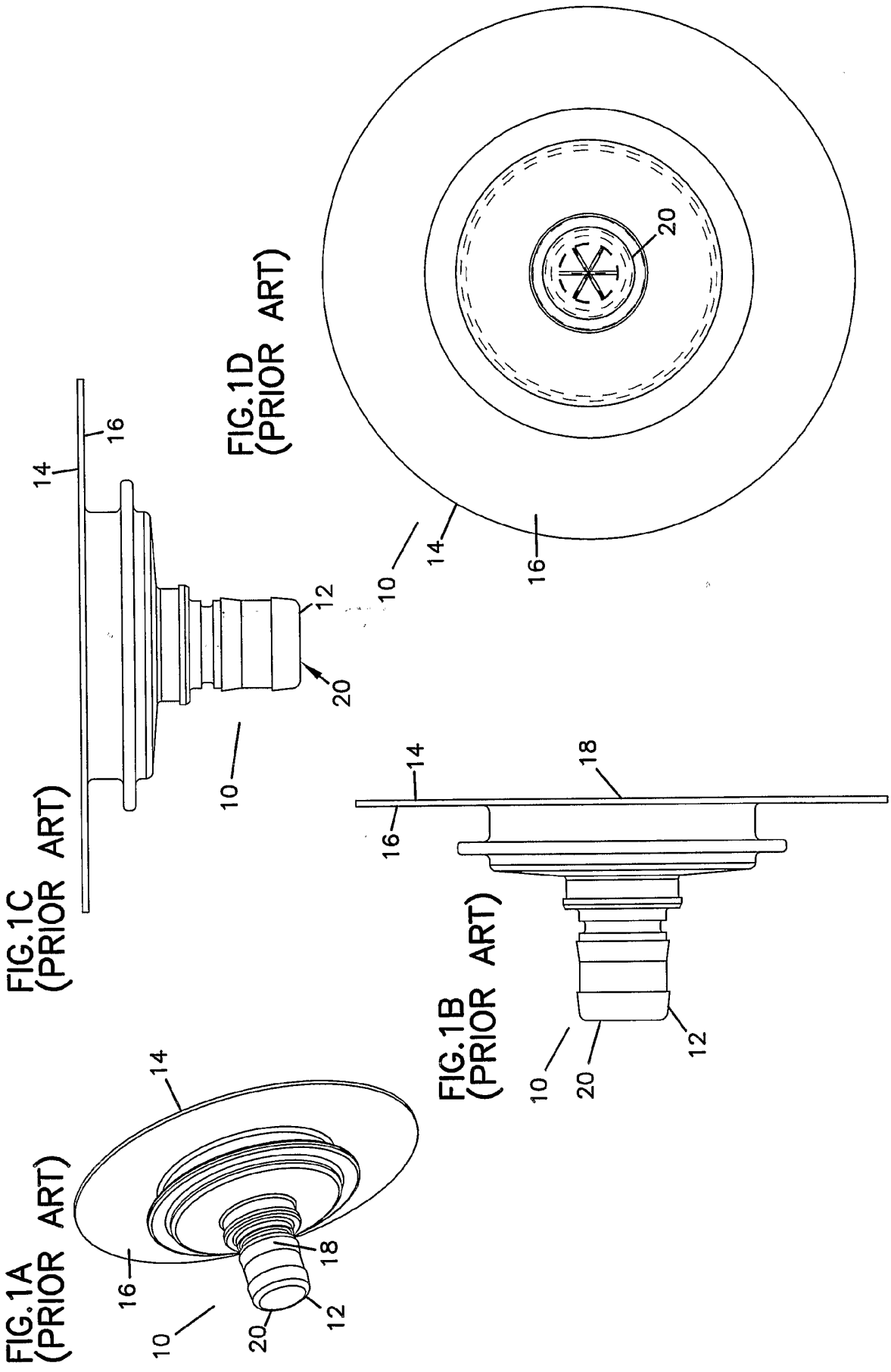
FIG.1A (PRIOR ART)
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16
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FIG.1B (PRIOR ART)
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FIG.1C (PRIOR ART)
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FIG.1D (PRIOR ART)
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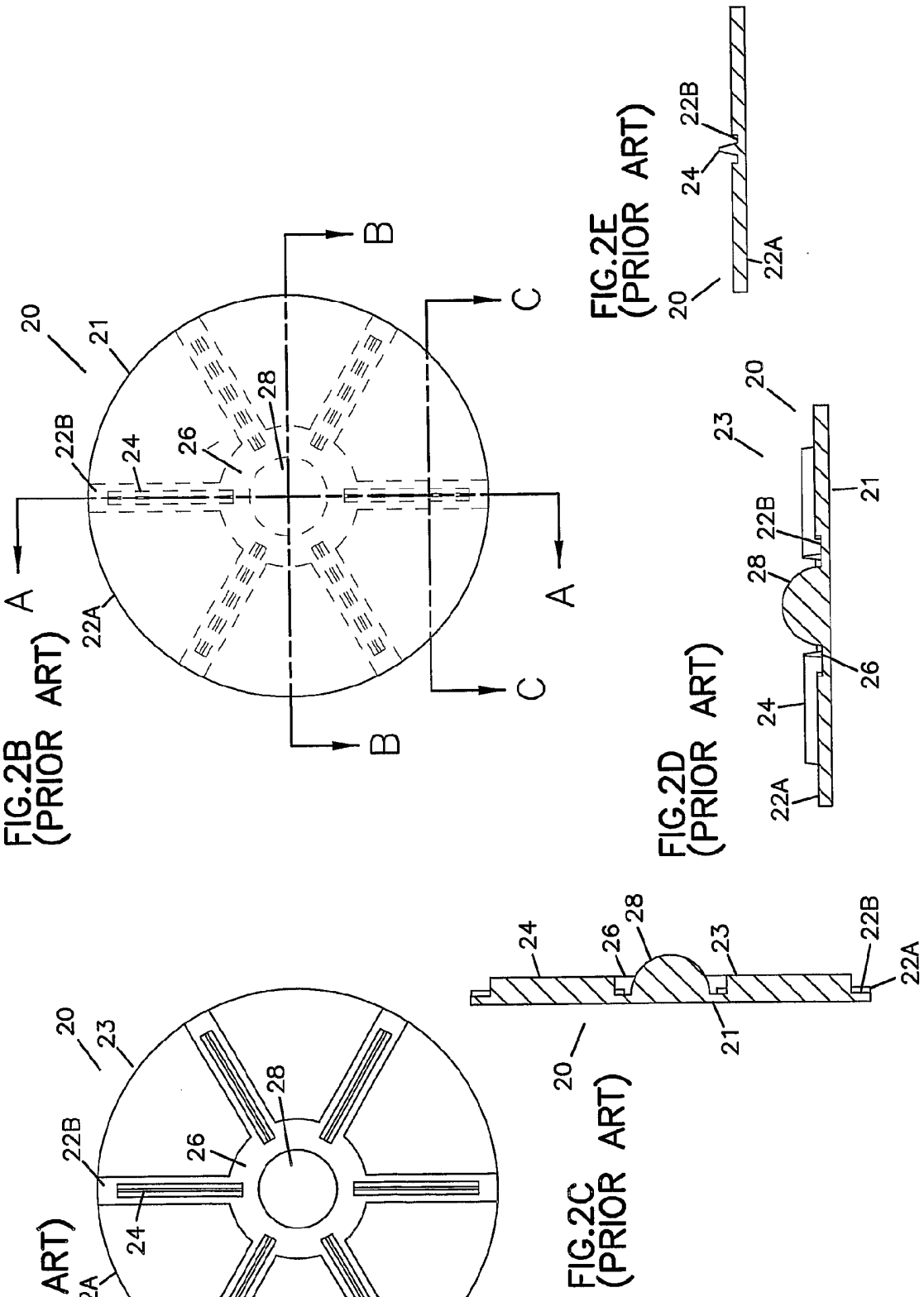

FIG.2A (PRIOR ART)

FIG.2B (PRIOR ART)

FIG.2C (PRIOR ART)

FIG.2D (PRIOR ART)

FIG.2E (PRIOR ART)

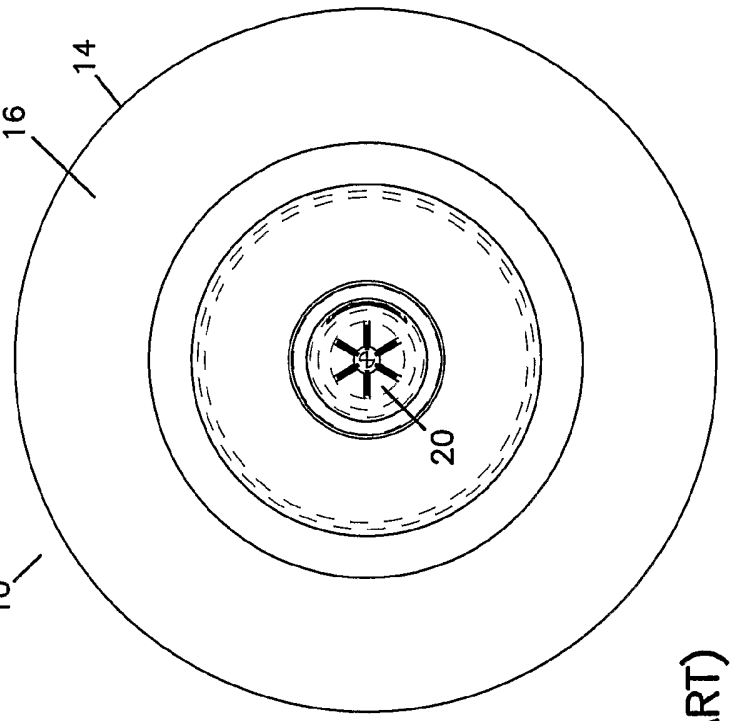

FIG.3B (PRIOR ART)

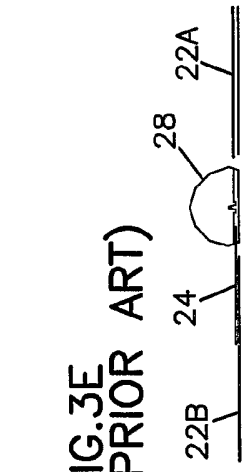

FIG.3E (PRIOR ART)

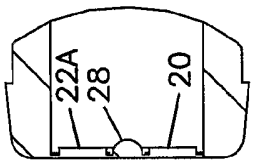

FIG.3D (PRIOR ART)

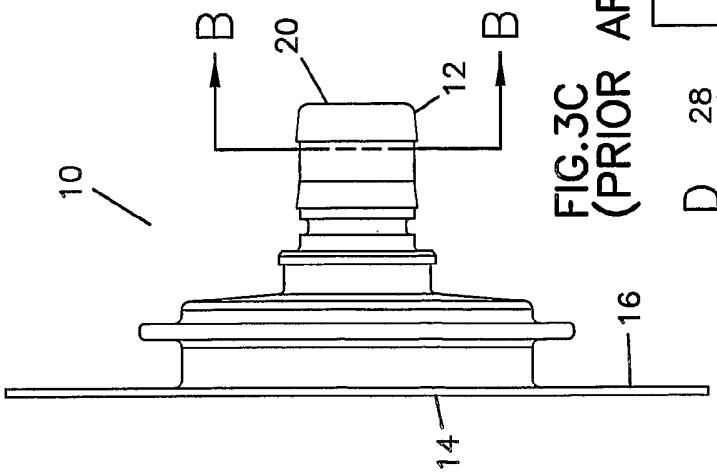

FIG.3A (PRIOR ART)

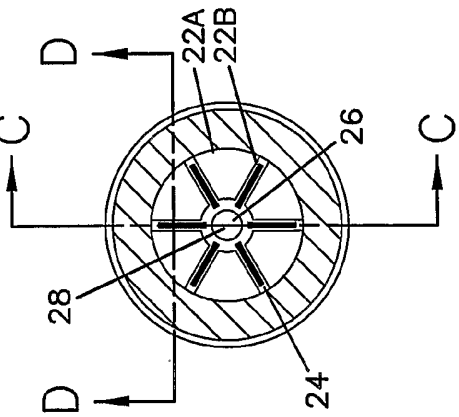

FIG.3C (PRIOR ART)

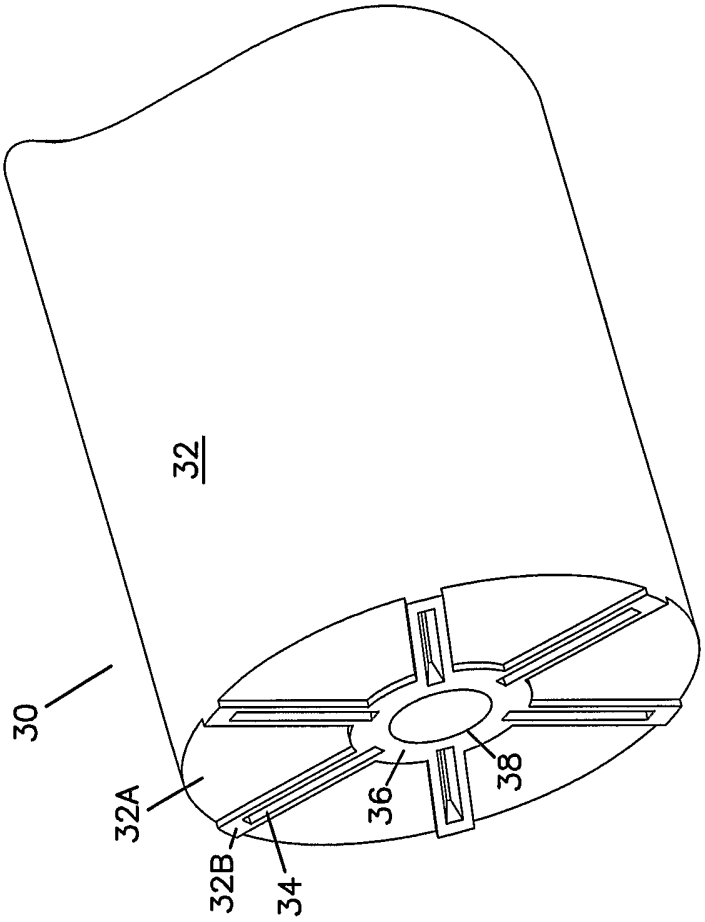

FIG.4 (PRIOR ART)

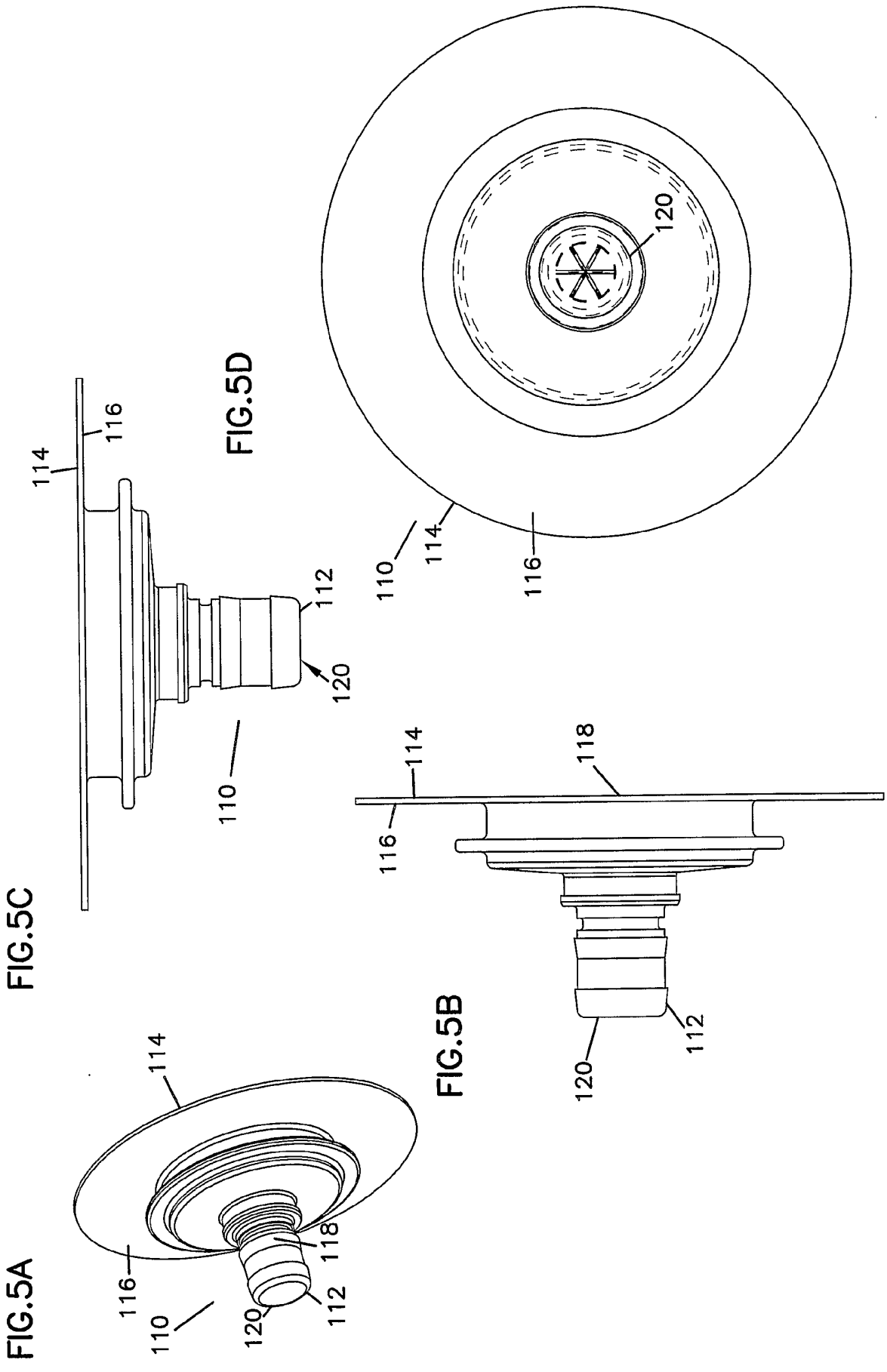
FIG.5A
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FIG.5B
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FIG.5C
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FIG.5D
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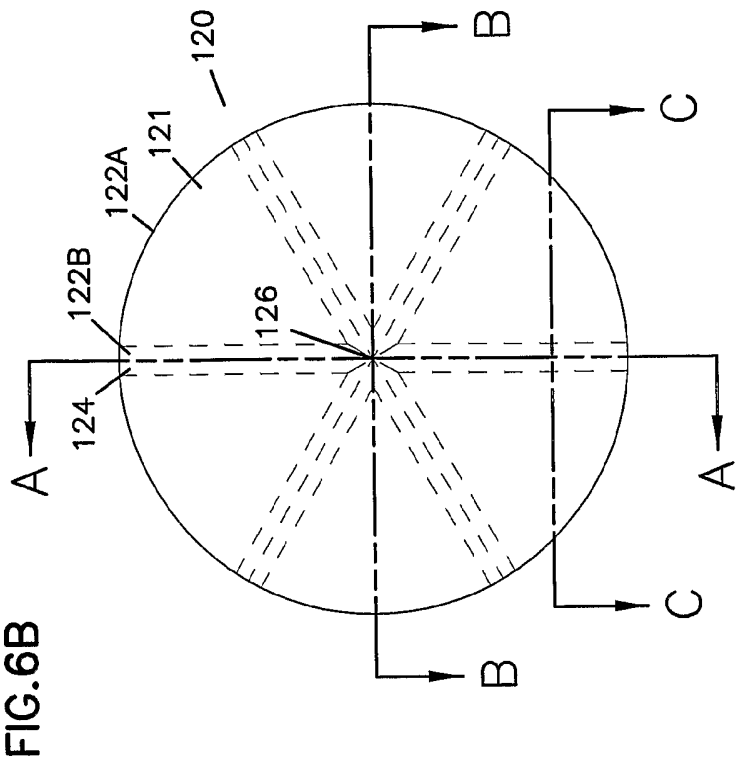

FIG.6B

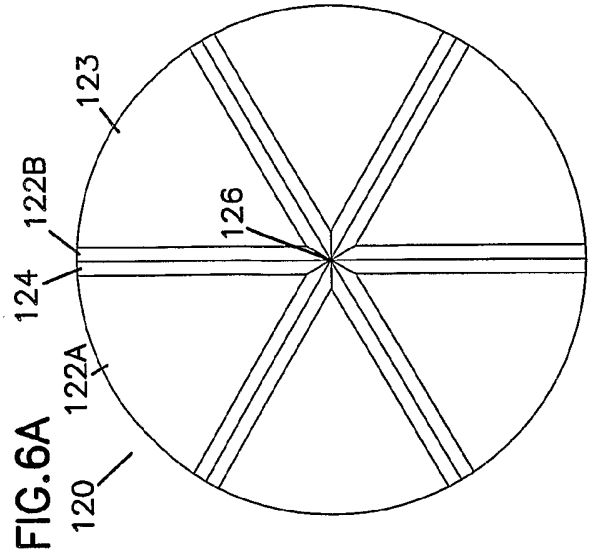

FIG.6A

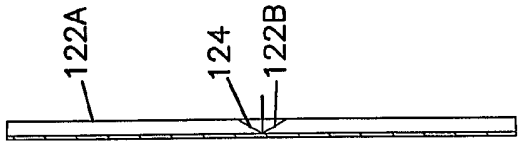

FIG.6C

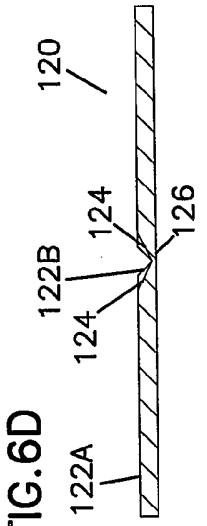

FIG.6D

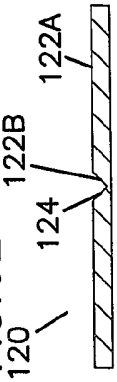

FIG.6E

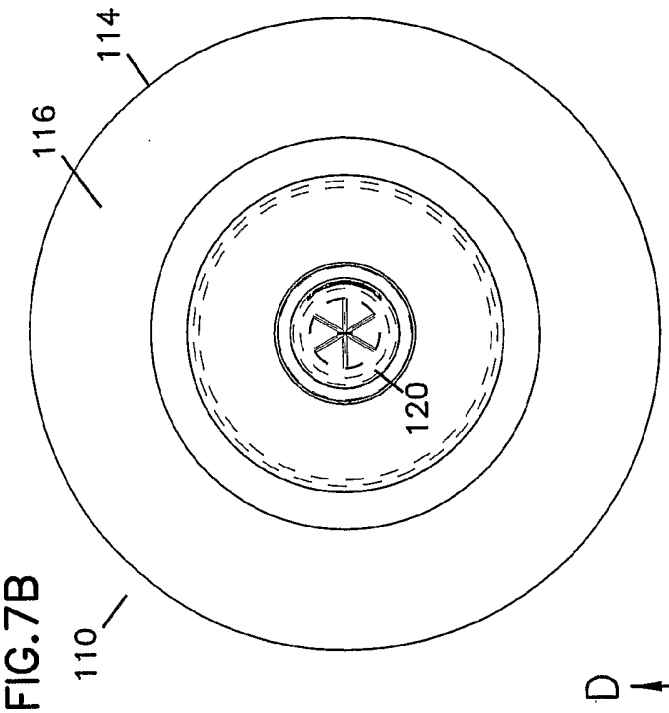

FIG.7B

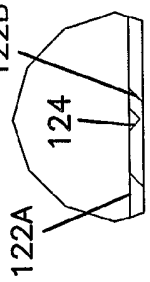

FIG.7D

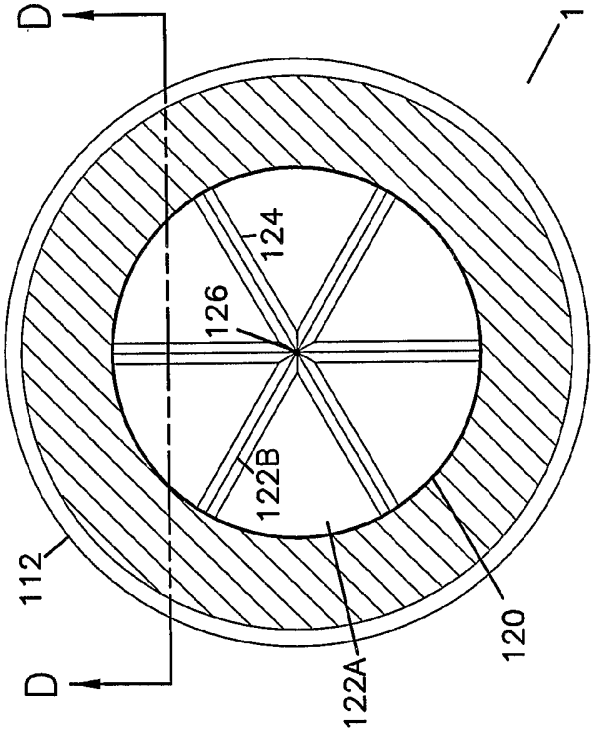

FIG.7C

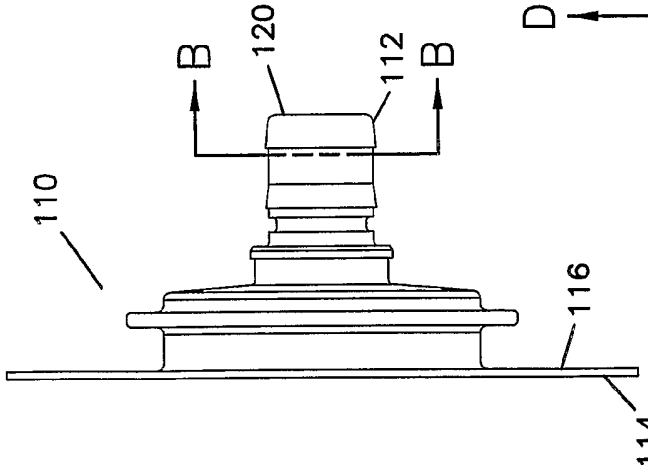

FIG.7A

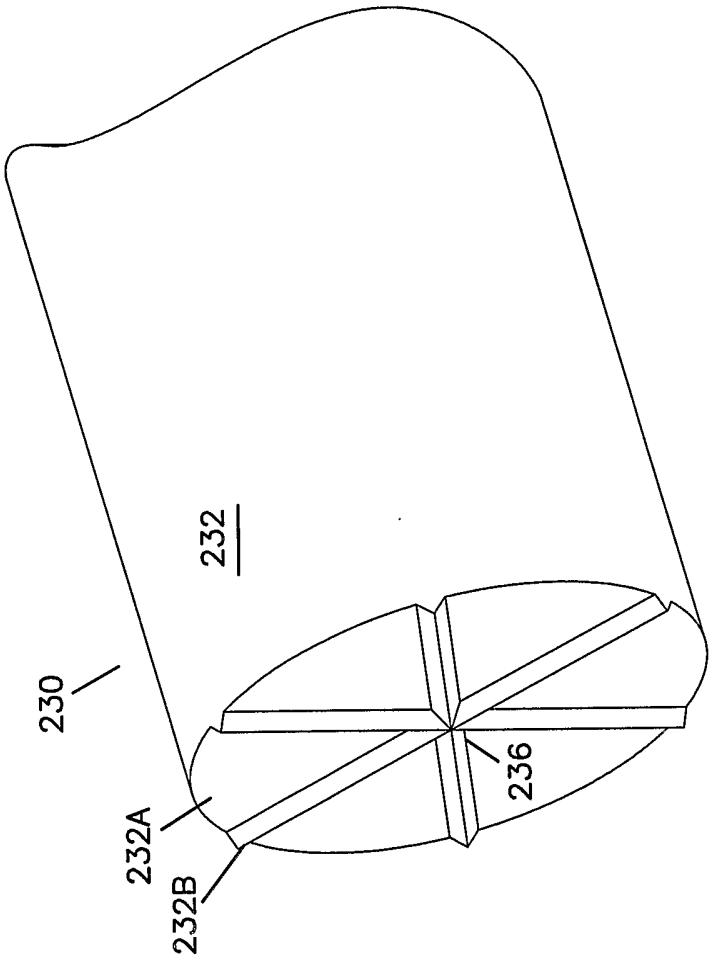

FIG.8

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/US2005/031765

A. CLASSIFICATION OF SUBJECT MATTER
F16L29/00 B65D51/00

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)
F16L 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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 746 023 A (BELTER ET AL) 24 May 1988 (1988-05-24)	1-3,6-9
Y	column 1, line 26 - line 37 column 1, line 63 - column 2, line 62 column 3, line 18 - line 49 claims 1,3,6,9-11,18 figures	13,14
X	FR 2 656 404 A (HUTCHINSON SA) 28 June 1991 (1991-06-28)	1-3,6, 10-13
Y	page 1, line 14 - line 23 page 2, line 14 - line 35 page 5, line 24 - page 6, line 6 claim 1 figures 1-5	13,14

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 December 2005	21/12/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Jankowska, M

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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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X	GB 2 386 115 A (THE * ENTERPRISE CRADLE LIMITED) 10 September 2003 (2003-09-10) page 1, line 25 - page 3, line 21 page 10, line 17 - page 14, line 2 figures 2,17-20	1-3, 7-11,14, 15
X	US 3 201 148 A (SHURTLEFF LOUIS CHARLES) 17 August 1965 (1965-08-17) column 1, line 7 - line 10 column 1, line 22 - line 67 column 2, line 9 - column 3, line 26 column 3, line 69 - column 4, line 55 figures	1-3,10, 11
X	US 6 029 981 A (HAWLEY ET AL) 29 February 2000 (2000-02-29) column 1, line 44 - column 2, line 5 column 2, line 33 - line 49 column 2, line 66 - column 3, line 55 figures 1,3-6	1-3, 6-11,14, 15

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Information on patent family members

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