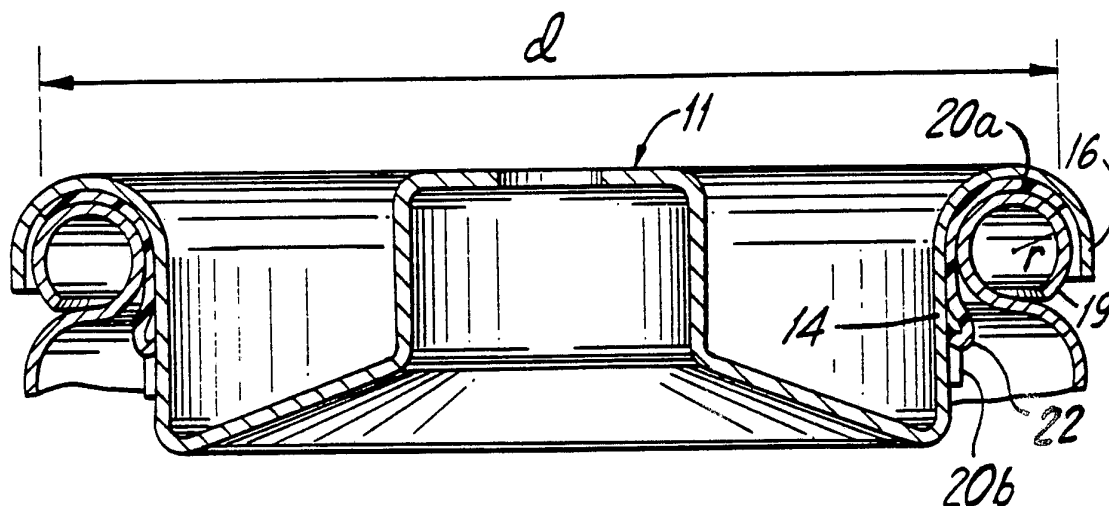




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : B65D 39/04</p>	<p>A1</p>	<p>(11) International Publication Number: WO 93/12982 (43) International Publication Date: 8 July 1993 (08.07.93)</p>
<p>(21) International Application Number: PCT/US92/11186 (22) International Filing Date: 23 December 1992 (23.12.92) (30) Priority data: 07/814,370 26 December 1991 (26.12.91) US (71) Applicant: PRECISION VALVE CORPORATION [US/US]; 700 Nepperhan Avenue, Yonkers, NY 10702 (US). (72) Inventor: RADTKE, Charles, S. ; 37 Beach Street, Little Ferry, NJ 07643 (US). (74) Agents: SKLAR, Brandon, N. et al.; Davis Hoxie Faithfull & Hapgood, 45 Rockefeller Plaza, Suite 2800, New York, NY 10111 (US).</p>		<p>(81) Designated States: AU, BR, CA, FI, JP, KR, NO, RU, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i></p>

(54) Title: A DIMPLED GASKET



(57) Abstract

A gasket (20) for sealing a channel (15) of a mounting cup (11) to a container bead (19) includes at least one dimple (22) at an end of the gasket (20) for retaining the mounting cup (11) in position on the container bead (19) prior to clinching. Six such dimples (22) can be equidistantly positioned about the gasket (20). A gasketed mounting cup including such dimples is also disclosed. A method for manufacturing such a gasketed mounting cup is disclosed as well.

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A DIMPLED GASKETBackground

Aerosol dispensing containers have found widespread use in the packaging of fluid materials including a variety of both liquid and powdered particulate products. Such containers are provided with a valve-controlled discharge orifice and operate by the action of a volatile propellant which is confined within the container together with the product to be dispensed. Because the propellant has an appreciable vapor pressure at room temperature, the product in the closed container is maintained under superatmospheric pressure.

A typical aerosol unit comprises a hollow cylindrical container which is tightly closed at one end and is provided with an opening at its opposite end for receiving a dispensing valve assembly. A closure, commonly referred to as a mounting cup, serves as the closure for the container and as a support for the valve assembly. Typically, the mounting cup comprises a pedestal portion for mounting the valve unit, a panel portion extending from the pedestal portion, a skirt portion depending from the periphery of the panel, and an annular channel portion extending outwardly from the skirt. When the mounting cup is placed in sealing position on the container, the channel is positioned over the bead surrounding the container opening and the lower portion of the skirt adjacent to the channel is flared or clinched outwardly against the underside of the bead. To

ensure adequate sealing between the closure and the container, the cup is provided with a gasket in the channel, or predominantly in the channel, of the cup.

In United States Patent Nos. 4,546,525 ("the 525
5 patent") and 4,547,948 ("the 948 patent"), a novel gasketed mounting cup system, including novel method and apparatus, is described wherein the gasket material is disposed on the mounting cup in the preferred position for effecting a seal between the mounting cup and the bead of the container, in
10 an exceptionally rapid and efficient manner to form gasketed-mounting cups having excellent sealing characteristics. In general, the method of invention of the '525 and '948 patents comprises passing a tubular sleeve of gasket material onto a compressible mandrel; initially
15 positioning and aligning the skirt of the mounting cup and the contiguous end of the mandrel such that the sleeve of gasket material may pass onto the skirt, said mandrel having fixed and moveable portions with respect to each other and to their movement toward and away from the mounting cup;
20 urging the moveable portion of the gasket material bearing mandrel toward the mounting cup such that the gasket material passes onto the skirt of the cup; causing the moveable portion of the mandrel to retract to its initial position, cutting the sleeve at a point between the mounting
25 cup and the mandrel to leave a band of gasket material; and subsequently, advancing the mounting cup to a station whereat the band of the gasket material is urged further

onto the skirt of the mounting cup, whereby, the band of gasket material does not extend beyond the skirt of the mounting cup. Subsequently, the gasket is advanced to the ultimately desired position partially within the channel of the mounting cup. The '525 and '948 patents are
5 incorporated by reference herein.

In the United States, aerosol containers are typically filled by the undercap filling method. First, the product to be dispensed is deposited into the container. Then a
10 mounting cup, including the valve and dip tube, is placed on the container such that the bead of the container is within the channel of the mounting cup. The filling head of an undercap filling machine then encompasses the top of the container, creating an airtight seal. Air is then evacuated
15 from the container. The suction created during evacuation raises the mounting cup off of the container bead. Propellant is then forced into the container opening beneath the mounting cup and the mounting cup is repositioned and clinched to the container bead. In certain applications,
20 the propellant can be dissolved in the product, mixed and inserted into the container in one step. Product saturated carbon dioxide is one common example.

During the filling process, suction during evacuation or the force of the propellant during filling can displace
25 the gasket from its position within the channel of the mounting cup, preventing a proper seal on clinching. In some cases, the gasket can be completely displaced by the

propellant filling the container, forcing the gasket into the container. This is referred to as a "blown" gasket.

The dip tube of the container is usually slightly longer than the height of the container to insure that its end is positioned at the bottom of the container. As shown in Figure 1, when the mounting cup is positioned on the container bead, the dip tube is slightly bent. This can provide an upward force which can displace the mounting cup from the container bead, interfering with proper clinching.

To ensure that the mounting cup is maintained on the container bead prior to clinching, protrusions are created around the skirt of the mounting cup which are below the container bead when the mounting cup is in position. Such protrusions 14a are also shown in Figure 1. The force provided by the bent dip tube is generally insufficient to overcome the retaining force provided by the protrusions. The protrusions are formed by a tool placed around the pedestal of the mounting cup, which forces out particular sections of the skirt of the cup.

Such protrusions can scratch the container bead or walls of the opening of the container when the mounting cup is being positioned, promoting corrosion. In addition, the mounting cup can be split or punctured during formation of the protrusion.

Summary of the Invention

In accordance with the broadest aspects of the present invention, a gasket and a gasketed mounting cup include means for securing the gasket to a container bead prior to filling, the means being disposed on a portion of the gasket contiguous to the skirt portion of the gasketed mounting cup. In another aspect of the invention, the means secures the mounting cup to the container bead prior to filling. The means preferably comprises one or more dimples in the gasket material.

A method for producing the gasket and gasket material is also disclosed wherein gasket material is positioned on the mounting cup such that a first portion of the gasket is in contact with the channel of the mounting cup and a second portion is in contact with the skirt of the mounting cup. A dimple is formed in the second portion of the gasket material. A punch having a plurality of lugs equidistantly positioned to form a plurality of dimples is preferably used.

Description of the Drawings

Figure 1 is a partial cross-sectional view of an aerosol container of the prior art;

Figure 2 is a side cross-sectional view of a gasketed mounting cup of the prior art;

Figure 2a is a top view of the mounting cup of Figure 2;

Figure 3 is a cross-sectional view of a portion of a container bead within the channel of the mounting cup;

Figure 4 is a partial cross-sectional view of the gasket and gasketed mounting cup of the present invention;

5 Figure 5 is a cross-sectional view of the gasketed mounting cup of the present invention positioned on a container bead;

Figure 6 is a side view of the gasketed mounting cup of the present invention;

10 Figure 6a is a top view of the gasketed mounting cup of Figure 6.

Figures 7a-7c are partial cross-sectional views of various steps in the method of positioning the gasket and forming the dimple in accordance with the present invention;

15 Figure 8 is a bottom view of the punch shown in Figures 7a-c; and

Figure 9 is a front view of one lug of the punch shown in the Figures 7a-c.

20 Description of the Invention

Figure 1 is a partial cross-sectional view of an aerosol container 1 showing a mounting cup 10 positioned on a container bead 19. A dip tube 3 extends from the valve 4 in the mounting cup 10 to the bottom of the container 1.

25 The dip tube is slightly longer than the height of the container and is therefore slightly bent by the bottom of the container.

Figure 2 shows a typical aerosol valve mounting cup of the prior art generally designated as 10. The mounting cup has a pedestal portion 12 which depends from the interior edge of a panel portion 13. A skirt 14 depends from the exterior edge of the panel portion 13 opposite the pedestal portion and is concentric thereto. The top portion of the skirt 14 curves into a channel portion 15 which terminates in an edge portion 16. The channel portion 15, edge portion 16 and skirt 14 form an annular concave receptor 15a for receiving the standard bead of an aerosol container, such as the container 1 of Figure 1. The gasket material 17 has a first portion 17a within the channel portion 15 of the mounting cup 10 for engaging the container bead 19 of container 1 for example. The gasket material 17 also has a second portion 17b in contact with the skirt 14 of the mounting cup 10. Also shown is a protrusion 14a in the skirt 14. A plurality of such protrusions 14a can be arranged around the skirt as shown in Figure 2a, which is a top view of the mounting cup 10 of Figure 2. The protrusions 14a maintain the mounting cup and valve assembly in position on a container bead prior to clinching.

Figure 3 shows the container bead 19 of the container 1 within the annular concave receptor 15a of the mounting cup 10 of Figure 1. The mounting cup has not yet been clinched to the container bead.

Figure 4 shows a cross-sectional view of the annular convex receptor portion 15a of a mounting cup 11, with a

gasket 20 made in accordance with the invention. The mounting cup 11 is the same as mounting 10 in Figure 2. Figure 5 is a cross-sectional view of the gasketed mounting cup of the invention positioned on the container bead 19 of a container 1. The gasket 20 has a first portion 20a located within the annular concave receptor portion 15a, for engaging the container bead 19 of container 1, for example. The gasket 20 also has a second portion 20b contiguous to the skirt 14 of the mounting cup 11. The gasket includes in its second portion 20b, means for securing the gasketed mounting cup to a container bead 19 prior to filling. This means is preferably a dimple 22 formed at the end of the second portion 20b of the gasket 20. The view of Figures 4 and 5 are through the dimples 22. The dimple 22 resists the upward force exerted by the dip tube 3, as shown in Figure 1, retaining the mounting cup in position on the container bead 19. The dimples do not prevent the lifting of the gasket 11 off the container bead by the suction generated during the evacuation phase of the undercap filling process.

The skirt 14 of the mounting cup 11 is smooth, which for the purposes of this specification means that the surface is free of deformations, such as the protrusions 14a shown in Figures 1-2, which can deform the outer surface of the gasket 20. An important advantage of the present invention is that it avoids the use of such protrusions 14a.

At least one such dimple is provided. Preferably, there are a plurality of such dimples arranged symmetrically

about the gasket, as shown in Figures 6 and 6a. Figure 6 is a side view of the gasketed mounting cup 11 of the present invention, with a gasket 20 in position. Figure 6a is a top view of the gasketed mounting cup of Figure 6. Satisfactory results have been obtained with the use of six such dimples equidistantly spaced around the second portion 20b of the gasket 20.

The gasket material 20 is preferably formed from a sleeve gasket and the dimple 22 is preferably formed by slightly folding over a portion of the end of the second portion 20b of the gasket material 20 during advancement of the gasket into the channel of the mounting cup, which is discussed in more detail, below. The cross-section of the sleeve should be smooth. Thinned areas can interfere with the integrity of the seal and cause displacement of the gasket prior to clinching. Visual inspection of the sleeve is sufficient to ensure that there are no such thinned areas.

To maximize sealing, in a standard mounting cup for a standard one inch aerosol container opening with a 0.06 inch bead (19) radius "r", as shown in Figure 5, the length "L-1" of the gasket as measured from the top of the channel 15 of the mounting cup to the end of the second portion 20b is preferably greater than 0.175 inches. The gasket material 20 should be positioned far enough into the channel 15 of the mounting cup so that the diameter "d" of the sleeve flare is preferably about 1.200 inches. To achieve the

preferred flare diameter, the length "L-2" of the gasket material after being cut from the sleeve, as described in the '525 and '948 patents, should be approximately 0.275 inches, as shown in Figure 7a. The gasket 20 is preferably
5 about 0.014 inches thick. The preferred dimensions are discussed in more detail in U.S. Serial No. 07/814,113, filed on the same day as the present invention and assigned to the same assignee. U.S. Serial No. 07/814,113 is incorporated by reference herein.

10 The gasket 20 of the present invention can be formed of any type of gasket material used in the art. The preferred gasket material is a mixture of approximately 57% linear low density polyethylene and 43% high density polyethylene. Such a gasket material is also described in more detail in
15 U.S. Serial No. 07/814,113.

In most aerosol applications, product is inserted into the container prior to the propellant. When propellant is inserted in the undercap filling method described generally above, the propellant is at high pressure. In such cases,
20 it has been found advantageous to securely adhere the gasket material 20 to the mounting cup 11. It is therefore preferred to bond the gasket to the channel of the mounting cup by a thermally activated adhesive. The adhesive can be applied to the inner surface of the sleeve gasket by
25 extrusion, as is known in the art. Preferably, the thermal adhesive is a mixture of about 64.67% Exxon Escor acid terpolymer ATX 325, about 35.67% DNDA-7340 Natural 7 LLDPE,

available from Union Carbide and 0.66% H. Kohnstamm PB 3962 blue dry colorant. The thickness of the thermal adhesive layer is preferably about 0.00075 inches. The use of the thermal adhesive is discussed in more detail in U.S. Serial
5 No. 07/814,113. Other means for resisting dislodgement of the gasket from the channel of the mounting cup, such as radial compressive deformations as disclosed in U.S. Patent No. 4,599,198, may be utilized as well.

The use of dimples 22 on the gasket 20 of the present
10 invention has been found to prevent dislodgement of the mounting cup 11 by the dip tube 3, securing the mounting cup 11 to the container bead 19 prior to undercap filling. This obviates the need for the protrusions 14a, shown in Figures 1-2. The additional manufacturing step required to add the
15 protrusions 14a to the mounting cup are eliminated, and the integrity of the cup and container is maintained.

Another aspect of the present invention is particularly applicable where the product is dissolved in the propellant prior to filling. The mixture of product and propellant is
20 inserted into the container by the undercap filling process at low pressure, in a higher total volume than when only propellant is inserted. In such cases, it has been found advantageous to maintain the gasket of the invention on the container bead 19 while the mounting cup is raised off the
25 bead by the suction generated during the evacuation phase of the filling process. A thermal adhesive, or other such means for securing the gasket to the mounting cup, would not

-12-

then be used. The gasket still adheres to the mounting cup sufficiently to prevent dislodgement of the mounting cup 11 by the dip tube 3. During evacuation, however, suction lifts the mounting cup off of the gasket, which remains
5 secured to the container bead by the dimples 22. After the propellant is forced into the container, the mounting cup is repositioned onto the gasket 20 and container bead 19, and is then clinched. It has been found that the gasket 20 will provide a more reliable and consistent seal when the
10 mounting cup is repositioned on the gasket than if the gasket had been adhered to the mounting cup itself. It is believed that the high volume of material inserted into the container gradually disengages the gasket from the mounting cup, despite the use of a thermal adhesive, causing a blown
15 gasket or a leak.

The dimple of the invention can be formed by the apparatus and process disclosed in the '525 and '948 patents, which are discussed above and incorporated by reference herein. A single station gasket mounting cup
20 assembly machine is utilized instead of the six station assembly machine shown in Figure 3 of the '948 patent. It has been found that the sleeve gasket material may be positioned on a single mounting cup faster and more accurately than if sleeve gasket material is concurrently
25 positioned on six mounting cups. In addition, higher temperatures are currently used than those disclosed in these patents. A temperature of 170°F, as measured on the

raceway about 1 foot from the punch station, less than one second after the final positioning of the gasket within the channel of the mounting cup, (a convenient point to monitor temperature), is preferred. This is disclosed in more
5 detail in U.S. Serial No. 07/814,113.

The punch utilized in these patents can be modified to provide a series of lugs corresponding to the number of dimples to be provided. The lugs are opened sections of the punch with shoulders lower than that of the rest of the
10 punch. We have been utilizing six such lug sections.

Figures 7a-c are cross-sectional views of the punch 30 and lug 32, showing the position of the gasket 20 on the skirt 14 of mounting cup 10 after the sleeve gasket is positioned on the mounting cup and cut, as discussed in the
15 '525 and '948 patents. As shown in Figure 7a and discussed above, the length "L-2" of the gasket is preferably 0.275 inches. The lug 32 preferably has a contoured shoulder 34 which engages the top of the second portion 20b of the sleeve 20. Another lug 32 is shown behind the mounting cup
20 in Figure 7a for forming a dimple in that location. The lugs 32 can be formed by pins 32a press fit into recesses in the punch, as is known in the art and shown in these
Figures. Figure 8 is a bottom view of the punch 30, showing six lug sections 32 and contoured shoulders 34. Figure 9 is
25 a front view of a lug section.

Returning to Figures 7a-c, during final positioning of the gasket 20 within the channel of the mounting cup 11, the

shoulder 34 of the lug 32 engages and advances the gasket 20 along the skirt 14 into the annular concave receptor 15a of the mounting cup 10. As the punch 30 approaches the bottom of the channel 15, the bottom edge of extension 30a of the punch engages the first portion 20a of the gasket 20, preventing its further advance and actually forcing it slightly back. The punch 30 itself, however, continues to advance until it bottoms in the channel 15. As the punch 30 continues to progress downward, the lug shoulders 34 fold over the portion 20b of the gasket 20 beneath it, forming the dimple 22. See Figure 7b. The sides of the dimple 22 may be slightly torn from the rest of the gasket 20 to form the dimple 22. The extension 30a is preferably positioned so that the flare diameter of the gasket is at least about 1.180 inches and is preferably about 1.220 inches, as discussed above and in U.S. Serial No. 07/814,113. The extension 30a also acts to prevent the punch from compressing the gasket material, forming thin regions that could weaken the seal. The height of extension 30a is 0.016 inches.

After engaging the first portion 20a of the gasket 20 and preventing further progress of the gasket, the punch preferably progresses approximately 0.050 inches, forming the dimple 22 approximately 0.050 inches from the top of the gasket. The dimple extends at least 0.008 inches from the outer wall of the gasket and preferably extends approximately 0.016 inches. The lug 32 is at least 0.035

inches wide and is preferably approximately 0.065 inches wide, forming a dimple of approximately the same width. These dimensions are preferred where six dimples are utilized. If fewer dimples are utilized, each dimple would need to extend out further and be wider, to provide increased support. If more than six dimples are utilized, they may be smaller. As the punch 30 bottoms in the channel 15 of the mounting cup, a circumferential shoulder 36 between the lug sections of the punch 30 engages the top 20b of the gasket 20 where the dimples are not formed, ensuring that the gasket is straight. See Figures 7-9.

What is claimed:

1. A gasket for sealing a channel of a mounting cup to a bead of a container, comprising gasket material having a first and second portion, the first portion for being positioned at least partially within the channel portion of a mounting cup and the second portion for being positioned contiguous to a smooth skirt of the mounting cup, and at least one dimple associated with the second portion of the gasket material.

2. The gasket of claim 1 wherein the dimple is located proximate an end of the second portion opposite the first portion.

3. The gasket of claim 1 further comprising a plurality of dimples arranged annularly around the second portion of the gasket.

4. The gasket of claim 1 comprising six dimples equidistantly positioned around the gasket.

5. The gasket of claim 2 wherein the dimple is located approximately 0.050 inches from the end of the second portion of the gasket.

6. The gasket of claim 4 wherein the dimples extend approximately 0.016 inches from the gasket.

7. The gasket of claims 1 or 4 further comprising a thermally activated adhesive on the surface of the gasket to be in contact with the mounting cup.

8. The gasket of claim 1 wherein the gasket material is in the form of a sleeve.

9. A gasketed mounting cup comprising a panel, a smooth skirt integral with and depending from the periphery of the panel, the skirt being outwardly flared to form an annular channel for receiving a container bead that defines a container opening, and a gasket comprising a first and second portion, the first portion being at least partially within the channel of the mounting cup and the second portion being in contact with the skirt of the mounting cup, the gasket further comprising at least one dimple associated with the second portion of the gasket.

10. The gasketed mounting cup of claim 9 wherein the dimple comprises a folded over section of the gasket.

11. The gasketed mounting cup of claim 9 comprising six dimples equidistantly positioned around the gasket.

12. The gasketed mounting cup of claim 10 further comprising a plurality of dimples equidistantly positioned about the second portion of the gasket.

5 13. The gasketed mounting cup of claim 10 wherein the dimples are located approximately 0.050 inches from the end of the second portion.

10 14. The gasketed mounting cup of claim 11 wherein the dimples extend approximately 0.016 inches from the gasket.

15 15. The gasketed mounting cup of claims 9 or 11 wherein the gasket is adhered to the channel of the mounting cup with a thermally activated adhesive.

16. The gasket of claim 9 wherein the gasket material is in the form of a sleeve.

20 17. A sleeve gasket for sealing a channel of a mounting cup to a bead of a container comprising gasket material and a means associated with the gasket material for maintaining the gasket in position on the container bead.

25 18. The gasket of claim 17 wherein the dimple comprises a folded over section of the gasket.

19. The gasket of claim 18 wherein the means comprises a plurality of dimples positioned annularly about the gasket.

5 20. A gasketed mounting cup comprising sleeve gasket material and a means associated with the gasket for maintaining the mounting cup in position on the container bead.

10 21. The gasket of claim 20 wherein the dimple comprises a folded over section of the gasket.

15 22. The gasket of claim 21 wherein the means comprises a plurality of dimples positioned annularly about the gasket.

20 23. A gasketed mounting cup comprising a panel, a smooth skirt integral with and depending from the periphery of the panel, the skirt being outwardly flared to form an annular channel for receiving a container bead that defines a container opening, and a gasket comprising a first and second portion, the first portion being at least partially within the channel of the mounting cup and the second portion being in contact with the skirt of the mounting cup,
25 the gasket further comprising a means associated with the second portion of the gasket for maintaining the mounting cup in position on the container bead.

24. The gasketed mounting cup of claim 23 wherein said means comprises a plurality of dimples.

5 25. A gasketed mounting cup comprising a panel, a skirt integral with and depending from the periphery of the panel, the skirt being outwardly flared to form an annular channel for receiving a container bead that defines a container opening, and a sleeve gasket comprising a first
10 and second portion, the first portion being at least partially within the channel of the mounting cup and the second portion being in contact with the skirt of the mounting cup, the gasket further comprising a means
15 associated with the second portion of the gasket for maintaining the mounting cup in position on the container bead.

26. The gasketed mounting cup of claim 21 wherein said means comprises a plurality of dimples.

20

27. A method for forming a gasketed mounting cup comprising the steps of;
 positioning gasket material on the mounting cup such that a first portion of the gasket material is in
25 contact with the channel of the mounting cup and a second portion is in contact with the skirt of the mounting cup,
and

forming a dimple in the second portion of the
gasket material.

28. The method of claim 27 wherein the dimple is
5 formed at an end of the second portion.

29. The method of claim 27 further comprising first
disposing the gasket material on the skirt of the mounting
cup;

10 then advancing the gasket material into the channel of
the mounting cup such that the first portion of the gasket
material is in contact with the channel of the mounting cup;
and

forming the dimple at the end of the second portion.

15 30. The method of claim 29 wherein the dimple is
formed by folding over a portion of the gasket material.

20 31. The method of claim 29 wherein the gasket material
is advanced by a punch.

32. The method of claim 29 wherein the dimple is
formed by a portion of the punch.

25 33. The method of claim 30 wherein the portion of the
punch which forms the dimple is a shoulder portion which
first advances the gasket material into the channel portion

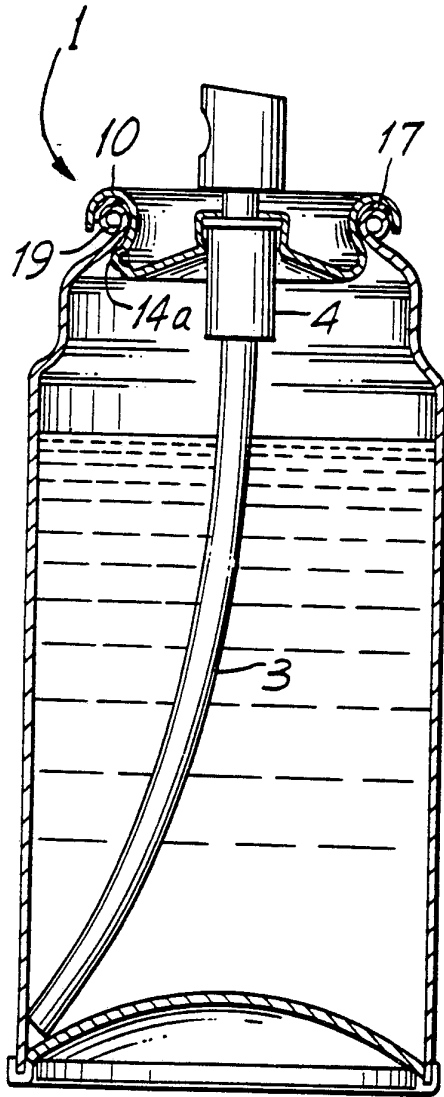
of the mounting cup and then folds over a portion of the gasket to form the dimple.

5 34. The method of claim 33 wherein the punch comprises a plurality of shoulders about its inner circumference, the plurality of shoulders forming a plurality of dimples annularly arranged around the end of the second portion.

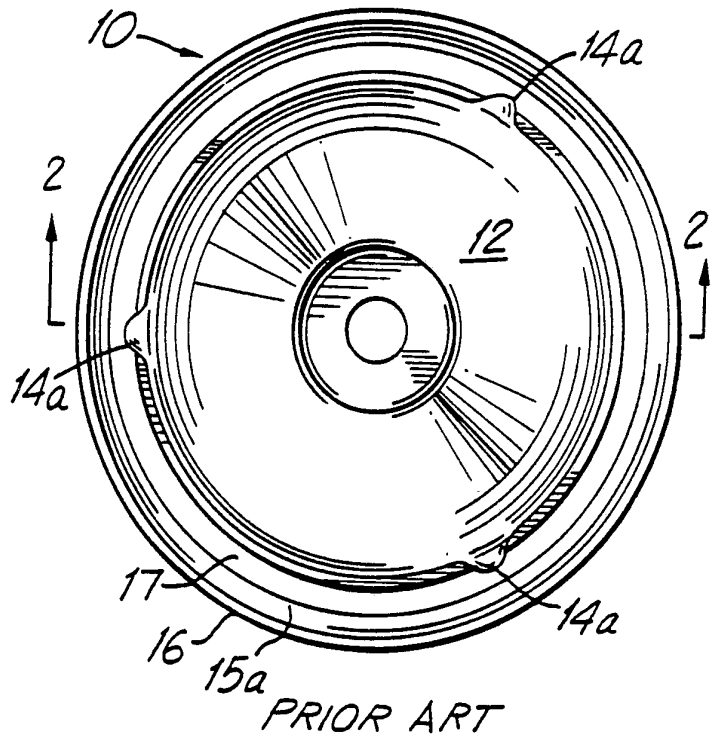
10 35. The method of claim 34 wherein the plurality of shoulders are positioned equidistantly about the punch, forming equidistantly positioned dimples.

15 36. The method of claims 27 or 34 further comprising adhering the gasket material to the mounting cup by a thermally activated adhesive.

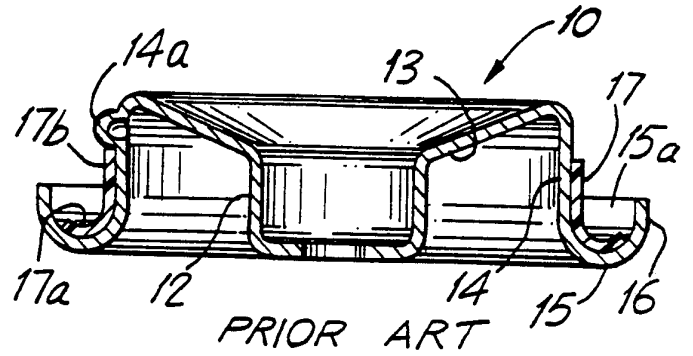
37. The method of claim 27 or 34 wherein the gasket material is a sleeve gasket.



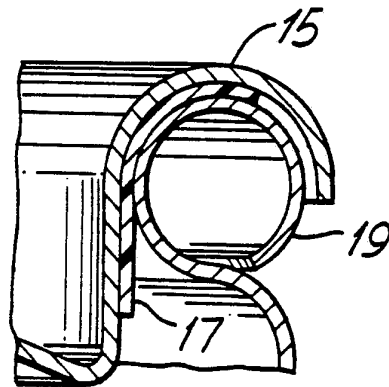
PRIOR ART
FIG. 1



PRIOR ART
FIG. 2a



PRIOR ART
FIG. 2



PRIOR ART
FIG. 3

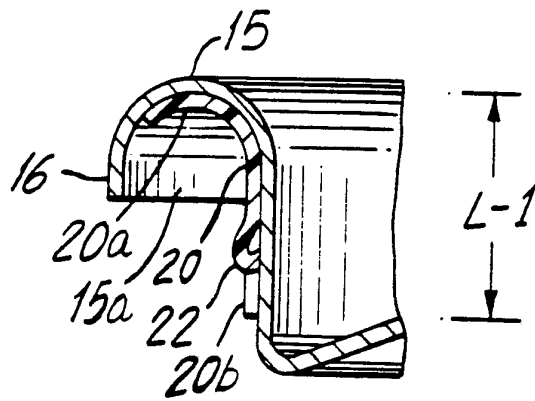


FIG. 4

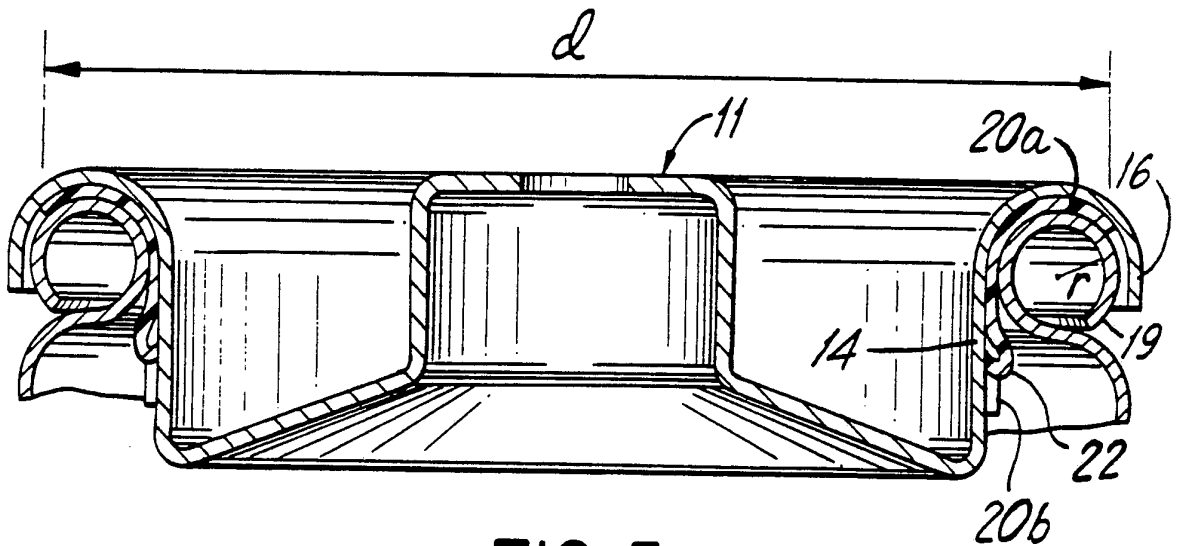


FIG. 5

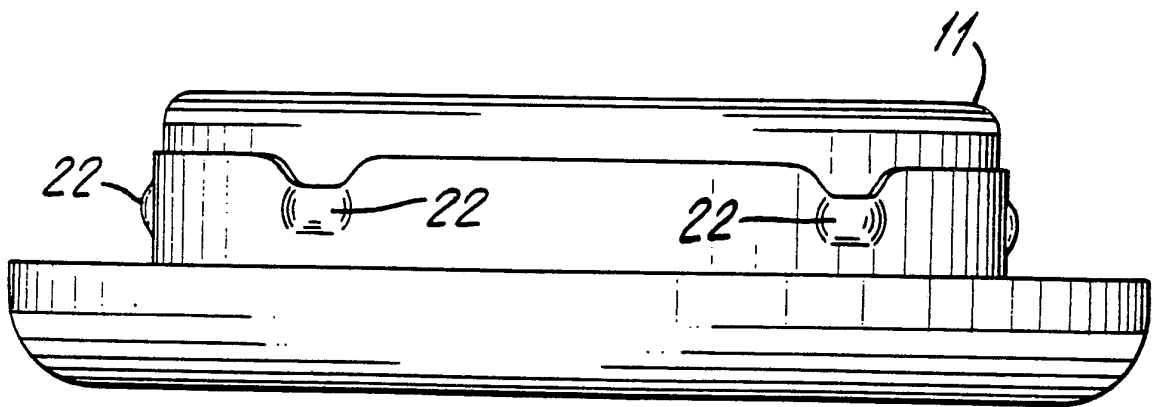


FIG. 6

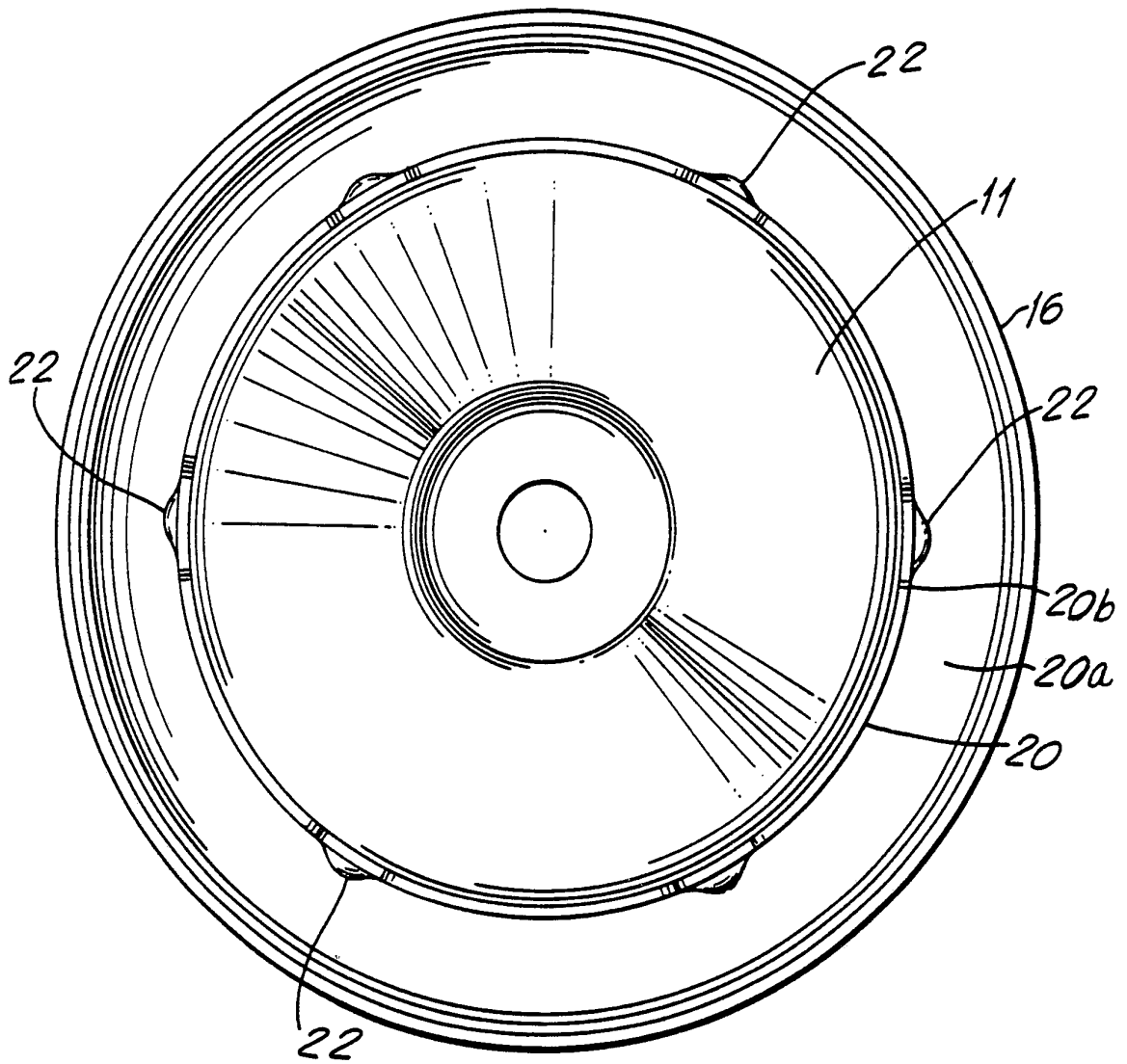


FIG. 6a

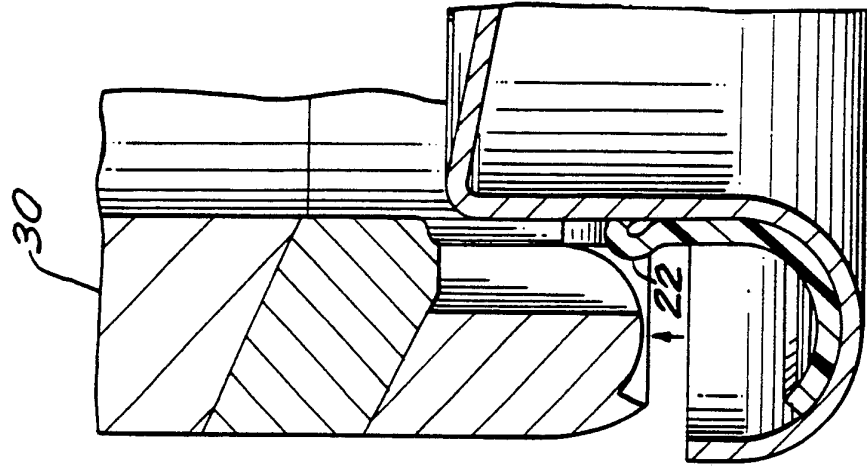


FIG. 7c

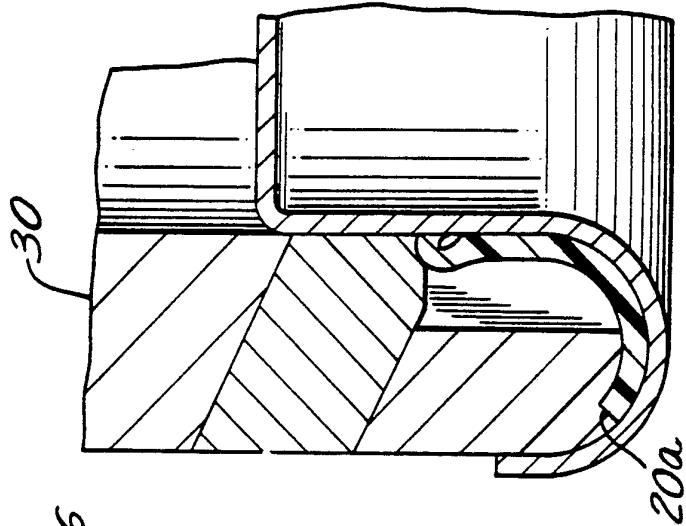


FIG. 7b

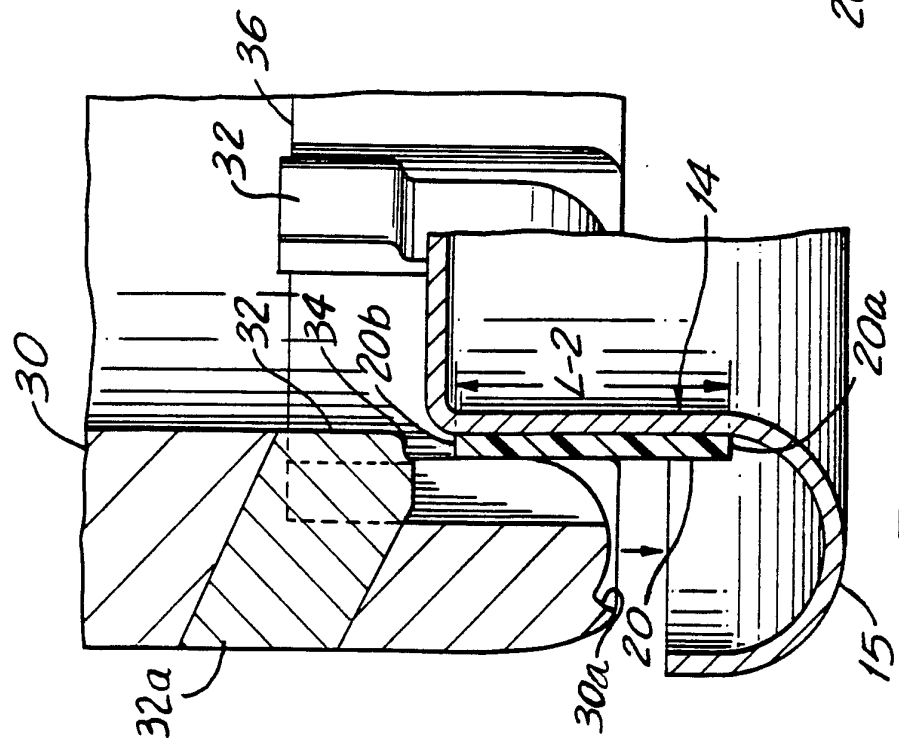


FIG. 7a

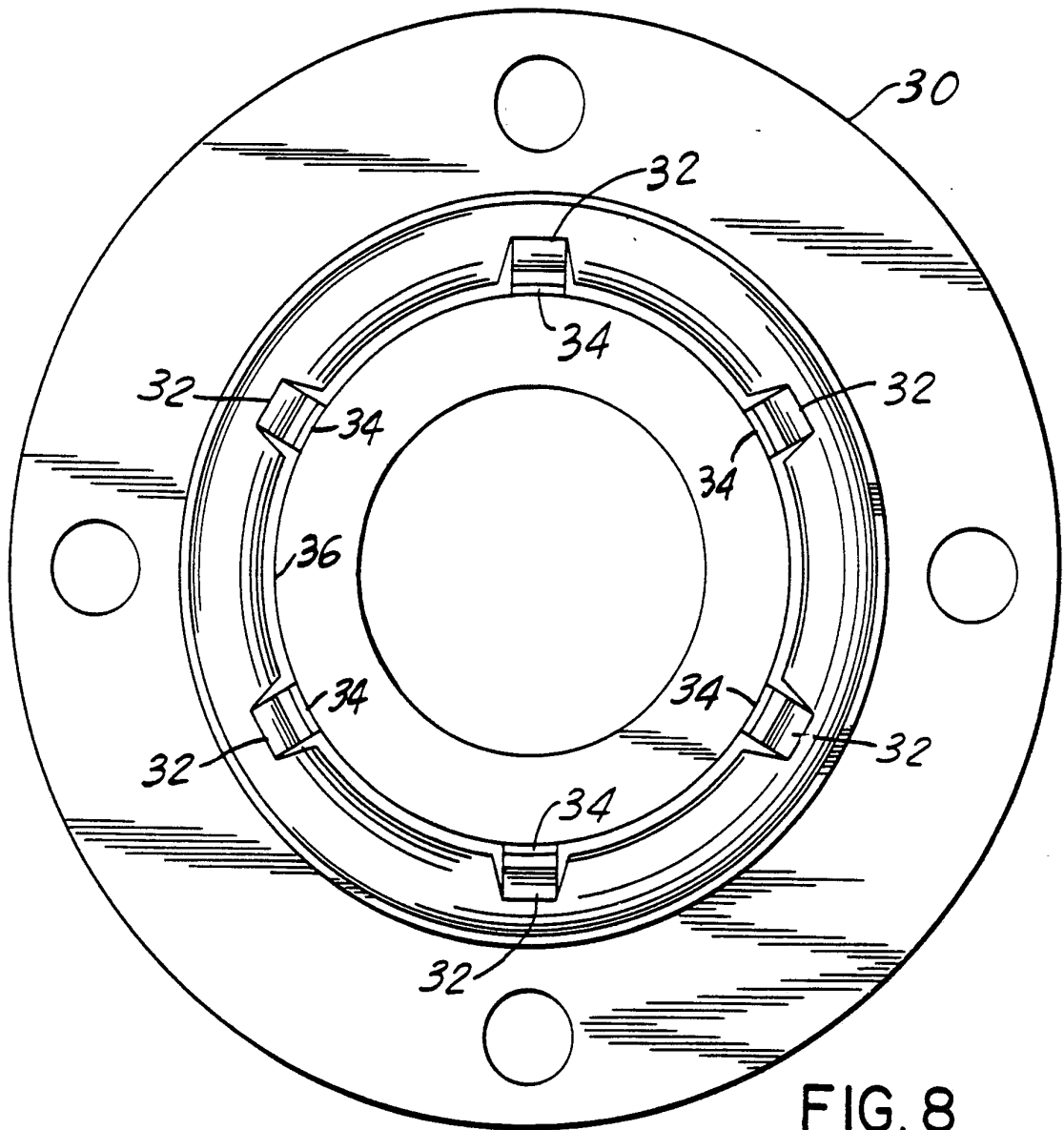


FIG. 8

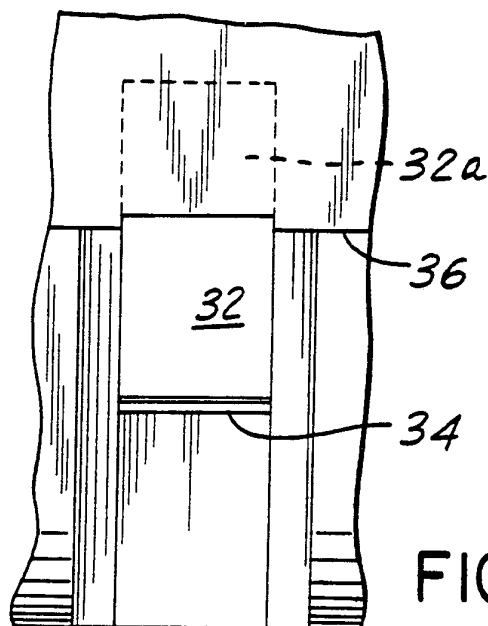


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/11186

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(5) :B65D 39/04
 US CL :220/378; 413/8
 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)
 U.S. : 220/307,308,351,356,358,378,612,613,614; 215/232,341,345,346

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US, A, 3,344,943 (ZIPPER) 03 October 1967, See col. 3, lines 40-51.	1-4,8,9,11, 12,16,17,20, <u>23-25</u> 5,6,7,13,14, 15
Y	US, A, 4,094,460 (SCANGA ET AL.) 13 June 1978, See col. 4, lines 24-36.	7 & 15
A	US, A, 2,772,012 (CRABTREE) 27 November 1956.	ALL
A	US, A, 3,979,015 (ARFERT) 07 September 1976.	ALL

Further documents are listed in the continuation of Box C. See patent family annex.

* 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 part 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 document 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	

Date of the actual completion of the international search 01 MARCH 1993	Date of mailing of the international search report 19 MAR 1993
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer For STEPHEN GARBE <i>Stephen Garbe</i> Telephone No. (703) 308-1207
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