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Stever

(54) **ASEPTIC PACKAGE FLUID DISPENSING APPARATUS AND METHODS OF DISPENSING LIQUIDS FROM FLEXIBLE PACKAGES**

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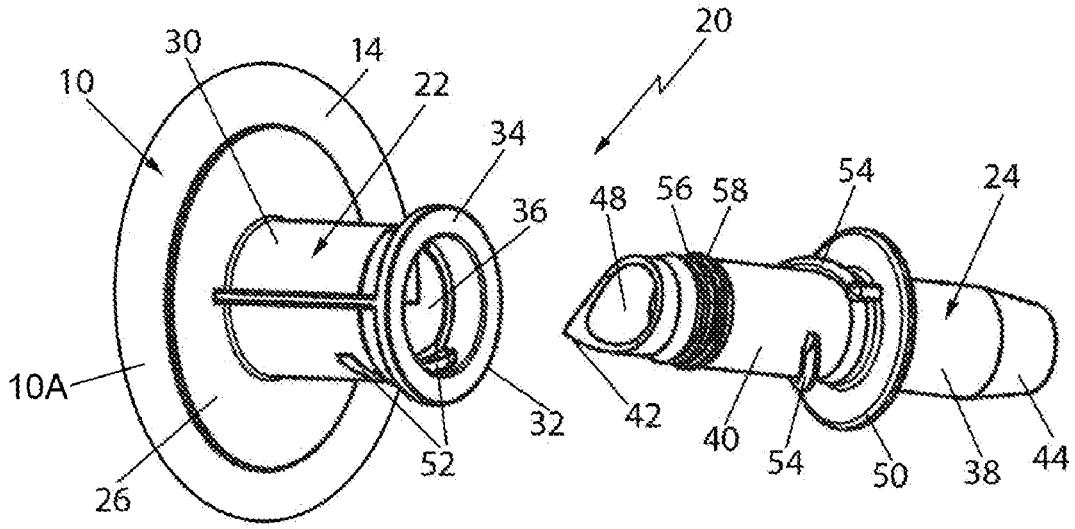
(57) **ABSTRACT**

Disclosed are apparatus for dispensing a liquid from within a flexible package and a method of dispensing a liquid from within a flexible package. The apparatus comprises a fitment and a piercing member. The fitment is secured to a wall of the flexible package and has a passageway extending through it and a screw-thread section. The piercing member has a passageway extending through it, a piercing tip, and a screw-thread section. The piercing member is configured for insertion in the passageway of the fitment, with the screw-thread sections engaging each other to cause the piercing tip to penetrate the package, whereupon the liquid within the package can flow into and through the piercing member.



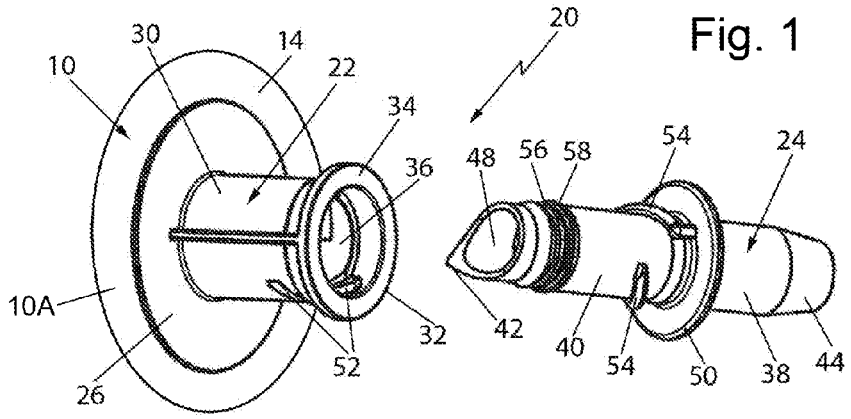


Fig. 1

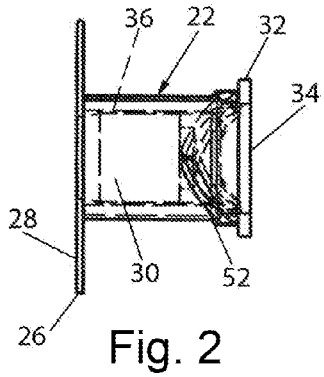


Fig. 2

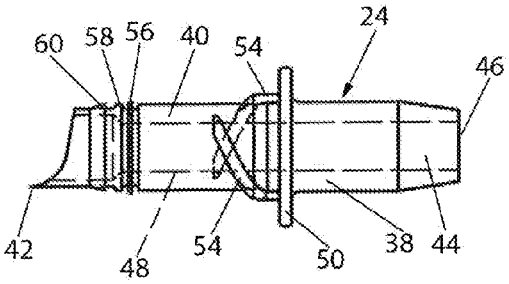


Fig. 3

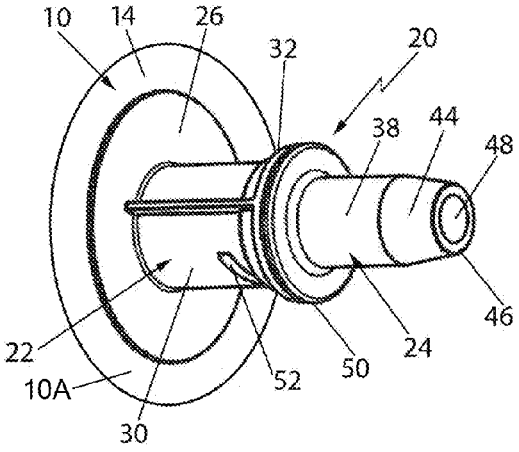


Fig. 4

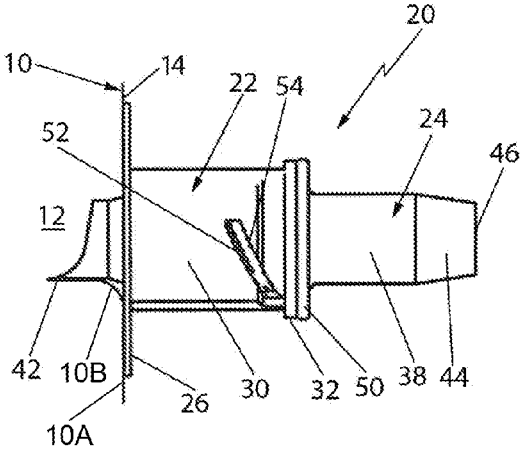


Fig. 5

Fig. 6

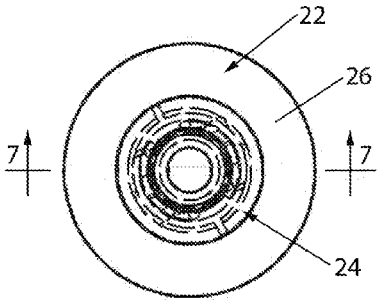
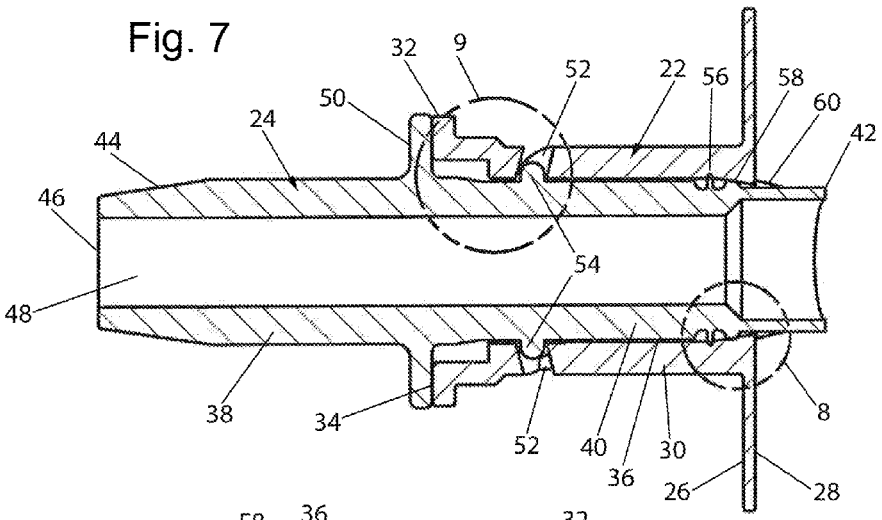


Fig. 7



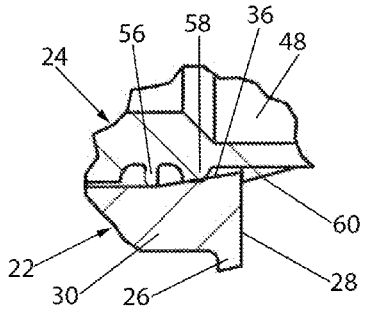


Fig. 8

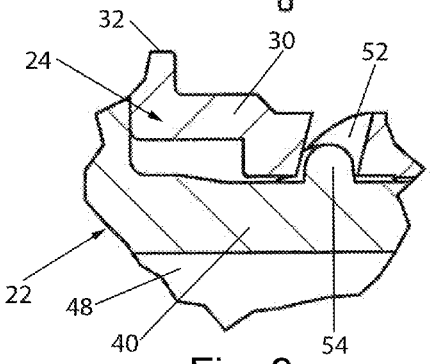


Fig. 9

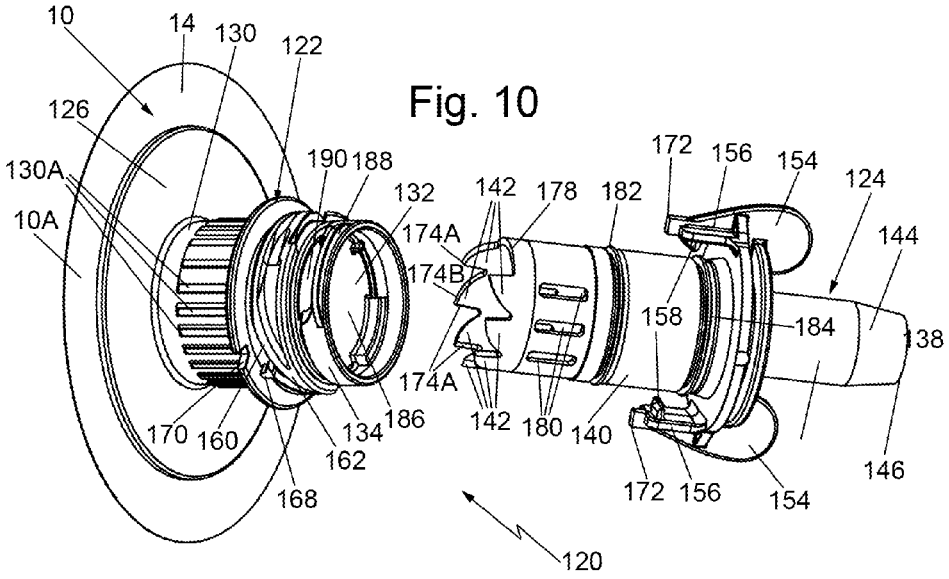


Fig. 10

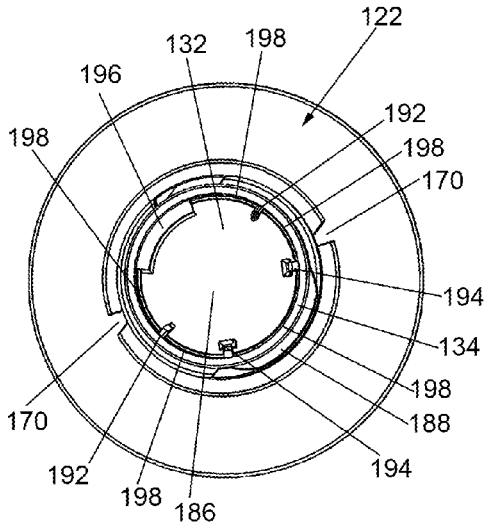


Fig. 11

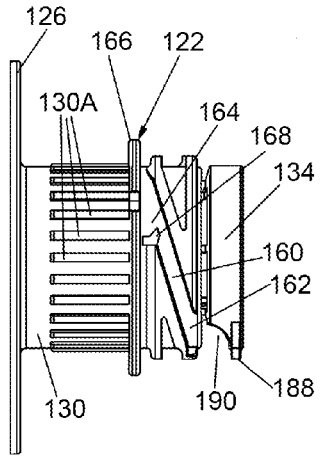


Fig. 12

Fig. 13A

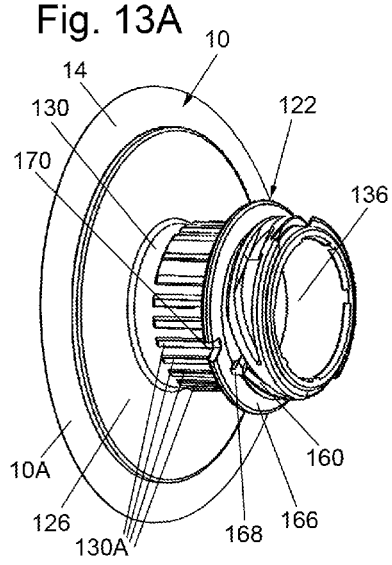
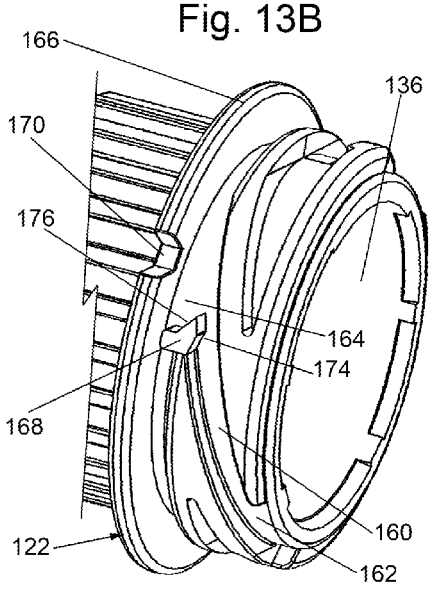


Fig. 13B



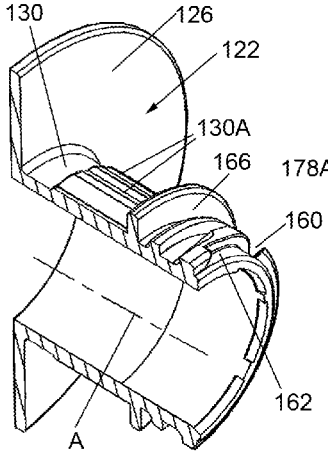


Fig. 14

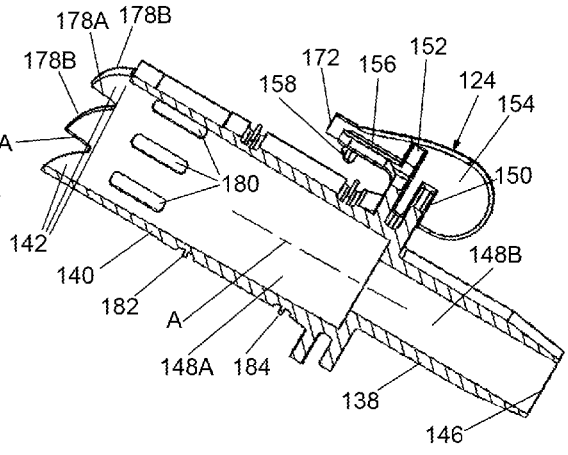


Fig. 15

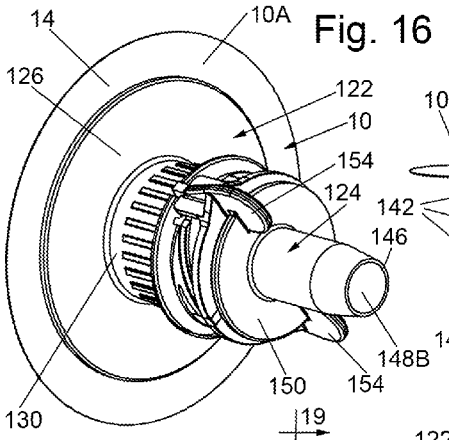


Fig. 16

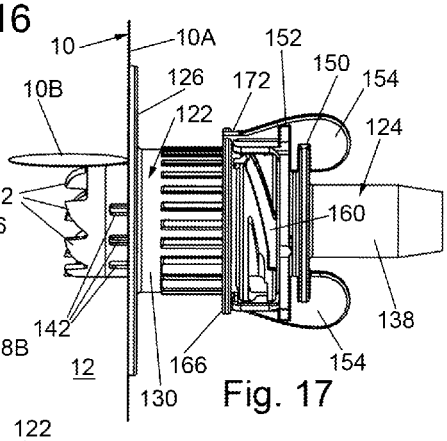


Fig. 17

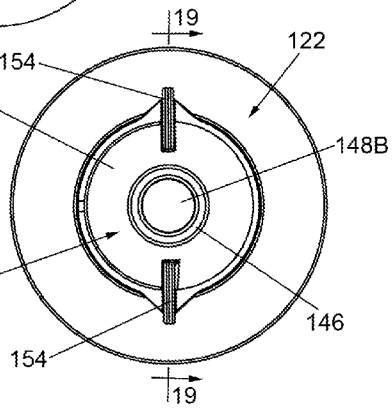


Fig. 18

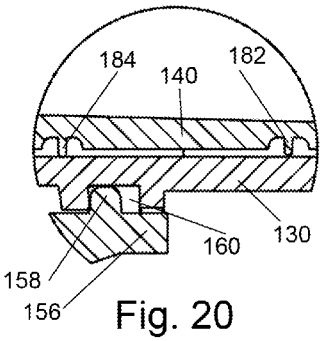


Fig. 20

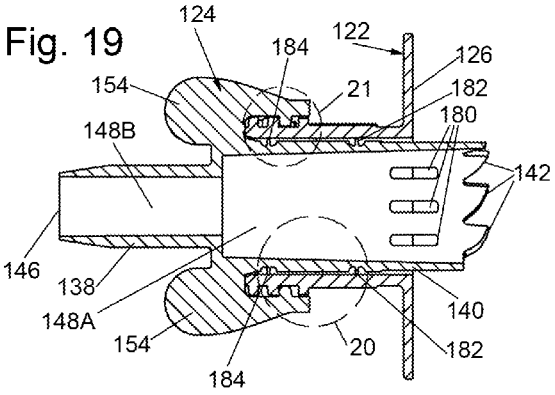


Fig. 19

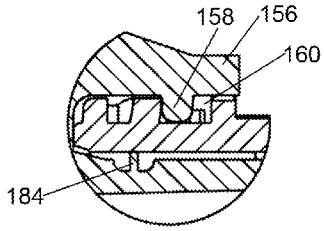


Fig. 21

ASEPTIC PACKAGE FLUID DISPENSING APPARATUS AND METHODS OF DISPENSING LIQUIDS FROM FLEXIBLE PACKAGES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional application claims the benefit under 35 U.S.C. §119(e) of Provisional Application Ser. No. 62/213,932 filed on Sep. 3, 2015, entitled Aseptic Package Fluid Dispensing Apparatus and Methods Of Dispensing A Liquid From A Flexible Package, the entire disclosure of that provisional application is hereby incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] Field of Invention

[0003] This invention relates generally to flexible packages and more particularly to apparatus in the form of a fitment for mounting on a flexible package holding a liquid and an associated piercer for insertion into the fitment to dispense liquid from the package and to methods for dispensing a liquid from a flexible package.

[0004] Description of Related Art

[0005] Various flexible packages, for dispensing bulk liquids are commercially available. Such packages are typically in the form of a flexible bag in which the liquid to be dispensed is located and a fitment mounted on the bag and which is arranged to receive a piercing member. Typically the fitment is mounted on the bag by means of a flange. The piercing member serves to pierce the wall of the bag on which the fitment is mounted to provide access to the liquid within the bag so that it can be dispensed therefrom. External attachment of the fitment's flange to the flexible bag permits the storage of liquids in air-tight and even sterile condition within the bag through means of high production capacity heat sealing equipment until, and possibly even after, such time as the liquid is dispensed. Other embodiments of dispensing apparatus have been long used for other functions. "Push to activate" and "twist to activate" dispensing apparatus that pierce a flexible or semi-rigid container are well known.

[0006] The patent literature includes various examples of flexible packages making use of fitments and piercing members received in the fitments to pierce the bag to dispense its liquid contents. See for example, U.S. Letters Pat. No.: 3,239,104 (Scholle); U.S. Pat. No. 4,322,018 (Rutter); U.S. Pat. No. 4,214,675 (Schmit); U.S. Pat. No. 5,497,909 (Wirsig et al.); U.S. Pat. No. 7,559,432 (Mavin et al.); U.S. Pat. No. 8,070,014 (Wisniewski et al.); and U.S. Pat. No. 8,733,600 (Pritchard).

[0007] While the aforementioned packages with fitments may be generally suitable for their intended purposes, they suffer from one or more drawbacks, e.g., simplicity of construction, cost, ease of use, etc. The subject invention addresses the needs of the prior art.

SUMMARY OF THE INVENTION

[0008] In accordance with one aspect of this invention apparatus for dispensing a liquid from within a flexible package is provided. The apparatus comprises a fitment and a piercing member. The fitment comprises a body having a passageway extending therethrough and a flange. The flange is configured for securement to a wall of the flexible package, whereupon a portion of the wall of the flexible package is located within the passageway. The fitment also includes a screw-thread section. The piercing member comprises a distally located section, a proximally located section, a passageway extending through the distally located section and the proximally located section, and a screw-thread section. The distally located section has a piercing tip and is configured for insertion in the passageway of the fitment, with the screw-thread section of the piercing member threadedly engaging the screw-thread section of the fitment to cause the piercing tip to penetrate the portion of the wall of the package, whereupon the liquid within the package can flow into and through the passageway of the piercing member.

[0009] In accordance with another aspect of this invention a flexible package for dispensing a liquid therefrom is provided. The flexible package comprises a hollow member having a wall formed of a flexible material and a dispensing apparatus. The dispensing apparatus comprises a fitment and a piercing member. The fitment comprises a body having a passageway extending therethrough and a flange. The flange is configured for securement to a wall of the flexible package, whereupon a portion of the wall of the flexible package is located within the passageway. The fitment also includes a screw-thread section. The piercing member comprises a distally located section, a proximally located section, a passageway extending through the distally located section and the proximally located section, and a screw-thread section. The distally located section has a piercing tip and is configured for insertion in the passageway of the fitment, with the screw-thread section of the piercing member threadedly engaging the screw-thread section of the fitment to cause the piercing tip to penetrate the portion of the wall of the package, whereupon the liquid within the package can flow into and through the passageway of the piercing member.

[0010] In accordance with another aspect of this invention a method of dispensing a liquid from within a flexible package having a wall is provided. The method basically comprises providing a fitment comprising a body having a passageway extending therethrough, a flange, and a screw-thread section. The flange is secured to the wall of the flexible package, whereupon a portion of the wall is located within the passageway. A piercing member is provided. The piercing member comprises a distally located section, a proximally located section, a passageway extending through the distally located section and the proximally located section, and a screw-thread section. The distally located section has a piercing tip. The distally located section of the piercing member is inserted in the passageway of the fitment with the screw-thread section of the piercing member threadedly engaging the screw-thread section of the fitment to cause the piercing tip to penetrate the portion of the wall of the package, whereupon the liquid within the package can flow into and through the passageway of the piercing member.

DESCRIPTION OF THE DRAWING

[0011] The invention will be described in conjunction with the following drawings in which like reference numerals designate like elements and wherein:

[0012] FIG. **1** is an exploded isometric view of one exemplary apparatus including a fitment and a piercing

member, constructed in accordance with this invention for mounting on a flexible package having a liquid therein to dispense the liquid from the package;

[0013] FIG. **2** is a side elevation view of the fitment shown in FIG. **1**;

[0014] FIG. **3** is a side elevation view of the piercing member shown in FIG. **1**;

[0015] FIG. **4** is an isometric view showing the piercing member inserted within the fitment;

[0016] FIG. **5** is a side elevation view of structure shown in FIG. **4**;

[0017] FIG. **6** is a front elevation view of the piercing member within the fitment;

[0018] FIG. **7** is an enlarged sectional view taken along line **7-7** of FIG. **6**;

[0019] FIG. **8** is an enlarged sectional view of the portion of the structure shown within the area designated by the broken circle **8** in FIG. **7**;

[0020] FIG. **9** is an enlarged sectional view of the portion of the structure shown within the area designated by the broken circle **9** in FIG. **7**;

[0021] FIG. **10** is an exploded isometric view of another and more preferred exemplary dispensing apparatus, including a fitment and a piercing member, constructed in accordance with this invention for mounting on a flexible package having a liquid therein to dispense the liquid from the package, with the fitment including a removable protective cover;

[0022] FIG. **11** is a front elevation view of the fitment shown in FIG. **10**;

[0023] FIG. **12** is a side elevation view of the fitment shown in FIG. **11**;

[0024] FIG. **13**A is an isometric view of the fitment of FIG. **10** mounted on a flexible package, but with the protective cover of the fitment removed so that the fitment is ready to receive the piercing member;

[0025] FIG. **13**B is an enlarged isometric view of the distal portion of the fitment shown in FIG. **13**A;

[0026] FIG. **14** is a longitudinal sectional view of the fitment shown in FIG. **13**A;

[0027] FIG. **15** is a longitudinal sectional view of the piercing member shown in FIG. **10**;

[0028] FIG. **16** is an isometric view showing the apparatus of FIG. **10** with its piercing member in its deployed position wherein it is fully inserted within the fitment with the distal end of the piercing member within the interior of the flexible package on which the fitment is mounted;

[0029] FIG. **17** is a side elevation view of apparatus with the piercing member shown in its deployed position;

[0030] FIG. **18** is a front elevation view of the apparatus with the piercing member shown in its deployed position;

[0031] FIG. **19** is an enlarged sectional view taken along line **19-19** of FIG. **18**;

[0032] FIG. **20** is an enlarged sectional view of the portion of the apparatus shown within the area designated by the broken circle **20** in FIG. **19**; and

[0033] FIG. **21** is an enlarged sectional view of the portion of the apparatus shown within the area designated by the broken circle **21** in FIG. **19**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0034] Referring now to the various figures of the drawing wherein like reference characters refer to like parts, there is shown in FIG. **1** one exemplary embodiment of a package **10** making use of a dispensing apparatus **20** constructed in accordance with this invention. The package is arranged for holding a liquid, aseptically packaged or otherwise, within it and for dispensing that liquid by means of the dispensing apparatus **20**. The apparatus **20** basically comprises a fitment **22** and a piercing member **24**. In the exemplary embodiment shown the package **10** is in the form of a bag or pouch formed of flexible sheet material defining plural walls, only one of which **10**A is shown. The walls bound a hollow interior **12** (FIG. **5**) in which the liquid to be dispensed is located. The bag or pouch can be of any conventional construction, e.g., it may be formed of a polymeric film of one or more layers. The fitment **20** is fixedly mounted, e.g., welded, on an exterior surface **14** of a portion of one of the walls making up the bag or pouch. In this case the fitment is fixedly mounted on the front wall **10**A of the bag or pouch **10**.

[0035] The fitment **20** basically comprises a body that is a molded, hollow component formed of any suitable material, e.g., a plastic. In one exemplary preferred embodiment of this invention the fitment is an injection molded plastic member made of a single thermoplastic polymer, such as polyethylene, that is able to be heat welded or ultrasonically welded to a flexible bag or container. The body includes a planar flange **26** having a planar rear surface **28** (FIG. **7**) that is configured to be fixedly secured, e.g., welded, to the outer surface **14** of a portion of the wall **10**A of the bag **10**. The portion of the body contiguous with the flange **26** is in the form of a collar **30**, the distal end of which includes a relatively short annular flange **32** having a planar front end surface **34**. A central passageway **36** extends through the collar from the front end surface **34** of the flange **32** to the rear surface **28** of the flange **26**. Thus, when the fitment **22** is secured to the wall **10**A of the bag **10** a portion of that wall is in communication with the passageway **36**. That portion of the wall **10**A forms a frangible penetration zone **10**B (FIG. **5**) in the bag (i.e., the portion of the wall of the bag that will be penetrated by the piercing member **24**, as will be described later). As best seen in FIG. **8**, the inner surface of the central passageway **36** tapers slightly inward immediately adjacent the rear surface **28** of the fitment for reasons to be discussed later.

[0036] The details of the construction and operation of the piercing member **24** will be described shortly. Suffice it for now to state that the piercing member is arranged to be received within the central passageway **36** of the fitment and moved to an extended or deployed position wherein a sharp tip portion of the piercing member passes through the frangible zone of the bag's wall to pierce that wall portion such that the tip and a contiguous portion of the piercing member will be located within the interior of the bag. Once the piercing tip portion is within the bag, the liquid contents can flow out through the piercing member.

[0037] The piercing member basically comprises a tubular member having a proximally located section **38** and a distally located section **40**. The distal end of the distally located section **40** is in the form of a sharpened piercing tip **42**. The proximal end portion of the proximally located section **38** has a tapering sidewall **44** terminating at a generally planar proximal end face **46**. The tapering sidewall **44** is provided to enable a dispensing tube (not shown) to be connected to it. The dispensing tube can form some portion of a dispensing device or can serve as the input to a

receptacle or storage container into which the liquid from the bag **10** will flow when the piercing member is fully deployed, as will be described later.

[0038] A central passageway **48** (FIG. **7**) extends the length of the piercing member from its distally located end face **46** to its piercing tip **42**. The internal diameter of the passageway **48** can be of any suitable size, for a desired flow rate. For example, for a relatively low flow rate the internal diameter of the passageway can be 0.390 inch. An annular flange **50** projects outward from the body of the piercing member **24** between the proximally located section **38** and the distally located section **40**. In accordance with one preferred exemplary embodiment of this invention the piercing member is an integral unit molded of the same material as that making up the fitment.

[0039] As mentioned above the piercing member **24** is configured to be inserted into the central passageway **36** of the fitment **22** and moved therealong so that its piercing tip **42** penetrates the frangible zone of the wall of the bag **10** on which the fitment is mounted. In accordance with one preferred aspect of this invention the piercing member is configured to be screwed into, e.g., threadedly engage, the fitment to provide a mechanical advantage in the deployment and piercing of the wall of the bag. In particular, a helical or spiral slot section **52** is provided in the collar **30** adjacent the flange **32**. The helical slot section forms a section of a screw-thread which is configured to receive a mating section of a screw-thread **54** on the piercing member so that the piercing member can be screwed into the central passageway. The screw thread **54** is located on the outer surface of the distally located section **40**. Thus, when the distally located section of the piercing member is inserted into the passageway **36** of the fitment the male screw-thread **54** of the piercing member will engage and slide along the female screw-thread **52** of the fitment as the piercing member is twisted about its longitudinal axis. This action will bring the sharp piercing tip **42** of the piercing member into engagement with the wall of the bag at the frangible zone to thereby penetrate through that zone like shown in FIG. **5**, whereupon the liquid within the bag can flow out of the bag through the piercing member and into a dispensing tube connected to the tapering sidewall **44** of the piercing member.

[0040] In order to prevent leakage of the liquid out of the interface between the piercing member and the fitment once the piercing member has penetrated the wall of the bag, the apparatus **20** includes two sealing members or rings. In particular, as best seen in FIG. **8**, the sidewall of the distally located section **40** of the piercing member includes a thin annular sealing ring **56** projecting radially outward from the outer surface of the piercing member. The outer diameter of the sealing ring **56** is slightly greater than the inner diameter of the fitment's central passageway **36** so that the sealing ring tightly engages the inner surface of the central passageway when the piercing member is inserted and screwed into it. In particular, the annular sealing ring **56** is located on the piercing member so that it will engage the inner surface of the central passageway **36** to form a compression seal before the piercing tip **42** engages the wall of the bag **10**. By so doing, the apparatus **20** ensures that once the piercing tip reaches and pierces the wall of the bag, but before the piercing member is in its fully deployed state (where it is fully extended into the interior of the bag), no liquid within the bag will be able to gain egress or leak out of the interface between the inner surface of the fitment's passageway and the outer surface of the piercing member. A second, and somewhat wider, annular sealing ring **58** (FIG. **8**) projects radially outward from the outer surface of the piercing member and is located slightly distally of the sealing ring **56**. The sealing ring **58** is also of slightly larger outer diameter than the inner diameter of the central passageway **36** to tightly engage the tapering portion of the inner surface of the fitment's central passageway **36** when the piercing member has been fully deployed to its fully extended state, i.e., screwed fully into to fitment so that the piercing tip is fully within the interior of the bag. Thus, the sealing ring **58** forms a final, compression seal for the apparatus to prevent any liquid from leaking out of the interface between the between the inner surface of the fitment's passageway and the outer surface of the piercing member.

[0041] In order to hold the piercing member in its fully deployed state to thereby prevent it from backing out of the fitment, the piercing member **24** includes an annular locking ring **60** having a ramped or inclined outer surface. The locking ring **60** is located distally of the sealing ring **58** and includes a proximally facing end surface that serves as a stop. In particular, when the piercing member is inserted into the central passageway **36** and screwed therein the ramped surface of the locking ring **60** will be compressed slightly and will slide along the inner surface of the passageway **36** until it passes the rear face **28** of the fitment, whereupon the ring **60** will expand outward so that its stop surface **60** will engage the rear face of the fitment like shown in FIG. **8**. At the same time, the flange **50** of the piercing member will engage the front face **34** of the fitment like shown in FIG. **7**, thereby creating an interference fit to securely hold the piercing member in its fully deployed state and thereby prevent its removal.

[0042] In accordance with one preferred aspect of this invention a removable dust cover (not shown), in the form of an adhesive sticker, is adhesively secured on the front face **34** of the fitment, thereby sealing the proximal end of the fitment's passageway **36**. Thus, with the fitment fixedly mounted on the outer surface of the wall **10**A of the bag **10**, the passageway **36** will be kept isolated from any dust or contaminants in the ambient surroundings by the removable cover, thereby ensuring that the interior of the passageway **36** is kept sanitary. When it is desired to dispense the liquid from the bag, all that is required is to remove (e.g., peel off) the removable cover and then insert the distal end of the piercing member into the proximal end of the passageway **36** so that the male screw threads **54** of the piercing member engage the female screw threads **52**, whereupon twisting of the piercing member causes the piercing member to be screwed into its extended or deployed position. In that position the sharp tip portion **42** of the piercing member will have cut through the frangible zone of the bag's wall such that the tip and a contiguous portion of the piercing member will be located within the interior of the bag. Thus, the contents of the bag can then flow through and out of the fitment's passageway **48**.

[0043] Turning now to FIGS. **10-21** another and more preferred embodiment of a dispensing apparatus **120** constructed in accordance with this invention is shown. The dispensing apparatus **120** is similar in general function to the apparatus **20** but different in construction. The apparatus **120** basically comprises a fitment **122** for securement to the wall of the bag or pouch in which the liquid to be dispensed is

located, and a piercing member **124** having a piercing tip which is configured to be inserted and screwed into the fitment to pierce the wall of the bag or pouch to provide access to the liquid therein. The fitment **122**, like the fitment **22**, is preferred an injection molded integral plastic member made of a single thermoplastic, such as polyethylene that is able to be heat welded or ultrasonically welded to a flexible bag or container. The body includes a planar flange **126** having a planar rear surface **128** (FIG. **12**) configured to be fixedly secured, e.g., welded, to the outer surface **14** of a portion of the wall **10**A of the bag **10**. The portion of the body contiguous with the flange **26** is in the form of a collar **130**. A plurality of longitudinal extending ribs **130**A are equidistantly spaced about the periphery of the collar **130** to enable the user of the dispensing apparatus **120** to tightly grasp the collar when the piercing member is inserted into the fitment and screwed therein, as will be described later. The distal end of the collar **130** includes a removable cover **132**. A central passageway **136** extends through the collar from the cover **132** to the rear surface **128** of the flange **126**. The cover **132** includes a ring **134** which is configured to be grasped and pulled by a user cause the ring and the cover to tear away from the collar **130** to expose the proximal end of the passageway **136**. When the fitment **122** is secured to the front surface **14** of the wall **10**A of the bag **10** a portion of the wall of the bag is in communication with the passageway **136**. That portion of the wall **10**A of the bag forms a frangible penetration zone **10**B (FIG. **17**) of the bag (i.e., the portion of the wall of the bag that will be penetrated by the piercing member **124**, as will be described later).

[0044] The piercing member **124** is also an integrally molded unit preferably formed of the same plastic material as the fitment, but can be of other suitable materials. In any case the piercing member is a tubular member having a proximally located section **138** and a distally located section **140**. The distal end of the distally located section **140** comprises a piercing tip that includes plural cutting teeth **142** extending a major portion of the periphery of the distal end of the distally located section **140**. The teeth **142** will be described later. Suffice it for not to state that when the piercing member is inserted into the fitment and screwed into its deployed position, the teeth **142** pierce and cut the wall **10**A of the bag or pouch at the frangible penetration zone **10**B to create a flap opening thereat. The proximal end portion of the proximally located section **138** has a tapering sidewall **144** terminating at a generally planar proximal end face **146** (FIG. **15**). The tapering sidewall **144** is provided to enable a dispensing tube (not shown) to be connected to it. The dispensing tube can form some portion of a dispensing device or can serve as the input to a receptacle or storage container into which the liquid from the bag **10** will flow when the piercing member is fully deployed.

[0045] As best seen in FIG. **15** central passageway **148** extends the length of the piercing member **124** from its distally located end face **146** to the tips of the teeth **142**. The passageway **148** includes a first section **148**A and a second section **148**B. The first section extends from the tips of the teeth **142** to a point beyond the mid-section of the piercing member. The second section **148**B extends from the end face **146** to the proximal end of the first section **148**A. The first and second sections may be of the same inside diameter or may be of different inside diameters, depending upon the desired flow rate through the apparatus **120**. The exemplary embodiment of the fitment **122** makes use of a passageway whose first section **148**A has an inside diameter, e.g., 0.590 inch, which is greater than the inside diameter, e.g., 0.310 inch of the second section. That configuration provides a dispensing apparatus which will dispense the liquid from the bag or pouch at a relatively low flow rate. As will be appreciated by those skilled in the art, if the piercing member **124** is molded such that its proximally located section **138** has a larger external diameter, the internal diameter of the second section **148**B of the central passageway **148** can be increased to increase the flow rate provided by the apparatus **120**.

[0046] A first annular flange **150** projects outward from the body of the piercing member **124** between the proximally located section **138** and the distally located section **140** at the location of the interface between the passageway sections **148**A and **148**B. A second annular flange **152** projects outward from the body of the piercing member **124** slightly distally of the flange **150**. As best seen in FIG. **10**, two generally planar finger tabs **154** are connected to the flanges **150** and **152** and project outward therefrom on diametrically opposed sides of the flanges. The tabs **154** serve as the portions of the piercing member **124** that are grasped by a user to screw the piercing member into the fitment. The two closely spaced flanges serve to reinforce the tabs to render the tabs resistant to flexing when the piercing member is screwed into the fitment. The distal portion of each of the tabs is in the form of an elongated finger **156**. Each finger **156** extends parallel to the central longitudinal axis A (FIG. **15**) of the piercing member. The inner surface of each finger **156** includes a short section **158** of a male helical thread. Each helical male thread section **158** projects radially inward toward the central longitudinal axis A of the piercing member so that the two thread sections **158** are diametrically opposed to each other. The two male thread sections **158** are configured to be received within respective ones of two diametrically opposed helical female thread sections **160** (FIGS. **10**, **13**A and **13**B) on the collar **130** of the fitment to enable the piercing member to be screwed into the fitment. In particular, two helical female thread sections **160** are provided on the proximal end portion of the collar **130** as best seen in FIG. **13**B. Each female thread section **160** includes an entrance **162** located at the proximal end of the collar **130**. The distal end of each female thread section **160** terminates at a point **164** located adjacent an annular flange **166** projecting radially outward from the collar **130**.

[0047] The male thread sections are configured to enter and slide along the female thread sections to screw the piercing member into the fitment, whereupon the teeth **142** of the piercing member will cut an opening in the frangible zone of the wall section **10**A. That cutting operation will be described in detail later. Suffice it for now to state that when the piercing member is screwed into its fully extended or deployed state or position, the open distal end of the piercing member will be located within the interior **12** of the bag or pouch. Thus, the liquid in the bag can flow into the section **148**A of the central passageway, from there it can flow into the section **148**B and out the open end **146**.

[0048] In order to hold the piercing member in its fully deployed state to thereby prevent it from backing out of the fitment, the dispensing apparatus includes a detent mechanism (to be described shortly). The detent mechanism also serves to ensure that the piercing cannot be reused after it has been fully deployed in the fitment. As will be seen from

the description to follow the apparatus **120** is configured so that when its piercing member has been screwed to its fully extended (deployed) position, it will be locked in place thereat by the detent mechanism. By so doing the piercing member is precluded from being reused on another bag, since such a reuse could expose the liquid in the other bag to contamination by any contaminants on the reused piercing member.

[0049] The detent mechanism basically comprises a pair of thread locks **168** (FIGS. **10**, **13**A and **13**B) that project outward from the fitment's collar **130** closely adjacent the points **164** at which the distal ends of the two female thread sections terminate, a pair of diametrically opposed notches **170** (FIG. **11**) in the annular flange **166**, and a pair of bosses **172** (FIGS. **10**, **15** and **17**) that project outward from the free end of the fingers **156**. The notches **170** are configured to receive respective one of the bosses **172** when the piercing member is in its fully extended (deployed) state, i.e., has been fully screwed into the fitment. As best seen in FIG. **13**B, the top or proximally facing surface of each of the thread locks **168** is in the form of a peaked cam surface **174**. Each of the thread locks **168** is undercut by an angularly extending surface **176** located below the peaked cam surface **174**.

[0050] Operation of the detent mechanism is as follows. The distal end of the piercing member is inserted into the proximal end of the central passageway **136** of the fitment by the user with the piercing member oriented so that its male thread sections **158** are axially aligned with the entrances **162** of respective female thread sections **160** of the fitment. The piercing member is then moved, e.g., pushed, distally so that the male thread sections enter the entrances of the aligned female thread sections. Once that has occurred, the user can screw the piercing member into the fitment to cause the teeth **14** of the piercing member to cut into the wall **10**A of the bag at the frangible zone **10**B. That screwing action is achieved by the user grasping the ribs **130**A of the collar with one hand, while grasping the finger tabs **154** of the piercing member with the other hand to twist the piercing member with respect to the fitment in the clockwise direction. That twisting action causes the helical male thread sections **158** to slide along the helical female thread sections from the entrance of those sections until the leading edge of the male thread sections reach the peaked cam surfaces **174** of the thread locks **168**. When that occurs, the male thread sections **158** slide along and ride up the up-sloped portions of the peaked cam surfaces **174** and then ride down the down-sloped portions of the peaked surfaces and flex somewhat until they reach the angularly extending undercut surfaces **176** of the thread locks, where they then snap into place. This action traps the male thread sections **158** at the locations **164** between the flange **166** and the undercut surfaces of the thread locks **168**. At the same time that this occurs, the bosses **172** of the finger tabs **154** will have slid into their respective notches **170** in the flange **166** of the fitment precluding any further twisting of the piercing member with respect to the fitment. Those combined actions effectively lock the piercing member in its extended or deployed position.

[0051] Turning now to FIGS. **10** and **16**, it can be seen that the distal end of the piercing member includes seven teeth **142** equidistantly spaced about the periphery thereof, except for a gap **178** which is the width of two of the teeth **142**. As best seen in FIG. **15**, each of the teeth **142** includes a leading edge **178**A and a trailing edge **178**B. The leading edge **178**A extends at a small acute angle to the central axis A. The trailing edge **178**B is arcuate and extends from the point at which it merges with the tip of the tooth to the point that it merges with the root of the next successive tooth. The leading and trailing edges are sharp, such that when the tips of the teeth first engage the wall **10**A at the frangible zone **10**B, they will pierce therethrough. The twisting of the piercing member in the clockwise direction, with respect to the fitment causes the leading edge and the trailing edge to bite into and cut a circular line through the material making up the wall **10**A of the bag. As should be appreciated by those skilled in the art, the shape of the teeth **142** ensures that the wall of the bag is cut readily with minimal twisting force applied. Moreover, since there is the gap **178** between the first and last tooth, the portion of the wall that is cut by the teeth will be an arc of less than **360** degrees, thereby creating a generally circular flap at the penetration zone **10**B as shown in FIG. **16**. That flap will remain connected to the wall of the bag by the uncut portion of the wall, thereby preventing it from becoming loose and possibly blocking the central passageway in the piercing member. In fact, the portion of the distal end of the piercing member that is within the interior **12** of the bag will act to hold the flap away from the open end of the piercing member so that the flap does not block or impede the flow of liquid into the central passageway of the piercing member. To ensure that the flap is held away from blocking the opening in the piercing member, the piercing member is dimensioned such that the tips of its teeth **142** are located a distance from the bag's wall **10**A that is at least more than half of the outer diameter of the distal end of the piercing member. In the exemplary embodiment the distance between the tips of the teeth and the wall of the bag is 0.038 inch.

[0052] As best seen in FIGS. **10** and **17**, the distal end portion of the piercing member includes a plurality of longitudinally extending windows or ports **180**. Those ports extend through the sidewall of the piercing member so that they are in fluid communication with the central passageway section **148**B. The ports enable one to dispense the entire liquid contents of the bag or pouch. In this regard, since the open distal end of the piercing member will be located some distance, e.g., 0.038 inch, from the wall **10**B of the bag or pouch, if the bag or pouch is oriented so that the fitment and piercing member are facing downward, any liquid that would otherwise be trapped below the open end of the piercing member will flow into the ports and thus into the passageway **148**B of the piercing member. Accordingly, irrespective of where the fitment is mounted on the wall of the bag, the entire liquid contents of the bag can be dispensed by merely orienting the bag so that the fitment and piercing member are directed downward, whereupon all of the liquid within the bag will flow into the fitment's central passageway, either through the open distal end of the piercing member or through the windows or ports **180**.

[0053] In order to prevent leakage of the liquid out of the interface between the piercing member **124** and the fitment **122** once the piercing member has penetrated the wall of the bag, the apparatus **120** includes two sealing members or rings. In particular, as best seen in FIGS. **10**, **15** and **20**, the sidewall of the distally located section **140** of the piercing member includes a thin annular sealing ring **182** projecting radially outward from an annular recess in the the outer surface of the piercing member. The outer diameter of the

sealing ring **182** is slightly greater than the inner diameter of the fitment's central passageway **136** so that the sealing ring **182** tightly engages the inner surface of the central passageway when the piercing member is inserted and screwed into it. In particular, the annular sealing ring **182** is located on the piercing member so that it will engage the inner surface of the central passageway **136** to form a compression seal before the teeth **142** of the piercing member engage the wall **10**A of the bag **10**. By so doing, the apparatus **120** ensures that once the teeth reach and pierce the wall of the bag, but before the piercing member is in its fully extended (deployed) state, no liquid within the bag will be able to gain egress or leak out of the interface between the inner surface of the fitment's passageway and the outer surface of the piercing member. A second thin annular sealing ring **184** projects radially outward from an annular recess in the outer surface of the piercing member. The ring **184** is located proximally of the sealing ring **182**. The sealing ring **184** is of slightly larger outer diameter than the sealing ring **182** so that it will tightly engage the inner surface of the fitment's central passageway **36** when the piercing member has been fully deployed to its fully deployed state, i.e., screwed fully into to fitment so that the piercing tip is fully within the interior of the bag. Thus, the sealing ring **184** forms a final, compression seal for the apparatus to prevent any liquid from leaking out of the interface between the between the inner surface of the fitment's passageway and the outer surface of the piercing member.

[0054] Turning now to FIGS. **10-12**, the details of the removable cover **132** will now be described. To that end, as can be seen the cover **132** basically comprises a thin circular wall or disk **186** located within the heretofore identified ring **134**. The sidewall of the ring includes a flange-like tab **188** projecting outward adjacent the top edge of the ring. A somewhat crescent shaped opening **190** is located in the sidewall of the ring below the tab **188**. A pair of narrow connectors **192** is connected between the inner surface of the ring **134** and the top surface of the disk **186**. A pair of wider connectors **194** is connected between the inner surface of the ring **134** and the top surface of the disk **186** and is located between the connectors **192**. A very wide arcuate connector **196** is connected between the inner surface of the ring **134** and the top surface of the disk **186** between the connectors **192** and generally opposite the connectors **194**. The top surface of the disk **186** of the cover at the interface with the ring **134** and located between the connectors **192**, **194** and **196** is in the form of arcuate sections **198** of a groove, whereupon the thickness of the disk under the groove is very thin, e.g., 0.007 inch. Moreover, the undersurface of the disk **186** at the locations of the connectors **192**, **194** and **196** is in the form of arcuate sections of a groove (not shown). The depth of the sections of that groove is equal to the thickness of the disk **186** minus the thickness of the groove sections **198**. Thus, the groove sections **198** in the top of the disk **186** and the groove sections in the underside of the disk conjoin to form a circular frangible tear line extending about the periphery of the disk. The tear line is generally flush with the inner surface of the central passageway **136** of the fitment's collar.

[0055] The cover **130** is configured to be torn away from the collar by the breaking of the frangible tear line. To that end, the tab **188** is arranged to be grasped by the user extending either his/her thumb or index finger into the opening **190** to engage the undersurface of the tab **188**, while his/her index finger or thumb (as the case may be) engages the upper surface of the tab. The user then pulls upward on the tab, whereupon the ring **134** and the disk **186** break away from the collar, leaving the fitment secured to the bag in the condition shown in FIG. **13**A, i.e., with the proximal end of the central passageway open and ready for receipt of the piercing member.

[0056] As will be appreciated by those skilled in the art from the foregoing, the apparatus of this invention makes use of the mating threads the fitment and the piercing member to provide a mechanical advantage in deploying the piercing member through the throat of the fitment to pierce the wall of the flexible bag. That mechanical advantage allows for typical hand force application to the piercing member in a twisting manner to penetrate bags or containers made of flexible films of much higher durability and puncture resistance than previously deemed possible without significant effort. The subject invention also allows for forward placement of the sealing ring on the outer circumference of the piercing member to ensure fluid-tight sealing of the assembly before, during and after piercing the container to permit fluid flow.

[0057] While the invention has been described in detail and with reference to specific examples thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

I claim:

1. Apparatus for dispensing a liquid from within a flexible package, said apparatus comprising:

a fitment comprising a body having a passageway extending therethrough, and a flange, said flange being configured for securement to a wall of the flexible package whereupon a portion of the wall of the flexible package is located within said passageway, said fitment including a screw-thread section;

a piercing member comprising a distally located section, a proximally located section, a screw-thread section, and a passageway extending through said distally located section and said proximally located section, said distally located section having a piercing tip configured for insertion in said passageway of said fitment with said screw-thread section of said piercing member threadedly engaging said screw-thread section of said fitment to cause said piercing tip to penetrate the portion of the wall of the package, whereupon the liquid within the package can flow into and through said passageway of said piercing member.

2. The apparatus of claim **1** wherein when said piercing member is located within said passageway of said fitment an interface is created therebetween and wherein said apparatus additionally comprises a first sealing member for sealing said interface.

3. The apparatus of claim **2** wherein said first sealing member comprises a ring which forms a compression seal in said interface.

4. The apparatus of claim **3** wherein said first sealing member is configured to form said compression seal before said piercing tip penetrates the wall of the package.

5. The apparatus of claim **4** additionally comprising a second sealing member, said second sealing member being configured to form a compression seal in said interface after said piercing tip has penetrated the wall of the package.

6. The apparatus of claim 1 wherein said piercing member is configured to be fully deployed in a fully deployed state wherein said piercing tip is within the package and wherein said apparatus additionally comprises a locking mechanism configured for locking said piercing member in place in said fully deployed state.

7. The apparatus of claim 1 wherein said piercing member comprises a pair of finger tabs configured for engagement by a user to cause said screw-thread section of said piercing member to threadedly engage said screw-thread section of said fitment to cause said piercing tip to penetrate the portion of the wall of the package, and wherein said screw-thread section of said piercing member comprises a pair of screw-thread sections, said screw-thread sections being mounted on respective ones of said finger tabs.

8. The apparatus of claim 1 wherein said piercing tip comprises a plurality of teeth, wherein each of said teeth includes a linear leading cutting edge and an arcuate trailing cutting edge.

9. The apparatus of claim 8 wherein said piercing tip additionally comprises a gap between two of said teeth, whereupon when said piercing member penetrates the wall of the package it creates a flap which remains connected to the wall of the package.

10. The apparatus of claim 1 wherein said passageway in said fitment comprises a distal end portion and a proximal end portion, said distal end portion being located adjacent the wall of the flexible package when said flange of said fitment is secured thereto, said proximal end portion having a cover releasably secured thereto to close said proximal portion of said passageway.

11. A flexible package configured for dispensing a liquid therefrom, said flexible package comprising;

a hollow member having a wall formed of a flexible material; and

a dispensing apparatus for dispensing a liquid from within said flexible package, said apparatus comprising:

a fitment comprising a body having a passageway extending therethrough, and a flange, said flange being secured to said wall of said flexible package whereupon a portion of said wall is located within said passageway, said fitment including a screw-thread section; and

a piercing member comprising a distally located section, a proximally located section, a screw-thread section, and a passageway extending through said distally located section and said proximally located section, said distally located section having a piercing tip configured for insertion in said passageway of said fitment with said screw-thread section of said piercing member threadedly engaging said screw-thread section of said fitment to cause said piercing tip to penetrate said portion of said wall of said package, whereupon the liquid within said package can flow into and through said passageway of said piercing member.

12. The flexible package of claim 11 wherein when said piercing member is located within said passageway of said fitment an interface is created therebetween and wherein said apparatus additionally comprises a first sealing member for sealing said interface.

13. The flexible package of claim 12 wherein said first sealing member is configured to form said compression seal before said piercing tip penetrates the wall of the package.

14. The flexible package of claim 13 wherein said first sealing member comprises a ring which forms a compression seal in said interface.

15. The flexible package of claim 14 additionally comprising a second sealing member, said second sealing member being configured to form a compression seal in said interface after said piercing tip has penetrated the wall of the package.

16. The flexible package of claim 11 wherein said piercing member is configured to be fully deployed in a fully deployed state wherein said piercing tip is within the package and wherein said apparatus additionally comprises a locking mechanism configured for locking said piercing member in place in said fully deployed state.

17. The flexible package of claim 11 wherein said piercing member comprises a pair of finger tabs configured for engagement by a user to cause said screw-thread section of said piercing member to threadedly engage said screw-thread section of said fitment to cause said piercing tip to penetrate the portion of the wall of the package, and wherein said screw-thread section of said piercing member comprises a pair of screw-thread sections, said screw-thread sections being mounted on respective ones of said finger tabs.

18. The flexible package of claim 11 wherein said passageway in said fitment comprises a distal end portion and a proximal end portion, said distal end portion being located adjacent the wall of the flexible package when said flange of said fitment is secured thereto, said proximal end portion having a cover releasably secured thereto to close said proximal portion of said passageway.

19. A method for dispensing a liquid from within a flexible package, the flexible package having a wall, said method comprising:

providing a fitment comprising a body having a passageway extending therethrough, a flange, and a screw-thread section;

securing said flange to said wall of the flexible package whereupon a portion of said wall is located within said passageway;

providing a piercing member comprising a distally located section, a proximally located section, a screw-thread section, and a passageway extending through said distally located section and said proximally located section, said distally located section having a piercing tip; and

inserting said distally located section of said piercing in said passageway of said fitment with said screw-thread section of said piercing member threadedly engaging said screw-thread section of said fitment to cause said piercing tip to penetrate said portion of said wall of said package, whereupon said liquid within said package can flow into and through said passageway of said piercing member.

20. The method of claim 19 wherein said passageway in said fitment comprises a distal end portion and a proximal end portion, said distal end portion being located adjacent the wall of the flexible package when said flange of said fitment is secured thereto, said proximal end portion having a cover releasably secured thereto to close said proximal portion of said passageway, said method additionally comprising removing said cover after said flange of said fitment is secured to the wall of the package to thereby expose said

proximal portion of said passageway and thereafter inserting said distal portion of said piercing member in said proximal portion of said passageway.

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