

SOFT CONFORMABLE HOLLOW BAG TAMPON AND SPREADING TAMPON APPLICATOR

FIELD OF THE INVENTION

This invention relates to catamenial tampons and associated applicators. More particularly, this invention relates to an improved tampon which is in the form of a soft, conformable, hollow bag and which covers a substantial portion of the interior of the vaginal cavity. This invention also relates to applicators for catamenial tampons, and more particularly to an applicator which is capable of inserting a tampon into the vaginal tract and spreading the tampon open within the vaginal cavity.

BACKGROUND OF THE INVENTION

It has been long recognized that the internal vaginal cavity in its normal collapsed state is of much wider dimension in its transverse plane than in its vertical plane. It is equally well known that the minimum dimension of the vagina is at the introitus while the maximum dimension is near the cervix. It is desirable therefore, when considering a tampon for catamenial use, to provide a structure which is in its initial state is of a size small enough to pass through the vaginal orifice without discomfort, and when once inside the vaginal cavity and beyond the restrictions of the orifice may be expanded, particularly in the lateral direction, to contact substantially all of surface of the vaginal walls from one side to the other in the vaginal cavity to prevent early bypass of the menstrual discharges from the cervix. Since the vaginal wall in its normal collapsed state is flaccid and has multiple folds and wrinkles which provide channels through which a significant portion of the menstrual fluids normally flow, it is also important that the absorbent tampon be as soft and conformable as possible, in order to conform to shape of the vaginal cavity and fit within these channels to minimize leakage.

The absorbent catamenial tampons now in general use comprise small, highly compressed, cylindrical plugs about three-eighths to one-half inch (about 1.0 cm to 1.3 cm) in diameter and from 1 ½ to 2 ½ inches in length (about 3.8 cm to 6.4 cm). Because of the need for absorbent capacity, they are usually formed from batts much larger in size

than the vaginal orifice, and compressed to the small size indicated above in order to facilitate insertion. As fluid is absorbed, these compressed tampons are expected to expand (or re-expand) toward their original precompressed size, and to eventually become large enough to effectively block the vaginal cavity against fluid leakage or bypass. While it has been found that these compressed tampons perform their intended function tolerably well, even the best of them do not expand sufficiently, or fast enough, to provide a good transverse block against leakage even though the vertical block may be satisfactory. Further, most of these tampons generally use only a portion of their absorptive capacity before leakage. Since these tampons rely on some fluid absorption to expand, it is clear that fluid bypass and leakage can occur prematurely, and can particularly occur immediately following the time of insertion.

Numerous attempts have been made to solve this problem with some approaches focusing on the applicator and others focusing on the tampon itself.

For example, some approaches in the patent art suggest a tampon with a built-in mechanical expansion means, a typical example being U.S. Patent 3,706,311 to Kokx et al. However, while a good transverse block appears to be produced, the mechanical expansion means disclosed in that patent is in the form of a flat spring-like element which after insertion permanently maintains the spread configuration of the tampon, may make it difficult to remove.

Another approach is described in U.S. Patent 3,512,528 to Whitehead et al, which teaches the use of a sack of absorbent material collapsed to a small size for insertion and which after insertion is expanded by the introduction of a gas or a fluid internally of the sack. The multiple steps and complicated manipulation of the gas or fluid introduction means required when using this type of tampon detract from what otherwise appears to be an effective solution of the problem.

Still another approach is described in U.S. Patent 3,857,395 issued to Johnson, et al. The Johnson, et al. patent teaches the use of an elongated inserter device over which a flat tampon is draped. The inserter is said to permit the draped portion of the tampon to be pulled, rather than pushed into the cavity from the point at which the tampon is supported on the leading end of the inserter. The inserter means is equipped with a bilateral expansion mechanism which at the user's option may be operated to transversely spread the tampon at the time of insertion. The inserter device described in the Johnson, et al. patent suffers from many drawbacks, however. The Johnson inserter device is a complicated device comprising a pair of hinged arms that are capable of

laterally diverging at a hinge or joint. The angular nature of the hinged arms would appear to make that inserter uncomfortable to use. The complex nature of the hinged arms would also appear to make it difficult and expensive to manufacture. As a result, it would not be suitable as a disposable applicator.

Another problem that exists in deploying tampons having a greater transverse dimension within the vaginal cavity is that this greater transverse dimension of the vaginal cavity is roughly perpendicular to the vaginal opening.

One attempt to address this latter problem is described in U.S. Patent 3,068,867 issued to Bletzinger, et al. The Bletzinger, et al. patent is directed to a tampon insertion device having a positioning indicator thereon. The device described in the Bletzinger, et al. patent comprises an insertion device for tampons which are either of cylindrical cross-section, or non-cylindrical cross-section but constructed to expand when subjected to fluids in a non-cylindrical shape. The insertion device is provided with an indicator that aids the user in inserting the tampon with its major cross-sectional axis transverse to the major axis of the vaginal opening.

The Bletzinger device, however, is awkward in that it requires insertion of the widest dimension of the tampon cross-wise to the narrowest dimension of the vaginal opening. Thus, a need exists for a tampon applicator which is capable of effectively deploying a tampon having a non-cylindrical shape in the vaginal cavity which does not require alignment of the widest dimension of the tampon cross-wise to the narrowest dimension of the vaginal opening.

Another series of attempts to overcome the problems associated with conventional, highly compressed, fluid expanding tampons is described in U.S. Patent 3,749,094 issued to Duncan and U.S. Patents 3,794,029 and 3,766,921 both issued to Dulle. The Duncan and Dulle devices are all generally conical and are designed to be dry-expanding. While these devices would be expected to overcome some of the problems associated with highly compressed, fluid expanding tampons, the Duncan and Dulle devices still require significant rigidity and compression in order to permit their use in a conventional "tube and plunger" type applicator for which they are designed.

It has been found during development of the present invention that a tampon constructed according to the invention described herein can provide even further improvements in comfort, low wearing awareness, and performance as compared to currently marketed tampons and previous attempts to improve upon such tampons such

as those described above. Tampons according to the present invention may be designed for digital insertion. Alternatively, a unique tampon applicator which is capable of effectively deploying a tampon of the type described herein may also be provided.

SUMMARY OF THE INVENTION

This invention relates to catamenial tampons and applicators for catamenial tampons. More particularly, this invention relates to an applicator which is capable of inserting a tampon into the vaginal tract and spreading the tampon open within the vaginal cavity. The tampon of the present invention is in the form of a soft, conformable, hollow bag and covers a substantial portion of the interior of the vaginal cavity. The present invention is also directed to the combination of an expandable catamenial tampon and a spreading tampon applicator.

In one embodiment, the tampon of the present invention, has a bag-like conformable absorbent body. The tampon has an outer surface, an inner surface, a head portion and a trailing portion. The inner surface of the tampon defines an interior of the tampon wherein the head portion is closed and the trailing portion defines an opening into the interior of the tampon. The tampon may have a shape modulus of compression of less than 0.05 pounds force. The tampon may also comprise a withdrawal sting attached to the absorbent part of the tampon. The withdrawal string may be attached to the head portion of the absorbent body. The string may also be disposed within the interior of the tampon. In some preferred embodiments, the string may be attached to the head portion of the tampon and a portion of the string may be disposed within the interior of the tampon such that the tampon is inverted when the withdrawal sting is pulled for removal.

In one embodiment, the tampon comprises an absorbent material selected from the group consisting of: rayon, cotton, superabsorbent material, and blends thereof.

In another embodiment, the outer surface of the tampon may comprise texturing elements. The texturing elements in one preferred embodiment comprise microfibrils. The texturing elements may be hydrophilic. The texturing elements may comprise capillary channel fibers. Additionally, the texturing elements may have a lower density than the outer surface of said tampon such that a density gradient is created from the texturing elements to the outer surface of the tampon.

In another embodiment, the tampon comprises at least one pleated fold in said outer surface. The tampon may comprise a pair of pleats located at opposite sides of said outer surface.

In one embodiment, the tampon may comprises a layered structure such that the material composition of the outer surface of the tampon differs from the material composition or density of the inner surface of the tampon. The tampon may comprise at least an outer layer and an inner layer wherein at least a portion of the outer layer defines the outer surface and wherein at least a portion of the inner layer defines the inner surface. The inner surface may comprises a liquid impervious barrier. The inner layer of the tampon may have a higher density than the outer layer. The inner layer may comprise primarily cotton. The outer layer may comprises primarily rayon.

In one embodiment of the tampon of the present invention, when the tampon is compressed in a flat configuration the outer surface has a maximum width which exceeds the width of the opening of the trailing portion of the tampon. The tampon may have a plan view when compressed which is generally balloon-shaped. The tampon may have a synergistic absorbency of from about 5 to about 30 grams.

The spreading tampon applicator is preferably capable of first inserting and then bilaterally spreading the tampon to a partially or fully-opened condition within the vaginal cavity. The tampon applicator comprises an applicator element with a leading end and a trailing end. In embodiments that are less preferred from a convenience standpoint, the inserter may comprise a rod or other structure that is used for inserting the tampon and the inserter is manually moved from side to side to deploy the tampon. In embodiments that are more preferred for convenience, the applicator includes a structure that expands the tampon without such action on the part of the user.

In such more convenient embodiments, the spreading tampon applicator preferably comprises a holder in the form of an elongate tube having insertion end, a gripping end, an interior, and an inside diameter. The spreading tampon applicator preferably further comprises at least one flexible, movable structure that is adapted to reside inside the tubular holder until it is pushed out the insertion end. The flexible, movable structure preferably has resilient opposed portions that are biased to expand when not subject to confinement in the tubular holder. A hollow "bag-like" tampon is preferably placed over the flexible structure when the flexible structure is inside the tubular holder. When the flexible structure is pushed out of the insertion end of the holder it spreads out to deploy the tampon. The flexible, movable structure can comprise

one or more elements. These elements preferably have opposing portions that are capable of flexing and expanding away from each other. In preferred embodiments, the elements are convexly rounded to provide a comfortable surface against the wearer's body.

In one preferred embodiment, the flexible, movable structure comprises at least one flexible loop of material. The loop of material preferably comprises an elongate piece of material, preferably in the form of a flexible rod, which has two ends. In a preferred embodiment, the flexible rod is bent so that one portion of the piece of material is formed into an expandable loop and the ends of the piece of material opposite the loop extend in the same general direction as one another. The loop is preferably slidably mounted within the tubular holder. The "bag-like" tampon is preferably placed over the flexible loop. The loop has an initial width which is less than or equal to the inside diameter of the tubular holder, and is expandable so that it has a deployed width which is greater than the inside diameter of the tubular holder.

The spreading tampon applicator described herein is small enough in size to pass through the vaginal orifice without undue stretching or friction. Once the flexible loop is inside the vaginal cavity, it expands the tampon in the lateral direction and positions the tampon in the proper orientation in the vaginal cavity. In all of the embodiments described herein, the spreading force that is exerted by the applicator can be regulated by the force applied by the wearer on the applicator. The spreading tampon applicator of the present invention, unlike prior angular and hinged devices, is very comfortable to use, simple and cost-effective to make.

A non-limiting number of embodiments of the present invention are possible. In the most basic form of the loop-type of embodiment, the applicator comprises a single loop of material (and such an embodiment can even be used alone without the tubular holder). In one particularly preferred embodiment, the applicator comprises two (or more) loops of material. Such a particularly preferred embodiment may be used with or without a tubular holder. Preferably, it is used in conjunction with a tubular holder. In this particularly preferred embodiment, the loops of material are preferably oriented at an angle of about 90 degrees relative to each other when the applicator is viewed from the end. This embodiment has the advantage of providing an increased likelihood of ensuring that one of the loops of material will be oriented in the same plane as the vaginal cavity. In another embodiment, the loop can be provided with the ability to rotate as it deploys. Such an embodiment is useful in initially aligning the loop parallel

to the opening of the vagina when the tampon is inserted through the vaginal opening, and then changing the orientation of the loop so that it is aligned parallel to the vaginal cavity when the tampon is deployed. In still another embodiment, the applicator has a loop that is constrained in length as it deploys by joining a portion of the loop to the inserter. The loop in this embodiment resembles a "ram's horn" in appearance.

Other embodiments are also possible. For example, the flexible, movable structure need not be in the form of a loop. It can, for instance, instead be comprised of separate prongs that are biased to flex away from each other, and spread out. Numerous other embodiments are possible. Many of the embodiments described herein are particularly useful because they provide a "signal" to the user that the tampon is properly oriented and is spread laterally across the vaginal cavity. The applicators described herein are also capable of deploying a tampon which closely fits the cross-section of the vaginal cavity. In particular, the applicators described herein may be suitable for fitting the tampon to the portion(s) of the vaginal cavity which have a cross-section that resembles a compressed upper case letter "H".

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a tampon of the present invention.

FIG. 2 is a perspective view of an additional embodiment of the tampon of the present invention.

FIG. 3 shows the tampon of FIG. 1 in a flattened configuration.

FIG. 4 is a front view of a tampon of the present invention in which the withdrawal cord is attached along one side edge of the tampon.

FIG. 5 shows an embodiment of the tampon of the present invention in which the outer surface of the tampon is provided with texturing elements.

FIG. 6 shows an embodiment of the tampon of the present invention in which the tampon is provided with an internal annular ring.

FIG. 7 shows an embodiment of the tampon of the present invention in which the sides of the tampon are pleated.

FIG. 8 shows an embodiment of the tampon of the present invention in which the interior of the tampon contains an interior projection.

FIG. 9 shows an embodiment of the tampon of the present invention in which the tampon has a layered structure.

FIG. 10 shows the inversion of a tampon of the present invention during removal with the withdrawal string.

FIG. 11 shows an embodiment of the tampon of the present invention in which the tampon has tufts or fingers at the insertion end.

FIG. 12 shows digital insertion of the tampon of the present invention.

FIG. 13 is a perspective view of one embodiment of a tampon applicator according to the present invention.

FIG. 14 is a perspective view of the tampon applicator shown in FIG. 13 with the loop partially deployed.

FIG. 15 is a perspective view of the tampon applicator shown in FIG. 13 with the flexible loop fully deployed.

FIG. 16 is a perspective view of the tampon applicator shown in FIG. 13 with the loop retracted.

FIG. 17 is a perspective view of another alternative embodiment of the tampon applicator of the present invention in which the flexible loop is provided with the ability to rotate 90 degrees during deployment to accommodate the difference in orientation between the vaginal opening and the vaginal cavity.

FIG. 18 is a perspective view of the tampon applicator shown in FIG. 17 which shows the flexible loop in a vertical position for insertion through the vaginal opening.

FIG. 19 is a perspective view of the tampon applicator shown in FIG. 17 which shows the flexible loop rotated 90 degrees for insertion of the tampon in the vaginal cavity.

FIG. 20 is a side view of the tampon applicator shown in FIG. 17, partially cut away, which shows the mechanism which provides the flexible loop with the ability to rotate.

FIG. 21 is a perspective view of a preferred alternative embodiment of the tampon applicator of the present invention which comprises two flexible loops that are oriented at a 90 degree angle relative to each other.

FIG. 22 is a perspective view of the tampon applicator shown in FIG. 21 which shows how the two loops will come together to a similar planar relationship to accommodate the shape of the vaginal cavity.

FIG. 23 is a partially fragmented perspective view of another alternative embodiment of the tampon applicator of the present invention in which the flexible loop is constrained in length as it deploys by having a portion thereof joined to the holder.

FIG. 24 is a perspective view of the tampon applicator shown in FIG. 23 in a partially deployed condition.

FIG. 25 is a perspective view of the tampon applicator shown in FIG. 23 in a fully deployed condition.

FIG. 26 is a perspective view of another alternative tampon applicator which comprises several flexible prongs instead of a flexible loop.

FIG. 27 is a perspective view of a simplified version of a tampon applicator and a tampon that it may be used to spread open by manually moving the applicator from side to side.

DETAILED DESCRIPTION OF THE INVENTION

This invention relates to catamenial tampons and applicators for catamenial tampons. More particularly, this invention relates to an applicator which is capable of inserting a tampon into the vaginal tract and spreading the tampon open within the vaginal cavity. The tampon of the present invention is in the form of a soft, conformable, hollow pad and covers a substantial portion of the interior of the vaginal cavity. The present invention is also directed to the combination of an expandable catamenial tampon and a spreading tampon applicator.

The tampon of the present invention is designed to achieve maximum fit (side-to-side coverage of the vaginal surface area) without significant distortion of the vaginal surface. FIG. 1 shows one embodiment of the tampon of the present invention, tampon 26. As shown in FIG. 1, the tampon 26 is generally shaped like a hollow bag or an inverted sock (that is, a shape like the portion of a sock that is worn on a wearer's foot, not including the angled portion that is worn over the wearer's ankle).

The tampon 26 has a head 26A or end that is the first portion of the tampon 26 to be inserted into the vaginal cavity, a trailing end 26B, surfaces 26C, and edges 26D. The tampon 26 is "bag like" or "bag shaped" in that it preferably has an open trailing end 26B, and a hollow, rather than a solid interior. Thus, the tampon 26 preferably has two or more surfaces (or sides) 26C that are joined together, a closed head end 26A, and an open trailing end 26B.

The tampon 26 is preferably highly flaccid and conformable to the body such that it compensates for and responds to body movements. The tampon 26 need not be, and preferably is not pre-compressed to a point where the fibers "set" and re-expand upon the absorption of fluid. Because the tampon 26 may be designed for digital insertion or insertion with a unique applicator, it need not rely on resiliency or "spring" within the fibers of the tampon itself to re-expand. This feature allows the tampon 26 to be significantly more flaccid and conformable than previous tampons and, consequently, more comfortable and effective for fluid acquisition than such devices.

The size and shape of the tampon 26 is important to its comfort and effectiveness. As described, the tampon 26 preferably has a hollow interior and can be configured in a wide variety of shapes such as a shape generally resembling an "oven mitt" or a "sock" without the ankle portion. The tampon 26 preferably has a generally flat configuration when deployed which allows it to conform to the shape of the vaginal cavity. (The shape of the vaginal cavity is described in greater detail in U.S. Patent 3,749,094 issued to Duncan on July 31, 1973.) The tampon 26 may have a number of suitable plan view shapes. Suitable plan view shapes, include, but are not limited to: generally rectangular with rounded edges, generally trapezoidal, conical, or as shown in FIG. 2, a shape that resembles an oven mitt (without the thumb portion). The tampon 26 can be of any suitable size. The tampon 26 shown in FIG. 1 preferably has a length measured from the head 26A to the trailing end 26B in the range of about 4 cm to about 7.5 cm, more preferably from about 5 cm to about 6 cm, even more preferably about 5.5 cm. The width of the tampon 26 measured from one edge 26D to the other is preferably between

about 2 cm and about 7 cm, more preferably from about 3 cm to about 5 cm, even more preferably about 3 cm to about 4 cm.

Caliper (or thickness) measurements given herein were measured using an AMES gage with a 0.25 psi (1.7 kPa) (gauge) load and a 0.96 inch (2.44 cm) diameter foot. Those skilled in the art will recognize that if a 0.96 inch (2.44 cm) diameter foot is not appropriate for a particular sample size, the foot size may be varied while the load on the gage is accordingly varied to maintain a confining pressure of 0.25 psi (1.7 kPa) (gauge). The caliper of the tampon 26 is preferably in the range of from about 2 mm to about 8 mm, more preferably from about 3 mm to about 6 mm.

The tampon 26 may also be constructed in the shape of an oven mitt, balloon, or light bulb such as shown in FIG. 2. In such an embodiment, the widest portion of the tampon 26 is near the head 26A, and is designated W_H . In the embodiment shown in FIG. 2, W_H may preferably be in range of from about 1.5 cm to about 8 cm, more preferably from about 4 to about 6 cm. The tampon 26 is narrower at the trailing end 26B. The width at the trailing end 26B is designated as W_B in FIG. 2. Preferably, this W_B is in the range of from about 1 cm to about 3 cm, more preferably about 2.5 cm.

The tampon 26 may be constructed from a wide variety of liquid-absorbing materials commonly used in absorbent articles such as rayon, cotton, or comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; synthetic fibers such as crimped polyester fibers; peat moss; tissue including tissue wraps and tissue laminates; or any equivalent material or combinations of materials, or mixtures of these. Preferred absorbent materials comprise cotton, rayon (including tri-lobal and conventional rayon fibers, and needle punched rayon), folded tissues, woven materials, nonwoven webs, synthetic and/or natural fibers. The tampon 26 may comprise a single material or a combination of materials. Additionally, superabsorbent materials, such as superabsorbent polymers or absorbent gelling materials may be incorporated into the tampon 26.

In the preferred embodiment shown in FIG. 1, the tampon 26 is formed of a soft absorbent material such as rayon, cotton (either long fiber cotton or cotton linters) or other suitable natural or synthetic fibers or sheeting. The materials for the tampon 26 can be formed into a fabric, web, or batt that is suitable for use in the tampon 26 by any suitable process. Suitable types of materials include woven fabrics, nonwoven fabrics,

including needle punched nonwoven fabrics, hydro entangled structures, chemically entangled structures, and other types of materials. Needle punched fabrics are particularly suitable if it is desirable to provide the tampon 26 with a textured outside surface. The tampon 26 may include osmotically swelling materials.

One non-limiting example of a simplified manner of constructing the tampon 26 is as follows. In this example, the tampon 26 is made from materials similar to those currently used in conventional tampons (e.g. rayon or cotton or a blend thereof). A rectangular web of absorbent material similar to that used to form a tampon pledget for conventional compressed tampons can be used as a starting material. This web of absorbent material can be of any suitable thickness that is capable of being formed into a bag that is conformable as described herein. A preferred thickness range for such a web is about one-half of the range given above for the preferred ranges of the overall caliper of the completed tampon 26.

As noted, a wide variety of materials are suitable from which to construct the tampon 26 of the present invention. Such a tampon may have a wide variety of such properties as density, basis weight, and the like. For example, a tampon 26 of the present invention may be constructed from a web of rayon and cotton (such as that used in conventional tampons) having a basis weight of about 165 g/m². Another suitable example is a web of chemically entangled cotton having a basis weight of about 180 g/m². Needle punched rayon (such as a tri-lobal rayon) or needle punched cotton may also be formed into a suitable web.

The web of absorbent material is then preferably covered with a single thin layer of overwrap material. The overwrap may be made of any suitable material and serves to help prevent surface fibers from the tampon 26 from coming loose in the wearer's body. It should be noted that not all materials from which the tampon 26 may be made will require the use of an overwrap. For example, when a needle punched or hydroentangled web is used to form the tampon 26, an overwrap is not always needed and is preferably dispensed with. Nevertheless, tampons both with and without an overwrap material are within the scope of the present invention.

A preferred material for the overwrap is rayon, although other materials including bicomponent fibers, or other natural or synthetic fibers, may also be suitable. The overwrap material is folded around the faces of the web of absorbent material. The overwrap material is preferably of a sufficient size such that it extends beyond the ends of the web of absorbent material. The portions of the overwrap that extend beyond the

ends of the web are preferably sealed together. The wrapped web of absorbent material is then folded about itself into a tube shape (or flattened tube shaped) and sealed with a seam along one side and at one end to form the wrapped web of absorbent material into a bag structure. If desired, the bag can be turned inside out so the seams will be on the inside of the bag structure.

In alternative embodiments, two webs may be used which are then sealed together in any suitable manner. Such techniques include stitching, ultrasonically bonding, gluing with adhesives, or any other suitable means known in the art. Two webs may be joined along two seams which may be located along the side edges 26D of the tampon 26. Construction of a tampon 26 of the present invention from two webs of material joined in the manner indicated may be more convenient when the tampon 26 will have a non regular overall shape such as that shown in FIG. 2. It is not necessary that tampon 26 be sealed along the entire side edge 26D of the tampon 26 to form the bag-like structure of the present invention. The tampon 26 may have a bag like, upper portion (the portion toward the head 26A of the tampon) and have more open "flaps" (that is, unsealed portions) toward the lower portion of the tampon 26.

The tampon 26 shown in FIG. 1 is highly conformable and flaccid. In this preferred embodiment, the tampon 26 has little to no resiliency. In other words the tampon 26 shown in FIG. 1 will tend to remain in its collapsed "bag like" state when not subjected to any external forces. The tampon 26 should have little tendency to "spring" to any particular opened state or shape. The tampon 26 may have a shape modulus of compression, i.e. the unidirectional pounds force required to deform the tampon 26 to its collapsed state, i.e. collapsed so any interior cavity is substantially eliminated and the interior surface is reduced to line contact between opposing points such as shown in FIG. 3, below 0.05 pounds.

The tampon 26 of the present invention because of its unique design (and through the use of the unique applicator discussed below) may be made of materials not previously utilized for a dry expanding, substantially non-resilient tampon. Previous dry-expanding tampons, such as those shown in U.S. Patent 3,749,094 issued to Duncan and U.S. Patents 3,794,029 and 3,766,921 both issued to Dulle. These and similar attempts at producing a dry-expanding tampon focused on the use of absorbent foam due to its resiliency. The tampon 26 of the present invention need not, and preferably, does not incorporate foam as the primary absorbent material of the tampon.

One advantage of the tampon 26 of the present invention is because of its highly effective shape and lack of fiber compression, less overall absorbent material need be used than in convention tampons. Only about half of the absorbent material found in a conventional tampon of the highly compressed type need be used in the tampon 26 of the present invention in order to obtain an overall absorbency of 6-9 grams in standard syngyna testing. In preferred embodiments, the overall absorbency of the tampon 26 ranges from about 5 to about 30 grams in standard syngyna testing.

The tampon 26 preferably has a removal string 44 that is attached thereto. The removal string 44 can be attached to the inside surface 42 or the outside surface 40 of the tampon 26. The removal string 44 may be attached generally down the center of one surface 26C of the tampon 26 (as shown in FIG. 1), or the removal string 44 may be attached generally along one of the edges 26D of the tampon 26 as shown in FIG. 4. In one particularly preferred tampon (shown in FIG. 10 and discussed further below), the removal string 44 is attached to the inside surface of the tampon 26, adjacent to the head 26A of the tampon 26 to facilitate inversion of the tampon 26 upon removal.

As shown in FIG. 7, the tampon 26 may have a cross section in which two of its sides are pleated so that it resembles a paper shopping bag when looking into the open end of the tampon 26. The pleats 54 will allow the sides of the tampon 26 to expand laterally. In another variation on the embodiment shown in FIG. 7, the tampon 26 may be provided with a plurality of pleats 54 disposed around its cross-section that are capable of opening in any desired direction. The tampon 26 may also be provided with a plurality of pleats across its major flat surfaces 26C such that it tends to expand laterally in a manner similar to an accordion. The pleats 54 in the tampon 26 also may improve its ability to conform to the shape of the vaginal cavity, which is often described as having an "H-shaped" cross-section. A pleated tampon 26 such as that shown in FIG. 7 is advantageously made from a tampon originally having a shape similar to that shown in FIG. 2. The wider head portion of the tampon 26 of FIG. 2 is tucked inward to form a pleated tampon 26 such as that shown in FIG. 7.

The outside surface 40 of the tampon 26 may be plain, or it can be textured. Preferably, it is textured. An example of such a textured outer surface 40 is shown in FIG. 5. The texturing can take the form of microfibrils 56 as shown in FIG. 5. Texturing may be provided by needle punching the outside surface 40 of the tampon 26. Additionally, the microfibrils 56 may be attached to the outer surface of the tampon 26 or may be attached to the interior of the tampon and pass through it. The microfibrils 56

may be attached to an intermediate location between the inside and outside surfaces of the tampon 26 or any combination of these locations.

The tampon 26 preferably has an outside surface 40 which comprises a plush or terry cloth type fabric which has a plurality of microfibrils 56 or other texturing elements extending outwardly therefrom. The microfibrils 56 may be randomly oriented or may be aligned in a particular direction or directions. Preferably these texturing elements are generally perpendicular to the surfaces of the expanded tampon 26. This is in contrast to current tampons in which the fibers generally lay flat relative to the surface of the expanded tampon. These microfibrils 56 or other texturing elements penetrate into the rugosities in the vaginal cavity to intercept menses and reduce "by-pass" failures (failures from menses traveling in these rugosities and around the tampon). Preferably, the microfibrils 56 or other texturing elements may have a tendency to flex and/or orient themselves in response to forces exerted by the vaginal surfaces.

The microfibrils 56 or other texturing elements may be "looped" and attached to the surface of the tampon 26 at both ends. Suitable texturing elements may be formed from a single long fiber or a series of fibers which are punched in and out of the surface of the tampon 26 to form a plurality of loops. In some embodiments, both the outside surface 40 and the inside surface of the tampon 26 may be provided with texturing elements such as microfibrils 56. A textured surface on the interior of the tampon 26 will help to transfer fluid from one side of the bags' absorbent surface to the other side of the absorbent surface so that the full capacity of the tampon 26 is most effectively used. Interior texturing elements are also useful when the tampon 26 is inverted upon removal, as more fully discussed below.

The microfibrils 56 or other texturing elements are preferably hydrophilic so as to facilitate the ready transfer of fluid from the vaginal surfaces to the tampon 26. The microfibrils 56 or other texturing elements may also be configured to transfer fluid from the vaginal surfaces to the tampon 26 through the use of a density gradient, hydrophilicity gradients, an osmotic driving force, capilarity, or a similar mechanism. Suitable materials for use in the fluid acquisition/transfer complex 30 are rayon (including, e.g., conventional, tri-lobed or multi-lobed rayon fibers), polyethylene, polypropylene, polyester, synthetic bi-component fibers, absorbent foams and combinations thereof, all of which fibers may be used either singly or in combination with other fibers are known in the art. Capillary channel fibers are a highly preferred fiber for the microfibrils 56.

In the embodiment shown in FIG. 6, the tampon 26 is provided with an annular ring 58 which assists it in contacting the vaginal surfaces. The tampon 26 may also be also be constructed such that it is generally cylindrical or circular in cross-section, without a major surface. In other words, in contrast to the tampon 26 shown in FIG. 1, in alternative embodiments, the tampon may be non-directional in terms of a tendency to flatten in a particular plane or direction. Such a feature allows the tampon 26 to be inserted in any orientation without losing its ability to expand effectively in the lateral direction once inserted. This is particularly helpful when the tampon is inserted digitally or with a non-directional inserter.

The tampon 26 of the present invention need not be completely hollow in its interior portion. In the embodiment shown in FIG. 8, the tampon 26 comprises an interior projection 78 inside of the main "bag" portion. This interior projection 78 is preferably constructed from absorbent materials and may be highly compresses absorbent material. When the interior projection 78 is comprised of a compressed absorbent material, it may be thought of as a "little tampon" within the overall highly conformable bag structure which comprises the overall tampon 26. The interior projection 78 is preferably attached to on the inside surface of the head 26A of the tampon 26.

The interior projection 78 may add some initial stiffness to the head 26A of the tampon to assist in digital insertion or insertion with a push-rod type applicator. The flacidity of the main portion of the tampon 26 will allow it to be spread laterally following insertion, while the stability provided by the interior projection 78 acts as an aid to insertion. The interior projection 78 may also be used to increase the capacity of the tampon 26 and may be used for ultimate storage of absorbed fluid. In other words the outer surface of the tampon 26 may be constructed of a hydrophilic material which transports fluid toward the interior projection 78 for ultimate storage thorough the use of capillary action, density gradients or other similar mechanism.

An insertion aid similar to that described above with respect to the interior projection 78 shown in FIG. 8, may also be provided in the form of a interior resilient member. The resilient member may be located in the head potion 26A of the tampon 26. The resilient member may comprise any suitable material, including an absorbent material such as a resilient sponge or foam or may be non-absorbent. The resilient member assists in the insertion of the flaccid tampon 26 and may also act to assist in its spreading once deployed within the vagina.

It has been found during development of the present invention, that the tampon 26 may be constructed from multiple materials. These materials may be blends of materials, or they may be layered throughout the tampon 26. FIG. 9 shows an embodiment of the present invention in which the tampon 26 is constructed of an outer layer 66 and an inner layer 68. As noted above, two preferred materials for the tampon 26 are rayon and cotton.

Rayon is a preferred material for use in tampons because of its high fluid absorption rate. Additionally, rayon is highly compressible and has a high fluid capacity on a gram per gram basis. One disadvantage with rayon, however, is that it tends to release previously absorbed fluid when subjected to an external confining pressure. This phenomenon, sometimes referred to as compression failure or "squeeze out," is discussed further in U.S. Patent 3,749,094. The forces exerted on the tampon by the wearer's body movements or muscle contraction may lead to compression failure.

Cotton has a lower fluid acquisition rate than rayon and also has a lower absorbent capacity than rayon a gram per gram basis. Nevertheless, cotton is a preferred material for use in tampons because of its superior ability to retain acquired fluid when subjected to external confining pressures.

The benefits of both rayon and cotton may be combined by constructing the tampon 26 with a layered structure as shown in FIG. 9. In the embodiment shown in FIG. 9, the outer layer 66 is comprised primarily of rayon, and the inner layer 68 is comprised primarily of cotton. In variations on this embodiments, the tampon 26 may be constructed of a single layer comprising a blend of such materials, such as a 50%/50% homogenous blend of rayon and cotton. Multiple layers of such blends may also be employed. The layers may be in the form of an airlaid nonwoven web or other suitable web or batt of material.

The embodiment shown in FIG. 9 may also comprise a liquid impervious barrier located between the inner layer 68 and the outer layer 66. Alternatively, such a liquid impervious barrier may line the inner surface of the tampon 26.

The rayon and cotton layered structure described above allows the tampon to quickly absorb fluid through the action of the rayon layer. The interior layer of cotton is then highly effective for retention of stored fluid. This structure is particularly effective when the tampon 26 is inverted upon removal as shown in FIG. 10. When the tampon is turned inside out for removal as shown in FIG. 10, the cotton will be the body contacting

layer. As such, it will tend to retain the absorbed fluid as the tampon is withdrawn through the vaginal introitus and squeezed by the pubo-coxis muscles.

If the tampon 26 is provided with a liquid impervious barrier between the inner layer 68 and 66, when the tampon 26 is inverted as shown in FIG. 10, the layer contacting the body upon withdrawal will be a clean absorbent surface. This provides a "wiping" action which tends to absorb any remaining fluid from the vaginal surfaces as the tampon 26 is withdrawn.

The interior layer 68 of the tampon 26 shown in FIG. 9 may also be provided with a different texture than the outer layer 66. The outer layer 66 may be provided with the microfibrils 56 described above and shown in FIG. 5, while the inner layer 68 is provided with a smooth texture. This allows for good vaginal contact and absorption during use, combined with a comfortable and smooth withdrawal when the tampon 26 is optionally inverted for removal. The inner surface 42 of the tampon 26 may comprise a material that has a lower coefficient of friction against the wearer's body than the outside surface. The inside surface 42 can also be provided with other features, such as a cleansing or lubricating composition that can clean the wearer's vaginal area when the tampon 26 is removed. Similarly, the outside surface 40 of the tampon 26 may be provided with a lubricant to facilitate the insertion of the tampon 26 (especially digital insertion).

In addition to microfibrils 56 or other texturing elements, the tampon 26 may be provided with larger structures such as "tufts" or "fingers" to further engage the ruggi. Examples of such "tufts" or "fingers" are shown in FIG. 11. The tufts or fingers 72 should be flexible and capable of independent movement relative to the main body of the tampon 26. In this manner they will tend to spread more or less randomly, and be held in by natural adhesion to the vaginal surfaces in their spread-out configuration. The tufts or fingers 72 may preferably be provided with a density gradient, hydrophilicity gradient, or similar mechanism to direct fluid toward the surface and interior of the tampon 26.

The tampon 26 of the present invention is designed to be inserted digitally (as shown in FIG. 12) or through the use of a unique applicator 20. Because the tampon 26 preferably has a hollow interior, the user may insert her finger within the tampon 26 to facilitate insertion and spreading. The tampon 26 is designed to reside "lower" in the vaginal canal than more highly compressed conventional tampons which contributes to their comfort and effectiveness at covering the entire vaginal surface. The tampon 26 of the type shown in FIG. 8 is especially effective for digital insertion because the interior

projection 78 provides a surface against which to insert the tampon 26. Additionally, although the tampon 26 is designed to reside "lower" in the vaginal canal than conventional tampons, the interior projection 78 may assist some users (such as those with small fingers) in achieving an acceptable depth of insertion for maximum product effectiveness.

In addition to digital insertion, the tampon 26 of the present invention may also be inserted with a unique applicator 20 an embodiment of which is shown in FIG. 13.

FIG. 13 shows one embodiment of the tampon applicator 20 of the present invention. The applicator 20 shown in FIG. 13 is an example of a simplified version of one embodiment of the present invention. The tampon applicator 20 shown in FIG. 13 generally comprises a holder in the form of a tube, preferably an elongate tube 22 and at least one flexible, movable structure that is adapted to reside inside the tube 22 until it is pushed out the end of the tube. In the embodiment shown in FIG. 13, the flexible, movable structure comprises flexible loop 24. The flexible loop 24 comprises the applicator element in such an embodiment. The tampon 26, one embodiment of which is shown in FIGS. 15 and 16, fits over the loop 24 and is capable of expanding when the loop 24 expands. As shown in FIG. 13, the tampon applicator 20 preferably also includes a plunger 28 for expelling the tampon 26. The plunger 28 is telescopically and slidably mounted inside the tubular holder 22. The applicator 20 is preferably inexpensive enough to manufacture that it can be disposable after a single use, although it is also possible for the applicator 20 to be reusable. The components of this embodiment of the tampon applicator of the present invention will now be looked at in greater detail.

The holder 22 is preferably an elongate hollow tube that has insertion end (or "expulsion end") 22A, a gripping end 22B, an interior I, and an inside diameter ID. The holder 22 can be of either the open end type, or the closed end type. The holder 22 can be constructed similarly to tubular holders of the type used in tampon applicators currently in use. Examples of such a tubular holder are described in U.S. Patent 5,346,468 issued to Campion, et al. on September 13, 1994, and U.S. Patent 5,558,631 issued to Campion, et al. on September 24, 1996. The holder 22 can be of any suitable cross-sectional shape. Suitable cross-sectional shapes include, but are not limited to circular, oval, flattened circular, and elliptical. Preferably, the holder 22 has a circular cross-sectional configuration. If the holder 22 is of a closed end type, the "petals" 23 that define the opening 25 at the insertion end 22A can be of any conventional type. It has

been found that it is not necessary to modify the shape of the opening 25 at the insertion end 22A to permit the flexible loop 24 to be pushed through the opening, since the petals 23 are sufficiently flexible to move out of the way of the flexible loop 24. In the embodiment shown in the drawings, the opening 25 has a cruciform shape.

In the embodiment shown in FIG. 13, the tubular holder 22 comprises an optional finger grip 30 for assisting the user in holding the tubular holder 22 when inserting the tampon, and pushing the plunger 28. The tubular holder 22 may or may not be provided with such an optional finger grip 30 to assist the user in inserting the tampon 26. The finger grip 30, if used, can be in any suitable form, including, but not limited to raised formations, depressions, and apertures. In the embodiment shown in FIG. 13, the finger grip 30 comprises a pair of embossed rings 32.

The flexible, movable structure 24 can comprise any suitable type of flexible, expandable, and preferably rounded element that is capable of remaining in the holder 22 until it is desired to deploy the tampon. When the time to deploy the tampon 26 arises, the flexible, movable structure 24 is capable of moving within the holder 22 (hence it is movable) and expanding to spread the tampon 26 within the vaginal cavity. Thus, the tampon applicators described herein, plus any variations of the same that will become apparent to one of ordinary skill in the art after reading this specification, may be described as comprising a means for expanding the tampon across the vagina.

The flexible, movable structure 24 is preferably in the form of a loop so that it is most comfortable when it is deployed. The flexible, movable structure 24 preferably has a relatively low force of expansion (force which it applies to objects in contact with it when it opens) so that it minimizes any distortion of the vaginal opening when the tampon 26 is inserted through the vaginal opening, and minimizes the distortion of the vaginal cavity when the tampon 26 is deployed within the vaginal cavity. The flexible, movable structure 24 preferably only distorts the vaginal cavity to the extent necessary to properly deploy the tampon 26 therein. The flexible, movable structure 24 is also capable of flexing to adjust to the shape of the vaginal cavity. This can be contrasted with devices that use structures employing hinged arms in order to expand.

The flexible loop 24 preferably comprises an elongate piece of material 34 such as a flexible rod or tube, having two ends 36 and 38 that extend in the same general direction. The flexible loop 24 may also be referred to herein as a "wisk" since it resembles a wisk of the type used for cooking (e.g., for beating eggs). (However, the loops on such a cooking implement are typically not flexible and expandable). The piece

of material 34 that comprises the flexible loop has one portion which is formed into the flexible and expandable loop 24. The flexible loop is advantageous in that all of the portions that will come into contact with the wearer's body are preferably convexly rounded to provide a comfortable structure for contacting the wearer's body, in contrast to prior devices having angular hinge-type mechanisms. However, it is also possible to modify the flexible loop 24 to provide one or more portions thereof with one or more segments along its length that are concavely rounded, rectilinear, or both.

Thus, not only is the leading end 24A of the flexible loop 24 convexly rounded, but the longitudinal sides 24B of the flexible loop 24 are also preferably convexly rounded. In some embodiments, the entirety of the longitudinal sides 24B of the flexible loop 24 is convexly rounded. The fact that the longitudinal sides 24B are convexly rounded causes them to be biased outward away from each other when the flexible loop 24 is constrained in width, such as when it resides in the holder 22. As a result, the flexible loop 24 expands on its own when it is pushed out of the end of the holder 22, and no mechanical mechanism is required to be present in the applicator 20 to spread the flexible loop 24.

The piece of material 34 that is formed into the flexible loop 24 can comprise any suitable material that has the characteristics described herein. The piece of material (or rod) 34 can have any suitable cross-sectional shape. Preferably, it has a round cross-sectional shape. The piece of material 34 should preferably be very comfortable when it comes in contact with the delicate parts of the user's body. The piece of material 34 is preferably resiliently elastomeric so that it does not undergo "set" when it is within the holder 22 and can expand when outside the holder 22. The piece of material 34 should preferably be substantially non-creeping. Preferred materials for the piece of material 34 typically comprise some type of elastomeric material including rubber, such as natural rubber, latex, nitrile, and silicone rubbers. Other materials that can be formed into structures with spring-like properties, such as a metal diaphragm spring material may also be used. Such other materials may optionally be coated with another material for improved comfort. Suitable coatings include, but are not limited to any of the foregoing rubber materials.

The flexible loop 24 is movable within the tubular holder 22, and is preferably slidably mounted within the tubular holder 22. The flexible loop 24 has an initial width, IW, which is less than or equal to the inside diameter, ID, of the tubular holder 22, and a deployed width, DW, shown in FIG. 15, which is greater than the inside diameter, ID, of

the tubular holder 22. That is, the flexible loop 24 expands from a first transverse width to a second transverse width. In one non-limiting example, the flexible loop 24 may have an initial width, IW, of about 7/16 inch (about 1 cm) and a deployed width, DW, of about 1 inch (about 25 cm) to about 1 1/4 inches (about 30 cm to about 35 cm).

One embodiment of the tampon 26 is shown in the FIG. 15. The tampon 26 fits over the flexible loop 24 and is capable of expanding bi-laterally when the loop 24 expands. As previously noted, one advantage of the tampon 26 described herein is that it can be provided with an absorbency that is considered to be "regular" absorbency (that is, about 6-9 grams of fluid) with only about one-half the amount of material that is used in conventional compressed tampons. This is attributable to, among other things, that the tampon 26 is flat like the vaginal cavity, and can be spread to fill the same, but need not be compressed in order to fit comfortably through the vaginal opening.

The plunger 28 comprises a component that is used to expel the tampon 26 from its position within the holder 22 when the plunger 28 is pushed manually into the holder 22. The plunger 28 can be any type of component that is suitable for this purpose. Preferably, the plunger is telescopically and slidably mounted into the holder 22. The plunger 28 can be constructed similarly to plungers of the type used in tampon applicators currently in use. An example of a suitable plunger is described in U.S. Patent 5,346,468 issued to Campion, et al. on September 13, 1994, and U.S. Patent 5,558,631 issued to Campion, et al. on September 24, 1996.

In the embodiment shown in FIGS. 13-16 of the drawings, the plunger 28 comprises a tube which has its distal end (the end farthest from the expulsion end 22A of the holder 22) 28B formed into a gripping portion 50. As shown in FIGS. 13-16, the gripping portion 50 comprises a portion of the plunger 28 that is flattened and formed into a tab structure at the distal end 28B of the plunger 28. The tab comprises a planar extension of the distal end 28B of the plunger 28. The gripping portion 50 can serve several purposes, including serving as a positioning indicator, and to facilitate the retraction of the flexible loop 24 after the tampon 26 is deployed.

It should, however, be understood that the plunger 28 is not limited to a component having the configuration shown in the drawings, and that numerous other configurations may also be used. For example, instead of being formed into a gripping portion, the distal end 28B of the plunger 28 could be left unmodified as shown on the embodiment in FIGS. 17-20. In other alternative embodiments, the plunger 28 can be provided with an optional feature to allow the user to better grip the plunger 28. Suitable

gripping features include raised formations, depressions, and apertures (similar to those structures which may be used as the finger grip 30 in the tubular holder 22).

It should also be understood that the plunger 28 is an optional, but preferred component for use with the present invention, and that the present invention will be fully functional if the plunger 28 is omitted, or if the plunger 28 comprises a part of the loop 24. Thus, the tubular plunger 28 shown in FIGS. 13-16 can be omitted altogether, and the tampon 26 can be expelled when the user pushes on the ends 36 and 38 of the piece of material 34 that lie opposite the end of the piece of material 34 that is formed into the flexible loop 24.

To use the tampon applicator of the present invention the user will typically hold the holder 22 in one hand at the finger grips on the same. The holder 22 should be positioned adjacent to the vaginal opening with the indicator (if present) aligned so that when the tampon 26 is deployed, it will expand laterally within the wearer's vaginal cavity. The user holds the end of the plunger 28, such as with her thumb and forefinger, and pushes the plunger 28 inward to slide the plunger 28 within the holder 22. The user pushes on the plunger 28 until the loop 24 opens and the tampon 26 is deployed as shown in FIG. 15. The user then pulls the plunger 28 back outward in order to retract the loop 24, and removes the applicator 20 from the vaginal opening.

The combination of the applicator 20 and the tampons described herein provides numerous advantages. One particular advantage is that the applicator 20 described herein is capable of applying a force to the inside of the leading end or "head" of the tampons of the type described herein. That is, it applies a force against the portion of the tampon that is oriented toward the wearer's cervix. This force preferably has a laterally outwardly-oriented vector component (more preferably, the applicators described herein provide two forces with outwardly-oriented vector components that are oriented in opposite directions) that act on the sides 26D of the tampon 26 adjacent to the leading end 26A. This will ensure that the tampon 26 is able to be expanded to a maximum width dimension at the head of the tampon 26. Thus, the applicator 20 of the present invention is able to fully deploy the bag-like tampons described herein, unlike prior spreading tampon applicators in which the greatest expansion occurs at some intermediate portion along the length of the applicator.

However, the present invention does not exclude embodiments of applicators (or tampons) in which the greatest expansion of the tampon occurs at intermediate portions thereof. For instance, the applicators described herein can be configured to apply a force

to a portion of the inside surface of the tampon 26 that is midway (or half way) from the trailing end 26B of the tampon 26 to the head 26A of the tampon, or to some such portion of the tampon that lies between such a point and the head 26A of the tampon. In other embodiments, the applicators 20 can apply a force to a portion that is on the inside of the tampon 26 that is one third of the way from the trailing end 26B of the tampon 26 to the head 26A of the tampon, or to some such portion of the tampon that lies between such a point and the head 26A of the tampon.

In addition, alternative embodiments of the tampon 26 can be constructed which are configured so that the applicators described herein provide the greatest expansion at an intermediate portion of the tampon. For example, if the bag-like tampons described herein are provided with an insert (such as a small compressed batt of absorbent material (or small compressed tampon) inside thereof at the head end 26A of the tampon 26, the applicators 20 described herein may press on the end of such a small compressed tampon rather than the head end of the bag-like structure. As a result, the greatest expansion may occur at some intermediate portion of the bag-like tampon. In still other embodiments, the applicators described herein can be used or modified to provide the greatest expansion at the trailing end of the tampon.

A non-limiting number of alternative embodiments of the present invention are also possible. In the form which is shown in FIGS. 13-16, the applicator 20 comprises a single loop of material 24.

FIGS. 17-20 show that in another embodiment, the flexible loop 24 can be provided with the ability to rotate as it deploys. Such an embodiment is useful in initially aligning the loop parallel to the opening of the vagina when the tampon is inserted through the vaginal opening, and then changing the orientation of the loop so that it is aligned parallel to the vaginal cavity when the tampon is deployed.

The applicator shown in FIGS. 17-20 is simplified in that it is of an open end type, and it is not provided with finger grips, or the like. The plunger 28 of this embodiment, as shown in FIG. 19, has a leading end 28A and a distal end 28B. As shown in FIG. 19, the flexible loop 24 is preferably joined to the plunger 28. The term "joined", as used in this specification, encompasses configurations in which an element is directly secured to another element by affixing the element directly to the other element; configurations in which the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element; and configurations in which one element is integral with another element, i.e., one element is

essentially part of the other element. The flexible loop 24 can be joined to the plunger 28 in any suitable manner. In this particular embodiment, the ends 36 and 38 of the flexible loop 24 are embedded in a material, such as a plastic material 54 that fills the interior of the leading end 28A of the plunger 28.

It should be understood, however, that any of the embodiments of the applicators described herein can be provided with any of the features described herein, or combinations thereof, and that the embodiments shown are not limited to having the particular features shown in the drawings. The applicator shown in FIGS. 17-20 is also shown without the tampon thereon for simplicity of illustration.

FIG. 17 shows the applicator 20 as the flexible loop 24 is just beginning to be deployed. FIG. 18 shows the flexible loop 24 as it is partially deployed before it rotates. As shown in FIG. 18, the flexible loop 24 is in a vertical position that matches the orientation of the vaginal opening. That is, the flexible loop 24 lies in the Y-Z plane. FIG. 19 shows the applicator 20 when the flexible loop 24 is fully deployed and rotated 90 degrees from the position shown in FIGS. 17 and 18 to correspond to the orientation of the vaginal cavity. That is, the loop lies in the X-Y plane.

FIG. 20 shows one preferred mechanism used to make the flexible loop 24 rotate. As shown in FIG. 20, a pin 60 passes through at least one of the components of the applicator that slides through the holder 22. The pin 60 is preferably connected either directly or indirectly to the flexible loop 24. The ends of the pin 60 engage with a pair of channels 62 on the inside surface of the tubular holder 22. The channels 62 are preferably initially oriented parallel to the longitudinal centerline, L, of the holder 22. This is shown as the portions of the channels 62 that lie to the left of the pin 60 in FIG. 8. The channels 62 then angle away from the longitudinal centerline of the holder 22 toward the expulsion end 22A of the holder 22. When the pin 60 slides through the channels 62, this angling away of the channels 62 toward the expulsion end 22A causes the flexible loop 24 to rotate.

The embodiment shown in FIGS. 17-20 is preferably intended to be capable of only operating properly when the user inserts the tampon in the proper orientation. This will automatically correctly spread the tampon laterally across the width of the vaginal cavity. The embodiment shown in FIGS. 17-20, once it is in the proper insertion orientation, thereby provides a "signal" to the user that the tampon is properly deployed.

In another embodiment, a particularly preferred embodiment, which is shown in FIGS. 21 and 22, the applicator comprises two (or more) loops of material. The loops of material 24 can be oriented in any suitable relationship relative to each other. In this particularly preferred embodiment, the loops of material 24A and 24B are preferably oriented at an angle of about 90 degrees relative to each other when the applicator 20 is viewed from the end. This embodiment has the advantage of providing an increased likelihood of ensuring that at least one of the loops of material will be oriented in the same plane as the vaginal cavity regardless of the orientation of the applicator 20 when it is inserted in the vaginal cavity. As shown in FIG. 22, even though the loops 24A and 24B were initially oriented at right angles, they are sufficiently flexible under low forces that one of the loops (in this case 24A) will be capable of "flattening" and adjusting its orientation to that of the other loop. This allows it to conform to the collapsed orientation of the vaginal cavity. The embodiment shown in FIGS. 21 and 22 is capable of adjusting in this manner regardless of how the loops are initially oriented relative to the vaginal cavity. As a result, there is no need for the user to be concerned with properly orienting the applicator 20 relative to the vaginal opening.

FIGS. 23-25 show that in another embodiment, the applicator 20 has a loop 24 that is constrained in length as it deploys. This provides the loop 24 with the desired transverse spreading action, but is in the form of a structure that has a shorter length when deployed. The constrained loop 24 in this embodiment may also provide a greater spread in the transverse direction (that is, in width) in comparison to the types of loops shown in the preceding figures.

In FIGS. 23-25, the loop 24 is preferably constrained in length by joining a portion of the loop 24 to another portion of the applicator 20. More specifically, in this embodiment the leading end 24A of the loop 24 is joined by an element, such as a string 64 that has one end 64A joined to the leading end 24A of the loop 24 and its opposite end 24B joined to a portion of the applicator, such as the holder 22. Preferably, in this embodiment, the end 24B of the string 24 passes through a hole 66 in the material 54 in which the ends of the flexible loop 24 are embedded. In the embodiment shown, the end of the string is joined to a pin 68 (which can be similar to the pin used in the previous embodiment) that passes through the holder 22. The plunger 28 has a pair of channels 70 therein that accommodate the pin 68 when the plunger 28 is pushed into the holder 22. The pin 68 and the end of string 64B attached thereto remain fixed in position, and the string 64. Since the string 64 is of a constant length, this maintains the leading end 24A of the loop in the same relative position before and after the flexible loop 24 is deployed.

As shown in FIGS. 24 and 25, when deployed, the loop 24 in this embodiment resembles a "ram's horn" in appearance.

FIG. 26 shows another alternative embodiment of the present invention in which the loop has been replaced with several prongs 74, which serve as the applicator element(s). In the embodiment shown in FIG. 26, there are four prongs 74A, B, C, and D that resemble the loops of the embodiment shown in FIGS. 9 and 10 in their arrangement relative to each other. This embodiment is an example of a flexible, movable structure that comprises one or more elements, the prongs 74. The prongs 74 are preferably convexly rounded to provide a comfortable surface against the wearer's body. The prongs 74 are preferably arranged in pairs, each having two opposing prongs 74 that are capable of flexing and expanding away from each other.

Numerous other embodiments and features can be provided. For example, as shown in FIG. 27, the spreading tampon applicator 20, in one simple, albeit less convenient embodiment, can comprise a member such as a simple rigid or semi-rigid rod or tube that is used in conjunction with the hollow, bag-like tampon 26. The rod 20 has a leading end (or distal end) 20A for insertion into portion of the tampon that will first enter the wearer's vagina and a trailing end (or proximal end, since it is closest to the wearer's hand during insertion) 20B that the user holds.

The type of applicator 20 shown in FIG. 27 is not limited to structures in the nature of rods or tubes, however. Such an applicator can be of many suitable shapes. For instance, the applicator 20 can be formed by flattening a cylindrical cardboard applicator of a conventional type, and binding the applicator so that it remains in a flattened condition. Alternatively, the applicator 20 can resemble an analytical spatula. The applicator 20 may have a portion adjacent to the leading end 20A that is spoon-shaped (or "shoe horn" shaped) to fit the wearer's cervix. In other embodiments, the portion of the applicator 20 that is adjacent to the leading end 20A (for example, the distal half of the applicator) can comprise a structure in the nature of a flattened stick. This portion of the applicator may resemble a tongue depressor.

Regardless of the configuration of such an applicator, the leading end 20A is preferably rounded or soft so that it is comfortable for the user. The leading end 20A can be provided in a rounded configuration, or with soft properties in many suitable ways. The leading end 20A can, for example, comprise a ball-like element, a bulbous projection, or a circular or semi-circular element. In these or other embodiments, the leading end 20A of the rod 20 can comprise a compressible material, or a soft material,

which may include, but is not limited to a compressed foam. Further, if it is desired to provide a more compact applicator of the type shown in FIG. 27, the applicator can comprise one or more telescoping pieces and a locking mechanism for locking the pieces in an extended configuration.

The hollow, bag-like tampon 26 is fit over the rod 20 and the tampon 26 is inserted into the vagina by pressing against the inside surface of the tampon adjacent to the "head" (or leading end) 26A of the tampon 26. The tampon 26 has an initial width when it is fit over the applicator 20. The user can then expand the tampon to a greater deployed width. Preferably, the user spreads the longitudinal sides 26D of the tampon 26 in some suitable manner so that the tampon 26 is spread across the width of the vagina. In the simplest embodiment, the user moves the rod 20 side to side manually until the tampon 26 is spread to the desired condition.

As noted above, the applicator 20 may optionally be provided with a positioning indicator for assuring that the tampon is deployed properly in the vaginal cavity. The positioning indicator can be any suitable type of element that assures that the tampon is properly deployed. Suitable positioning indicators include, but are not limited to: a discontinuity on one or more portions of the applicator 20 or difference in the shape of one or more portions of the applicator 20 (such as a flattened portion of the same); indicia such as a mark on one or more portions of the applicator 20, or combinations of any of the foregoing. If a positioning indicator is used, it is preferably sensitive to touch to enable the user to properly position the applicator for insertion of the tampon without the necessity of viewing the indicator to ensure proper insertion. In the embodiment shown in FIGS. 13-16, the gripping portion 50 on the trailing end 28B of the plunger 28 can serve as the positioning indicator. Preferably, however, the applicator 20 is one which can be used regardless of how it is initially oriented, and is of a type that does not require a positioning indicator.

In addition, as shown in FIG. 26, the applicator 20 may be spring-loaded, such as by providing it with a spring 80 near the trailing end 28B of the plunger 28 (or on some other element of the applicator) that biases the plunger 28 toward a retracted position. Thus, when the user pushes on the plunger 28 to deploy the tampon, the spring 80 will be compressed. The spring 80 will exert a force which will tend to make the plunger 28 return toward the retracted position. After the user stops pushing on the plunger 28, the plunger 28 will automatically return to its retracted condition with no action required on the part of the user.

The disclosures of all patents, patent applications (and any patents which issue thereon, as well as any corresponding published foreign patent applications), and publications mentioned throughout this patent application are hereby incorporated by reference herein. It is expressly not admitted, however, that any of the documents incorporated by reference herein teach or disclose the present invention. It is also expressly not admitted that any of the commercially available materials or products described herein teach or disclose the present invention.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention.





What is claimed is:

1. A catamenial tampon applicator characterized in that said applicator comprises at least one flexible loop of material which has a convexly rounded leading end and a pair of opposed convexly rounded sides.
2. A spreading tampon applicator characterized in that said applicator comprises:

a flexible, expandable, and movable structure comprising one or more flexible elements, said flexible structure having a proximal end and a distal end; and

a tubular holder having two ends and an inside, wherein said flexible, movable structure resides inside said tubular holder until it is manipulated so that said distal end is pushed out one of the ends of said tubular holder, and when said flexible structure is pushed out the end of the tubular holder, said flexible structure expands to a greater width than it had inside said tubular holder.
3. The spreading tampon applicator of Claim 2 wherein said flexible structure comprises at least one flexible loop of material wherein said flexible loop is preferably constrained in the length to which it is capable of deploying, and wherein said said flexible structure preferably comprises two said flexible loops of material that are oriented at an angle relative to each when said applicator is viewed from one of the ends of the tubular holder.
4. The spreading tampon applicator of Claim 2 wherein said flexible structure comprises at least one pair of opposed prongs.
5. A spreading tampon applicator comprising:

an elongate tube having insertion end, a gripping end, an interior, and an inside diameter, characterized in that said applicator further comprises

at least one flexible loop comprising an elongate piece of material having two ends, said piece of material having one portion which is formed into an expandable loop so that said ends extend in the same general direction, said loop being slidably mounted within said elongate tube and having an initial width which is less than or equal to the inside diameter of said elongate tube, and a deployed width which is greater than the inside diameter of said elongate tube.

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6. A catamenial tampon characterized in that said tampon comprises: a bag-like conformable absorbent body, said tampon having an outer surface, an inner surface, a head portion and a trailing portion, said inner surface of said tampon defining an interior of said tampon wherein said head portion is closed and said trailing portion defines an opening into said interior of said tampon, wherein said tampon comprises an absorbent material selected from the group consisting of: rayon, cotton, superabsorbent material, and blends thereof.
7. A catamenial tampon characterized in that said tampon comprises: a bag-like conformable absorbent body, said tampon having an outer surface, an inner surface, a head portion and a trailing portion, said inner surface of said tampon defining an interior of said tampon wherein said head portion is closed and said trailing portion defines an opening into said interior of said tampon, said tampon having a shape modulus of compression of less than 0.05 pounds force, said tampon preferably comprising an absorbent material selected from the group consisting of: rayon, cotton, superabsorbent material, and blends thereof.
8. The tampon of Claim 7 further comprising a withdrawal string attached to said head portion of said absorbent body of said tampon, preferably at least a portion of said withdrawal string preferably being disposed within said interior of said tampon such that said tampon is inverted when said withdrawal string is pulled for removal.
9. A catamenial tampon characterized in that said tampon comprises: a bag-like conformable absorbent body, said tampon having an outer surface, an inner surface, a head portion and a trailing portion, said inner surface of said tampon defining an interior of said tampon wherein said head portion is closed and said trailing portion defines an opening into said interior of said tampon, wherein said outer surface of said tampon comprises texturing elements, said texturing elements preferably having a lower density than said outer surface of said tampon such that a density gradient is created from said texturing elements to said outer surface.
10. A catamenial tampon characterized in that said tampon comprises: a bag-like conformable absorbent body, said tampon having an outer surface, an inner surface, a head portion and a trailing portion, said inner surface of said tampon defining an interior of said tampon wherein said head portion is closed and said trailing portion defines an opening into said interior of said tampon, wherein said tampon comprises at least one pleated fold in said outer surface.





11. A catamenial tampon characterized in that said tampon comprises: a bag-like conformable absorbent body, said tampon having an outer surface, an inner surface, a head portion and a trailing portion, said inner surface of said tampon defining an interior of said tampon wherein said head portion is closed and said trailing portion defines an opening into said interior of said tampon, wherein said absorbent body comprises a layered structure such that the material composition of said outer surface differs from the material composition of said inner surface.
12. The tampon of Claim 11 wherein said tampon comprises at least an outer layer and an inner layer wherein at least a portion of said outer layer defines said outer surface and wherein at least a portion of said inner layer defines said inner surface, preferably said inner layer has a higher density than said outer layer, and wherein said inner surface comprises a liquid impervious barrier.
13. A catamenial tampon characterized in that said tampon comprises: a bag-like conformable absorbent body, said tampon having an outer surface, an inner surface, a head portion and a trailing portion, said inner surface of said tampon defining an interior of said tampon wherein said head portion is closed and said trailing portion defines an opening into said interior of said tampon, wherein when compressed in a flat configuration said outer surface has a maximum width which exceeds the width of said opening of said trailing portion.
14. A combination of a catamenial tampon applicator and a tampon, characterized in that said combination comprises:

an applicator comprising an applicator element with a leading end and a trailing end; and

a tampon having a bag structure, said tampon having a flaccid initial configuration which defines an initial width, and a spread deployed configuration which defines a greater deployed width, wherein said tampon fits over at least a portion of the leading end of said applicator element.
15. The combination of Claim 14 wherein said tampon has an inside surface, an outside surface, and two ends, said two ends comprising a head that will be oriented toward the wearer's cervix when deployed and a trailing end, wherein said applicator element is configured to contact the portion of the inside surface of said tampon along the head of the tampon.

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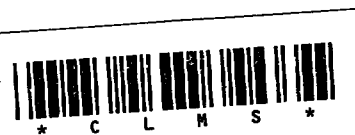


16. The combination of Claim 14 wherein said applicator element comprises a rod, said rod preferably comprising a bulbous projection, said rod also preferably comprising at least two telescoping pieces and a locking mechanism on at least one of said pieces for locking said pieces in place.
17. A combination of a catamenial tampon applicator and a tampon, characterized in that said combination comprises:

an applicator comprising an applicator element with a leading end and a trailing end wherein said applicator element comprises at least one laterally expandable structure; and

a tampon having a bag structure, said tampon having a flaccid initial configuration which defines an initial width, and a spread deployed configuration which defines a greater deployed width, wherein said tampon fits over at least a portion of the leading end of said applicator element.
18. The combination of Claim 17 wherein said applicator element comprises at least one flexible loop of material.
19. The combination of Claim 17 wherein said applicator element comprises at least one pair of opposed prongs.
20. A combination of a catamenial tampon applicator and a tampon, characterized in that said tampon has a bag structure which fits over at least a portion of said applicator, and said applicator comprising at least one pair of opposed prongs that are at least indirectly joined together, and are able to move apart to spread open said tampon.
21. A combination of a catamenial tampon applicator and a tampon, characterized in that said tampon has a bag structure which fits over at least a portion of said applicator, said applicator comprising an applicator element having a distal end inserted into the vagina and a proximal end held by the user and a means that allows said user to expand said tampon across the width of the vagina so that the deployed width is greater than the initial width.
22. The combination of Claim 21 wherein said tampon has an inside surface, an outside surface, sides, and two ends comprising a head that will be oriented toward the wearer's cervix when deployed and a trailing end, wherein said applicator element





is configured to contact the portion of the inside surface of said tampon along the head of the tampon and the applicator is capable of applying forces having a laterally outwardly-oriented vector components to this portion of the inside surface of the tampon to expand sides of the tampon adjacent to the head of the tampon.

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