May 19, 1970 H. A. WHITEHEAD ET AL 3,512,528

EXPANDABLE TAMPON

Filed May 29, 1967 2 Sheets-Sheet 1

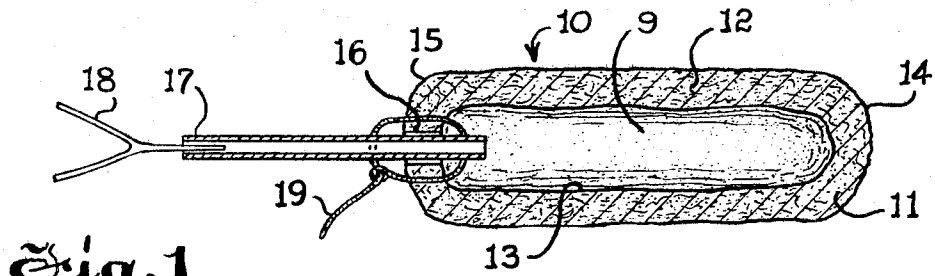

Fig. 1

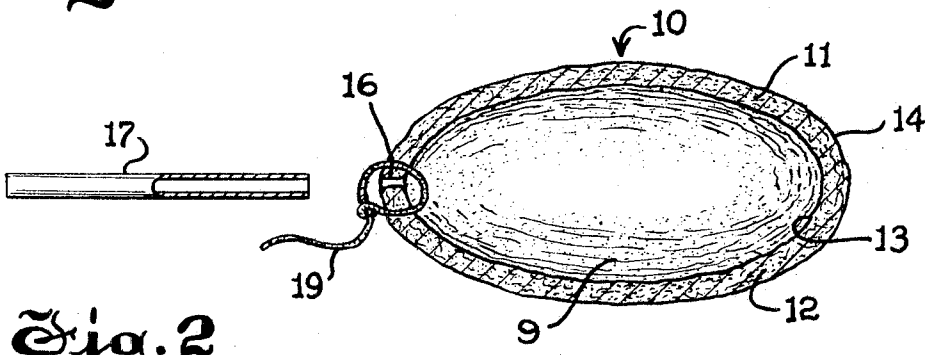

Fig. 2

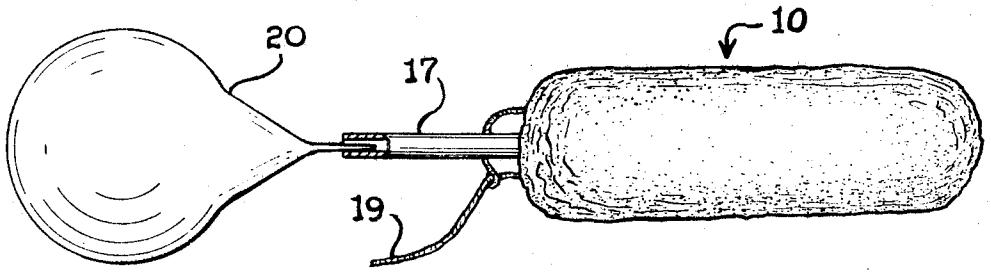

Fig. 3

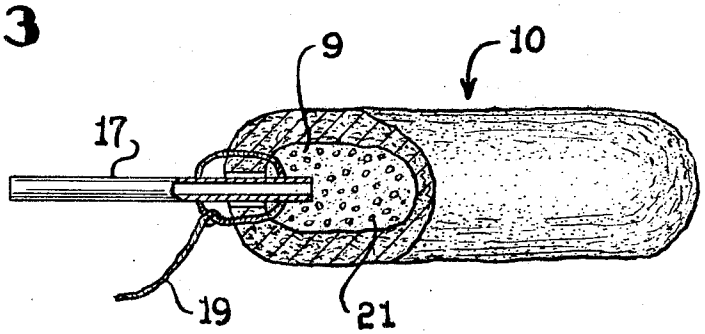

Fig. 4

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EXPANDABLE TAMPON

Filed May 29, 1967 2 Sheets-Sheet 2

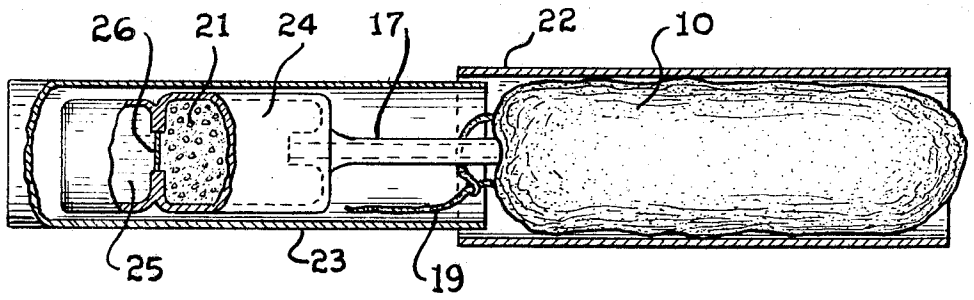

Fig. 5

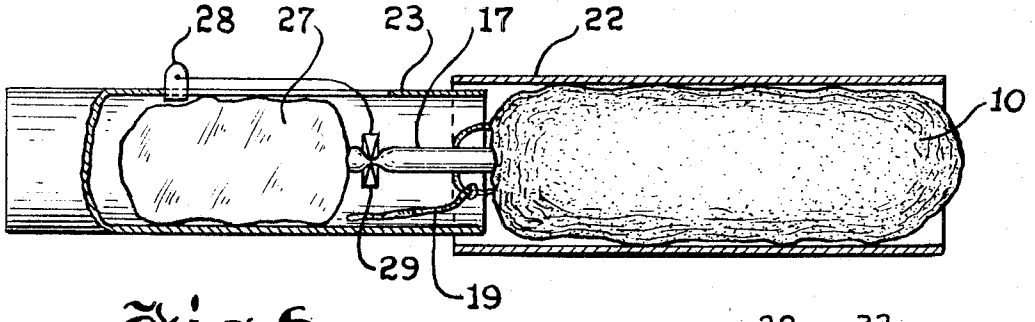

Fig. 6

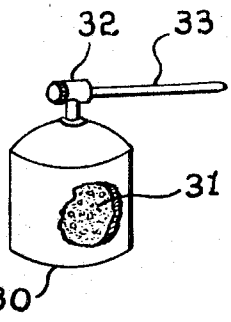

Fig. 7

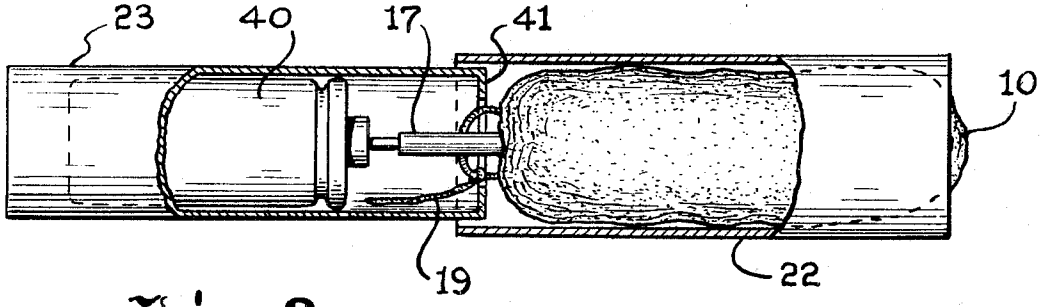

Fig. 8

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3,512,528

EXPANDABLE TAMPON

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Int. Cl. A61f 13/20, 5/46
U.S. Cl. 128—285 19 Claims

ABSTRACT OF THE DISCLOSURE

An expandable catamenial tampon in the form of an elongate hollow shell of absorbent material collapsed to a size suitable for insertion in the vaginal tract. The tampon has a fluid-permeable outer surface, an inner sack, and a withdrawal string. The leading end of the shell is closed. The trailing end of the shell to which the withdrawal string is attached has a restricted aperture, into which there is inserted a removable fill tube for introducing gas, liquid, or foam under sufficient pressure to inflate the tampon after insertion. The inner sack may be semi-permeable or impervious. The tampon is inserted into the vaginal canal in collapsed condition and expanded in place to form a flexible seal with the vaginal wall to prevent leakage of body fluids.

BACKGROUND OF THE INVENTION

This invention relates to improvements in absorbent tampons. More particularly it relates to an absorbent catamenial tampon small enough in diameter and size to facilitate insertion, but which may be expanded diametrically immediately after insertion to provide a circumferential seal with the vaginal walls and prevent menstrual exudate from bypassing the tampon before its effective absorbent capacity is utilized.

Ideally, a catamenial tampon should be small enough in size to facilitate insertion into, and removal from, the vaginal cavity. Yet it should be large enough in size to permit the tampon to be worn for an extended period of time during which it will hold and contain menstrual exudate without leakage. These anomalous requirements are difficult to reconcile. In the form which is generally believed to be the most satisfactory compromise, tampons now in use generally are constructed from absorbent pads whose original size would tend to fill the normal collapsed vaginal canal, but which must be compressed from their original size to a temporarily self-sustaining size several times smaller to facilitate insertion.

Because of their inherent structural limitations, when such tampons are used for catamenial protection two types of leakage often result. One type of leakage occurs when the tampon becomes completely saturated and, since the tampon can hold no more, excess menstrual exudate is discharged externally. This rarely happens because most tampons do not use their entire absorptive capacity.

The second and most common type of leakage occurs when exudate bypasses the newly inserted tampon before it has had a chance to expand and adequately fill the vaginal canal to block flow. In such cases, that part of the flow which takes place immediately after insertion is not absorbed at all.

As noted above, because of the requirement for ease of insertion and removal, conventional tampons now on the market are generally cylindrical in shape and of a size

considerably smaller than the internal diameter of the vaginal cavity. These tampons are made of highly compressed absorbent material which has a natural resiliency, and which when wetted with fluid the tampon will tend to expand in an attempt to regain its initial uncompressed dimension. While these tampons generally have sufficient absorbent capacity to remain serviceable for one hour or more, the fact that they rely on absorbed body fluids to fully expand and seal the cavity prevents full use of that capacity, and also permits premature side leakage.

Many attempts have been made to solve the premature leakage problem, both by the use of retentive devices and absorption devices.

In retentive devices, some sort of elastic material is commonly used, either in the form of individually fitted diaphragms, or in the form of collecting sacs which have expanding rings at their open end for frictional sealing contact with the vaginal walls. These devices require complicated venting means to prevent the buildup of undesirable pressure within the tract. Even so, there is still a danger that the exudate may plug these vents. In addition to the fact that these devices usually require individual fitting, a further disadvantage is that they are often difficult to remove and replace without soiling the hands or underclothing.

In absorptive devices designed to alleviate the problem, attempts have been made to increase the rapidity and degree of expansion, by including resilient materials in the compressed structure which expand quickly when wetted. While these latter constructions show some improvement in performance, they are also not entirely satisfactory in that they rely on some initial fluid absorption before they can expand.

The absorbent tampons of this invention overcome the above disadvantages in that they can be immediately expanded after insertion to provide an occlusive seal, and that while an occlusive seal is formed at the perimeter of the tampon, the permeability of the absorbent media employed is such that no undesirable pressure builds up within the cavity.

SUMMARY OF THE INVENTION

The invention comprises a hollow shell of absorbent material having a fluid permeable outer surface and an inner wall which may be semi-permeable or impervious. The anterior of the absorbent shell is closed and preferably rounded. The posterior of the shell is provided with a restricted aperture, and has a withdrawal string attached thereto. The withdrawal string may be arranged in the form of a draw-string to restrict the size of the posterior aperture. The posterior aperture may also be encircled by an elastic thread or band for such restriction purposes. The absorbent shell is collapsed or compressed to a small size preferably of cylindrical shape. This may be done by drawing the original full-size tampon through a funnel-like device, which may also be used to place the tampon into an insertion device.

A small tube-like member is inserted in the restricted posterior aperture to act as a fill tube. The fill tube may be a separate element or may be integral with an inflation device of the types later described. With the fill tube in place, the compressed tampon is inserted in the vaginal cavity by a suitable insertion device such as a pair of telescoping tubes. After insertion, the tampon is re-expanded in position in the vaginal tract to the size desired by the user, up to its original dimension. Expansion may be accomplished by introducing gas, liquid or foam

through the fill tube. After expansion, the fill tube is then removed and the restricted posterior opening tends to close because of the expansion, which may be further assisted by an elastic thread as aforesaid. When the tampon expands it tends to conform to the configuration of the vaginal wall thus providing a seal against peripheral leakage. It has been found that once the tampon has been expanded while in place within the vaginal trace, it substantially retains its expanded configuration to remain in contact with the vaginal walls, even though the gas or liquid is allowed to escape, or the foam allowed to collapse.

The expanded tampon thus provides a positive seal for the vaginal cavity immediately after insertion. Furthermore, its absorbent construction permits the expanded tampon to be used for long periods of time without change.

As briefly described above, it is the object of this invention to provide an expandable absorbent tampon of a size which facilitates insertion and which may be expanded immediately after insertion to provide an occlusive seal against the vaginal walls to prevent leakage of body exudate.

It is a further object of the invention to provide an absorbent tampon which may be easily expanded after insertion to prevent leakage of exudate yet may be easily withdrawn after use.

Another object is to provide an expandable tampon with useful absorbent capacity.

Still another object is to provide an expandable tampon having internal expanding means which may be utilized to selectively expand the tampon after insertion.

An additional object is to provide various methods and means for expanding an absorbent tampon after insertion.

Other objects and advantages will become apparent to those skilled in the art from the following detailed specification and attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a stylized and enlarged sectional view of one embodiment of the tampon before insertion.

FIG. 2 is a sectional view of the FIG. 1 tampon after expansion and with the fill tube removed.

FIG. 3 illustrates an air syringe arrangement for inflating the FIG. 1 tampon.

FIG. 4 is a view, partially in section, of another embodiment of the tampon containing gas generating means.

FIG. 5 is a sectional view of an expandable tampon and a gas generating means disposed in an insertion device ready for use.

FIG. 6 is a sectional view illustrating another embodiment of the invention in which an expandable tampon is disposed in an insertion device along with a gas cartridge for inflation purposes.

FIG. 7 illustrates a pressurized aerosol can modified with a metering valve and an integral fill tube for use with the expandable tampon.

FIG. 8 is a sectional view illustrating still another embodiment of the invention in which an expandable tampon is disposed in an insertion device along with a single shot aerosol means for inflation purposes.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The sectional view of FIG. 1 illustrates a stylized embodiment of a tampon made in accordance with the invention. The tampon **10** comprises a hollow cylindrical body member of absorbent material **11** having a central cavity **9**. The sectional view shows the tampon in its collapsed condition which preferably takes the form of an elongated cylinder of a size to fit easily into the vaginal opening. The absorbent material **11** making up the hollow body, preferably is enclosed in a fluid permeable cover **12** and has a semi-permeable or impervious liner **13**. The walls of the absorbent material itself may form the cover and the liner, or they may be separate elements.

The anterior end **14** of the collapsed tampon is closed and in its collapsed condition preferably is of a rounded configuration. The posterior end **15** is provided with an aperture **16** of sufficient size to permit insertion of a hollow fill tube **17**. Fill tube **17** is used to conduct gas, liquid or foam material from delivery means **18** into central cavity **9** to expand the tampon. A withdrawal string **19** is also attached to posterior end **15**, preferably encircling aperture **16** to help restrict its size. An elastic thread may also be used to encircle opening **16** to cause the aperture to close more completely when fill tube **17** is withdrawn.

FIG. 2 illustrates the tampon of FIG. 1 after it has been expanded and hollow fill tube **17** removed. As shown, the absorbent material **11** has been expanded from its original collapsed condition until it substantially assumes its original dimension, that is, to the size it had been before being collapsed to suitable insertion size. The absorbent body **11** is made of a material flexible enough so that when the tampon is expanded, the outer surface **12** will conform closely to the internal contours of the vaginal wall and seal against leakage by preventing fluid from bypassing the tampon. Even when aperture **16** is not completely closed after fill tube **17** is removed, and the induced pressure in central cavity **9** is thereby relieved by leakage through the aperture, it has been found that the tampon will substantially retain its expanded form and maintain a positive seal.

FIG. 3 illustrates how an air syringe **20** may be introduced into fill tube **17** to inflate the tampon after insertion. A syringe having a capacity of 20 to 40 cc. is quite suitable for this purpose. The tube and plunger of an ordinary hypodermic needle device of similar capacity may also be used for this purpose.

FIG. 4 illustrates an embodiment of the invention in which cavity **9** of the tampon contains a non-toxic gas-generating chemical mixture **21** which can be activated by the introduction of a suitable chemical through fill tube **17**. One example of a suitable gas-generating chemical is a mixture of citric acid and sodium bicarbonate which may be activated to produce carbon dioxide gas by the introduction of a small quantity of water through fill tube **17**.

FIG. 5 illustrates how the same gas-generating chemicals may be utilized in a separate gas-generating device suitable for dispostion within one of the telescoping applicator tubes used for insertion of the tampon.

As shown, in this figure, tampon **10** is contained within the front section **22** of a conventional insertion device comprising a pair of telescoping tubes. The tube used for the rear section **23** of the device contains a plastic vial having a front chamber **24** containing a citric acid-sodium bicarbonate mixture **21** and a rear chamber **25** containing water. The gas-generating chemical mixture **21** is separated from the activating water by a breakable seal **26**. The front end of the vial **24** is connected to filler tube **17**. In use, inserter tube **22** is inserted in the body cavity, pusher tube **23** is then used to slide tampon **10** into place. Seal **26** is then broken by finger pressure causing the water in rear chamber **25** to mix with the chemical mixture **21** to generate carbon dioxide gas and cause tampon **10** to expand in situ.

FIG. 6 illustrates another tube-type insertion arrangement in which a gas cartridge is used to inflate the tampon. After tube **22** is inserted, tampon **10** is pushed into position by tube **23**. Trigger **28**, which is connected to valve **29** is then activated, releasing gas from gas cartridge **27**, which passes through filler tube **17** to inflate the tampon in situ.

FIG. 7 illustrates an aerosol can, of the type commonly used to generate a stable foam such as shaving cream, wherein a metering valve and a fill tube or the like has been added so that the can may be used with the expandable tampon of this invention.

Pressurized container **30** contains a mixture of a non-toxic foamable material **31** and an aerosol gas which gen-

erates a stable foam upon release. Metering valve **32** is of a type which may be adjusted to release a predetermined volume of foam through a narrow nozzle **33** adapted to fit within the previously described filler tube **17**. When a large volume pressurized can of this type is used as the inflation means, it is preferred that the amount capable of being discharged at one time be limited in volume to insure against overcharging of the tampon.

FIG. 8 illustrates an insertion arrangement in which a small, one-shot pressurized aerosol container **40** contained within pusher tube **23** contains sufficient material to expand tampon **10** upon release. The aerosol may be released by suitable means such as by pushing the cartridge against shoulder **41** to activate valves of a well-known type after the tampon is in place.

There are many materials available suitable for use in constructing a tampon of the type described. The absorbent material should be conformable so that it will expand readily while conforming to the internal dimensions of the vaginal tract to provide a good seal. It should also be porous so that it picks up and holds fluids readily, while preventing undesirable pressure build-up. Materials which are satisfactory for this purpose include fiber batts made from cotton, wood pulp, rayon, and other synthetic as well as natural fibers; sponges, both natural and synthetic; absorbent powders such as guar gum, carboxymethylcellulose, tamarin powder etc., and various combinations of the above. Whatever material is chosen, it must, of course, be non-toxic and non-irritating.

The cover may be made of any material readily permeable to fluids. Open weave woven and non-woven fabrics are especially suitable. Other materials include non-woven webs and wet-strength paper of open formation. The principal purpose of the cover, besides containing the absorbent material, is to limit the size to which the tampon can be expanded. The cover also serves as a reinforced base material for positive attachment of the withdrawal string. The cover may also be an integral part of the absorbent component.

The inner liner is that portion of the tampon which when inflated, forces the tampon to expand. It therefore must be able to retain most of the inflating medium at least temporarily during the inflation period, so that the tampon will expand as desired. When gas or air is used as the inflating medium it is preferred that the liner be impervious. A suitable material for this latter purpose is a thin plastic or rubber film.

If the inflation medium is an aerosol foam, the liner may be permeable or semi-permeable since the expansion forces comes from the foam structure. In the latter case, a permeable liner is useful in that it accelerates the eventual collapse of the foam, which collapse is desirable when the time comes for the expanded tampon to be removed. The inner wall of the absorbent material may in itself serve as a permeable liner.

The timing of the escape of the inflation medium after expansion, whether early or late, is not important. Once the tampon is inflated, it has been found quite unexpectedly that the inflated shape will maintain itself quite well even against the normal pressures exerted by the vaginal walls. In many cases it has been found desirable to design the tampon so that the inflation medium escapes completely, or that it be dissipated in some way over the time period in which the tampon is worn, so that removal of the tampon is facilitated.

The fill tube is preferably a plastic tube of small dimension. It may also be an integral part of the inflation device. It is removed after inflation, and when removed leaves only a small aperture which permits the gas in the inflation medium to escape over a short period of time. If a longer period is desired, the aperture can be surrounded by an elastic band or thread which contracts after the fill tube is removed, to more fully restrict the size of the aperture.

Of the inflation mediums used, an aerosol foam is presently preferred because the foam can be formulated to break or collapse over a predetermined period of time. The ingredients of course, should be non-toxic and non-irritating. A non-toxic gas such as air or carbon dioxide is also a good choice. However, the use of a foam is advantageous in that it eliminates the need for a rubber or plastic liner.

While several preferred embodiments of the invention have been shown and described herein, it will be appreciated that the details may be more or less modified without departing from the principles and scope of the invention as defined in the appended claims.

What is claimed is:

1. An expandable absorbent tampon device comprising a hollow shell of porous absorbent conformable material of appreciable wall thickness collapsed to a size suitable for easy insertion into a body cavity; the main body of said shell comprising fluid permeable absorbent material capable of maintaining an expanded conformed condition; the anterior portion of said main body being closed and the posterior portion of said main body having a restricted aperture disposed therein through which expansion media may be introduced into said shell and through which portions of said expansion media may escape after expansion; and a withdrawal string attached to said posterior portion.

2. The device of claim **1** in which the porous absorbent conformable material is selected from the group consisting of absorbent fiber batts of natural or synthetic fibers; absorbent natural or synthetic sponge; absorbent powders; and combinations thereof.

3. The device of claim **1** in which said main body has a permeable outer surface comprised of an open weave woven fabric.

4. The device of claim **1** in which said main body has a permeable outer surface comprised of an open weave non-woven fabric.

5. The device of claim **1** in which said main body has a permeable outer surface comprised of a non-woven web.

6. The device of claim **1** in which said main body has a permeable outer surface comprised of a wet strength paper of open formation.

7. The device of claim **1** in which said main body also has a thin inner liner collapsed therein.

8. The device of claim **7** in which said liner is semi-permeable and the wall thickness of said absorbent material is substantially thicker than said liner.

9. The device of claim **7** in which said liner is impervious and the wall thickness of said absorbent material is substantially thicker than said liner.

10. The device of claim **9** in which said impervious liner is a thin film selected from the group consisting of plastic and rubber.

11. The device of claim **10** in which a fill tube is disposed in said aperture.

12. The device of claim **11** in which an inflating means is cooperatively attached to said fill tube.

13. The device of claim **12** in which said inflating means is a syringe.

14. The device of claim **12** in which said inflating means is an aerosol container.

15. The device of claim **12** in which said inflating means is a capsule containing an activatable gas-generating composition.

16. The device of claim **12** in which said tampon and said inflating means are disposed in a telescoping tube inserter.

17. The device of claim **14** in which said tampon and said inflating means are disposed in a telescoping tube inserter.

18. The device of claim **15** in which said tampon and said inflating means are disposed in a telescoping tube inserter.

19. The device of claim 14 in which said aerosol container contains a non-toxic foam-forming material.

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U.S. Cl. X.R.

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