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CATAMENIAL TAMPON

Filed May 18, 1966

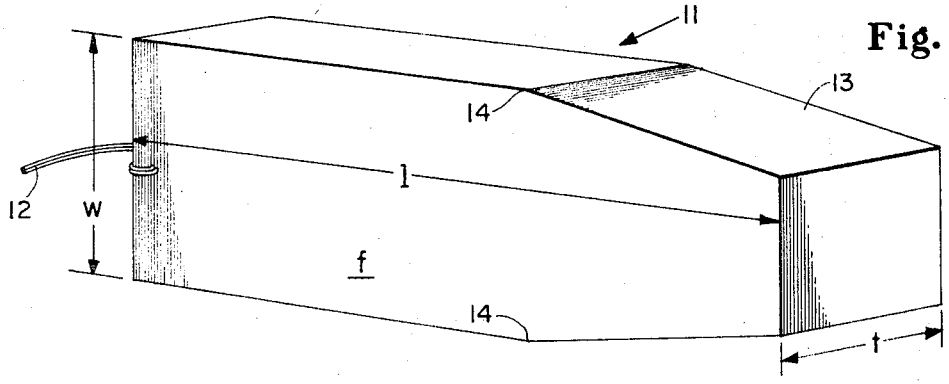


Fig. 1

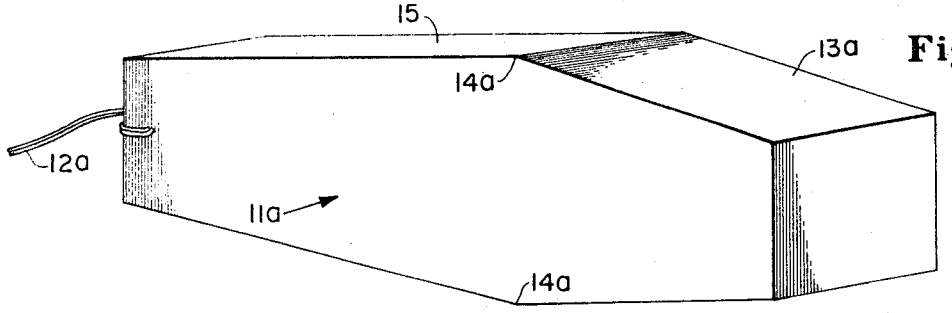


Fig. 2

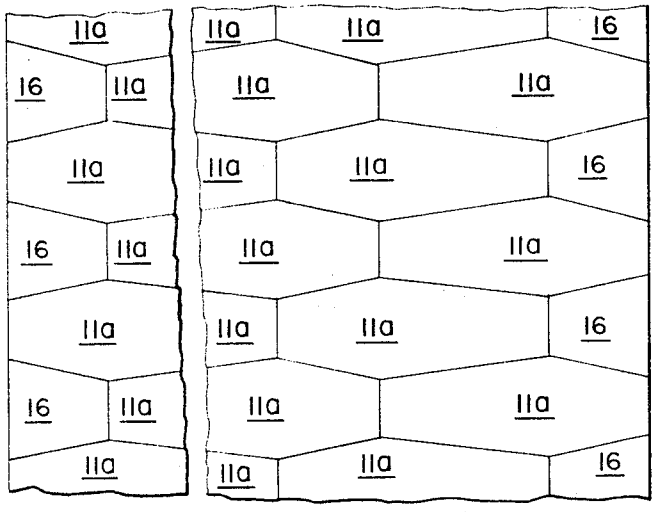


Fig. 3

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CATAMENIAL TAMPON

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ABSTRACT OF THE DISCLOSURE

A catamenial tampon blank comprising an assemblage of absorbent fibers having a weight of at least about 3.6 grams, a length of between about 3½ and 5 inches, a maximum transverse cross sectional area of about 1.2 square inches and with a tapered distal end, i.e., the end first inserted in use, having transverse cross sectional areas which do not exceed a maximum based on a given equation.

This invention relates to a catamenial tampon blank and more particularly to a catamenial tampon blank which is anatomically configured and allows the user to accept a large quantity of highly absorbent material without discomfort.

Presently available catamenial tampons generally have inadequate in-use absorptive capacity and have universally employed tampon blanks of a length which is less than about 3½" because of in-use comfort problems associated with longer devices. In this connection, it is thought that when a tampon constructed of a blank of greater length is placed in a vaginal chamber the expansion of the tampon in the lengthwise direction causes the uppermost end thereof to abut the user's cervix which in turn directs subsequent expansion downwardly, forcing the lower tampon end into the sensitive introital area of the user, thus causing substantial discomfort.

Tampons of inadequate in-use capacity cannot be used by some women as a sole means of catamenial protection during times of heavy flow of menses in the menstrual period because of the high risk of embrassing failure. Therefore such women have frequently resorted to the use of sanitary napkins in addition to the catamenial tampon at least until the flow rate of menses is such that the tampon is capable of providing the extent of protection desired. Even so, it has been necessary to change or replace the tampon quite frequently, an inconvenience and expense to the user. In a commercial sense, this situation presents a particularly critical problem inasmuch as such women are frequently lost to the tampon market because they revert to napkin-only users.

In an effort to improve catamenial devices attempts have been made to scale-up the size of tampons to provide additional absorbent material in the tampon whereby to increase the in-use capacity and, hence, catamenial protection afforded by the devices. Thus, the length of the tampon blank is increased to the 3½" maximum described above and the cross-sectional area of the tampon blank is made larger whereby to increase the absorptive capacity of the devices to the desired extent. However, as with the length, it is found that there is a maximum cross-sectional area of tampon blank which can be accepted in comfort by most females. These apparent dimensional limitations have imposed a ceiling or maximum on the absorptive capacity of catamenial tampons.

It has been found that the previously believed maximum length of 3½" for a tampon blank can be exceeded provided that the cross-sectional area of the tampon blank at any point greater than 3½" from the string end is sized so as to allow the tampon to expand in a longitudinal direction past the user's cervix and into the

posterior fornix of the vaginal cavity, rather than to abut the cervix. Expansion of the upper end of the tampon past the cervix of the user can be accomplished only if the cross-sectional areas of the tampon blank at points spaced from the string end by 3½" or more are decreased in accordance with a critical relationship dependent on such spacing.

It is an object of the present invention to obviate the above-stated problems.

Another object of the present invention is to provide a catamenial tampon which has sufficient in-use absorptive capacity to provide the sole means of catamenial protection for a woman during periods of heavy menses flow.

It is a further object of the present invention to provide a catamenial tampon which is economical to manufacture, comfortable, which has an in-use absorptive capacity substantially higher than that of prior art devices, and which provides increased protection against soiling of undergarments and/or increases wearing time.

Briefly stated, in accordance with one aspect of this invention there is provided a highly absorbent tampon blank of absorbent fibers which has in an uncompressed condition an overall length in the range of from about 3½" to about 5" and has a taper at its proximal end, the end first inserted in use. At no point does the tampon blank have a transverse cross-sectional area (i.e., the cross-sectional area perpendicular to the longitudinal axis of the tampon) which is greater than about 1.2 square inches when measured under a pressure of 0.25 p.s.i.g. exerted on the opposed faces of the blank. The blank intermediate the proximal end and points spaced 3½" from the distal end (the end opposite the proximal end) is sized and configured so that the transverse cross-sectional area thereof do not exceed a maximum based on the equation:

$$A=1.2[1-e^{2.7(L-5)}]$$

where A is the maximum transverse cross-sectional area in square inches at a specified distance from the distal end, e is the base of the natural logarithmic system (about 2.72) and L is the distance of the area from the distal end, in inches.

Although the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the present invention it is believed that the invention will be better understood from the following description taken in connection with the accompanying drawing in which:

FIGURE 1 is a perspective view of one embodiment of a catamenial tampon blank of the present invention;

FIGURE 2 is a perspective view of a further embodiment of a tampon blank of the present invention; and

FIGURE 3 is a plan view illustrating the manner in which the tampon blanks of FIGURE 2 may be nested for cutting from a sheet or batt of absorbent material.

Referring to FIGURE 1, there is illustrated a catamenial tampon blank **11** which has been cut to size from an absorbent, fibrous, batt of substantially uniform thickness. The material from which the blank is made can comprise cotton, rayon or other absorbent fibers of staple length (having a length of from about ½" up to about 4"). The material can be carded or garnetted and preferably is needle punched. The thickness t of the batt which can be used varies in accordance with the other dimensions of the blank whereby to result in cross-sectional areas thereof falling within desired limits. While the embodiment of blank **11** described is cut from a single batt, similar results can be achieved by cutting the blanks **11** from a plurality of superposed batts which are united in some manner, e.g., as by sewing, and whose cumulative thickness is equal to the thickness t; or, alternatively, could be formed by folding a batt having a thickness of $t/2$ over on itself whereby to result in the desired thick-

ness. In any event, where the width w of the blank, as shown in FIGURE 1, is about 1½", the batt should be at least about 0.5" and not more than about 0.8" thick when measured under 0.25 p.s.i.g. pressure exerted on the opposite faces f of the batt. Due to varying conditions of fluffiness, etc. of batts of this type, it is necessary for accuracy that the measurement of thickness t be made under conditions in which a finite light pressure is exerted across this dimension and when so measured (at 0.25 p.s.i.g.) the above-described absorbent materials usually have densities ranging between about 1.2 to about 1.4 grams per cubic inch. Unless otherwise specified it should be understood that all dimensions hereinafter mentioned relative to the blank, are measured with the aforesaid pressure applied. Thus the maximum cross-sectional area for the embodiment of the blank of FIGURE 1 is equal to about 1.2 square inches and the minimum is 0.75 square inch for superior absorbency.

In connection with the relationship of width w and thickness t in such blanks, it has been found that the maximum transverse cross-sectional area of tampon blanks at any point along its length l between the distal (drawstring) end and a point spaced therefrom by about 3½" should not exceed about 1.2 square inch. For tampon blanks having a length l greater than 3½", the maximum transverse cross-sectional areas at distances greater than 3½" from the distal end should be gradually reduced as the distance increases, in accordance with the derived equation set forth above. If a cross-sectional area substantially higher than 1.2 square inches is used in such blanks, or if the transverse areas at a distance greater than about 3½" from the distal end exceed the maximum specified by the equation, the discomfort level of the device increases to such an extent as to make it undesirable and impractical for a commercial product.

"Discomfort level" as used herein is equal to the percentage of women feeling definite discomfort when employing a particular catamenial tampon. With respect to tampons, it has been found that about 10% of women always feel discomfort regardless of the size of the device, e.g., with the so-called "junior" sizes made from blanks which have a transverse cross-sectional area of about 0.45 square inch and a length of about 2¼". As the size of the tampon blank transverse cross-sectional area is increased to about 1.2 square inches the discomfort level of 25% is reached. Increasing the maximum transverse cross-sectional area beyond 1.2 square inches causes the increase in discomfort level to accelerate to such an extent, as indicated above, that it is commercially infeasible to produce commercial catamenial tampons substantially in excess of that size. The same is true about increases over the maximum specified in the equation for transverse cross-sectional areas at distances greater than about 3½" from the distal end of the tampon blank.

Referring once again to FIGURE 1, the tampon blank **11** is provided with a drawstring **12** at its distal end and has a tapered configuration or portion **13** adjacent its proximal end. The drawstring **12** can be any waterproof, non-wicking, soft, flexible string having sufficient tensile strength to avoid failure when employed to withdraw the used tampon. The drawstring **12** can have a length of about 11" and is looped and secured through the blank at a point centrally located at a distance of about ½" from the distal end. The type of drawstring, its application and other details of this particular feature are well known in the prior art and are not significant aspects of the present invention and therefore are not described in detail.

Intermediate the distal end and the points **14** at the start of the tapered configuration **13**, the blank **11** has substantially uniformly sized rectangular transverse cross-sectional areas. From the points **14** to the proximal end of the blank **11**, the transverse cross-sectional areas thereof are rectangular and decrease until reaching a

minimum at the proximal end. Using dimensions previously given, e.g., a 1½" width w and a .8" thickness t, a suitable taper can be employed whereby the distal end of the blank has a width of approximately ⅞", when the taper commences at points **14** which are approximately 2½" from the distal end and the length of taper is approximately 1½". When so dimensioned the absorbent material comprising the tampon weighs approximately 5.8 grams.

It is not essential that the reduction of the cross-sectional area of the blank at the proximal end result from use of a rectilinear taper. It is within the purview of this invention to utilize any tapering configuration which results in the limitation of the transverse cross-sectional area at any point of the blank intermediate the proximal end and points spaced 3½" from the distal end to a value which does not exceed a maximum defined by the equation:

$$A=1.2[1-e^{2.7(L-5)}]$$

wherein A is the maximum transverse cross-sectional area of the tampon blank in square inches at the specified distance from the distal end thereof, e is the base of natural logarithmic system, about 2.72, and L is the distance of the area from the distal end, in inches. This equation defines in effect, the maximum dimensions which the tampon blank can have along the tapered portion **13** in order to maintain the device within the critical 25% comfort level. As indicated above in the discussion of comfort level, if the maximum areas defined by the equation are exceeded, the discomfort level increase is accelerated rapidly making the tampon unmarketable for all practical purposes.

It has also been found that a catamenial tampon constructured of materials presently used must weigh at least about 3.6 grams in order to have a minimum preferred absorbent capacity of 18 grams of liquid in accordance with the "Syngyna" method of absorbency measure. In the "Syngyna" method a tampon is placed within the confines of a thin, flexible, waterproof, baloon-like membrane, the entire exterior of which is subjected to a constant hydrostatic pressure. The distal end of the tampon is within the lumen of the membrane, approximately 45 mm. from the opening thereof, and the removal string extends through the opening. With the longitudinal tampon axis held at about 15° with the horizontal, drops of a test fluid are applied to the proximal end of the tampon at a constant predetermined rate by an applicator tip located within the membrane. The end point of the test is determined when the first drop of test fluid leaks from the opening of the membrane, at which time the tampon is withdrawn by means of the string. The gain in tampon weight by reason of the absorbed fluid is termed the absorbent capacity of the tampon. In determining the absorbent capacities described herein, the pressure used was about 1" of water and the rate of application of fluid was about 1 cc. per minute. The test fluid composition was as follows:

	Grams
Sodium carboxymethylcellulose (Hercules Powder Company CMC 7M)	5
Glycerol	100
Sodium chloride	10
Sodium bicarbonate	4
Water, to make 1000 ml.	

While the use of lesser quantities of absorptive materials may be satisfactory for some women, as pointed out above, if a tampon has inadequate in-use capacity many potential users are subject to the possibility of embarassing failure during periods of heavy menses flow. A weight of at least about 3.6 grams of absorbent material provides the minimum sufficient capacity to alleviate this problem.

Because of the above-described construction, a tampon made from the blank **11** will be comfortable for a sub-

stantial majority of all females and provides a satisfactory amount of absorbent material to permit good performance under all conditions. In this connection, it will be noted that since the portion of the blank adjacent the proximal end thereof is tapered, in use most of the absorbent material will be located between approximately the user's cervix and introital area, the region in which the menses is first absorbed. Thus, while the supplemental material of the tapered portion adjacent the distal end is available for absorption by wicking action and therefore increases the absorptive capacity of the tampon and while the bulk of the material comprising the tampon will be located in the area best suited for receiving menses, the discomfort level of the tampon will remain at or below the critical 25% value.

Another preferred embodiment of this invention is illustrated in FIGURES 2 and 3 in which the tampon blank **11***a* is provided with a tapered configuration or portion **15** at the distal (string-equipped) end in addition to the tapered portion **13***a* at the proximal end. The blank can be made of the same material described above in connection with FIGURE 1 and has similar dimensional limitations so that while the size and configuration of the tapered proximal end can be varied, it must have dimensions which result in the limitation of its transverse cross-sectional areas to those falling within the equation set forth above. In addition, the maximum transverse cross-sectional area at any point along the blank must not exceed 1.2 square inches and the blank should preferably have a weight of at least about 3.6 grams. For example, the blank **11***a* can be 0.8" thick, 4" long and 1½" wide between points **14***a* (which are located 2½" from the distal end of the blank) and ⅞" wide at the distal and proximal ends. Note that by reason of identical distal and proximal end widths in the double tapered shape, i.e., where the tapered portions of the blank abut, this embodiment is nestable and so may be severed from wide, flat batts of material with very little waste **16** to be discarded or reprocessed, as shown in FIGURE 3. Moreover, because of the tapered distal end of the blank, the tampon, following use, can be removed from the vagina more readily than a tampon made from the tampon blank of FIGURE 1. It will also be noted, though, that the improvement facilitating removal and nestability reduces the quantity of material which may be incorporated in the blank; however, the use of the tapered proximal end still permits the comfortable inclusion of sufficient absorbent material to substantially exceed the 3.6 gram minimum weight and makes it possible to use the tapered distal end without substantial detriment. When dimensioned as indicated above, the device of this embodiment weighs approximately 4.9 grams.

Many modifications of the above invention may be used and it is not intended to hereby limit it to the particular embodiments shown or described. The terms used in describing the invention are used in their descriptive sense and not as terms of limitation, it being intended that all equivalents thereof be included within the scope of the appended claims.

What is claimed is:

1. A highly absorbent tampon blank comprising absorbent fibers and having in an uncompressed condition an overall length of at least about 3½ inches and less than about 5 inches, said blank having a proximal end and an oppositely disposed distal end, said distal end having a drawstring attached thereto, said blank being tapered in the portion thereof adjacent said proximal end whereby the transverse cross-sectional areas thereof are reduced as the proximal end is approached, said blank weighing at least about 3.6 grams and having a maximum transverse cross-sectional area which does not exceed about 1.2 square inches when measured under a pressure of 0.25 pound per square inch gage exerted on the opposed faces of the blank, said blank intermediate said proximal end and points spaced 3½ inches from said distal end being sized and configured so that the transverse cross-sectional areas thereof do not exceed a maximum based on the following equation:

$$A = 1.2[1 - e^{2.7(L-5)}]$$

wherein A is the maximum transverse cross-sectional area, in square inches, at a specified distance from said distal end, e is the base of the natural logarithmic system, about 2.72, and L is the distance of the area from said distal end, in inches.

2. The tampon of claim **1** in which said blank is of uniform transverse cross-sectional area from said distal end to said tapered portion.

3. The tampon of claim **1** in which said blank is tapered along a second portion thereof, said second portion being adjacent said distal end and tapering from a maximum transverse cross-sectional area in the central region of said blank to a smaller transverse cross-sectional area at the distal end thereof.

4. The tampon of claim **3** in which the transverse cross-sectional dimensions of the distal and proximal ends of said blank are identical and the tapered said portion and second portion abut, whereby a plurality of said blanks are nestable and may be cut from a flat batt without substantial waste.

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