Nov. 13, 1962 G. BRECHT 3,063,453

ABSORBENT PRODUCT

Filed April 6, 1960

FIG. 1.

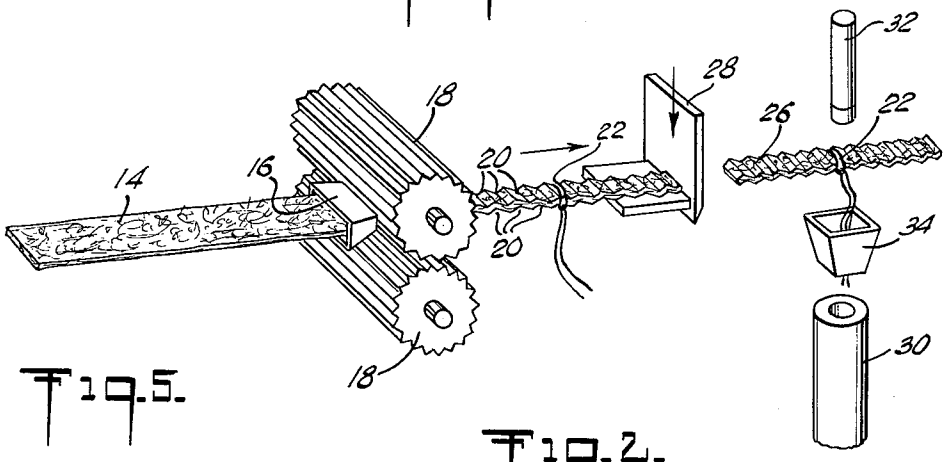


FIG. 5.

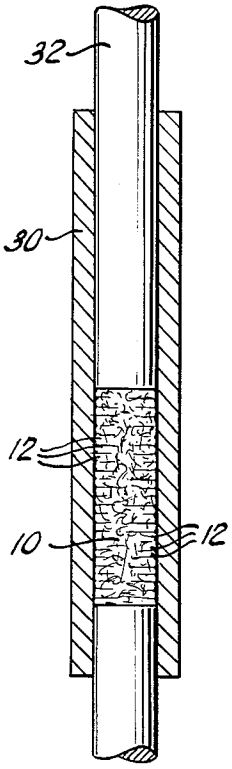


FIG. 2.

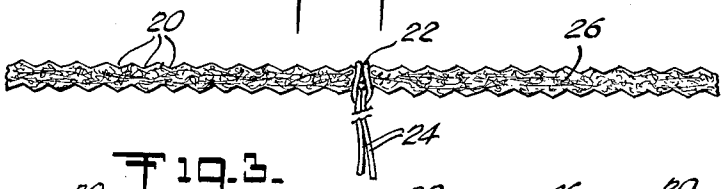


FIG. 3.

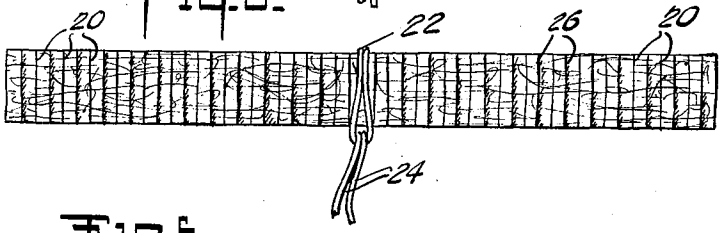


FIG. 6.

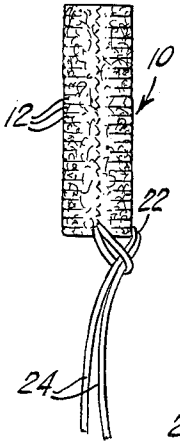


FIG. 4.

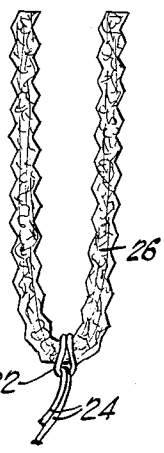
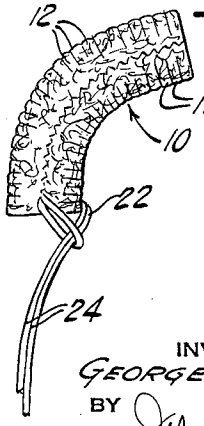


FIG. 7.



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ABSORBENT PRODUCT

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11 Claims. (Cl. 128—285)

This invention relates to tampons, and more particularly to improvements in highly compressed, highly absorbent tampons which are flexible, and to a method for making them.

Conventional tampons of the highly compressed, highly absorbent type are elongated and cylindrical in shape and are usually made by highly compressing a web of absorbent material, such as cotton, into the desired form. Due to the size of the vaginal cavity within which they are positioned in use, and due to the considerations of comfort, ease of insertion and retraction, it has been found necessary, as a practical matter, to limit the size of such tampons. Based upon these factors, highly compressed tampons achieving widest commercial acceptance range from about seven-sixteenths to five-eighths of an inch in diameter, from about one and one-half to about two inches in length and weigh from about twenty-five grains in the smaller sizes to about sixty grains in the larger sizes.

These tampons are considerably smaller than the vaginal cavity within which they are positioned and do not fill the cavity. Consequently, menstrual fluid often by-passes the tampon, particularly when the tampon is positioned off center in the cavity.

Various types of tampons have been developed to overcome the leakage problems which arise because of the differences in size between the tampons and the vaginal cavity. Some of these tampons have been so constructed and arranged to expand upon contact with menstrual fluid, or to assume a different configuration in the vaginal cavity upon such contact, to form a more effective barrier. Tampons of this type require contact with menstrual fluid before they become operative. If the menstrual fluid by-passes the tampon, or does not contact it in adequate amounts, the tampon will not function in the intended manner and leakage results. Other tampons designed to provide an effective barrier to the flow of menstrual fluid, especially during the initial stages of such flow, include tampons which are flexible and so designed to bend upon insertion to provide a barrier across the vagina.

Under normal conditions, the vaginal cavity is in a collapsed form due to the pressure of the body above and below it and it resembles a vertical section of a collapsed tube with the upper and lower walls adjacent or in contact with each other. As a tampon is inserted into the vaginal cavity, the leading end must overcome the resistance imposed by the collapsed upper and lower walls and push them apart. In addition, resistance to insertion of the tampon is imposed by the frictional resistance of the vaginal walls. If the tampon is made sufficiently flexible, these resistances will cause the tampon to bend upon insertion into the vagina. In this position, the tampon forms a dam across the vagina to provide a barrier to the flow of menstrual fluid immediately after it is inserted.

The degree of flexibility to obtain such bending has been defined in terms of a "Gurley Stiffness Reading," which is a reading obtained on a Gurley R.D. Stiffness Tester of the type described on page 43 of the December 30, 1934, issue of the Paper Trade Journal. Tampons which have sufficient flexibility to give a "Gurley Stiffness Reading" below 2.8 have been found to bend upon

insertion into the vagina under normal conditions. Flexibility is measured by loading the pointer with a two hundred gram weight placed four inches below the center. The clamp on the clamp arm is placed with its lower edge one inch from the end of the pointer in the vertical position of the arm. A tampon whose flexibility is to be measured is positioned in the clamp with one and one-quarter inches of its length extending below the lower edge of the clamp. The tester is then operated as described in the above publication to obtain readings. Reference herein to a "Gurley Stiffness Reading" means readings obtained by testing under the above described conditions.

A tampon which functions in the above described manner may be obtained by forming a web of absorbent fibers of predetermined length, placing the web into a die having a diameter about that of the desired tampon diameter and compressing the web mainly in the direction of its length. The ratio of the length of the web from which the tampon is formed to the length of the finished tampon is significant in obtaining tampons having the desired flexibility. Generally, webs of long lengths are used to make large tampons and webs of short lengths are used to make small tampons.

I have found that further improvements and advantages in flexible tampons may be obtained by forming the tampons from webs of absorbent material which have been crimped transversely and then compressing the web mainly in the direction of its length. Crimping the web prior to compressing it to form the tampon provides tampons which have a greater and more uniform flexibility and which function more uniformly and also permits greater manufacturing speeds and economies in manufacture. By means of the invention, variations in the manufacturing processes and in the properties of the finished product may be obtained. By crimping the web prior to compressing, folds and creases of uniform size and shape are formed uniformly over all or part of the length of the tampon, as desired. Tampons made from webs of adsorbent material which have been crimped transversely have a greater and more uniform flexibility than those made from uncrimped webs of the same length. The tampons provide better comfort in use, better conformability in the vaginal cavity and improved protection against premature leakage. By means of the invention, a tampon of a specified flexibility may be obtained from a crimped web whose length is shorter than the length of an uncrimped web of the same material used to form a tampon with the same flexibility.

Reference is made to the accompanying drawings and the following description wherein a preferred embodiment of the invention is illustrated and described by way of example.

In the drawings:

FIG. 1 is a schematic view of apparatus for making a tampon embodying the invention;

FIG. 2 is a side elevational view of a web of absorbent material crimped prior to compressing to form the tampon, with a withdrawal string attached;

FIG. 3 is a top view of FIG. 2;

FIG. 4 is a view of the web of FIG. 2 folded at the midpoint of its length;

FIG. 5 is a view of the folded web of FIG. 4 compressed in a compression device to form the tampon;

FIG. 6 is a side elevational view of a tampon incorporating the invention; and

FIG. 7 is a view of the tampon of FIG. 5, illustrating the bent form it assumes upon insertion into the vaginal cavity.

A tampon embodying the invention may be made by forming a thick elongated bat or web of absorbent fibrous material having a cross sectional area larger than the

transverse cross sectional area of the tampon, crimping the web transversely of its length and reducing the cross sectional area of the web during the crimping operation to a size slightly smaller than that of the finished tampon and then placing the crimped web lengthwise into a compression device having a cross sectional area about that of the completed tampon and compressing the web mainly longitudinally to form the tampon.

A typical tampon of the invention weighs about forty grains, has a diameter of about one-half inch, a length of about one and three quarters inches and has sufficient flexibility to give a "Gurley Stiffness Reading" of below 2.8.

Referring to FIGS. 6 and 7 of the drawing, a tampon **10** embodying the invention is in the shape of an elongated cylinder formed from highly compressed, highly absorbent material such as cotton or other absorbent material or combinations hereof. The tampon has transverse creases **12** of uniform size and shape uniformly disposed along its length. The creases may extend, as illustrated, throughout the entire length of the tampon or they may extend throughout a portion of its length, such as a major portion. The creases, which are more than superficial creases and extend into the interior of the tampon, impart the feature of flexibility to the tampon. The creases are generally circumferentially of the tampon and are ordinarily discontinuous. Their uniformity of size and shape and the uniformity with which they are disposed over the length of the tampon provides it with uniform flexibility and uniformity of operation.

When the tampon is inserted into the vagina, it bends and assumes the configuration illustrated in FIG. 7 due to the presence of the creases. The creases thus permit the side of the tampon on the outside of the bend to elongate by opening up, while simultaneously permitting the side of the tampon on the inside of the bend to contract by coming into closer contact with each other. Since the creases extend generally circumferentially of the tampon, bending of the tampon can occur in any direction.

Referring to FIG. 1 wherein there is shown schematically apparatus for making the tampon, an elongated web **14** of absorbent fibers formed by any of the well known processes, such as carding, air deposition and the like, is obtained from any suitable source. The web may be a plurality of superposed card webs of cotton supplied directly from carding machines, folded to a width of approximately one inch and a thickness of about one quarter of an inch, and having a weight of 5 grains per inch length and a bulk density of 0.16 gram per cubic centimeter. Preferably, the fibers in the web are arranged to extend predominantly lengthwise of the web so that the crimps to be formed therein will extend across the fibers. The web so formed is fed into a horn or funnel **16** which may be in the form of a hollow truncated pyramid having an opening at the apex which compacts and densifies the web and reduces its cross sectional area. For a web of the above type weighing 5 grains per inch length, the web is reduced to a cross sectional area of about 0.18 square inch by providing an opening in the apex of the funnel through which the web passes, 0.36 inch wide and 0.5 inch high.

Directly after the web is reduced in cross sectional area by passage through the funnel **16**, it is passed between a pair of crimping rollers **18** positioned immediately adjacent the funnel wherein the web is formed with crimps **20** extending transversely of its length and wherein it is simultaneously reduced in cross sectional area to approximately that of the die within which the web will be placed to be compressed to form the tampon. Preferably, the density of the crimped web as it emerges from the crimping rollers is from about 90–100 grains per cubic inch. The crimping rollers are adjusted so that sufficient pressure is imposed upon the web to obtain the desired density and to form a definite crimp without cutting, damaging or unduly compressing it. The cross sectional area of the opening in the funnel and the amount of pressure exerted upon the web by the crimping rollers is adjusted to provide the web with a cross sectional area sufficient to substantially fill the die, and of sufficient density so that the web will hold the crimps. If the web is made too dense, or the amount of pressure exerted upon the web by the crimping rollers is too high, the web may be cut. If the web density, or the amount of pressure applied is too low, definite crimps will not be obtained and the desired creases in the completed tampon will not be formed during the compression operation. The number of crimps formed in the web may be varied and suitably are about 4 to 5 crimps per inch of the length of the web.

Crimping rollers of a small diameter, e.g., one inch drafting rolls having rounded teeth, are preferred to minimize cutting of the web. With rolls of small diameter, only a few teeth impart a crimp to the web at any single instant whereas when rolls of larger diameter, e.g., four to five inches, are used, a greater number of teeth are in contact with the web at the same time with the result that teeth which are adjacent the teeth which impart the crimps hold the absorbent material and may cause it to tear. The speed of rotation of the crimping rollers is regulated so that the absorbent material is between the rollers sufficiently long for the crimps to be formed.

After the web has been crimped transversely by passage through the crimping rollers, a withdrawal string **22** having extending ends **24** for withdrawing the tampon after use is looped around the web at appropriate spaced intervals, e.g., every eight inches. The web with withdrawal cord attached is next cut into individual lengths **26** by a suitable cutting device **28**. The web is cut at the midpoint between two attached withdrawal cords which in the case of withdrawal cords positioned every eight inches apart will form individual lengths eight inches long.

After cutting, each length of crimped web is positioned over a forming die **30** with the midpoint of the length of the web directly over the longitudinal axis of the die. The web is then folded at the midpoint of its length, as illustrated in FIG. 4, and is forced into the die, folded end first. With the folded web so positioned in the die, a plunger **32** compresses the crimped web mainly in the direction of its length, and, accordingly, in a direction perpendicular to the transverse crimps, to form a highly compressed tampon of the desired size. Because of the crimps in the web, transverse creases of regular size and shape are induced to form uniformly throughout the length of the tampon. The finished tampon is then removed from the die. The lengths of web material which have been crimped prior to forming the tampon may be of forms which differ from the folded preferred form described above by way of example. For example, a single unfolded length of crimped web material having the desired length, density and weight of fibers may be used.

Prior to positioning the web of absorbent material in the die, it is reduced in cross sectional area to approximately the cross sectional area of the die. As stated above, the reduction in cross sectional area of the web is preferably made by passing the web through the funnel **16** and then through the crimping rollers **18**. In addition, a second funnel or cross sectional area reducing device **34** may be located directly above the opening in the die **30** to control the cross sectional area of the web just before it enters the die, or to further reduce the cross sectional area to some extent if necessary or desired. Alternatively, if the size of the starting web is essentially that desired, the funnel **16** may be dispensed with and funnel **34** used alone to reduce the cross sectional area of the web to the approximate cross sectional area of the die before it is positioned therein and compressed to form the tampon. The cross sectional area of the web may be slightly larger

than the cross sectional area of the die providing the web may be inserted into the die without unduly destroying the crimp in the web. The web may also be and preferably is somewhat smaller in cross sectional area than the cross sectional area of the die. However, its cross sectional area should be such that the web will not sag or fold over in the die as it is being compressed longitudinally therein and form large folds and convolutions. If the cross sectional area of the web is too small with respect to the cross sectional area of the die, and does not substantially fill the die, large folds and convolutions, separate and apart from the creases which are induced by the crimps, will form in the finished tampon and provide an unsatisfactory product. On the other hand, if the cross sectional area of the web is too large, it may be necessary to force the web into the die and thereby disrupt the crimps in the web with the result that uniform creases regularly disposed along the length of the completed tampon will not be formed.

The number of crimps per unit web length and the length of the web may also be suitably varied to provide tampons of varying flexibility. Generally, if the length of the web is increased, and the number of crimps per unit length maintained constant, a more flexible tampon will result. Also, if the web length is maintained constant and the frequency of the crimp per unit web length is increased, the flexibility of the tampon will increase. It is apparent that the length of the web and the frequency of the crimp may exceed practical limits with regard to manufacturing operations and a suitable product.

Since the size and weight of conventional highly compressed tampons is generally established in accordance with standard practices, the length of the web of absorbent fibrous material with a given number of crimps per unit length used to form a tampon in accordance with the present invention and having sufficient flexibility to give a "Gurley Stiffness Reading" of below 2.8 may be established. For example, to form a tampon with the desired flexibility, and whose size is one-half inch in diameter, one and three-quarter inches long and weighing forty grains, a forty grain web of carded absorbent cotton fibers having four and one-half crimps per inch length at least about three and one-quarter inches long is used. This will provide the tampon with about seven crimps per inch tampon length. A longer web having the same number of crimps per unit length may be used and will provide a tampon which has greater flexibility. For example, if the above web is four inches long and also has four and one-half crimps per inch web length, it will provide a tampon of the above size which will have a flexibility which will give a "Gurley Stiffness Reading" of about 1.6 and which will have about nine crimps per inch tampon length. Using a similar web five inches long and with the same number of crimps per unit web length, the tampon formed will have a flexibility which will give a "Gurley Stiffness Reading" of about 1.15 and will have about twelve crimps per inch tampon length.

To form a tampon seven-sixteenths of an inch in diameter, one and three-quarter inches long and weighing thirty grains and having a flexibility to give a "Gurley Stiffness Reading" of below 2.8, a web of carded absorbent cotton fibers having four and one-half transverse crimps per inch length at least about three and one-eighth inches long is used.

The number of crimps per unit web length may be varied with changes in the length of the web to obtain a tampon of specified size and flexibility. If the web length is increased, the number of crimps per unit web length may be decreased and conversely.

The tampon of the invention formed from a web of absorbent fibrous material which has been crimped transversely may be compared with a tampon made from an uncrimped web. To prepare a highly compressed tampon of carded absorbent cotton fibers one-half inch in diameter, one and three-quarter inches long, and weighing forty grains and having sufficient flexibility to give a "Gurley Stiffness Reading" of about 2.25, an uncrimped web five inches long and compresed mainly longitudinally is used. By transversely crimping the web prior to compressing four and one-half crimps per inch length, a web three and one-quarter inches long may be used to form a tampon having the same flexibility. In the case of a larger tampon, five-eights of an inch in diameter, one and nine-tenths inches long and weighing fifty-five grains, an uncrimped web six inches long is used to form a tampon having sufficient flexibility to give a "Gurley Stiffness Reading" below 2.8, whereas crimping the web four and one-half crimps per inch web length permits the use of a web three inches long to form a tampon with the same flexibility. It is thus apparent that by forming the tampon from a web of absorbent material which has been crimped transversely, shorter lengths of web material may be used. Also, by forming flexible tampons from crimped webs in accordance with the present invention, a more flexible tampon may be obtained than may be obtained from an uncrimped web of equal length.

It is apparent that variations of and changes in the form of the invention described and illustrated may be made while still remaining within its spirit.

This application is a continuation-in-part of my copending application Serial No. 727,932, "Absorbent Product," filed April 11, 1958 now abandoned.

What is claimed is:

1. The process of forming a highly compressed, highly absorbent flexible tampon having an oblong, cylindrical shape comprising forming an elongated web of absorbent fibrous material, crimping said web transversely of its length, reducing the cross sectional area of said web to approximately the cross sectional area of the tampon, and highly compressing said web mainly in the direction of its length to form the tampon.

2. The process of forming a highly compressed, highly absorbent flexible tampon having an oblong, cylindrical shape comprising forming an elongated web of absorbent fibrous material, the fibers in said web extending mainly lengthwise of said web, reducing the cross sectional area of the web to approximately the cross sectional area of the tampon, crimping said web transversely of its length, and highly compressing said web mainly in the direction of its length to form the tampon.

3. The process of forming a highly compressed, highly absorbent flexible tampon having an oblong, cylindrical shape comprising forming an elongated web of absorbent fibrous material, reducing the cross sectional area of the web to approximately the cross sectional area of the tampon, crimping said web transversely of its length with from about four to about five crimps per inch, and highly compressing said web mainly in the direction of its length to form the tampon.

4. The process of forming a highly compressed, highly absorbent flexible tampon having an oblong, cylindrical shape comprising forming an elongated web of absorbent fibrous material, the fibers in said web extending mainly lengthwise of said web, crimping said web transversely of its length, simultaneously reducing the cross sectional area of the web to approximately the cross sectional area of the tampon, and highly compressing said web mainly in the direction of its length to form the tampon.

5. The process of forming a highly compressed, highly absorbent flexible tampon having an oblong, cylindrical shape comprising forming an elongated web of absorbent fibrous material, crimping said web transversely of its length, simultaneously reducing the cross sectional area of the web to approximately the cross sectional area of the tampon and to a density of from about 90 to 110 grains per cubic inch, and highly compressing said web mainly in a direction perpendicular to the direction of said crimps to form the tampon.

6. A flexible tampon comprising an elongated web of absorbent fibrous material having crimps extending transversely of its length highly compressed into an oblong cylindrical shape, said tampon having uniformly disposed transverse creases of uniform size and shape.

7. A flexible tampon comprising an elongated web of absorbent fibrous material having crimps extending transversely of its length highly compressed into an oblong cylindrical shape, said tampon having uniformly disposed transverse creases of uniform size and shape throughout a major portion of its length.

8. A flexible tampon comprising an elongated web of absorbent fibrous material having crimps extending transversely of its length highly compressed into an oblong cylindrical shape, said tampon having uniformly disposed transverse creases of uniform size and shape throughout its length.

9. A flexible tampon comprising an elongated web of absorbent fibrous material having crimps extending transversely of its length highly compressed into an oblong cylindrical shape, the fibers in said web extending mainly lengthwise of the web, said tampon having uniformly disposed transverse creases of uniform size and shape throughout its length.

10. A flexible tampon comprising an elongated web of absorbent fibrous material having from about four to about five crimps per inch extending transversely of its length highly compressed into an oblong cylindrical shape, said tampon having uniformly disposed transverse creases of uniform size and shape throughout its length.

11. A flexible tampon comprising an elongated web of absorbent fibrous material having crimps extending transversely of its length highly compressed into an oblong cylindrical shape, said tampon having transverse creases of uniform size and shape disposed throughout a major portion of its length.

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CERTIFICATE OF CORRECTION

Patent No. 3,063,453

November 13, 1962

George Brecht

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 40, for "adsorbent" read -- absorbent --; column 3, line 18, for "hereof" read -- thereof --; line 73, for "90-100" read -- 90-110 --; column 4, line 25, for "crimps" read -- crimp --.

Signed and sealed this 21st day of May 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents