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METHOD OF MAKING NON-WRINKLING BRASSIERES

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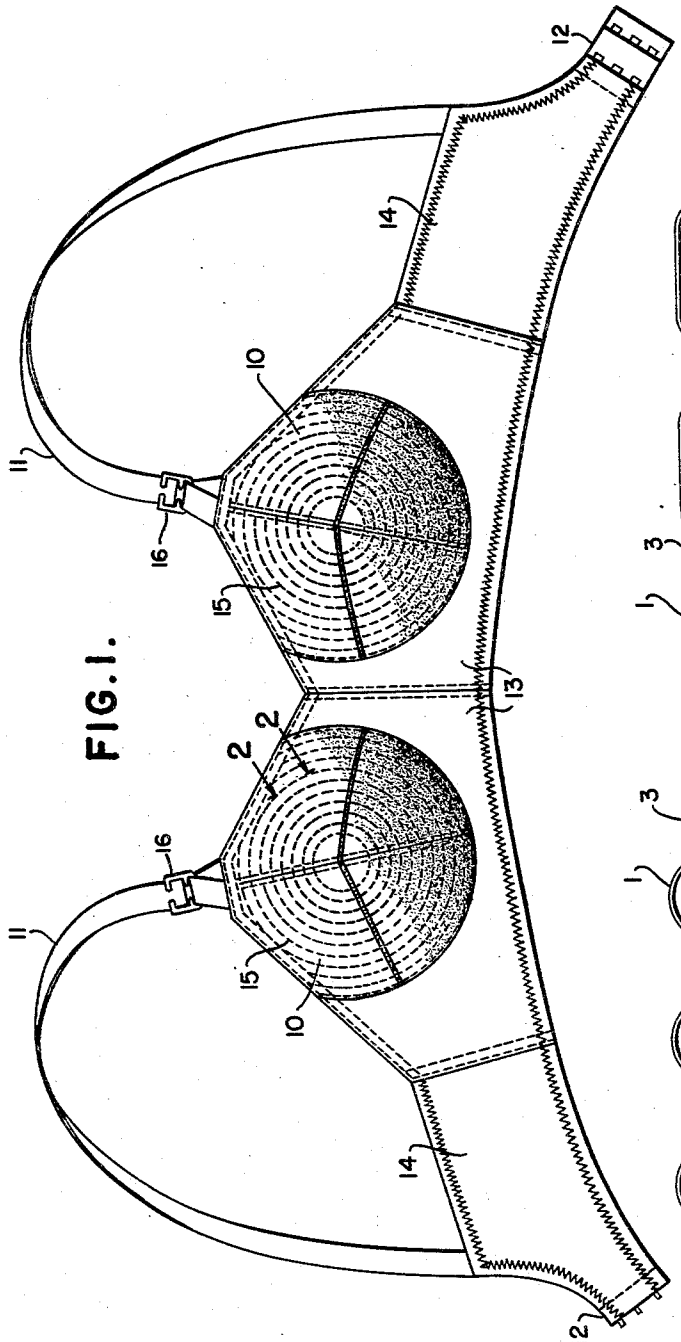


FIG. 1.

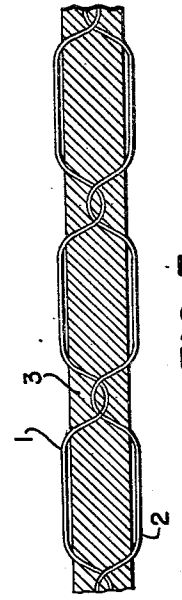


FIG. 3.

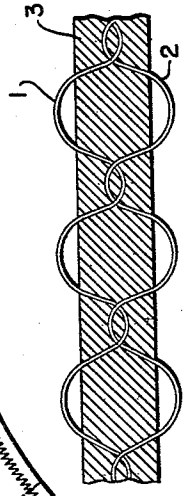


FIG. 2.

INVENTOR

Charles M. Sachs

BY Anthony P. Mentis

ATTORNEY

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METHOD OF MAKING NON-WRINKLING BRASSIERES

Charles M. Sachs, Dover, Del., assignor to International Latex Corporation, Dover, Del., a corporation of Delaware

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This invention relates to processes whereby wrinkling and puckering of sewn brassieres may be greatly reduced or eliminated, and to the smooth, non-wrinkling brassiere produced thereby.

Brassieres having stitching on the breast cups enjoy public acceptance because of the decorative effect which the stitching imparts to the brassiere. The stitching, which is in the form of lock-stitches, also has the additional purpose of acting as reinforcing to the fabric of the cup and assists in maintaining the shape thereof. Generally speaking, the fabric of the breast cups desirably has as small a shrinkage factor as possible, cotton broadcloth which has been preshrunk, as by Sanforizing, to have a water shrinkage of about 1% being an acceptable material. Such stitching may take a variety of shapes and conformations, as for example, circular stitching wherein the stitching is in concentric circular pattern, said circles being in equidistant relationship. Other designs and patterns may also be formed by the stitching.

Brassieres made with breast cups containing lock-stitching, while decorative and popular with the public, nevertheless suffer from a disadvantage in that the cups become wrinkled or puckered after washing and thus lose their original smooth, unwrinkled appearance. The advent in recent years of wash and wear garments which upon being washed drip dry to a wearable appearance with a minimum of preparation, has conditioned the general public to look with disfavor on clothing which shows unsightly wrinkling or puckering after washing. Needless to say, brassieres which are subject to such wrinkling or puckering after washing also cause such dissatisfaction to the wearer.

It has been found that the above defects may advantageously be overcome and smooth, non-wrinkling brassiere cups obtained by using a relaxed sewing process and by using threads having certain characteristics. This results in the threads being in the fabric so free of tension that puckering of the brassiere is lessened. The invention is useful with zig-zag stitch lines but also has peculiar applicability to so-called straight line stitching.

In the drawings, FIGURE I is a front view in elevation showing a brassiere containing circular stitching.

FIGURE II is a diagrammatic view showing the fabric of the breast cups wherein the threads are in a slack condition and form loops which extend relatively far from the surface of the fabric.

FIGURE III is a diagrammatic view showing the fabric of the breast cups wherein the threads lie relatively flat and close to the surface of the fabric.

FIGURE I illustrates in general a brassiere having a pair of fabric breast cups **10**, and a pair of conventional shoulder straps **11**, each of these last shown as including two strap elements connected by a friction type buckle **16** whereby the shoulder straps are adjustable as to length. The body-encircling band is comprised of front panels **13** and back panels **14**, either or both of which being of elastic material. The ends **12** of panels **14** have suitable fastening means for clasping the brassiere about the body. The breast cups **10** contain stitching **15** in equidistant concentric circles.

The relaxed sewing may be accomplished by careful adjustment of the sewing machine to reduce the tension

on both the bobbin thread and the needle thread as much as possible, consistent with the formation of presentable stitches. This may be done by loosening the thread tension assemblies on the machine, care being taken to avoid reducing the tension to such an extent that poor stitching results. The two tensions should be approximately equal so that the knot where the loops of thread lock is near the center of the material being sewn.

It has been found particularly advantageous to achieve relaxed sewing by means of a bobbin differing from the conventional, flanged, center-axle bobbin. In the conventional lock-stitch sewing machine, the bottom thread is fed from a bobbin, usually made of metal and having a central axle, which contains the thread wound thereupon in such a manner that the thread is fed to the workpiece by the rotation of the bobbin. This may be characterized as a circumference-feed bobbin. In the process, this bobbin tends to resist the pull of the thread as it leaves the bobbin, and this resistance, due to inertia and friction, causes the thread to become taut and stretched. Also, when the sewing machine is temporarily stopped, the bobbin has a tendency to keep spinning momentarily and thus releases thread which more or less bunches up. This may be termed as overspin. Upon restarting, the machine, running at high speed, uses up the bunched thread so quickly that the bobbin is started rotating with a jerk. This jerk causes the thread to tighten up and may be severe enough to break the thread. A further way that tension or stretching is applied to the thread occurs as the rotating bobbin becomes progressively emptier. When the fully wound bobbin is first started, it rotates slowly in order to feed the required amount of thread to the fabric. When it is half used up, it rotates considerably faster to supply the same amount of thread, and when it is nearly empty of thread it goes many times faster to supply the same amount of thread. The increase in the speed means an increase in friction and therefore the tension on the thread will be increased automatically from the beginning of the bobbin to the end. It is apparent that the workpiece sewn with a conventional bobbin will have thread in it which is under a tensed condition, which tenseness may also vary within the workpiece itself as well as in different workpieces.

By replacing this circumference-feed bobbin with an all-thread, center-feed, non-rotating bobbin, the above-mentioned tensions are eliminated. A center-feed bobbin is one having no center-axle therein and in which the thread is so wound that it is released from the center of the wound mass of thread rather than from the circumference. The all-thread, center-feed bobbin may be described as comprising a mass of coiled thread composed of a continuous thread helically and tightly wound about the axial center, wherein the bobbin has no axial bore, thus enabling removal of the thread from the bobbin in a uniform feed from the center, over the top of the bobbin and out through a conventional thread feeding aperture in the bobbin case. There is no shaft in the bobbin case itself upon which conventional bobbins revolve. In this way, the bobbin remains stationary and does not rotate and consequently none of the above-mentioned tension-producing forces occasioned by inertia, friction, or overspin can possibly be generated. As a consequence, the thread is fed to the workpiece under relaxed condition, since, with the bobbin absolutely stationary, the thread simply releases itself from the center of the coiled mass. As a result of this stationary release of thread from the center-feed bobbin, the bobbin thread is not stretched or drawn taut and the sewn article contains thread in its slack, relaxed state. For further details of center-feed bobbins, reference should be made to U.S. Patent No. 2,780,191, issued February 5, 1957, to Joel M. Philips.

It should be noted at this point that use of the center-feed bobbin results in such a low tension on the bobbin thread that the tension on the needle thread may correspondingly be reduced to the same low level, far lower than could be accomplished by merely loosening the tension assemblies on the machine.

Even with such a reduced tension upon the needle thread, however, it has been observed that some threads still will cause puckering even before washing. For example, the use of nylon as a needle thread even under relaxed sewing tension causes a brassiere of the type concerned to pucker and wrinkle quite severely before being washed. The sewing machine, even when adjusted to reduce the tensions as much as possible, still generates sufficient tension on the needle thread that nylon, for example, is stretched to a considerable extent. The nylon having a quick elastic recovery immediately reverts to its original length and in so doing carries the fabric with it to such an extent that puckering and wrinkling occur, in some cases practically as soon as the material is sewn. To overcome this difficulty, only those threads that have a low degree of elongation should be used as needle threads. Threads which have an elongation of not over 2% under a pull of 150 gram weight have been found suitable. In this way, the sewn article will contain threads which are in as slack a condition as possible and which have a low degree of elongation. Further, the slack condition of the threads is sufficient to absorb any shrinkage which may occur after the article has been subjected to water-washing, and thus the smooth, unwrinkled contour of the brassiere cups remains relatively unaffected.

The threads suitable for use in the practice of this invention should have a shrinkage factor as close as possible to that of the fabric used in making the breast cups so that the fabric and threads will shrink approximately equally. Where the fabric has a water shrinkage of about 1%, for example, both the bobbin and needle threads should have a corresponding water shrinkage of about 1%. The needle thread also should have an elongation of not over 2% when placed under tension of a 150 gram weight. With the use of threads having the above characteristics and with the use of relaxed sewing, it is possible to greatly reduce or eliminate all puckering or wrinkling of the brassiere breast cups containing reinforcing, decorative stitching.

As an example of the prior art, a brassiere having breast cups of Sanforized cotton broadcloth was circularly stitched with ordinary cotton thread in a conventional lock-stitch sewing machine. Both the top and bottom threads were of cotton. The sewn article was water-washed and then air-dried after which it was observed that due to the inherent water-shrinkage characteristics of the cotton thread, puckering and wrinkling of the brassiere cups occurred. The cotton thread used in this example had a water shrinkage of about 4% and an elongation of 2% under a pull of 150 grams.

The water shrinkage was determined in the following manner and was the method by which was obtained the water shrinkage of all the threads mentioned. Cut five (5) samples of thread to be tested approximately fourteen (14) inches in length. Knots are tied near each end of the thread samples to prevent the twist from coming out during the wash test. Place marks on the threads ten (10) inches apart with an indelible pen. Place the samples in pint Launder-Ometer jars using 1% soap solution of Ivory Snow and preheated to a temperature of 140° F. Place the preheated samples in the Launder-Ometer and agitate for forty-five (45) minutes at 42 r.p.m. The water temperature during the test must be maintained at 140° F. At the completion of the washing test, the samples are removed from the jars, rinsed in cold water, and allowed to dry on a flat surface. Care must be taken not to tangle samples while removing them from jars. Samples are then measured and shrinkage calculated as follows: Based on ten inch sample,

$$\frac{10-B\times(100)}{10}$$

equals percent shrinkage were "B" represents length after shrinkage. The Launder-Ometer is described on page 82 of the Technical Manual of American Association of Textile Chemists and Colorists, 1958.

The elongation was determined in accordance with A.S.T.M. D 204–57 T using an I.P. 4 tester with a 150 gram weight. This test generally takes only about one (1) minute and is relatively easy and simple to perform.

As another example of the prior art, a brassiere having breast cups of Sanforized cotton broadcloth was circularly stitched with nylon thread in a conventional lock-stitch sewing machine, both top and bottom threads being of nylon. The sewn article was observed to pucker shortly after being sewn due to the shrinkage of the inherently elastic nylon thread. Upon being washed and air-dried, a further puckering was observed of the brassiere cups due to the water shrinkage characteristic of the nylon thread. The nylon thread of this example had a water shrinkage of 5.2% and an elongation of 3.2% when stretched by a 150 gram weight.

TABLE I

Thread	Twist	Percent Elongation Under Tension of 150 Gm. Weight	Percent Water Shrinkage
Fortisan [1]	10	0.60	0.50
Nylon [2]	15	3.20	5.20
Dacron [3]	14	1.00	1.00
Cotton	22	2.00	4.00
Silk	11	1.20	4.20

[1] Highly oriented, regenerated, saponified cellulose acetate supplied by Celanese Corporation of America.
[2] Linear polyamide supplied by Du Pont Company.
[3] Linear polyester supplied by Du Pont Company (polyethylene glycol terephthalate).

A thread may have a low water shrinkage characteristic and a low elasticity factor and yet be too weak to operate satisfactorily. This may be overcome by using a thread having a sufficient number of twists per inch to raise its strength to the point where it can be used but not too high a number of twists as will cause it to stretch unduly during the relaxed sewing process. Although the relaxed sewing method eliminates the greater part of the tension placed upon the thread, there is still some slight tension generated which will cause some elongation of the thread. As the number of twists per inch increases, the total length of thread per inch increases which thus allows more stretching since there is more of the thread to be stretched. The greater the stretching, the greater the amount of resultant shrinkage and if the twist is so high that the resultant stretching and consequent shrinkage is great enough, puckering and wrinkling of the sewn article will occur in the sewn article even before washing. Stated in other words, an increase in twist increases the elasticity of the thread and for this reason it is necessary to use a thread whose elasticity factor has not been unduly raised by an excessive number of twists.

Example 1

As an example of the practice of this invention, a lock-stitch sewing machine in which the thread tension assemblies had been reduced as much as possible, consistent with presentable stitch formation, was threaded with a 3-cord, 14-twist, Dacron thread having an elongation of 1% under a pull of a 150 gram weight and a water shrinkage of 0.7%. The bottom thread was supplied in the form of a center-feed bobbin while the top thread was furnished from a cone. Both top and bottom threads were of the aforementioned Dacron. A brassiere having

breast cups of Sanforized cotton broadcloth was sewn with circular stitches using the above Dacron thread and as a result of the relaxed sewing, the Dacron thread was incorporated in the brassiere in a slack, relaxed state. No puckering or wrinkling of the brassiere cups occurred after sewing and the cups had a smooth, unwrinkled contour. The brassiere was then subjected to a water-washing and air dried. No puckering or wrinkling of the breast cups was observed and the breast cups retained their original smooth contour.

A microscopic examination of the stitching prior to washing of the brassiere showed the threads to be in a slack, relaxed state. The slack condition may be visualized by reference to FIGURE II which shows diagrammatically the fabric **3**, of the breast cups containing the slack stitching therein. As shown, the top thread **1** and the bottom thread **2** are in the form of loops which extend relatively far from the surface of the fabric **3**.

After washing of the brassiere, the inherent water shrinkage characteristic of the Dacron thread results in a shrinkage which reduces the slack originally imparted to the threads by the relaxed sewing method, and causes the top thread **1** and the bottom thread **2** to lie much closer to the surface of the brassiere cup fabric as shown in FIGURE III. It should be understood that the threads are now in an untensed, yet unrelaxed, state in the brassiere so that the original smooth, unwrinkled contour of the brassiere cup is not disturbed. This state of the thread, in a condition which is neither tensed nor relaxed whereby the thread is in complete harmony with the fabric, may be characterized as a normal state.

As a further aspect of this invention, it is advantageous to use two different threads in obtaining a brassiere which will not pucker or wrinkle upon washing. For example, it is possible to use a thread having a shiny, glossy surface as the outside thread of the brassiere. Such a shiny, glossy thread will add greatly to the decorative effect of the circular stitching and if selected to possess water shrinkage and elongation factors within the limits taught by this invention, smooth, non-wrinkling brassieres will also be obtained.

Example 2

As an example of this phase of the invention, a conventional lock-stitch sewing machine in which the thread tension assemblies had been reduced as in Example I, was supplied with Dacron thread as the top or cone thread and a modified type of rayon commercially available as Fortisan was used as the bottom thread. The Fortisan was supplied in the form of a zero-twist thread contained in an all-thread, center-feed bobbin. A brassiere having breast cups of Sanforized cotton broadcloth fabric was circularly stitched with the above combination of threads with the outer surface of the fabric face down so that the shiny Fortisan thread was the outside thread in the brassiere cup and the Dacron thread was the inside thread. The stitching comprised thread in a slack, relaxed condition. The circularly stitched breast cups of the brassiere exhibited a smooth, unwrinkled contour before washing, and also after washing followed by air drying. The brassiere successfully withstood a number of washings (20) without material change.

Example 3

Example 2 was repeated using a Fortisan thread which had five twists to the inch instead of a zero twist. The brassiere was also of a smooth unwrinkled contour and withstood an even higher number of washings (30) without material change.

Example 4

Example 2 was repeated using a Fortisan thread having ten twists to the inch instead of a zero twist. The brassiere was again of a smooth unwrinkled contour and withstood unchanged an even greater number of washings (40–60) than did the brassiere of Example 3.

It is to be understood that the embodiments of the invention shown and described herein are for the purpose of illustration only, and that changes can be made therein without departing from the spirit and scope of the invention.

I claim:

1. Method for producing a brassiere having fabric breast cups of smooth, unwrinkled contour said fabric having a low water shrinkage and said cups containing reinforcing, decorative stitching therein comprising lock-stitching the breast cups under as relaxed sewing tension as possible consistent with presentable stitch formation with threads having a water shrinkage approximately equal to that of said fabric, the needle thread having an elongation of not over 2% under tension of a 150 gram weight, including the use of a bobbin thread fed from a center-feed, non-rotating bobbin wherein the tensions on the bobbin thread and the needle thread are approximately equal, whereby the threads in the fabric are free of tension so as to lessen puckering of the brassiere.

2. Method of producing a brassiere having cotton broadcloth fabric breast cups of smooth contour said fabric having a water shrinkage of about 1% and said cups containing equidistant concentric circular stitching in lock-stitch relationship comprising stitching said cups under as relaxed sewing tension as possible consistent with presentable stitch formation, with threads having a water shrinkage of about 1%, the needle thread having an elongation of not over 2% under tension of a 150 gram weight, including the use of a bobbin thread of ten-twist highly oriented, regenerated, saponified cellulose acetate fed from a center-feed, non-rotating bobbin and a needle thread of linear polyethylene glycol terephthalate wherein the tension on the bobbin thread and the needle thread are approximately equal, the fabric of breast cups being sewn so that the bobbin thread is the outside thread therein, and the threads in the fabric are free of tension so as to lessen puckering of the brassiere.

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