

[54] **PROCESS FOR PRODUCING PANTIES**
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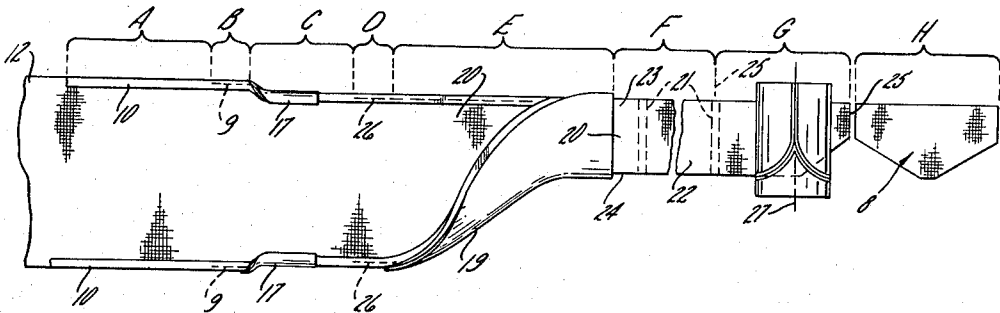
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[57] **ABSTRACT**
A panty having a reinforced elastic waist is made from a single sheet of approximately rectangular shaped fabric material.

[56] **References Cited**
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8 Claims, 5 Drawing Figures



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2 Sheets-Sheet 1

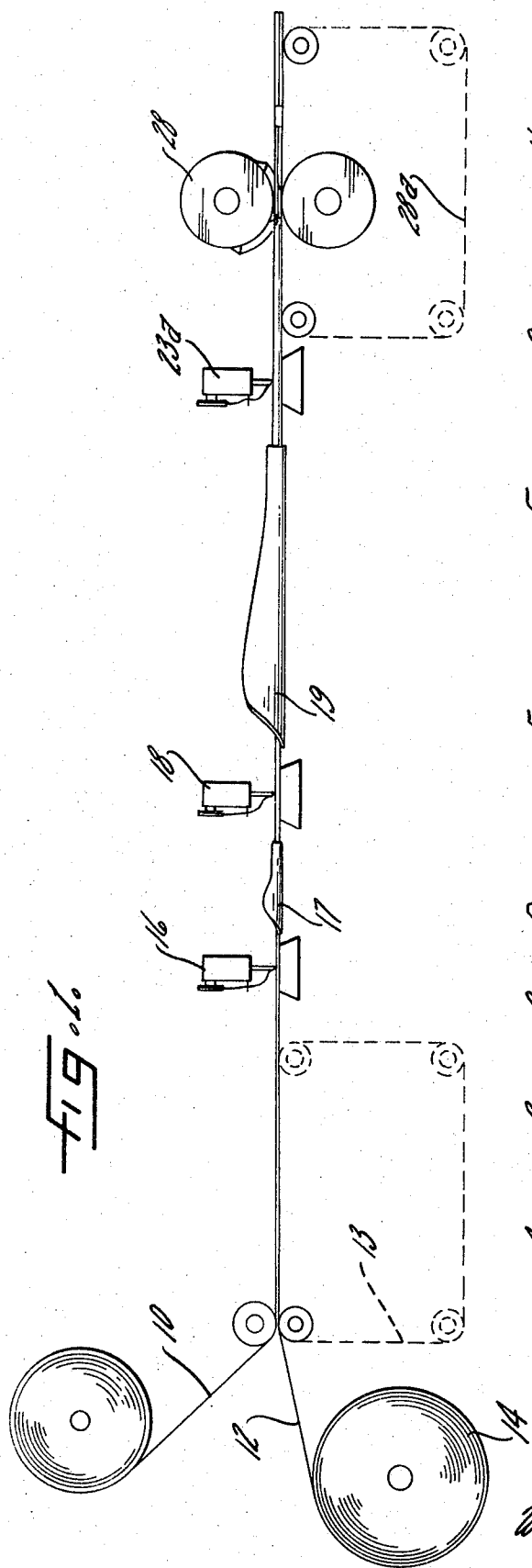


Fig. 1

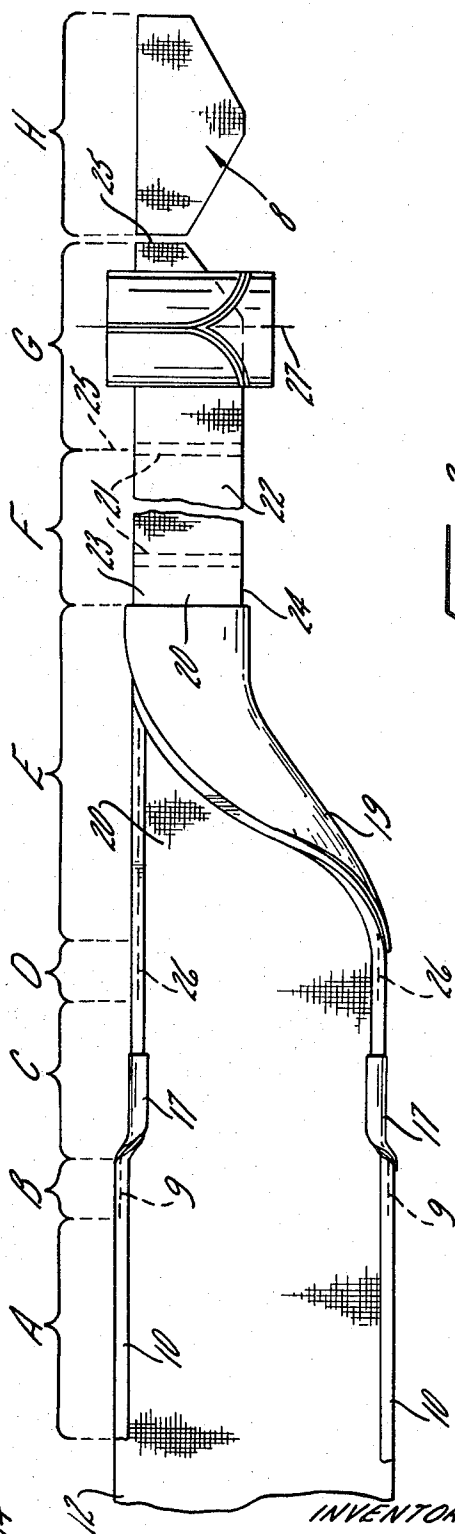
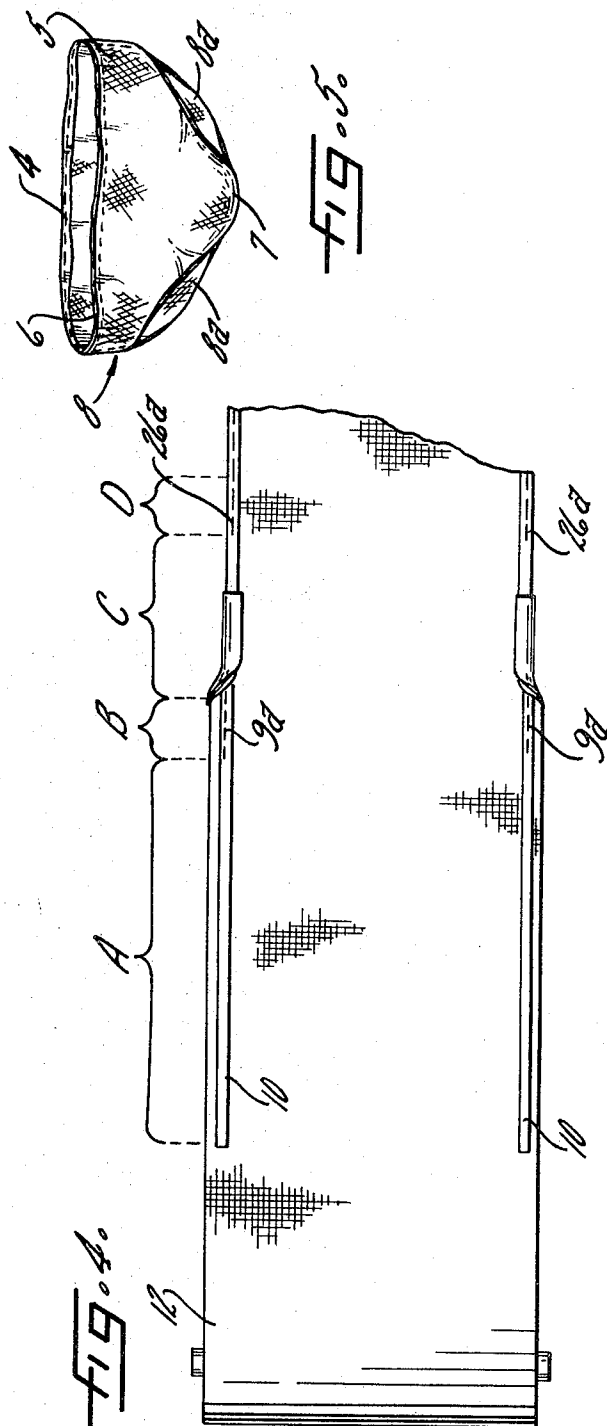
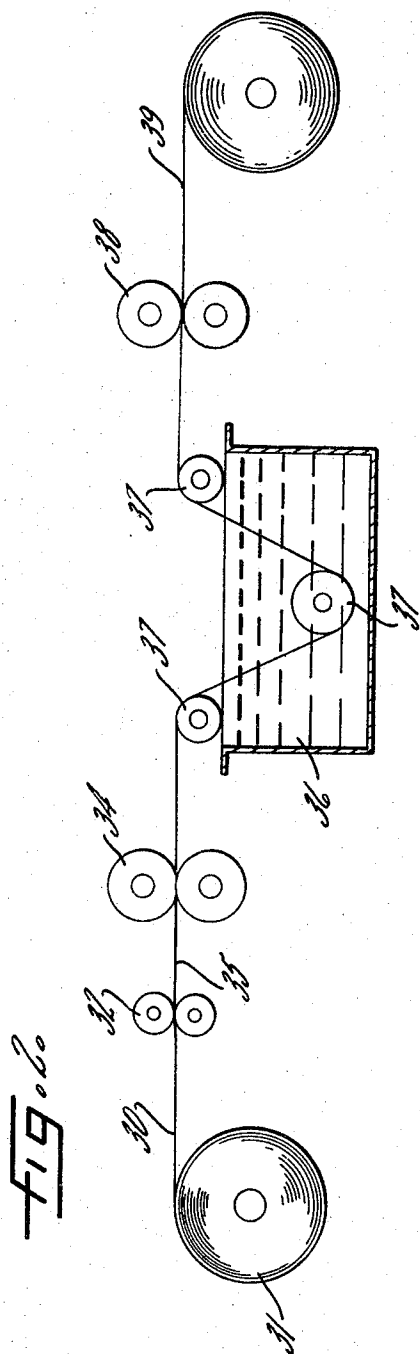


Fig. 2

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PROCESS FOR PRODUCING PANTIES

DESCRIPTION OF THE INVENTION

This invention relates generally to a process for making panties and more particularly concerns a process for making disposable panties. It should be noted that the use of the word panty is meant to include undergarments covering the lower trunk which may be adapted to be worn by women, men and children alike.

It is a primary object of this invention to provide a process for making an improved panty which can be easily and rapidly made from a single piece of fabric material with only a few simple fabricating operations.

With regard to a particular aspect of this invention, it is another object to provide a process for making a disposable panty of the foregoing type with a reinforced waist having elastic properties.

It is yet another object of the invention to provide a process for making such a panty having a reinforced waist with elastic properties.

A still further object of the present invention is to provide such an improved panty which can be efficiently manufactured at high production rates and is readily adaptable to automated production.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIG. 1 is a schematic side view of apparatus which may be used in carrying out the process of this invention.

FIG. 2 is a schematic side view of apparatus which may be used in internally immobilizing elastic ribbon in a stretched state.

FIG. 3 is a schematic diagram illustrating the various process steps for the process shown in FIG. 1.

FIG. 4 is a schematic diagram illustrating distinguishing process steps for an alternative process to that shown in FIG. 1.

FIG. 5 is a front elevation of a disposable panty embodying the invention and made from a single piece of nonwoven fabric.

While the invention will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention.

Turning now to the drawings there is shown in FIG. 1 apparatus for carrying out the process of this invention. In describing the process shown in FIG. 1, FIG. 3 which schematically illustrates the various process steps performed in the apparatus of FIG. 1 will also be referred to from time to time to more clearly demonstrate the particular process step involved.

In forming the reinforced elastic waist 4 of the panties of this invention two elastic ribbons are first placed on portions of an approximately rectangular shaped pattern of fabric material while they are in a stretched state. The degree of stretch defined as $(L_1 - L_0)/L_0 \times 100\%$ where L_1 is the stretched length and L_0 is the length of the rubber ribbon in its normal contracted state typically varies from about 40 to about 200 percent of the normal length of the elastic ribbon and is preferably 100 percent of the normal length. Accordingly, FIG. 1 shows the application of two continuous elastic ribbons 10 from rolls (not shown) onto a continuous web of fabric material 12 being fed from roll 14 onto a conveyor 13. As shown most clearly in step A of FIG. 3, the elastic ribbons 10 are placed along opposite longitudinal edges of the fabric material 12.

The fabric web 12 may be either woven or nonwoven. However, it is preferably a nonwoven material since the process of this invention is particularly adaptable in producing disposable panties, which are typically made of nonwoven materials. In a preferred embodiment, the nonwoven material comprises

at least two cross laid layers of a carded web. While more than two layers could be used, a two-layered, cross-laid carded web assembly is preferred. The carded webs are preferably cross-laid so that fibers in the adjacent layers cross one another at angles of about 30° to about 80°, and most preferably at about 60°. Furthermore, with regard to this particular embodiment the fibers which are used in producing the carded webs are crimped so that the final panty product 8 has inherent elasticity and can therefore be more comfortably worn even by large individuals.

The manner in which the carded webs are prepared is generally well known. Briefly stated, staple length fibers are fed in a side-by-side relation through a drafting roll to produce a flat light-weight web of substantially aligned fibers. This web is then bonded. Web bonding takes place by first applying the web to a discontinuous pattern of adhesive-printed, ready release sheet while maintaining the web under tension. The combined sheet and web while maintained in contact with one another are then subjected to heat and pressure so as to embed the individual fibers of the web into the adhesive patterns and set the adhesive. The fibrous web is thereafter stripped from the sheet.

The bonding adhesive used in preparing the carded webs is preferably one which will set during the formation of the bonded webs and which will subsequently be heat activatable to also serve as the means for attachment of adjacent cross-laid carded webs. While various adhesives may be employed, advantages reside in the use of plastisols, which as is well known are colloidal dispersions of synthetic resins in a suitable organic ester plasticizer. While many adhesives of this nature are known, those found particularly useful include vinyl chloride polymers, and copolymers of vinyl chloride with other vinyl resins, plasticized by organic phthalates, sebacates or adipates. These combinations provide a fast plastisol adhesive characterized by relatively low viscosity, low migration tendencies, and minimum volatility. Such adhesives remain soft and flexible after curing, can be reactivated by the application of heat and pressure, such as by hot-calendering, and insure that the resultant product retains the desired softness, and proper hand and feel which is a very necessary characteristic of the panty product.

Fibrous material which may be used to prepare the carded web may be either natural or synthetic. Typical synthetic fibers are viscose, acetate, rayon, nylon, polyesters, acrylonitriles and the like. Cotton is an excellent example of a natural fiber which may be used as noted by U.S. Pat. No. 2,407,548 wherein there is shown means for drawing cotton fibers to their maximum length by lengthwise tensioning and alignment into a straited web of uniform density.

The manner in which the fibers are cross-laid may vary. However, such cross laying may be conveniently accomplished by employing a machine specifically designed for that very purpose. An example of such a machine is the "cross-lapper" manufactured by Hunter Company in North Adams, Massachusetts. The weight of the final cross-laid product may vary as a function of the type of panty being produced but it will typically be from about 15 to about 25 grams/yd² and is preferably about 18 to 22 grams/yd².

The elastic ribbons 10 may be either natural or synthetic solid rubbers. The only requirement which the rubber constituting the elastic ribbon must meet is that it be relatively elastic, and capable of stretching to at least about 400 percent of its normal length. The width of the elastic ribbon is normally about 0.10-0.40 inches; its thickness is about 8 gauge inch.

After the elastic ribbons 10 have been applied to the longitudinal edges of the fabric web 12 they are attached thereto. Attachment as indicated in FIG. 1 is accomplished by passing the fabric web 12 with the applied elastic ribbons 10 through the sewing machine 16 whereby the elastic ribbons 10 and the fabric web 10 are stitched together, the stitching lines being shown as the dotted lines 9 in FIG. 3. While a sewing means is shown, other suitable attaching means such as adhesives and

the like may also be used. It is critical that the elastic ribbons 10 remain in a stretched state, i.e., preferably about 80 percent to about 120 percent their normal contracted lengths, while they are being attached and furthermore, in order to facilitate the packaging of the final panty product it is advantageous to maintain the elastic ribbons in their stretched state until the packaging step is completed.

It is generally well known that the difficulty in achieving a good seam or adhesive bond when attaching a stretched elastic ribbon to a fabric web, particularly if the elastic ribbon is thin, is primarily caused by the ribbons tendency to resist lying flatly on the material while in the stretched state. This tendency is greatly reduced if the elastic ribbon is attached in accordance with a preferred embodiment of this invention which calls for the application and attachment to the elastic ribbons 10 to the fabric web 12 while they are internally immobilized in a stretched state as described in my copending patent application, U.S. Ser. No. 75,495, filed Sept. 25, 1970, the disclosures of which are included herein by reference. Therein it is shown how a stretched elastic ribbon, subjected to a temperature between the freezing point of said ribbon and the glass transition point thereof, is internally immobilized by being frozen in its stretched state.

The elastic ribbons 10 are allowed to return to their contracted state after they have been attached and preferably after the panties have been fully produced and packaged. The frozen ribbon is allowed to contract by simply permitting it to thaw.

FIG. 2 shows an apparatus for freezing an elastic ribbon 30 while it is in its stretched state. As elastic ribbon 30 is unwound from a roll 31 by the first pair of drive rolls 32 and passed through the second pair of drive rolls 34 which turn at a greater surface speed than the rolls 32. Consequently, the elastic ribbon 30 is stretched to an extent proportionate to the surface speed differential between the pairs of first and second drive rolls 32 and 34. The resulting stretched elastic ribbon 35 is then passed through a low temperature bath 36 as a result of the combined operation of transfer rolls 37 and drive rolls 38, the surface speed of drive rolls 38 being the same as that of the drive rolls 34. The stretched elastic ribbon 35 is thereby maintained in its stretched state as it is passed through the bath 36. The temperature of the bath 36 and the time interval within which the stretched elastic ribbon 35 is submerged in the bath, i.e., contact time, are such that a frozen stretched elastic ribbon 39 exits from the bath 36 in an internally immobilized stretched state.

After the elastic ribbons 10 have been attached to the fabric web 12 those portions of the fabric web 12 having the elastic ribbons attached thereto are folded onto the remaining fabric material by passing the fabric web 12 through the folding iron 17; this folding operation is identified as step C in FIG. 3. Preferably such folds are made so that the elastic ribbon 10 is between overlapping portions of the fabric web 12.

In order to attach the respective overlapping portions of the fabric web 12 and the elastic ribbons 10 to one another the folded portions of the fabric web 12 are passed through the sewing machine 18 in order to apply longitudinal stitches to the folds, the stitches being shown in step D of FIG. 3 as dotted lines 26. Other means may also be used to permanently maintain the folded portions of the fabric material in its folded position. For example, adhesive may be placed between the adjoining faces of the folded portions.

At this point it should be noted that in one alternative to the process described thus far, in the initial application and attachment of the elastic ribbons 10 to the web 12, the elastic ribbons 10 may be spaced inwardly from the longitudinal edges of the web 12 at a distance equal to about at least the width of one of the elastic ribbons 10 as shown in step A of FIG. 4. When such is the case, after the elastic ribbons 10 are attached to the fabric web 12 by means of stitching shown as dotted line 9a, the portions of fabric web 12 lying between the elastic ribbons and the longitudinal edges are folded onto the elastic ribbons, as shown in step C, and attached thereto by stitches shown as dotted line 26a in step D.

Next, for the purpose of forming the front and rear body portions 5 and 6 and the crotch panel 7, all shown in FIG. 5, a folded web is produced when the fabric web 12 is folded along a fold line 24 corresponding to the approximate longitudinal center line of the fabric web 12 by passing the fabric web 12 through the folding iron 19, the overall result being shown in step E of FIG. 3. The folding step results in forming adjoining symmetrical web panels 20 lying in a face-to-face relationship. The adjoining panels 20 are attached to one another along two spaced, approximately cross directional lines of attachment 21 between which is defined the panty fabric area 22 which will eventually constitute the body of a panty product, comprising the aforementioned front and rear body portions 5 and 6, and the interconnecting crotch panel 7. This attachment is achieved by passing the folded web 23 through the sewing machine 23a although again, other suitable attaching means such as adhesives may also be used. In a process as shown in FIG. 1, it is preferred to successively attach the adjoining panels to one another such that the distance 24 between cross directional lines of attachment between adjacent panty fabric areas is kept to a minimum and preferably only large enough to accommodate a single cut along a cross directional cut line 25 between the two adjacent cross directional lines of attachment as shown in step F of FIG. 3. In this manner, fabric web spoilage is minimized.

Finally, in order to cut a given panty area 22 free from the remaining folded web 23, two cross directional cut lines 25 which are substantially parallel to the cross directional lines of attachment 21 and outside of the panty fabric area 22. Cuts for the leg opening 8a are also made on both sides of a cross directional line 27 passing through the approximate center of the panty from a point on the fold line 24 to a second point on the cross directional cut line 25. These cuts as shown in step G of FIG. 3 are preferably mirror images of one another. In continuous process as shown in FIG. 1, the attached adjoining panels 20 of the folded fabric web 23 are passed onto a metal conveyor 28a from the sewing machine 23a and through a rotating die 28, which cuts the panty area of the folded web 23 as described above. The final panty product as shown in step H of FIG. 3 and in FIG. 5 produced after the cutting operation continues on the metal conveyor 28a and is then folded and packaged.

This invention should not be restricted to the sequences of process operations as described above since it would appear quite obvious that the performance of several of the operations can take place in a sequence or combination of sequences other than that described. The final panty product 8 is shown in a front elevation in FIG. 5, and comprises a reinforced elastic waist 4, a front body portion 5, a rear body portion 6, an interconnecting crotch panel 7, and leg opening 8a, the several portions being contiguous by reason of their being formed from a unitary sheet of material.

In conclusion the process of this invention provides a panty which can be efficiently manufactured from a single piece of fabric material at high production rates and which is readily adaptable to automated production.

Having described my invention, I hereby claim:

1. A process for making a panty comprising the steps of:

- placing two elastic ribbons in a stretched state along opposite horizontal edges of an elongated approximately rectangularly shaped fabric web;
- attaching the stretched elastic ribbons to the fabric web;
- folding those portions of the fabric web having the elastic ribbons attached thereto onto the remaining fabric web;
- attaching the respective folded portions of the fabric web and the elastic ribbons to one another;
- folding the fabric material along a fold line corresponding to an approximate longitudinal center line extending widthwise of the panty so as to form adjoining symmetrical panels in a face-to-face relationship;
- attaching said adjoining panels to one another along two spaced, approximately parallel cross directional lines of attachment defining a panty fabric area therebetween which will constitute the panty product;
- cutting the folded web along;

1. two cut lines which are substantially parallel to the cross directional lines of attachment and outside of the panty fabric area to sever the panty from said elongated web; and
2. two additional cut lines located on both sides respectively of a cross directional line passing through the approximate center of the panty area, each cut being made as the approximate mirror image of the other along a line passing through a point on the fold line and a second point on the adjacent cross directional cut line; thereby forming the panty product.
2. The process of claim 1 wherein the two elastic ribbons in step (a) are placed inwardly from the longitudinal edges of the web at a distance equal to about at least the width of the elastic ribbon and the following step (c) is accomplished by folding those portions of the fabric web between the elastic ribbons and their respective longitudinal edges onto the elastic ribbons.
3. A process for making a panty comprising the steps of:
 - a. stretching two elastic ribbons;
 - b. internally maintaining the elastic ribbons in their stretched state by freezing them while they are in their stretched state;
 - c. placing two internally immobilized elastic ribbons along opposite horizontal edges of an elongated approximately rectangularly shaped fabric web;
 - d. attaching the internally immobilized ribbons to the fabric web;
 - e. folding those portions of the fabric web having the internally immobilized elastic ribbons attached thereto onto the remaining fabric web;
 - f. attaching the respective folded portions of the fabric web and the internally immobilized elastic ribbons to one another;
 - g. folding the fabric material along a fold line corresponding to an approximate longitudinal center line extending

- widthwise of the panty so as to form adjoining symmetrical panels in a face-to-face relationship;
- h. attaching said adjoining panels to one another along two spaced, approximately parallel cross directional lines defining a panty fabric area therebetween which will constitute the panty product;
- i. cutting the folded web along:
 1. two cross directional cut lines which are substantially parallel to the cross directional lines of attachment and outside of the panty fabric area to sever the panty from said elongated web; and
 2. two additional cut lines located on both sides respectively of a cross directional line passing through the approximate center of the panty area, each cut being made as the approximate mirror image of the other along a line passing through a point on the fold line and a second point on the adjacent cross directional cut line; thereby forming the panty product.
4. The process of claim 3 wherein the two elastic ribbons in step (a) are placed inwardly from the longitudinal edges of the web at a distance equal to about at least the width of the elastic ribbon and the following step (c) is accomplished by folding those portions of the fabric web between the elastic ribbons and their respective longitudinal edges onto the elastic ribbons.
5. The process of claim 4 whereas the fabric web is a disposable material.
6. The process of claim 5 where the disposable material is a cross laid carded web assembly having a weight of about 15 to about 25 gm/yd².
7. The process of claim 6 where the fibers of adjacent carded webs transverse one another at angles of about 30° to about 80°.
8. The process of claim 7 where the fibers transverse one another at angles of about 60°.

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