The invention is directed to a combination fabric of warp knit construction (as distinguished from circular knit, woven, etc.) which is comprised of a body portion having two-way effective elasticity, and integrally knitted, spaced selvedge portions having one-way effective elasticity. The fabric is constructed in a continuous web form, with the elastic selvedges forming the opposite edges of the web. The selvedges are constructed principally of yarns having substantially heavier denier than the yarns principally constituting the body portion. The elastic selvedge portions are constructed to have lateral running yarns imparting the characteristic of substantial non-extensibility to the selvedge portion in the course-wise direction of the fabric. The lateral running yarns of the selvedge are, in addition, of substantially heavier denier than the warp-wise running yarns of the selvedge, to impart substantial wall rigidity to the selvedge portions, in the course-wise direction, while providing a high degree of flexibility in the warp-wise direction. The body portion of the fabric may be constructed entirely or partly of elastic yarns, or may derive its effective elastic characteristics solely from the knitted construction of the fabric. The fabric of the invention is especially adapted for use in the manufacture of one- or two-piece garments, such as panties or panty girdles.
The application is closely related to the co-pending applications of Louis Sarmiento, Ser. No. 10,770, filed Feb. 12, 1970 and entitled "Panty-Type Garment and Process of Making Such Garment" [P-1414], and Ser. No. 36,552, filed May 12, 1970, entitled "Panty-Type Garment Construction Utilizing Combination Fabrics" [P1424]. The related co-pending applications, to which reference advantageously may be made for a fuller appreciation of the present invention, disclose panty-type garments having elastic waist band and leg band portions and, if desired, an elastic body portion, constructed principally of a generally rectangular section of warp knitted fabric. The length of material is selected so that the side edges of the material, as knitted, form top and bottom portions of the garment, and cut edges of the material (knitted as a substantially continuous web) are brought together and sewed to form a tube. A second seam made at the lower edge of the tube, joins front and back sections of the tube to form a crotch and separate leg-encircling bands. Where desired, a separate crotch portion may be formed of combined knit fabric, or may be utilized. By reason of this new manufacturing technique, enormous savings may be realized in the manufacture of panty-type garments, as compared to more conventional manufacturing techniques.

The present invention is directed more specifically to the construction of a special fabric ideally suited for the manufacture of garments in accordance with the above-mentioned related Sarmiento applications Ser. No. 10,770, and Serial No. 36,552. This application is also closely related to the subject matter of my copending applications Ser. No. 86,582, filed Nov. 3, 1970, Ser. No. 92,700, filed Nov. 25, 1970, and Ser. No. 94,837, filed Dec. 3, 1970.

BACKGROUND AND SUMMARY OF THE INVENTION

In the construction of panty-type garments by conventional techniques, it is customary to separately construct and cut sections of fabric to constitute body portions of the garment. Sections of elastic webbing are cut to appropriate length and sewed to the top and bottom edges of body fabric sections, during assembly of the garment. The finished garment includes an elastic waist band portion and separate, elastic leg band portions, in a conventional manner. As will be appreciated, there are substantial and complicated handling and sewing operations involved in the cutting to proper size and the joining together of the elastic webbing and the body portions of the garment. Pursuant to the inventions of the co-pending Sarmiento applications Ser. No. 10,770, and Ser. No. 36,552, the cutting and handling operations required to produce a garment are greatly reduced and simplified by making the garment substantially of a single piece of fabric of special construction. The construction of that fabric constitutes the subject of the present invention.

In accordance with the invention, a new and improved garment of fabric is provided, which is of warp knit construction, in continuous or substantially continuous web form, and which is adapted to be cut into generally rectangular sections, from which a one- or two-piece panty-type garment may be constructed. The warp knit fabric, which is most advantageously constructed on a Raschel-type knitting machine, is provided with selvedge portions in the form of relatively narrow elastic webbing, and a central web portion of substantially greater width. The overall width of the knitted web, from edge extremity to edge extremity is determined so as to correspond to the overall height dimension of a garment constructed with the fabric.

As one of the specific aspects of the invention, the elastic webbing selvedge portions are constructed to have only one-way effective elasticity, that being in the longitudinal or warpwise direction as the fabric is knitted. In the width or coursewise direction, the elastic webbing is provided with lateral running yarns which substantially prevent any widthwise ex-

tension and, in addition, impart to the webbing a rather substantial degree of wall rigidity. The central section of the knitted web, which may be referred to for convenience as the body section, is constructed to have effective two-way elasticity. In the case of the elastic webbing selvedges, the desired one-way elasticity is imparted at least in part through the use of elastic yarns (e.g., rubber). In the case of the fabric of the body section, two-way effective elasticity may be provided solely by reason of the knitted construction, or it may be provided through the use of elastic yarns (e.g., Spandex), or (more typically) by a combination of knitted structure and elastic yarns.

In the construction of the new fabric of the invention, it is critical that certain relationships be observed in the relative weights of the yarns of which the several dissimilar fabric portions are principally constituted. Thus, the weight (denier) of the yarns principally constituting the elastic webbing must be at least about 50 percent greater than the weight of the yarns principally constituting the body portion of the fabric. Moreover, the lateral running yarns of the elastic webbing is of substantially greater weight than the supporting warp yarns of the webbing.

In the case of combination fabric, constructed in accordance with the invention, in which the body portion of the fabric is constructed entirely or in part of elastic yarns, the knitting operation is so carried out that, upon release of longitudinal tension from the knitted fabric, there will be a substantially uniform lengthwise contraction of the fabric across its entire width. Accordingly, in the manufacture of one- or two-piece panty-type garments from such fabric, the knitted fabric may be severed into generally rectangular fabric sections and sewed in the manner described in the before-mentioned Sarmiento applications. In the case of combination fabric in which the two-way effective elasticity of the body section is derived from its knitted construction rather than from elastic yarns, there is inherently some gathering and bulging of the fabric body section when longitudinal tension is released from the fabric after knitting. Thus, in accordance with the invention, such fabrics are, subsequent to knitting and prior to cutting and sewing, laterally distended to an extent sufficient to reduce the length of the body portion to correspond to that of the contracted elastic webbing sections. The fabric is, while in its thus distended condition, starched or otherwise impregnated with a temporary stabilizing agent. This enables the fabric to be severed from the web in rectangular sections, for the manufacture of garments, and also enables the fabric to hold its laterally distended configuration while the garment manufacturing operations are carried out. The temporary stabilization is removed in any suitable manner prior to the sale of the garment. Typically, the routine mechanical handling of the garment during the various stages of processing, packaging, etc., is sufficient for this purpose.

For a better understanding of the invention, reference should be made to the following detailed description and to the accompanying drawing.

DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of a section of combination fabric constructed in accordance with the invention and incorporating elastic yarns in the body section of the fabric.

FIG. 2 is a plan view of a section of combination fabric constructed in accordance with the invention, in which the body section of the fabric is constructed with non-elastic yarns.

FIGS. 3 and 4 are enlarged photographic representations of upper and lower margins of the fabric of FIG. 1.

FIGS. 5 and 6 are enlarged photographic representations of upper and lower margins of the fabric of FIG. 2.

FIG. 7 is a highly simplified diagrammatic illustration of a fabric constructed in accordance with the principles of the invention.

FIG. 8 is a plan view of the fabric of FIG. 2 illustrated as laterally distended to impart a rectangular geometry to the severed and longitudinally relaxed fabric section.
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FIG. 9 is a perspective view illustrating a panty-type garment constructed utilizing the fabric of FIG. 1 or FIG. 2.

Referring now to the drawing, and initially to FIG. 1 thereof, the reference numeral 10 designates generally a cut-off section of combination fabric according to the invention. The fabric section 10 includes a body portion 11 forming the center of the web, and narrow selvedge portions 12, 13. The fabric section 10 is, according to the invention, constructed by warp knitting, as distinguished from circular knitting, weaving, etc., and is most desirably constructed on Raschel machines. The warp-knitted structure is left-right in FIG. 1, and the course direction is vertical. It will be understood, of course, that the fabric is knitted in substantially continuous lengths in the warp-wise direction, being gathered in suitably sized rolls as it comes off the machines.

In accordance with one aspect of the invention, the fabric of FIG. 1 is constructed so that the selvedge portions 12, 13 are provided with one-way effective elasticity, that being in the warp-wise direction. In the course-wise direction, the selvedge portions are constructed to be substantially non-extensible and also to have a substantial degree of wall stability or wall rigidity. Typically, warp-wise elasticity is imparted to the selvedge portions 12, 13 by means of rubber or other suitable elastic yarns incorporated into the knit structure and extending generally warp-wise in the fabric. The thus-constructed selvedge portions comprise, in effect, narrow bands of elastic webbing. Typically, although not necessarily, one of the selvedge portions 12 is of somewhat greater width than the other section 13. The wider section suitably constitutes an elastic waist band, and the narrower section suitably forms elastic leg bands, in a one-piece panty-type garment manufactured with the fabric.

In the fabric of the invention, the center or body portion 11 is constructed to have two-way effective elasticity. That is, the body portion is provided with elastic characteristics in both the warp-wise and the course-wise directions. Such two-way elasticity may be imparted by reason of the knitted structure or by reason of incorporated elastic yarns, or by a combination of both. In the fabric of FIG. 1, the body section incorporates elastic yarns and derives at least some of its elastic characteristics therefrom. In the fabric 10c of FIG. 2, the body section 11a contains no elastic yarns, and thus derives its effective elasticity from the nature of its knitted structure. The selvedge portions 12a and 13c of the FIG. 2 fabric correspond in their construction principles to the selvedges 12, 13 of the FIG. 1 fabric.

With reference to FIG. 7, there is shown an extremely simply diagrammatic representation of the fabric representative of those of FIGS. 1 and 2. The portions encompassed by the brackets E1 and E2 are representative of elastic selvedge portions, it being understood, of course, that a commercially acceptable fabric would have a much larger number of warps than are shown in the diagrammatic illustration and also that the knitted structure of a typical commercial fabric may be of much greater complexity than is indicated by the diagram while incorporating the relevant inventive principles.

In the upper elastic webbing section E1, for example, there are shown three sets of supporting warp yarns 14, the knitted structure of which is designated for Raschel machine manufacture as 2/0-2/0-2/0-2 (repeating). There is also shown a structure of lateral running yarns 15, the knitted structure of which is indicated by the Raschel machine designation 0/6-6/0-6/6-6 (repeating). Incorporated in the structure of supporting warp yarns 14 and lateral running yarns 15 are elastic warp yarns 16, and the Raschel knitter's designation for these is 0 (repeating). The lower elastic webbing E2 may be of construction similar to the section E1, but it is typically nontensioned. In the illustration, the webbing E2 has supporting warp yarns 17, lateral running yarns 18, and incorporates elastic yarns 19. In the case of both of the elastic webbing sections E1 and E2, the lateral running yarns 15, 18 are shown to extend across the full width of the webbing or selvedge section, but that not be the case and typically may not be the case where the selvedge portions are comprised of a substantially larger number of warp rows than is indicated in FIG. 7. The structure of lateral running yarns may typically comprise an overlapping series of lateral loops, each extending over, for example, two or three warp rows.

In the diagrammatic representation of FIG. 7, the body section B of the fabric is indicated to be a simple tricot construction in which principal warp yarns 20 may have a Raschel knitter's designation of 2-0-2/4-2/0-2-4 (repeating). The body yarns may be constructed of suitable elastic yarns, such as Spandex yarns, or may incorporate additional yarns (not specifically indicated in FIG. 7) to impart elasticity. This is especially desirable where it is intended to utilize the fabric in the construction of panty girdles, for example. Where the fabric is intended for use in the manufacture of panties, it is more desirable, usually, to construct the fabric body from non-elastic yarns and to rely on the structure of the knitting to impart the necessary degree of two-way elasticity to the fabric. A tricot construction, using conventional acetate or nylon yarns is highly suitable for the latter type of fabric, as are certain types of lace constructions. For panty girdle fabrics, tricot or lace structures are also suitable, but in that case elastic yarns will be incorporated. Conventional "powerknit" constructions are also suitable for panty girdle fabrics. In all cases, however, the body section of the fabric will be provided with two-way effective elasticity, while the elastic selvedges are provided with only warp-wise effective elasticity.

In accordance with one feature of the invention, the elastic portions of the fabric are constructed of yarns of significantly greater weight than the yarns of the body portion. This relationship must prevail whether or not the body portion of the fabric incorporates elastic yarns. In the new fabric, the yarns of which the elastic selvedges are principally constructed are at least about 50 percent heavier than the yarns of which the body portion is principally constructed. Thus, in a typical fabric according to the invention and as reflected in FIG. 7, the supporting warp yarns 14, 17 of the elastic selvedges E1, E2 may be of about 100 denier nylon, while the lateral running yarns 15, 18 may be of about 200 denier nylon. The elastic yarns 16, 19 may be of about 50 gage rubber. For the body section, the yarns (20) advantageously are of about 50 denier, if of acetate, and of about 50–70 denier, if of nylon. The relationship between the warp and lateral yarns of the elastic webbing is also of significance, in that the substantially heavier lateral yarns 15, 18 impart a highly desired degree of wall stability to the selvedge, so it does not tend to roll or curl when extended lengthwise in use.

In the fabric of the invention, the elastic selvedges are constructed to provide for a significant degree of warp-wise extension. Thus, for the selvedge intended to function as a waist band in a finished garment an extensibility of at least about 120 percent, and more desirably around 160 percent, is provided for. For the selvedge intended to function as a leg band, a minimum extensibility of at least 100 percent, and more desirably around 120 percent, is provided. In a fabric according to the invention, the leg and waist bands can and typically will have different degrees of extensibility while being of equal length in the relaxed state. This high extensibility is especially desirable in the construction of one- or two-piece panty-type garments according to the co-pending Samiento applications. Such garments are particularly well adapted for low cast, high volume production, and the provision of high extensibility in the fabric selvedges enables further economies to be realized in that fewer garment sizes are required to cover a full range of body sizes.

As a further specific feature of the invention, fabrics incorporating elastic yarns in the body portion (i.e., panty girdle fabrics) are so constructed in the knitting operation that, when knitting tensions are released and the fabric is permitted to contract lengthwise, all portions of the fabric will contract uniformly, across the full width of the web. (The knitting operation usually proceeds with the elastic yarns 16, 19–FIG. 7–tensioned to a condition of near-maximum desired extension.) Thus, the relaxed and fully contracted panty girdle
fabric will lay flat and have a generally straight-across course structure. This enables fabric web sections, as shown in FIG. 1, to be readily cut off of a large fabric roll in a generally rectangular configuration, and subsequently to be easily formed into a panty girdle in accordance with the teachings of the co-pending Sarmiento applications.

In the case of panty fabrics, constructed without the use of elastic fabrics in the body section, relative contraction of the elastic selvedges, upon release of the tensions of knitting, cannot be accompanied by a corresponding contraction of the body portion of the fabric, which has a significantly lesser effective elasticity. This will cause the fabric to gather along the edges and pucker, in the manner reflected in FIG. 2. As will be understood, such gathering and pucker would render somewhat difficult the task of cutting uniform garment sections from a fabric roll, and also somewhat complicate the sewing operations, as compared to corresponding operations carried out with the fabric of FIG. 1. Accordingly, as a further specific feature of the invention, a fabric in which no elastic yarns are incorporated in the body section, as reflected in FIG. 2, is re-shaped and given temporary stabilizing treatment prior to cutting and sewing, so that, at the time such operations are carried out, the fabric lays flat and has a generally straight-across course structure.

In accordance with the foregoing aspect of the invention, the panty fabric is, prior to cutting and sewing, laterally distorted as reflected in FIG. 8, so that the selvedges 12a and 13a are separated from the positions indicated in broken lines to the positions indicated in solid lines. The body section 11a, having an interdependency of length and width dimensions because of the two-way effective elasticity constructed into it, will decrease in length as it is distended in width until, at some point, the forcibly contracted body length will equal the naturally contracted selvedge length. At this stage the fabric will be in its desired working geometry, and the fabric is temporarily stabilized in such geometrical condition by the application or impregnation of starch or suitable resins. The temporary stabilization is sufficient to enable the fabric to be cut into generally rectangular working sections and to enable the sewing of such sections into garments. Ideally, however, the stabilization is rendered ineffective in due course simply by reason of the further routine handling to which the completed garment will be subjected before final marketing.

The fabric structures of the invention can be converted into garments of the type disclosed and claimed in the co-pending Sarmiento application in a fully economic manner. Desirably working with a generally rectangular flat fabric section, the upper length dimension of which corresponds to a desired waist size, and the height dimension of which corresponds to a desired garment height, the fabric section is first sewed into a tube, along a generally vertical seam 21, as shown in FIG. 9. In a one-piece garment, a crotch is formed by making an inverted U-shaped seam 22 along the lower edge of the tube, connecting the front and back panels thereof. The crotch seam 22 serves to divide the lower selvedge 13 into two separate elastic leg bands, while the upper selvedge functions as an elastic waist band. In a two-piece garment, a special crotch piece of combination fabric is inserted, as described in the Sarmiento application, Sec. No. 36,532 (P-1414, P1424). In each case, the entire operation may be quickly and economically accomplished, as will be readily understood.

The fabric of the invention may be constructed in a wide variety of specific forms, so long as the relevant relationships, heretofore mentioned, are observed. Typical examples of commercially produced fabric according to the invention are reflected in the photographic enlargements of FIGS. 3-6 of the drawing. Many other variations within the teachings of the invention, will suggest themselves to the competent designer. By way of example, it may be advantageous to incorporate a narrow net-like section between the principal body section and the elastic selvedge intended to form leg band elastics in the finished garment. Such a section would accommodate an increased degree of relative movement between the body fabric and the leg bands. The principles of the invention enable the high volume production of a warp knitted fabric which integrally incorporates all of the components of a panty-type garment, including an elastic waist band and elastic leg bands, and also including a body fabric which may or may not incorporate an elastic component as desired. The various essential components are so related to each other in the integrated structure as to enable the desired function to be derived without compromise from each of the components. More importantly, perhaps, the structural relationship of the components is such as to enable a flat fabric, having a generally straight-across course structure, to be achieved, either directly in the knitting, as in the case of the panty girdle fabrics, or upon subsequent reshaping and temporary stabilization, as in the case of the panty fabrics.

The integrated combination of the present invention is utilized synergistically and with extraordinary advantage in the construction of garments described and claimed in the co-pending Sarmiento applications Ser. No. 10,770, and Ser. No. 36,532 (P-1414, P1424). One important advantage of the new fabric resides in the fact that, by knitting the elastic waist and leg bands in an integral relationship, the subsequent processing and handling of the integrated components is identical. This becomes especially significant in the dyeing, because all parts of a garment, constructed of the new fabric, are identically dyed. Under conventional practices all of the several individual components of a garment typically are separately handled and dyed, and accurate color matching is virtually impossible in a realistic production operation.

It should be understood, of course, that the specific forms of the invention herein illustrated and described are intended to be illustrative only, as certain changes may be made therein without departing from the clear teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. A warp knit combination garment fabric, comprising a. a unidirectionally elastic selvedge portion extending along each edge of the fabric web, b. said unidirectionally elastic selvedge comprising a plurality of knitted warp columns interconnected by lateral running yarns, c. said knitted warp columns incorporating elastic yarns, laid-in in a single needle space, to impart warp-wise elasticity to the selvedge, d. said lateral running yarns being laid-in across a plurality of needle spaces and being comprised of heavy, effective- ly non-elastic yarns whereby to impart non-extensibility to the selvedge portions in the widthwise direction and to impart substantial wall stability to the selvedge portions as compared to the body portions of the fabric, and e. a fabric body portion integrally interconnected to said selvedge portions, f. said body portion being constructed to have effective elasticity in the warp-wise and course-wise directions, g. the principal structural yarns of said elastic selvedge portions being non-elastic and being of substantially heavier denier than the principal structural yarns of said body portion, h. one of said elastic selvedges constituting a garment waistband portion, i. the elastic yarns of said one selvedge being constructed into the fabric while extended to about 220 percent to about 280 percent of their relaxed length, j. the other of said elastic selvedges constituting a garment leg band portion, k. the elastic yarns of said other selvedge being constructed into the fabric while extended to about 200 percent to about 280 percent of their relaxed length, l. a one-piece panty band elastic like constructed with the fabric of claim 1, characterized by a. the garment being constructed of a single section of such fabric, cut and sewn together in a course-wise direction.
whereby the separate selvedges respectively form waistband and leg band elasticities, and
b. said leg band elasticities being sewn together in a crotch area of the garment to form separate leg-encircling elasticities.

3. The warp knit fabric of claim 1, further characterized by
a. the supporting structure of the fabric body portion being of a wholly independent stitch construction from the supporting structure of the elastic selvedges.

4. The warp knit fabric of claim 1, further characterized by
a. the warp-wise extending structural yarns of the elastic selvedge portions being at least 50 percent heavier than the structural yarns of which the body portion is principally constituted.

5. The warp knit combination fabric of claim 1, further characterized by
a. said elastic yarns comprise rubber-like elastic elements of about 50 gage.

6. The warp knit combination fabric of claim 1, further characterized by
a. the lateral running yarns of said selvedge portions being of substantially heavier denier than the yarns of the warp columns of said selvedge, and
b. the principal structural yarns of said body portion being of substantially lighter denier than the yarns of said warp columns.

7. The warp knit combination fabric of claim 1, adapted especially for the manufacture of one-piece panties or the like and in which the body portion of the fabric is substantially free of elastic yarns, further characterized by
a. said fabric being constructed with the elastic yarns of the selvedge portions in a sufficiently extended condition that the warp-wise relaxation of said selvedge portions, upon warp-wise relaxation of the fabric after construction, is substantially greater than the warp-wise relaxation of said body portion,
b. said fabric being laterally distended subsequent to its construction to a degree sufficient to reduce the length of said body portion substantially to the relaxed length of said selvedge portions, and
c. at least the body portion of said fabric being at least temporarly stabilized in its laterally distended condition to enable cutting of the fabric across its width and sewing of the fabric into a one-piece garment while said fabric body portion remains in its laterally distended condition.

8. The warp knit combination fabric of claim 1, further characterized by
a. an integrally knitted section of fishnet-like structure extending in a warp-wise direction and interconnecting one of said selvedges to the body portion of said fabric to accommodate a limited degree relative movement between said selvedge and said body portions.