Dec. 21, 1937. P. ADAMSON 2,103,133

ELASTIC FABRIC AND GARMENT

Filed June 10, 1933 2 Sheets-Sheet 1

Fig. 1.

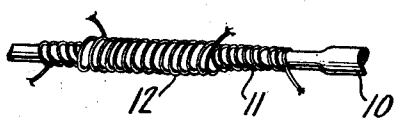


Fig. 2.

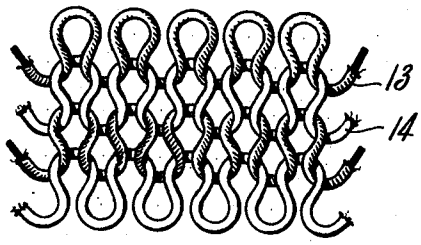


Fig. 4.

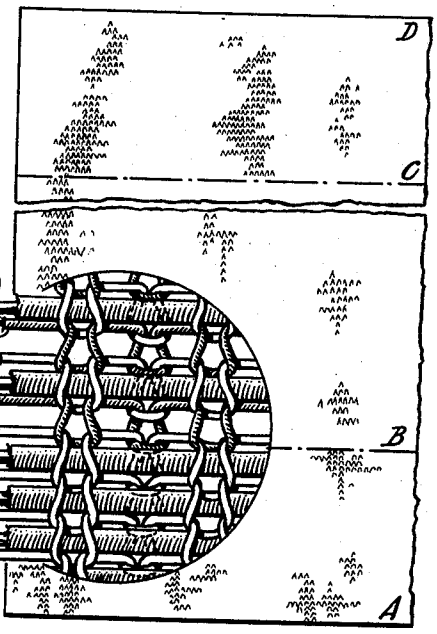
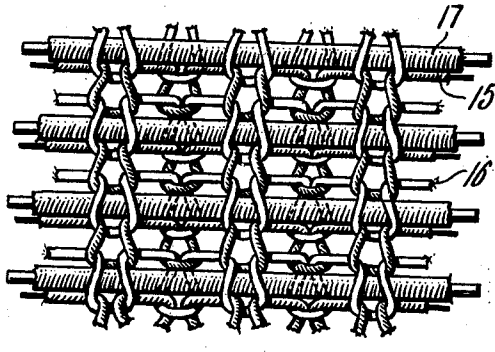


Fig. 3.



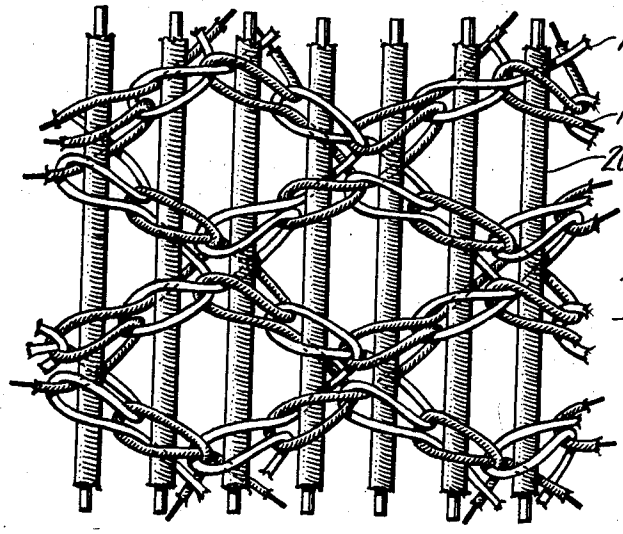


Fig. 5.

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Dec. 21, 1937. P. ADAMSON 2,103,133

ELASTIC FABRIC AND GARMENT

Filed June 10, 1933 2 Sheets-Sheet 2

Fig. 6.

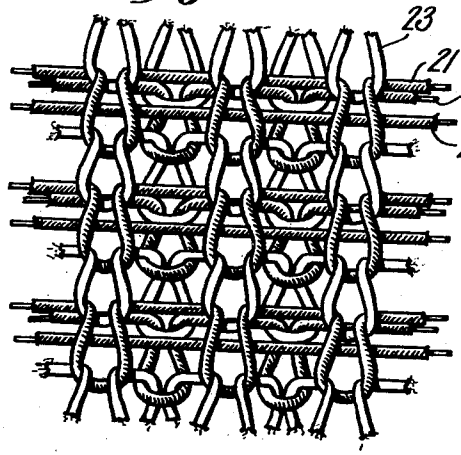
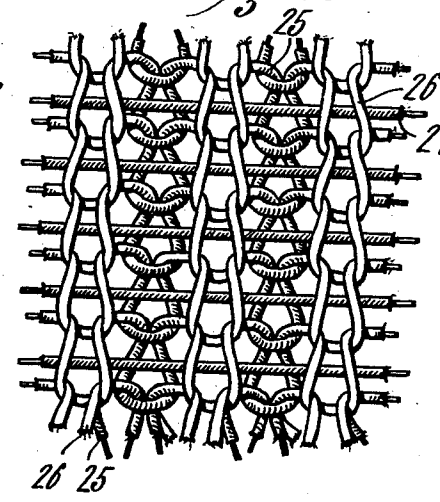


Fig. 7.



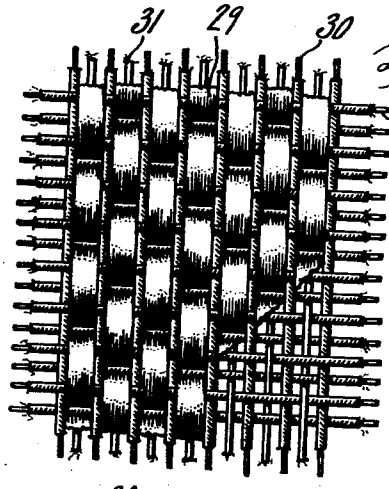
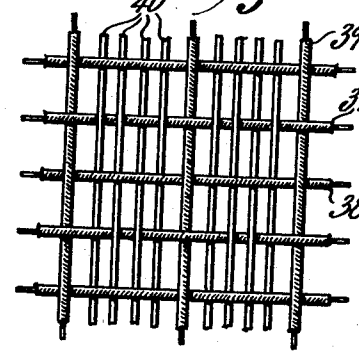


Fig. 8.

Fig. 10



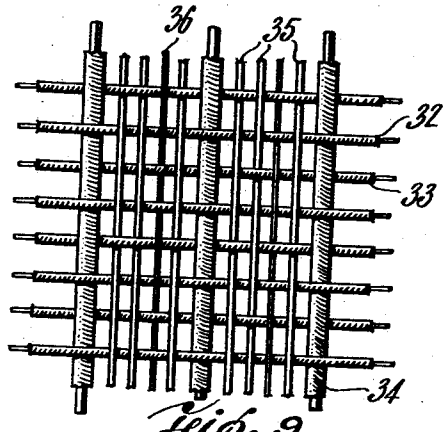


Fig. 9.

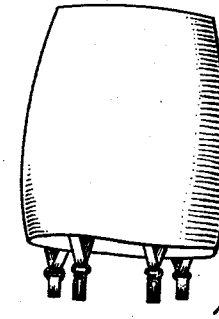


Fig. 11.

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Patented Dec. 21, 1937

2,103,133

UNITED STATES PATENT OFFICE

2,103,133

ELASTIC FABRIC AND GARMENT

Percy Adamson, Rye, N. Y., assignor to United States Rubber Company, New York, N. Y., a corporation of New Jersey

Application June 10, 1933, Serial No. 675,190

9 Claims. (Cl. 66—190)

This invention relates to improvements in elastic fabrics and garments, and more particularly to knitted and woven fabrics and garments of a new type having a predetermined or controlled stretch in two directions.

This application is a continuation-in-part of my application Serial No. 604,379, filed April 11, 1932.

In my prior Patent No. 1,822,847, granted Sept. 8, 1931, there is disclosed a new type of elastic thread or yarn having a fine rubber core covered with textile fibres preferably helically wound with two windings in opposite directions over the elastic core. This elastic yarn is capable of being knitted on fine gauge knitting machines, and may be readily woven into fabric materials utilizing the elastic thread in the warp and weft, or filling, of such woven material. The core of the elastic yarn described in my prior patent is preferably made directly from an aqueous dispersion of rubber such as latex, as described in the patent to Hopkinson and Gibbons No. 1,545,257, granted July 7, 1925, in order to produce an elastic yarn or thread of a gauge fine enough for use in such knitting and weaving operations, but it is not essential to so produce the rubber core where the article or fabric is of a quality permitting less uniform rubber cores to be used and for such articles or fabrics other methods of producing the rubber cores may be utilized.

The rubber core, preferably made directly from latex as above described, is preferably round and is covered with a relatively inelastic fibrous covering of textile material of the type desired. The relatively inelastic fibrous covering may be applied in any suitable and convenient manner, as those skilled in the art will understand. Yarns of cotton, linen, flax, silk, rayon, wool or the like, or mixtures of these, may be employed, and while they may be braided about the rubber core, it is preferred to use right and left helical windings of the same or different pitch, the relative pitch of the windings being selected with due consideration to the size and nature of the materials being wound in order to obtain an approximately balanced elastic yarn, relatively free from a tendency to kink. The helical windings may be of like or different materials and may either consist of one or more ends of yarn or plied yarn depending upon the characteristics it is desired to build into the elastic yarn to meet the requirements of the service to which it is to be subjected in the fabric manufactured therefrom. In general the rubber core while being wound and covered should be elongated uniformly. The final size of the covered elastic yarn will depend on the rubber core and the type of covering threads and the amount of stretch given the core while covering.

Covered elastic yarns preferably with a round core of rubber deposited directly from an aqueous dispersion of rubber may be made in finished sizes small enough to knit on fine gauge knitting machines and, if desired, of a size approximately the same as a yarn made wholly of textile material, with which it may be knitted, if desired, in alternate courses or plated with the same. In fabrication it is knitted under no tension as distinguished from the knitting of non-elastic yarns. Coarse and fine elastic yarns may be used as laid-in yarns in knitted materials and may be used in conjunction with knitted fine elastic yarns as above described.

Rubber threads preferably with a round rubber core deposited directly from an aqueous dispersion of rubber and covered with textile material may be used in woven materials, preferably in conjunction with relatively inelastic threads of textile material, in the warp and weft, or filler, to produce a new type of commercial woven material having a stretch both in the direction of the warp and weft. Many different types of new fabrics may be evolved by utilizing the elastic threads in the warp or weft or both, alone, or together with relatively inelastic threads.

As stated in my prior patent above referred to, the old elastic yarns, as heretofore utilized in making fabrics and articles, generally, if not invariably, imparted a capacity to stretch in one direction only. In other words, they were practically only used for making articles which resisted a one-direction pull or which exerted a constrictive force in one direction. Knitted and woven fabrics, as described herein, may now be made with a capacity to stretch in two directions, lengthwise and widthwise of the fabric. In other words, fabrics and articles may now be made which will resist a two-directional pull, or exert the desired contractive forces in two directions.

Several embodiments of the present invention especially adapted for the manufacture of corsets, girdles, or like supporting garments are illustrated in the accompanying drawings and it is without intention to limit the invention to the particular fabrics shown, that the same are included since many fabrics differing from the ones illustrated may be made without departing from the spirit of the invention.

In the drawings:

Figure 1 illustrates a covered elastic yarn preferably used in the manufacture of the fabrics of the present invention;

Figs. 2 to 10 illustrate a wide variety of textile fabrics made according to the present invention; and

Fig. 11 illustrates a girdle made in whole or in part of one or more of the fabrics of the present invention.

Referring more particularly to Fig. 1, there is shown an elastic yarn capable of being knitted on a fine gauge knitting machine or used in the warp and weft of woven materials, with a round rubber core 10 deposited directly from latex by extruding the latex through a nozzle into a bath of coagulant, removing the thus formed filamentary coagulum from the coagulating bath, drying and vulcanizing. The rubber core is covered while under tension with right and left windings 11 and 12 of textile yarn of the type desired. This preferred type of elastic thread or yarn, with a round rubber core deposited directly from an aqueous dispersion of rubber, is the type of elastic thread or yarn preferred for both fine and coarse elastic yarns in the various fabrics, although as above described other kinds of core may be utilized in producing the elastic yarn.

Fig. 2 illustrates a fabric composed of elastic yarn and inelastic or ordinary yarn. The fabrics in this figure and the other figures illustrating knitted fabrics are shown in greatly stretched condition for facilitating the illustration of the constructions thereof. In Figure 2, the elastic yarn 13 and inelastic yarn 14 are knitted in alternate courses providing an elastic material with a desired amount of stretch and recovery from stretching or resistance to stretch, sometimes called contractive force, in the direction of the courses and wales. The degree of stretch and recovery from stretch may be varied as desired by utilizing various types of yarns, sizes of yarns, varying the courses of elastic and non-elastic yarns, for example, having alternate bands of two of each kind of courses or one course of inelastic and two courses of elastic yarns, or the like. Such a knitted fabric may be said to have a predetermined or controlled stretch in two directions, in this case both in the direction of the courses and in the direction of the wales of the material. A foundation garment made with the material of Fig. 2 with the knitted courses running vertically of the garment will have a firm or strong stretch around and an easy or weak stretch up and down, the contractive force being materially greater in the direction of the wales than in the direction of the courses under like conditions. This type of fabric similarly to the various other fabrics is especially adapted for the manufacture of corsets, girdles or like supporting garments where the stretch in two directions produces a garment that will not ride up and down during natural movements of the body.

Figure 3 illustrates another knitted fabric for foundation garments having coarse elastic yarns laid in the knitted fabric. The fabric as illustrated shows alternate courses 15 and 16 of elastic and inelastic yarns respectively and coarse elastic yarn 17 laid in the courses of inelastic yarn. This produces an entirely new type of material with laid-in elastic yarns which has a capacity for stretching a desired amount, depending on the types of yarns used, in two directions, that is along the laid-in yarns or courses and also along the wales or in a direction at right angles to the laid-in coarse elastic yarns. This is due, as may readily be seen, to the laid-in coarse elastic yarns and to the courses of knitted elastic yarn between the laid-in coarse elastic yarns. Such a fabric may be knitted on a Dubied or other flat knitting machine in a manner well understood by those skilled in the art. Such a fabric when made into corset, girdle or like supporting garment is preferably utilized with the coarse laid-in yarns 17 running horizontally of the garment to give the garment a greater resistance to stretching around the body and a lesser resistance to stretching up and down, the laid-in elastic yarns producing a strong contractive effort and the knitted elastic yarns producing a materially lesser contractive effort as the garment is worn. The direction in which stretch is more greatly resisted results in the garment having a greater contractive force in that direction.

Fabrics having a predetermined or controlled stretch in two directions may be formed with selected portions, such as borders and the like having a stretch in only one direction. For example, the new type two-way stretch fabric with laid-in coarse elastic yarns and fine knitted elastic and inelastic yarns as shown in Fig. 3 may be integrally knitted with borders or other sections made of one-way stretch fabric with only laid-in coarse elastic yarns and fine knitted inelastic yarns, in other words with the knitted elastic yarn of the fabric shown in Fig. 3 omitted. Such a composite fabric is shown in Figure 4 where the borders A to B and C to D are made with laid-in coarse elastic yarns and fine knitted inelastic yarn and have a capacity to stretch in only one direction lengthwise of the fabric, while the middle section B to C is made with laid-in coarse elastic yarns and fine knitted elastic and inelastic yarns as shown in Figure 3 and has a capacity to stretch in the two directions lengthwise and crosswise of the fabric. The construction may readily be seen in the enlarged portion of the Figure 4. The middle section B to C is the same as the fabric of Figure 3, with alternate csourses of elastic yarn 15 and inelastic yarn 16, with coarser elastic yarn 17 laid in the courses of inelastic yarn. The border sections A to B and C to D are composed of knitted courses of the inelastic yarn 16 and coarse elastic yarns 17 laid in the courses of inelastic yarn, and without the knitted elastic yarn as in the sections B to C. This produces a fabric or web, especially adapted for corsets, girdles or like supporting garments capable of stretching lengthwise of the fabric, and with only a selected portion of its width capable of stretching transversely of the fabric. The intermediate two-way stretch portion of the fabric is capable of simultaneous stretching both lengthwise and crosswise of the fabric while the border portions are capable only of stretch in a lengthwise direction. As with the fabric of Figure 3, the fabric of Figure 4 is preferably made into the supporting garment with the laid-in yarns running around the garment. The one-way stretch portion may, of course, constitute one or more marginal, border, or inlaid portions, of the desired width.

Fig. 5 illustrates another type of foundation garment fabric having a predetermined or controlled stretch in two directions and composed of knitted elastic and inastic yarns together with laid-in coarse elastic yarns. This material, as will readily be understood, may be knitted on a Raschel warp knitting machine. The construction of the fabric may be termed a one-in

and one-out knit, with a heavy elastic yarn laid in. In practice, one beam will be of fine elastic yarn 18 and one beam of inelastic yarn 19 and a heavy elastic yarn 20 laid-in, covering the entire width of the piece. The fabric will have a quicker recovery from stretching and hence a so-called stronger stretch or greater resistance to stretching in the direction of the coarse laid-in yarns, that is widthwise of the fabric, and a slower recovery from stretching and hence a so-called weaker stretch or lesser resistance to stretching lengthwise of the fabric. In general, this type of fabric is of a looser construction than the fabric shown in Fig. 3 and is well adapted to the manufacture of light weight foundation garments.

Figure 6 illustrates another fabric for a supporting garment having the desired resistance to stretching in the two directions lengthwise and widthwise of the fabric. This fabric comprises knitted inelastic yarn and knitted elastic yarn commensurate in size with the inelastic yarn, and laid-in elastic yarns preferably of the same size as the knitted elastic yarn. The fabric, which, as is readily discernible, may be made on a flat bed knitting machine with the proper laying-in attachments, is preferably utilized in a supporting garment with the straight laid-in elastic yarns horizontal of the garment or running around the same, since the contractive effort of the straight laid-in yarns as the garment is worn is stronger than that of the knitted elastic yarns due to their freedom from a looped or knitted structure, thus providing a greater resistance to pull or stretching around the body than up and down. The fabric shows knitted fine elastic yarns 21 and 22 and knitted fine inelastic yarn 23 with fine elastic yarns 24 similar to the knitted elastic yarns 21 and 22 laid-in the loops of the knitted elastic yarns 21 and 22 as shown. Such a fabric is capable of simultaneous stretching in the direction of the laid-in elastic yarns 24 and at right angles thereto, and it is obvious that under the same conditions a greater resistance to stretching or pull-back will be exerted in the direction of the parallel laid-in yarns by virtue of their freedom from loops than in the direction at right angles thereto.

Figure 7 illustrates a fabric for use in supporting garments made on a ribber with a plating and laying-in attachment as will be obvious to those skilled in the art. Fine elastic yarn 25 and fine inelastic yarn 26 are knitted together on a ribber and plated so that the inelastic yarn appears on both faces of the fabric on the outside of the ribs. Fine elastic yarns 23, substantially identical with knitted elastic yarns 21 (but obviously not necessarily so), are laid in each of the knitted courses of the plated elastic and inelastic yarns. As in the case of the fabric illustrated in Figure 6, this fabric is capable of simultaneous stretching in two directions, along the courses of the knitted yarns, that is, along the laid-in yarns, and at right angles thereto or along the wales or ribs of the knitted yarns. Also under the same conditions of stretching or elongation, or as in wear, there will be a greater resistance to the stretching or a greater contractive force in the direction of the laid-in yarns by virtue of their freedom from loops due to knitting than in the direction of the wales. As is usual with elastic fabrics having knitted elastic yarns and laid-in elastic yarns as shown in Figures 3 to 6, the resistance to stretching of the parallel laid-in elastic yarns is greater under the same conditions than the resistance to stretching of the knitted elastic yarns which are situated between the parallel laid-in yarns and in angular relation to the same.

Fig. 8 illustrates a woven foundation garment material and is a double faced woven material with a weft entirely of fine elastic threads 28 covered with cotton and a warp composed of silk threads 29, fine elastic threads 30 with cotton covering, and cotton threads 31. The silk threads 29 form one face of the material, as clearly shown in the figure, and the back of the material is of the cotton covered elastic threads, the cotton inelastic thread being practically hidden in the finished material in a manner well known in the art. This material, due to the incorporation of elastic threads in the weft as well as warp, may also be described as a predetermined or controlled two-way stretch fabric. As stated above, many other types of new fabrics may be evolved by utilizing the elastic threads in the warp or weft, or both, alone, or together with relatively inelastic threads. Various known weaves may be used, and if desired, silk or other inelastic material may be used for both the front and back faces, or, if desired, woven materials with elastic yarn in both the front and back faces or entirely composed of elastic yarn may be made.

In corsets, girdles and like foundation garments made with controlled two-way stretch elastic woven fabrics, it is obviously desirable, as in the case of garments made with two-way stretch knitted fabrics, that there be a greater resistance to stretching circumferentially of the body of the wearer than in the direction up and down the body as the garment is worn. It is desired to confine or hold the body in radially and thus enhance the figure, and yet allow freedom for bending movements and the like without the garment riding up and necessitating its being pulled down to its proper position on return of the body to normal posture. It is thus preferred to have greater resistance to stretching or stronger contractive force in one direction of the woven fabric than in the other direction. The warp and weft may be so controlled that the greater resistance to stretching may be either lengthwise or widthwise of the fabric, and the fabric should preferably be incorporated in the foundation garment so that the direction of greater resistance is around the garment. This greater resistance to stretching or stronger contractive force in one direction, and lesser resistance to stretching or weaker contractive force in the other direction of the fabric, is sometimes termed "firm" or "quick" or "strong" stretch in the one direction and "easy" or "sleazy" or "weak" stretch in the other direction. The greater resistance to stretching in one direction than in the other provides a quicker recovery from stretching or greater "snap" or "kick" or "pull-back" in that direction than in the other. The resistance of the fabric to stretching may be varied in numerous ways. For example, a larger number of elastic threads of the same size and under the same tension will obviously produce a greater resistance to stretching than a smaller number. The weaving of the elastic threads under a high tension or near their safe limit of stretch will generally give a greater resistance to stretching than weaving the same under a lower tension or only at a fraction of their safe limit of stretch. The covering of the rubber core while it is held under a high degree of tension will produce an

elastic thread with the covering holding the core elongated and hence produce a thread having itself a greater resistance to stretching than a rubber thread covered while the core is under relatively little tension, and when such threads are incorporated in a fabric they will exert a greater contractive effort than threads covered while under little tension. Likewise elastic threads having a larger size of rubber core will effect a greater contractive effort than elastic threads of smaller size and provide a greater resistance to stretch in the fabric, other conditions being equal. The amount of stretch or elongation is generally different in the lengthwise and widthwise directions, and may be varied by the amount of tension put on the elastic thread in the weaving operation, especially if used in conjunction with parallel inelastic threads. The elastic threads are generally incorporated in the warp at or near maximum safe tension, while in the weft they are generally incorporated at less than the maximum safe tension in order to reduce the shrinkage widthwise of the fabric by virtue of the elastic weft threads. When inelastic threads are woven parallel to the elastic threads, such inelastic threads limit the stretch of the elastic threads. If the elastic threads are woven at or near their maximum safe tension and inelastic threads are incorporated in the same direction in the fabric, the inelastic threads will allow substantially full stretching of the elastic thread and will only limit the stretch of the elastic thread at or near its maximum extensibility. If the elastic threads are woven at less than the maximum safe tension and inelastic threads are incorporated in the same direction in the fabric, such inelastic threads will obviously limit the stretch of the elastic threads to less than their maximum extensibility. The amount of stretch may also be varied by varying the size and numbers of the elastic threads. The amount of stretch and the resistance to stretching of the fabric or garment may also be varied by the sizes and amount of inelastic threads used with the elastic threads, and by the construction of the weave and by many other factors. Other means of accomplishing these results will obviously suggest themselves to persons skilled in the art.

Figures 9 and 10 show conventional weaving diagrams of woven fabrics having a controlled stretch in two directions and are naturally only intended to further illustrate the present invention.

Fig. 9 is a diagram of a woven fabric having a weft composed of fine elastic threads **32**, **33**, and a warp composed of heavy elastic threads **34**, the elastic warp threads being associated with three cotton threads **35** and one rayon thread **36** for each elastic warp thread. As clearly shown in the diagram, the elastic wefts **32** and **33** are not interwoven with the elastic warps **34** and are face and back wefts, the inelastic warps **35** and **36** being interwoven with the elastic wefts as indicated.

Fig. 10 is a diagram of a woven fabric having a weft composed of fine elastic threads **37**, **38**, preferably incorporated at less than their maximum tension to prevent too great a decrease in width when taken off the loom and finished, and a warp composed of fine elastic threads **39**, said elastic warp threads being incorporated under substantially maximum tension and associated with four inelastic threads **40** for each elastic warp thread. The elastic wefts **37** and **38** are not interwoven with the elastic warps **39** and are face and back wefts, the inelastic warps **40** being interwoven with the elastic wefts as indicated.

Figure 11 illustrates a typical girdle made in whole or in part of any one or more of the various fabrics of the present invention.

It is understood that the invention is not limited to the specific textile fabrics and articles shown in the illustrations and described in the specification, as it will be evident to those skilled in the art that the invention permits of various modifications and applications without departing from the spirit thereof, and it is my intention not to be limited in the scope of the invention except as required by the state of the art and as set forth in the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A warp knit fabric comprising elastic and inelastic yarns incorporated therein in a one-in and one-out knit, said fabric also comprising elastic yarn laid-in the width of the fabric.

2. A warp knit fabric comprising elastic and inelastic yarns incorporated therein in a one-in and one-out knit, said fabric also comprising elastic yarn of a larger size than said knitted elastic yarn laid-in the width of the fabric.

3. A garment of the corset type comprising a body-encircling member having a section formed of material closely knit from elastic and inelastic threads, said threads being so arranged in said garment as to permit substantial stretching by said section in all directions but providing a firm molding action transversely of the body and an easier stretch longitudinally of the garment to avoid slippage of said section relative to the body in bending.

4. A garment of the corset type comprising a body-encircling member having a section formed of material closely knit from elastic and inelastic threads, said threads being so arranged in said garment as to permit substantial stretching by said section in all directions but providing a firm molding action to the abdomen, hips and buttocks transversely of the body and an easier stretch longitudinally of the garment to avoid slippage of said section relative to the body in bending.

5. A garment of the class described for molding and confining the lower portion of the body, comprising a wide body-encircling member having a section formed of knitted elastic and inelastic threads and which section is capable of substantial and simultaneous stretching longitudinally and transversely and is adapted to impart to the garment as worn a firm molding action to the abdomen, hips and buttocks transversely of the body and an easier stretch longitudinally of the body to avoid slippage of said section relative to the body in bending.

6. A garment of the corset or girdle type, comprising a body encircling member having a section formed at least to a substantial degree of knitted elastic threads to cause the section to be capable of a substantial and simultaneous stretch longitudinally and transversely and to be capable of imparting to the garment as worn a firm molding action to the abdomen, hips and buttocks transversely of the body and an easy stretch longitudinally of the body to avoid slippage of said section relative to the body in bending.

7. A garment of the corset or girdle type, comprising a body encircling member having a sec-

tion formed of knitted elastic and inelastic threads and laid-in elastic threads extending along certain courses and arranged to cause the section to be capable of a substantial and simultaneous stretch longitudinally and transversely and to be capable of imparting to the garment as worn a firm molding action to the abdomen, hips and buttocks transversely of the body and an easy stretch longitudinally of the body to avoid slippage of said section relative to the body in bending.

8. A garment of the corset or girdle type, comprising a body encircling member having a section formed of knitted elastic and inelastic threads and laid-in elastic threads extended along certain courses, said laid-in threads being so arranged in the garment as to impart to the garment when worn a firm molding action to the abdomen, hips and buttocks transversely of the body while the knitted elastic threads impart to the garment when worn a substantial stretch longitudinally of the body to avoid slippage of said section relative to the body in bending.

9. A garment of the character described adapted to encircle the hips of the wearer and be worn next to the body, said garment including porous material comprising knitted strands at least some rows of which are of elastic material in combination with other strands of elastic material laid along certain of said knitted rows, said material being positioned at the rear of the wearer and extending between points on the posterior portions of the wearer above and below a point of greater posterior projection than either of said points.

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